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Genome editing in popular rice variety 'Swarna' targeting Ideal Plant Architecture (IPA1) gene for yield enhancement

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Abstract:

Rice (*Oryza Sativa* L) is the major staple foods source for more than three billion people and cultivated throughout the world. It has been estimated that 40% more rice is needed by 2050 to meet the food demands of the ever-increasing population. However, the rice yield is gradually declining in recent decades. The recent emergence of genome editing technologies has superseded the limitations of traditional breeding methods, starting a new era of crop improvement. CRISPR/Cas 9 (Clustered regularly interspaced short palindromic repeats) is the most advanced genome editing tool in plant biology. The present investigation aimed at increasing the yield traits in indica rice variety "Swarna" which is the highly popular variety known for providing reasonable yield and profit to the farmers even under low input management. The miRNA binding site of the Ideal Plant Architecture (IPA1) gene was targeted through CRISPR/Cas9 genome editing approach. A single guide RNA (sgRNA) specific to IPA1 and Cas9 protein were assembled to a specific expression vector specific for rice. The gRNA expression cassette was transferred into Swarna callus through Agrobacterium mediated transformation. The analysis of edited lines showed significant difference in the traits namely plant height, no. of panicle branches, panicle length and no. of spikelet per panicle relative to Swarna cultivar. Mean performance analysis in four out of 35 edited lines showed increase in plant height by 30.4%, 20.40% increase in number of panicle branches, 38.15% and 20.24% increase in the no. of spikelets and panicle length, respectively. In conclusion, utilization of CRISPR/Cas9 based editing approach could be useful in yield enhancement of other popular cultivars for the profit of the farmers.