

# 1.2 Is hybrid vigour possible in native balsam poplar breeding?

## Fall - 2016

### OVERVIEW

Poplars (*Populus* L.) are the most widespread deciduous trees in Canada's boreal forest, covering a total of 13.1% of the boreal region, and are second only to spruce (47.3%) in total area covered. Hybrid poplars occur both naturally and artificially and result from crossing two (or more) distinct species or two individuals within one species with desirable characteristics. Hybrid vigour, typically achieved through controlled crossing of two species, or pure genetic lines of the same species, has long been exploited in agriculture and in some tree species including *Populus*. When two or more species are crossed to produce hybrid progeny, some of them can be expected to yield growth performance far superior than either parent (ie: hybrid vigour/heterosis).

In project 1.2, we are testing the hypothesis that within species breeding of widely spaced populations of balsam poplar will lead to the expression of hybrid vigour. We are exploring the potential underlying mechanisms through both field and greenhouse assessments. In September 2009, three field trials (two in Alberta (AB) (Field 7 and 23) and one in Quebec (QC) (Field QC)) were established in conjunction with Alberta-Pacific Forest Industries Inc. (Al-Pac) and Mr. Pierre Périnet (Ministry of Forestry, Quebec). Five male parents from each province with five female parents from Quebec, and four female parents from Alberta were used for breeding, both for within region and between region crosses. Preliminary analysis on 6-year height and diameter from the Alberta field sites only, indicate differences in family performance among the different cross-types. The preliminary results showed that AB x QC crosses ranked first for height and DBH and exhibited a later bud-burst.

Clones were selected, based on growth performance in the field trials, for a greenhouse trial carried out in summer 2016. Trees were grown in a randomized complete block design under near-optimal greenhouse conditions from May 2016 to August 2016. Diameter and height growth was measured biweekly and photosynthesis three times during the growing season. In late June internode tissue samples were collected from 2-3 trees from each cross and each parent for hormone analysis (gibberellic acids (GAs), indole-3-acetic acid (IAA) and abscisic acid (ABA)). These hormones will tell us if hybrid vigour is due to hormone levels and linked to photosynthetic performance.

Overall, the above approaches will determine the potential of using disparate, native populations of balsam poplar to produce superior progeny with enhanced stem growth traits. Future use of this material on crown land for reforestation or reclamation may require additional field testing to meet policy regulations.

### Goals & Objectives

Determine if hybrid vigour:

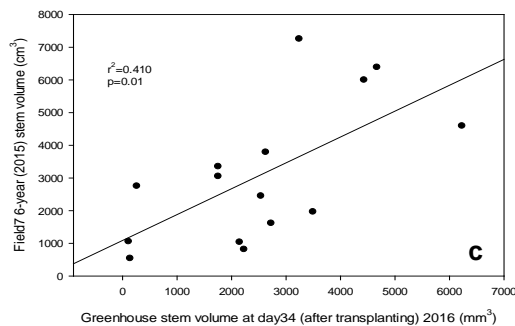
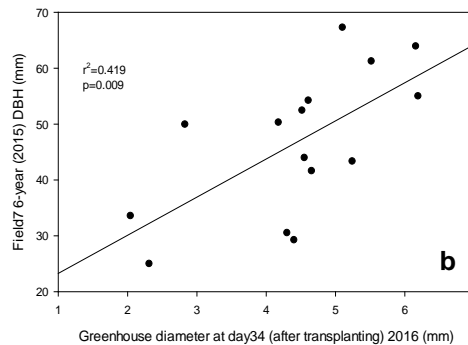
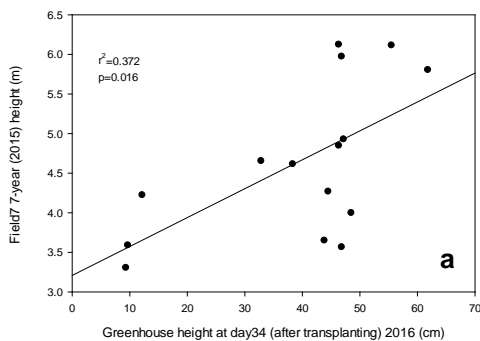
- Is due to specific gene interactions;
- Is due to hormone levels and linked to physiological performance;
- Is due to phenology (bud-burst & bud-set) resulting in a longer growing season.

# Outcomes & Deliverables

## 1.0 Greenhouse set-up



## 2.0 Preliminary results



- Field growth (height, DBH, and stem volume) at year-6 (2015) and greenhouse growth were significantly correlated for 15 selected progenies

**Figure 1.** Correlation between field growth data and greenhouse growth data for 15 selected progenies in 2016 for a) height; b) diameter; c) stem volume.

## 3.0 Deliverables

- Preliminary results suggest height and DBH of 6-year old field grown trees are significantly correlated with Day 34 greenhouse grown rooted cuttings under optimal growing conditions
- Day 34 greenhouse grown rooted cuttings' (height and caliper) may be used as one of the methods for early selection of new genotypes

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