

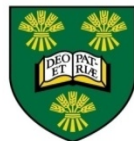
Effects of Competition Control on Juvenile Hybrid Poplar on Sites of Varying Quality

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Natural Resources
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Prairie Tree Plantations

- Northern edge of the great plains
- Dry environment (380 mm precipitation)
- Rich soils
 - Chernozems (Mollisols)
 - Glacial origin
 - High C, N and base cation levels



Prairie Tree Plantations

- Intense competition from agricultural weeds
- Past research has focused on breeding more than management
- Fertilization trials have had poor results.



Goals

1. Determine which resource is most limiting in hybrid poplar plantations in Saskatchewan.
2. What is the impact of competition stress on tree growth and resource availability?
3. How does site quality interact with competition?

Methods

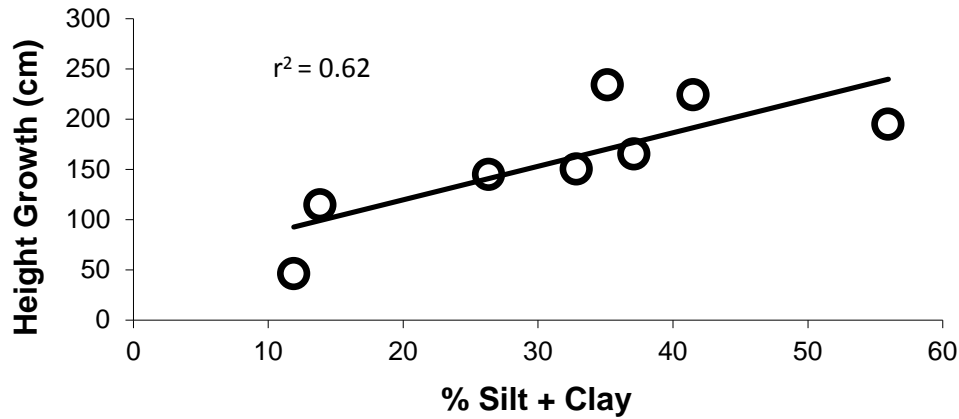
- 8 sets of paired plots
- Half plots had complete weed control, other half allowed weeds to grow
- Range of site productivity
- 2-year old plantations



Measurements

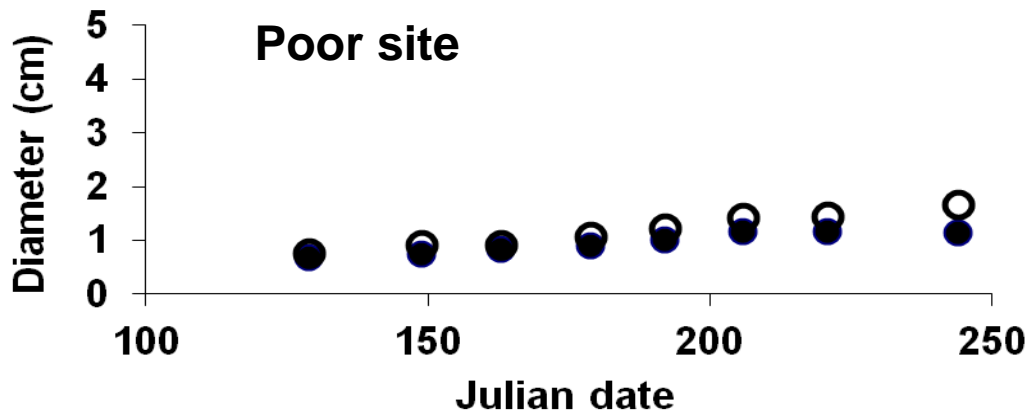
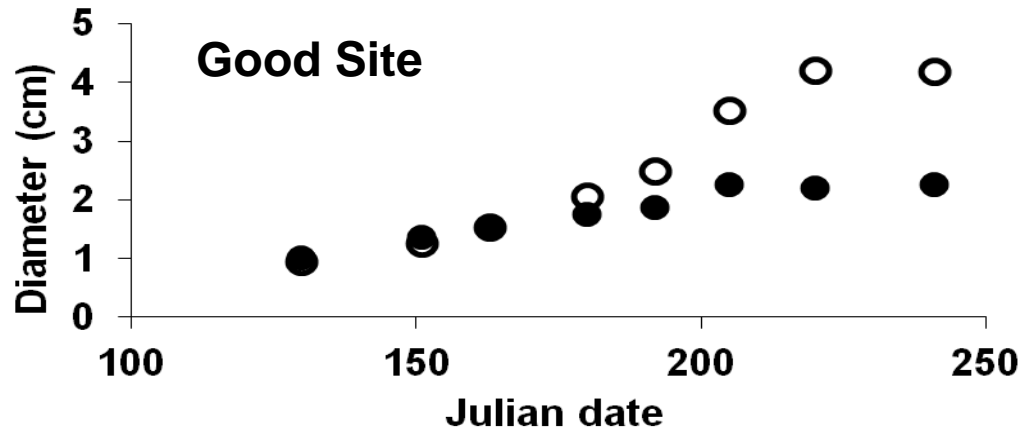
- Biweekly measurements
 - diameter and height
 - soil moisture
 - weed control
- Soil characteristics
 - Ap horizon texture and nutrients
- Plant Samples
 - 15 upper leaves for nutrient and ^{13}C analysis from each tree
 - weed biomass samples





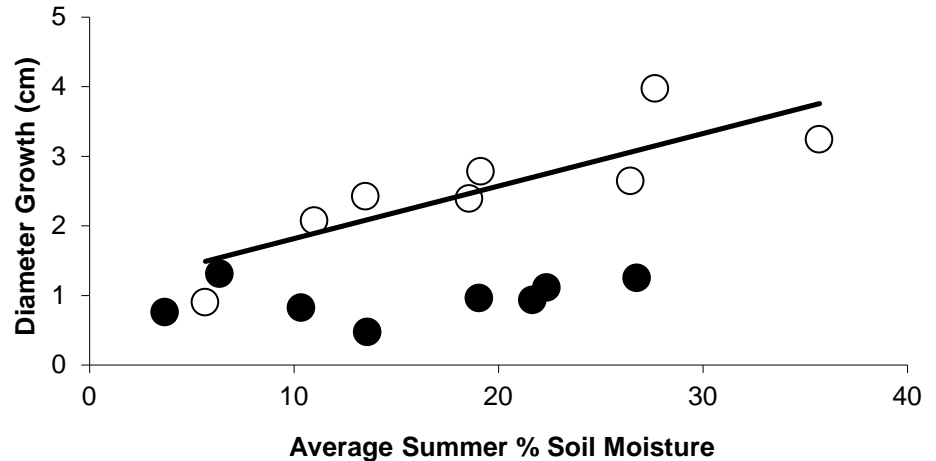
Site Quality

- Range of site productivity – average height growth ranged from 40 to 240 cm
- The benefit of competition control is much greater on good sites.
- Very little difference in growth on poor sites.



Soil moisture

- **Strong relationship in weed-free plots**
- **More soil moisture in weed-free plots indicates that competition is primarily for water**
- **Carbon isotope analysis (^{13}C) confirmed greater moisture availability in weed-free plots**



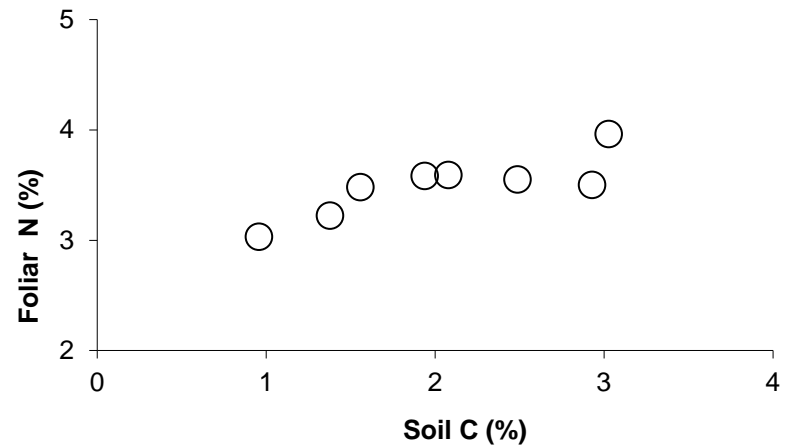
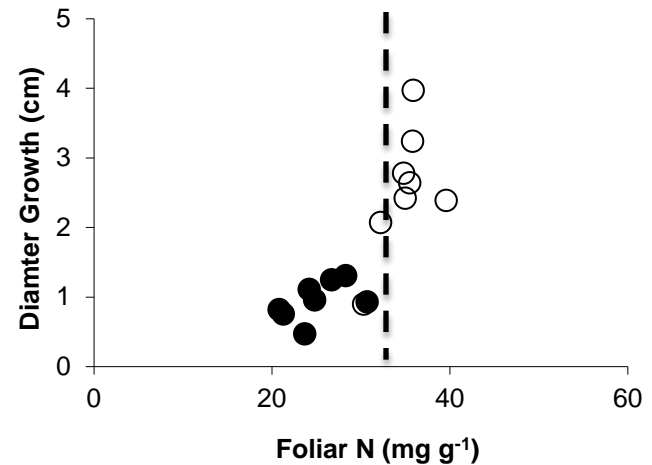
Foliar Nutrients

- Leaves in weed-free plots were much larger and greener than in weedy plots
- Which nutrients are most highly competed for?
- Which nutrients are related to tree growth?



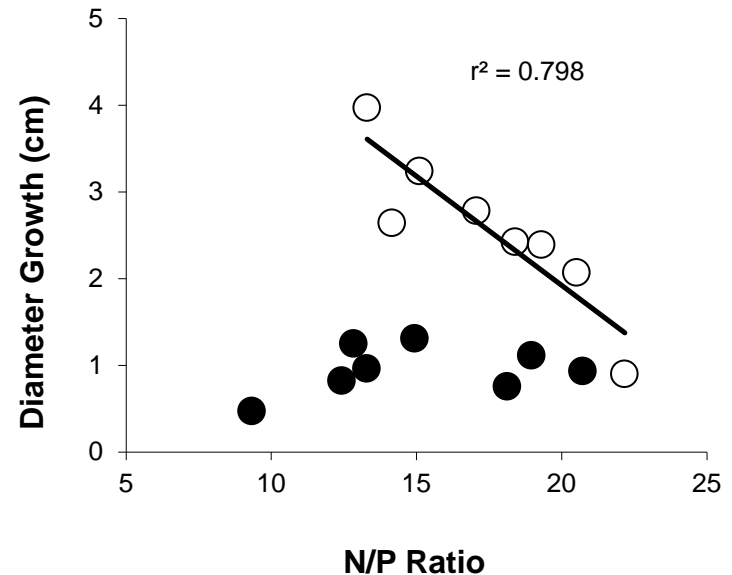
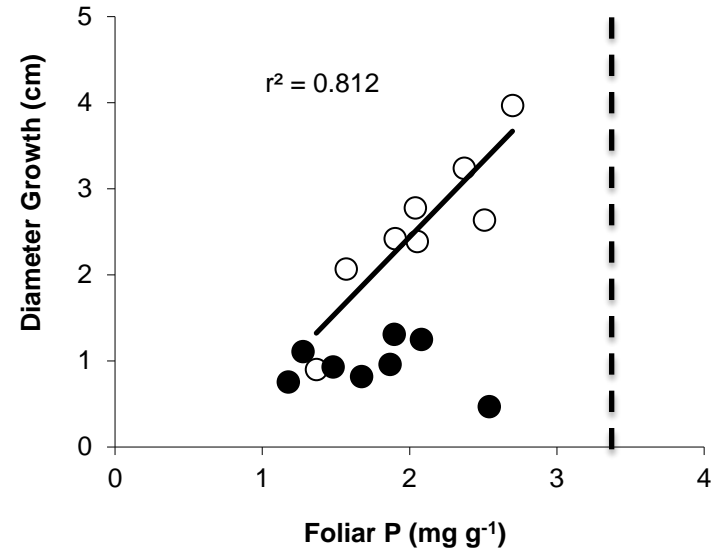
Foliar Nitrogen

- Distinct ranges of foliar N concentrations for weed-free and weedy trees suggest that weeds compete strongly for N.
- Tracer fertilization (^{15}N) 1.6% uptake in weedy plots vs 3.0% in weed-free plots.
- Most weed-free trees are above the adequate level. No relationship between foliar N and tree growth.
- No relationship between soil properties and foliar N.



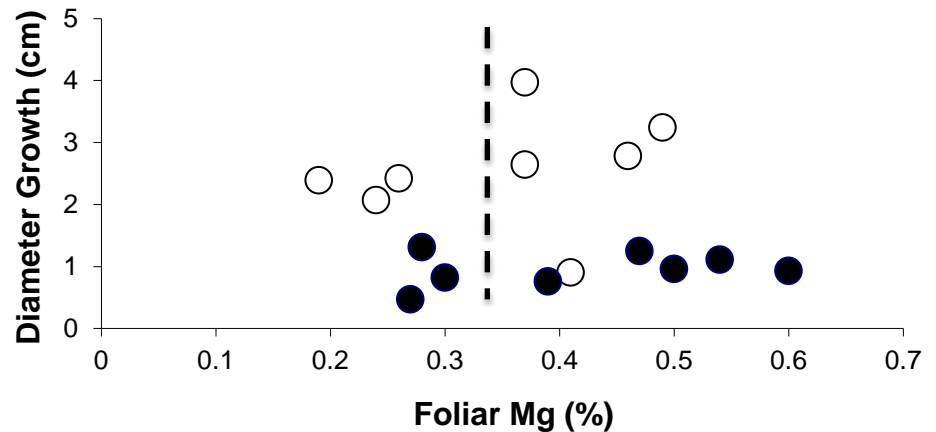
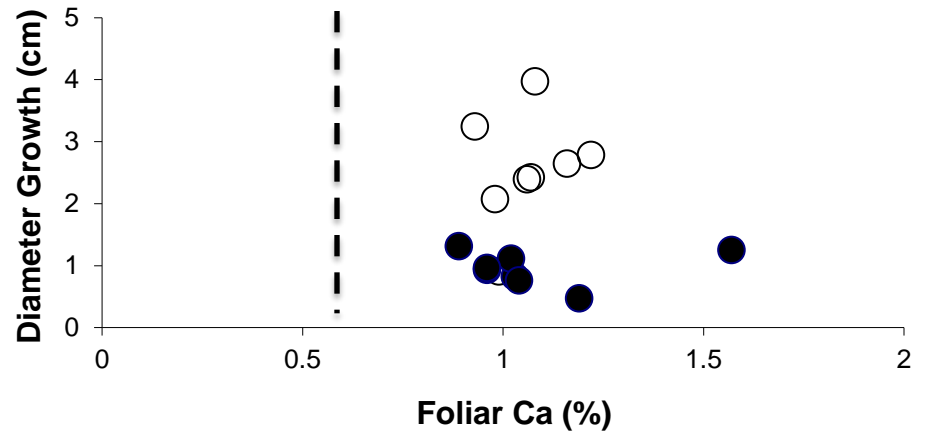
Foliar Phosphorous

- Same range of foliar P concentrations for weed-free and weedy trees indicates that it is not as strongly competed for with weeds
- Strong relationship between leaf P and growth in weed-free trees indicates that P is the nutrient impacting growth the most
- Once trees can access all available water and N, P appears to be the limiting nutrient.



Base cations

- No difference between weedy and weed-free plots for foliar base cation concentration
- Adequate Ca and K in all plots.
- Mg may be limiting on certain sites.



Management Implications

1. **Nutrient dynamics and foliar nutrition depends on both site properties and management.**
2. **Weed control is beneficial to tree growth, especially on good sites**
3. **Phosphorus fertilization combined with weed control may offer best potential in this region.**



Same plot at the beginning and end of the 2006 growing season.



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