Regulatory Control of Autumn Senescence in *Populus tremula*

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Abstract
Autumn senescence is a visually spectacular phenomenon in which trees prepare for the oncoming winter. The mechanism for regulation of autumn senescence in trees has been very hard to pinpoint. In this thesis the main focus is to investigate how autumn senescence is regulated in aspens (*Populus tremula).*

Previous work has established that autumn senescence in aspens is under daylight control, in this thesis the metabolic status and the effect on autumn senescence was investigated. The metabolic status was altered by girdling which leads to accumulation of photosynthates in the canopy. This resulted in an earlier onset of senescence but also the speed of senescence was changed. At the onset of senescence the girdled trees also accumulated or retained anthocyanins.

The nitrogen status of aspens during autumn senescence was also investigated, we found that high doses of fertilization could significantly delay the onset of senescence. The effects of various nitrogen forms was investigated by delivering organic and inorganic nitrogen through a precision fertilization delivery system that could inject solutes directly into the xylem of the mature aspens. The study showed that addition of nitrate delayed senescence, addition of arginine did not have any effect on the autumn senescence in aspens, and furthermore the nitrate altered the trees leaf metabolism that was more profound in high dosages of supplied nitrate.

Cytokinins are plant hormones believed to delay or block senescence, studies have suggested that the decrease of cytokinins and/or cytokinin signalling may precede senescence in some plants. To investigate how cytokinin regulates autumn senescence in aspens we profiled 34 cytokinin types in a free growing mature aspen. The study begun before autumn senescence was initiated and ended with the shedding of the leaves, and spanned three consecutive years. The study showed that the individual cytokinin profiles varied significantly between the years, this despite that senescence was initiated at the same time each year. Senescence was furthermore not connected to the depletion of either active or total cytokinins levels. The gene pattern of genes known to be associated with cytokinin was also studied, but no gene expression pattern that the profile generated could explain the onset of senescence. These results suggest that the depletion of cytokinins is unlikely to explain the tightly regulated onset of autumn leaf senescence in aspen.

Keywords
Aspens, Autumn senescence, Girdling, Arginine, Anthocyanins, Cytokinin, *Populus tremula*

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