

- If rice crop is damaged or not sown in higher upland fields due to early drought, cultivate low water consuming crops like maize, cowpea, black gram, green gram, sesame or horse gram etc. after late onset of monsoon.

Mid season drought (drought at flowering time)

This type of drought occurs at panicle initiation or flowering stage which causes maximum loss of yield. At this stage there is chance of formation of maximum unfilled grains. If such situation arise-

- Strengthen field bond to prevent seepage of water to other fields.
- Irrigate the field with harvested water from rain collected in the nearest pond.
- Apply fertilizer through foliar spray.
- If gundhi bug is spotted then apply appropriate insecticide in morning/ evening as mentioned earlier.
- Harvest when 85% of the crop panicle turns yellow.
- If the rice crop is completely damaged then cultivate pulses such as Green gram, Black gram, horse gram and sesame at late shower of monsoon.

Terminal drought (drought at maturity/grain filling)

This type of drought generally occurs at the end of the crop life cycle.

- If possible, give need based life saving irrigation.
- Harvest when 85% of the crop panicles turn yellow.
- If the main crop is completely or partially damaged, then plough again and prepare the field to cultivate rabi crops such as green gram, black gram, sun flower and sesame at late shower of monsoon.



Rice Cultivation in Rainfed Upland and Drought Prone Areas Under Changed Climate

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Deforestation, urbanization, industrialization and excessive use of different gadgets are main causes for climate change in the present scenario, more specifically; atmospheric temperature rise, irregular rainfall and decrease in water table depth are three major constraints in Indian agriculture under changed climate. Due to irregular rainfall and decrease in water table depth, rice cultivation in rainfed areas is getting drastically affected and apprehension of damage due to frequent drought is more. Out of total 43 million hectare rice area, 5.5 m ha are rain fed upland and drought prone, while 2.0 m ha in rain fed lowland are drought prone. Keeping this in view, some popular and good quality high yielding rice varieties have been developed by Central Rice Research Institute and its substation CRURRS, Hazaribag for rainfed upland and drought prone areas. Cultivation of these varieties with proper package of practices could mitigate the adverse effect of climate change in greater extent.

Cultivation procedure

- Summer ploughing 2 to 3 times during March/April helps to control weed population and increases water holding capacity of soil.
- Mid of June (immediately after monsoon break) is the appropriate time for sowing. If sowing is delayed, it is expected that the crop might be affected by drought before maturity.



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- Sowing in rows 20 cm apart either by seed drill or behind the plough with a seed rate of 80 kg/ha helps in better crop stand with less weed population which ultimately improves the crop yield.
- Sowing of seeds should be within 5 cm deep from the soil surface.
- Sowing in rows helps to carry out weed control by finger weeder and other intercultural operations in a better way.

Varieties

- Rice varieties of 70 to 110 days duration are suitable for cultivation in rainfed uplands.
- Generally, these varieties grow faster, they have weed competitiveness and protective mechanism against drought, diseases and insects.
- It is better to use certified seeds for sowing, or else high density seeds can be obtained from the stored seeds of previous year by dipping it in salt solution (600 gm/ 10 liters water). The weed seeds and chaffs that float in salt solution should be removed and the separated rice seeds should be dried under shade before sowing for better vigour.



- Some of the Rice varieties developed for rainfed upland and drought prone areas (giving yield from 12-15 quintal/acre) are: Vandana, Sahabgadhyan, Anjali, Kaliinga-III, Virendra, Annada, Pyari, Satyabhama, NDR-97, Heera, and Dhalahaera etc.
- Among these varieties, Vandana and Sahabgadhyan are very popular having weed competitiveness and drought tolerance capacity.

Fertilizer application

- Minimum one month before sowing, 5-10 trucks of cow dung or compost should be applied in the field. Just before sowing phosphate (8 kg/acre) and Potash (8 kg/acre) to be applied in the field. Sowing is done after land is leveled with a ladder.
- For light textured soil, application of potash twice at the rate of 6 kg/acre as basal dose and 2 kg/acre at booting stage gives better yield.
- Nitrogen should be applied in three splits (8kg/acre of N in 15-20 days after germination, 4 kg/acre in next 15-20 days during tillering and another 4 kg/acre between panicle initiation and booting stage).
- Fertilizer should be applied in wet soil after proper weeding.



Weed control

- Application of Nominee gold at 130 ml/200 lt of water at 10-12 days after sowing as post emergence application provides adequate weed control at early stage.

- At 15-20 days of germination, application of Rice Star at 350 ml/200 lt of water or weeding with the help of finger weeder integrated with hand weeding within rows give better yield.

Disease and insect control

- Need based application of insecticide and pesticide in integrated manner should be done.
- Wherever termite is a problem, treat 1 kg of seeds with 37.5 ml of chloropyriphos or 2.5 ml of imidachloprid to avoid termite attack.
- If 2-3 Gundhi bug is spotted in one sq. meter area at milky stage, then 10 kg of Malathion should be dusted with a duster at morning/evening or Ethophenprox should be sprayed at 1ml/1lt water to control it.
- In disease prone areas, seeds should be treated before sowing with 2 gm of bavistin/kg of seeds to prevent manifestation of disease.
- Need based application of Dithane M-45 (Mancozeb) @ 0.12% or Tilt@1.5 ml is required at action threshold level (ATL) 8-10% of leaf infection.
- For blast disease, Hinosan (Ediphenphos) @ 2 ml/lt or Bavistin @ 2 g/lt should be sprayed at 8-10% action threshold level.

Contingency plan for unpredictable drought

There are chances of occurrence of drought at different developmental stages of rice crop due to irregularity in south west monsoon rain fall. Such types of drought results in loss of yield to different extent at 3 important stages between seed sowing to tillering, at flowering and at grain filling stage. Control measures/Contingency plan have been developed to withstand against such situations.



Early drought (between seed sowing to tillering)

- Early drought occurs when monsoon rainfall is delayed upto 2-3 weeks in June and July.
- Fifteen days old seedling of early duration varieties like Sahabgadhyan, Naveen, Satabdi, Lalat, Annada, and Chandan can be transplanted at first week of September.
- If there is no rainfall up to last of August then very early varieties like Vandana, Kalinga-III, Anjali, Sahabgadhyan, Khandagiri, Parijata, Narendra 97 can be sown in medium low land fields through line sowing or broadcasting.
- Basal application of P₂O₅ and Potash at 8 kg/acre should be applied. Initial dose of nitrogen should be applied at 8 kg/acre between 7-15 days after sowing followed by a second dose at booting stage.
- To control weed apply appropriate herbicide as mentioned earlier.
- Strengthen field bond to prevent seepage of water to other fields and keep the field free from weeds.
- To protect crop from disease and insect attack caused due to delayed sowing, foliar spray of Imidachloprid @ 0.5 ml/lt or Ethophenprox @1 ml/lt can be done.
- At milky stage if Gundhi bug is spotted then 10 kg of Malathion should be dusted with a duster at morning/evening or Ethophenprox should be sprayed with 1ml/1 lt water to control it.

