CR Dhan 315 :
A high zinc biofortified rice variety

K. Chattopadhyay, T. B. Bagchi, L. K. Bose, A. Poonam, A. Mukherjee, S. D. Mohapatra, B.C. Marndi, S. Samantaray, M. Chakraborti, A. Kumar, N. Basak, P. Sanghamitra, P. Dehuri, N. Moharana, S. S. Mohapatra, C. N. Neeraja and B.C. Patra

CR Dhan 315 (IET 27179: CR 2826-1-1-2-4B-2-1) has been developed through bulk-pedigree method of breeding from the cross between Swarna/ARC10075 in the Biofortification breeding programme at NRRI, Cuttack. In AICRIP Bio-fortification trials, IET 27179 performed well especially in Western zone **(Zone VI)** with an average **25 ppm zinc** content in milled rice over the years (2017 - 2019). The mean grain yield of this line in **Zone VI** was **5054 kg/ha** showing **19.17%, 6.45% and 1.83% yield superiority** over yield checks, BPT 5204, DRR Dhan 45 and IR 64, respectively. In agronomic trial of AICRIP in 2019 this was observed **promising with higher agronomic efficiency** in 150% recommended dose of fertilizer.

CR Dhan 315 is a medium maturity duration (125-135 days) variety with semi-dwarf (110 cm) plant type. It possesses medium slender grain, higher number of panicles per m^2 (300) with 100 days to 50% flowering, normal tillering (7-10), long and dense panicles with moderate test weight (23.1g). It is **resistant to leaf folder and moderately resistant to stem borer** (dead heart & white ear head) while **moderately tolerant to leaf blast, neck blast and brown spot.** Further, this line is also not susceptible to any major diseases. This nutrient-rich rice is high yielding in irrigated ecosystem and yield is at par with IR 64 and Sambha Mahsuri. Therefore, it is widely accepted by farmers. The presence of high nutritious element (more zinc) and good cooking quality with intermediate amylose content (25.2%) and intermediate alkali spreading

value (4) combined with low GC (22) contribute to high consumer acceptability. High head rice recovery (65%), medium slender grain, very occasionally grain chalkiness and higher nutritious value assist in easy marketability and fetches higher profitability to the miller. **As biofortified rice variety CR Dhan 315 has been released and notified for Gujarat and Maharashtra in 2021.**

Recommendation for scientific cultivation

Land suitability

- Suitable for cultivation in favourable shallow rainfed medium and in irrigated land during *wet/kharif* season.

Nursery preparation for rice seedlings

Method for preparing nursery

- Select a suitable land near a water source for irrigation during mid-June.
- Plough the field 3-4 times and level the field well with the help of a leveler.
- Apply fertilizer N: P: K in the nursery bed at the rate of 100:20:20 kg per hectare.
- Apply 5 tons of farmyard manure or compost per hectare of nursery.
- By raising the soil, prepare nurseries of one meter width and convenient length and maintain a gap of 30 cm between the lines in nursery bed. Prepare drainage channel all around the beds for easy drainage of excess water.
- Seedlings obtained from one nursery bed can be planted in ten times the area of its size.

Selection of seeds

- Prepare a salt solution by adding 60g common salt in one liter of water and pour the seeds in the solution. The volume of total solution depends on the amount of seeds to be used in nursery bed.
- Remove the floating seeds and wash the remaining seeds in fresh water. Dry the seeds in shade.

Seed rate and seed treatment

- For direct sowing, use seeds @ 40-50 kg/ha and for transplanting @ 30-35 kg/ha. If seed drill or pneumatic seeder is used, 25 kg of seeds per hectare will be sufficient.
- Mix well 2 gm of carbendazim (Bavistin) or Agrosan GN with one kg of seed.

Sowing time

- For direct sowing, sow the seeds directly until first fortnight of June in favourable shallow medium lands.
- For transplanting, sow seeds in seed bed in first week of June.

Maintenance of nursery

- After 24 hours of soaking the seeds, drain out the water and cover the seeds with gunny bags for quick germination.
- Sow the germinated seeds in the nursery and keep it wet for first few days.
- Apply Pyrazosulfuron ethyl (10WP) @ 200 g/ha, 1-3 days after sowing.
- When the seedlings grow up to one inch, maintain one cm water level in the nurseries.
- Fifteen days after the germination, apply Furadon 3G (Carbofuran) @ 33 kg/ha to the bed.

Main field preparation and transplanting

- At seven to eight days of interval, plough the field twice and make a fine puddled field.
- Use 20-25 days old seedlings in *kharif/wet* season

Spacing and crop establishment

- During mid of July, transplant in the main field by maintaining a spacing of 15 cm from plant to plant and 20 cm between the rows.

Fertilizer application

- The dose of N: P: K for the variety is 100:50:50 kg/ha. Use farmyard manure @5 tons/ha. In agronomic trial of AICRIP, this was observed promising with higher agronomic efficiency in 150% recommended dose of N-fertilizer. So if feasible and required N:P:K can be applied with higher dose (150:60:60 kg/ha).
- Before final puddling, apply half of nitrogen (75 kg), entire amount of phosphorous (60 kg) and three fourth of potash (45 kg) in the field.
- Initially, apply zinc at the rate of 25 kg/ha in zinc deficient soil.
- Apply rest amount of nitrogen by splitting into two equal parts, initially three weeks after transplanting and later during panicle initiation stage. Also, apply the rest one fourth of potash during initiation of panicles.
- Use the Leaf Color Chart (LCC) for increasing the nitrogen use efficiency and for saving nitrogen fertilizer.

Weed control

- For effective weed control , use Bensulfuron methyl 0.6+ Pretilachlor 6 GR @ 10 kg/ha at 7days after transplanting (DAT) followed by spraying of Penoxulam 21.7 SC @ 120 ml/ha, at 15 DAT or at 3-4 leaf stage of weeds.
- All the herbicides are to be applied in saturated soil moisture using knapsack sprayer fitted with flat fan nozzle, with total spray volume of 350 l/ha.
- Granules of Bensulfron methyl 0.6+ Pretilachlor 6 GR is to be applied by mixing with 10 kg sand/ha.

- Alternatively, manual weeding can be done 20 and 40 days after transplanting.

Water management

- After transplanting, keep the field saturated with water for one week so that the roots can grow and plants become firm.
- Throughout the crop development period, maintain a water level of 3-5 cm in the field. Before applying fertilizers as top dressing, drain out the water from the field and irrigate the field after 24-36 hours.
- After 15 days of milking stage, drain out the water from the field.

Insect and Disease Control

- Generally, this variety is tolerant to major insect pests and diseases. To minimize the insect pest and disease infestation, keep the bunds of the field clean. To control stem borer, before transplantation, dip the roots of seedlings overnight in 0.02% Chlorpyriphos. During panicle initiation stage, apply of Chlorpyriphos @ 2.5 l/ha for effective control of stem borer.
- If symptoms of the sheath blight disease appears, apply Sheathmar (Validamycin) or Tilt at 2.5 ml/l. About 500 liters are required for covering one hectare of land.

Harvesting, drying and milling

- Harvest the crop at 20-22% grain moisture or when 80-85% grains are straw colored and those in the lower part of the panicle are in the hard dough stage.
- Thresh the crop immediately after harvest and sun dry the grains to 12% moisture content for seed purpose and to 14% for grain purpose for milling and consumption purpose.

Cropping system

- As this is a mid-early duration variety, after harvesting in the *wet* season, sorghum, mung, black gram, maize, groundnut, wheat, cotton, mustard and vegetables can be grown with the available soil moisture.
- Cropping systems like rice-mung-groundnut, rice- sorghum-sorghum ratoon, rice-sweet corn-black gram, rice-fenugreek-okra are recommended for higher returns.

CR Dhan 315: A high zinc biofortified rice variety

NRRI Technical Bulletin No. 161

Acknowledge to the project 'CRP in Bio-fortification in selected crops for nutritional security', ICAR, New Delhi for funding

Laser typeset at the National Rice Research Institute, Indian Council of Agricultural Research, Cuttack (Odisha) 753 006, India and printed at Printech offset, BBSR. Published by The Director, for the National Rice Research Institute, Cuttack (Odisha) 753 006.