Artificial Regeneration of Northern Red Oak (*Quercus rubra* L.) On High Quality Mesic Sites: Early Results Characterizing Nursery Production, Early Juvenile Growth, and Acorn Production

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There is intense concern among forest resource managers about the rapid decline in the northern red oak (NRO) component of high quality mesic sites throughout the United States. Currently this versatile oak species, so important for its lumber value as well as its dietary staple status for hundreds of wildlife species, is being replaced by hardwood species that lack the economic and biodiversity potential of this species on the better mesic sites. Various modifications of the shelterwood and other natural regeneration procedures have been and are currently being utilized in attempts to increase the NRO component in stands. The success of these modifications has fallen short of the original expectations on high quality sites (site index 21 m, base age 50 years) when compared to results obtained on lower quality sites. Because the lower sites have little competing vegetation, a productive oak component can usually be maintained over multiple rotations using various seed tree and shelterwood methods of management. However, these sites have lower economic, wildlife, and biodiversity values. It has been suggested that if new reforestation technologies are not developed in the near future, this species may become endangered or absent on the better mesic sites in the eastern United States.

In the early 1990's, artificial regeneration of NRO was of minor importance in both regeneration and reforestation. The limited availability of planting stock as well as the questionable quality of the seedlings severely limited the use of bare-root NRO plantings for at least 50 years. As a first step in correcting this situation, a 17-year-old NRO stand, which was originally used for progeny test, and beginning to bear acorns, was thinned in 1987 to encourage crown expansion for more acorn production by the better trees. The original progeny test contained open-pollinated half-sib progeny from 250 mother trees; nearly all progeny groups were maintained in the resulting seed orchard. In 1994 progeny seedlings from 43 mother trees were used to

establish potential mast-producing areas on two high quality mesic sites (SI 29 m at 50 years) in southern U.S.A. One of the sites was clear-cut prior to reforestation, while the other site was managed by underplanting beneath a high shelterwood cover of approximately 30 trees per hectare.

The acorns were sown at a Georgia Forestry Commission nursery, and managed using the fertility protocol developed at the Institute of Tree Root Biology (ITRB) in Athens, Georgia, U.S.A. (Kormanik et al, 1994). The seedlings were graded for outplanting based on first-order lateral root numbers (FOLR), root collar diameter (RCD), and heights (HGT). Minimum standards were six FOLR, eight mm RCD, and 0.7 m HGT. Of the 43 progeny groups used, 7 were common to both locations, while 18 groups were unique to each specific site.

The seedlings were outplanted in March 1995, with 10 replications at each site. Each replication consisted of five seedlings for each of the 25 mother trees, resulting in 1250 seedlings per location. The seedlings were planted on a 3.3 x 3.3 m grid. Sites were managed to appropriately different standards: the clear cut area received herbicide applications to control competing vegetation, while the competing vegetation on the high shelterwood site was controlled mechanically. The established NRO in the clear cut site produced a few mature acorns at age 7. Judging from the number of acornets observed in December 2001, a large crop can be expected in the autumn of 2002. No acorn production has occurred on the oaks at the shelterwood location.

The nursery production schedule, field establishment, and stand maintenance will be discussed, as will the competitive factors responsible for the productivity between the two sites.

Reference

Kormanik, P.P., S.S. Sung and T.L. Kormanik. (1994):
Toward a single nursery protocol for oak seedlings. Pp. 89-98 in Proc. 22nd Southern Forest Tree Improvement Conference, 14-17 Jun 1993, Atlanta, GA.

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