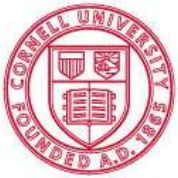


Best Practices for Tree Plantation Establishment and Management

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Cooperative Extension
Department of Natural Resources



United States Department of Agriculture
National Institute of Food and Agriculture



Resources

“Northeastern Tree Planting & Reforestation”

(Google search “cornell reforestation bulletin”)

Northeastern Tree Planting & Reforestation



Jim Ochterski, Cornell University Cooperative Extension of Ontario County
Peter Smallidge, Cornell University Cooperative Extension, Department of
Natural Resources
Jeff Ward, The Connecticut Agricultural Experiment Station, Department of
Forestry and Horticulture

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Types of Reforestation

- Natural
 - Seed rain (within or adjacent)
 - Advanced reproduction
 - Coppice
 - Root suckers
- Artificial
 - Direct seeding
 - Planting seedlings



Why Artificial Reforestation

- Inadequate or non-suitable seed supply
- Desire a genotype or species that isn't present
- Want to control stocking rate
- Want to accelerate establishment
- Doubt the potential success of natural methods



Overview of Issues for Artificial Reforestation

- Planting Plan
- Soils
- Planting objectives
- Species Selection
- Site Preparation
- Reforestation Techniques
 - Handling and Planting Seedlings
 - Protecting / Enhancing Seedlings
- Activities After the Planting



The Secret for Successful Artificial Reforestation

- Match: Objective, Species, & Soil/Site
- Correct technique
- Control competing vegetation
- Protect the seedlings from deer and mice / voles



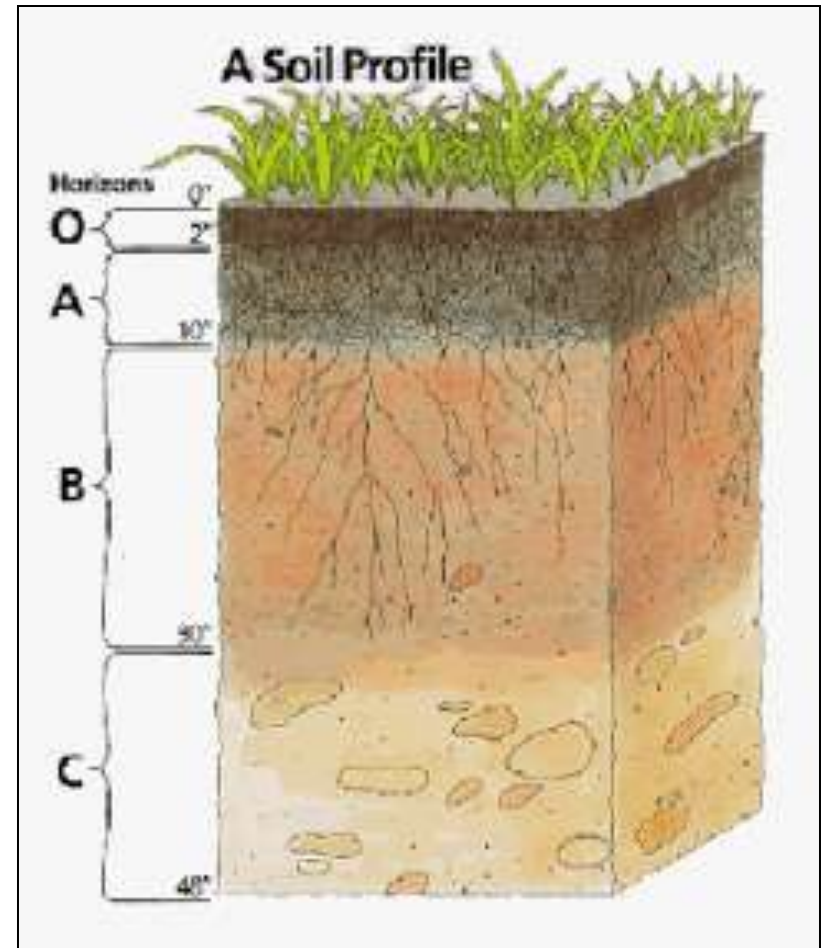
Planting Plan

- Planting objectives
- Property map, soils map
- Strategy for site preparation
- Planting design (shape, orientation, spacing)
- Number of trees needed by species
- Plans for controlling brush and weeds
- Schedule of needs for 3-10 years



Soils

The most critical factor to consider when planting (dirt is at the root of the plantation)



Soils and Black Locust

- Occurs on many soils
- Best growth on
 - Moist
 - Loamy
 - Limited clay
- Avoid
 - Excessive moisture
 - Excessively dry
 - Compacted



Planting Objectives: Species Considerations

- Species selection
- Additional objectives
- Buffer: what is buffered?
- Timber: markets, form, quality
- Recreation & Aesthetics: fall color, shape, etc.



Planting Objectives: Species Considerations

- Capacity to grow on soils
- Support planting objective
- Suitable for the management planned
- Complement other species in the mix
- Consider costs of establishment
- Resist likely pests



Planting Objectives: Design Considerations

- Plantation Design
 - Shape
 - Future access
 - Spp. mixtures



Planting Objectives: Area and Access Considerations

Area and Access

- Corridor vs. block
- Alignment of rows
- Random arrangement



Planting Objectives: Interplanting Considerations

Interplanting

- Crops
- Livestock



Site Preparation

- Assess abundance of competing vegetation
- Hand vs. machine planting
- Drainage limitations
- Costs and Future Returns



Site Preparation - Actions

Mechanical:

- Scalp, furrow, till, mow, burn
- Best to treat the previous August
- Frost sensitive cover crop



Site Preparation - Actions

Chemical

- Chemical: spot, band, broadcast
- Mow + spray previous August
- Mow + plant + spot spray



Spacing Considerations - 1

- Spacing determines
 - Canopy closure (self pruning, competition, understory)
 - Plantation utility and management



Spacing Considerations - 2

- Equipment access (mowing, thinning, harvesting)
- Costs (# seedlings, tree tubes)
- Common spacing:
 - 6 x 8 (908 trees/ac)
 - 8 x 10 (545 trees/ac)
 - 6 x 25 (290 trees/ac)



<https://www.treeplantation.com/tree-spacing-calculator.html>

Reforestation Techniques

- Direct Seeding
- Planting Seedlings
 - Cuttings
 - Nursery Stock – bare root
 - Containerized seedlings
 - ball and burlap

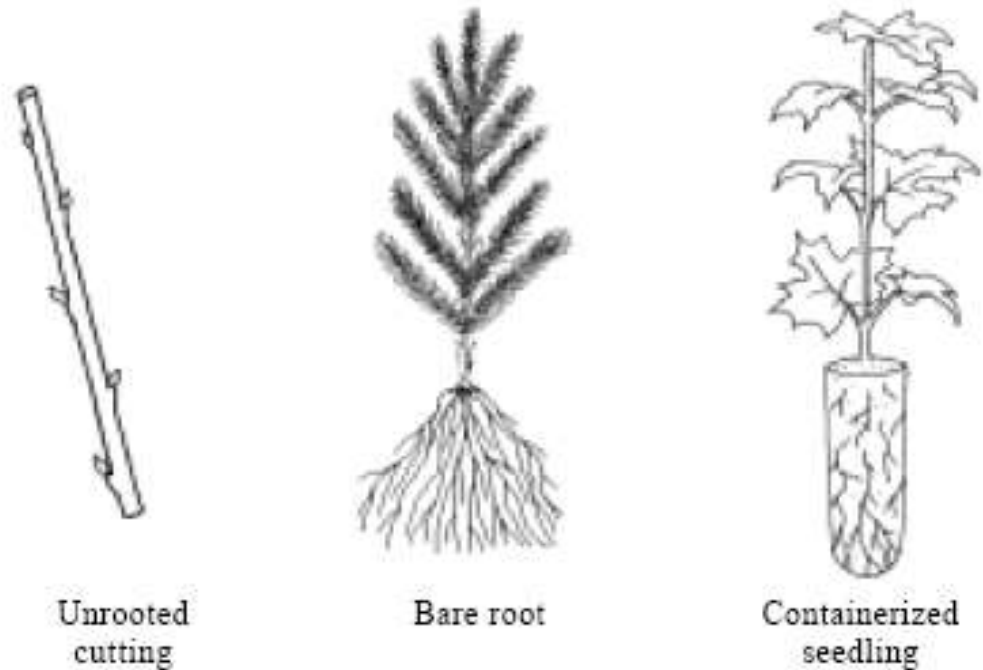


Figure 1. Types of seedlings.

Bare root vs. Containerized

Bare-Root

- Cheaper production
- Cheaper storage/transport
- Various ages
 - 1-0
 - 1-1
 - 2-0
 - 2-2

Containerized

- Longer planting season
- Enhance microsite
- Easier handling
- Mechanized planting
- Quicker effective hand planting
- Usually 1-0

Containerized seedlings



Handling and Planting Seedlings

- Roots are fragile
- Balanced root:shoot ratio
- Cull for large diameter and first order lateral roots
- Keep cool and moist
 - Store in original containers in shade / refrigerator
 - Heel – in



Techniques - Planting Considerations

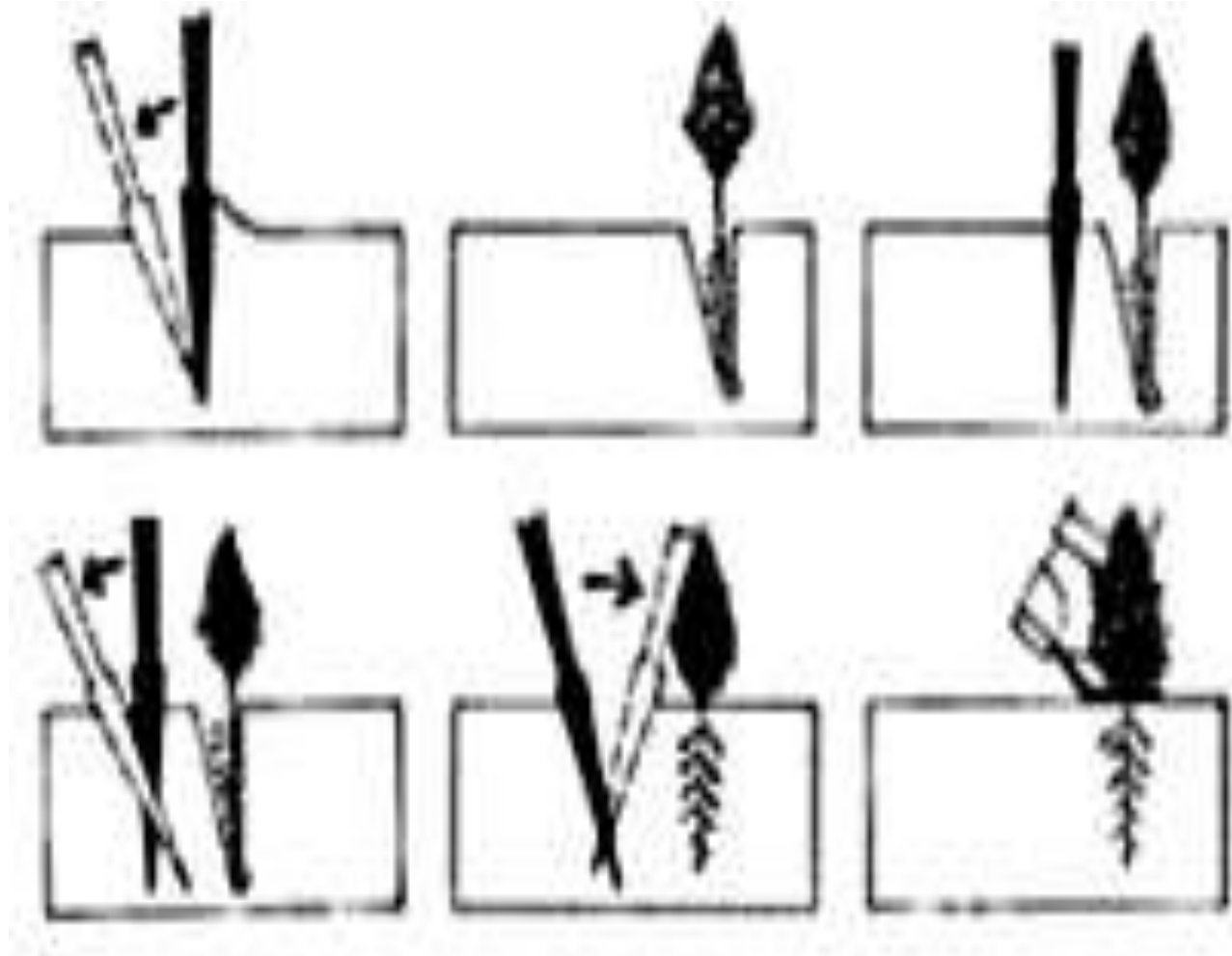
- Keep Roots Healthy
 - Roots with natural arrangement
 - Keep roots moist before and after planting
- Plant at correct depth
- Try to avoid advance digging
- Use quality tools





Hand Planting Tools

Hand planting – roots down, no air



Machine planting



UGA0908056

Protect trees. Deer, mice and voles all eat seedlings.



Weed Protection

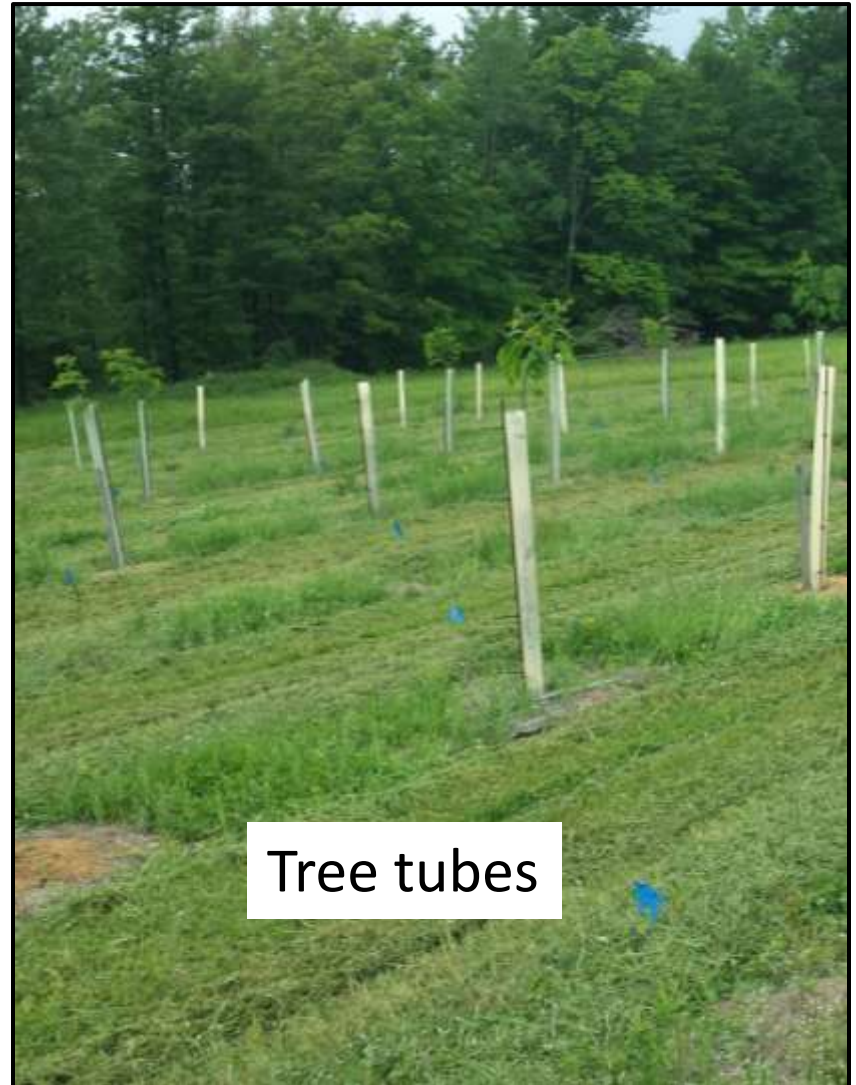
Physical Barriers

- Weed control
- Rodent habitat
- Weed mats
- Mulch
- Mowing and herbicide



Protection from Deer

- \$3 - \$5 per tube plus stakes
- Install at or below ground level
- Rodent and herbicide protection
- Annual inspection
- Weed control



Tree tubes

Protection from Deer

- Cost of wire fence plus labor
- Re-usable
- No rodent protection (low incidence)
- Annual inspection
- Weed control



Tree Cages

Black Locust Seedling Growth

2013 - 2016

Tree Tube Type	# Stems	Average DBH (inches)	Average Height inches/ft
Acorn	28	1.5	151 / 12.6
Control	19	0	29 / 2.4
Miracle	23	2.9	165 / 13.8
Plantra	23	1.2	128 / 10.7
Tree Pro	26	2.1	185 / 15.4
Tubex	25	1.6	158 / 13.2

Protection: Buck rubs



Protecting and Enhancing Seedlings

Fencing

- No direct effect on microclimate or growing conditions
- \$2 - \$5 per linear foot (if economy of scale)
- Annual inspection and repair
- Not 100% effective at exclusion

Activities After the Planting

- Inspect seedlings for take and bud break (yr. 1)
- Inspect for insect infestations (annually)
- Look for frost heave (before bud break yr 2)
- Inspect and straighten tree tubes (annually 5 - 7 years)
- Control grass, herbs, shrubs (3 years)
 - Herbicides
 - Mowing
- Prune trees (as appropriate)

I repeat...secrets for success

- Match: Objective, Species, & Soil/Site
- Correct technique
- Control competing vegetation
- Protect the seedlings from deer and mice / voles

