

## Genome editing of yield related traits of rice in rainfed ecologies using CRISPR-Cas9 approach

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### Abstract:

Rice is a major staple food crop in India. The productivity of rice in India shows high variability with average yield of ~ 2.665 t/ha. Besides, rate of increase in productivity in India over the last two decades is only ~50 kg/ha in India. The varietal development program for rice in India has resulted in green revolution and enhanced rice production by 3-5 folds in the last five decades. Though >1000 rice varieties are released in India for cultivation, the average yield of rice varieties has increased from ~ 4 t/ha in 1970 to 5t/ha in the year 2018-19. However, yield gap for rice in India is around 28% considering the high yielding varieties in India. The yield gap can be significantly reduced through enhancing the genetic potential of yield and yield related traits of rice. Among the several traits, number of spikelets per panicle is one of the important yield contributing traits for rice. But the average number of spikelets of rice varieties is only 133.3 spikelets. CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats) is one of the genome-editing technologies which shows its potentiality in enhancing the genetic gain and reduce yield gap of rice in India. Several genes have been identified for regulating panicle architecture in rice. Genes namely Ideal Plant Architecture 1 (IPA1), dense and erect panicle (DEP), grain number, plant height and heading date (GHD7) have been reported to increase the yield of the rice plants. The genome-editing of yield related genes in japonica rice increased the yield by 10-15% in rice. Thus, utilization of CRISPR-Cas9 based genome editing approaches in indica rice could potentially improve the yield stability of rice in India which could increase the productivity and income of farmers in India. The development of genome edited lines has the potential to increase the average yield by 5-6t/ha and reduce the yield gap by 10% in India.