

RICE

Botanical Name: *Oryza sativa*

Family: Gramineae

Origin: Indo Burma region a. Asian Rice: India, China b. African rice: West Africa.

Economic Importance:

1. Rice is the staple food crop of more than 60% of the World's population.
2. Rice is primarily high energy or high calorie food.
3. The protein content of milled rice is usually 6 to 7% which is lower than wheat.
4. The fat content of rice is 2.0 to 2.5% and much of the fat is lost during milling.
5. Rice grain contains some amount of calcium & vitamin B group.
6. Rice bran is used as cattle and poultry feed.
7. Rice hulls can be used for manufacturing insulation materials, cement, and cardboard and as a litter (bedding material) in poultry keeping.
8. Cattle straw can be used as cattle feed as well as litter during winter.
9. Rice straw used for packing material and ripening of fruits.
10. Rice husk useful for fuel.

Area & Distribution:

Among the rice growing countries **India has the largest area** followed by China and Indonesia. In respect of production, **India rank second next to China**. In regards to productivity Egypt rank first followed by USA. In India rice is grown in almost all the states. A.P., Bihar, M.P., West Bengal lead in the area. West Bengal & Uttar Pradesh has the highest rice production. The average yield per unit hectare is highest in Punjab.

Classification:

Rice belongs to genus *Oryza* of Gramineae family. The genus *Oryza* includes 24 species, out of which 22 are wild and two namely *Oryza sativa* and *Oryza glaberrima* are cultivated. All the varieties found in Asia, America and Europe belong to *O. sativa* and varieties found in West Africa belong to species *glaberrima*.

Oryza sativa is a diploid species having 24 chromosomes. The sativa varieties of the world are commonly grouped in to three sub species namely *Indica*, *Japonica* and *Javanica*.

	Character	Indicas	Japonicas	Javanicas
1	Leaves	Very broad to narrow, pale green	Narrow, dark green	Broad, very stiff, light green
2	Grain quality	Long to short, slender, somewhat flat	Short, roundish	Long, broad, very thick grains
3	Tillering	Profuse	Medium	Low
4	Height (stature)	Tall to intermediate	Short to intermediate	Tall
5	Awn	Mostly awnless	Both awned & awnless	Both awn & awnless Eg: HR 19, 47
6	No of ears & ear weight	Many & light	Many & heavy	Few and heavy
7	Hairs on leaves and glumes	Present	Present, dense	Present but are very long
8	Plant tissue	Very soft	Very hard	Very hard
9	Sensitivity	Varying	None to low	Low
10	Flag leaf	Narrow & long	Narrow & short	Broad & long
11	Varieties from	India, Southern China, Taiwan, Ceylon, Java & other regions	Japan, Korea, N. China	Small no of varieties from Indonesia.

Climatic Requirements:

Rice crop needs **hot and humid** climate. It is best suited to regions which have high humidity, prolonged sunshine and an assured supply of water. The average temperature requirement throughout crop period is **21 to 37⁰C**. At the time of tillering crop requires higher temperature than for growth. The temperature requirement at blooming is range between **26.5 to 29.5⁰C** while at the time of maturity is **20 to 25⁰C**. Rice grown up to 3000 meter from MSL.

Soil requirements:

Rice is a **Semi aquatic crop** can be grown in a wide range of soils such as saline, alkaline, acidic and other types of soils. **Soils having good water retention capacity with good amount of clay and organic matter are ideal for rice cultivation.** Clay or clay loamy soils are the most suited for rice crop. Rice grows well in submerged and waterlogged soils.

Sowing Season:

Rice growing seasons vary in different parts of India, depending upon temp., rainfall and other climatic conditions.

Crop season	Local Name	Sowing time	Harvest time
Kharif	Aus (West Bengal, Bihar)	May-June	Sept-Oct
Rabi	Aman	June-July	Nov-Dec.
Summer or Spring	Dalua (Orissa) Boro (W. Bengal)	Nov-Dec	March-April

Systems of rice Cultivation:

In India rice is grown mainly on two types of soils i.e. upland and lowlands. The following are the principal systems of rice cultivation.

1. Dry or semi dry upland cultivation a) Broadcasting the seed b) Sowing the seeds behind the plough or drilling.
2. Wet or Low-land cultivation a) Transplanting in puddled soils b) Broadcasting sprouted seeds in puddled soils.
3. System of rice intensification (SRI)

When rice cultivates in Rabi or Summer season wet method is followed mostly transplanting in puddles field and SRI method.

WET OR LOWLAND CULTIVATION

This system of rice culture is practiced where there is an assured and adequate supply of water. In this system, sprouted seeds may be directly sown in puddled field or the crop may be transplanted with seedlings raised in a nursery.

1. Transplanting Method:

Much of the success in this system depends on seedlings. If nursery is good and the seedlings are robust and healthy can gives good yield.

Raising Seedlings in Nursery

1. Select a fertile, well drained upland field near the source of irrigation.
2. For transplanting one ha. area about 500 sq.m. Area is sufficient for nursery rising. In case of late sowing 750-1000 sq.m.
3. Select seed should always be true to the variety, healthy, viable, clean and high germination percentage.
4. In case of bold grain varieties, about 40-45 kg seed would be required whereas, for fine grain varieties 30-35 kg seed is enough.
5. Pre germinated seeds should be used for raising seedlings because they start to grow quickly in the field or seedbed.
6. Pre germination consists of soaking and incubating the seeds.
7. Put the seeds in container then pour the water until it is about 10 cm above the seeds. Stir the seeds slowly and remove unfilled seeds which are float on water surface. Remove seeds from container and repeat the procedure to remove unfilled seeds. Thereafter soak the seeds in fresh water and keep it at room temperature for 24 hours. After 24 hrs, wash the seeds thoroughly with fresh water. Thereafter place the seeds in a clean and moist bag, fold the bag tightly and keep it in a shady place. Stir the seeds every 12 hrs. for better air circulation and sprinkle water over seeds. Incubation period 24-36

hrs. is require for wet and dry bed methods and 36-48 hrs. For Dapog method of raising seedlings.

Methods of raising seedlings:

There are three major methods, i.e. wet bed, dry bed and dapog for raising seedlings.

WET BED METHOD

1. Wet nurseries are prepared under irrigated conditions. Soil is puddled by two to three runs of puddler or three to four ploughing with local plough.
2. After one or two days of puddling, divide the nursery area in to narrow beds of 1.25 m width and any convenient length depending upon the slope.
3. Apply 225g urea or 500g ammonium sulphate & 500g SSP per 10 sq. m area.
4. Uniformly broadcast two to three handfuls of seeds on a square meter of seed bed.
5. Keep the seed beds saturated with water for first five days and then increase water level up to 5 cm. drain excess water when heavy rainfall.
6. Adopt suitable disease and pest control measures.
7. In zinc and iron deficient soils apply zinc sulphate and ferrous sulphate through foliar spray.
8. Seedlings would be ready for transplanting at an age of 20-25 DAS.

DRY BED METHOD

In water deficient areas this method is followed for raising seedlings.

1. Plough the field three to four times till the soil is thoroughly pulverized.
2. Prepare the bed same size as in wet bed method but 15 cm high with channels between them.
3. Sow the seeds on beds 10 cm apart in dry or moist condition.
4. Special care should be taken for water management in these beds.
5. Do not flood water in beds. Maintain a thin film of water if possible after 5 days of sowing.
6. Follow all the operations as described for wet nurseries.

DAPOG METHOD

1. This method of raising nursery has been introduced in India from Philippines.
2. The main merit of this method is it requires less area for raising seedlings only 25-30 sq. m of area is enough.
3. In this method, beds could be prepared on an even open field or even cement floor. Kept a width 1.5 m for easily manageable.

4. Cover the soil surface or floor with banana leaves or plastic sheet. About 36-48 hours pre-germinated seeds should be broadcasted uniformly over plastic or banana leaves @ 3 kg per sq. meter area.
5. Sprinkle the water three to four times in a day up to 4 days to keep the seed bed wet. Thereafter cover it with one or two cm of water till end.
6. Also press the seeds lightly once a day till fourth day and protect from birds.
7. Dapog seedlings can be ready for transplanting 11 to 14 DAS.
8. Loosen the interlocked roots carefully before transplanting.
9. Three to four seedlings should be transplanted per hill instead of two.

Preparation of Field:

1. After harvesting of kharif crops remove the stubbles and weeds present in plot and then saturate with water for 4 to 5 days then start puddling operation.
2. Before puddling, an earthen bund, about 30 cm high should be made around the field.
3. Puddling helps to kill the weeds and buried them in puddled layer.
4. Puddle the field by three to four runs of puddler in standing water.
5. Apply half quantities of N and full dose of P & K fertilizers at the time of last puddling and incorporate in the top 10-15 cm deep soil.

Transplanting:

1. The seedlings are uprooted from nursery at optimum age (Three to four weeks) Transplanting of healthy seedlings which is four to five leaf stage or they 15-20 cm in height.
2. Delayed in transplanting leads to poor tillering, early flowering and reduction in yield.
3. Transplant two to three seedlings per hill at 20x15 or 25x15 cm distance.
4. Increase the number of seedlings per hill if old seedlings are used. Seedlings should not transplant deeper than 2-3 cm.

Manures and fertilizers:

Apply about 10-15 tons of FYM or Compost per hectare 4 to 6 weeks before sowing. Application of chemical fertilizers depends basically upon the fertility status. Apply 100:50:50 Kg NPK per ha. for lowland transplanted rice. In which apply half dose of N and full dose of P & K at the time of last puddling and remained half quantity of N apply in two split doses first split at tillering stage and second split at panicle initiation stage.

Water management:

1. Assured and timely supply of irrigation water has a great influence on the yield of crop.

2. The water requirement is high during the initial seedling period covering about 10 days.
3. Tillering to flowering is the most critical stage when rice crop should not be any water stress condition.
4. Application of short quantities of water at short intervals to keep the soil saturated is more effective than long intervals.
5. Flooding suppresses the weed growth increased availabilities of many nutrients particularly phosphorous, potassium, calcium iron and silica.

Weed control:

Though there is a less problem of weed in transplanted rice, sometimes weeds emerge when the soil is exposed to atmosphere as submergence is not possible continuously. Under such conditions yield may be reduced from 20-40 per cent. Weeds should be removed at 20 DAT and second time at 50 DAT. A number of herbicides like Butachlor @ 1.5 kg a.i./ha, Pendimethalin @ 1.0 Kg a.i./ha have been found effective in controlling weeds.

Harvesting and Threshing:

Harvest the crop as soon as it matures. If delayed, grain may be lost due to damage by rats, birds, insects, shattering and lodging. Timely harvesting ensures good grain quality, consumer acceptance. Right stage for harvesting is when about 80 per cent panicles have about 80 per cent ripened spikelet. At the time of harvest the upper portion of the spikelet should be straw colored. The grain contents about 20 % moisture. The plant should be cut close to ground level and left in the field for few days to dry. The most common method of threshing are trampling by bullocks or lifting the bundles and striking them on the raised wooden platform. On big farms pedal threshers or power driven threshers are also in use.

Yield:

1. Short duration varieties: 40-45 q ha⁻¹.
2. Mid late and late varieties: 50-55 q ha⁻¹.
3. Hybrid varieties: 60-65 q ha⁻¹.

Varieties:

1. **Early maturing varieties:** Karjat 4, 184, Phule Radha, Ambica, Parag.
2. **Medium maturing varieties:** Jaya, Phule Mawal, Phule samrudhi, Palghar-1, Ratnagiri-24 Rtnagiri-1.
3. **Late maturing varieties:** Ratnagiri-2, Karjat-2, Masuri, Suvarna.
4. **Secented Rice:** Basmati-370, Indrayani, Bhogavati, sughanda.
5. **Hybrid Rice:** Sahyandri, Sahyandri- 2,3,4,5 APRH-1, KRH-1, PHB-71.