

SUPPLY CHAIN OF MAKHANA MARKETING AND PROCESSING IN BIHAR



Sponsored by
Ministry of Agriculture & Farmers Welfare, Government of India
New Delhi - 110 001

Peer Reviewed by
AER Centre, Jawaharlal Nehru Krishi Vishwavidyalaya
Jabalpur, Madhya Pradesh

Ranjan Kumar Sinha
Project Leader



Submitted by
AGRO-ECONOMIC RESEARCH CENTRE FOR BIHAR & JHARKHAND
T. M. BHAGALPUR UNIVERSITY, BHAGALPUR - 812 007 (BIHAR)
www.aercbhagalpur.org

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Preface

Makhana is an aquatic crop with large floating leaves. It has a fair distribution in North-Eastern and Eastern region of the country. However, its commercial cultivation is largely confined to Bihar. In Bihar, it is mainly cultivated in flood prone areas of Mithilanchal, Kosi and Seemanchal regions. The crop has tremendous potential to support the livelihood of resource poor farmers, particularly fisherman (*mallah*) community, who constitutes more than one-fifth of India's total fisherman population in Bihar.

Till recently, makhana cultivation was done on traditional lines and farmers use to follow the old practice of cultivation. As of now, makhana cultivation is also practicing in cropping system mode in shallow water depth with optimum yield. So, it is mainly grown by using two systems viz., traditional (ponds/jalkars) and field system. But makhana sector in the state is highly unorganized, witnessing several challenges particularly in production, processing and marketing as well. However, several initiatives have been taken up to makhana sector by ramping up production technologies with marketing and strengthening the farmers.

In above backdrop, this study was undertaken in two sample districts, representing one each from two different agro-climatic zones with 200 sample cultivators, apart a few stakeholders' case studies. The draft report reviewed by the designated AER Centre i.e., AERC, Jawaharlal Nehru Krishi Vishwavidyalaya Jabalpur, Madhya Pradesh and presented in virtual mode before the Economics, Statistics and Evaluation Division of the Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi, chaired by Sr. Economics & Statistical Adviser on 28th July 2023. Now it is brought out by incorporating the comments given by the reviewer and suggestions of the Ministry as well. We hope that the findings of the study will be useful across the policy makers, academicians and professionals.

We deem it our duty to acknowledge and appreciate the cooperation extended by all those, who have greatly helped us in completion of this study. First of all, we express our heartfelt gratitude to the respected Chairperson & Members of RAC, MoA & FW, GoI for granting approval on our study proposal. We record deep gratitude to our Hon'ble Vice-Chancellor, Prof. (Dr.) Jawahar Lal for his consistent interest in completion of the study. We are grateful to Dr. I. S. Singh, Director and his colleagues, ICAR's – Research Centre for Makhana, Darbhanga, Bihar for providing us their kind cooperation and necessary information. We express our thankfulness to Dr. S M Rahman, Assistant Professor, Department of Agricultural Economics, Bihar Agricultural University, Sabour, Bihar for sparing his valuable time for discussions and all need based support.

We are very much thankful to all the members of the Project Team for involving themselves in collection and tabulation of data. We will be failing in our duty, if we do not thank the respondents of both the districts for sparing their valuable time and providing information and data in course of field survey exercise.

Sanjay Kumar Jha
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Executive Summary

Introduction

Makhana (*Euryale ferox*), an important aquatic cash crop is unique, highly nutritious dry fruit mainly grown in stagnant perennial water bodies, like ponds/jalkars, land depressions, oxbow lakes, swamps, ditches and low-lying agricultural fields. It has tremendous potential to support the livelihood of resource poor farmers, particularly belonging to the fisherman/mallah community in the Eastern region of India, where agriculture is by and large diverse, complex and risk prone. It is considered as a native of South-East Asia and China. In India, it has a fair distribution in North-Eastern and Eastern Regions, Jammu & Kashmir. The country produces 90 per cent of the world production; however, its commercial cultivation is confined to northern Bihar. In Bihar, Makhana is mainly cultivated in the flood prone areas of Mithilanchal, Kosi and Seemanchal regions of the state, accounting for 90 per cent of India's total Makhana production. It's about Rs. 250 crore market at farmers' end, Rs.550 crore at traders' end and Rs. 1500 crore at consumers' end.

Makhana is a crop that under goes 100 per cent processing and the entire system of processing is manual till date, which is carried on through generations from time immemorial. Most of the experts of this technology belong to the women population of a specific community of 'mallah' of north-Bihar. Natural concentration of these experts is limited to a few areas of north-Bihar

particularly in Darbhanga and Madhubani districts and that is the only reason, that the processing of Makhana is restricted to Bihar only. After processing, popped Makhana is sold to local and distant markets. But the Makhana supply chain is lengthy as there are many market functionaries between the farm gates to end product markets.

During the last decade (2014-2023), several initiatives have been made to boost Makhana sector by ramping up production with marketing and strengthening the farmers. In 2020 under *Atmanirbhar Bharat Abhiyaan*, a scheme of Rs. 10,000 crores was launched for Micro Food Enterprises (MFEs) to promote 'Vocal for Local with global outreach' for six agricultural produces and of it 'Makhana' was the one. Subsequently in 2022, Government of India awarded GI tag to Mithila Makhana. It further led to Makhana Vikas Yojana in 09 districts to help farmers and promoting Makhana cultivation for the use of HYVs of Makhana (*Swarna Vaidehi & Sabour Makhana - 1*) at the subsidized rates of Rs. 72,750/ha (75% of the total cost) and seed production of HYVs @ Rs. 97,000/ha (100% of the cost) to BPS Agricultural College, Purnea and ICAR's RCM-Darbhangha. Despite all this, the sector is highly unorganized and besieged with much inefficiency. The study is based on primary data collected from 200 Makhana cultivators, distributed equally in two sample

districts viz., Darbhanga (ACZ-I) and Katihar (ACZ-II); apart secondary data and selected case studies.

Findings

- Till 1980s the area under Makhana cultivation was estimated at 10,000 ha which increased to 13,000 ha in 2012-13 and further to 35,224 ha in 2021-22. The total seed production has been increased from 20,800 tones in 2012-13 to 56,389 tones in 2021-22 and the pop production from 9,360 tones in 2012-13 to 23,656 tones in 2021-22. It reveals that during the period of 2012-13 to 2021-22 (9 years), the increase in area was by 270 per cent, production of seeds by 271 per cent and pop production by 253 per cent. Average yield rate of Makhana seed production was 16 qtl/ha during the period.
- As regards marketable surplus, it was 98.15 per cent (*Choudhary et.al, 2003*), 88 per cent (*Mahawar, 2016*) and about 98 per cent (*APEDA, 2017*).
- Per household net operated area under Makhana cultivation was 2.02 acres and of it 1.84 acres (91.08%) was leased-in. It reveals that Makhana cultivators are largely marginal and small sizes. The annual average rental value of Makhana land/pond was reported at Rs. 17,813/acre.
- Per acre total paid out cost of Makhana seeds in traditional and field systems was estimated to be Rs. 41930 (Rs. 5554/qtl) and Rs. 46175 (5497/qtl) respectively. Per acre net returns were Rs. 18093 and Rs. 21241 and CB ratios 1:1.43 and 1:1.46 respectively. Among different components of costs, harvesting and cost on leasing of ponds/lands occupied 80 to 87 per cent of total cost.
- The cost of processing was estimated at Rs. 2575/qtl of Makhana seeds and the recovery rate of Makhana pops out of Makhana seeds was 44.25 kg/qtl (44.25%). Of the total processing cost, labour charge alone constitutes nearly 70 per cent.
- The supply chain of the produce varies according to chain of intermediaries and channels. The study found following market channels:
 - i. *Producer --- Aggregator --- Processor (Phodia) --- Local Wholesaler/ Trader --- Distant Wholesaler --- Retailer --- Consumer.*
 - ii. *Producer --- Processor (Phodia) --- Local Wholesaler / Trader/ Commission Agent --- Wholesaler (Distant or Regional) --- Retailer --- Consumer.*
 - iii. *Producer --- Processor (Phodia) --- Trader --- Retailer --- Consumer*
- Nearly 70-80 per cent volume of produce was disposed through channel - I (Distant Markets), 20-25 per cent through channel-II

(Regional Markets) and 10-15 per cent through channel - III (Local Markets).

- The producer's share in consumer's rupee across the channels was 38.19 per cent, 34.20 per cent and 40.58 per cent respectively. It reveals that the price spreads were 61.81 per cent, 65.80 per cent and 59.42 per cent of the retailer's price respectively.
- Marketing efficiency was measured through four alternate methods. *Traditional method (TME)* suggests channel - II is more efficient, but not suitable as price received by the producer in this channel was lowest.
- *Shepherd method (SME)* suggested channel - II as more efficient but it did not consider the price received by the producer. According to the *modified marketing efficiency (MME)* channel- II was more efficient but the margins of marketing functionaries as compared to marketing cost were very high. *Acharya method (AME)* suggested for channel - II followed by channel - I & III.
- Around 57 per cent of the sample households borrowed and the average amount of borrowings and outstandings were Rs. 15893 and Rs. 10663 respectively. Nearly 88 per cent borrowers borrowed from the non-institutional sources.
- The production related constraints as faced by growers, use of traditional cultivars was the Garret's first rank constraint. This was followed by uncertainties in profit due to short term settlement of jalkars and renting of fields, lack of working capital due to weak economic status, drudgerous and costly harvesting, climatic stress, lack of irrigational facilities, numerous inefficiencies in distribution of jalkar, siltation of beds of water bodies, lack of technical interventions, health risk to women and children and infestation of aquatic weeds.
- Among the processing related constraints, lack of mechanical processing was the Garret's first rank constraint followed by lack of ready to consume local market, drudgery activity, high dependence on traders, small size of output, low demand due to less popularity of the produce, weak socio-economic conditions of processors, lack of infrastructural facilities, migratory life and lack of subsidies on machines.
- A glimpse of market related constraint shows that there is one causal factor for many constraints. As the Makhana marketing system has been well organized in the hands of a few big traders, who dictated the price and earned a lot at the cost of poor farmers. This results

dependency on organized traders for disposal of output and thus, it ranked first followed by formation or cartel of market entities, determination of prices on will and wishes of the wholesalers, lack of Makhana mandies, high transportation cost, lack of brands, hindrance in export as produce being the minor, absence of terminal market in the state etc.

Suggestions

The study recognizes the immense scope of development in production, processing and marketing if following interventions are taken care of :

- i. Popularization and availability of improved varieties of seeds (*Swarna Vaidehi* & *Sabour Makhana - 1*) released in 2013 & 2016 respectively for commercial cultivation should be made adequately to increase the production. At present about 400 quintals of improved seeds are produced by two prominent institutions viz., BPS Agricultural College, Purnea (BAU) and ICAR's - Research Centre for Makhana at Darbhanga at 100 per cent subsidy, provided by the Directorate of Horticulture, Government of Bihar. But, there is need for seedlings preparation at the farmers' level for replacing local/landraces from the Makhana jalkars/ponds/fields.

Besides, promotion to R & D for crop improvement and harvesting machine, strict and timely adherence to Bihar Fish Jalkar Management Act (2006), cleaning of Jalkars, scientific and technical support etc. are to be ensured.

- ii. In case of processing mechanization is highly needed. This can be addressed by inventing cost effective and successful popping machine. It requires promotion to institutions like CIPHET (ICAR), BAU (Sabour, Bihar) and ICAR's - Research Centre for Makhana Darbhanga, Bihar and other interested entrepreneurs on R & D in popping, roasting and other machines. Besides above, subsidization of machines, establishment of processing clusters/common facility centres at Makhana locations, support to Makhana enterprises for value addition etc. are also required.
- iii. Creation of mass awareness about high nutritional value of Makhana by increasing participation of Makhana industries in exhibition, fair, meet/conclave etc., farmers' integration with markets (domestic & export), forming FPOs/Co-operatives, branding and certification, promoting transportation through railways etc. are the major suggestions for hassle free marketing of the prod

CHAPTER – I

INTRODUCTION

1.1 Background

Makhana (*Euryale ferox* Salisbury) also known as fox nut or gorgon nut, belonging to the *Nymphaeaceae* family, is an important aquatic cash crop having both nutritional and medicinal values. It is a minor crop comprising approximately 18,000 ha area in India, which yields nearly 24-26 thousand MTs of makhana seed. It is mainly distributed in South-East and East Asian countries viz., India, China, Nepal, Bangladesh, Japan, Russia, Korea etc. and widely prevalent in tropical and sub-tropical regions accomplished with a humid to sub-humid environment. In India, its cultivation is limited to a few states like; Bihar, Assam, Manipur, West Bengal, Tripura and Odisha (Kumar et. al, 2011). Though in India, it was once distributed, covering a long range from Kashmir to Manipur alongside the Himalayan Stretch from North West to Fareast (Mandal et. al, 2010). But its commercial cultivation is limited to Bihar, Manipur, some parts of Assam, West Bengal and Madhya Pradesh.

In Bihar makhana is mainly cultivated in the flood prone districts and also found to be an important crop of the wetland parts in Mithila and Kosi-seemanchal regions of the State. It is traditionally grown in stagnant perennial water bodies like; ponds, land depressions, lakes, ditches or wetlands having stagnant shallow water with depth up to 2 to 6 ft. In India, total neglected wetlands are around 15.26 million hectare which comes to 4.63 per cent of the total geographical area of the country. Till date these areas are under exploited with low productivity. These areas are heavily infested by aquatic weeds. Farmers are unable to grow commercial crops and from these wetlands they harvest less quantity of wild makhana.

Makhana seeds are black to brownish, small and rounded characterized by their hard seed coat (shell), which are the edible part of the plant and are consumed in the form of popped *lawā* after processing. Cultivation of makhana is highly tedious, cumbersome, labour intensive and involves human drudgery. It is very

popular among Indian households and largely consumed in the form of snacks, kheer, curry, sweet porridge etc. During festive seasons its demand increases tremendously as the devotees consume it as non-cereal food. Besides its consumption, starch is also extracted from Makhana for industrial use. The crop has immense potential to support the livelihoods of lakhs of the resource poor farmers specially belonging to the fishermen community.

1.2 Nutritional and Medicinal Benefits

Makhana or fox nut is a kind of hydrophytes used both as drug and food which exhibits much application and development prospects in the fields of medicine, food and economy. Makhana is the seed of a cash aquatic

crop, which was popularly used as herb and food in China. Makhana possessed high nutritional value and many medicinal and health protection effects. Popped makhana is one of the most common dry fruits utilized by the people due to its low fat content, high proportion of carbohydrates, protein and minerals. It is considered to be nutritious and healthy food superior to dry fruits such as almond, walnut, cashew nut etc. Both raw and fried makhana are fairly rich in essential amino acids. The values relating to essential amino acid index (EAAI) and Chemical Score (CS) of makhana are close to that of fish. The nutritional contents of makhana seed and popped makhana have been presented in table 1.1.

Table 1.1 : Nutritional Content of Makhana Seed and Popped

Parameters	Units	Makhana Seed	Popped Makhana
Carbohydrate	% by wt	57.0	79.8
Protein	% by wt	7.2	8.7
Fat	% by wt	0.3	0.5
Moisture	% by wt.	34.7	10.4
Total Ash	% by wt	0.3	0.4
Crude Fiber	% by wt	0.5	0.2
Amylose	%	19.0	18.2
Calorific Value	k. cal/100 gm	259	358
Phosphorus	mg/100 gm	66.1	53.2
Potassium	mg/100 gm	35.6	42.0
Iron	mg/100 gm	0.8	1.4
Calcium	mg/100 gm	9.5	18.5
Magnesium	mg/100 gm	11.3	13.9
Sodium	mg/100 gm	48.2	71.0
Copper	mg/100 gm	0.3	0.5
Manganese	mg/100 gm	0.9	1.3
Zinc	mg/100 gm	0.9	1.1

Source: NIFTEM (www.niftem.ac.in), Haryana
Reading material for Fox nut (Makhana), under PMFME Scheme

1.3 Makhana Trade

In the present age of liberalization, privatization and globalization (LPG), trade of makhana is gaining momentum in order to fetch more foreign currency. A good quantity of makhana is marketed to other states of the country and abroad. Owing to its high nutrient value and several health benefits, the demand for makhana has increased steadily in recent times. Makhana is now consumed across the country. Though its commercial production is limited to selected districts of north Bihar, West Bengal, Assam and Manipur; however, it reaches to all major cities of the country through a chain of traders. Since makhana is a minor crop and thus, APEDA has not allocated a separate HS (Harmonized System) code for makhana rather it falls under HS Code: 19041090, meant for other prepared foods obtained by the puffing or roasting of cereals or cereals products and exported with many other products. So, separate data of makhana export from India is not available. But *Choudhary et. al (2003)* reported that a good quantity of makhana is marketed to other states of India and outside India. Thus, it is a source of earning

foreign exchange also. Further it has also been estimated that 1900 MT of makhana worth about Rs. 95 million were marketed out of Bihar during 1991 from three railway stations namely; Barauni (1016.26 MT), Katihar 280.56 MT) and Samastipur (619.36 MT). Though the crop has vast potential for internal as well as external trade, due attention has not been given to its development. As per APEDA sources India exported makhana worth \$ 23 million in 2016-17 and \$ 21.20 million in 2017-18. During 2019-20 India exported 11777 MT of makhana along with related products worth Rs. 13859 lakhs (\$19.42 million). USA (34.5%) was the major destination followed by UAE (11.5%), Nepal (9.7%), UK (5.3%), Australia (4.8%) and about 34 per cent from the rest of the world (table 1.2). According to an official figure, around 25 thousand MT of makhana are produced every year in Bihar with an annual turnover of Rs. 300 crores (*IE, 2020*). India's exports for makhana have increased @11.2 per cent annually since 2013-17. Further it is expected that the global makhana market size will grow by US \$ 72.5 million during 2019-23 at a CAGR of 7 per cent.

Table 1.2 : Quantity, Value and Major Destinations for Export of Makhana
(including other products under HS Code 19041090) from India 2019-20

Country	Quantity (MT)	Value (Rs. Lakhs)	% tage Share in Total Export
USA	3069.21	4790.42	34.57
UAE	2090.62	1598.65	11.54
Nepal	863.52	1348.97	9.73
UK	613.21	746.67	5.39
Australia	595.44	666.49	4.81
Qatar	597.74	454.00	3.28
Bangladesh	196.81	428.98	3.10
Saudi Arab	563.13	422.25	3.05
Maldives	181.24	401.80	2.90
Canada	250.52	376.58	2.72
Oman	398.39	319.16	2.30
Kuwait	354.77	298.64	2.15
Sri Lanka	210.50	286.48	2.07
Singapore	331.35	277.95	2.01
Bhutan	353.06	258.35	1.86
Malaysia	150.41	133.06	0.96
Bahrain	156.43	118.29	0.85
Pakistan	49.40	108.08	0.78
Others	751.80	823.99	5.93
Total	11777.55	13858.81	100

Source: APEDA, 2020.

India being the production hub of makhana witnessed a host of initiatives and incentive schemes being rolled out from time to time by both the central and the state governments. There has been a concentrated effort undertaken to boost and scale up makhana manufacturing by improving the entire supply chain from the farmer and growers to when the product reaches to final consumers. In the last decade, makhana's demand had crossed the domestic market and there has been an ever increasing demand for its nutritious seeds in a host of countries including the USA, UK, European Union, Australia, New Zealand etc.

The need to gear up the makhana production to meet both domestic and global demand for this nutritional non-cereal food led to a series of government interventions and change mechanisms. Introducing technological interventions, reduction of intermediaries in supply chain, making the sector more organized, creating efficiencies in the marketing structure, and most importantly improving the socio-economic conditions of makhana growers.

1.4 GoI's Schemes for Makhana

The year 2014 became a game changing year for makhana or fox nut. It was

during the Parliamentary election campaign that the Prime Minister vowed to boost makhana cultivation, processing and marketing in Bihar. Since Bihar is already a leading producer of this commercially grown crop, it made sense to give makhana a further boost. This proved as a boon to farmers as it increased their household incomes, helped them in overcoming perennial challenges for growing the crop. Makhana farming has been literally revolutionized by the government during the last few years. As a part of revolutionizing the farming methods, scientists at ICAR developed a new seed known as "*Suvarna Vaidehi*." The unique feature of this special seed was the ability to be sown and grown just like paddy. This further enabled inter-cropping for makhana growers and farmers.

The goal of the "*makhana revolution*" for Bihar was to have an all-round agricultural development, also termed as the second green revolution. The idea of this agricultural revolution was to pace up and provide impetus to all the states lagging behind on the development front in the eastern region of India. The new seed '*Swarna Vaidehi*' was initially tested in more than 100 hectares and was found to give high yields and proved to be quite successful. The seed also enables a very

good crop and less harvesting time. It was a part of the government strategy for ramping up makhana production by strengthening the farmers, providing additional manpower and improving agricultural infrastructure at Darbhanga (Bihar) based Makhana Research Centre (ICAR). Scientists at the research institutes translate into faster research and implementation.

The Government of India also helped a number of other eastern and north-eastern states like, Jammu & Kashmir, Rajasthan etc. The Bihar Government's Schemes for Makhana, and the Government of India announced a major economic package of INR 20 lakh crores under *Atmanirbhar Bharat Abhiyaan during the Covid - 19 pandemic* in 5 tranches and of them, the 3rd tranche (15th June, 2020) was related to agriculture sector wherein a scheme of Rs. 10,000 crores was formalized for Micro Food Enterprises (MFEs) to promote '*Vocal for local with global outreach*,' and help around 2 lakh micro-food enterprises covering six produces across the country. Of them is makhana from Bihar. The scheme was intended in a cluster based approach to help in reaching untapped export markets in view of improved health consciousness. The scheme is being implemented over a period of five years from 2020-21 to 2024-25. The scheme has special focus

on supporting Groups engaged in Agri-food processing such as FPOs (Farmer Producer Organizations), SHGs (Self Help Groups) and Producers Cooperatives (PCs) along their value chain.

The scheme launched on 29th June, 2020 and named as Pradhan Mantri Formalization of Micro Food Processing Enterprises (PMFME). Under the scheme, one district one product (ODOP) was identified that included 688 districts by 32 states/UTs with 119 unique products and of them, Makhana (fox nut) is one, which has been identified for six districts in Bihar. These districts are Araria, Darbhanga, Katihar, Madhubani, Saharsa and Supaul to reap the benefits of scale in terms of procurement of inputs, availing common services and marketing of products.

1.5 Bihar Government's Initiatives

There have been a number of initiatives that the state government has taken over the last few years depending on what was the need of makhana growers, right from farmers, to processors, to wholesalers, to retailers etc. Some of the initiatives included:

- i. Stamp duty and registration fee waiver in lease/ sale/ transfer of land for setting up units.

- ii. Tax rebates and reimbursement of deposited amounts for people setting up makhana farming and other infrastructure.
- iii. Reimbursement on the capital investment on plant and machinery for captive power.
- iv. State and district committees set up for approval of applications within stipulated time lines.

The state government also introduced a single window clearance system for boosting of all agricultural products including makhana. The idea of this system was to provide all entry level services with a minimum interface with different government departments, faster the process in totality for farmers and other stakeholders in the supply chain.

The state government also introduced a cluster approach in various districts of Bihar to ramp up the production and also help farmers to overcome the issues of makhana farming. The state interventions for enhancing makhana production in these clusters include:

- i. Setting up of integrated facilities for makhana processing.
- ii. Budding up capacity and improving links with

marketing and products promotion teams.

- iii. Development of ponds.
- iv. Intensive training of makhana growers and processors.

In August, 2022 the Government of India had awarded the **Geographical Indication (GI) tag** to **Mithila Makhana**, a move which is expected to help growers get the maximum price for their premium produce. As soon as the **GI tag** was awarded to **Mithilanchal Makhana Utpadak Sangh**, the Horticulture Directorate of the Government of Bihar has revised its scheme namely; “Makhana Vikas Yojana (MVY)” in 11 districts spread over Kosi, Seemanchal and Mithilanchal regions of Bihar. It was launched in December, 2019 under the State Horticulture Mission. These districts were Katihar, Purnea, Madhubani, Kishanganj, Supaul, Araria, Madhepura, Saharsa, West Champaran, Darbhanga and Sitamarhi. The scheme is aimed to increase production of makhana by promoting two types of seeds in the state which includes *Sabour Makhana - 1* and *Swarna Vaidehi Prabhed*. Farmers can get seeds of

Sabour Makhana - 1 from Bholu Paswan Shastri Agricultural College (Bihar Agricultural University), Purnea whereas the seeds of *Swarna Vaidehi Prabhed* of Makhana can be obtained from Makhana Research Centre (ICAR), Darbhanga. It is said that farmers can double their production by using these two seeds of Makhana. According to the directorate of Horticulture (GoB), at present productivity of up to 16 quintals/hectare can be obtained from the seeds of common makhana. But if farmers use the above noted two seeds, they can produce up to 28 quintals/hectare instead of 16 QHs/ha. Moreover, under the scheme, the government will provide the benefit of subsidy to the extent of 75 per cent of the total cost of per hectare production, which is estimated @ Rs. 97,000/- per hectare and thus, Rs. 72,750/- per hectare will be the subsidy amount.

Hence, from the above statements, it is clear that the Government of India as well as Bihar is keen on business development and wishes rejigging the whole makhana industry in India, particularly in Bihar.

1.6 Cultivation System

The plains of Bihar are divided into two unequal parts viz., North (21 of 38 districts) and South (17 of 38 districts) of Bihar by the river Ganges, which flows in the middle from west to east. Moreover, the state has been divided into four agro-climatic zones namely; North Alluvial Plain (Zone-I), North East Alluvial Plain (Zone-II), South-East Alluvial Plain (Zone-III A) and South-West Alluvial Plain (Zone-III B). Out of these four zones, makhana is commercially cultivated in Zone-I (North-Alluvial Plains) and Zone-II (North-East Alluvial Plains) only.

The state is endowed with a variety of natural water resources viz., rivers and associated water bodies like floodplain wetlands (oxbow lakes, meanders, seasonal flood plain), Reservoirs, ponds and tanks. Innumerable aquatic resources of various dimensions are scattered throughout Bihar (particularly in north Bihar) in terms of 3200 hectares of rivers (0.52%), 5,00,000 hectares of wetlands (81.01%), 25,000 hectares of reservoirs (4.05%), 9000 hectares of oxbow lakes and 80,000 hectares of ponds/tanks (12.96%). These scattered and isolated water bodies are suitable

for rearing and culturing of useful aquatic organisms and plants of high economic importance managed for fish culture as well as for growing water fruits like Makhana and Singhara (*Trapa natans* Var. *bispinosa*), which are of high nutritive value and broadly relished by people in India and abroad.

As regard the system of cultivation of Makhana is concerned, it is mainly grown by using two systems viz., pond/jalkar system and low lying fields system. Pond/jalkar system is largely practiced in agro-climatic zone - I districts namely; Darbhanga, Madhubani, Sitamarhi etc whereas low lying fields and pond system both have significant area in agro-climatic zone-II districts namely; Purnea, Katihar, Saharsa, Supaul, Araria, Madhepura etc. where water up to one feet is maintained in makhana fields during the crop season. Due to the existence of a large number of ponds/jalkars and fishermen population in the state (tables 1.3 & 1.4) pond system of cultivation had been a traditional practice but in recent years particularly in Kosi and Seemanchal regions, farmers take paddy in the same field where they grow makhana.

Table 1.3 : Number of Ponds/Jalkars in Bihar

Government		Private		Total	
Ponds	Water Area (In ha)	Ponds	Water Area (In ha)	Ponds	Water Area (In ha)
31643 (32.15%)	54797.86 (58.78%)	66777 (67.85%)	38419.49 (41.22%)	98420 (100.00%)	93217.80 (100.00%)

Source: www.fisheries.bihar.gov.in

Table 1.4: Fishermen Population (2019-20)

Particulars	Bihar	All India
Population (%)	6027375 (21.48)*	28063538 (100.00)
Population per District	158615*	38182

Source : *Handbook of Fisheries Statistics: 2020, Govt. of India*

*Highest across the States on both counts.

Government ponds are to be made available only to the fisherman cooperative societies, which are found at the block level and their present strength is 534 having 1,12,952 registered fisherman as members; on lease basis. The Secretary of the Fisherman Co-operative Society then lends these ponds to a group of farmers for cultivation of makhana on an annual rent basis.

1.7 Makhana Cycle

The cultivation of water fruit makhana is an age-old practice and its cultivators use to cultivate this as one of the cash crops. Majority of the cultivators are cultivating makhana as mono-crop. Though, makhana-cum-fish culture in the ponds/tanks is not in vogue particularly in Mithilanchal region. In

fact very few farmers integrate makhana with fish culture. Makhana crop is largely and best grown in age-old perennial ponds, apart from new ponds and low lying fields. The usual time of sowing seeds is October-November @ 80-90 kg/ha of water spread area for new ponds and @ 35-40 kg/ha of water spread area in annually cultivated ponds. Germination of seeds took place in December-January. The germinated seeds sprout in February-March. During April-May, the water surface gets covered with huge, sprawling, thorny, elliptical leaves; which float on the surface of water. Flowering starts by the end of May and fruits appear in June. The mature fruits burst around August-September and the seeds (guri) get all over the bottom

of the pond. The scattered seeds at the bottom of the pond are collected manually during September-October, which is very tedious and strenuous. During November-December, pops are prepared. In this way its production cycle runs once in a year.

1.8 Varieties of Makhana

Besides traditional varieties, makhana has mainly two improved varieties namely; Swarna Vaidehi and Sabour Makhana-1. The yield level of the traditional variety is 1.7 to 1.9 tons/hectare of makhana seeds whereas that of Swarna Vaidehi or Sabour Makhana-1, it is 3.0 to 3.5 tons/hectare of makhana seed. Swarna Vaidehi which is the first ever variety of makhana released in India by ICAR Research Complex for Eastern Region, Patna for Bihar, Assam, Chattisgarh and Odisha on 15th November 2013. This variety developed through pure line selection has the production potential of 2.8 to 3.0 ton/hectare in farmer's field, which is almost two-fold higher than

the productivity of traditional cultivars. It is grown in stagnant perennial water bodies like ponds, land depressions, oxbow lakes, swamps and ditches. Currently this variety is being grown by about 50 progressive farmers and co-operative groups located in Darbhanga, Purnea, Madhubani, Katihar and Sitamarhi districts of Bihar (www.icar.org.in>node).

Sabour makhana -1 was developed at Bhola Paswan Shastri Agricultural College, Purnea of Bihar Agricultural University, Sabour, Bhagalpur, Bihar and was released on 29th August, 2016. It is characterized by large spherical leaves, dark purple flowers, medium size fruits and small oval seeds with a very thin seed coat. It is a high yielding (3.2 to 3.5 tons/hectare) variety with good quality makhana pop recovery (55-60%). It is a potential variety to get higher net return from underutilized and neglected water logged areas without eroding natural resources (Kumar, et.al 2020).

1.9 SWOT Analysis of Makhana Cultivation in Bihar

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • In India, commercial cultivation of Makhana is limited to Bihar. • The state is endowed with a variety of scattered and isolated water bodies (Natural+Man made) which are suitable for growing aquatic fruits like; Makhana. • The state has the highest population of the Mallah / Fishermen community (21.48% of the total fishermen population in India), who are regarded as highly skilled labourers for makhana. • Well developed R & D infrastructure namely; NRC-Makhana (ICAR) at Darbhanga, BPSCA (BAU) at Purnea etc. particularly for seed production and processing technology. • GI (Geographical Indication) tagged produce. 	<ul style="list-style-type: none"> • Painstaking and less remunerative agro-enterprise. • Weak market infrastructure and linkages. • Malpractices in allotment of ponds and other water bodies. • Harvesting and processing are mainly manual and require drudgery operations. • High transportation cost. • No authentic data set. • Encroachments and poor maintenance of Jalkars.
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • The state is the leading producer of Makhana in India and the world as well. • Wide scope for horizontal and vertical expansion. • Possibility of Mechanized processing. • Availability of improved variety of seeds and area extension assistance. • Out of 38 districts, 6 are ODOP for makhana. 	<ul style="list-style-type: none"> • Migration of the younger generation of skilled labourers for new and smart employment. • Effect of climate change. • Shifting of river beds and recurring floods-Bagmati and Kosi rivers particularly. • Being a minor crop - no HS code for trade, resulting in loss of identity.

CHAPTER – II

APPROACH AND METHODS

While announcing COVID-19 stimulus package part-3 (Agriculture) on 15th May 2020 under *Aatmanirbhar Bharat Abhiyaan Scheme* with a sum of Rs. 10,000 crores for Micro Food Enterprises (MFEs) which was framed with expected outcomes of improved health and safety standards, integration with retail markets and improved income of the farmers could be evidently instanced. Under the scheme, a cluster based approach for six selected commodities was included. Out of these commodities, Makhana in Bihar was one. In fact, makhana sector in the state is highly unorganized and faced with several constraints. The sector witnesses several challenges that are common across the makhana districts and the traditionally involved fisherman community engaged from generations. The people of the mallah or fisherman community are switching over to new jobs because of tedious harvesting, highly labour intensive processing, poor marketing linkage and high dependence on non-institutional

credit delivery systems. Despite all, the sector holds immense potential for value addition, product development, technological breakthroughs and innovation, which would not only enhance the livelihood of millions of fishermen but also bolster the economy of the state and bring glory to this unexplored wonder crop. Keeping this brief approach or rationale in background this study was undertaken with some specific objectives, as mentioned below:

2.1 Objectives of the Study

- i. To study acreage, production, yield and extent of marketable surplus of makhana in the state.
- ii. To estimate the cost of production of makhana in the state.
- iii. To identify the supply chain of makhana marketing in the state.

- iv. To trace the methods, extent and possibility of processing of makhana in the state.
- v. To identify the constraints in production and marketing of makhana in the state, and;
- vi. To review existing interventions and suggest policy measures for necessary improvement.

2.2 Method, Sample and Coverage

The plains of Bihar are divided into two unequal halves (north & south Bihar) by the river Ganga which flows in the middle from west to east. This study was undertaken in northern Bihar, a major makhana growing region of India. Out of the 38 districts in Bihar, north-Bihar comprises 21 districts. Bihar lies in the Agro-Climatic Zone - IV, which is called Middle Gangetic Plains region and on the basis of rainfall, temperature, soil and terrain; the state is further divided into three Agro-Climatic Zones (ACZs), viz., Zone - I: North -West Alluvial Plain (13 districts), Zone - II: North-East Alluvial Plain (08 districts) and Zone - III: South Bihar Alluvial Plain (17 districts). So far as makhana cultivation is concerned, it is mainly grown in Zones - I & II. These two zones lie in Northern Bihar, and

largely in flood and seepage prone areas of three river basins viz; Bagmati-Adhwara basin, Kamla-Balan basin and Kosi basin. These river basins have originated from the Himalayas. Makhana is mainly cultivated in 11 districts but specifically there are nine districts, which are recognized as potential districts. Out of these 09 districts, 03 districts (Sitamarhi, Darbhanga and Madhubani) are from ACZ-I and 06 districts (Supaul, Saharsa, Katihar, Purnea, Araria and Kishanganj) from ACZ-II. Under Makhana Vikas Yojana, the state has included 11 districts. These 11 makhana growing districts may be called '*makhana road.*'

The study is based on both primary and secondary data and information. Primary data was collected from two selected districts, which were from two different agro-climatic zones. These were Darbhanga from agro-climatic zone-I and Katihar from agro-climatic zone-II. Darbhanga is one, out of three potential districts in ACZ-I where cultivation of makhana is traditionally done in ponds/jalkars ecosystem and also recognized as natural adobe of makhana production. In Katihar, makhana cultivation is largely practiced in fields system and it is one out of the six makhana potential districts in ACZ-

II. In fields system, makhana cultivation is carried out in agricultural fields at a water depth of at least 1 foot. Similarly from each of the chosen districts, two blocks and villages/ cluster of villages were selected for in depth study. A sample of 50 makhana cultivators from each of the selected blocks/villages randomly drawn from the composite list of growers, prepared with the help of local people and stakeholders for the purpose of study.

This way a total of 200 makhana cultivator forms the size of the sample for analyzing the results.

Besides, a few processors and traders from both the sample districts were also interviewed with a view to fulfill the set objectives of the study. Four selected case studies were also done. Details of the sampled districts, blocks, villages and respondents are presented in table 2.1.

Table 2.1 : Sample Distribution

Districts	Blocks	Village Cluster	Makhana Cultivators	Processors	Traders
Darbhanga	Benipur	Pohaddi	50	3	3
	Darbhanga Sadar	Singhwara	50		
Katihar	Barari	Barari	50	5*	4**
	Korah	Korah	50		
Total			200	8	7

*Koshi Region/Saharsa

**Purnea & Saharsa

2.3 Stakeholders' Profile

2.3.1 Makhana Cultivators

There are two systems of makhana cultivation viz; Pond system and Field system. Ponds are also classified in two categories viz., Government Ponds/Jalkars and Private Ponds. As far as the Government water bodies/Jalkars are concerned, these are under the control of the Department of Fisheries and given on lease basis to the Fishermen

Co-operative Societies (FCSs) only of a particular area. The leasing rates of these jalkars are fixed by the department on auction or negotiation basis. The Secretary of the FCS then lends these water bodies/jalkars to an individual farmer or group of farmers of the FCS. The rent or lease rate varies from jalkar to jalkar based on quality, location, depth etc. In case of private ponds, cultivation is performed either

by the owner farmer or lessee farmer on mutually agreed rates and period of lease as well. Pond system of cultivation is largely practiced in Mithilanchal region i.e., Darbhanga, Madhubani and Sitamarhi districts (ACZ-I). In the field system, farmers cultivate makhana in low lying fields where standing water level is maintained from 1.5 to 2.0 feet during the crop season. This system is largely practiced in Kosi & Seemanchal regions i.e., Katihar, Purnea, Saharsa, Supaul and other districts of ACZ-II and cultivated either by the owner or lessee farmers.

2.3.2 Processors

Makhana processing is a highly skilled, cumbersome and time consuming process. It is a family based industry in which a group of traditionally skilled people (also called Phodia) convert the makhana seed into popped makhana. This is the post harvesting exercise, which involves sun drying (24 hrs.) size grading (generally in 4-5 grades), pre-heating, temperating, roasting & popping, polishing, grading and packaging. The entire process is conventional, which is passed on to the generations from time immemorial. The natural distribution of these skilled processors, mainly belonging to the

women population of *Mallah community*, is limited to some parts of Mithilanchal area of north Bihar particularly in Darbhanga - Madhubani districts. Probably, this is the only reason that the processing of makhana is restricted to Bihar only. It is to be noted here that the system of makhana processing is almost manual due to non-availability of successful machines. So a large chunk of processors are traditional, who besides processing of makhana, are also involved in trading of popped makhana by purchasing the makhana seed and then converting it into pop. They used to sell it to local traders/commission agents for distribution of the produce to local or big city markets. Besides traditional processors, this study has also covered a processor, who mechanically processes makhana seeds into popped makhana and claims that roasting and popping machines developed by the CIPHET, Ludhiana; are successful.

2.3.3 Traders

Traders play an important role in distribution of produce to various locations in the country. Local wholesalers located in makhana producing areas are most important among traders as they deal with large volumes of produce and perform many

marketing functions such as grading, packing, transport and storage. These functions add value to makhana at different stages. They sell makhana in local areas i.e; in nearby cities as well as obtain orders from distant markets located in Delhi, Surat, Kolkata, Varanasi etc. They take popped makhana from processors and sell it to local wholesalers and distant wholesalers. They have multifaceted businesses like; financing to the processors, purchasing of makhana seeds, storage business etc. They are itinerant and gaddidar both in their trade. Such traders are also a part of this study.

2.4 Analytical Tools and Techniques

Simple descriptive statistics was used to analyze the results. After identification of major marketing channels of Makhana, the price spread in each marketing channels was drawn using the following formula:

Price spread = Price paid by the Consumer - Net price received by the Producer

To find out the efficiency of each of the marketing channels, the producer's share in Consumer's rupee was calculated using the following formula:

**Ps = Net price received by the producer
÷ Price paid by the Consumer**

Analytical framework for measuring market efficiency is illustrated below. Market Efficiency (ME) is about maximizing output to input in marketing a commodity. This concept has been used for different purposes. Traditionally the market is said to be efficient if total marketing margin is reduced for a given marketing cost; abbreviated often as TMEI. In addition to TMEI, Shepherd (1965) measures market efficiency index as the ratio of value of goods sold or price in consumers market (PC) to marketing cost (MC) incurred by different functionaries in post harvest operations of litchi and the same is abbreviated as (SMEI).

The concept of ME has been modified as the ratio of output of marketing system or value added (difference between consumer and producer price, VA) to input used in marketing (marketing cost, MC). Thus, modified marketing efficiency index (MMEI) = (VA/MC).

Acharya & Agrawal (2001) suggest marketing efficiency (AMEI) as ratio of net price received by grower (NPg) to total marketing margin (MM), marketing cost (MC) and loss of litchi in

post harvest operation (TL). Thus
 $AMEI = (NPg)/(MC+MM+TL)$.

Ranking of problems of respondents was worked out by Garret's method. The respondents were asked to rank various constraints. Their orders of merits were transformed to unit of scores by using formula, wherein per cent position of a problem = $100 (R_{ij} - 0.50) / N_j$ where, R_{ij} is the rank given for i th problem of j th individual. N_j is the number of problems/factors ranked by the j th individual.

The per cent position of each problem was converted to scores by referring to a table given by *Garrett & Woodworth (1971)*. Subsequently, scores for each factor of individual respondents were added together and divided by the number of respondents for whom scores were added. The mean score for all factors were ranked in descending order and relative position of a problem was identified through the ranks assigned.

RESULT AND DISCUSSIONS

This chapter dealt with area, production and marketable surplus of makhana along with a brief overview of selected Makhana growers followed by discussions on their land holding account, cropping pattern, holding of Makhana area, cost of cultivation of Makhana, cost of processing of Makhana seeds, supply chain and marketing channels, price spread, efficiency of alternate market channels, borrowing status, constraints perceived by farmers, processors and market functionaries and a few case studies of selected stakeholders.

3.1 Area and Production of Makhana in Bihar

Bihar is the leading producer of Makhana, accounting for about 85 per cent of total production of India and also in the world. Out of the 38 districts of the state, it is cultivated largely in nine (09) districts namely; Sitamarhi in Tirhut division, Darbhanga & Madhubani in Darbhanga division, Saharsa & Supaul in Kosi division and

Araria, Kishanganj, Purnea and Katihar in Purnea division. These districts are in the north-eastern part of Bihar and lie sequentially in Mithilanchal, Kosi and Seemanchal regions of the state. Of the nine, seven (07) districts touch the international borders of Nepal and Bangladesh. These districts lie in the state's sub-zone - I (North-West Alluvial plain zone) and II (North-East Alluvial plain zone) of the Middle Gangetic plain region. Makhana production in Bihar is limited to such areas which are flood prone having high average annual rainfall. Farmers take makhana as an aquatic cash crop in North Bihar where about 5 lakh families mostly from fishermen community are directly involved in its cultivation, harvesting and processing (ICAR, 2019).

Makhana is a minor crop with limited production and acreage. Till 1980s, the area under makhana cultivation was not properly estimated but it was about 10,000 hectares in 1991, which increased to 25,000 to 30,000 hectares in 2021

(Pushya Mitra, 2021). In fact makhana cultivation is limited to such areas which are flood prone and having average rainfall. According to one estimate, makhana is grown in about 35,000 hectares in Bihar and is likely to extend to over one lakh hectare (Kumar, 2021). However, as per estimates of National Research Centre for Makhana, Darbhanga (ICAR-RCER, 2011), total area under makhana cultivation in India is estimated to be 15,000 hectares with production of 1.20 lakh MT of makhana

seeds, which after processing yields 40,000 MT of makhana pop. The estimated value of the production at farmers end is Rs. 250 crore and it generated revenue of Rs. 550 crore at trader's level (GoB, 2020). An annual turnover of makhana pop was estimated to Rs. 300 crore (Indian Express, 2020). Bihar produces about 90 per cent of the total production of makhana in the country. The year wise area and production of makhana is depicted in table 3.1.

Table 3.1: Area and Production of Makhana in Bihar

Particulars	2012-13	2019-20	2020-21	2021-22	% Change in 2021-22 over 2012-13
Area (ha)	13000	27887	29584	35224	(+) 270 %
Seed Production (MT)	20800	44638	47534	56389	(+) 271 %
Pop Production (MT)	9360	18048	20634	23656	(+) 253 %

Source : Bihar Makhana --- at a Glance (2023), Directorate of Horticulture, Department of Agriculture, Government of Bihar, Patna

Table 3.1 reveals that the area under makhana cultivation has increased by 270 per cent in last nine years from approximately 13000 ha in 2012-13 to 35224 ha in 2021-22 and the total seed production has been increased by 271 per cent from 20800 tones in 2012-13 to 56389 in 2021-22. Similarly the pop

production increased by 253 per cent from 9360 tones to 23656 tones during the same period of time. Further, the district wise details of area and production of makhana in Bihar for the year 2021-22 has been presented in table 3.2 as below:

Table 3.2 : District wise Area, Seed Production and Makhana Pop Production in Bihar (2021-22)

SN	Districts	Area (ha)	Seed Production (tones)	Pop Production (tones)
1.	Darbhanga	4389	7421	2969
2.	Madhubani	4160	7281	3012
3.	Sitamarhi	146	277	112
4.	Purnea	5549	11653	5234
5.	Katihar	6043	11759	4858
6.	Saharsa	4443	5267	2167
7.	Supaul	5463	5183	2260
8.	Madhepura	2461	2908	1180
9.	Araria	1427	2640	1056
10.	Kishanganj	1143	2000	800
	Total	35224	56389	23656

Source: Bihar Makhana --- at a Glance (2023), Directorate of Horticulture, Department of Agriculture, Government of Bihar, Patna

3.2 Makhana Processing and Marketing

Makhana is a crop that goes under 100 per cent processing, which is limited to a small area scattered in the selected part of Bihar. Most of the processing of makhana takes place in traditional form. It is small scale family based industry in which a group of highly skilled people purchase makhana seed and convert it into popped makhana through a series of activity viz., sun drying --- Grading of seed --- Pre-heating & tempering --- Roasting & Popping --- Polishing --- Grading. In fact, processing of seeds is the most intricate step in makhana cultivation. Nearly 85 per cent of the makhana is processed manually by the

traditionally skilled labourers, who belong to the Mallah Community. However, there is value addition in makaha by several private enterprises in the state. These enterprises prepare different value added products of makhana like; makhana snacks, atta (flour), bhujia, flakes, cookies, makhana-chura-mixture. Makhana kheer mix, makhana powder, makhana burfi, makhana kalakand etc.

Besides private enterprises, there are a few makhana processing companies which add value to raw popped makhana. M/s Shakti Sudha Industries at Patna first started to manufacture and sell value added products. Besides this,

there are many makhana manufacturers in the state, which also add value to raw popped makhana namely; Maruti Makhana at Madhubani, Manju Makhana also at Madhubani, A K Makhana & Company at Purnea etc. Purnea, Darbhanga and Madhubani are major contributors of processed makhana.

As regards makhana marketing is concerned, it is a traditional crop mainly cultivated in flood prone locations of the state and bulk of raw makhana seeds are marketed through the markets located at Purnea, Madhubani and Darbhanga districts. Generally, farmers sell the raw seeds to local aggregators who sell it to the processors. After processing Makhana pops are sold to local and distant markets situated across the country. Major markets of makhana seeds in the state are Darbhanga (approx. sale of 2000 MT), Madhubani (approx sale of 3500 MT), Katihar (approx. sale of 3000 MT) and Purnea (approx sale of 3500 MT). While the major outside the state markets for processed Makhana are in Delhi, Varanasi, Kanpur and Indore (*Patel et. al; 2017*). As reported, Purnea market is the largest one, where approximately

5000 MT of Makhana pops and 12,500 MT of Makhana seeds are sold annually.

3.3 Marketable Surplus

As per APEDA's estimates (2017) around 50 thousand MT of makhana is annually produced in India of which around 2 per cent is consumed domestically leaving a large marketable surplus. *Choudhary et. al. (2003)* in their study estimated the yield of makhana at 1982 kg/ha and out of that 12.54 kg (0.63%) was retained for seed purpose. Out of the total quantities of makhana (1982 kg - 12.5 kg = 1969.46 kg/ha) is available for processing. On an average 826.78 kg edible popped makhana was obtained, showing thereby a recovery of 41.98 per cent. Home consumption of edible makhana accounted for 15.26 kg/ha. Thus on an average marketable surplus and marketed surplus accounted for 811.52 kg and 809.78 kg which were 98.15 per cent and 97.94 per cent respectively of total/ha edible makhana produced (826.78 kg). Being a high value cash crop marketable and marketed surplus were quite high and a very negligible quantity is retained for self consumption. *Mahawar (2016)* wrote

in his paper that being a cash crop, makhana exhibits high marketable surplus. Home consumption of edible makhana amounted to 1.72 per cent of the total production. However, wastage was estimated at 3.46 per cent and about 3.5 per cent of total production was paid as wages and others. On an overall level about 88 per cent of the total production among the selected producers was estimated at marketed surplus.

3.4 Socio-Economic Profile of Selected Makhana Growers

Table 3.3 presents a brief profile of selected Makhana growers in four village clusters spread across four development blocks of two selected districts. As mentioned in the previous chapter under table 2.1 that 100 Makhana growers were selected from each of the sample districts representing to the different system of makhana cultivation, constituting a total of 200 makhana growers for this study. The age group classification of the sample respondents reveals that about 63.50 per cent were in the group of 36-59 years followed by 20.50 per cent in the 18-35 years' age bracket and 16.00 per cent in

60 years and above age groups. On the educational status majority of sample growers were literate and had received education up to graduation and above levels. Of the total, 47.50 per cent were just literate and 7.00 per cent illiterate followed by 23.50 per cent who had attained primary education, 14.50 per cent secondary education, 6.00 per cent higher secondary and 1.50 per cent graduation & above levels including 0.50 per cent BE degree holders at the overall level. The social classification data reveals that 70 per cent were from OBC category constituting 40.50 per cent from non-mallah and 29.50 per cent mallah (fishermen) communities followed by general (24.50%) and scheduled castes (5.50%). Agriculture was the primary occupation for 53.50 per cent and secondary occupation for 28.00 per cent of the sample growers. Other primary occupations were business and trade for 19.00 per cent, others (18.50%), service (5.50%) and agricultural labour (3.50%). On an average, household size was 5.37 persons per family and of them 2.04 members per family were engaged in makhana cultivation.

Table 3.3 : Profile of Sample Makhana Growers

Particulars		Traditional : Pond/Jalkar ACZ – I: Darbhanga (N = 100)	Field System ACZ-II: Katihar (N=100)	Total (N=200)
A	Age Group (%)			
a.	18-35 yrs	17.00	24.00	20.50
b.	36-59 yrs	68.00	59.00	63.50
c.	60 yrs & above	15.00	17.00	16.00
B.	Educational Qualifications (%)			
a.	Illiterate	9.00	5.00	7.00
b.	Literate	43.00	52.00	47.50
c.	Primary	26.00	21.00	23.50
d.	Secondary	17.00	12.00	14.50
e.	Higher Secondary	5.00	7.00	6.00
f.	Graduation & above	---	3.00	1.50
C.	Social Group (%)			
a.	Scheduled Castes	4.00	7.00	5.50
b.	Scheduled Tribes	---	---	---
c.	General	26.00	23.00	24.50
d.	OBC- Mallah	31.00	28.00	29.50
e.	OBC-Non Mallah	39.00	42.00	40.50
D.	Primary Occupation (%)			
a.	Agriculture	59.00	48.00	53.50
b.	Agril. Lab	4.00	3.00	3.50
c.	Service	9.00	2.00	5.50
d.	Business/Trade	17.00	21.00	19.00
e.	Others	11.00	26.00	18.50
E.	Secondary Occupation (%)			
a.	Agriculture	24.00	32.00	28.00
b.	Agril. Lab	17.00	9.00	13.00
c.	Service	---	3.00	1.50
d.	Business/Trade	18.00	10.00	14.00
e.	Others	4.00	3.00	3.50
F.	Avg. Size of Family (In Persons)	5.02	5.71	5.37
G.	Family Members Engaged in Makhana Cultivation (In Persons)	2.08	2.01	2.04

Source: Primary Survey.

3.5 Land Holding Account

The details of per household land holding account of the sample makhana

growers presented in table 3.4, indicate that on overall level net operational area was 2.39 acres, which was smaller than

the average owned area (2.98 acres), mainly due to either uncultivated/fallow land or locational disadvantages in operation. The average net operated area in Darbhanga was 2.66 acres/Hh whereas the same in Katihar was 2.21 acres/Hh. The average rental value of the land was reported to be Rs. 16045 per acre and the per acre water charges for providing irrigation to the crop was

estimated at Rs. 2,613 per household. However it was substantially decreasing due to the onset of agricultural feeder in the area. Since the major source of irrigation is bore wells, run by electricity on reduced irrigation charge/cost as the government has been continuously providing agricultural connections to farmers.

Table 3.4: Land Holding Account of the Sample Makhana Growers (In acres/hh)

Particulars	Traditional : Pond/Jalkar ACZ – I: Darbhanga	Field System ACZ-II: Katihar	Total
Owned Land	3.02	2.93	2.98
Leased-In	0.31	0.11	0.21
Leased-Out	0.67	0.92	0.80
Net-operated Area	2.66	2.12	2.39
Rental Value (Rs./Acre)	14740	17350	16045
Water Charge (Rs./Acre)	2150	3075	2613
Irrigation Sources	Borewell, Ponds	Borewell	Borewell, Ponds, etc.

Source: Primary Survey.

3.6 Cropping Pattern

Usually the cropping pattern followed by farmers depends upon availability of irrigation, soil condition and agricultural practices and so on. So it is

worthwhile to study cropping patterns adopted by the farmers in general. Crops grown by the sample farmers are shown in table 3.5.

Table 3.5 : Cropping Pattern of Sample Makhana Growers during 2021-22*(Area in acres & % in brackets)*

SN	Crop	Traditional: Pond/Jalkar ACZ – I: Darbhanga	Field System ACZ-II: Katihar	Total
1.	Paddy	128.35 (37.83)	117.10 (43.22)	122.73 (40.22)
2.	Jute	17.10 (5.04)	---	8.55 (2.80)
3.	Wheat	84.25 (24.83)	32.30 (11.92)	58.28 (19.10)
4.	Maize	30.17 (8.89)	68.20 (25.17)	49.19 (16.12)
5.	Rabi Pulses (Lentil, Peas, etc.)	38.65 (11.39)	24.15 (8.91)	31.40 (10.29)
6.	Moong	5.15 (1.52)	3.85 (1.42)	4.50 (1.47)
7.	Garma Paddy	---	2.90 (1.07)	1.45 (0.48)
8.	Vegetables	27.45 (8.09)	17.25 (6.37)	22.32 (7.32)
9.	Others (fodder etc.	8.20 (2.41)	5.22 (1.92)	6.71 (2.20)
GCA		339.32 (100.00)	270.97 (100.00)	305.16 (100.00)
NSA		228.17	190.25	209.21
CI (%)		148.71	142.43	145.86

Source: Primary Survey.

The sample farmers mainly grew paddy and jute in kharif season; wheat, maize, major pulses etc. in rabi season and moong, garma paddy etc. in summer season, besides vegetables and other crops (like; fodders etc.) across the seasons. It is evident from the table that paddy, wheat and maize together accounted for more than 75 per cent of the gross cropped area. Pulses occupied less than 12 per cent. Jute is grown in a smaller area i.e., 2.80 per cent of the GCA, but Bihar is the second largest producer of jute in India, after West Bengal. Cropping intensity was estimated at 145.86 per cent, which is

almost equal to the state's average. So the analysis of data reveals that the cropping pattern is largely cereal based.

3.7 Holding of Makhana Area

The data presented in table 3.6 showed per household holding of the Makhana area. On an average, net operated area under Makhana cultivation was found 2.02 acres per household at overall level. Out of it, the share of owned area was about 0.47 acre indicating only 23.26 per cent of the net operated area under Makhana cultivation. It means leasing practices were in vogue in the study area.

Table 3.6 : Holding of Makhana Area (In acre/household)

SN	Particulars	Traditional : Pond/Jalkar ACZ – I: Darbhanga	Field System ACZ-II: Katihar	Total
1.	Owned Area	0.58 (25.78)	0.36 (23.26)	0.47 (23.26)
2.	Leased-in Area	1.67 (74.23)	2.02 (113.48)	1.84 (91.08)
3.	Leased-out Area	0.01 (0.44)	0.60 (33.71)	0.31 (15.34)
4.	Net Operated Area	2.25 (100.00)	1.78 (100.00)	2.02 (100.00)
5.	Rental Value (Rs./acre)	18400	17225	17813

*Source: Primary Survey.
In brackets percentage figure is shown.*

No doubt, Makhana cultivation is high, mainly due to the fact that majority of the marginal and small farmers, who did not possess much of their own area rather largely depended on leased-in private ponds or jalkars. This is also revealed from table 3.6 that on an average leased-in area at overall level was as high as 1.84 acres per household, whereas the leased-out area was 0.31 acre (15.34%) per household against the net operated area. Further Rs. 17813 per acre was reported to be the annual rental value of Makhana ponds/jalkars. Though, it was quite high in case of traditional ponds, mainly due to good returns from Makhana cultivation.

3.8 Cost of Cultivation of Makhana

This section presents cost and return on cultivation of Makhana in the traditional system i.e., ponds/jalkars; and the field system in the study area. Makhana is basically a low input but highly labour intensive crop and thus, costs incurred on harvesting and to some extent processing were higher than other inputs. Majority of expenditures is made on payment of wages and rental value of lands/ponds/jalkars. As discussed earlier, this study has covered both systems of cultivation of Makhana viz., ponds/jalkars (traditional) system and field system, so the table 3.7 presents per acre cost of cultivation of Makhana seeds exclusively on both the systems.

Table 3.7 : Per Acre Cost of Cultivation of Makhana Seeds (In Rs)

SN	Items/Particulars	Traditional : Ponds/Jalkars	Field System
1.	Leasing of Pond/Jalkar/Land	15935 (38.00)	17950 (38.87)
2.	Cleaning	1550 (3.70)	1230 (2.66)
3.	Seeds/Seedlings	1210 (2.89)	1809 (3.92)
4.	Fertilizer/Manure	745 (1.77)	932 (2.02)
5.	Irrigation	---	2650 (5.74)
6.	Weeding	1645 (3.92)	1850 (4.00)
7.	Harvesting	19975 (47.64)	18842 (40.80)
8.	Miscellaneous (Transportation, bags, storing etc.)	870 (2.08)	912 (1.08)
Total Cost (Rs.)		41930 (100.00)	46175 (100.00)
a.	Output (Qtl.)	7.55	8.48
b.	Selling Price (In Rs./Qtl)	7950	7950
c.	Gross Return (Rs.)	60023	67416
d.	Net Return (Rs.)	18093	21241
e.	Cost of Production of Makhana Seeds (In Rs./Qtl)	5554	5497
f.	C B Ratio	1:1.43	1:1.46

*Source: Primary Survey.
In brackets percentage figure is shown*

The average per acre cost of cultivation of Makhana seeds was Rs. 41930 in the traditional system whereas it was a bit higher estimated at Rs. 46175 in the case of the field system. This may be due to higher rental value of land and irrigation expenditures. The component/ item wise data on cost reveals that harvesting of Makhana seeds is a major activity where cost was the highest among all other items. The average cost of harvesting was Rs. 19775/acre and Rs. 18842/acre in

traditional and field systems respectively. These accounted for nearly 48 and 41 per cent respectively of the total costs. Generally Makhana seeds are harvested in three different phases, which are locally called as *LOUSAR* (1st harvesting), *MARKAT* (2nd harvesting) and *CHARKAT* (3rd harvesting) particularly in Kosi-Seemanchal region. In fact the harvested output declines in each subsequent phase while the cost of harvesting every unit of seed increases sharply. Hence,

farmers stop harvesting seeds after the third phase, because in subsequent phases the marginal cost of harvesting becomes higher against the marginal returns. Moreover, the second major component was cost on leasing of ponds/land. It was Rs. 15935/acre and Rs. 17950/acre respectively and in terms of percentage of total costs these were about 38 almost equal on both the systems. If these two cost components are taken together, its share is about 86 and 80 per cent to total costs respectively. Among other items, irrigation cost which was Rs. 2650/acre (5.74%), is important particularly in the field system of cultivation. Makhana is an aquatic crop that requires at least 2-3 feet standing water in the field. Generally fields are filled with water by submersible pumps run by electricity supplied by agriculture feeders. As Makhana is traditionally cultivated in flood prone districts, the demands for fertilizer and manure are relatively low, so it costs Rs. 745/acre and Rs. 932/acre respectively, accounting for about 2 per cent of the total costs of cultivation. On an average the costs of cleaning ponds and fields were Rs. 1550/acre (3.70%) and Rs. 1230/acre (2.66%) and seeds &

seedlings Rs. 1210/acre (2.89%) and Rs. 1809/acre (3.92%) respectively. The costs on miscellaneous items were Rs. 870/acre (2.08%) and Rs. 912/acre (1.98%) respectively.

As regards the output, it was on an average 7.55 quintals/acre and 8.48/acre respectively and the average selling price was reported to be Rs. 7950/quintal. Though there were wide fluctuations in the selling price of Makhana seeds, which declined to even Rs. 5000 per quintal. However, the last year's peak price was reported to be Rs. 16000/quintal. Further looking at the return per acre, the gross and net returns obtained by the farmers were Rs. 60023 and Rs. 18093 respectively in case of traditional system and Rs. 67416 and Rs. 21241 in case of field system. Per quintal cost of production of Makhana seeds was calculated at Rs. 5554 and Rs. 5457 respectively. The cost-benefit ratio on production of Makhana seeds was calculated at 1:1.43 and 1:1.46 respectively.

3.9 Cost of Processing of Makhana Seeds

The processing of Makhana involves various post harvest activities such as sun drying of harvested Makhana

seeds, size grading, preheating and tempering, roasting and popping, polishing, grading and packaging. The entire system of Makhana processing is almost manual as no successful machine has been in operation till now, despite several trials and claims. However, CIPHET, Ludhiana had developed a Makhana processing machine in the last decade but the same was not in practice even after many changes. The popping process is done manually, which is highly skilled, time consuming and pain taking. Majority of the skilled labourers of this technology belonged to the limited women population of 'Mallah' community of north Bihar. The entire process is conventional, which is passed on to the generations from time immemorial. Perhaps this may be the only reason that processing of Makhana is restricted to Bihar only.

As regards the cost of Makhana processing, cost of raw seeds, labour

charges and costs of fuel are the major items of processing activity. The data presented in table 3.8 shows the cost of processing of Makhana seeds. The average cost of processing incurred on per quintal of Makhana seeds was Rs. 8101 including cost of raw seeds whereas it was Rs. 2575/quintal excluding raw seeds. Cost of raw seeds constitutes a significantly larger portion of the total cost of Makhana processing. It was on an average Rs. 5526/quintal, constituting 68.21 per cent of total processing cost. Cost associated with labour charges constituted another major component, which was Rs. 1810/quintal, accounting for 22.34 per cent of the total processing cost. Puffing of Makhana requires intensive and repeated roasting of seeds. This necessitates fuel worth Rs. 289/quintal (3.56%) of the total processing cost. Transportation, packaging and other costs constituted 1.56 per cent, 0.96 per cent and 3.56 per cent respectively.

Table 3.8 : Cost of Processing of Makhana Seeds (In Rs./Qtl)

SN	Items/Particulars		Cost (In Rs./Qtl)
i.	Cost of Raw Seeds (In Rs./Qtl)		
	a.	Ponds system	5554
	b.	Field system	5497
		Average Cost	5526
			5526.00 (68.21)
ii.		Fuel	289.00 (03.56)
iii.		Labour Charges	1810.00 (22.34)
iv.		Packaging	78.00 (00.96)
v.		Transportation	126.00 (01.56)
vi.		Others (Pots, storage, etc.)	272.00 (03.56)
		Total Cost	8101.00 (100.00)
		Cost of Processing of Makhana Seeds	2575.00

Recovery rate : @44.25kg/qtl.
 Avg. selling price of makhana pop: @ Rs. 340/kg
 Total value of makhana pop: Rs. 15045/- (Rs. 340 x 44.25 kg)
 Net return: Rs. 15045-8101 = Rs. 6944

Source : Primary Survey.
 In brackets percentage to total shown

The net return was estimated at Rs. 6944/quintal at a recovery rate of 44.25 per cent and average selling price of makhana pop at the rate of Rs. 340/kg. So the final product fetches relatively higher net profits, provided the prices of makhana seeds and puffs do not abruptly fall, as evidenced in post-COVID-19 period.

3.10 Supply Chain and Marketing Channels

Supply chains are the routes through which produce moves from the point of production to the point of consumption. These are alternative paths and the

chain of intermediaries through which Makhana passes from producers to consumers. Moreover, the survey revealed that marketing and distribution of popped makhana involve multiple intermediaries depending on time of sale and the destination market. Besides, no support either infrastructural or financial is given for makhana processing and marketing. The key players involved in supply chains are; producers, processors, commission agents, wholesalers, retailers and consumers. The marketing of makhana in the study

region i.e., in local as well as distance markets is prominently reported to be carried out mainly through three different marketing channels, which are as below:

- i. Producer --- Aggregator --- Processor (Phodia) --- Local Wholesaler/ Trader --- Distant Wholesaler --- Retailer --- Consumer.
- ii. Producer --- Processor (Phodia) --- Local Wholesaler/Trader/Commission Agent --- Wholesaler (Distant or Regional) --- Retailer --- Consumer
- iii. Producer --- Processor (Phodia) --- Trader --- Retailer --- Consumer.

In this way, there are mainly two tracks i.e., distant and local. In channel - I, Makhana is marketed in distant markets rather in big cities across the country whereas in channel - II, selling to local or regional city markets and in channel - III is meant for local markets. So far as the disposal of Makhana through different channels is concerned, it was observed that 70-80 per cent of total Makhana was marketed through distant wholesalers in major cities i.e., channel -

I, 20-25 per cent to regional markets through channel - II and 10-15 per cent sold in local markets through channel- III. The producers usually chose the channel for disposal of their produce on the basis of scale of production, location and distance of markets and financial conditions either of producers or processors or both. Moreover, Makhana is mainly cultivated in 11 districts but the major markets are Darbhanga and Madhubani in Mithilanchal and Purnea & Katihar in Kosi-Seemanchal regions. These are the places where processing of Makhana seeds are made into popped Makhana.

3.11 Price Spread

Market functionaries move the commodities from the producers to consumers. In marketing of agricultural commodities, the difference between price paid by consumer and price received by the producer, an equivalent quantity of produce has traditionally been referred to as the price spread. Table 3.9 presents the marketing margin in sequence.

**Table 3.9: Price Spread of Makhana through different Marketing Channels
(In Rs./quintal of Makhana Seed).**

SN	Particulars	Channel – I	Channel – II	Channel - III
i.	Net price received by the Producer for Makhana Seeds	8040 (38.19)	7952 (34.20)	7958 (40.58)
ii.	Purchase price of Aggregator	8040	---	---
iii.	Cost insured by Aggregator	152 (0.72)	---	---
iv.	Purchase price of Processor	8429	7952	7959
v.	Net margin of Aggregator	237 (1.26)	---	---
vi.	Price of Makhana Pop received by the Producer (RR @ 44.25%)	9215	9370	9382
vii.	Cost incurred by the Processor	342 (1.62)	468 (2.01)	479 (2.44)
viii.	Net price received by the processor	444	950	945
ix.	Purchase price of Makhana Pop by local wholesaler (LWS)/Trader	9547	9609	9487
x.	Cost incurred by LWS/Trader	117 (0.56)	103 (0.44)	417 (2.13)
xi.	Net margin of LWS/Trader	1830 (8.69)	2108 (9.07)	2277 (11.61)
xii.	Purchase price of distant wholesaler (DW)	11494	11820	---
xiii.	Cost incurred by distant wholesaler	667	667	---
xiv.	Selling price of distant wholesaler to retailer	16671	16997	---
xv.	Net margin of distant wholesaler	4510 (21.43)	4510 (19.40)	---
xvi.	Purchase price of retailer	---	---	12181
xvii.	Selling price of retailers to consumers	21050 (100.00) @ Rs. 475.71	23245(100.00) @ Rs. 525.31	19609 (100.00)
xviii.	Cost incurred by the retailer	398 (1.89)	442 (1.90)	459 (2.34)
xix.	Net margin of the retailer	3981 (18.91)	5706 (24.54)	6969 (35.54)
xx.	Producer's share in consumer's rupee (%)	38.19	34.20	40.58
xxi.	Price spread	13010 (61.81)	15293 (65.80)	11651 (59.42)
xxii.	Total cost of marketing	1676 (7.96)	1680 (7.23)	1355 (6.91)

Source: Calculated on the basis of primary data.

In brackets percentage figures are shown

The difference between price at producer's and consumer's level in a perfectly competitive market situation consists of marketing costs and margins. These are indicators of efficiency of the marketing system. Higher the

difference between marketing cost and margin, the lower the efficiency and vice-versa. The absolute value of marketing costs and margins varied across channels, markets and time. The

same are presented in table 3.9 as it reveals many facets of price spread.

It is apparent from table 3.9 that in channel - I (Producer --- Aggregator --- Processor/Phodia --- Local Wholesaler/Trader --- Distant --- Wholesaler --- Retailer --- Consumer), the average producer's price was Rs. 21050 at the recovery rate (RR) of 44.25 per cent of Makhana seeds. Of the consumer's price the net margin of distant wholesaler was Rs. 4510 (21.43%) followed by net margins of retailer (18.91%), local wholesaler/trader (8.69%), processor (2.11%) and aggregator (1.26%). Interestingly, the wholesaler's margin in this channel was higher than other channels whereas it was lower in case of retailer's margin than other channels. In fact, Makhana price in distant markets is generally 60-70 per cent higher than local markets, which yields higher margins to the wholesalers.

In channel - II (Producer --- Processor/Phodia --- Local Wholesaler/Trader/CA --- Distant or Regional Wholesaler --- Retailer --- Consumer), the average producer's share in consumer's rupee was 34.20 per cent (Rs. 7952). The consumer's price was Rs. 23245, higher than the other two channels. In this channel, retailers were

more active who retained about 24.54 per cent of the consumer's price, followed by regional or distant wholesaler (19.40%), local wholesaler/trader (9.07%) and processor (4.08%). Besides the above, producers directly sell their produce to processors (locally known as phodia), who used to purchase Makhana seeds from out of their borrowings, generally obtained from local moneylenders @ 4-5 per cent of monthly interest rates and that is why the net margin of the processors was 4.08 per cent (Rs. 950), double as compared to channel - I. Processors who prepared popped Makhana sold to local wholesalers located at Darbhanga, Madhubani, Purnea and Katihar. These wholesalers (local and regional) generally controlled the price of Makhana in local as well as regional markets; local retailers procure smaller quantities of Makhana as per requirement and sell to consumers.

In channel - III (Producer --- Processor/Phodia --- Trader --- Retailer --- Consumer), the average producer's share in consumer's rupee was 40.58 per cent (Rs. 7958) and the consumer's price was Rs. 196.09, lowest as compared to other two channels. In this channel, Makhana is primarily sold in the local market. Very small quantity of

Makhana is sold in the local market without involvement of the wholesaler. Some of the processors have direct linkage with the retailers or used to sell their produce through traders/CA in the local area. Therefore the retailer's margin was as high as 35.54 per cent, which was highest compared to other two channels. Due to less number of intermediaries farmers got nearly 41 per cent of consumer's price through this channel.

Some points which emerge from comparison of the above channels were as under. The marketing operation of makhana in Bihar was mainly performed by wholesalers and retailers, they accounted for 47 to 53 per cent of the consumer's price. In fact Makhana is transported to long distances at big mandis at Varanasi, Delhi, Kanpur, Lucknow, Kolkata, Amritsar, Patna etc. by the local wholesalers. Wholesalers at distant markets purchased it through Commission Agents who usually charge on an average 5 per cent of its sale value. From distant wholesalers retailers purchased Makhana from major mandis and sold it to consumers. That is why in all the existing marketing channels, the role of wholesalers are at margin (2 to 4%) despite processing

being a highly skilled, cumbersome and time consuming process.

3.12 Efficiency of Alternate Market Channels

Market efficiency in alternate channels was worked out with different methods; the same is presented in table 3.10. Traditional or conventional method is the ratio of market margin and cost and it suggests that channel - II is more efficient than channel - I & III. Interestingly, in the channel - II share of producer in consumer's price is the lowest; therefore if maximization of farmer's welfare is the objective, this method is not suitable.

The *Shepherd's method* (SME) is the ratio of price in the retail market to marketing cost. As per SME the channel - III is more efficient than other channels (I & II). Since this method does not consider the price received by the producer, market efficiency was modified to include value addition with respect to the cost of marketing. According to this Modified Marketing Efficiency (MME), Channel - II is distinctively better than others. In this market channel value addition is much more higher to marketing cost, which suggests that margin of market functionaries as compared to marketing costs are very high.

Acharya & Agrawal (2001) noticed the above problem and considered market efficiency as ratio of producer's price to

market margin and cost in marketing. This found that channel - II followed by I & III, is more efficient.

Table 3.10 : Marketing Efficiency of Makhana under different Marketing Channels

(In Rs./quintal of Makhana seeds)

SN	Particulars	Channel – I	Channel – II	Channel - III
1.	Retailer's sale price or consumer's purchase price (PC)	21050	23245	19609
2.	Total marketing cost (MC)	1676 (7.96)	1680 (7.23)	1355 (6.91)
3.	Total margins of intermediaries (MM)	11334 (53.84)	13613 (58.56)	10296 (52.51)
4.	Net price received by producers (FP)	8040 (38.19)	7952 (34.21)	7958 (40.58)
5.	Value added (1-4)	13010	15293	11651
6.	Index of Marketing Efficiency			
	a. Traditional method (TME) (3 ÷ 2)	6.76	8.10	7.60
	b. Shepherd's method (SME) (1 ÷ 2)	12.56	13.84	14.47
	c. Modified marketing efficiency (MME) (5 ÷ 2)	7.76	9.10	8.60
	d. Acharya's method (AME) (4 ÷ (2 + 3))	1.62	1.92	1.46

Source : Calculated from primary survey.

Figures in brackets are percentage of items in retail price.

3.13 Borrowing Status

Makhana is mainly cultivated and processed by fishermen, who belong to a backward community consisting of seven sub-communities/castes i.e., Banpar, Keot, Khulwat, Suraiya, Koal, Chain and Turaha. They are mostly illiterate and migrate from one place to another during Makhana harvesting and processing season. Most of the fishermen were very poor and their main activity is cultivation and processing of Makhana and fishing.

They have a poor resource base and most of them cultivated Makhana on leased-in ponds/jalkars and rented Makhana fields. These arrangements are usually oral. So it is difficult for a landless or marginal and small tenant to avail credit from the institutional sources when they have no documents or written lease agreement. Under these circumstances, they availed credit mainly from informal sources. Table 3.11 gives the borrowing status of

sample Makhana growers as on date of survey.

As is evident from table 3.11 that of the total sample growers, 114 growers (57%) had borrowed as per their needs. The average amounts of borrowing and outstanding were Rs. 15893 and Rs.

10663 respectively. So far as the sources of borrowings are concerned, it was 87.72 per cent from non-institutional sources, dominated by Makhana traders/wholesalers followed by moneylenders and cooperatives/SHGs.

Table No. 3.11 : Borrowing Status of the Sample Growers.

SN	Particulars	Traditional : Pond/Jalkar ACZ – I : Darbhanga	Field System ACZ-II: Katihar	Overall
i.	No. of Growers who Borrowed	61 (100.00)	53 (100.00)	114 (100.00)
ii.	Average Amount of Borrowing (Rs)	18972	12350	15893
iii.	Average Amount of Outstanding	11500	9700	10663
iv.	Institutional Source of Borrowings			
	a. CBs	---	---	---
	b. RRBs	---	4	4
	c. Cooperatives/SHGs	3	7	10
	Total	3 (4.92)	11 (20.75)	14 (12.28)
v.	Non-Institutional Source of Borrowings			
	a. Traders/Wholesalers	35	26	61
	b. Cultivators	---	3	3
	c. Moneylenders	23	13	36
	Total	58 (95.08)	42 (79.25)	100.00 (87.72)

*Source: Primary Survey
In brackets percentage to total are given.*

In fact sales of the produce are linked with the loans taken from the traders/local wholesalers, who have their own cartels. There was linkage of

sales with non-institutional credit facilities. Farmers and processors lost their bargaining capacity in exchange of credit facilities from the local

wholesalers. Amount of credit was generally fixed against the expected value of the produce @ 5 per cent per month interest. That is why the producers and processors have little choice of selling their produce except to few traders/wholesalers. So, production and processing of the Makhana sector were largely associated with the cartel of traders/wholesalers as they provided credit facilities to them. Above analysis reveal that the cost of credit is high, due to no choice or little choice of selling the produce.

3.14 Constraints as Perceived by the Farmers, Processors and Market Functionaries

In order to identify constraints in production, processing and marketing of Makhana; farmers, processors and marketing intermediaries in the sample districts, apart from other locations, were discussed, ranked and presented separately in tables 3.12, 3.13 and 3.14 respectively.

3.14.1 Production Constraints

As is evident from table 3.12, the order of constraints varies. Altogether 11 major constraints relating to different issues of production were identified and ranked as per Garret ranking table, which helps to understand the order of the constraints. Among the constraints

at the overall level, use of traditional cultivars got the first rank. In fact, production is restrained due to use of traditional cultivars in a time when two new high yielding cultivars size; Swarna Vaidehi and Sabour Makhana - I were being promoted under Makhana Vikas Yojana launched by the State Department of Horticulture, which could produce 28-32 quintal/hectare instead of 10-12 quintal/hectare from traditional cultivars, thus this constraints was considered as first and foremost, followed by uncertainties in profit mainly as a result of short term leasing of jalkar and renting of low lying field at the village level. These two scored for second and third rank respectively. Certainly harvesting of Makhana is drudgery and costly. The labourers' painstaking nature of harvesting process is the important point of strength, which requires the individual to dive into the open cold waters during winter time and collect Makhana seeds under water. Besides, high cost of harvesting can be attributed to limited availability of skilled and hardy labour force (mainly of the mallah community) and harvesting in three phases sequentially with less production and more remuneration and thus, it qualified for scoring the fourth rank.

Table 3.12 : Major Constraints in Production of Makhana

SN	Constraints	Garret's Rank		
		Traditional : Pond/Jalkar	Field System ACZ-II:	Overall
i.	Distribution of jalkars at the village level is besieged with numerous inefficiencies	II	XI	VII
ii.	Siltation or sand filling of beds of water bodies	V	X	VIII
iii.	Uncertainties in profit due to short-term leasing of jalkar and renting of field	I	VI	II
iv.	Use of traditional cultivars	III	I	I
v.	Lack of working capital due to weak economic status of cultivators	VI	II	III
vi.	Infestation of aquatic weeds	IX	IX	XI
vii.	High health risk particularly of women & children	XI	VII	X
viii.	Drudgerous and costly harvesting	IV	V	IV
ix.	Lack of technical interventions/backstopping	X	VIII	IX
x.	Climatic stress --- Drought, percolation of water	VII	IV	V
xi.	Lack of Irrigation facilities led to problem of maintaining water level in pond/jalkar/field	VIII	III	VI

Source: Primary Survey

Constraint like climatic stress resulting from drought and percolation of water is one of the important constraints, which ranked fifth. Further, makhana is cultivated in pond and field system both apart from natural depressions of oxbow lakes, wetlands etc. where during summer time, at least 2 to 3 feet of standing water is required and to maintain the requisite water level irrigational facilities are essential, which

lack in the study area particularly. And thus, this constraint scored for sixth rank, among the constraints faced in makhana production.

Moreover, makhana sector is besieged with a number of constraints and of them distribution of jalkar at the village level is a major one which scored seventh rank. As per the **Bihar Fish Jalkar Management Act, 2006** settlement of jalkars are made to Block

level Fishermen Co-operative Societies generally for 5 years subject to annual deposition of the reserve jama. Further the Block level fishermen co-operative society distributes the jalkars to its members only, which generally did not perform fairly. Nepotism, allocation to non-members, influence of strongmen etc. have gripped the distribution system, mainly having been lured to fetch subsidies from out of the development schemes of Makhana and fisheries sector. Siltation or sand filling of the beds of water bodies due to recurring floods, lack of technical support, involvement of women and children apart from male in drudgerous harvesting, health risk to them and infestation of aquatic weeds perceived and scored for constraints being ranked as eighth and onwards respectively.

3.14.2 Processing Constraints

Constraints experienced by the farmers and processors in processing of Makhana with their ranks are presented in table 3.13. Some of such significant constraints are constraint in processing. Constraints in processing have also been identified and ranked. As is

revealed from the table 3.13 that lack of mechanical processing scored the first rank at the overall level. This makes the role of humans pivotal to the processing process, as processing machine developed by CIPHET was not so successful and also out of reach of the processor. Thus, the problem of makhana processing was that it is completely traditional or manual, which requires huge skilled human labourers belonging to a particular community i.e., 'Mallah' while mechanized processing was a costly affair (Rs. 3 lakh approx.). Besides, this lack of processing cluster or common facility centre also hindered processing practices. Local processors with their small size of output, lack of ready to consume local market, drudgery involved in processing, high dependency on traders, poor socio-economic conditions of the processors, lack of infrastructural support like; hygienic working place, credit support subsidies on equipments/machines etc. were the major problems.

Table 3.13 : Major Constraints in Processing of Makhana

SN	Constraints	Garret's Rank		
		Traditional : Pond/Jalkar ACZ – I: Darbhanga	Field System ACZ-II: Katihar	Overall
i.	Lack of mechanical processing as manual processing requires skilled human labour	III	I	I
ii.	Small size of output	IV	VIII	VI
iii.	Drudgery activity	II	VII	IV
iv.	Lack of subsidy on roasting and popping machines	XI	X	XI
v.	Lack of ready to consume in local market	V	II	III
vi.	Lack of infrastructural support	IX	X	IX
vii.	Lack of processing cluster or common facility centre	I	III	II
viii.	Migratory mode of life	X	XI	X
ix.	High dependency on traders	VI	IV	V
x.	Low demand due to less popularity of the produce	VIII	VI	VII
xi.	Weak socio-economic condition of processors	VII	V	VIII

Source: Primary Survey

In addition to above, the processors were bound to spend their lives in migratory mode as they used to leave their original or permanent abode with their family and sometimes relatives also for six months or so and temporarily settled in Makhana producing belts for their livelihood, which are naturally hard and unsecured. However, these constraints somewhat varied in their rankings with respect to the sample districts.

3.14.3 Marketing Constraints

Constraints in marketing of makhana mainly faced by makhana processors and market functionaries were identified, ranked and presented in table 3.14. The makhana marketing system has been well organized in the hands of a few big traders who dictated prices and earned a lot at the cost of poor farmers. About 60-70 per cent of makhana is routed through wholesale markets at Delhi, Mumbai, Varanasi,

Kanpur etc. which are considered to be the most important markets. Due to lack of local demand, farmers are completely dependent on organized traders for disposal of their output and thus, ranked first among all other constraints. The processors and wholesalers involved in makhana trade formed a cartel and enjoyed monopoly position. The price is determined by the will and wishes of the wholesalers and not by the demand and supply forces of the market. The cartel system was so strong in makhana seeds as well as makhana pops that it was difficult for farmers and processors to change the preferred seller particularly in absence of specified mandis in the state itself. On an average Rs. 65/kg was charged for transporting makhana to Delhi based wholesale markets by roadways whereas if the same quantity was

transported by Railways only Rs. 28-30 could be charged. But Railways did not consider makhana's weight; rather charges were determined at par with the cereals. In this way transportation became costlier. Lack of infrastructure support, brand building exercises by large retail companies, lack of value added products such as ready to eat products along with its promotion, hindrance in export due to being a minor crop and so makhana has no separate HS code i.e., it fell in the category of other products, imposition of GST @ 18 per cent and lack of terminal market in the state for export, however, a terminal market is being constructed at Bihta, Patna were also some of the major concerns, faced by the market intermediaries.

Table 3.14 : Major Constraints in Marketing of Makhana

SN	Constraints	Garret's Rank		
		Traditional : Pond / Jalkar ACZ – I: Darbhanga	Field System ACZ-II: Katihar	Overall
i.	Lack of Infrastructural support	V	VIII	VI
ii.	High transportation costs	IV	V	V
iii.	Cartel of market entities/monopoly position	I	IV	II
iv.	Being a minor crop, hindrance in export	IX	X	IX
v.	Lack of local demand led to dependency on organized traders	II	I	I
vi.	Imposition of GST	X	XI	X
vii.	Lack of terminal market in the state	XI	IX	XI
viii.	Absence of specified mandis in the state	VI	II	IV
ix.	Determination of price is on the will and wishes of wholesalers and not by demand & supply forces	III	III	III
x.	Lack of value added products and its promotion	VIII	VII	VIII
xi.	Lack of brand building exercise by large retail companies	VII	VI	VII

Source: Primary Survey

3.15 Selected Case Studies

Out of the sample, as mentioned in table 2.1, a few case studies on important stakeholders, who were engaged in

makhana sector in integrated manner, have also been made. The details of case studies are presented in table 3.15 and ensuring boxes:

Table 3.15: Details of Selected Case Studies

SN	Name	District/Location	Activities
1.	Rajesh Sahni	Darbhanga	Producer-Cum-Trader
2.	Md. Sahid Parvez	Saharsa	Processor-Cum-Trader
3.	Shailendra Kumar Jaiswal	Katihar	Trader
4.	Saajan Sahni	Katihar	Primary Processor/Phodia

Source: Primary Survey.

Case Study No. 01: Rajesh Sahni, Producer-Cum-Trader M/s Maa Vaishnavi Makhana, Benipur, Darbhanga, Bihar

Rajesh Sahni (maavaishnavimakhana@gmail.com), aged 33 years, secondary passed, belongs to Banpar sub-cast of Mallah community of Sunderpur, Sahni tola, Ward No. 04, Darbhanga is the proprietor of M/s Maa Vaishnavi Makhana, Benipur, Darbhanga. Involved in the Makhana sector since 1998 when he was only 8 years old and the then price of Makhana was @ Rs. 65 to 80 per kg. At present he is a Makhana cultivator as well as trader. He formed a FPO in the name of his village, Benipur Federation Farmer Producer Company, Darbhanga during 2019-20. His wife Smt. Archana Kumari, 28 years, MA (Home Science), is the CEO of the FPO.

Operating four leased-in ponds with a total water area of 12 acres, of which 2 are devoted to integrated farming (Makhana + Fish) and in another 2, only Makhana is grown. As reported the lease-in rate of his ponds was on an average Rs. 1000 per katha for a year (1 acre = 22 kathas).

Mr. Sahni has been awarded by BAMETI, Directorate of Horticulture, ICAR--NRC for Makhana (Darbhanga), Aatma (Darbhanga), District Agriculture Officer (Darbhanga) etc. Her wife has also been awarded by the District Administration for total Development of Makhana in May, 2022 under ODOF Scheme for which the District had received the **PM Excellence Award - 2021**. Both have attended and participated in different training programmes, workshops, meetings held at the district and staff levels for the development of Makhana. Besides, he uses Neem Ka Khalli, Cow dung, ash, natural shampoo etc. in place of chemical fertilizers and pesticides. No application of farm machineries was reported by the entrepreneur.

Per acre cost of cultivation was reported to be about Rs. 20,000/- and yield rate 8-9 quintals. No application of improved varieties of Makhana seeds such as *Swarna Veidehi (2013)* and *Sabour Makhana - I (2016)* was reported by him. Improved varieties were also not used in the neighbouring areas. Harvesting and processing are tedious and thus, suggested for mechanical interventions. However, he said that mechanical processing would be possible only when the crop size is large. As of now, Makhana is a minor crop. Machine for popping is ready and the trail has been successful but its price being very high (Rs. 3 lakh approx), it was not accessible to the resource crunched farmers. He believed that mechanical processing was not needed; rather the first and foremost need was to create demand by popularizing the product and promoting value addition. He has launched many ready to eat value added products like; sugar free Makhana kheermix, chura-mixture, biscuits, candies, etc. but in absence of proper brandings of the products, marketing issues came up. Though he sold Makhana pops locally and to a few institutional buyers like; Reliance, various Co-operative Companies in Gujarat & Mumbai markets through on-line deals.

His wife **Smt. Archana Kumari** has been benefitted under Mukhyamantri Mahila Udyami Yojana on 08/05/2021 for which an amount of Rs. 10 lakh was sanctioned with 50 per cent subsidy. The loan amount was to be repaid in 84 equal installments. Mr. Sahni is also one of the beneficiaries of a state plan scheme i.e., Bihar Makhaa Vikas Yojana (BMVY). Under the scheme, a sum of Rs. 26,000/- was received by him, which had then been revised to Rs. 72,750 per hectare (75% subsidy against Rs. 9000 per hectare cost of cultivation).

Finally, he suggested for mechanical harvesting to save time and money, rationalization of freight rate for Makhana by the Railways as the Railway Considers Makhana at par with other cereals subsidy on puffing, packaging and other machines, strict adherence to **Bihar Fish Jalkar Management Act, 2006** that restricts others in distribution of Jalkars at the village level except to the members of Block level Matsyajeevi Cooperative Societies and Formation of Makhana Marketing clusters at important locations. With implementation of these measures, Bihar will certainly be a **GLOBAL MAKHANA HUB** in no time.

Case Study 02: Md. Sahid Parvez, Processor-Cum-Trader

M/s Agro Farm Solutions Pvt. Ltd. Saharsa, Bihar

(Email: ofspl12016@gmail.com)

Md. Sahid Parvez, 50 years, M Sc (AMU), is the proprietor of M/s Agro farm Solutions Pvt. Ltd. Saharsa; supported by RKVY-RAFTAAR, MoA & FW, Government of India under start-up Agribusiness Incubation Programme (SAIP-II) in 2020 by the Bihar Agricultural University (BAU), Sabour. The MVP of the enterprise is Roasted Makhana Seeds. Raw Makhana seeds are roasted and stored for 8 months and popped into LAWA during the whole year. It is the USP of the enterprise. The enterprise is fully automated with a mechanical processing platform of Makhana for farmers and branding the product. Obviously the domain is farm mechanization, post-harvest and food technology.

Engaged in Makhana processing and marketing since 2013, Mr. Md. Parvez purchased a Makhana popping machine from CIPHET, Ludhiana in the same year for Rs. 3 lakh. As of now that popping machine is available in its 5th model/generation after several improvements. Once there were nine popping machines in Bihar comprising four in Government Institutions viz., 2 at ICAR-- NRC for Makhana (Darbhanga), one each at KVK, Jalalgarh (BAU) & Bhola Paswan Shastri College of Agriculture (BAU) at Purnea for demonstration, training and own farm operations. Remaining 5 were in private hands including one with Md. Parvez. Out of these popping machines, only one is functional and that is with Md. Parvez, fully involved in R & D of the Makhana sector followed by trading (since 2019). He also arranged several visits & training programmes and the recent one was a 5 days' Training Programme on Makhana Roasting (12-16 November 2022) at his enterprise with a key Resource person of CIPHET, Ludhiana namely Dr. R K Vishwakarma (*Sr. Scientist*). He believes that creation involves pain. Very soon he was likely to start manufacturing the popping machine as he had already obtained the Manufacturing License from the Government.

Mechanical processing requires large production as the installed capacity of the popping machine is 15 kg of roasted Makhana seeds per hour. Md. Parvez bought Makhana seeds from nearby growers by deploying his own staff and thereafter except sun drying (natural) and grading (manual) the entire activities under post-harvest technology such as pre-heating and tempering, roasting and popping, polishing, grading and packaging were performed mechanically. Crunchy Makhana was also produced in his firm and sold under the brand name of ZYKA. During the last year (2021-22), his business value (marketing of makhana) was Rs. 3 lakh. He performed business in online mode and platforms such as Philip card, Amazon etc. and packed supplies to distant mandis located at Hyderabad, Bengaluru, Nagpur, Kanpur etc.

Main constraints highlighted by him were blockage in processing, seeds lie in the fields if cultivation increased, with the provision or increase in subsidies--- chain increased, imposition of GST@5% below the packet of 20 kg, rail freight rates were based on volume in place of weight, non-availability of export terminal in the state, less focus on research & development in mechanical harvesting & processing, low awareness about its medicinal & nutritional value etc.

The entrepreneur suggested focused attention and assistance in R & D activities particularly in processing to CIPHET, SAUs & others for removing the blockages in processing, promotion of produce in internationally and domestic markets both, emphasis on demand for providing subsidies on six important machines; such as seed harvester (after developing), seed washer, seed drier, grader, roasting machine and popping machine. In fact hand touch free processing devices are desired in view of increased concerns for hygienic foods.

Case Study 03: Shailendra Kumar Jaiswal, Trader

Village : Barari, Katihar, Bihar

Shailendra Kumar Jaiswal, 53 years, Matriculate, a resident of Barari village and block of Katihar district in Bihar, is involved in Makhana trading business for the last 25 years. He is largely operating in Katihar & Purnea markets at local and Delhi & Varanasi mandies as distant markets. For storage, total capacity of godowns was 5000 sq feet, which were owned and rented both. Invested about Rs. 25 lakh and earned up to 20 per cent of the total sales' value.

The business model is integrated like; purchase of Makhana seeds is being done directly from the producers and after getting them processed on payment of processing charges then after sorting, grading and packaging the processed seeds were sold to local or distant wholesalers (through CA); secondly, purchase of Makhana pops was made directly from primary processors/phodia and sold to retailers or wholesalers. Thirdly, purchase at discounted price from producers (of Makhana seeds) and primary processors (Makhana pops) as a result of financing made to producers and primary processors in production and processing activities respectively.

As yet, he is an unregistered trader and thus, transactions were made in cash for local business and RUKKA for outside/distant businesses. RUKKA (Hundai) is one of the traditional Indian Negotiable Instruments since ancient times for transfer of money but this system was affected by NI Act, 1981. It substantiates that the makhana sector is still unorganized.

Major marketing constraints as enumerated by him were three times high freight rates for Makhana transportation through Railways, high custom and excise duties, decline in prices after 2nd phase of COVID-19 pandemic, high mandi tax (@7½ %) etc.

Advocated for establishment of at least two Makhana mandies at Katihar/Purnea & Darbhanga, promotion of the produce & products at domestic and international levels both, certification or branding facilitation etc. so that GI benefits could be reaped by all the stakeholders with respect to their stakes.

**Case Study 04: Saajan Sahni, Primary Processor/Phodia
Village - Kadua, Block - Benipur, District. - Darbhanga, Bihar**

Saajan Sahni, 24 years, married, belonged to Mallah community, Middle level education, a resident of Kadua village of Benipur block in Darbhanga district. A seasonal migrant for traditional vocation, passed on to the next generations from time immemorial. This time he has come to Barari, Katihar district along with his younger brother (married) namely Mukesh Sahni (22 years) with families, comprising 4 adults and 3 children. Also carried tools and kits of processing such as; iron pan of different sizes, wooden hammers, baskets (made of bamboo splits), sieves of different sizes along with their utensils, clothes, beds and other essentials.

Hired a thatched roof structured area (12' x 20') with open area (40' x 20') surrounded by bamboo lights on fixed rent (Rs. 50 thousand for 6 months). With respect to amenities; a hand pump, kutcha toilet and one electricity point were found. Almost similar nature of structure was also seen for other phodias. All adult members were engaged in processing but the participation of women was significantly large, as most of the experts of this conventional technology belonged to women of 'mallah' community of north Bihar. They work round the clock mainly as a chain of activities, which are required to be followed one after next.

While performing his traditional vocations, a business model was also noticed. That was purchasing of raw seeds (on cash or deferred payment) then after processing or puffing Lawa was sold to the local traders. This way these phodias sometimes entered directly into marketing activities also. But they gained little as they were generally resource crunched. In this case, Mr. Sahni had borrowed a sum of Rs. 5 lakh @Rs. 4-5 per hundred per month for operating the noted business model. In addition, he got on an average Rs. 850 per quintal as remuneration for processing of makhana seeds. Despite all these limitations and pains their lives and livelihoods remained at subsistence and of course migratory in nature, which have their own drawbacks and inefficiencies.

Lack of processing clusters, non-allotment of area for their seasonal settlement/habitation, lack of credit facilities, controlling and the determining prices by big traders, lack of welfare measures specifically for women and children etc. were the major problems; reported by him.

Indeed, processing of makhana is restricted to Bihar only, so there is need to provide basic facilities to the phodias (belonging to Mallah community) so that compulsion of their migration outside the state in search of other non-traditional jobs could be stopped or at least mitigated.

CHAPTER – IV

CONCLUDING REMARKS AND POLICY SUGGESTIONS

4.1 Introduction

Euryale ferox Salisbury (Makhana), an important aquatic minor crop, has tremendous potential to support the livelihood of resource poor farmers, particularly belonging to the fisherman/mallah community in the Eastern region of India, where agriculture is, by and large, complex, diverse and risk prone. It has a fair distribution in North-Eastern and Eastern Regions, Jammu & Kashmir, however, commercial cultivation is confined only in the northern part of Bihar. In order to tap the potential of seasonal water bodies of Eastern and North-Eastern regions, Makhana cultivation offers a unique opportunity. It is a cash crop and marketed in the form of popped Makhana commonly known as Makhana *lawwa*. India produces 90 per cent of the world production of makhana.

In Bihar, Makhana is mainly cultivated in the flood prone areas' and is an important crop of Mithila and Kosi-Seemanchal regions of the state. Its cultivation is highly tedious, cumbersome, labour intensive and

involves human drudgery. Bihar is a leading producer of Makhana, accounting for 90 per cent of India's total production. Of the 38 districts in Bihar, Makhana is largely cultivated in 09 (*nine*) districts namely; Sitamarhi (*Tirhut Division*), Darbhanga & Madhubani (*Darbhanga Division*), Saharsa & Supaul (Kosi Division) and Araria, Kishanganj, Purnea & Katihar (*Purnea Division*). These districts are in north-eastern part of Bihar and lie sequentially in Mithilanchal, Kosi and Seemanchal regions and Agro-climatic zones - I (North-West Alluvial Plain) and II (North-East Alluvial Plain) respectively of Middle Gangetic plain region.

In absence of a reliable database, the area under Makhana cultivation till the 1980s was estimated at 10,000 hectare, which has now increased to 35224 hectare in 2021. The seed and pop production are 56389 tones and 23656 tones respectively in 2021-22. The estimated value of production at farmers' end in 2020 was estimated at Rs. 250 crore and the generated revenue at Rs. 550 crore at the traders' end.

Makhana is a crop that goes under 100 per cent processing and the entire system of Makhana processing is manual till date, which is carried on by the generations from time immemorial. The popping process is highly skilled, tedious, time consuming and painstaking. Most of the experts of this technology belong to the women population of a specific Mallah community of north Bihar. Natural concentration of these experts is limited to a few parts of north Bihar particularly in Darbhanga and Madhubani districts and that is why the processing of Makhana is restricted to Bihar only. After processing Makhana pops are sold to local and distant markets situated across the country. Major markets of Makhana seeds in Bihar are Darbhanga, Madhubani, Katihar and Purnea while the major markets for processed Makhana outside the state are in Delhi, Varanasi, Kanpur and Indore. But the Makhana supply chain is lengthy as there are many market intermediaries between the farm gates to the end product markets.

The year 2014 was a game changing year for the Makhana sector when the Prime Minister in the course of Parliamentary Election campaigning vowed to boost Makhana cultivation,

processing and marketing. Subsequently initiatives made by the Government of India and Government of Bihar have helped the Makhana sector in ramping up production with marketing and strengthening the farmers. Further in 2020 out of the major economic package of INR 20 lakh crores made under the *Atmanirbhar Bharat Abhiyaan* during the COVID - 19 pandemic, a Scheme of Rs. 10,000 crores was announced for Micro Food Enterprises (MFEs) to promote 'vocal for local with global outreach.' Under the Scheme Makhana was one out of six selected producers. In August, 2022 Government of India awarded the Geographical Indication (GI) tag to Mithila Makhana. It led to extending of Makhana Vikas Yojana in 11 districts, spread over Kosi-Seemanchal and Mithilanchal regions of Bihar. Under the scheme, the Government of Bihar provides financial assistance @ Rs. 72750/ hectare for area expansion. All these efforts brought happiness to Makhana growers as the prices of Makhana were highly remunerative till 2021 but thereafter it again fell tremendously, calling the attention of policy makers and functionaries. Keeping this brief approach or rationale in background, this study entitled

“Supply Chain of makhana Processing and Marketing in Bihar” was proposed to the AER Division, Department of Agriculture & Farmers Welfare, Government of India by this Centre for the work plan year 2021-22, which was accorded permission by the Government of India.

4.2 Objectives of the Study

- i. To study acreage, production, yield and extent of marketable surplus of makhana in the state.
- ii. To estimate the cost of production of makhana in the state.
- iii. To identify the supply chain of makhana marketing in the state.
- iv. To trace the methods, extent and possibility of processing of makhana in the state.
- v. To identify the constraints in production and marketing of makhana in the state, and;
- vi. To review existing interventions and suggest policy measures for necessary improvement.

4.3 Methods, Sample and Coverage

The study is based on both primary and secondary data and information. Primary data was collected from two selected districts, which were from two different agro-climatic zones. These were Darbhanga from agro-climatic zone-I and Katihar from agro-climatic zone-II. Darbhanga is one, out of three potential districts in ACZ-I where cultivation of makhana is traditionally done in pnds/jalkars ecosystem and also recognized as natural adobe of makhana production. In Katihar, makhana cultivation is largely practiced in fields system and it is one out of the six makhana potential districts in ACZ-II. In fields system, makhana cultivation is carried out in agricultural fields at a water depth of at least 1 feet. Similarly from each of the chosen districts, two blocks and villages/cluster of villages were selected for in depth study. A sample of 50 makhana cultivators from each of the selected blocks/villages randomly drawn from the composite list of growers, prepared with the help of local people and stakeholders for the purpose of study. This way a total of 200 makhana cultivator forms the size of the sample for analyzing the results. Besides, a few processors and traders were also

selected for understanding the processing and marketing aspects of Makhana. Out of them, 4 case studies were also conducted. For measuring marketing efficiency different methods were applied. Ranking of problems of respondents was worked out by Garret's method.

4.4 Summary of Findings

- As per latest available data, the area under makhana cultivation in Bihar has increased from 13000 ha in 2012-13 to 35224 ha in 2021-22, registering an increase of 270 per cent during last nine years. Similarly the seed production increased from 20800 tones to 56389 tones and pop production from 9360 tones to 23656 tones during the same period, registered an increase of 271 and 253 per cent respectively. The average yield rate of makhana seed production was estimated at around 16 qtl. per ha during the period. The recovery rate of makhana pop was found to be 41 to 45 per cent.
- In regard to the marketed surplus, APEDA's estimates (2017), data reveals that about 50,000 MT of makhana is

annually produced and out of it about 2 per cent is consumed domestically, leaving a large marketable surplus. Moreover, *Mahaawar* in 2016 wrote that makhana exhibits high marketable surplus. Home consumption of edible/popped makhana accounted for 1.72 per cent and 3.46 per cent as wastages, 3.5 per cent for payment of wages and other and the remaining 88 per cent was estimated as marketed surplus.

- On overall level, per household net operational area of the sample growers was 2.39 acres. The annual rental value of land was reported to be Rs. 16045 per acre. Major source of irrigation was bore well, largely run by the electric energy under agriculture connection.
- Among the crops grown by the sample farmers at the overall level, area under paddy (40.22%) was the largest followed by wheat (19.10%), maize (16.12%), rabi pulses (10.29%), vegetables (7.32%) and others (7%). Cereals accounted for nearly 76 per cent. The cropping intensity was calculated at about 146 per cent.

- On an average, per household net operated area under Makhana cultivation was 2.02 acres and of it 1.84 acres (91.08%) was leased-in. It shows that Makhana cultivation is largely done by marginal and small cultivators who did not possess much of their own land rather largely depended on leased-in ponds/jalkars. The annual average rental value of leased-in area was reported at Rs. 17813 per acre.
- As regards the total paid out cost and return of makhana seeds are concerned, it was estimated to be Rs. 41930 per acre in cultivation of traditional ponds/jalkars system whereas it was a bit higher in field system of cultivation i.e., Rs. 46175 per acre. Further, net returns were Rs. 18093 per acre and Rs. 21241 per acre respectively in both the systems. Per quintal cost of production of Makhana seeds was estimated at Rs. 5554 and Rs. 5497 respectively. The CB ratios were 1:1.43 and 1:1.46.
- Among different components of the cost, harvesting was the major one, which accounted for nearly 48 per cent of the total cost in the traditional ponds system and 41 per cent of the total cost in the field system. These were followed by nearly 38 per cent of the cost on leasing of ponds/lands in both the systems of cultivation of makhana. These two components alone occupied 87 per cent and 80 per cent respectively of the total cost of cultivation.
- The output was estimated at 7.55 quintal per acre in the traditional pond system and 8.48 quintal per acre in the field system. On an average the selling price was reported to be Rs. 7950 per quintal of makhana seeds, which was almost half as compared to the last year's peak price.
- On an average, the cost of processing in the traditional manual system was estimated at Rs. 2575 per quintal of Makhana seeds and out of the total processing cost, labour charge alone constitutes about 70 per cent. The average recovery rate of makhana pops from out of makhana seeds was 44.25 kg per quintal.

- There are 03 marketing channels for marketing of Makhana, as identified in the study area. These are as below:
 - i. Producer --- Aggregator --- Processor (Phodia) --- Local Wholesaler /Trader --- Distant Wholesaler --- Retailer --- Consumer.
 - ii. Producer---Processor (Phodia) --- Local Wholesaler/ Trader/ Commission Agent --- Wholesaler (Distant or Regional)--Retailer-- Consumer
 - iii. Producer --- Processor (Phodia) --- Trader --- Retailer --- Consumer.
- Channel wise estimated volumes of disposals was 70-80 per cent through channel - I (Distant Markets), 20-25 per cent through channel - II (Regional Markets), and 10-15 per cent (local Markets) through channel - III.
- The producer's share in consumer's rupee was 38.19 per cent in channel - I, 34.20 per cent in channel - II and 40.58 per cent in channel - III, meaning thereby the price spreads were 61.81 per cent, 65.80 per cent and 59.42 per cent of the retailer's price respectively.
- For measuring Marketing efficiency in Makhana, four alternate methods were worked out. The traditional method suggests that channel - II was more efficient than other channels but the price received by the producer in this channel was the lowest, so this is not suitable. In *Shepherd's method*, as suggested channel - III was more efficient but it did not consider the price received by the producer. According to the modified marketing efficiency channel - II was more efficient but the margins of market functionaries as compared to marketing cost were very high. *Acharya suggests* channel - II followed by channels I & III is more efficient.
- The figures on the borrowing status of the sample growers reveal that altogether 114 growers (57%) borrowed from different sources and average amount of borrowings and outstanding were Rs. 15893 and Rs. 10663 (67% of the borrowings) respectively. About

88 per cent of the borrowers borrowed from the non-institutional sources.

- The production related constraints, as perceived by the sample cultivators, use of traditional cultivars was the *Garret's* first rank constraint. This was followed by uncertainties in profit due to short term settlement of jalkar and renting of field, lack of working capital due to weak economic status of cultivators, drudgerous & costly harvesting, climatic stress, lack of irrigational facilities, numerous inefficiencies in distribution of jalkar, siltation or sand filling of beds of water bodies, lack of technical interventions, health risk to women and children and infestation of aquatic weeds.
- Among the processing constraints, lack of mechanical processing was the *Garret's* first rank constraint followed by lack of processing cluster or common facility centre, lack of ready to consume local market, drudgery activity, high dependency on traders, small size of output, low demand due to less popularity of the produce, weak socio-economic conditions of processors, lack of infrastructural facilities, migratory life and lack of subsidies on machines, etc.
- The makhana marketing system has been well organized in the hands of a few big traders, who dictated the price and earned a lot at the cost of poor farmers. Among the marketing constraints; due to lack of local demand farmers were completely dependent on organized traders for disposal of their output, followed by formation or cartel by market entities, determination of prices on will and wishes of the wholesalers, lack of makhana mandies in the state, high transportation cost lack of infrastructural support, lack of branding initiatives for makhana and its value added products, being a minor crop hindrance in export, imposition of GST and absence of terminal market in the state.
- While recognizing the immense scope of development in production, processing and marketing of makhana in Bihar, selected stakeholders' views have been captured as Case Studies.

These stakeholders are Producer--Cum---Trader, Processor---Cum---Trader, Trader and Primary Processor/Phodia. The interactions with these selected stakeholders revealed their operational pattern, constraints and solutions as well, which are briefly presented in boxes of chapter - III.

4.5 Policy Suggestions

The study recognizes the immense scope for development in production, processing and marketing of makhana and thus, on the basis of primary survey, observations and discussions with the stakeholders following interventions are required in the area of production, processing and marketing:

4.5.1 Production

- i. Popularization of improved varieties of seeds released so far (*Swarna Vaidehi & Sabour Makhana - I*) for commercial cultivation should be made available adequately to increase the production. And for this, there is need for seedlings preparation at the farmers' level for replacing local/landraces.

- ii. To reduce the requirement of human labour and drudgery involved in harvesting R & D programmes should be focused on crop improvement and affordable & efficient Makhana harvester.
- iii. Leasing of jalkars should strictly be made in accordance with the **Bihar Fish Jalkar Management Act, 2006** and the minimum tenure of distribution of jalkar at the village level should be 3 to 5 years and patta should be in written form so that the allottee could get the Kisan Credit Card (KCC) facility.
- iv. Cleaning and siltation of jalkars/ponds/water bodies should be made at regular intervals along with irrigation facilities particularly in Kosi-Seemanchal regions (ACZ - II) so that minimum level of standing water could be maintained for this aquatic crop.
- v. Scientific and technical interventions, such as training for management of weeds and pests, seed coat, SoP in

adoption of improved varieties of seeds etc. should be made.

4.5.2 Processing

- i. To minimize wastage, reduce skilled labour requirement and get rid of drudgerious activity; mechanized processing is the need of time. Machine is already invented, trailed and updated but not adopted. It requires promotion to institutions like CIPHET (Ludhiana), BAU (Sabour, Bihar) and ICAR's --- Research Centre for Makhana, Darbhanga, Bihar and other interested entrepreneurs on R & D in popping, roasting and other machines; besides subsidization of machines.
- ii. Processing Clusters and Common Facility Centres at some important Makhana hubs/locations should be established for redressal of bottlenecks such as dependency on traders, weak socio-economic conditions of the processors, marketing inefficiencies, lack of standardized and hygienic produce etc.

- iii. Promotion for value addition support to Makhana industries is required, as Makhana takes more space leading to high transportation cost, loss of tax revenue etc. Processing and value addition such as; Makhana powder, flakes, soup, candies, kheermix, snacks etc. will increase its value manifold; and will thus be advantageous for **GI tagged monopoly produce of Bihar.**

4.5.3 Marketing

- i. Need to create mass awareness about high nutritional value of the produce, as Makhana is still considered a primitive minor crop with limited consumption across the states and foreign markets.
- ii. There is a need for marketing linkage and brand promotion as marketing is a real challenge in today's world. In-depth understanding of the market needs is required, which can be achieved by strategic market linkages (backward & forward),

- product innovation and standardization of the products.
- iii. Demand for organically grown produce is growing rapidly and Bihar's Makhana is almost grown organically so, if quality certification of the produce is done, the produce may be sold at premium price.
 - iv. Makhana markets are controlled by cartels of market entities which can be undone by organizing FPOs and approaching the non-conventional markets. This will be instrumental in increasing the demand of Makhana, making its market larger and competitive.
 - v. Popularization of Makhana is needed for increasing the demand at all levels. It necessitates participation of Makhaa FPOs & entrepreneurs in exhibitions, fairs, meets/conclaves etc.
 - vi. To enable market discovery price, which is less evident in the Makhana marketing system--- financial dependency of the cultivators and processors need to be minimized. It will also promote the cultivators in Makhana value chain and enhance farmers' integration with the market.
 - vii. Infrastructural support like; allotment of separate HS Code for export, subsidized freight rate for transportation through Railways, establishment of Makhana mandies in Bihar, storage assistance, promotion to Makhana food industries etc. is highly required.

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COMMENTS ON THE DRAFT REPORT

**Agro-Economic Research Centre, Bihar and Jharkhand
TM Bhagalpur University, Bhagalpur-812007**

Comments from Agro-Economic Research Centre, JNKVV Jabalpur (M.P.)

- 1) Title of the Draft Report Examined: Supply Chain of Makhana Marketing and Processing in Bihar
- 2) Date of Receipt of Draft Report: 01.06.2023
- 3) Date of Dispatch of the Comments: 15.06.2023
- 4) Comments on Draft Report:
 - a. Objective 1 is not addressed in Chapter-III (Results and Discussion), although information regarding this is mentioned in Chapter-I (Introduction). It will be better to shift this portion from Chapter-I to Chapter-III. The Primary data collected from the field survey may also be analysed in the same manner for making the manuscript more valuable.
 - b. To estimate cost of production of *Makhana* (Objective 2) should match with subhead 3.5 i.e. cost and return on cultivation of *Makhana* (page 24).
 - c. It seems that instead of stratified random sampling technique, purposively sampling was used for selection of districts and snowball sampling technique was used for drawing sample. Therefore, make necessary correction accordingly.
 - d. Table 3.1,3.2,3.3,3.4,3.9, 3.10, 3.11 and 3.12 should be synchronised with table 3.5 (Traditional-Ponds/*Jalkars* Vs Field System) and interpreted accordingly.
 - e. Instead Supply Chain, Marketing Channels are identified and discussed in the Chapter-III. Therefore, it may be better to make suitable correction in objective – 3.
 - f. In Chapter-III only processing of *Makhana* was discussed; therefore It would be better to omit value addition from the objective 4.
 - g. Problems should be replaced with Constraints (as per objective 5) in Chapter III (Heading 3.11).
 - h. Necessary editing is also required for spelling mistakes and grammatical errors.
- 5) General Remark: After going through the Objectives, Methodology, Results and Discussion it is advised to change the title of the report as 'Marketing and Processing of *Makhana* in Bihar' instead of 'Supply Chain of *Makhana* Marketing and Processing in Bihar'.
- 6) Overall view on Acceptability of Report: The overall quality of report is good and covers most of the basic issues related to marketing and processing of *Makhana* in Bihar. The report is informative for researchers and policy makers. The report may be accepted after incorporating necessary corrections as suggested above.

Sd/-
(Hari Om Sharma)

Annexure - II

**AGRO-ECONOMIC RESEARCH CENTRE FOR BIHAR & JHARKHAND
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Action Taken Report

1. Title of the Report : **Supply Chain of Makhana Marketing and Processing in Bihar**
2. Date of dispatch of the draft report : 01/06/2023
3. Date of receipt of the comments on draft report : 15/06/2023
4. Date of dispatch of the revised/ final report : 03/10/2023
5. Action taken on Comments :
 - a. Relevant portion shifted from Chapter – I to Chapter – III
 - b. Matched accordingly.
 - c. Necessary correction made.
 - d. Suggested tables synchronized and interpreted accordingly
 - e. Suitable correction and explanation made.
 - f. Omitted accordingly.
 - g. Replaced accordingly
 - h. Done.

As per comments, the write-up modified accordingly.

Ranjan Kumar Sinha
Research Officer-Cum-Principal Investigator



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