Points to remember

- Paramount importance and best approach is necessary in weed management and nutrient deficiency.
- Water should not be a constrained during critical stages like, tillering, panicle initiation, flowering and grain filling.
- Water must be withheld one week before harvest of the crop to facilitate uniform ripening of grains.

Advantages of aerobic rice cultivation

- Nursery preparation, puddling and transplanting cost can be avoided.
- Rational use of water for field preparation and irrigation helps in 35-45% of water saving.
- Reduction in number of irrigations will help in cost cut and savings in power consumption.
- Green house gas as methane emission has been reduced.
- Maintenance of soil structure is beneficial to non-rice crops in the rotation and timely sowing of succeeding crop after rice.

High Yielding and Water Saving NRRI Aerobic Rice Varieties

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High Yielding and Water Saving NRRI Aerobic Rice Varieties

A. Anandan, S.K. Pradhan, S.D. Mohapatra, Sanjoy Saha, P. Panneerselvam and O.N. Singh

Escalating in use of fresh water from all sectors has made water as an important commodity and threatening the traditional rice cultivation practices all over the world. Further, climate change has aggravated the situation and stresses the importance of water. Irrigation for agriculture consumes two thirds of fresh water and rice alone consumes more than 50 per cent of the water used for irrigation. Research results reveal that around 5000 liters of water is being utilized to produce one kilogram of rice under flooded irrigated situation, but aerobic rice can be taken up by using 3000-3500 L of water. Increase in population, rapid urbanization and higher demand of water for intensive agriculture and industrial sector, affects the sustainability of agriculture production and in particular to rice in India. Siphoning of more water from deep layer for intensive agriculture leads to decline in water table and further affecting poor water quality by pollution, seawater intrusion, etc. It is evident from the states of Punjab, Haryana, northwest Rajasthan, south Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu, where water table has declined >2 m. Similar situation may arise in future, in other parts of India. Therefore, water-use efficiency and water productivity must be increased in agriculture, particularly in rice cultivation. As per an estimate by the end of 2025, 15 million hectares of irrigated rice would suffer from "physical water scarcity" and 22 million hectares would experience "economic water scarcity" in South and Southeast Asia (Tuong and Bouman, 2003). Therefore, food security is challenged and threatened by declining water availability.

Thus, agriculture scientists proposed different approaches to reduce water use in rice production and increase the water use efficiency. An approach called aerobic rice cultivation uses less water and labour in rice cultivation is picking up among the scientific arena. Growing rice crop in a soil where oxygen is in plenty as irrigated crop such as maize, wheat and pulse cultivation. Cultivation of suitable high yielding rice varieties in direct sown, non-puddle, aerobic soil under supplementary irrigation and fertilizer to achieve high yield is a new water saving technique called aerobic rice.

Target areas for aerobic rice includes irrigated medium land areas where rainfall is insufficient to sustain rice production, delta regions where there is no availability of water in-time or delay in water release from reservoir, pumping from deep bore well has become so expensive for irrigated system of rice cultivation and favorable upland has access to supplementary irrigation. Accordingly, Karnataka, Tamil Nadu, Jharkhand, Chhattisgarh, parts of Bihar, Odisha, and eastern Uttar Pradesh are the projected area where there is uneven distribution and frequent occurrence of soil moisture limitation.

Aim of the aerobic rice is to keep field completely under unsaturated condition throughout the growing season and irrigating by surface or sprinkler system to keep soil wet. Therefore, water productivity (calculated as grams of grain produced per kg of water input) was reported to be higher in aerobic rice by 64-88 per cent and utilizes 3000 to 3500 liters of water to produce 1 kg of rice compared to rice raised under transplanted rice system. By mechanized sowing, absences of puddling, transplanting and frequent irrigation in aerobic rice reduce labour more than 50% compared to irrigated rice. Varieties suitable for this type of cultivation should be responsive to high input, possess tolerance for moisture stress, weed competitiveness and lodging tolerance. Therefore, with these traits NRRI has developed several aerobic rice varieties. Details of the recently released aerobic rice varieties with improved traits are given below for benefit of the farmers.

CR Dhan 200 (Pyari) (CR 2624-IR 55423-01)

Variety CR Dhan 200 (Pyari) is suitable for target areas of Odisha state with high grain yield in normal season and resilient to changing climatic condition of uneven rain distribution. This variety has been released by State Variety Release Committee, Odisha during 2012. In Odisha state, the variety gives an average yield of 4.0 t/ha under aerobic situation. Maturity duration of the

Field view of CR Dhan 200 (Pyari)

Irrigation should be given up to 50 days after sowing at the interval of 5 days. Thereafter, crop should be irrigated once in 3 days, in the critical stages like active tillering, panicle initiation, flowering and grain filling. Water must be withheld one week before harvest of the crop to facilitate uniform ripening of grains. By adopting aerobic rice cultivation method, the water can be saved to the tune of 35 to 45 per cent.

Pest and disease management

Insect Pests


Flowering stage

Stem borer, brown plant hopper (BPH), leaf folder, gundhi bug and nematodes significantly damage the crop. In the stem-borer endemic areas, install pheromone traps @ 8 traps/ha for pest monitoring. If 2 egg masses /m^2 or 1 moth/m^2 or 25 moths / trap / week noticed, apply chlorantraniliprole 0.4 G @ 10kg/ ha or imidacloprid 0.3 G @15kg/ha or cartap 4 G @ 25 kg/ha or fipronil 0.3 G @ 25 kg/ha or carbofuran 3G @ 33 kg/ha if standing water is available in the field or spray with chlorantraniliprole 18.5 SC @ 150 ml/ ha or flubendiamide 20 WG @125 g/ha or chlorpyriphos 20 EC @ 1250 ml/ha. When gundhi bug population exceeds 2 per hill, spray carbaryl 50 WP @ 1,500 g/ha or dust with methyl parathion 2 D @ 25 kg/ha or malathion or carbaryl 10DP @ 30 kg/ha in afternoon hours. As BPH population reaches 10 insects/hill, spray imidacloprid 200 SL @ 125 ml/ha or thiamethoxam 25 WG @ 100 g/ha or ethofenprox 10 EC @ 500 ml/ha or acephate 75 WP @ 1000 g/ha for controlling the insect.

Diseases

Blast, bacterial leaf blight, sheath blight are the important diseases. If bacterial blight is observed, streptomycin sulphate 9% + tetracylin hydrocloride 1% SP @ 1g + copper oxychloride @ 2 g/ liter of water may be sprayed to manage this disease. In case of leaf blast and sheath blight disease occurrence, spray hexaconazole 5 EC at 2 ml/ liter of water. For blast, kasugamycin 3SL @ 2 ml/ liter or tricyclazole 75 WP @ 1 g/liter may be sprayed. Validamycin 3 L @ 2 ml/ liter or propiconazole 25 EC @1g/liter may be sprayed for sheath blight management.

Harvesting

- Harvest the crop at 25-30 days after flowering. Threshing, winnowing and proper drying upto the level of 12% moisture has to be done before storage.

50 days after sowing. During the time of fertilizer application, sufficient moisture in the soil has to be ensured to make the nutrients available to plants. Further, Zinc sulphate 20 kg and Iron sulphate 12 kg per hectare have to be applied at the time of sowing to avoid micro-nutrient deficiency. Continuous cultivation of rice crop in same field would lead to depletion of nutrients and organic matter. Therefore, to improve soil physical health, green manures such as Dhaincha or Sunhemp or legumes can be raised for green manuring. Crop rotation should be followed with pulses to improve the soil fertility under continuous aerobic rice cultivation.

Weed management

- Spray Bispyribac sodium @ of 30 g a.i/ha after 8-10 days of seeding as post emergence herbicide to control major grasses weeds and sedges. In case of fertilizer application, nitrogen should be applied after spraying of first post emergence herbicide. For controlling late emergent weeds, spray Fenoxaprop-p-ethyl (60 g a.i/ha) at 20-25 days of seeding with spray volume of 350 liters/ha.

Intercultural operation to keep field free from weeds

- Hand weeding or inter cultural operation with hand hoe or weeder will control weeds effectively and increases aeration for better root growth and also increases tiller number.

Water management

- Aerobic rice crop does not require continues flooding. Rice crop under aerobic situation could be successfully raised with 700 to 900 mm of total water.
- After sowing in dry condition in fine tilth soil, surface irrigation should be done immediately. Irrigation can be provided with interval of 4-5 days and time of irrigation can be adjusted based on the soil type and moisture availability.

Well leveled field minimizes irrigation water and easy to control weeds

variety is 115-120 days, semi-dwarf (95-100 cm) plant type, resistance to lodging with an average of 272 panicles/m^2. The variety possesses short bold grain, moderate tillering (7-10) and compact panicle with test weight of 24 g. This cultivar has good grain quality, short bold grain, no grain chalkiness, intermediate alkali spreading value (4), intermediate amylose content (21.8%), L/B ratio of 2.33 and high milling recovery (68%). Pyari is moderately resistant to leaf blast, neck blast, brown spot, stem borer dead heart and white ear head damage, whorl maggot, gall midge biotype 6 and leaf folder attack. The genotype has high response to fertilizer.

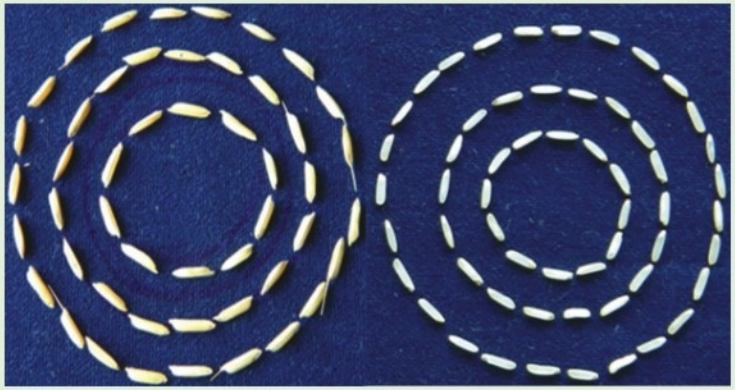
Grains, panicles and kernels of CR Dhan 200

CR Dhan 201 (CR 2721-81-3-IR 83380-B-B-124-1)

Variety CR Dhan 201 is suitable for target areas of Bihar and Chhattisgarh states with high grain yield in normal season and resilient to changing climatic condition of uneven rain distribution. This variety has been released by Central Sub-Committee on Crop Standards, Notification and Release of Varieties during 2014. This line has exhibited stability for yield and other characters in region III of the country with an average yield of 3.8t/ha across 35 locations of the country under aerobic situation. Maturity duration of the variety is 110-115 days, semi-dwarf (95-100 cm) plant type, resistance to lodging with an average of 305 panicles/m^2. The variety possesses long slender grain, normal tillering and compact panicle with 1000 grain weight of 25.5 g. This cultivar has good grain quality, long slender grain, no

Field view of CR Dhan 201

grain chalkiness, low alkali spreading value (7.0), intermediate amylose content (23.26%), L/B ratio of 3.19 and high milling recovery (67%). CR Dhan 201 is moderately resistant to leaf blast, sheath rot, stem borer (both dead heart and white ear heads), leaf folder, whorl maggot and rice thrips attack. The genotype has high response to fertilizer.



Grains and kernels of CR Dhan 201

CR Dhan 202 (CR 2715-13-IR84899-B-154)

Variety CR Dhan 202 is suitable for target areas of Jharkhand and Odisha with high grain yield in normal season and resilient to changing climatic condition of uneven rain distribution. This variety has been released by Central Sub-Committee on Crop Standards, Notification and Release of Varieties during 2014. This line has exhibited stability for yield and other characters in region III of the country with an average yield of 3.7t/ha across 18 locations of the country under aerobic situation. Maturity duration of the variety is 110 days, semi-dwarf (100-105 cm) plant type, resistance to lodging with an average of 285 panicles/m^2. The variety possesses short bold grain, normal tillering (7-10), medium and dense panicle with 1000 grain weight of 21.3 g. This cultivar has good grain quality, short bold grain, no grain chalkiness, low alkali spreading value (7.0), intermediate amylose content (22.99%), L/B ratio of 2.33, good hulling and milling recovery (68.5%). CR Dhan 202 is moderately resistant to leaf blast, brown spot, sheath rot, stem borer (both dead heart and white ear heads), leaf folder, whorl maggot and rice thrips. The genotype has high response to fertilizer.

Field view of CR Dhan 202

Package of practices for high yield

Seed selection

- Ensure genetic purity with more than 80% germination by obtaining seeds from a reliable source.
- Select well-filled seeds from a healthy crop, free from insect and disease attack.

Panicles of CR Dhan 202

Land preparation

- Plough the land using mould board plough and use rotavator to fine tilth for ensuring uniform germination, enables easy root growth and enhances root growth.
- Level the land to minimize irrigation water, easy to weed control and proper crop stand.

Time and method of sowing

- Sowing of seeds should be done in the second week of June for wet season and early December for dry season.
- Seed rate of around 50 kg per hectare is recommended for aerobic rice. The seeds are sown 20 cm between rows and 15 cm within rows with 3 to 5 cm depth.
- Use seed drill in well leveled field for sowing. In case seed drill is not available, sowing can be done behind the country plough with appropriate spacing.
- After sowing, light irrigation should be followed immediately. Sowing can also be done during the onset of monsoon.

Fertilizer management

Apply N: P: K @ of 80:40:40 kg/ha. Apply full P and 50% of K fertilizer as basal dose before land leveling. Apply N in 3 splits, as 30% at 10-12 days after germination, 40% at 30 days after sowing and balance 30% at booting or panicle initiation stage of the crop (50 DAS). Potassium fertilizer has to be applied in 2 splits, 50% at sowing and 50% at

Active tillering stage