OsFBK4, a Novel GA Insensitive Gene Positively Regulates Plant Height in Rice (*Oryza Sativa* L.)

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Abstract: Semi-dwarf is one of the most valuable agronomic characteristics for rice improvement programs because it affects lodging resistance and grain yield. In the present study, a semi-dwarf mutant, *RE9586*, exhibits reduced plant height, panicle length and decreased grain yield. Scanning electron microscopic observation results showed that the longitudinal length of the uppermost internode of *RE9586* significantly reduced, resulting in a semi-dwarf phenotype. Employing a MutMap-based strategy, LOC_Os02g11790 was preliminarily identified as the candidate gene, which encoded the F-box domain and kelch repeat-containing protein (*OsFBK4*). A point mutation in the 3rd exon of *OsFBK4* resulted in an amino acid change of 414R→G that was subsequently confirmed by linkage analysis. Real time-PCR showed the *OsFBK4* gene was predominantly expressed in the internode. The knockout lines of *OsFBK4* by CRISPR/Cas9 showed a short plant height, while *OsFBK4* overexpression lines recovered the phenotype of plant height. We have also demonstrated that the expressions of GA-signaling genes such as *SRL1*, *CIGR*, *GID1*, *GID2*, *D*1, and *SPY* showed clear differences in which *SRL1* was down regulated, while other genes were up-regulated in *RE9586* mutant. GA biosynthesis genes, *OsKAO*, *OsGA3ox2*, and *OsGA2ox*2, also displayed apparent differences in expression level. In addition, the *OsFBK4* protein probably localized to the nucleus and plasma membrane. In conclusion, *OsFBK4* regulates plant height involving in GA signaling, providing further insights into the mechanisms underlying the regulation of plant height in rice.

Keywords: Plant Height, *OsFBK4*, Semi-dwarf, CRISPR/Cas9, Gibberellin, *Oryza sativa* L.