Improving the quality of choke cherry seedlings for reclamation

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Choke cherry

- Choke cherry (*Prunus virginiana* L.) is important in restoring ecological function during reclamation of disturbed forest landscapes across Canada
- It has an extensive root system that readily produces adventitious buds that further develop into suckers and rhizomatous stems

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Choke cherry

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Choke cherry

- Suckers and rhizomes (clonal expansion) quickly create dense thickets
- (Heavy fruit production also likely important)

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E.A. Mills

http://esp.cr.usgs.gov

Choke cherry

- Consequently, on disturbed sites, choke cherry provides rapid site occupancy that
- Re-establishes nutrient cycling
  - leaf litter and root decomposition
- Prevents erosion
  - interception of rainfall by leaves and extensive root system

Choke cherry

- Dense thickets also provide shelter and nesting for wildlife
- Flowers (late May/early June) provide food for pollinators and fruits (August) provide food for birds and mammals
- Good for “bees, birds, and bears” – Michele Coleman

http://science.halleyhosting.com/nature/gorge/5petal/rose/prunus/choke.htm

http://prairie-elements.ca

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Choke cherry

- Choke cherry reproduces well naturally from seed
- However, it has proven difficult to produce high quality seedlings from seed in containerized nursery culture
- Attributed to (i) non-uniform seed germination and (ii) poor root development within peat plugs
- In silviculture it is known that reduced seedling quality* reduces survival after planting

  *seedling quality results from a combination of various morphological and physiological traits that bestow fitness for purpose (survival)

Choke cherry

- Our overall research goal is to produce high-quality choke cherry seedlings
- The first objective was to synchronize seed germination with the aim of producing uniform germinants that would lead to uniform seedlings, the first step towards quality seedlings

Choke cherry

- Shrub species with fleshy fruits (containing seed) have a physiological trait known as seed dormancy
- Seed dormancy ensures that seed only germinates when environmental conditions are suitable for growth
  - makes sense given fruits are shed in summer and winter is coming
- Seed dormancy is typically broken by a period of cool, moist chilling
  - autumn conditions
- In some species, a period of warm, moist conditions is also needed
  - late summer conditions
- When seed dormancy is broken, seeds are free to germinate under suitable environmental conditions
  - spring conditions

Choke cherry

- For nursery culture of seedlings, it is necessary to find out the combination of conditions that uniformly break seed dormancy
- It is an iterative process of trying various durations of treatments and various combinations of treatments until the optimal treatment or combination of treatments that break seed dormancy is identified

- After three years, we found that combining 2 weeks of warm, moist conditions followed by 20 weeks cool, moist conditions was most effective in breaking seed dormancy
- With dormancy broken, seed germinated uniformly
- Starting nursery culture with germinants of uniform size is key to managing seedling culture so that seedlings are of high quality when lifted

Choke cherry

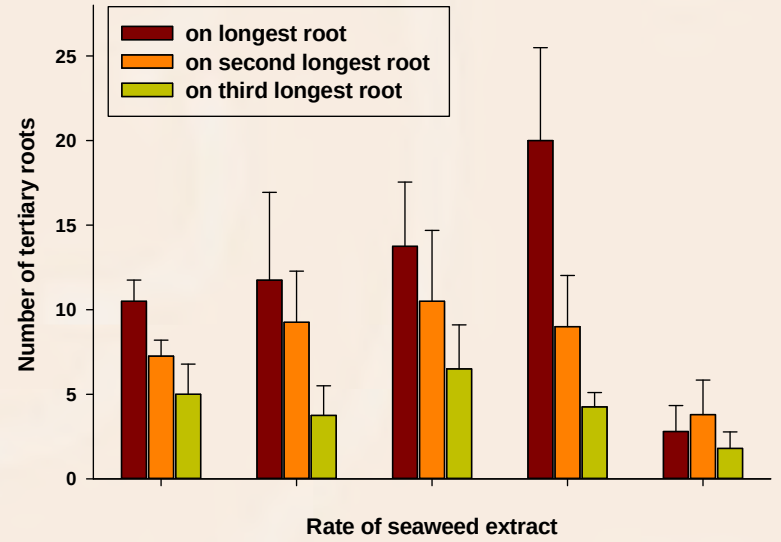
- Our overall research goal is to produce high-quality choke cherry seedlings
- The second objective was to increase germinant root-system development, the second step towards quality seedlings
- Vigorous rooting at germination establishes the framework for further root development later in culture
- Good root development at lifting is a key characteristic of high quality seedlings
- For seedling survival after planting, seedling roots need to make a connection with the substrate so they can provide water to seedling shoots

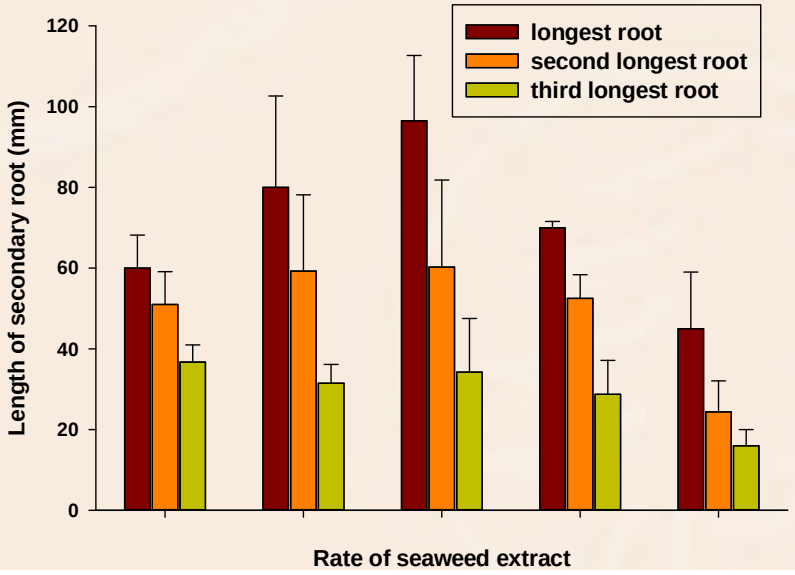
Choke cherry

- Applied plant growth regulators (PGR) stimulate plant growth and physiology when applied in small quantities
  - making them low-cost crop inputs
- We applied a PGR shown to stimulate auxin biosynthesis
  - auxin is important in root production and elongation
- It is an iterative process to find the optimal rate

Choke cherry

- We found that applying a plant growth regulator to germinants at the optimal rate increased both:
  - number of fine (tertiary) roots compared with control
    - fine roots absorb water and nutrients
  - length of fine roots compared with control
- Number of coarse roots was not affected by plant growth regulator; it is under genetic control
    - coarse roots extend the roots system and form the skeleton carrying fine roots





Choke cherry

- Chose a seaweed extract that
  - is manufactured using a process initially developed by the National Research Council of Canada – Institute of Marine Biosciences
  - has Canadian Food Inspection Agency registration
    - a product that can be used in forest nurseries, without regulatory violation
    - uptake of science by nurseries is important to the CFS