



CR Dhan 310 and CR Dhan 311

High Protein, Nutrient-Rich Rice Varieties of NRRI

CR Dhan 310

CR Dhan 311



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Importance of high protein, nutrient-rich rice

Rice is the staple food and main source of nutrition for about 50% world and 70% of Indian population. Protein malnutrition is predominant in Asia and India. Although rice is deficient in protein (7-8%), due to higher digestibility and better nutritive value of glutelins, major fraction of seed protein of rice is nutritionally superior to other cereals. Therefore, the impact of increasing the protein content in rice would be enormous, particularly in the scenario where more than one third of world's children are affected by protein-energy malnutrition (PEM). In addition, if rice varieties are fortified with zinc alongwith high protein, it helps to combat the Zn-malnutrition of people dependent on rice-based diet.

High protein, nutrient-rich rice varieties of NRRI

Using a high grain protein content donor (ARC 10075) several introgression lines in high yielding varieties such as Swarna and Naveen were developed by ICAR-National Rice Research Institute, Cuttack and tested in multi-locations. Most of them had significantly higher level of lysine, threonine, leucine, isoleucine, valine, phenylalanine, alanine, proline, glutamic acid, arginine and total amino acid as compared to recurrent high yielding parents. Among them a high yielding (4.5 t ha^{-1}) variety in Naveen background, CR Dhan 310 has been released as the first biofortified high protein (10.2%) rice variety by Central Variety Release Committee (CVRC) and notified for cultivation in Odisha, Uttar Pradesh and Madhya Pradesh.

Subsequently, another nutrient-rich variety, CR Dhan 311 (Mukul) with high protein (10.1%) and moderately high Zn (20 ppm) content has been released by the State Variety Release Committee (SVRC), Odisha and notified by Govt. of India in 2019. These high protein varieties had significantly higher glutelin content than Naveen. Using SNP genotyping of a backcross derived mapping population from ARC10075/Naveen, a consistent QTL (*qGPC1.1*) on chromosome 1 was identified over the environments, encoding a glutelin family protein. High protein varieties CR Dhan 310 and CR Dhan 311 also contained this QTL. High protein rice varieties can be easily distinguished from the low protein recurrent parent, like Naveen with the help of the *Xanthoproteic test* as the former gives more intense yellow or orange color than the latter.

Both the varieties have high head rice recovery (>60%) and acceptable grain and cooking quality with intermediate amylose content (22-24%). The high protein varieties have been well accepted by the farmers due to their resemblance for grain and plant type with its recurrent parent, Naveen, a popular variety in Odisha, West Bengal, Tripura, Assam, Jharkhand and Goa.



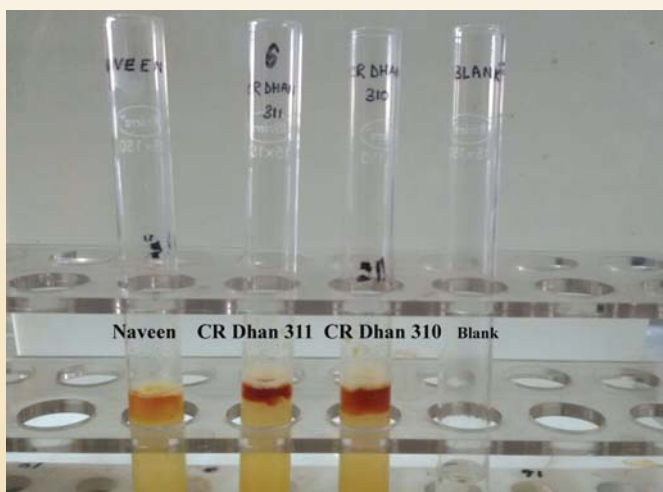
CR Dhan 310 (IET24780: CR2829-PLN-37)

It has been released in National level as first high protein rice variety for the states of Odisha, Uttar Pradesh and Madhya Pradesh. It has medium duration (120-125 days), semi-dwarf plant type (110 cm) with medium slender and good grain quality. It is suitable for irrigated and favorable shallow rainfed areas. National average of grain yield is 4.5 t ha⁻¹ and it contains average 10.2% protein in polished rice.



CR Dhan 311 (Mukul) IET 24772: CR2829-PLN-100

It has been released by SVRC for Odisha as nutrient rich rice and notified by Govt. of India. It has high protein content (10.1%) and moderately high level of Zn content (20 ppm) in 10% polished rice. It has medium duration (120-125 days), semi-dwarf plant type (110 cm) with long bold grain and good cooking and eating quality. It is suitable for irrigated and favorable shallow rainfed areas. National average of grain yield is 4.3 t ha⁻¹ and in Odisha it is 5.5 t ha⁻¹.



Xanthoproteic test to differentiate high and low protein rice



Characteristics of CR Dhan 310 and CR Dhan 311.

Characters	CR Dhan 310	CR Dhan 311
Plant height (cm)	109	115
Plant type	Semi-dwarf	Semi-dwarf
No. of effective tillers/plant	12	10
No. of panicle m ⁻²	311	256
Days to 50% flowering	97	95
Seed to seed duration (day)	125	123
Panicle type	Compact	Compact
Panicle exertion	Well exerted	Well exerted
Awning	Absent	Absent
Apiculus colour	Straw	Straw
Lemma palea colour	Straw	Straw
1000 grain weight (g)	24	26
Kernel length (mm)	5.49	6.26
Kernel breadth (mm)	2.06	2.21
L/B ratio	2.66	2.83
Grain type	Medium slender	Long bold
Chalkiness	Very occasionally	Very occasionally
Milling recovery (%)	71.9	69.0
Head rice recovery (%)	64.7	60.1
Alkali spreading value	5.0	5.0
Amylose content (%)	25.1	23.7
Gel consistency (mm)	37	24

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