Optimizing rhizomal propagation of rivercane (*Arundinaria gigantea*)

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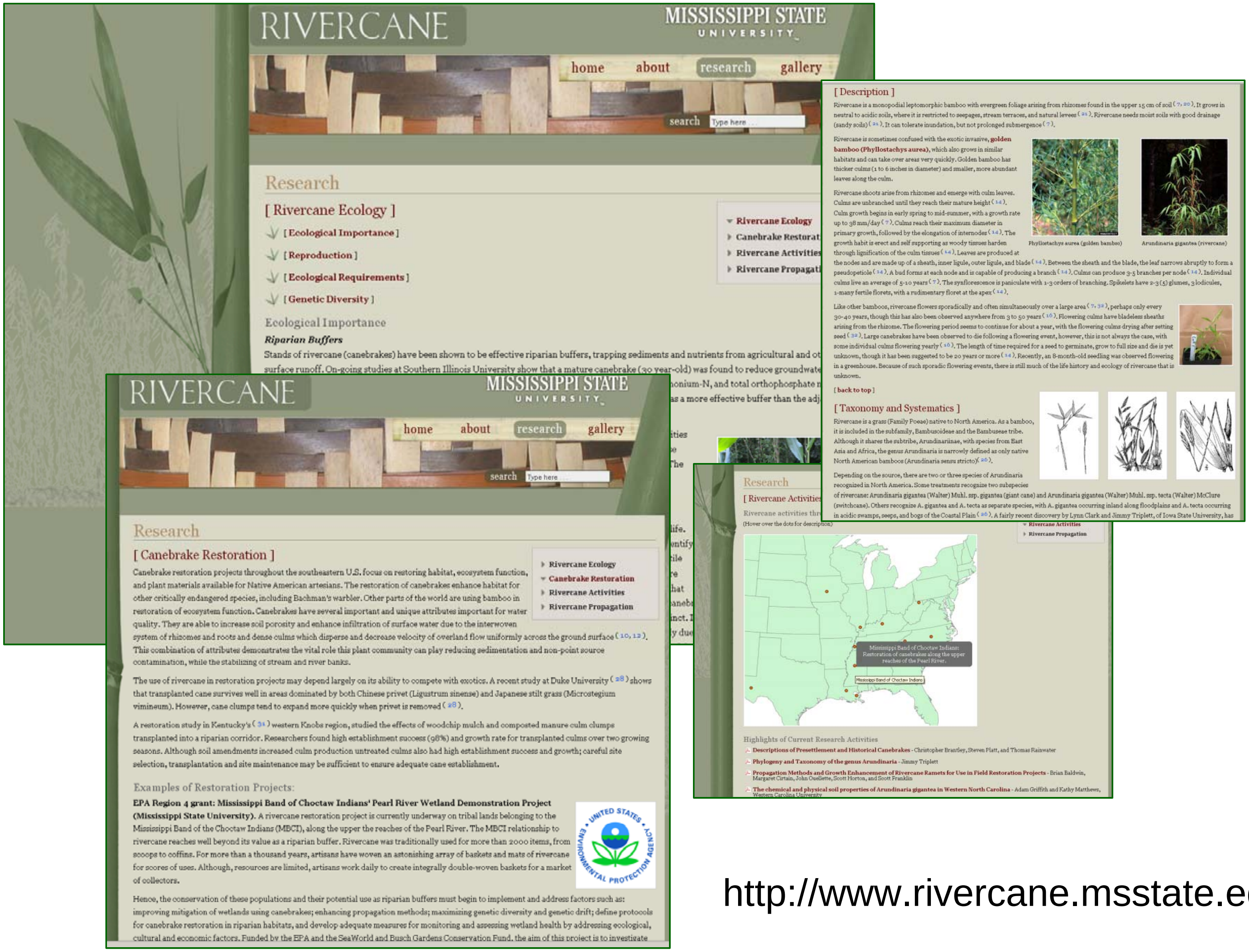
MSU Pearl River Project

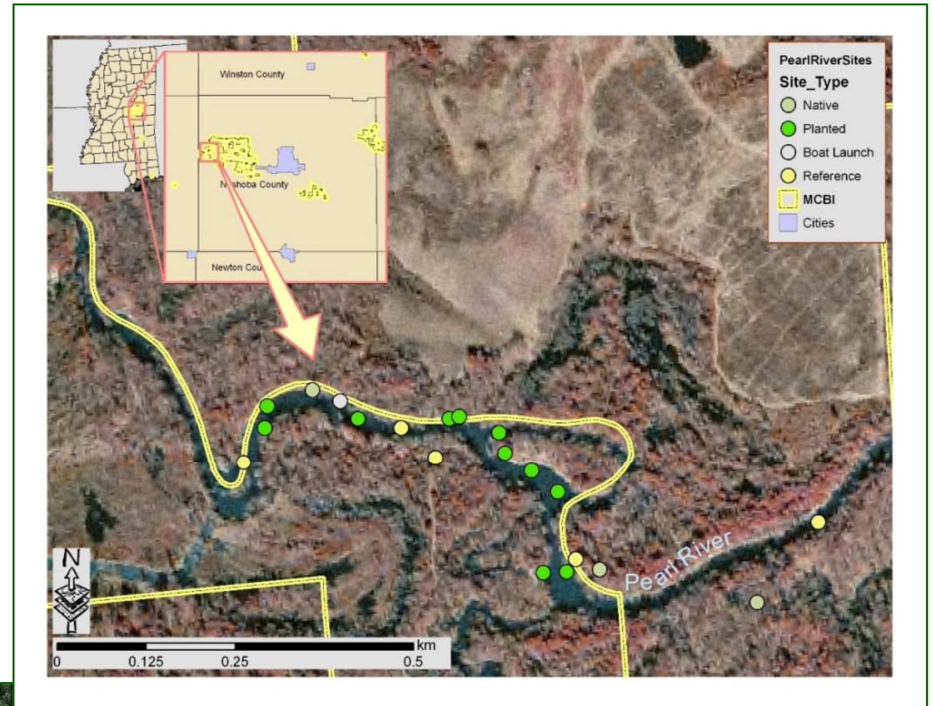


http://www.rivercane.msstate.edu

Restoration objectives

- Restore riparian buffers along the Pearl River to:
  - enhance water quality
  - stabilize banks
  - reduce sediments entering main channel.

Experimental plantings along the upper Pearl

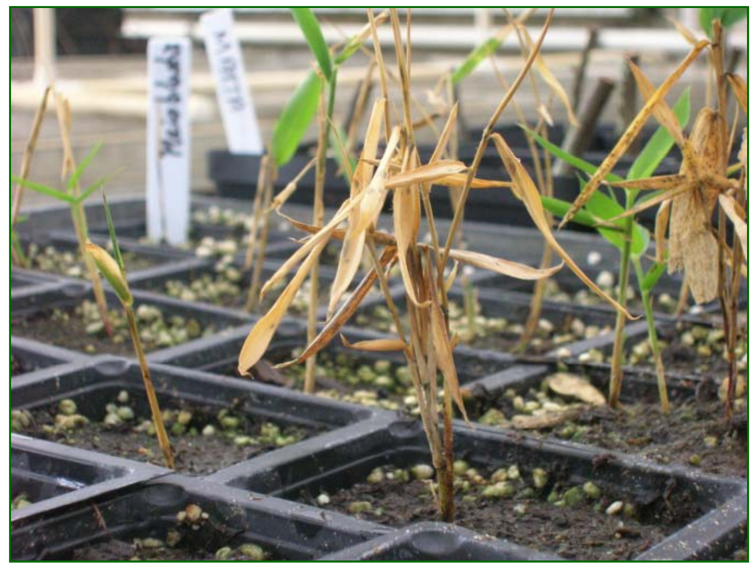


Rivercane Reproduction

- Important to restoration
- Not completely understood in any of the bamboos, much less rivercane

Reproduction via Rhizomes

- Rhizomes or plants, usually dug and transplanted
  - Suffer embolisms, often resulting in death



Reproduction via Rhizomes

- Extensive restoration via vegetative reproduction creates a mono-culture
  - Problematic in another endangered grass
    - Seaoats (*Uniola paniculata*)

Reproduction via Flowering

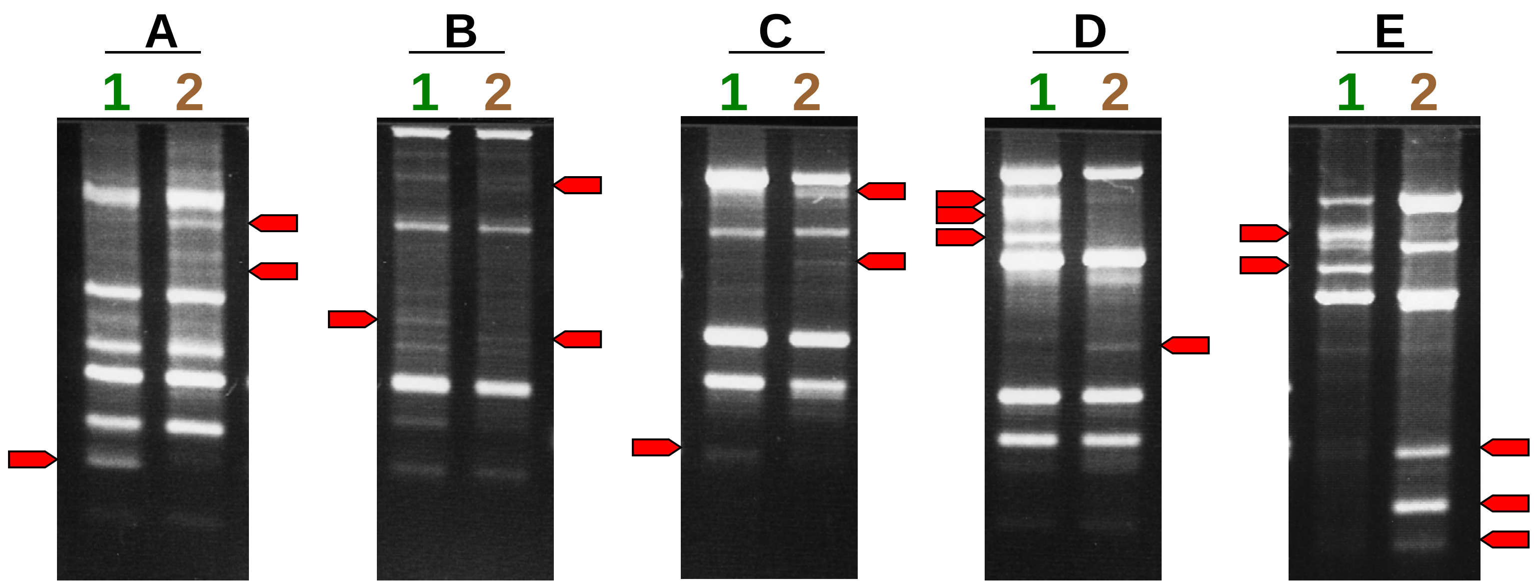
Regional variation in success

- Canebrakes in NC and Kentucky are producing seed in large quantities
- Canebrakes in Mississippi are producing little to no seed

Specific examples

- Koshy & Jee, 2001
  - Tropical bamboos are often self incompatible based on factors involving pollen viability and pollination.
- Judiewicz et al., 1999
  - Rivercane produces significant numbers of sterile or nonviable seed
- Baldwin et al., 2009
  - In an isolated plant with 1000 receptive flowers that produced 11 seed total, and ONLY 3 germinated.
  - However, manually crossing different genotypes resulted in viable seed (20 out of 28 germinated)
  - Appears to be self-incompatibility system

Rivercane DNA Fingerprinting



Microsatellite approach:
DNA was digested with a specific restriction endonuclease, then amplified with one of five different sets of primers (**A**-**E**).

Samples (**1**, **2**) were taken from rivercane brakes 0.8 miles apart.

= DNA band not present in sample from other location

Goals

- Collect rivercane accessions from around state & region (locally native ecotypes)
- Genotype accessions to optimize genetic diversity in restoration activities
- Develop protocol for successful propagation of rivercane from rhizomes

Rivercane Propagation

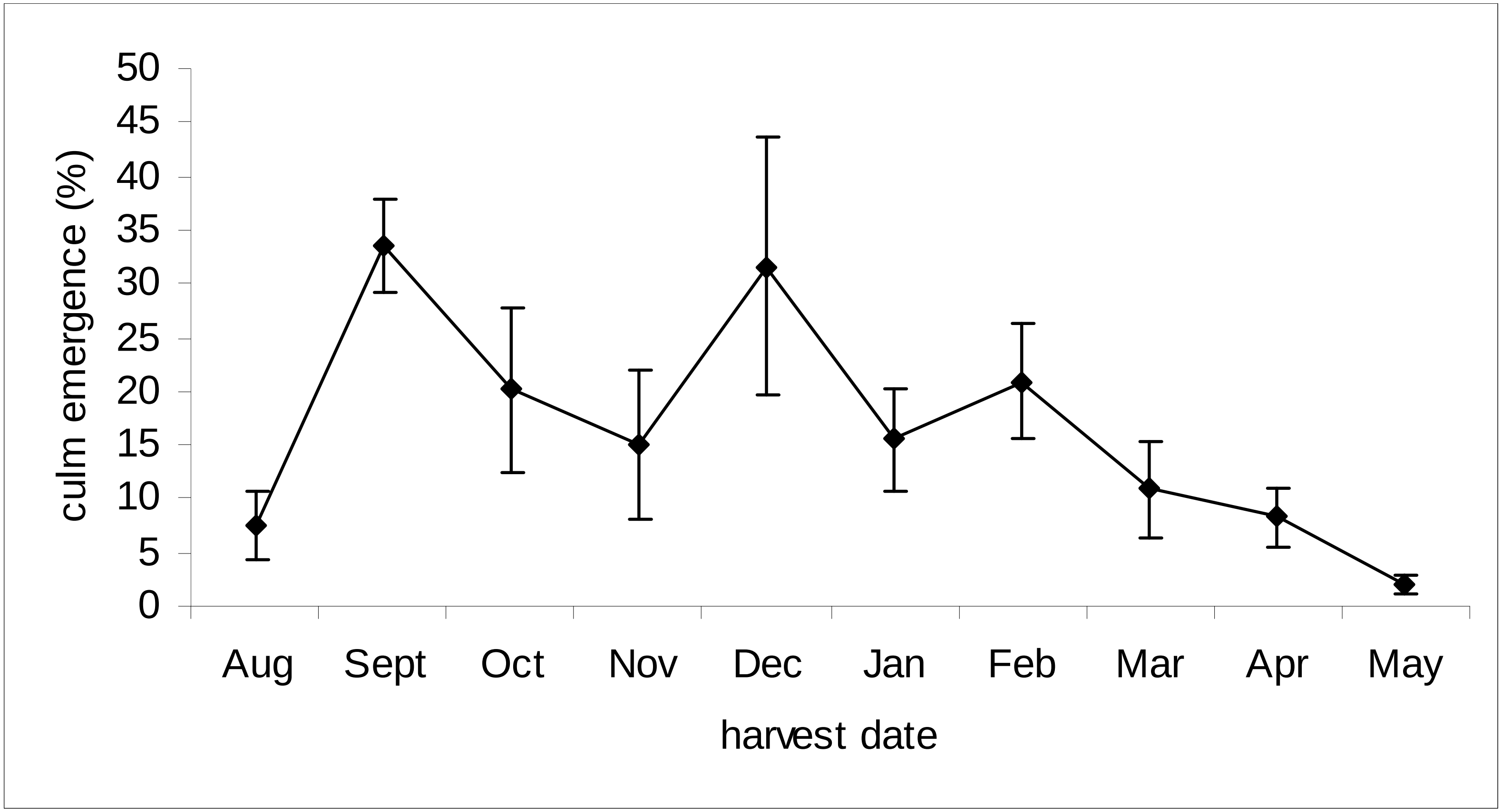
- Objective: Refine methods for vegetative propagation in order to increase materials available for restoration projects.
  - Understand factors leading to highest success in bare rhizome propagation:
    - Timing of rhizome harvest
    - Diameter and location of rhizome segments
    - Rhizome pre-treatments (fungicide, GA)
    - Environment (i.e., temperature, humidity)

Methodology

- 44 genotypes
- 10 planting dates
- Planted by:
  - Segment location (proximal, mid, and distal)
  - Diameter size

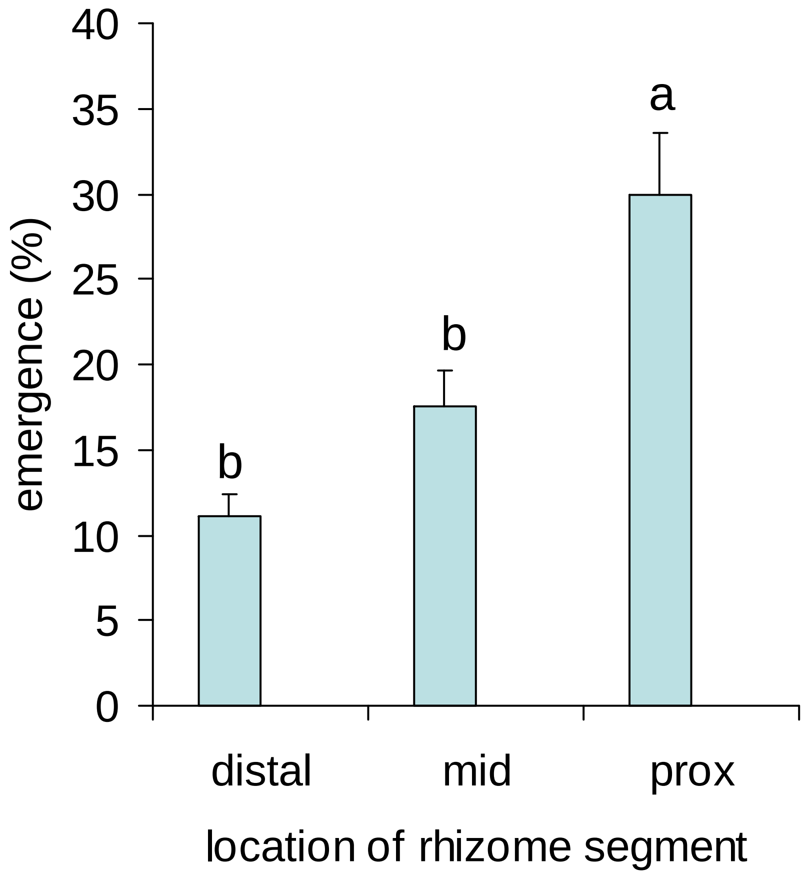
    (<3mm, 3-6 mm, >6 mm)
  - Treatment
    - Fungicide soak (40 ppm triadimefon)
    - Gibberelic acid soak (1,000 ppm)
    - Control

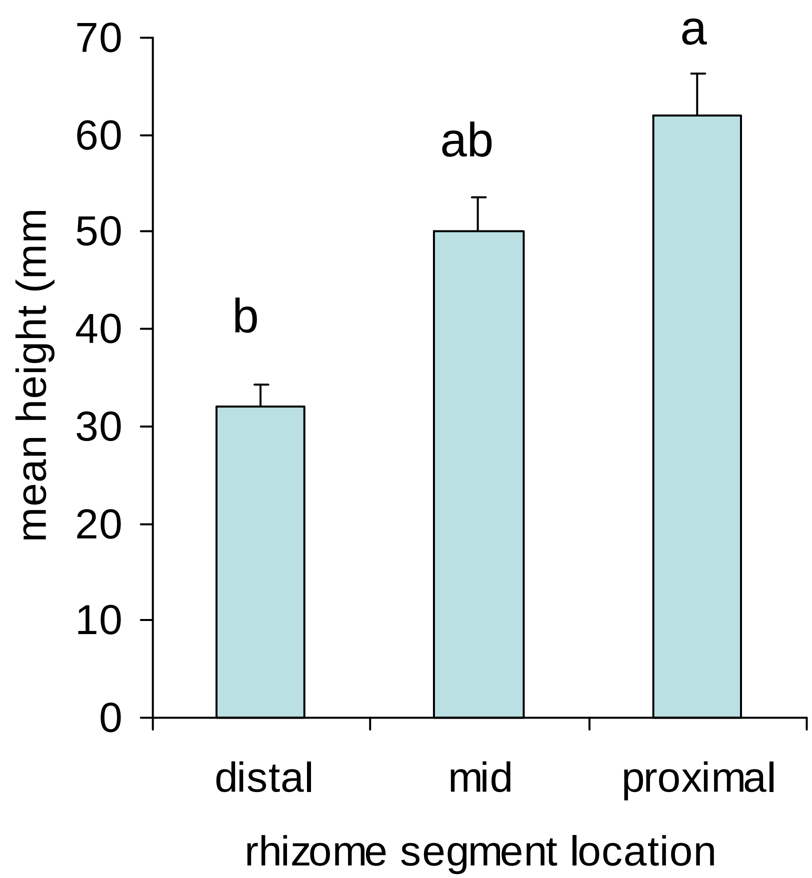
Time of rhizome harvest



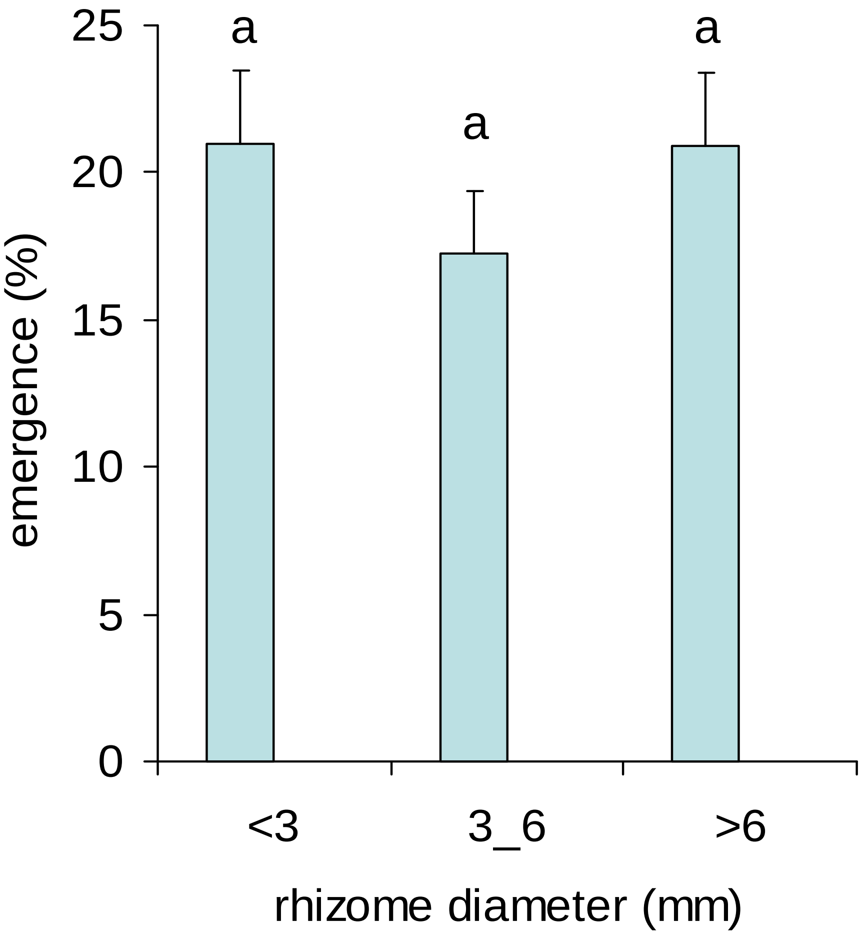
Percent culm emergence at week 5 for each harvest date.

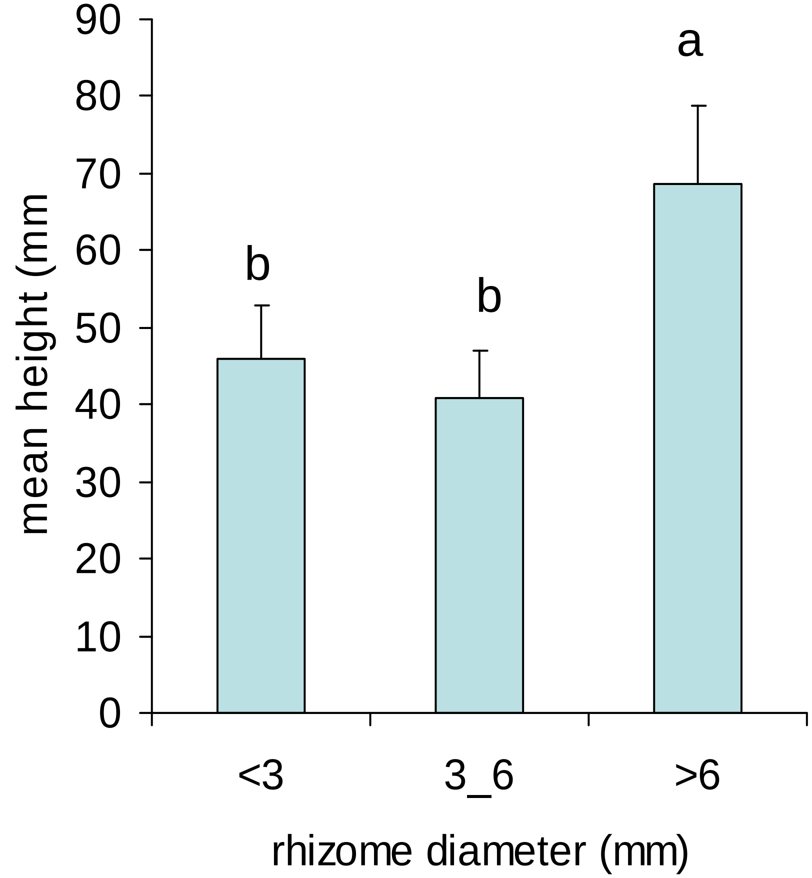
Rhizome segment location



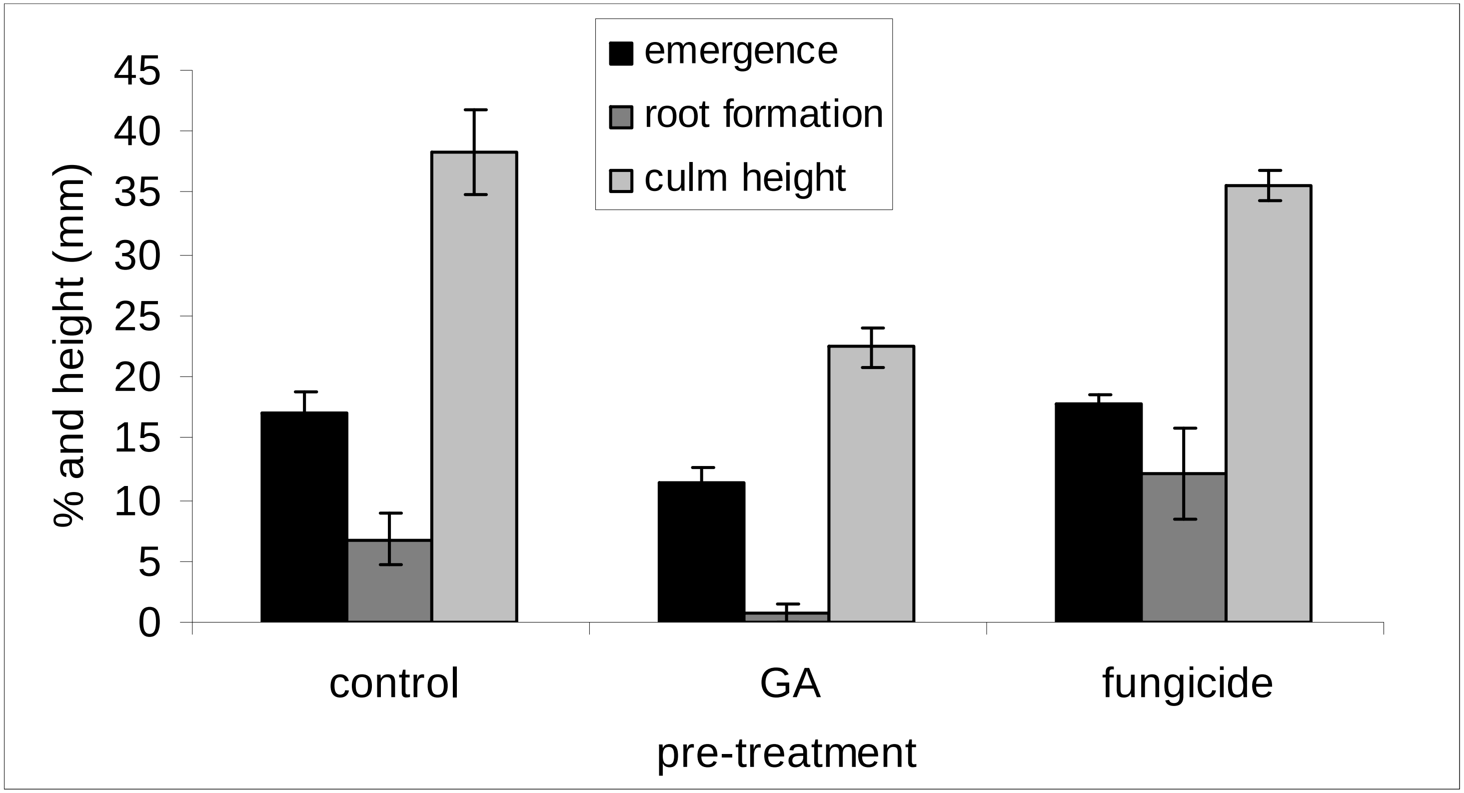


Rhizome segment diameter

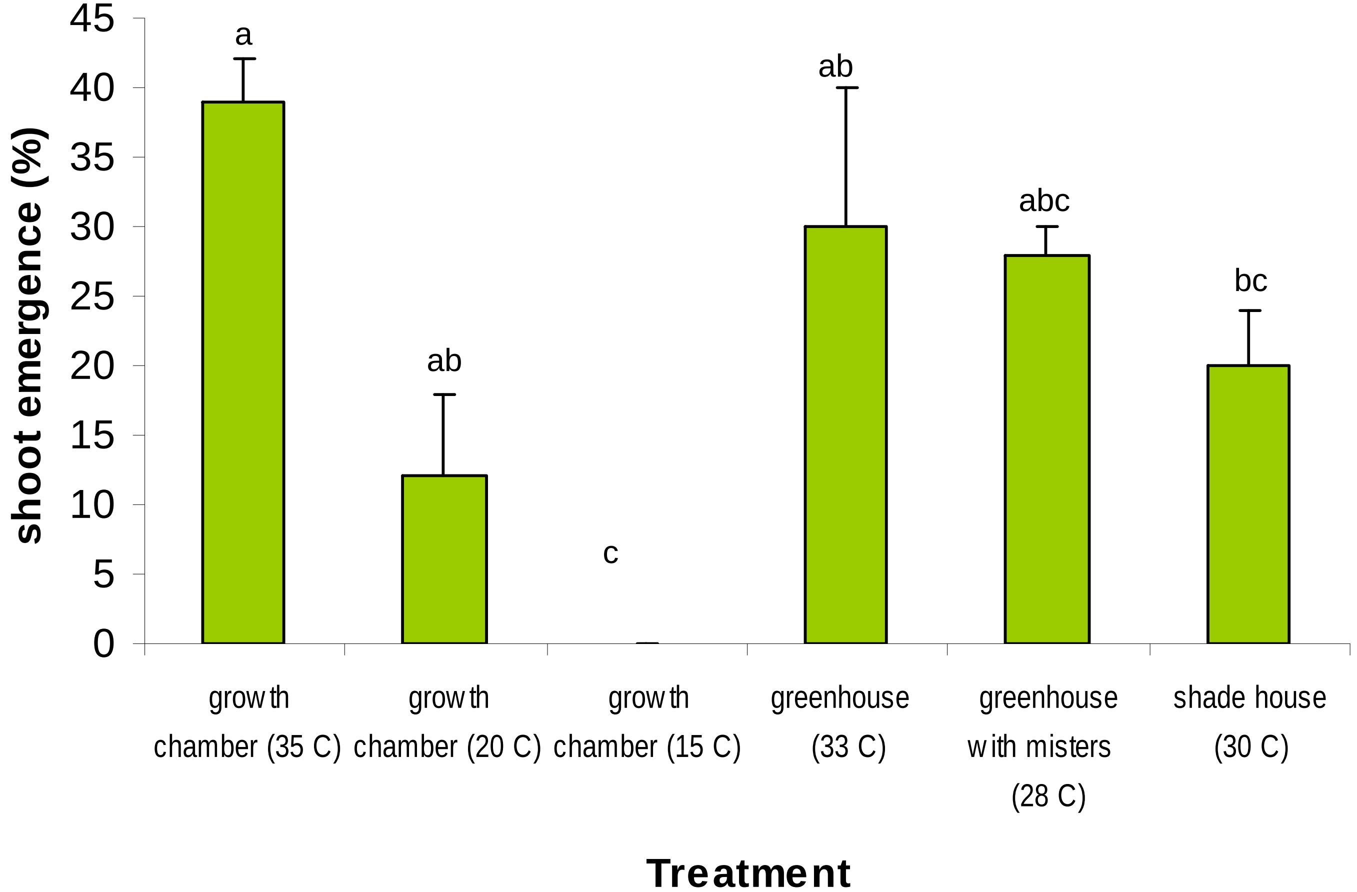




Pre-Treatments



Treatments


shoot emergence (%)
45
40
35
30
25
20
15
10
5
0
a
ab
c
ab
abc
bc
growth chamber (35 C)
growth chamber (20 C)
growth chamber (15 C)
greenhouse (33 C)
greenhouse with misters (28 C)
shade house (30 C)
Treatment

Propagation – Summary

- Highest success from rhizomes harvested from proximal region and during autumn.
- Diameter unimportant to emergence success.

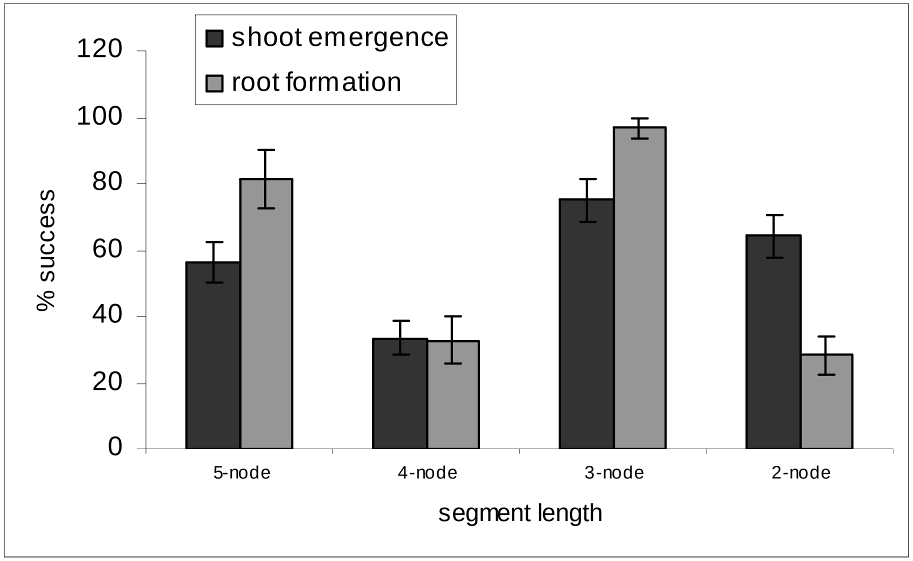
Propagation – Summary

- Pre-treatment of no benefit.
- Warmest environments produced the highest number of culms (but also highest mortality).

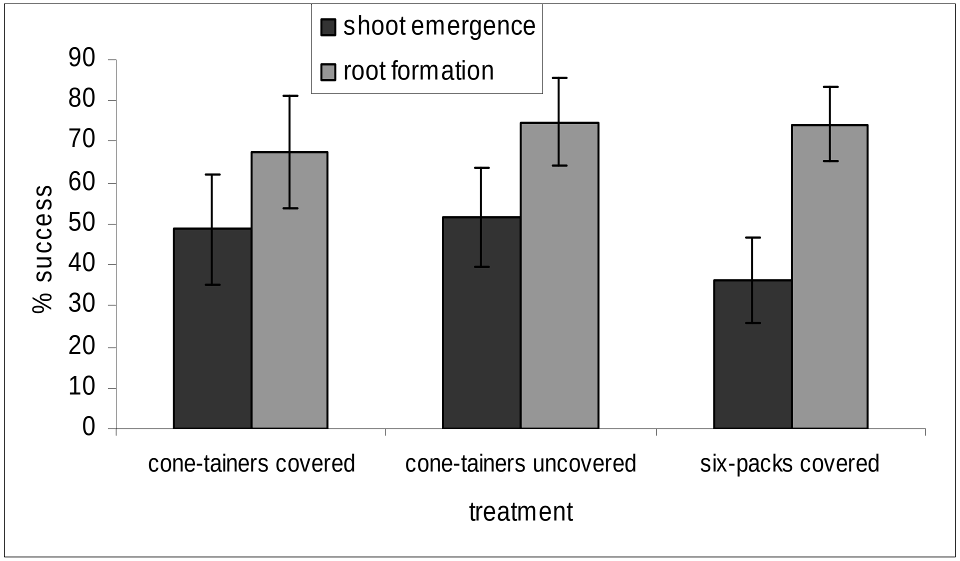
Propagation – current studies

- Comparing different growth media and planting techniques

Results



shoot emergence
root formation
120
100
80
60
40
20
0
% success
5-node
4-node
3-node
2-node
segment length



shoot emergence
root formation
90
80
70
60
50
40
30
20
10
0
% success
cone-tainers covered
cone-tainers uncovered
six-packs covered
treatment

Questions…

MISSISSIPPI STATE UNIVERSITY

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY