Tree improvement and seed source monitoring: operational production of hardwood seedlings in the eastern USA

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Evelyn (1664) discusses genotype and seed selection: "...as to what concerns the election of your Seed, It is to be consider'd, that there is vast difference in Trees even of the same growth and bed, which I judge to proceed from the variety and quality of the Seed... and therefore choose not your Seeds always from the most Fruitful-trees, which are commonly the most Aged, and decay'd; but from such as are found most solid and fair..."

Background
Successful plantation establishment depends on many factors, including seedling quality, matching species to the appropriate site, and the silvicultural practices employed. Given the tremendous genetic variation in forest tree species, the origin of plant material is one of the most important factors in successfully establishing plantations.

Tree Improvement
Improvement of conifer species and poplar (Populus spp.) has significantly increased plantation productivity, tree form, wood quality, and pathogen resistance. Fine hardwoods (e.g., black walnut (Juglans nigra L.) and northern red oak (Quercus rubra L.)) are grown for timber and veneer in eastern North America. Both are major components of the Central Hardwood Forest Region. Veneer grade black walnut lumbar has historically been among the most lucrative forest products in the region and for this reason has been the focus of many tree improvement programs. These programs have yielded increased black walnut growth and survival.

Seed Source Monitoring
Use of seed adapted to a specific region can increase resistance to pest and pathogen damage and yield higher seedling survival and better performance. Extensive guidelines for transfer of conifer seed and seedlings exist in much of the USA, and were developed based on climatic data as well as geographic and genetic information. Less information is available for hardwoods, although provenance testing resulted in recommendations that black walnut can be moved northward as much as 322 km without risk of cold damage. However, there are few examples of operational seed source regulation for hardwood species in the eastern USA.

Findings

- 52 completed questionnaires were returned (response rate of 51%), representing almost 70 million hardwood seedlings produced/year
- < 20% of improved hardwoods are fine hardwoods (Figure 2)
- 27% of respondents do not identify seed zones for their hardwood seedling production, and of those that do, 20% make no attempt to ensure that seed collection corresponds to the intended outplanting zone

Most respondents stated that use of genetically improved materials would benefit forestry in their region (Table 1); however, less than 40% have germplasm in tree improvement programs

- While 64% of respondents stated that they intend to use more genetically improved hardwood material in the next 10 years, only 48% have tree improvement programs from which improved material is not yet available

What is tree improvement?

Tree selection, evaluation and breeding for more desirable characteristics

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Conclusions

- Hardwood tree improvement is not extensively practiced at an operational level
- Fine hardwood species represent only a small percent of improved hardwood seedling production
- Increased attention to incorporating tree improvement into operational hardwood seedling production is needed
- Nursery managers view seed zones as beneficial to forestry
- From the perspective of nursery managers, genetic improvement is seen as more beneficial to timber production than to ecological restoration
- Increases in production of improved seedlings will likely require more advanced breeding programs

References

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