Directorate of Horticulture
Bihar

MAKHANA (*Euryale ferox*)

Bihar Horticulture Development Society, Patna

Contents

1. **Description of makhana crop:** 3
   - **1.1 Origin:** 3
   - **1.2 Importance:** 3
   - **1.3 Nutritional value:** 3
   - **1.4 Medicinal value:** 4
   - **1.5 Distribution:** 4
   - **1.6 Cropping Pattern:** 4
   - **1.7 Demand and supply scenario of Makhana produce:** 4
2. **Area, production & yield of Makhana (FY 2019-20) in Bihar:** 5
3. **Important varieties notified:** 6
4. **Crop production practices:** 6
5. **Issues in Makhana Popping** 7
6. **Prominent institutions working towards improvement and development of makhana:** 7
7. **Government Schemes promoting Makhana in the state** 7
8. **Bihar's journey in getting the GI tag for Makhana:** 9

MAKHANA (Gorgon nut/ Fox nut) *Euryale ferox.*

1. Description of makhana crop:

Makhana is an exclusively self-pollinated plant in which fertilization takes place at an early stage of their development. It is a most popular, ceremonial, and unique product of Bihar. Makhana cultivation provides livelihood to thousands of resource poor farmers, particularly in Bihar. It is a cash crop and is marketed in the form of popped makhana commonly known as Makhana Lawa.

1.1 Origin:

Makhana plant is considered as a native of South- East Asia and China but distributed to almost every part of the world.

1.2 Importance:

Makhana is one of the most common dry fruits and has low fat content, but in rich in carbohydrates, protein, and minerals. Makhana is used for milk-based food preparations like kheer, puddings and curry, snacks. It serves as a source of starch for textile industries and has appreciable amount of amino acid. The expanded and popped kernels are used in almost all the *Vedic* oblation and other religious rituals.
Besides medicines, Makhana is used as starch for coating in the quality fabrics like Banarasi sarees etc. Despite the unique properties of makhana, the consumers have lack of information about the product and its various uses. The benefits of the wonder crop have not been disseminated properly and the sector needs urgent attention.

1.3 Nutritional value:

Nutritional components	Quantity (100 gm)
Fat (Low)	0.1 gm
Carbohydrate (High)	76.9 gm
Proteins	9.7 gm
Minerals	0.5 gm
Calorific value	raw seeds - 362 k cal puffed seeds - 328 k cal (*Close to staple foods like wheat, rice, other cereals, and some aquatic plants like Nelumbo and Trapa*)
It is considered as dry fruit (panchmewa) and is comparable with almond, walnut, cashew nut and coconut	
It falls under one of the superior food qualities, which is reflected in its **high amino acid index (89% - 93%) and arginine + lysine/proline ratio (4.74 - 7.6).**	
The values relating to essential amino acid index (EAAI) and chemical score (CS) of makhana are close to that to fish (Jha V, et. al, 1991). The of essential **amino acid index (EAAI) in raw Makhana and popped Makhana are 93 per cent and 89 per cent** respectively which are higher than the values for rice (83 per cent), wheat (65 per cent), bengal gram (81.5 per cent), cow's milk (88.8 per cent), fish	

(89.2 per cent), and mutton (87.24 per cent).

1.4 Medicinal value:

- Makhana has medicinal value and is recommended for treatment of many diseases especially rheumatic and bile disorders.
- It is used as a tonic and for the treatment of leucorrhoea and have good immuno-stimulant property.
- A lot of medicinal uses are recommended in the Indian and Chinese system of medicine. It is also used in heart disease because of high amounts of thioredoxin-1 (Trx–1) and thioredoxin-related protein-32 (TRP32) content.
- The rhizome of the plant is used as diuretic and in the treatment of dropsy, jaundice, anti-inflamatory, scabies and gonorrhoea.
- Ripe seeds are used in the treatment of chronic diarrhoea. Makhana contains flavonoids which are antioxidants and reverse the adverse effects of free radicals in the body (Song et al., 2011).
- Makhana is known as anti-aging foods because of powerful antioxidants, besides aphrodisiac properties.

1.5 Distribution:

Makhana crop is distributed in South-East Asian countries such as China, Korea, Japan, Russia, North America, Nepal, Bangladesh, Holland, and Pakistan.

In India, it is distributed in Bihar, West Bengal, Assam, Manipur, Tripura, Eastern Odisha, Kashmir, East Bengal, Madhya Pradesh, Chhattisgarh, Rajasthan, and Eastern Uttar Pradesh. However, its commercial cultivation is limited to North Bihar, Manipur, parts of West Bengal and Madhya Pradesh. In the state of Bihar, major makhana producing districts include Darbhanga, Sitamarhi, Mahbubani, Saharsa, Supaul, Araria, Kishanganj, Purnea and Katihar.

1.6 Cropping Pattern:

Makhana is a fresh-water aquatic plant and grows in submerged conditions, flood plain wetlands and shallow reservoirs are the favoured habitats. It naturally grows in stagnant perennial water bodies like ponds, land depressions, oxbow lakes, swamps, and ditches. Growth of Makhana is found best in the locations with hot summers and cold winters. Natural and man-made water bodies in such regions are ideal locations for field cultivation of this crop. Presently, *Makhana* cultivation has spread to off-season lowland rice fields in the districts of North Bihar. It is estimated that *makhana* cultivation done in ponds accounted for 90 percent of total production 10 years ago, while 65 and 35 percent of current production comes from ponds and lowland rice fields, respectively.

1.7 Demand and supply scenario of Makhana produce:

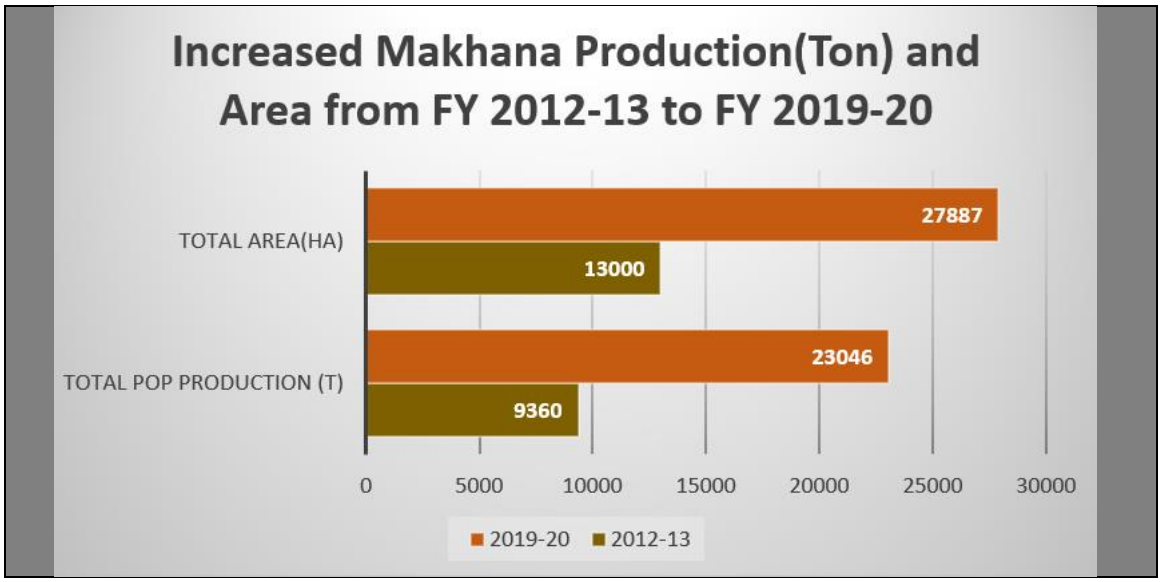
Annually more than 40,000 MT of Makhana pop is traded which is worth thousands of crores. Despite having high demand in the market, the Makhana growers show less interest in harvesting, processing, and marketing of Makhana. Though retail market price of Makhana is equivalent to the high value cash crops like dry fruits, the actual

share of farmer in retail price is too low. Farmers get nearly half of the price paid by the consumers due to their poor participation Makhana harvesting, processing and value addition. Farmers are aware about the fact that they are losing large majority of their profit owing to their inability to harvest, process and market the Makhana in processed form.

2. **Area, production & yield of Makhana (FY 2019-20) in Bihar:**

The state alone produces approximately 90% of total Makhana production in the country. The area under Makhana cultivation has increased by ~114% in last 7 years from approx.13000 ha in FY 2012-13 to 27887 ha in FY 2019-20 and the total pop production has been increased by ~146% in last 7 years from approx.9360 ton makhana pop to 23046 ton makhana pop production.

The increased area and production under Makhana cultivation from FY 2012-13 to FY 2019-20 has been depicted in the graph as below:



The district wise details of area, seed production and makhana pop production in Bihar has been given in the table below:

S.N.	District	Area (Ha)	Total Seed Production (T)	Total Pop Production (T)
1	Darbhanga	3534	7421.4	**23,046.396**
2	Madhubani	3467	7280.7	
3	Sitamarhi	146	277.4	
4	Purnea	5549	11652.9	
5	Katihar	6143	12900.3	
6	Saharsa	2549	5352.9	
7	Supaul	2468	5182.8	
8	Madhepura	1461	2907.39	
9	Araria	1427	2639.95	
10	Kishanganj	1143	2000.25	
Total		**27,887**	**57,615.99**	

3. Important varieties notified:

Only two improved varieties are released for commercial cultivation:

3.1 Swarna Vaidehi:

The seeds of Swarna Vaidehi are bold with average productivity of 28-30 q/ha per pop recovery of 35-40 per cent. This variety showed 60 per cent higher seed yield than local/landraces.

3.2 Sabour Makhana-1:

Seed (Guri) yield of 32-35q/ha and pop recovery of 55-60 per cent. Large spherical leaf, dark purple flowers, medium size fruit; small, oval and smooth seeds with very thin seed coat (0.29mm). Maturity (range in number of days) seed to seed is 240-250 days.

4. Crop production practices:

Parameter	Pond System	Field System
Water requirement	Min 4 to 6 feet	Approx. 1 feet
Seed requirement	80-90 kg/ ha	20 kg. Ha
Source of water	Natural water as perennial water bodies	Irrigation water or any other source of perennial water
Fertilizers and manure	Not possible due to high depth of standing water	Can be applied very easily before and after transplantation
Weed Management	Very tedious	Very easy
Crop duration	Long to very long (8-10 months)	Short (4-5 months)
Seed Yield	1.8- 2.0 ton/Ha	2.6- 3 ton/ Ha
Scope for Grain and Fodder production	Not possible	Water chestnut, rice, wheat, Barseem and other field crops can be grown in rotation
Possibility of maximum no of crops in a year	Two	Three
Intensification of cropping system	Makhana with water chestnut	Makhana water chestnut, Makhana- Barseem and Makhana-rice- wheat
Crop protection measures	Very tedious	quite feasible
Cropping Intensity (%)	In General (100%) in traditional system	200-300%
Net Income	Low to Medium in traditional system	High to very high
Feasibility of Harvesting	Very tedious. It can be done only by trained labourers	Very simple. It can be done even by unskilled labourers
Capital Investment	High to very high depending on the situations	Invariable medium to low
Scope of horizontal expansion of	Limited scope because it would depend on the	Wide scope

Makhana cultivation	availability of natural water bodies	

Harvesting (Buharai):

Harvesting of seed is still carried out by traditional methods. The entire floor of the pond is swept by experienced fishermen to form heaps of the sunken seeds that are scooped out with the help of a horn shaped split bamboo contrivance. Collected seeds are thoroughly thrashed by feet to remove the membranous cover. Time of harvesting is very important for maximum yield. The optimum harvesting time is July-August.

5. **Issues in Makhana Popping**

- The Popping of ***Makhana*** is a laborious, time intensive and cumbersome process
- In a 3-stage manual process, the seeds are roasted in a traditional earthen pot or in cast iron pan at very high temperatures ranging from 250^{o} C to 320^{o} C, tempered for 2 to 3 days, roasted again, and popped manually using a mallet.
- The Malleting after roasting requires highly skilled workers as a few seconds delay in the malleting would lead to poor quality popped *makhana*.
- Popping causes burns and injuries to the processors hands as it involves handling of hot roasted nuts manually.
- Manual popping keeps processors on health risk as during popping season, a day for processors starts at 3 AM and ends at 11 AM usually. Continuous sitting in squatting posture leads to backaches, spine problems and inhaling smoke from the dingy kitchen leads to breathing related health problem.

6. Prominent institutions working towards improvement and development of makhana:

6.1 Bhola Paswan Shastri Agricultural College, Purnea (Bihar Agricultural University, Sabour, Bhagalpur)

6.2 ICAR-RCER Research Centre for Makhana, Darbhanga, Bihar.

7. Government Schemes promoting Makhana in the state

Directorate of Horticulture, Bihar is implementing various schemes / initiatives towards development of makhana sector in the State. The key schemes / initiatives are as follows:

7.1 Makhana Development Scheme: This scheme is 100% state supported to help farmers and promote improved variety Makhana area under Makhana Cultivation in selected districts of Bihar. According to the state government, the cost of cultivation of an improved variety of Makhana in the state is Rs.97,000 per hectare. On this, 75 percent subsidy is being given to the farmers. 8 districts of Bihar named Katihar, Darbhanga, Supaul, Kishanganj, Purnia, Saharsa, Arariya, West Champaran are covered under the scheme.

The major components covered under this scheme are:

a) **Seed Production of HYV** (Sabour Makhana-1 and Swarn vaidehi): Assistance (Rs. 97000/ ha.) for seed production is provided to BPS Agricultural College, Purnea and RCM Darbhanga – 100% subsidy

b) **Demonstration of improved seed** of (Sabour Makhana-1 and Swarn vaidehi) in the field: Assistance (Rs.72,750/ ha.) for demonstration is provided to farmer – 75% subsidy

c) **Capacity building:** It is done with help of the scientist of above-mentioned organization @Rs. 1000 / person. New district like West champaran is included in this scheme.

7.2 **Bihar Agri Investment Promotion Policy (BAIPP):** This scheme extended credit linked capital subsidy for establishment of new unit or modernization / expansion / diversification of existing units in the sectors of Makhana, Fruits & vegetables, Maize, Honey, Seed, Medicinal & aromatic plant and Seed processing. The incentive extended are as follows:

Subsidy/Support	Quantum	Purpose of the support
Capital subsidy* for project cost (land value, land development, plant and machinery, factory building, civil construction, MFA) – credit linked ***cost of land shall not exceed a limit of 10% of the total project cost*** *and* ***land development cost to be capped at 2.5% of the total project cost***	**(i) for individual investors - 15% of the project cost (project cost – min. Rs. 0.25 cr. and maximum of Rs. 5 cr.)** 1st installment – 50% (purchase and installation of plant and machinery) 2nd installment – 50% (commencement of commercial production of the unit / project) **(ii) for Farmer Producer Companies (FPCs) - 25% of the project cost (project cost – min. Rs. 0.25 cr. and maximum of Rs. 5 cr.)** 1st installment – 50% (purchase and installation of plant and machinery) 2nd installment – 50% (commencement of commercial production of the unit / project)	Setting up / expansion & diversification / modernization for agro and food processing units (*definition of expansion and modernization same as BIIPP 2016)*
Scheduled Castes (SC), Scheduled Tribes (ST) and Extremely Backward Castes (EBC) investors, the maximum limit of capital subsidy shall be increased by additional **5%**		
For women, differently abled entrepreneurs, war widows, acid attack victims and third gender entrepreneurs, the maximum limit of capital subsidy shall be increased by additional **2%**		

7.3 Makhana identified as ODOP under Pradhan Mantri Formalization of Micro Food Processing Enterprises Scheme (PMFME scheme)

This centrally sponsored scheme is being implemented by Directorate of Food Processing, Department of Industries, Bihar across the State. Under the said scheme makhana has been identifies as ODOP for districts of Araria, Darbhanga, Katihar, Madhubani, Saharsa and Supaul. The support extended under the scheme include:

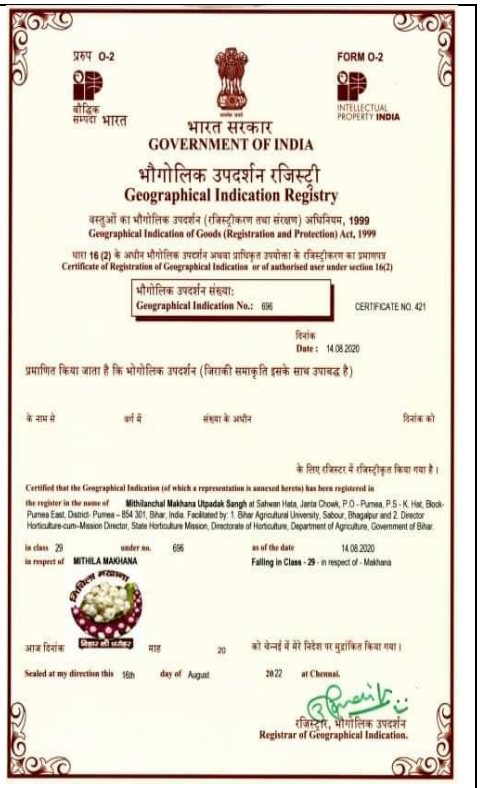
a) **Credit-linked capital subsidy**@35% of project cost (Maximum ceiling of subsidy- Rs. 10 Lakh per unit for individual micro enterprises and for groups Maximum limit of grant in such case would be as prescribed)
b) **Seed capital to SHG members** @Rs. 40,000/- per member for working capital and purchase of small tools
c) Support for common infrastructure would be provided to FPOs, SHGs, Cooperatives, any Government agency or private enterprises - Credit-linked capital subsidy@35% of project cost
d) **Support for Incubation Center**: Cost norms- 2.75 Cr (for 3 to 5 processing lines); Govt. Institute / Organization- 100% of project cost; Private Agency- 50% of project cost; SC/ST category- 60% of project cost
e) **Branding and marketing support limited to 50% of total expenditure**: SPV; Groups- FPOs/SHGs/ Cooperatives; Up to Rs. 5 lakh support per proposals for preparation of DPRs from professional agencies

8. **Bihar's journey in getting the GI tag for Makhana:**

The government has awarded Geographical Indication (GI) tag to Mithila Makhana, in a bid to help farmers get the maximum price of their produce. "Mithila Makhana" which, as indicated by its name, is cultivated in the Mithila region of Bihar and some parts of Nepal — is the fifth product from Bihar which has received the GI tag.

It is important to form Farmer producer Organization (FPO) before applying for Geographical Indication (GI). For this, Mithilanchal Farmer Producer organization was formed on 20/04/2018 under society registration act 21,1860 with the technical support of Bhola Paswan Shashtri College, Purnea (BAU, Sabour, Bhagalpur) with the objective for overall development of Makhana growers and branding of Makhana.

According to the registration certificate, Bihar state's Darbhanga, Muzaffarpur, Champaran, Begusarai, Madhubani and Katihar among other districts have been defined as the geographic location for the production of Mithila Makhana.



प्ररूप O-2 FORM O-2

बौद्धिक सम्पदा भारत INTELLECTUAL PROPERTY INDIA

भारत सरकार
GOVERNMENT OF INDIA

भौगोलिक उपदर्शन रजिस्ट्री
Geographical Indication Registry

वस्तुओं का भौगोलिक उपदर्शन (रजिस्ट्रीकरण तथा संरक्षण) अधिनियम, 1999
Geographical Indication of Goods (Registration and Protection) Act, 1999

धारा 16 (2) के अधीन भौगोलिक उपदर्शन अथवा प्राधिकृत उपयोक्ता के रजिस्ट्रीकरण का प्रमाणपत्र
Certificate of Registration of Geographical Indication or of authorised user under section 16(2)

भौगोलिक उपदर्शन संख्या:
Geographical Indication No.: 696

CERTIFICATE NO. 421

दिनांक
Date : 14.08.2020

प्रमाणित किया जाता है कि भौगोलिक उपदर्शन (जिसकी समाकृति इसके साथ उपाबद्ध है)

के नाम से वर्ग में संख्या के अधीन दिनांक को

के लिए रजिस्टर में रजिस्ट्रीकृत किया गया है।

Certified that the Geographical Indication (of which a representation is annexed hereto) has been registered in the register in the name of **Mithilanchal Makhana Utpadak Sangh** at Sahwan Hata, Janta Chowk, P.O - Purnea, P.S - K. Hat, Block- Purnea East, District- Purnea – 854 301, Bihar, India. Facilitated by: 1. Bihar Agricultural University, Sabour, Bhagalpur and 2. Director Horticulture-cum-Mission Director, State Horticulture Mission, Directorate of Horticulture, Department of Agriculture, Government of Bihar.

in class 29 under no. 696 as of the date 14.08.2020
in respect of MITHILA MAKHANA Falling in Class - 29 - in respect of - Makhana

आज दिनांक माह 20 को चेन्नई में मेरे निदेश पर मुद्रांकित किया गया।

Sealed at my direction this 16th day of August 2022 at Chennai.

रजिस्ट्रार, भौगोलिक उपदर्शन
Registrar of Geographical Indication.