

Biofortification in rice and its potential impact on increasing farmers' income and achieving food and nutritional security in India

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Abstract:

Biofortification refers to the genetic enhancement of major food crops with for grain nutrients such as micronutrients (Fe, Zn, etc.), protein, essential amino acids, vitamins, etc. Rice is the major caloric supplement for two thirds of Indian population with a consumption of around 220gm per day. But it is deficient in protein (7-8%) and micronutrients such as Zn (10-15 ppm) and Fe (2-3 ppm) in polished rice. In India ICAR-National Rice Research Institute, Cuttack has released two high protein (10%) rice varieties, CR Dhan 310 and CR Dhan 311 (Mukul). ICAR-Indian Rice Research Institute, Hyderabad and Indira Gandhi Krishi Viswavidyalaya, Raipur have released two high Zinc (22 ppm) rice varieties, DRR Dhan 45 and Zinco Rice –MS, respectively. All these varieties have been released and made available for cultivation in last 3-4 years. First high protein (10.2%) rice variety, CR Dhan 310 was released in 2016 for cultivation in Odisha, Uttar Pradesh and Madhya Pradesh. Subsequently Mukul (CR Dhan 311) with high protein (10.1%) and moderately high level of zinc content (20 ppm) also was released in Odisha and notified in 2019 as nutrient-rich rice variety. Both of them are in the genetic background of cv. Naveen, a well adopted popular rice variety of Odisha and eastern India as a whole for irrigated ecosystem. The high protein varieties have been well accepted by the farmers due to their resemblance for grain and plant type to recurrent parent, Naveen. They are the valid replacement of more than 10 years old variety, Naveen for irrigated ecosystem. The rapid detection technique has been standardized for differentiating Naveen with its high-protein counterpart. Higher content of glutelin and some of the essential amino acids such as Lysine was found in high protein lines with quantitative trait loci (QTL) for grain protein content, qGPC1.1. High protein lines (CR 2830-PLS-17, CR 2830-PLS-156) in the background of the high yielding variety, Swarna (MTU 7029) were found promising in national and state level multilocal testing. Rice based food and feed industry is growing very fast. High protein and high zinc rice varieties can significantly contribute in this industry. At present no support price for farmers for cultivation of high nutrient rich is available. Therefore, for popularization of the variety in suitable lands and for increasing the higher commercial value of this rice initiatives from Institutional and extension machinery as well as modification in policy decision are collectively required. Higher support price for growers and subsidy for mid-day meal rice are required to give benefits both the poor rice-farmers and our underprivileged children in villages of India. Therefore, high yielding rice varieties with high nutritional values developed through biofortification breeding intervention have significant potentiality to contribute towards the better nourishment of millions of poor who depend mainly on rice for their nutrition and also in improving the economic level of the farming community.