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Makhana (*Euryale ferox* Salisb.): Possibilities for cultivation in Haryana

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ABSTRACT

Makhana (*Euryale ferox* Salisb.) was cultivated at the Botanical Garden, CCS HAU, Hisar during 2022–23 to evaluate its cultivation potential under Haryana conditions. Seeds were sown in October 2022 in puddled clay soil at a depth of 4–5 cm in a water tank containing a 10 cm soil layer. Seedlings emerged approximately one month after sowing, with initial leaves exhibiting a reddish-purple coloration and triangular shape. Plant growth remained slow during the winter months due to low temperature stress, but accelerated from March onwards, producing large, round, spiny leaves. Vegetative growth continued until September, followed by flowering from October 2023 to January 2024. Flowering, seed set, maturation, and seed dispersal occurred simultaneously on different shoots. The seed yield ranged from 50 to 100 g per plant.

Makhana (*Euryale ferox* Salisb.) is cultivated in stagnant perennial water bodies such as ponds, land depressions, oxbow lakes, swamps, and ditches. It is commercially grown in countries like India and China. In India, Bihar is the leading state in makhana cultivation, followed by West Bengal (Kushari and Bhowmik, 2025). The seeds, commonly referred to as “black diamond,” are valued for both nutritional and economic importance. Makhana is a crop suited to tropical and subtropical climates (Mandal *et al.*, 2010).

‘Swarna Vaidehi’ is a high-yielding variety developed by ICAR-RCER, Patna, which has been widely adopted by farmers in Bihar and has played a significant role in the commercialization of this crop. Its adoption has substantially enhanced farmers’

income. Makhana cultivation is particularly popular in flood-prone districts of eastern and northeastern India. It is grown in ponds and waterlogged areas across approximately 10 states, covering about 20,000 ha. Bihar alone contributes nearly 90% of global production (Kushari and Bhowmik, 2025).

Makhana seeds possess medicinal properties, including analgesic and aphrodisiac effects. They are traditionally used in the treatment of chronic diarrhoea, vaginal discharge, impotence, premature ejaculation, nocturnal emissions, and kidney weakness associated with frequent urination. Additionally, makhana exhibits cardioprotective properties (Das *et al.*, 2006). Nutritionally, makhana is a rich source of energy (405 kcal/100 g), protein (11.5%), carbohydrates (64.7%), fat (7.6%), minerals

(2.2%), and calcium (303 mg/100 g). It is widely used in the preparation of various traditional dishes such as kheer, vermicelli, and halwa.

With the increasing extent of waterlogged areas in many regions, makhana offers a viable alternative to utilize such lands productively, particularly after fish cultivation. Considering its economic importance and potential for effective utilization of waterlogged ecosystems, the present study was undertaken to evaluate the feasibility of makhana cultivation under Haryana conditions.

An experiment was conducted at the Botanical Garden of the MAP Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar during 2022–23 to assess the adaptability of makhana under Haryana agro-climatic conditions. Seeds were sown in October 2022 at a depth of 4–5 cm in puddled clay soil within a water tank, maintaining a soil depth of approximately 10 cm. Five plants were randomly selected for recording observations on growth, flowering, and yield parameters. Data were collected on seed germination (days), seedling colour and leaf shape, foliage characteristics, flower colour, number of flowers per plant, number of seeds per ovary, ovary characteristics, seed traits, and seed yield per plant.

Seedlings emerged within 25–40 days after sowing. The initial leaves were reddish-purple and triangular in shape (Table 1). Early growth was slow during the winter season due to low temperature stress, which limited active development. Growth accelerated from March onwards with rising temperatures. During the active growth phase, plants produced large, round, spiny leaves. Vegetative growth continued until September, followed by flowering from October 2023 to January 2024.

Flowering, seed formation, maturation, and seed release occurred simultaneously on different shoots. On average, 10–20 flowers per plant were recorded. Flowers were pink in colour, while the ovary turned whitish-green at maturity and was oval in shape. Each ovary produced approximately 10–25 seeds. The seed coat was initially brown, later turning dark brown to blackish. Seeds were round, with sizes ranging from 0.5 to 1.5 cm. Seed yield ranged from 50 to 100 g per plant.

Makhana cultivation represents a low-cost production system capable of generating high-value produce from otherwise unproductive waterlogged areas where conventional crops cannot be successfully grown. It has strong potential to enhance farmers' income with minimal additional investment, primarily limited to seed cost.

Table 1. Characteristics of Makhana variety Swarna Vaidehi

S. No.	Plant characters	Observation
1.	Seed germination	25-40 days
2.	Seedling colour	Reddish-purple
3.	Seedling leaf shape	Triangular
4.	Foliage leaf colour	Light-dark green
5.	Foliage leaf shape	Round shape
6.	Flower colour	Pink colour
7.	No. of flowers/ plant	10-20 flowers/ plant
8.	Ovary colour	Whitish green
9.	Ovary shape	Oval shape
10.	No. of seeds/ ovary	10-25 seeds/ ovary
11.	Seed coat colour	Brown to dark brown
12.	Seed size	0.5-1.5 cm
13.	Seed shape	Round shape
14.	Seed yield/ plant	50-100 g/ plant

The present investigation demonstrates that makhana can be successfully cultivated under Haryana conditions, particularly in waterlogged areas. Its cultivation offers an effective means of converting otherwise unproductive lands into economically viable production systems. Adoption of makhana farming can enhance farmers' income by utilizing underexploited waterlogged resources with minimal additional inputs. Furthermore, the crop can be integrated into natural ponds and water bodies developed under watershed management schemes. In addition to its economic benefits, makhana cultivation may help reduce water evaporation losses due to its extensive leaf cover over the water surface.

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Conflict of Interest

The authors have no conflict of interest to declare.

Data Sharing

All relevant data are included in the manuscript.

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