Flowering signals modulate bud outgrowth in pea and reveal a pivotal role of the strigolactone signalling pathway

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Abstract

The timing and patterning of shoot branching are important determinants of crop yield and are greatly affected by photoperiod. The outgrowth of buds is significantly altered by changes in photoperiod and in photoperiod-insensitive and other flowering mutants. The mechanism by which photoperiod regulates bud outgrowth and the position of branches is unknown, but photoperiod effects are observed in many plants including strigolactone deficient garden pea (*Pisum sativum*) mutants. We show that photoperiodic regulation of bud outgrowth involves long-distance signalling, activation of genes involved in the strigolactone response and downstream pathway and through modulation of bud cytokinin content. Experiments with photoperiod-insensitive and strigolactone double mutants showed that strigolactone response, but not strigolactone synthesis, is required for photoperiod regulation of shoot branching patterns. Through modulating expression of *RAMOSUS4* (*MORE AXILLARY GROWTH2*), *SUPPRESSOR OF MAX2-LIKE* (*SMXL*) homologs and *BRANCHED1* in buds, it is likely that the photoperiod response pathway pre-conditions buds for differing growth response capacities to endogenous signals. These insights into how photoperiod regulates bud outgrowth will help future endeavours to predict and optimise flowering and branching responses in different environments, ultimately improving crop yield and reproductive success.