

# Increasing rice production

## from waterlogged rice ecologies by adopting high yielding varieties and their package of practices

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*Water logging is one of the major issues in the lowland area of our country. Nearly, 3.0 million hectares rice grown area is affected by water logging. Important cash crops cannot survive under this flooded ecology, while rice crop grow happily. The rice crop is well suited to water availability areas however, excessive water logging, long duration water logging and poor drainage brings the rice crop under stress. Water logged ecology is broadly classified into three groups viz; (1) Semi-deep-water ecology: standing water depth is up to 75 cm and remain water logged for about a month, (2) Deepwater ecology: water depth goes up to one-meter and remains submerged for about a month, and (3) Floating rice or Very deep-water ecology: water depth is more than a meter and remains submerged around a month.*

**Keywords:** High yielding variety, Rice, Water logged ecology

**T**HIS lowland ecology is less responsive to better cultural management due to frequent submergence and water logging. Thus, the productivity from this water-logged ecology is very low, less than a ton/ha only, which is nearly 60% less than the national average. Due to waterlogging tillering ability of the plant is suppressed in the early growth stages and causes more plant mortality. Further, due to poor drainage in the water-logged areas accumulation of toxic substance like iron toxicity, sulphide injury is very high, which is detrimental to crop growth and crop production. Overall, the fertilizers and plant protection chemicals have also less effective in this ecology.

To assured maximum production from this ecology we need to adopt suitable high yielding varieties for cultivation recommended for this ecology with better cultural management. Few promising varieties released for water logged ecology are listed in the Table 1.

### Few widely adopted varieties

#### CR Dhan 500

The deep-water variety, CR Dhan500 was released and notified for cultivation in the states of Odisha and UP. The variety was developed by ICAR-National Rice Research Institute, Cuttack. Maturity duration of the variety is 155-160 days, tall plant type, possess moderate kneeing ability and elongation ability. It produces medium slender grain, 220-270 panicles/m<sup>2</sup> with 130-135 days to 50% floweirng, moderate tillering (6-10), more grains/panicle and compact panicle with test weight of 24 g. The variety possess good hulling, milling, white kernel, medium slender grain, no grain chalkiness and desirable alkali spreading value. The variety is moderately resistant to leaf blast, neck blast, brown spot, gall midge biotype1 & 5, stem borer, whorl maggot and EHB attack while resistant to rice thrips and leaf folder attack.

#### Varshadhan (CRLC 899)

It is a late maturing (160 days), tall (150 cm), non-lodging and photosensitive popular variety with stiff straw. It was released in 2005 by SVRC, Odisha for semi-deep-water ecology in the state. The variety was notified during 2006 for cultivation in the low land areas of Odisha state. It has long bold grains with average productivity of 4.0 t/ha. It is tolerant to neck blast, bacterial leaf blight, shealth rot and white backed plant hopper. It can tolerate prolonged water logging up to depth of 75 cm.

#### CR Dhan 505

CR Dhan 505 was released in the year 2014 by Central Variety Release Committee for the states of Odisha and Assam. Maturity duration of the variety is 160 days. The average yield of the 4.3 t/ha. Flowering duration of the variety is 132-135 days and it produces long and heavy panicle producing high seed test weight (31.6gm). Kernel is white with length of 5.5 mm and breadth of

**Table 1.** List of promising varieties for semi-deep and deep-water ecologies

| Name                       | Duration (day) | Average yield (t/ha) | Potential yield (t/ha) | Remarks                                                                                                                                                                    |
|----------------------------|----------------|----------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Semi-deep water</b>     |                |                      |                        |                                                                                                                                                                            |
| Varshadhan                 | 160            | 3.5-4.0              | 5.5                    | Grain-LB; Plant height-150 cm, stiff straw for water logging situation, moderately resistant to neck blast, bacterial leaf blight, sheath rot                              |
| CR Dhan 501                | 152            | -                    | 3.4                    | Resistant to neck blast                                                                                                                                                    |
| CR Dhan 506                | 165            | 3.8                  | 4.4                    | Moderately resistant to Sheath Blight, Sheath rot, brown Spot                                                                                                              |
| CR Dhan 507 (Prasant)      | 160            | 4.75                 | 5.6                    | Moderately resistant to Brown Spot, Sheath Blight, Sheath Rot, Short Bold, Leaf Folder                                                                                     |
| CR Dhan 508                | 187            | 4.4                  | 7.8                    | Moderately resistant to Sheath Blight, Sheath Rot, Brown Spot                                                                                                              |
| CR Dhan 510                | 160            | 4.6                  | 5.88                   | Moderately resistant to Leaf Folder, blast, Bacterial Leaf Blight, Stem Borer                                                                                              |
| CR Dhan 511                | 160            | 4.2                  | 5.17                   | Moderately resistant to leaf blast, neck blast and bacterial blight diseases, stem borer (both dead heart and white ear heads), white backed plant hopper and leaf folder  |
| Sarala                     | 150            | 4.75                 | -                      | Non-lodging and photosensitive                                                                                                                                             |
| CR Dhan 70 (Hanseswari)    | 150            | 3.0                  | -                      | Moderately resistant to blast                                                                                                                                              |
| Gayatri                    | 155            | 4.0-6.0              |                        | Moderately resistant to bacterial leaf blight, blast & gall midge                                                                                                          |
| Durga                      | 155            | 4.3                  |                        | Resistant to rice tungro disease and suitable for late planting                                                                                                            |
| Gayatri                    | 155            | 4.0-6.0              | -                      | Gain-SB; Semi dwarf (100 cm), moderately resistant to bacterial leaf blight, blast & gall midge                                                                            |
| CR Dhan 409 (Pradhan Dhan) | 160-165        | 4.7                  | 7.55                   | Moderately resistant to bacterial leaf blight, neck blast, sheath blight, sheath rot, stem borer, leaf folder                                                              |
| <b>Deep water ecology</b>  |                |                      |                        |                                                                                                                                                                            |
| CR Dhan 500                | 160            | 3.5                  | 4.7                    | Moderately resistant to blast, neck blast, brown spot, gall midge, stem borer. Resistant to leaf folder                                                                    |
| CR Dhan 502 (Jayantidhan)  | 160            | 4.6                  | 4.7                    | Resistant stem borer, leaf folder; moderately resistant to bacterial leaf blight, neck blast, sheath blight, sheath rot, rice tungro virus and gall midge                  |
| CR Dhan 503 (Jalamani)     | 160            | 4.6                  | 6.3                    | Moderately resistant to leaf folder, bacterial leaf blight, green leaf hopper, neck blast, brown spot, gall midge, short bold                                              |
| CR Dhan 505                | 162            | 4.5                  | 6.1                    | Tolerance to submergence, blast, neck blast, sheath rot, sheath blight and rice tungro virus, stem borer (both dead heart and white ear heads), leaf folder, whorl maggot, |

2.01 mm producing L/B ratio of 2.73. The variety is moderately resistant to leaf blast, neck blast, sheath blight, sheath rot, rice tungro virus, leaf folder, stem borer, rice thrips and whorl maggot. CR Dhan 505 exhibit higher hulling, milling, head rice recovery and desirable intermediate amylose content.

#### CR Dhan 503

The variety CR Dhan 503 (Jalamani) was released in the year 2012 by State Variety Release Committee for the states of Odisha. The produces average yield of 3.8 t/ha. Maturity duration of the variety is 155-160 days. The plant type is tall, moderate kneeing, and elongating type, suitable for deepwater/ semi-deep areas of region III of the country. Plant height of the variety is 140cm, produces medium slender grain, 220-270 panicles/m<sup>2</sup> with 132-135 days to 50%

flowering, moderate tillering (6-8), more grains/panicle, extra long panicle (27-28 cm) with test weight of 24 gm. Kernel appearance is white with L/B ratio is 2.6. High milling (71%), head rice recovery (57%), intermediate amylose (22.86%), alkali spreading value (5.0) and gel consistency (23mm) was observed in the variety CR Dhan 503. The line is moderately resistant to leaf folder, blast, brown spot, gall midge biotype 1 & 5, stem borer, whorl maggot, rice thrips and EHB.

#### CR Dhan 502

CR Dhan 502 (Jayantidhan) was released for the water-logged area of Odisha state by the SVRC, Odisha. The variety matures in 160-165 days, tall plant type, possess moderate elongation ability and kneeing ability. It produces medium slender grain, 221 panicles/m<sup>2</sup> with 135-138 days to 50% flowering, moderate tillering

(6-8), more grains/panicle and test weight of 22.5g. The variety is moderately resistant to leaf blast, sheath blight, neck blast, sheath rot, rice tungro virus and gall midge biotype 1 while while resistant to stem borer, rice thrips, leaf folder, EHB and whorl maggot. Jayantidhan produces good hulling, milling, medium slender grain, no chalkiness and desirable alkali spreading value. Adaptive traits namely good kneeing ability, elongation ability, tolerance to major diseases and pests for deep water ecology are present in the variety.

#### CR Dhan 506

Semi-deep-water variety, CR Dhan 506 was released for Assam, Andhra Pradesh and Karnataka states. CR Dhan 506 was released in the year 2017 by Central Variety Release Committee. The variety is strongly photosensitive and matures in 160



Fig. 1. CR Dhan 506



Fig. 2. Panicles of CR Dhan 506

days. It produces long bold grain with moderate test weight (23g). The variety is moderately resistant to leaf blast, neck blast, sheath blight, brown spot, sheath rot, tungo virus, stem borer, whorl maggot and leaf folder. The variety has good hulling, milling, head rice recovery, desirable alkali spreading value, intermediate amylose content, long bold grain and other grain quality parameters.

#### CR Dhan 507

The variety, CR Dhan 507 (Prasant) was released for water logged rice areas of Odisha by the State Variety Release Committee, Odisha. The mean yield in Odisha was observed to be 4,751 kg/ha. The variety is strongly photosensitive and matures in 160 days. The variety produces short bold grain with a long heavy panicle having moderate test weight (25g). The variety is moderately resistant to neck blast, sheath blight, brown spot, sheath rot,

stem borer, leaf folder and whorl maggot. The variety produced good hulling, milling, head rice recovery, alkali spreading value (6.5), intermediate amylose content, medium slender grain and other desirable grain quality parameters.

#### CR Dhan 508

CR Dhan 508 was recommended by CVRC for release in the year 2017 for the water-logged rice areas of states of Assam, Odisha and West Bengal. The mean yield in West Bengal, Assam, and Odisha were 6.4, 3.4 and 3.6 t/ha, respectively. The variety is photosensitive and matures in 160-165 days. plant height of the variety is 130-150cm and it produces produces short bold grain, with heavy panicle having high test weight (28g). The variety is moderately resistant to brown spot, neck blast and sheath rot, stem borer, leaf folder and whorl maggot. CR Dhan508 showed good hulling, milling, alkali

spreading value (4.5), head rice recovery, intermediate amylose content, and other desirable grain quality parameters.

#### CR Dhan 510

CR Dhan510 was released in the year 2019 recommended by Central Variety Release Committee for the states of West Bengal and Odisha. The variety is strongly photosensitive and matures in 160-165 days. Tall, erect plant type and possesses short bold grain with a long heavy panicle having moderate test weight (23.9g). The variety is moderately resistant to neck blast, leaf blast, bacterial blight, leaf folder and stem borer. CR Dhan 510 has good hulling, milling and head rice recovery, intermediate amylose content and other desirable grain quality parameters.

#### CR Dhan 511

CR Dhan 511 was released by Central Variety Research Committee



Fig. 3. CR Dhan 507



Fig. 4. Panicles of CR Dhan 508

for the states of West Bengal and Andhra Pradesh in the year 2019. The mean yield in Andhra Pradesh and West Bengal was 3.76 and 4.73 t/ha, respectively. The variety is strongly photosensitive and matures in 160-162 days. It possesses short bold grain with a long heavy panicle having moderate test weight (21.8g). The variety has purple pigmented leaf sheath and apiculus colour which is easy for maintaining genetic purity. The variety is moderately resistant to neck blast, leaf blast, bacterial blight, stem and leaf folder. CR Dhan 511 has good hulling, milling and head rice recovery, intermediate amylose content, short bold grain and other desirable grain quality parameters.

### Practices for raising a healthy crop in water logged ecologies

#### *Suitability of the variety for the area-agroclimatic zone:*

Select a suitable variety recommended for the respective agroclimatic zone. Purchase certified or truthfully labelled seed for grain production.

#### *Selection of field/land preparation practices:*

Plough the land immediately after the harvest of wet season rice, preferably with a mould board plough to open the field soil. Allow the field to sun dry properly. After the 1-2 summer ploughings to improve soil health, and avoid perpetuation of pest. During pre-monsoon rain (April-May) prepare

the field for sowing and ploughing before sowing to make fine tilth.

#### *Sowing time:*

The optimum time of sowing is from last week of May to first week of June. Sowing should be done after receiving pre-monsoon rain, so that plant stand establishment will be higher before accumulation of water in the semi-deep and deep-water rice fields.

#### *Seed rate/sowing:*

The optimum seed rate is 40-60 kg seeds/ha. Seed should be treated with agrosan GN or cerasan (dry) or bavistin at the rate of 2gm/Kg of seed before sowing.

#### *Fertilizer doses and time of application:*

Apply N: P: K @ 40:20:20 kg/ha in case of poor soil fertility status. It is advised to apply the fertilizers on the basis of soil testing report. Apply farm yard manure @ farm yard manure @ 5t/ha enrich with half N, full P and 3/4<sup>th</sup> K as basal in the line sown rice. Apply 10 kg of N as top dressing at beushening in broadcast rice and after weeding on line sown rice and the rest N and K fertilizers at panicle initiation stage, if water recedes.

#### **Weed control**

Before accumulation of rain water, the beushening and weeding operations are to be completed which is around 45-60 days after seeding. Spray herbicide bispyribac sodium at the rate of 30g a.i/ha in direct seeded

rice for control of major grasses, sedges and broad leaf weeds. This is a post-emergence herbicide and it can be applied after 12 days of sowing.

### **Disease and pest control**

Apply Streptocyclin (150mg) + Copper Oxychloride (1g) in one litre of water for controlling bacterial leaf blight disease. For controlling sheath rot disease, soak the seeds in 0.05%-0.1% Bavistin for 30 minutes before sowing. After raising the crop, minimize the disease by foliar spray of 0.05%-0.1% Bavistin or 0.4% Dithane M-45 or 0.1% Hinosan. For controlling the insect attack, spray is not feasible due to deepwater situation. Use of bio-control method is preferable. Release of *Trichogramma japonica*, an egg parasite at the rate of 50,000 numbers/ha is recommended for control of the pest. If water level reduces apply Monocrotophos at the rate of 0.5Kg a.i/ha or apply granular insecticides Carbofuran 3G at the rate of 33 Kg/ha or Cartap 4G at the rate of 25 Kg/ha on the basis of ETL (One egg mass/ m<sup>2</sup> or 5% dead heart)

### **Harvesting**

Harvest the crop at 25-30 days after flowering. Thresh immediately after harvesting and dry gradually under shed up to 12% moisture content for seed purpose and up to 14% moisture for milling.

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