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Methods to reduce grain chalkiness in rice by overexpressing OsMADS29 under seed-specific promoters

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Rice is a staple food crop for more than half of the world's population. Various grain characteristics like grain length, aroma, and texture have varied likings or dislikings in different cultures. However, one universally undesirable trait is grain chalkiness. The chalkiness is caused by suboptimal starch accumulation during the final stages of grain filling, causing a disordered cellular structure, rounder amyloplasts, and more air spaces than head rice. Chalky grains are more brittle than non-chalky grains and can break more easily during milling. The MADS29 (M29) gene is a primary regulator of seed development in rice. Our earlier experiments have also demonstrated that the mere expression of M29 enhances starch accumulation in a completely heterologous system of tobacco BY-2 cells, suggesting that M29 could be the master regulator of starch biosynthesis. Therefore, to augment the starch biosynthesis machinery in the center of the endosperm, we planned to express M29 under the control of two seed storage protein promoters, namely, P26 (2062 bp) and O18 (1249 bp). This intervention reduces grain chalkiness by up to 90% and increases grain width, length, and grain weight by up to 6%, 16%, and 23%, respectively. Thus, we can improve grain quality by expressing M29 outside its expression domain, in the center of the endosperm.

Speaker Biography

Vibha Verma completed her Ph.D. in 2019 from the faculty of interdisciplinary and applied sciences, the University of Delhi, from the laboratory of Prof. Sanjay Kapoor in the department of plant molecular biology. Her focus has been on post-transcriptional regulation of a MADS-box transcription factor which seems to be one of the master regulators of rice seed development and grain filling. She has also used heterologous systems like tobacco BY-2 cells and Physcomitrella patens to elucidate the role of this transcription factor in influencing auxin: cytokinin homeostasis and its downstream effects on plastid biogenesis and starch synthesis. She has also been exploring avenues of biotechnological applications of M29 by altering its expression in different cell types of rice.

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