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Sabour Makhana-1: A new makhana variety

Sabour Makhana-1 was developed at Bhola Paswan Shastri Agricultural College, Purnea of Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India and was released by State Varietal Release Committee, Bihar on 29 August 2016. Sabour Makhana-1 is characterized by large spherical leaves, dark purple flower, medium size fruits, small oval seeds with very thin seed coat (0.29 mm). It is a high yielding (32-35 q/ha) variety with good quality makhana pop recovery (55-60%). It has moderate field resistance to leaf blight disease (*Altenaria* spp.) and important insect pests, viz. aphid (*Rhopalosiphum nymphaeae*), case worm (*Eiophila depunctalis* and *E. crisonalis*) and leaf midge (Chironomus spp). It is a potential variety to get the higher net return from underutilized and neglected waterlogged areas without eroding natural resources.

FOX nut or gorgon nut (*Euryale ferox* Salisb.), popularly known as Makhana, has been widely used in traditional oriental medicine to cure a variety of diseases including kidney problems, chronic diarrhoea, excessive leucorrhea and hypo function of the spleen. Makhana is the only extant species in the genus *Euryale*. It is a flowering plant classified in the water lily family, Nymphaeaceae, although it is occasionally regarded as a distinct family Euryalaceae. Bihar accounts for nearly 85-90% makhana production in the country. Northern parts of Bihar, comprising districts of Madhubani, Darbhanga, Sitamarhi, Saharsha, Katihar, Purnea, Supaul, Kishanganj and Araria, with similar Agro-climatic conditions are most suitable for its cultivation. Most of the makhana growers grow traditional local genotypes having low seed yield as well as pop recovery (35-40%) resulting in low net returns. Swarna Vaidehi, an improved variety identified and released by ICAR-RCER Research Center for Makhana, Darbhanga, Bihar has yield potential of 28-30q/ha but also low pop recovery of 35-40%. The germplasm collection, evaluation and selection were done to meet the requirement of makhana growers for a variety having higher yield and pop recovery. As a result, an improved selection BR Makhana-7 (IC No. 620551) has been identified and released as Sabour Makhana 1 for commercial cultivation in the state. Sabour Makhana 1 was developed through seedling selection (BR Makhana 7) from the makhana germplasm collected at Bhola Paswan Shastri Agricultural College, Purnea under BAU, Sabour. It has seed (Guri) yield of 32-35q/ha and pop recovery of 55-60% as compared to standard check variety 'Swarna Vaidehi' (seed yield-28-30 q/ha and pop recovery 35-40% only) and other genotypes under test.

Plant morphology

Root: The germination of makhana seed is hypogeal. Upon germination, the cotyledons and hypocotyls of seeds remain in the soil. It has thick fibrous roots comprising 3-5 clusters each consisting of about 15 rootlets. The roots are thick, long (40-50 cm), fleshy and having several air

One day old leaf

Two days old leaf

Fully open leaf

Lower side of leaf

Flower bearing plant

Fully open flowers

Flower size

LS of flower

Mature fresh fruit

TS of fresh fruit

Bursted fruit

pockets. The plant has rhizomatous stem. The rhizome is short, thick and erect. The stem is less prickly, herbaceous with short internodes.

Leaf: The leaves are submerged, oblong, peltate, elliptic or orbicular, corrugated about 175 cm in diameter, reddish green above, deep bluish purple beneath with strong spiny rib which is densely spinous. Spines are sharp and curved, present both on abaxial and adaxial leaf surface. Ribs are dichotomously branched over the whole leaf. Petiole is long wavy and spiny. The leaf while in bud is folded up and enclosed in an involucre, which burst as the leaf expands. Leaf stalk is attached to the center of the lower surface. Leaves have a quilted texture. The stems, flowers and leaves which float on the surface are covered by sharp prickles. Other leaves are submerged.

Flower: The flowers are small and are open for a brief time in the morning and often occur under the water. Flowers are characterized by bright purple colour, long pedicel, consisting of 4 fleshy and goblet-shaped thalami. It is covered with dense and sharp prickles. As flowers open under water, *Euryale* is almost exclusively self-pollinated. The pollens mostly dehisce a day before the flowers open. The flower is 1-2 inches long (2.5-5 cm), bright red or violet inside, green and shiny outside. The flowers are solitary, submerged, and epigynous with four persistent, thorny sepals inserted on the torus above the level of the ovary, together with many seriate petals. Flowers are mostly cleistogamous, but chasmogamous flowers may also be produced. Sepals are four in number, erect in shape and inserted on the edge of the torus above the carpels. Petals are numerous (about 20), violet in colour, shorter than the sepals. Stamens are many in number, many seriate. Fascicled in eight filaments, linear, pollen spherical in shape and three nucleated. Ovary is eight celled sunk in the dilated top of the torus. Stigma is sessile, discoid and concave in shape. The inferior, multicarpellary ovary develops into a spongy berry like fruit. Berry is spongy, 5-10 cm in diameter and it is crowned with persistent sepals.

Fruit: Fruits are big and spheroidal in shape, outer peel is whitish brown and densely covered with sharp prickles. The fruit is a berry, large (5-8 cm diameter), spongy, spiny and crowned with persistent sepals. Each fruit has 20 to 200 seeds with hard black seed coat and a pink mucilaginous aril. The fresh pulpy aril keeps the seeds floating for a few days (about 3-4 days) after they dehisce.

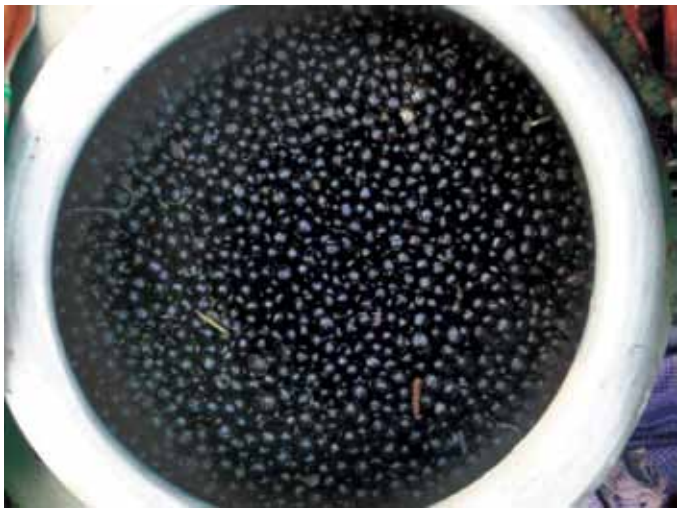
Seeds: The fresh seeds are lumpy, and surrounded by streaked bright red and pinkish arils and keep on floating on water surface until the red aril gets partially decomposed and stick with seed coat. Thereafter, the seeds settle at the bottom surface of pond and acquire black colour. Testa is thick, albumen merely with small embryo. The seeds are oval and smooth with very thin seed coat (0.29 mm).

Production technology

Clayey to loamy soil is suitable for growing successful makhana crop. The field should be ploughed 2-3 times and puddled 3-4 days before transplanting of makhana seedlings. Sabour Makhana 1 is a mid-season maturing variety. The optimum temperature range for its growth, flowering and fruiting in summer season is 20 to 32°C.

Nursery raising and planting

Seeds are sown in the nursery in the month of December. Seedlings are ready for transplanting after 55-60 days of sowing and this stage can be identified by presence of soft spines having 7-9 cm leaf diameter. The colour of seedling turns from bronze to light green. The



Fresh seeds

Germinated seeds

optimum transplanting time of seedlings is February to March at spacing 1.25 m × 1.25 m. About 22-25 kg/ha of seeds is required for raising seedlings and 40-45 kg/ha for direct seeding. For raising seedling, 500 sq meters area is prepared by supplementing 25-30 kg well-decomposed farmyard manure and 20-25 kg lime dust a day before sowing. Seed treatment is done with Imidacloprid 70 WS or thiomethoxam 25 WG @ 5 g/kg seed. The seed should be sown in well-prepared nursery pond/field. The minimum and maximum depth of water in nursery area in field and pond system is 6 inch and 5 to 6 ft. respectively.

Fertilizer application

At the time of field preparation, about 20-22 tonnes of farmyard manure is added to the field. The chemical fertilizer in the ratio of 75 N : 45 P_2O_5 : 30 K_2O + 40-50 kg lime per ha is also required. Half dose of N and full dose of lime, P_2O_5 and K_2O are added at the time of field preparation for transplanting. Rest half dose of N is divided into 4-5 splits and applied as solution which is sprayed on leaves after 20-25 days interval.

Water management

Makhana is an aquatic plant. Sabour Makhana 1 can be cultivated both under field and pond system. Minimum 6 inch water depth is to be maintained in field conditions from transplanting to flower initiation while 5-6 ft is enough under pond system. Minimum 1 ft water must be maintained from flower initiation till harvesting (buharai) of Makhana seed (Gurri).

Weed management

The weeds need to be kept under control especially during early stages after transplanting, since these compete with the main crop for nutrients, water and light. At least 2-3 manual weedings are required in early stages till the water surface gets covered by Makhana leaves.

Harvesting (Buharai)

The Sabour Makahana 1 fruits mature after 240-250 days of seed sowing, hence, the optimum harvesting time is first fortnight of August. Harvesting and processing of seeds is carried out mainly 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 device. Smaller and lighter seeds which float on the water are collected with the help of small nets. Collected seeds are thoroughly thrashed by feet to remove the membranous cover. Sabour Makhana 1 gives seed (Guri) yield of 32-35 q/ha and pop recovery of 55-60%.

Insect-pests and Diseases management

The variety Sabour Makhana 1 is moderately field resistant to important insect pests, viz. Aphid (*Rhopalosiphum nymphaeae*), Case worm (*Elophila depunctalis* and *E. crisonalis*), leaf midge (*Chironomus* spp.) and also leaf blight disease (*Altenaria* spp). Insects-pests can be managed in field system through seed treatment with Imidacloprid 70 WS or Thiomethoxam 25 WG @5 g/kg seed at the time of seed sowing in nursery and before transplanting, root dip with Imidacloprid 70 WS or thiomethoxam 25 WG @ 5 g/litre of water for half hour . Foliar spray of NSKE @ 5% at 25 days interval from 40 DAT has been found very effective against Leaf blight disease(*Altenaria spp.*).

Economics

The adoption of Sabour Makhana 1 variety can lead to overall increase in utilization of wetlands, leading to enhanced income and self employment, especially for small and marginal farmers. The net return from selling of Makhana seeds is ₹ 1, 60,000 to 1, 70,000/ha with B:C ratio 3.7:1. The net return on the basis of pop selling is 3,04,800/ha with B:C ratio 4.09:1.

For further interaction please write to:
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