

Influence of planting treatments on American chestnut (*Castanea dentata*) seedling performance in eastern Tennessee mine spoil.



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April 15, 2009 12:20 pm Room 125, Plant Science Building

Outline

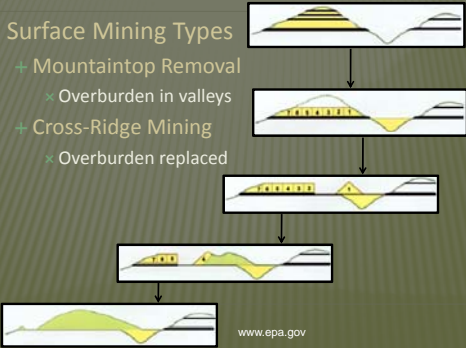
- × Background
 - + Mining Practices
 - + American chestnut
- × Goal
- × Objectives
- × Methods



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Mining

- × Surface Mining Types
 - + Mountaintop Removal
 - × Overburden in valleys
 - + Cross-Ridge Mining
 - × Overburden replaced



www.epa.gov

Surface mining

- ✖ Historic surface mining reclamation practices
 - + Left "as is"
 - + Valleys filled in
 - + Erosion/Landslides
 - + Mass Instability
 - + Water Pollution
 - + Trees Planted



Surface Mining

- ✖ Surface Mining Control and Reclamation Act of 1977
 - + Compaction
 - + Erosion
 - + Heavy Liming
 - + Grass Planted



Surface Mining

- ✖ The Forestry Reclamation Approach (FRA)
 - ✖ 1. Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and comprised of topsoil, weathered sandstone and/or the best available material.
 - ✖ 2. Loosely grade the topsoil or topsoil substitute established in step one to create a noncompacted growth medium.
 - ✖ 3. Use ground covers that are compatible with growing trees.
 - ✖ 4. Plant two types of trees--early successional species for wildlife and soil stability, and commercially valuable crop trees.
 - ✖ 5. Use proper tree planting techniques. (Burger et al., 2005).

Surface Mining

- × Current FRA Practices
 - + Less erosion
 - + Equal or greater productivity
 - + Valuable forested land



What Species Do we use?

- × Alternative Species Used:
 - + Black Locust (*Robinia pseudoacacia*)
 - + Green Ash (*Fraxinus pennsylvanica*)
 - + Pine (*Pinus spp.*)

× However,

- + Black Locust
 - + Green Ash
 - + Pine
- Potentially Invaluable
- Not Representative of Ecosystem

American Chestnut

- × Not available in the past
 - + Chestnut blight (*Cryphonectria parasitica*)
- × Center of Range
- × Grows well in
 - + Increased light levels
 - + Moderately acidic soils
 - + Well drained soils



Goal

- ✦ Determine the effect planting treatments have on physiology and performance of American chestnut on mine spoil



Objectives

- ✦ Determine relationship between
 - + 1. Available water and performance
 - + 2. Available nutrients and performance
 - + 3. Soil sterilization and performance

Study Site

Campbell County
-Elk Valley

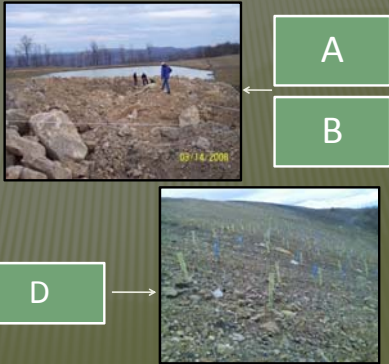


2 sites
4 plots



Methods

- × 2 sites, 4 plots
 - + Flat (A,B)
 - + Sloped (C,D)



Methods


- × 9 Treatments (3x3 factorial)

Terra-Sorb Applied	Fertilizer Applied	Soil Sterilized
Terra-Sorb Not Applied	Fertilizer Not Applied	Soil Un-Sterilized



Methods

- × 1.5m x 1.5m spacing
- × Treatments randomly assigned to planting spots
- × Directly seeded with planting treatments and ½ cup of pro-mix
- × 18" tall direct seed Blue-X shelter
- × Pile Native Rock around tube



www.coalcreekaml.com

Methods

- × 1. Determine relationship between water availability and performance



www.planthealthcare.com



Methods

- × 1. Determine relationship between water availability and performance
- × Water potential (Mpa): Scholander Pressure Chamber

+ $\Psi_w = \Psi_\pi + \Psi_p + \Psi_g$

- × Where
- × Ψ_w = water potential
- × Ψ_π = osmotic potential
- × Ψ_p = turgor potential
- × Ψ_g = gravitational potential

Methods

- × 2. Determine relationship between nutrient availability and performance

+ 20-10-5



Methods

- × 2. Determine relationship between nutrient availability and performance
- × Height, root collar diameter
- × Photosynthetic rate (Anet): Li-Cor Infrared Gas Analyzer
 - + $Anet = mg\ CO_2\ m^{-2}\ s^{-1}$

Methods

- × 3. Determine relationship between soil sterilization and performance



Methods

- × 3. Determine relationship between soil sterilization and performance
- × Height, root collar diameter
- × Photosynthetic rate

Statistical Analysis

- × CRD factorial
- × ANOVA
- × Mean comparison
 - + Pairwise - LSD
 - + Treatment – Contrast
- × All tests will be performed at $\alpha = 0.05$
- × SAS® system

Acknowledgements

- × Dr. Jennifer Franklin
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- × National Coal Corporation



Questions?