
STAND AND INDIVIDUAL TREE GROWTH RESPONSE TO TREATMENTS IN YOUNG NATURAL HARDWOODS

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Young even-aged upland Piedmont mixed hardwood and pine stands were treated with a variety of fertilizer and release (competition control) treatments. The sites studied are on the NC State University Hill Demonstration Forest in central North Carolina, and are characterized by formerly highly eroded agricultural sites (Richter et al. 2000) now in their third rotation of tree cover. Tree growth response was assessed periodically over several years, on both an individual-tree and stand-wide bases. Stand-basis response to fertilizer treatments was vigorous, with treated stands growing more than untreated controls. Whereas individual tree response within treated areas were less. Responses varied between species, with specific consideration of yellow poplar, red/black oak, white oak, and loblolly pine. Significant increases in the rate of stand development can be achieved, thereby reducing the anticipated time to final harvest and number of years necessary to attain commercial size stems. Modest fertilizer inputs on these types of sites have significant effects. The long term response of individual trees at these young ages to release treatments remains difficult to determine. This study adds to the growing body of experience with these kinds of treatments (Auchmoody 1989, Berenguer et al. 2009, Schuler and Robison 2006, others).

Individual Tree Release Study – In summer 1998 we identified three similar adjacent upland mixed hardwood stands regenerated by clearcutting 6, 8, and 13 years prior; aged 18, 20 and 25 years old at the time of the final measurements reported here. About 60 dominant/co-dominant non-stump sprout trees on a 6 x 6m grid across each site of red/black oak, white oak and yellow poplar were identified on each site. About 20 stems of species on each site were treated as:

- 1) Control,
- 2) Mechanical – brush saw clearing of a 1.8m radius around the trees in year 1,
- 3) Mechanical + Chemical Year 1 [Garlon herbicide on cut stems in year 1],

- 4) Mechanical + Chemical Year 2 [Accord/Oust herbicide mixture in year 2],
- 5) Mechanical + Chemical Year 1 + Fertilization [DAP fertilizer year 2 (DAP at equivalent of 100 and 112 kg/ha N and P in released area)].

Tree size was measured in 1998, 2000, 2001, 2004 and 2010. Representative results are reported in Figure 1.

Area-Based Treatment and Individual Tree Release Study – In spring 2003, a loblolly pine plantation with a hardwood component was salvage clearcut after ice damage, and in spring 2004 study plots (20.3 x 40.6 m) were established. Trees were measured (in 2 x 30 m strips) and fertilizer was broadcast on 1-year-old regeneration as follows:

- 1) Untreated Control,
- 2) Nitrogen fertilizer (N fert),
- 3) Nitrogen and Phosphorus fertilizer (N+P fert), and
- 4) Nitrogen, Phosphorus and Potassium fertilizer (N+P+K fert), with nitrogen applied at 200 kg N per ha ammonium nitrate (34-0-0), phosphorus applied at 50 kg per ha triple super phosphate (0-46-0), and potassium applied at 100 kg per ha muriate of potash (0-0-60).

In fall 2005 tree size was measured. In winter 2005/2006 the plots were split, half left alone (non-released) and in half select trees were released. In winter 2008/2009 tree response was measured in both the non-released and released areas. Released trees were five each of loblolly pine, northern red oak, and yellow poplar. In non-released areas five each of the same species were also measured, and trees in 2 x 15 m transects were also measured in the unreleased areas. For all species combined from transect data, the response of stems under the different fertilizer treatments are illustrated in Figure 2. For the individually released trees (and their counterparts in the non-released portion of this study) (data not shown here), for loblolly pine, there were substantive growth gains in diameter and volume index but not height

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under all fertilizer conditions. Also for loblolly pine across fertilizer conditions with respect to the control under release and non-release conditions, the trees treated with N and N+P+K were larger than those in control or N+P conditions. For northern red oak the responses were similar but smaller in magnitude, and the positive fertilizer responses were for the N and N+P treatments. For yellow poplar the responses were similar again, but for height as well as diameter and volume, larger in magnitude than for loblolly pine, and positive for all fertilizer treatments relative to the fertilizer control.

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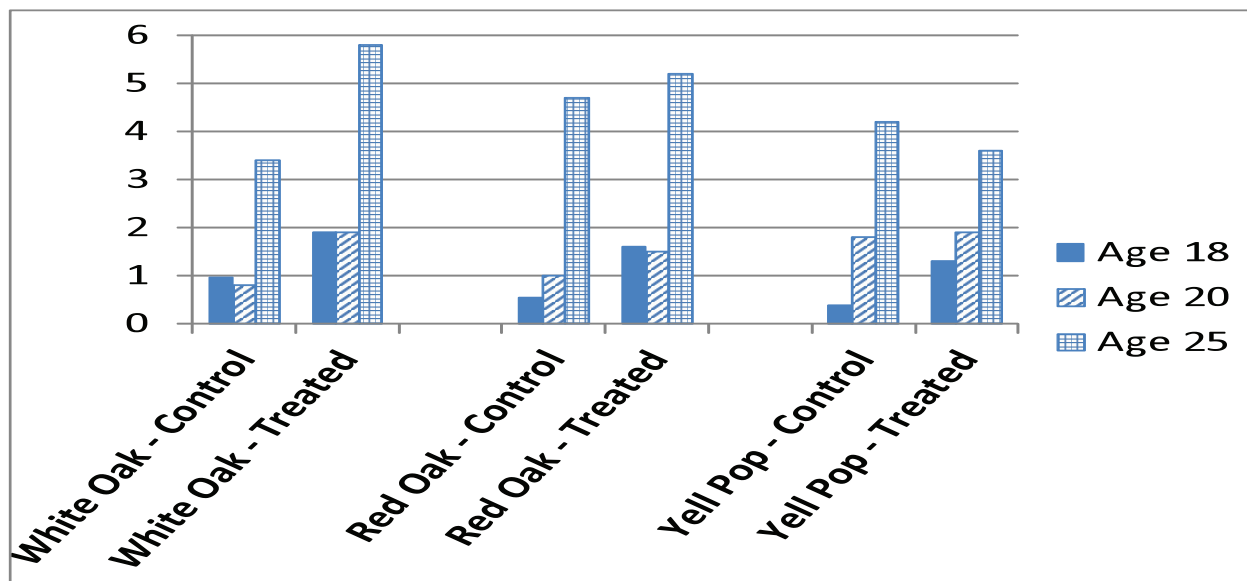


Figure 1—Mean volume index of individual stems 12 years after the maximum Individual Tree Release Treatment of Mechanical Release + Chemical Herbicide + Fertilizer in the Individual Tree Release Study (see text). Volume index was based on the d-squared*height approximation. Results for trees at 18, 20 and 25 years old, were from trees first treated when they were 6, 8 and 13 years old, respectively, 12 years earlier.

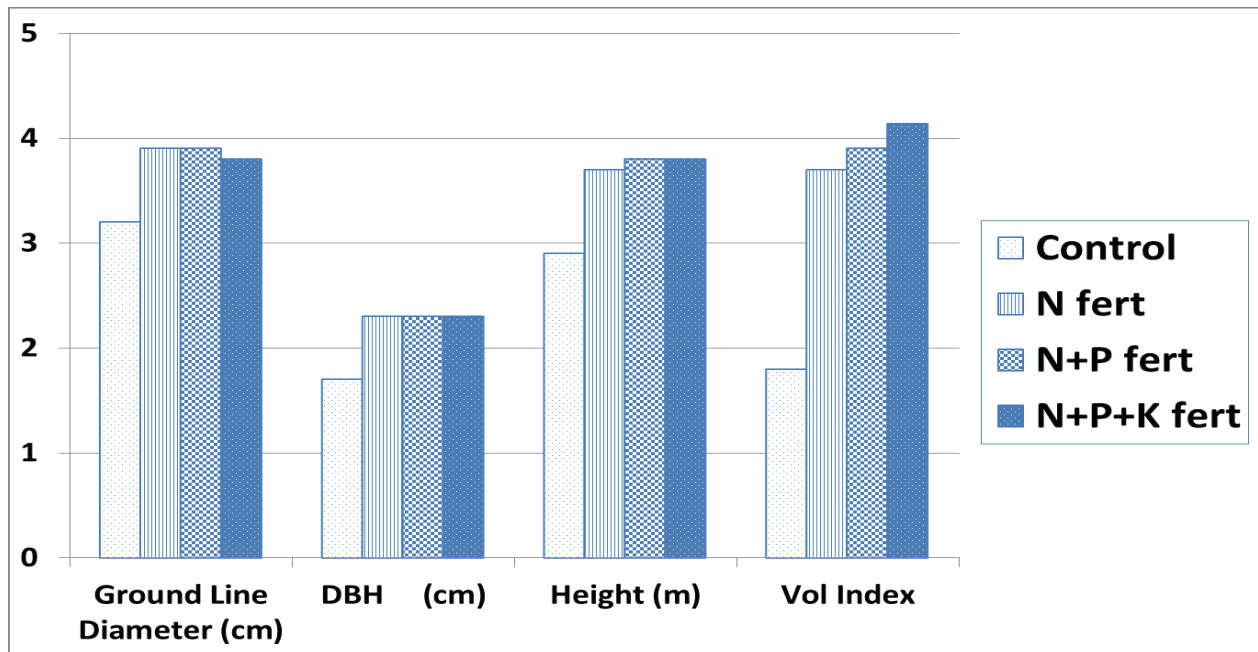


Figure 2 – Mean size of six-year-old stems for all species combined (for stems greater than 60 cm tall) from area-based transect plots 5 years after fertilizer treatments were applied to 1-year-old regeneration in the Area-Based Treatment and Individual Tree Release Study (data for the individual tree portion of this study not shown).