Changes in gene expression and stress protective pathway regulations of potato tubers after sprout inhibitor treatments

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Abstract

Premature sprouting of potato tubers is a serious postharvest storage problem resulting in poor tuber quality. Finding safe sprout inhibitors as alternatives to current commercial treatment (Chlorpropham/ CIPC) is essential due to emerging regulatory concerns. In this study, dormant Russet Burbank tubers were treated with 1,4-dimethylnaphthalene (DMN) and methyl jasmonate (MeJa) alone or in combination and changes in dormancy related gene expression and stress protective pathway regulation were investigated 0-21 days after treatment. Results indicated significant changes in abundance of transcripts involved in cell cycle, phytohormone biosynthesis, and signaling pathways. Particularly, transcripts involved in ABA catabolism were increased, while transcripts involved in cytokinin biosynthesis and signaling were decreased. Transcriptome analysis also showed changes in biosynthesis, metabolism and signaling of gibberellic acid, ethylene, jasmonic acid and salicylic acid pathways. Additionally, upregulation of stress protective pentose phosphate pathway relevant for biosynthesis of phytohormones, amino acids, and secondary metabolites was observed in MeJa treated tuber tissues. The same treatment also resulted in higher stress protective phenolic content and enhanced activity of antioxidant enzyme (peroxidase) in potato meristem tissues. These results elucidate the potential role of stress signaling pathway regulation and polymerization of secondary metabolites in potato tuber dormancy and sprout suppression.