

About the variety:

Swarna (MTU 7029); also known as Swarna-Masuri attained the status of the most popular high yielding rice variety (HYV) covering approx. 6 million ha area mostly in Andhra Pradesh, Bihar, Odisha, West Bengal, eastern Uttar Pradesh, Chhattisgarh, Tripura and Assam. It is also popular in Bangladesh and Nepal. During the kharif (wet) season, nearly 12 million ha rice area, both in rainfed and irrigated ecosystems, are flood-prone in India and half of this area gets flooded almost every year. Flooding generally affects the low-lying rice areas, but in years of high floods, the medium rice lands and even the uplands can be affected. Swarna does not have tolerance to continuous submergence for more than 4-5 days, and a longer period of submergence causes serious crop loss. The farmers of flood prone areas, therefore, face risk of uncertainties in rice production and because of this they use little inputs. The International Rice Research Institute (IRRI), Philippines, in collaboration with the Central Rice Research Institute (CRRI), Cuttack and other institutions in India has developed a new version of Swarna, which has the capacity to tolerate continuous submergence for 14-17 days and give high yield. Released and notified in 2009 in India and in 2010 in Bangladesh, Indonesia and Philippines, the new Swarna is called "Swarna Sub 1" in India.

Difference between Swarna and Swarna Sub 1:

The mega variety Swarna suffers badly, if completely submerged for periods longer than 4-5 days. A new gene "SUB1" imparting longer duration of submergence tolerance was transferred into Swarna by the IRRI scientists through hybridization and marker-assisted backcross breeding. Since the gene transfer has been effected by using the normal conventional breeding methods, therefore, Swarna Sub 1 is NOT a genetically modified (GM) crop.

Seed of Swarna Sub 1 was shared with CRRI in 2006, which got it evaluated throughout the country by different institutions and also at farmers' fields. It was released in India by CRRI and Narendra Dev University of Agriculture & Technology (NDUAT), Kumarganj, Faizabad, UP. It was notified in August 2009. Both the varieties, Swarna Sub 1 and Swarna are similar in all characteristics except for their submergence tolerance and husk colour. While the husk colour of Swarna is golden, that of Swarna Sub 1 is white (straw colour). A character preferred by many farmers. Swarna Sub 1 can tolerate complete submergence for 14 to 17 days while Swarna can't tolerate submergence beyond 4-5 days. Because of presence of SUB 1 gene, when submerged under water, unlike Swarna, growth of Swarna Sub 1 plant is stopped to conserve energy which results in better survival under water.

Quite often under longer submergence (10 days or more), after receding of water, plants of Swarna Sub 1 look withered and dead, but due to presence of SUB1 gene, there is rapid regeneration of new tillers resulting in faster crop recovery. Yield loss of up to 2 t/ha can be reduced by replacing Swarna with Swarna Sub 1.

Land Suitability:

Like the parental variety, Swarna Sub 1 can be cultivated in shallow low-lands as well as in medium lands in the kharif season. Due to its short height, farmers should avoid growing in the areas that experience prolonged (more than 20days) water logging or water stagnation of more than or equal to 25 cm depth following complete submergence.

Field preparation (the same applies to seedbed preparation):

- If available, apply compost uniformly shortly before soil preparation in the field and incorporate.
- Plough and harrow the field at least 3 times (2 ploughings and 1 harrowing or 1 ploughing and 2 harrowing with 2 weeks in between to allow emergence and destruction of weeds).
- Repair the bunds to reduce water losses from the field during the cropping season.
- Level the fields, best with a shallow water layer in the field.



Use good seed:

- Good seed reduces the necessary seed rate, provides healthy and strong seedlings, gives a uniform crop stand in the field, and results in higher yields.
- Good seed is clean (contains no stones, soil particles, and weed seed), pure (contains only grains from one variety) and healthy (full big grains, same colour and no cracks).

Seed Treatment:

In areas having pest/disease problem, it is advisable to adopt seed treatment with carbendazim @1g/kg seed before seeding.

Crop Establishment:

(a) Direct Seeding

- In submergence prone environments, direct seeding often gives better result than transplanting. Optimum time of seed sowing is May to June.
- Use a seed rate of about 80 kg/ha for broadcasting seed, and about 60-70 kg seed/ha for direct seeding in lines using a drill seeder at 20 cm apart.

(a) Nursery Management and Transplanting

- Nursery seeding is done during May and June and transplanting is performed in July after onset of wet season. For 1 ha field, the seedbed size should be 1000m² of seedbed area.
- Apply 500 kg FYM/compost in the nursery. If possible, use 4-5 kg nitrogen, 4-5 kg P₂O₅ and 4-5 kg K₂O at sowing time (incorporated into the soil); don't apply too much nitrogen in the seedbed because it reduces survival under submergence.
- Use 30 days old seedlings for transplanting.
- Transplanting distance 20 x 15 or 15 x 15 cm spacing (closer for older seedlings), plant best seedlings in lines, use 2-3 seedlings per hill.
- In transplanted field, it is desirable to have 35-40 hills per square meter.

Fertilizer Application:

- Use required amount of organic manure/compost at the time of land preparation.
- Nitrogen, Phosphorus and Potash @60:40:40 NPK/ha (N: P₂O₅:K₂O) is recommended for Odisha. Basal application of Zinc Sulphate is recommended @25 kg/ha.
- Apply the entire amount of Phosphorus and Potash fertilizer at the time of seeding (dry) or transplanting (basal dose). For Nitrogen, 1/3rd of the fertilizer to be used as basal dose (along with P&K). Of the remaining 2/3rd, half of it (total 1/3rd) to be applied at 50-70 days (20-25 days after transplanting) age of the crop and the remaining 1/3rd to be applied at panicle initiation (PI stage).
- If submergence occurs, apply 20 kg N per hectare 5-7 days after the water is completely receded, it helps the crop to recover faster.

Weeding

- Keep your field weed free as much as possible.
- Conduct the first hand weeding 3-4 weeks after transplanting, the second 6-7 weeks after transplanting. Always weed before fertilizer application. If available, use cono weeder for weeding.
- If there are a lot of weeds, herbicides can be useful (but chemical weeding should be followed by manual/mechanical weeding later in the season). Use herbicides at the recommended time, at the recommended rate, and use the correct herbicide for the dominant weeds in your field. Always read and follow the instructions on the product label. See options in the table below.

Control of disease and pests

At recommended fertilizer dosage, diseases and insect pests problems are less. Only at higher N level they are more severe. However, if required, diseases and insect pest management practices recommended for Swarna can be used for Swarna Sub 1 also.



Active ingredient (in %)	Weed type	Amount (gm/ha)	Time of application	Remarks/spray volume (amount of water to be mixed with the chemical)
Pretilachlor (30)	Sedges, grasses, broad leaves	300	0-3 days after transplanting	Apply to shallow water layer and retain water for 2-3 days. Spray volume is 150-200 litre/ha
Butachlor (80)	Sedges, grasses, broad leaves	750	2-5 days after transplanting	Apply on saturated soil. Spray volume is 150-200 litre/ha
2,4-D (40)	Sedges, grasses, broad leaves	320	15-21 days after transplanting	Weeds need to be above the water. Re-flood within 2-3 days after application.
Pyrazosulfuron Ethyl	Sedges, grasses, broad leaves	20	3-6 days after transplanting	Apply in a thin film of water after 3-6 days after transplanting
Bispyribac Sodium	Sedges, grasses, broad leaves	25	20-25 days after transplanting	Spraying, broadcast granules in a thin water layer, or mix EC formulations with sand 50k/ha before broadcasting/transplanting
For direct seeded rice				
Pretilachlor (with safener) (30)	Sedges, grasses, broad leaves	300	0-3 days after seeding	Drain and apply to saturated soil. Spray volume is 150-200 litre/ha.
Butachlor (80)	Sedges, grasses, broad leaves	750	6-8 days after transplanting	Apply to saturated soil. Spray volume is 150-200 litre/ha.

Harvesting

- Harvest the crop at about 25-30 days from flowering (when 80-85% of the grains are straw coloured).
- Sun-dry the grains properly before storing.

If produce is to be used as seed for the next season:

- To maintain high purity of the seed, roughing is essential before harvest to remove off-types both at pre and post-flowering stages in the field. For this, remove all rice plants that clearly look different at flowering (differing in height, plant colour, flowering time, panicle type, grain shape). Also remove sick and insect damaged plants/panicles.
- Harvest at full maturity (80-85% of the grains are straw coloured)
- Thresh and dry quickly after harvest. Clean thoroughly (repeated winnowing). Take proper care during threshing/drying to avoid admixture.
- Use a separate container for the seed, label it with the name of the variety and the year it was harvested, and store the seed in a cool, dry and clean place.
- For proper germination of the seeds for next crop, keep the seed at less than 14% moisture.

Yield/Production of Swarna Sub 1

- Under favourable conditions, i.e, if there is no flood, yield of Swarna Sub 1 is similar to that of Swarna (i.e, 4.5 to 7 tons/ha).
- When crop gets submerged due to flash flood, Swarna Sub 1 yields 1-2 tns/ha more than Swarna, depending upon the duration of submergence and floodwater characteristics.
- Even under flash flood of short duration (3-4 days), the yield of Swarna Sub 1 is higher than Swarna by 0.5 to 1.0 ton/ha.
- Farmers can earn about Rs. 5,000/- to Rs. 25,000/- extra per hectare by growing Swarna Sub 1.

Limitations

- Swarna Sub 1 is good only for flash flood conditions where complete submergence occurs for 7-17 days. But it has no tolerance to longer duration of stagnated flooding and greater than 25 cm of water.
- SUB 1 gene is not expressed in germinating seeds. Therefore, it doesn't provide protection, if seeds get submerged before germination in nursery or direct seeded condition.