Molecular Mechanisms Underlying Antagonistic Role of Two Soybean FT Homologs, GmFT2a and GmFT4, in Soybean Flowering

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[Introduction]
FLOWERING LOCUS T (FT) is a major determinant of day length-dependent flowering in plants. To understand the role of FT homologs in the short-day flowering soybean plant, we identified soybean FT genes, GmFTs, and analyzed their roles in photoperiod-dependent flowering of soybean.

[Materials and Methods]
The cDNAs for soybean FT homologs were cloned based on the genome sequence information taken from plant genome website Phytozome v.12.1 (http://www.phytozome.net). The in silico analysis of cis-acting element of GmFTs was performed in 2000 bp upstream region of each GmFT by using PlantCARE web bioinformatics tool. To screen binding partners of GmFTs, we used the Matchmaker Gold Yeast Two-Hybrid System (Clontech) constructed with soybean cDNAs.

[Results and Discussions]
We identified 10 homologs of FT gene in soybean, a short-day plant. Analyses of gene expression patterns in response to day-length and ectopic expression in Arabidopsis suggest the antagonistic roles of GmFT2a/GmFT5a and GmFT4 in soybean flowering. To uncover the molecular mechanism of diversification in expression patterns between GmFT2a/GmFT5a and GmFT4, we analyzed cis-acting regulatory elements in the promoter regions of those genes. The motifs involved in light perception were commonly found among those genes. Compared to GmFT4, GmFT2a and GmFT5a contain more diverse regulatory elements, such as hormone-dependent, biotic-, and abiotic-stress related motifs. To understand the mode of biological functions of GmFT5a, floral activator, and GmFT4, floral repressor, in soybean flowering, we performed yeast-two-hybrid screening by using GmFT5a and GmFT4 as baits. We identified 145 and 38 candidates for GmFT5a- and GmFT4-binding proteins, respectively. Moreover, 17 candidates were identified to bind both GmFT5a and GmFT4. These results suggest that, in some conditions, GmFT5a and GmFT4 genes function in the same flowering pathway, but simultaneously, these two genes might have specific function in soybean flowering by differentially modulating gene expression and employing different binding partners.

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