

Comparing Four Nursery Production Methods on Chestnut Hybrid Seedling Quality

Taylor Evans and Dr. Heather Griscom
James Madison University



METHODOLOGY

INTRODUCTION

- American chestnut (*Castanea dentata*) was a keystone species in the Appalachian region until its removal by chestnut blight (*Cryphonectria parasitica*) in the early 20th century
- Backcrossing Chinese chestnut (*Castanea mollissima*) with American chestnut has produced a tree that resembles the American phenotype in order to re-establish the tree in its native range and ecological niche
- Current restoration efforts focus on three techniques: direct seeding, bare-root seedlings, and container grown seedlings
- Propagation methods and their effect on seedling quality are species specific; there is a research gap on propagation methods and American chestnut
- Air-pruning roots can produce a more fibrous root system with higher first order lateral roots (FOLR) and root collar diameter – qualities linked with increased field performance
- Research on other *Fagacea* suggest that propagation method can have significant effects on seedling morphology, seedling quality and establishment in field after planting



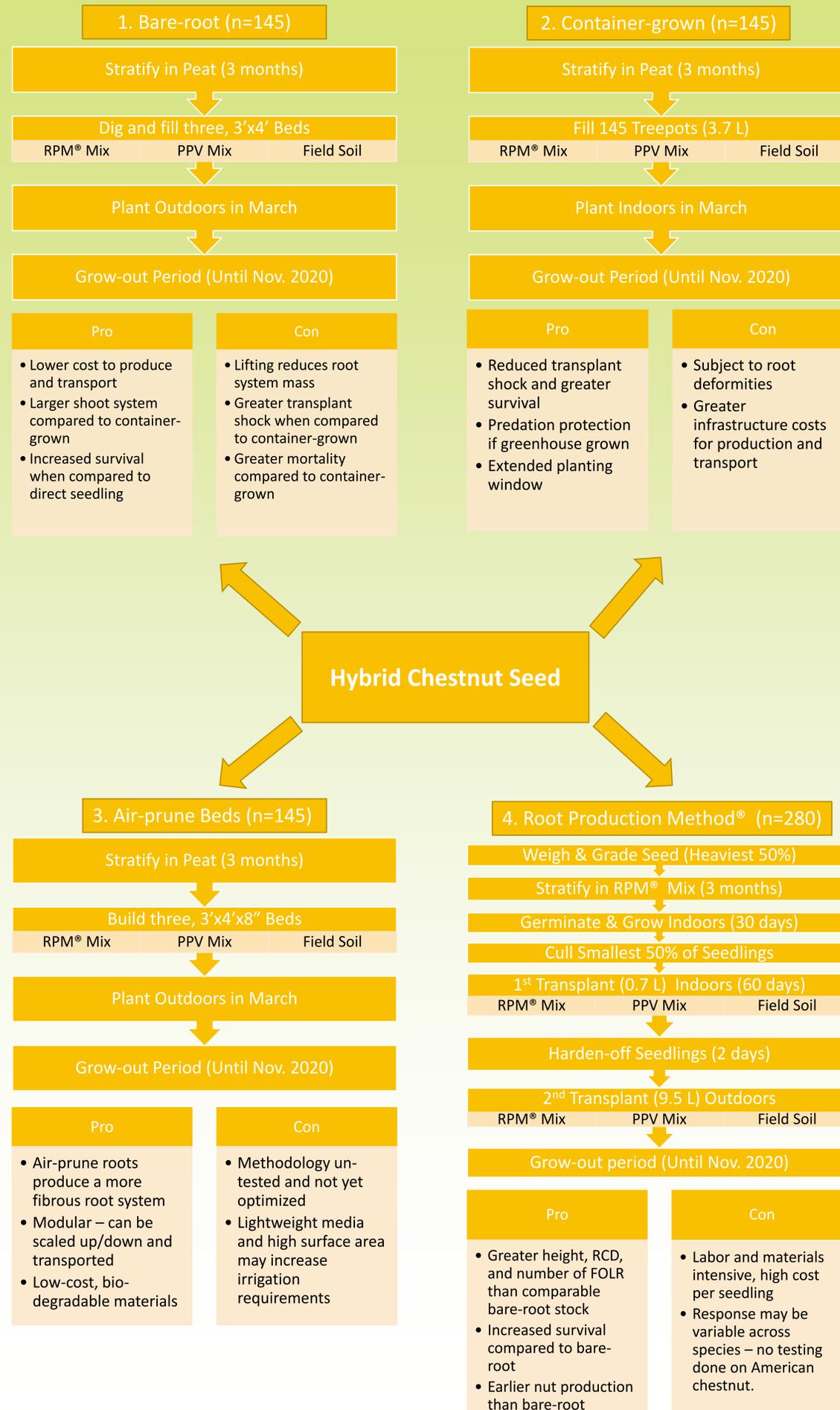
Photo 1: Comparison of 210-day root growth of bare-root (left) and RPM seedling (right).
Source: Forrest Keeling Nursery.

GOALS

- Fill a gap in research on chestnut seedling propagation by comparing the effect of methodology on seedling morphology and overall seedling quality
- Test two novel propagation techniques against industry standards to determine their effects on seedling morphology and overall quality
- Provide growers with information on least cost approaches to produce seedlings with beneficial morphological characteristics
- Provide seedlings for long-term survival and growth testing based on nursery technique

How does nursery propagation method influence seedling quality and seedling cost?

Treatments (12) = Propagation Method (4) * Media Type (3)



DATA COLLECTION AND ANALYSIS

- After one growing season, seedlings will be removed from their growing treatment and measured for:
 - Height (root collar to terminal bud)
 - Root-collar diameter
 - Root volume
 - Number of first order lateral roots (FOLR) greater than 1mm.
- Overhead materials cost and labor hours will be used to determine cost per seedling
- An ANOVA analysis and appropriate post-hoc tests will be performed for each measurement to test for significance.



Photo 2: Example of an air-prune bed filled with lightweight media. Source: Twisted Tree Farm

PREDICTIONS

- Air-prune and RPM® seedlings will show greater height, root collar diameter, FOLR count, and root volume than bare-root or container grown seedlings
- Container seedlings will show greater root collar diameter, FOLR, and root volume than bare-root seedlings
- There will be no difference between air-prune and RPM® seedlings in any morphological characteristic
- We expect RPM® to show the highest cost per seedling and bare-root the lowest cost per seedling.

SELECTED WORKS CITED

- Davis, A. & Jacobs, D. 2005. Quantifying root system quality of nursery seedlings and relationship to outplanting performance. *New Forest* 30: 295.
- Dey, D. C.; Lovelace, Wayne; Kabrick, John M.; Gold, Michael A. 2004. Production and early field performance of RPM® seedlings in Missouri floodplains. *Proceedings of the 6th Walnut Council Research Symposium*; Gen. Tech. Rep. NC-243. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 59-65
- Jacobs, D., Salifu, K. & Seifert, J. 2005. Relative contribution of initial root and shoot morphology in predicting field performance of hardwood seedlings. *New Forest*. 30: 235.
- Van Sambeek, J.W.; Godsey, L.D., Walter, W.D., Garret, H.E., Dwyer, J.P. 2016. Field performance of *Quercus bicolor* established as repeatedly air-root-pruned container and bare-root planting stock. *Open Journal of Forestry*. 06(03): 163-176.
- Walter, W.D., Godsey, L.D., Garret, H.E., Dwyer, J.P., Van Sambeek, J.W., Ellersieck, M.R. 2013. Survival and 14-Year Growth of Black, White, and Swamp White Oaks Established as Bareroot and RPM®-Containerized Planting Stock. *Northern Journal of Applied Forestry*. 30, 43-46.
- Wilson, E.R., Vitols, K.C., & Park, A. 2007. Root characteristics and growth potential of container and bare-root seedlings of red oak (*Quercus rubra* L.) in Ontario, Canada. *New Forests*. 34, 163-176.