



Growth Response of White Oak to Repeated Crop Tree Release and Fertilization

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On April 26, 2005, a study was installed in the Burnham Unit of the Appomattox-Buckingham State Forest in a 15-year-old mixed hardwood stand. The objective was to assess the combined effects of crop tree release and fertilization on the growth of white oak (*Quercus alba* L). Three-tree replications were matched based on diameter breast height (dbh) and total height. Two of the three stems in each replication were selected at random for release (by felling all surrounding trees touching their canopy), and one of those two was then randomly selected to be fertilized at a rate of 200 lbs. nitrogen (N) plus 50 lbs. phosphorus (P) per acre over a tree-centered 10-foot-radius circle. The response to the added fertilizer diminished beginning in the third year after treatment, and surrounding hardwoods began to once again encroach on the crowns of the released trees. As a result, the same treatments (crop tree release with or without 200 lbs. N plus 50 lbs. P fertilizer per acre) were re-applied in April 2011 to the same trees that received them six years earlier.

The trees have been re-measured for total height and diameter breast height (dbh) annually for nine years after the initial treatment (**Table 1**). Previous years' results have been summarized in VDOF Forest Research Reviews from March 2007, March 2010, May 2011 and August 2012 (www.dof.virginia.gov).

Height growth continues to be modest and statistically not affected by treatment. This is at least partly because it is difficult to measure with precision and can actually decline if ice or wind damages the tree crowns. On average, these white oaks have grown only 1.6 feet per year between ages 15 and 24.

Diameter growth, meanwhile, is the important statistically significant response variable (**Figure 1**). Over the life of the test, released trees have now outgrown unreleased trees by 70 percent in dbh, and adding fertilizer has boosted that difference to 83 percent. The unreleased trees now average 4.5 inches in dbh. The released trees were that large four years ago, so release appears to have accelerated individual tree diameter growth by four years. The majority of the response has come from the release treatment, while a smaller component has been added by the fertilizer application (**Figure 2**). The second treatments applied in 2011 seem to have enhanced diameter growth again.

Another key point from these plots is that the larger trees have responded more to the treatments than have the smaller trees, so the best strategy with crop tree release of white oak is to release the largest, healthiest trees available.

Table 1. Summary of white oak growth response through nine years following crop tree release and fertilization treatments.

	Treatment	Stand Age (years)										Nine-Year Growth
		15	16	17	18	19	20	21	22	23	24	
DBH (in.)	Untreated	3.11	3.26	3.47	3.64	3.79	3.98	4.11	4.23	4.41	4.52	1.41
	Released	3.12	3.35	3.63	4.01	4.25	4.51	4.72	4.97	5.30	5.52	2.40
	Released and Fertilized	3.12	3.46	3.82	4.14	4.39	4.61	4.84	5.15	5.49	5.72	2.60
Total Height (ft.)	Untreated	26.0	29.0	31.2	32.3	34.3	36.3	36.3	37.7	38.51	39.91	13.94
	Released	26.3	28.2	30.3	31.5	33.2	34.9	35.0	37.1	37.61	39.93	13.63
	Released and Fertilized	26.6	28.9	31.3	32.5	34.8	37.0	36.3	38.1	38.91	41.24	14.63

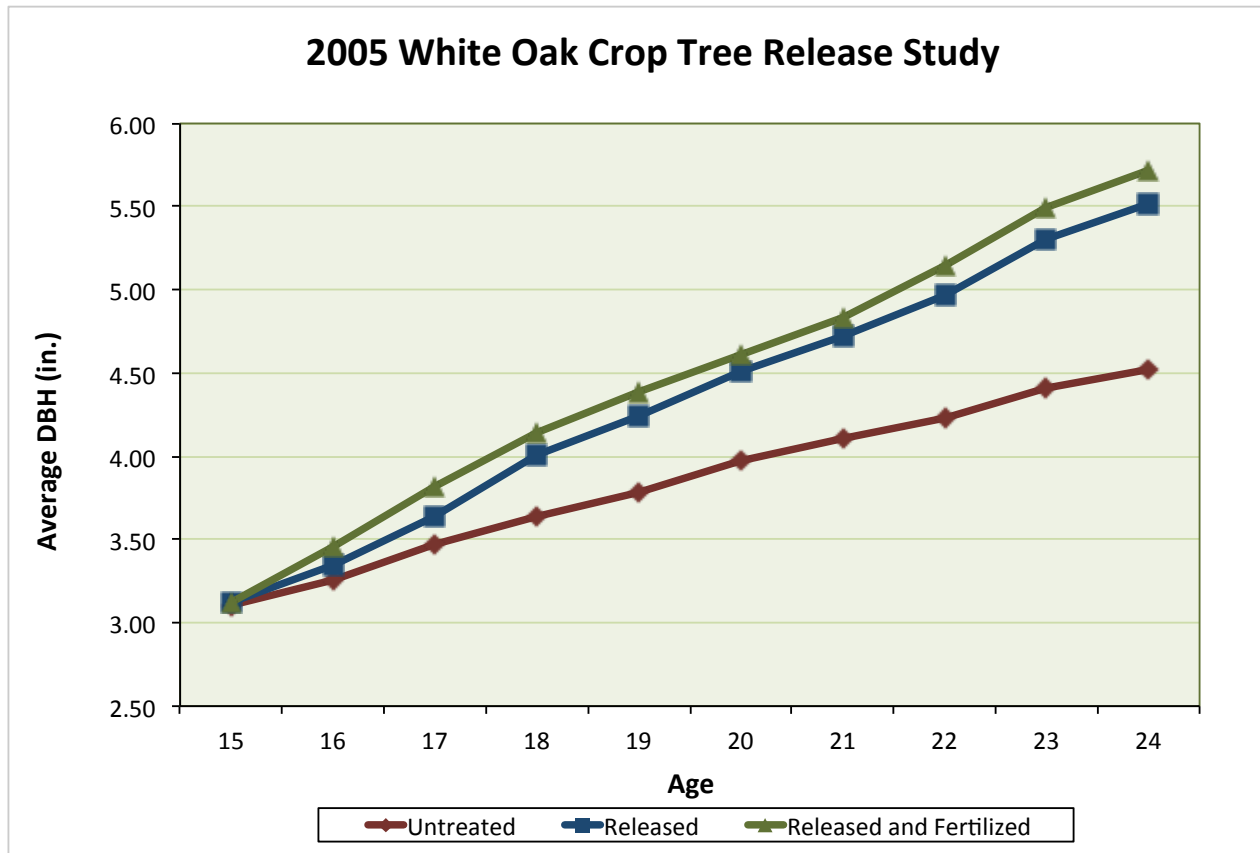


Figure 1. Average yearly diameter breast height (dbh) of white oak trees from 2004 to 2013.

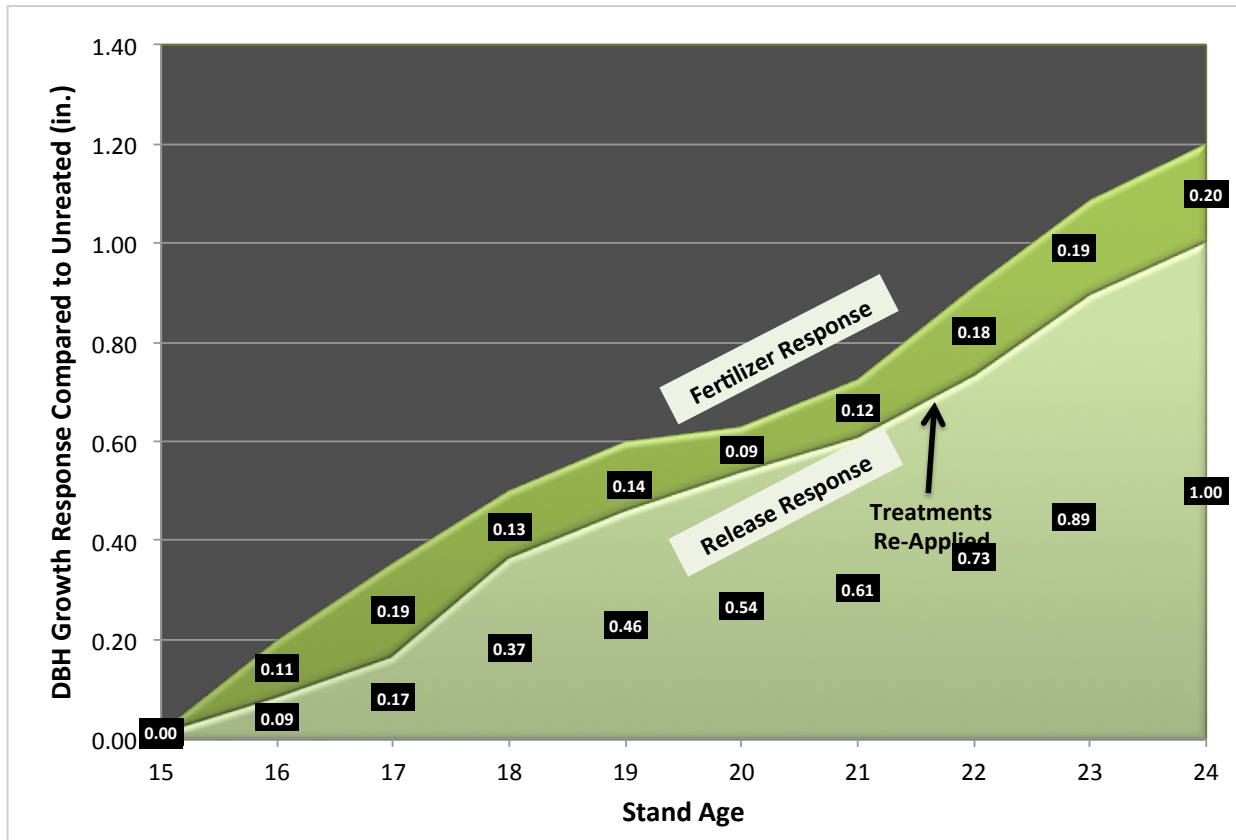


Figure 2. Diameter breast height (dbh) growth gain (compared to untreated trees) of released and fertilized white oak for nine years following crop tree release and fertilization.