

Regulation of synthesis and transport of cytokinins for quantitative and qualitative tuning of actions for plant growth optimization

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Cytokinin (CK) plays an important role in regulation of plant growth and development, and its action is finely controlled by various steps including biosynthesis and metabolism, transport, and signaling. We have demonstrated that *IPTs*, *CYP735As*, and *LOGs*, which are key genes for *de novo* CK biosynthesis, are expressed in various parts during growth and development, and differentially regulate the synthesis of N⁶-(Δ^2 -isopentenyl)adenine (iP) and *trans*-zeatin (tZ). Detailed studies on *CYP735As* mutants show that tZ is important for the normal growth of shoot rather than that of root, suggesting a mechanism that modulates physiological function of CKs by modification of the side-chain structures. This regulation is one of the qualitative controls of CK action involved in shoot growth regulation by root-borne signal. In addition, *ABCG14*, a member of ABC transporter family, has been recently identified as a key gene for root-to-shoot translocation of CKs via xylem. The biosynthesis and transport genes are regulated by nutritional cues for linking its status to growth regulation. Our studies show that external (nitrate) and internal (Gln) N-status, and C-status (sugar) independently regulate *de novo* CK synthesis in phloem, where N and C-nutritional information are integrated, to convert metabolic signal to growth regulation signal. Furthermore, our recent studies suggest importance of translocation of active form CK via xylem (i.e. tZ) for regulation of specific traits in shoot growth. We will outline our recent progress in CK study, and discuss the physiological significance of regulation of CK action to optimize growth and development at whole plant level.