Title Improving the postproduction quality of floriculture crops

Author Nicole Waterland, Michelle L. Jones and John J. Finer

Citation Thesis, Doctor of Philosophy , The Ohio State University. 2010.

Keywords Floriculture; Senescence; Abscisic acid; Postproduction

Abstract

Senescence is the last stage in the life cycle of plants and eventually leads to organ or plant death. The senescence process is regulated by plant hormones including ethylene and abscisic acid. During senescence, the cell components are broken down and resources are redistributed. Proteases play a crucial role during nutrient degradation. Senescence can be accelerated during environmental stresses and the quality of crops during periods of stress can be reduced. Floriculture crops are often exposed to many environmental stresses during shipping and retailing, and these stresses often result in damaged crops and profit losses. Understanding the senescence process will allow us to develop floriculture crops with higher postproduction quality and to improve the quality of crops under various environmental conditions.

The long-term goal of this research is to improve the postproduction quality of floriculture crops by developing methods to prevent or reduce damage from senescence. To accomplish these goals, a putative senescence-specific protease from *Petunia hybrida* (PhCP10) was characterized and its functional role during petal senescence was investigated. Secondly, the effects of exogenous applications of ABA on drought stress tolerance were evaluated in several important floriculture crops. The *Petunia hybrida* cysteine protease, *PhCP10* , is up-regulated relatively early during petal senescence. Expression patterns and high sequence homology to the senescence-specific cysteine protease from *Arabidopsis* (*SAG12*), suggested that *PhCP10* might be involved in senescence. Transcript levels of *PhCP10* increased during senescence regardless of the cause (aging, pollination or abiotic stresses). Drought-stressed and nutrient deprived leaves had increased *PhCP10* expression only when the leaves were senescing. Cloning and sequencing of the *PhCP10* promoter also revealed a senescence-specific region homologous to that of the *SAG12* promoter. A putative enhancer element was also identified through expression of GFP driven by the *PhCP10* promoter.

To further understand how to delay stress-induced senescence ABA applications were investigated as a way to enhance drought tolerance and extend the shelf life of important floriculture crops. ABA enhanced tolerance to drought stress by closing stomata to reduce water loss. Exogenous ABA applications delayed wilting and allowed plants to survive during short periods of drought stress. However, leaf chlorosis in some bedding plants was observed following ABA application. To prevent the

development of leaf chlorosis additional plant hormones known to delay senescence, including cytokinin (benzyladenine or BA), gibberellic acid (GA_{4+7}) or the ethylene perception inhibitors, 1-methylcyclopropene (1-MCP), were applied prior to ABA treatments. Although the individual application of these hormones had no effect on the development of s-ABA-induced leaf chlorosis, application of a mixture of benzyladenine and gibberellic acid (BA + GA_{4+7}) prevented leaf chlorosis. The application of ABA alone or a combination of ABA and BA + GA_{4+7} will allow floriculture crops to tolerate temporary drought stress without significant loss of postproduction quality.