GROWTH ANALYSIS OF OAK TREES IN BOTTOMLAND HARDWOOD RESTORATION PLANTINGS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY

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Abstract—The Lower Mississippi Alluvial Valley (LMAV) once had the largest expanse of bottomland forest cover in the United States, but these diverse forests have been heavily cleared for agricultural purposes. In recent decades significant forest restoration efforts have been attempting to restore bottomland forest cover and the environmental services it provides (e.g. water quality, soil conservation, wildlife habitat). One of the most commonly planted groups of species in these afforestation efforts are different oak (*Quercus* spp.) species However, information about their growth and yield are lacking. The objective of this study is to collect information related to oak growth and yield in bottomland hardwood restoration plantings by using a complete stem analysis approach. Different oak species, ranging in age from 8 to 20 years, were felled and tree discs were removed from the base and at regular intervals along the tree stem. Each tree disc was dried, sanded and then their growth rings measured. Overall, mean height increment varied over time, but generally increased with age. There was substantial height increment variation among individual trees, with increment ranging from less than 0.5m/year, to 2m/year or more in some years. Height growth trajectories differed widely among sample trees, likely reflecting differences in site quality, genetic differences, seedling stock quality, and/or vegetation competition. The information about height, diameter and volume growth over the years acquired by a complete stem analysis can be used in the development of site index curves, employed to classify and compare the growth rates of different sites. This information will increase our knowledge about oak growth and yield in afforestation stands, and improve bottomland hardwood restoration efforts in the LMAV.

INTRODUCTION

The Lower-Mississippi Alluvial Valley (LMAV) once had the largest expanse of bottomland forest cover in the United States but extensive conversion to agriculture has diminished forest cover to less than 25% of its original extent. Forest restoration in the LMAV has been implemented over the past several decades, supported in large part by federal incentive programs aimed at restoring forest cover for the enhancement of wildlife habitat, soil conservation, and water quality. Oaks (*Quercus* spp.) are the most widely planted species, due to their wildlife and timber value. Many afforestation stands are reaching 20 years of age and yet there is limited information about stand development and growth performance of these species following afforestation.

MATERIALS AND METHODS

This study is evaluating planted hardwood stands throughout the Lower Mississippi Alluvial Valley. Sites include private lands registered in federal incentive programs such as the Conservation or Wetland Reserve Programs (CRP, WRP), state Wildlife Management Areas (WMAs), and federal lands such as US Army Corps of Engineers Mitigation lands.

The trees were felled and sectioned in discs taken at ground level, 0.3m, 1.3m, and then meter by meter until the top of the tree. Tree discs were dried in the oven prior to preparing. The discs were sanded to allow identification and measurement of individual growth rings. Tree discs were sanded in several stages, first using a belt sander (80 grit), and then sanding with an orbital sander (120 grit and 220 grit). The discs were analyzed in two orthogonal positions for the growth rings count, with the first measuring line drawn 22.5° to the largest diameter. Rings were identified and marked with the aid of a machinist ruler and dissecting microscope. Each growth ring represents one year of growth. The radius of each ring was measured in each direction of the orthogonal lines based on its distance from the pith. Average ring width was calculated as the average of the four measurements.

RESULTS AND DISCUSSION

The information obtained from ring measurements can be used to create a stem profile graph for all ages of the tree, each line corresponding to one growth year of the tree. The total height for the respective ages was

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estimated using Carmean's regression approach (Dyer and Bailey 1987). In order to evaluate growth increment over time, the rings series were normalized by age. Overall, mean height increment varied over time, but generally increased with age. There was substantial height increment variation among individual trees, with increment ranging from less than 0.5m/year, to 2m/year or more in some years. Height growth trajectories differed widely among sample trees, likely reflecting differences in site quality, genetic differences, seedling stock quality, and/or vegetation competition (fig. 1).

The information about height, diameter and volume growth over the years acquired by a complete stem analysis can be used in the development of site index curves, employed to classify and compare the growth rates of different sites. We expect that this study will increase our knowledge of oak growth and yield for afforestation stands in the LMAV. This information will be important to developing management approaches for afforestation stands, particularly as they mature.

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LITERATURE CITED

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Figure 1—Height growth trajectories over time for sampled trees.