



Canadian Agri-Science Cluster for Horticulture 2

Progress Report December 2014

<p>Activity 12, Apple 11</p> <p>New Biological Control Agents for Postharvest Diseases of Pome Fruit</p>
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<p>Activity Objectives</p> <p>We have identified several bacterial antagonists from Canadian soils which show efficacy against postharvest pathogens of pome fruit under controlled atmosphere and air storage. Our objectives are to test these antagonists in storage trials in British Columbia and Ontario in order to assess their potential for commercial development. This will be accomplished by determining:</p> <ol style="list-style-type: none"> 1. the efficacy of the bacterial antagonists under varying storage conditions and with different fruit varieties, 2. optimal concentrations and timing of application of the antagonists, 3. the effect of the antagonists on fruit quality, 4. the performance of the antagonists alone or in combination with other chemical control methods 5. the suitability of the antagonists for commercial development <p>The long-term objective of this research is to enhance the quality and safety of Canadian fruit and increase Canada's competitive ability in global markets.</p>
<p>Research Progress to Date</p> <p>In British Columbia three soil isolates of <i>Pseudomonas fluorescens</i> 4-6, 1-112 and 2-28, were examined <i>in vitro</i> and <i>in vivo</i> as potential biocontrol agents under commercial cold storage conditions with five varieties of apple in year 1: Gala, McIntosh, Spartan, Ambrosia and Red Delicious. All three isolates inhibited the growth of three postharvest pathogens <i>Botrytis cinerea</i>, <i>Penicillium expansum</i>, and <i>Mucor piriformis</i> <i>in vitro</i>. Lesion diameters of apples inoculated with each of the three pathogens and biocontrol strains were determined after 5, 10 and 15 weeks in commercial cold storage or after varying</p>

periods of times in Controlled Atmosphere (CA) storage and compared with the fungicide Scholar[®] (fludioxonil), the biocontrol agent Bio-Save[®] (*P. syringae*) and Bio-Save[®] in combination with Mertect[®] (thiabendazole). On Gala, McIntosh and Red Delicious apples in cold storage, *P. fluorescens* isolate 4-6 was the most effective at inhibiting the three fungal pathogens, *B. cinerea*, *M. piriformis* and *P. expansum*, after 15 weeks. *P. fluorescens* isolate 1-112 had the greatest efficacy in reducing postharvest disease on Ambrosia after 15 weeks of cold storage. On Spartan apples, all 3 isolates of *P. fluorescens* provided significant levels of control of the three fungal pathogens.

In the CA storage trials, *P. fluorescens* isolate 4-6 provided the greatest level of control of the three fungal pathogens on Gala, McIntosh and Spartan apples stored for 24, 18 and 17 weeks respectively. Significant differences in physiological fruit quality parameters, firmness, titratable acidity, starch and sugar content, were observed between apple varieties before and after commercial storage and may contribute to their differing susceptibility to pathogens. McIntosh apples had the highest percentage of malic acid and lowest firmness and were most susceptible to fungal disease during commercial storage. In general, disease control by *P. fluorescens* isolates on the 5 varieties of apples was comparable to Bio-Save[®] but less effective than Scholar[®]. Year 2 storage trials with *P. fluorescens* isolates, Scholar[®], and Bio-Save[®] on Gala, McIntosh, Ambrosia and Spartan apples in cold and controlled atmosphere storage are underway.

In Ontario postharvest disease management studies were conducted using apples from four different cultivars, Gala, Ambrosia, McIntosh and Empire that were obtained either from Agriculture and Agri-Food Canada (AAFC) Farm in Jordan Station, Ontario or from commercial orchards in Simcoe area from trees maintained according to standard orchard practices. Apples were harvested on Sept 10-October 3, 2014, based on the maturity of each of the apple cultivars and stored at 4 °C until ready for processing. Between September 17 to October 16, 2014, experiments were conducted with all the cultivars of apples.

Two antagonists, *P. fluorescens* 4-6 and *P. fluorescens* 1-112 alone or in combination with the pathogen were tested for biological control activity against blue mold (*P. expansum*) and gray mold (*B. cinerea*) on all four apple cultivars. Positive and negative controls were also included. Two chemical fungicides, Mertect and Scholar were also compared against biological control agents. Following the treatments, the apples will be incubated for 165 days at 4 °C. The apples will be evaluated for disease incidence and lesion diameter approximately once every 4 weeks. After the 165 day incubation period the remaining apples will be placed in a Conviron growth cabinet set at 20°C and no light for 7 days and then evaluated for disease incidence.

Early Outcomes or Challenges

In British Columbia in the first year of trials some of the apple varieties provided by BC Tree Fruits Coop were culls and were of lower quality than desired. This may have influenced the outcome of trials with the biocontrols. In year 2 we are using first grade apples. No challenges in Ontario.

Key Message(s)

Because of the postharvest nature of the study, it is too early to draw conclusions, as we are in the middle of the studies. However, early results suggest that *P. fluorescens*, has potential for control of common postharvest fungal pathogens during commercial cold and Controlled Atmosphere storage comparable to that of another commercial biocontrol product, BioSave.