Duplication of an upstream silencer of FZP significantly increases grain yield in rice (Abstract)

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ABSTRACT

Transcriptional silencer and copy number variants (CNVs) are associated with gene expression. However, their roles in generating phenotypes have not been well studied. In this study, we identified a rice quantitative trait locus (QTL), SGDP7 (Small Grain and Dense Panicle 7). SGDP7 is identical to FZP (FRIZZLE PANICLE), which represses the formation of axillary meristems. An 18-bp fragment, named CNV-18bp, was inserted ~5.3 kb upstream of FZP, thus resulting in a tandem duplication in Chuan 7. The CNV-18bp duplication repressed FZP expression, prolonged the panicle branching period and increased grain yield by more than 15% by substantially increasing the number of spikelets per panicle (SPP) and slightly decreasing 1000-grain weight (TGW). The transcription repressor OsBZR1 binds the CGTG motifs in CNV-18bp and represses FZP expression, indicating that CNV-18bp is the upstream silencer of FZP. These findings showed that CNVs of the silencer coordinate a trade-off between SPP and TGW by fine-tuning FZP expression, and balancing the trade-off would enhance yield potential.

Keywords: China, rice grain yield, rice QTL, FZP, SGDP7, tandem duplication, transcription repressor, upstream silencer.