SOCIO-ECONOMIC RESEARCH INSIGHTS
INTERNATIONAL JOURNAL OF SOCIAL SCIENCE
E-ISSN:.....
समाजिक-आर्थिक अनुसंधान अंतदृष्टि
सामाजिक विज्ञान की अंतर्राष्ट्रीय शोध पत्रिका

SERI 2026; 1(1): 02 Received: 10-01-2026 Edited: 22-05-2026

Makhana Farming in Bihar

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Abstract
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. Makhana has been considered as a natural gift to Mithila, a major part of North Bihar. Mithila has an excellent and distinguished cultural and traditional heritage based on its ecology. An ecological study of Mithila reveals that this region is occupied by vast number of wet-lands in the form of ponds, lakes, chaurs, tanks, swamps, canals, road and railway side depressions, which have enormous potential for Makhana cultivation and fish culture. Mithila has a great alluvial plain with a general slope from north to south.

Key words- hydrophytes, cash aquatic crop, development prospects, carbohydrates, protein, minerals, Mithila

Background

Makhana, the wonder pop from aquatic resources, is known as Euryale ferox Salisbury. There are evidences about its wide-spread distribution in Europe and Asia encompassing the temperate and subtropical regions. Their occurrence in northern Europe is documented in several fossil records. However, as the most versatile living fossil among fruits, presently it occurs in wild form in China, Japan and Russia. By far, India is the only country where makhana is being cultivated particularly in north Bihar and lower Assam, Manipur, West Bengal and some parts of Madhya Pradesh. It yields nearly 2.5 thousand metric tonnes of makhana seeds.

Ecologically, makhana grows in shallow water bodies which have a certain amount of organic detritus accumulated at the bottom. Such water-bodies are generally those which occur in rural areas and acquire the characteristics due to man's neglect on one hand and on the other hand due to vagaries of nature.

The significance of makhana pops in fancy diets more for palate rather than for nutrition, its use in religious rituals and offerings, the rarely occurring commodity fetches high price. It is a blessing for the rural poor, especially of north Bihar and lower Assam who have perfected the art of cultivating makhana as a vocation. The traditional involvement of certain localized populations in north Bihar and lower Assam has made makhana an exclusive aquatic crop.

Makhana has not only scientific information but is also significant in traditional way in many states of India. For

instance in Mithila region of Bihar a marital folklore exclusively associated with this aquaphyle, involves its usage during kojagar festival solemnized on the occasion of the full moon day of Aswin (October). It is obligatory for a bride's parents to send makhana to the groom's house for being served to the latter's kith within first year of their marriage. Eating makhana along with betel and betelnut is considered auspicious on this day.

Makhana is a modified name of 'Makhan' having ritualistic importance because of Shakti cult of Hinduism. In Sanskrit Makhan means makh = Yagya and Ann = food (makhan). It means that Makhan (Ann) which is commonly offered in Yagya and rituals. Makhana also finds significance in religious ceremonies in India and is a popular 'fasting' dish prepared during Navratri and other occasions.

Makhana is *Euryale ferox* Salisb. grown in thousands of stagnant freshwater bodies in about a dozen districts of north Bihar. It provides livelihood to thousands of fishing families in the region. It is a potential earner of foreign exchange. It is known for its nutritional and medicinal properties. Recent studies on its dietary evaluation have revealed it to have a good amount of protein (11.5%) with a high percentage of essential amino acid index and chemical score (Jha 1987, Jha et al. 1991). The crop has attracted the attention of biologists and ecologists in this region (Dutta 1984, Laal and Duttamunshi 1985, Dudani et al. 1986).

E. ferox Salisb. is widely distributed in South Asia and is extensively cultivated in north Bihar and in lower Assam. Its wild population is also available in Madhya Pradesh, West Bengal, Orissa, Manipur, Uttar Pradesh and Bangladesh. The plant is best grown in old, perennial water bodies having thick layer of mucky bottom which is rich in nutrients. Freshly excavated ponds or water area with hard substratum are not good for the purpose.

The usual time of seed sowing in north Bihar region is October - November. Seeds (7,000 – 10,000) are required @ 100 - 125 kg/ha water area. Seeds sink to the bottom and germinate in the muck. Sprouting takes place by December - January and the early leaves appear on the pond surface during January - February. Thinning operation is carried out in March - April and samplings are transplanted all over the available water space by keeping a gap of about 1 m in between the 2 plants. During April - May entire water surface gets covered with huge leaves. Flowering starts by early May and the fruits are set by the end of the month. The asynchronous emergence of flowers continues till the plants are uprooted in September - October, thus rendering it the status of an annual crop in north Bihar. Mature fruits burst around August - September and the seeds get scattered all over the bottom. The gigantic leaves are cut and thrown out or left to decay.

Scattered seeds of makhana at the bottom are collected manually during September - October. The process of collection is pretty strenuous involving a thorough sweeping of the entire bottom floor of the water area. Sweeping of floor, making heaps and their retrieval requires several dives inside the water. This makes the job a really painstaking one.

Topography of North Bihar

North Bihar is situated at longitude 83° 20' to 88° 17' and latitude 24° 55' to 27° 31' and comprises 20 districts, out of which Darbhanga, Madhubani and Saharsa are famous for cultivation of Makhana (Euryale ferox Salisbury). It comprises of a large number of natural and perennial wetlands, which are rich repositories of plant and animal gene pool. The wetlands in the form of large number of ponds and tanks of various dimensions are scattered throughout north Bihar with a water spread area of 39,997.16 hectare, covering 42% of the total water spread area of 95,116.84 hectares in the entire state.

Cultivation SystemThe 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 is 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 ox-bow 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.

Makhana Cycle in Ponds

Makhana crop is best grown in age-old perennial ponds having a thick layer of highly nutritive mucky bottom. The herbaceous plants are especially adapted to grow in 1-1.5m deep water. The most favourable and usual time of sowing seeds is October-November. When makhana is grown for the first time in a new pond, the rate of sowing is 90 to 100kg/ha. However, when sowing is done annually, 35 kg of seeds are required for 1 ha water spread area. This is because mature makhana fruits burst and the seeds fall and lie at the bottom of the pond and germinate in the subsequent year. In new ponds the seeds are broadcast on the surface of the pond which gradually sink to the bottom and finally germinate in the muck.

The germinated seeds sprout during February or March. This is the time when thinning operation is carried out and saplings are transplanted all over the available water space by keeping a gap of about 1 m in between the two plants. During April-May, the entire water surface gets covered with huge, sprawling, thorny, elliptical or orbicular leaves which float on the surface of water. The leaf grows as big as over 1 m in diameter. Flowering starts by the end of May. Fruits appear in June. The mature fruits burst around August-September and the seeds get scattered all over the bottom of the pond. During the period the farmers cut into pieces the huge sprawling leaves and throw it into the pond for decay and decomposition. The scattered seeds at the bottom of the pond are collected manually during September-October. Collection of the seeds is generally completed by the end of October. The process of collection of seeds is cumbersome, tedious and strenuous. It involves thorough sweeping of the entire bottom floor of the pond. A team consisting of 20-25 trained fishermen dive into the water one by one and sweep the muddy floor by specially prepared bamboo sticks.

The seeds are accumulated in several heaps which are generally marked with sticks of bamboo. At the end all the heaps are collected with the help of a cylindrical object made of bamboo stakes commonly known as gaanja which is made up of bamboo stakes woven in such a way that the same works like a sieve.

Area and Production of MakhanaArea and Production of Makhana

Bihar is the leading producer of Makhana, accounting for about 90 percent of total production of India and also in the world. Out of the 38 districts of the state, it is cultivated largely in ten districts namely; Sitamarhi, Darbhanga, Madhubani, Saharsa, Supaul, Araria, Kishanganj, Purnea and Katihar. 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 till 2000, which increased to 13000 hectare in 2012-13 and touched to 45000 hectare in 2024-25 (P). Similarly makhana seed production increased from 20800 tonnes in 2012-13 to 75000 tonnes in 2024-25 and popped makhana from 9360 tonnes to 30,000 tonnes during the same period. The details of area and production of makhana in Bihar, is shown in Table No 1.2.

Table 1.1 : Area and Production of Makhana in Bihar

Particulars / Years	2012-13	2019-20	2020-21	2021-22	2024-25 (Provisional)
Area (ha)	13,000	27,887	29,584	35,224	45,000
Seed production (tonnes)	20,800	44,638	47,534	56,389	75,000
Pop production (tonnes)	9,360	18,048	20,634	23,656	30,000

Source: Directorate of Horticulture, Govt. of Bihar, and; Hindustan (dailies in Hindi) dt. 17.09.2025.

Above table reveals that during the period of 2012-13 to 2024-25, the area increased by 246 percent, seed production by 260 percent and popped production by 220 percent. Such a tremendous growth could be made mainly due to introduction of new varieties of Makhana seeds.

New Varieties of Makhana Seeds

Till 2010, makhana was cultivated by traditional varieties of seeds. As of now besides traditional seeds, two improved varieties of seeds are invented namely; Swarna Vaidehi and Sabour Makhana-1. The yield rate of traditional varieties is 1.5 to 2.0 tonnes per hectare of makhana seeds whereas that either Swarna Vaidehi or Sabour Makhana-1 is 3 to 4.0 tonnes per hectare of makhana seed. Swarna Vaidehi was released in 2013 by the Eastern Region of ICAR and Sabour Makhana-1 was developed by Purnea (Bihar) based Bhola Paswan Shastri Agricultural College and released in 2016. The rate of makhana pop recovery is 40 percent in traditional varieties whereas that of 55-60 percent in improved varieties of seeds.

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:

Production

- 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.
- 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.
- 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.
- 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.
- 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.

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