

# HERBICIDE COMPARISONS FOR MID-ROTATION COMPETITION RELEASE IN LOBLOLLY AND SLASH PINE

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**Abstract**—In October, 2002, different combinations of herbicides (Arsenal®, Chopper®, and Forestry Garlon® 4) were applied with a tank-mounted skidder, in an experiment to evaluate their effectiveness for controlling competing vegetation in the understory of a 16-year-old loblolly (*Pinus taeda* L.) and slash pine (*Pinus elliottii* Engelm.) plantation in Louisiana. Two years after treatment, volume responses are significant for loblolly pine where the understory had been treated with 2 quarts Forestry Garlon® 4 and 48 ounces Chopper®. The best treatment reduced competing vegetation in percent cover and total height. Slash pine has not responded to release treatments.

## INTRODUCTION

In recent years, a number of studies have shown pines grow significantly faster when competing vegetation in the understory is controlled (Quicke and others 1996, Shiver 1994). A problem arises when difficult-to-control species are growing alongside crop trees. In the Gulf Coastal Plain, several species of arborescent and non-arborescent plants can grow just under or into the canopy of pines, making herbicide application difficult. Also, foresters are limited to a select group of herbicides that have proven effective when applied to waxy leafed species such as yaupon (*Ilex vomitoria* Ait.) and waxmyrtle (*Myrica cerifera* L.). This makes spraying a challenge, since aerial application is not an option.

## METHODS AND MATERIALS

Two sites in Allen Parish, LA, were selected for the study. The loblolly pine site is on a Malbis soil, planted in 1986, fertilized in 1995 with 35 pounds of nitrogen (N) and 40 pounds of phosphorus (P), commercially thinned in 2000, and fertilized again in 2002 with 200 pounds of N and 25 pounds of P. Prior to treatment application, trees averaged 5.8 inches d.b.h. and 42.9 feet in height. The slash pine site is located on a Caddo soil, planted in 1986, fertilized in 1995 with 35 pounds of N and 40 pounds of P, commercially thinned in 2001, and fertilized again in 2002 with 100 pounds of N and 25 pounds of P. Prior to treatment application, trees averaged 5.6 inches d.b.h. and 42.7 feet in height. The thinning procedure for each stand consisted of harvesting every fifth row, with selections from below coming from the two rows on either side of the harvested row.

Competing species included American beautyberry (*Callicarpa americana* L.), American holly (*Ilex opaca* Ait.), blackgum (*Nyssa sylvatica* Marsh.), Chinese tallow (*Sapium sebiferum* L.), red maple (*Acer rubrum* L.), sumac (*Rhus* spp.), sweetgum (*Liquidambar styraciflua* L.), water oak (*Quercus nigra* L.), waxmyrtle, and yaupon. Prior to treatment application, three species (sweetgum, waxmyrtle, and yaupon) constituted more than 50 percent of the competing vegetation cover on both sites (table 1).

A randomized complete block design was chosen for this experiment with three blocks per site. Four herbicide treatments

**Table 1—Percent cover and height of major competing species, prior to treatment, in Allen Parish, LA**

Species	Initial cover		Initial height	
	Loblolly site	Slash site	Loblolly site	Slash site
	----- % -----		----- feet -----	
Yaupon	52	19	15	14
Waxmyrtle	9	20	8	11
Sweetgum	9	13	19	23

were chosen for the loblolly pine site and one herbicide treatment for the slash pine site (table 2). All tank mixes included a 99 percent non-ionic surfactant. In order to ensure adequate coverage in these dense stands, a tank-mounted skidder was used to apply the herbicide mixture at 45 gallons per acre at 40 pounds per square inch pressure. Nozzles were mounted on a boom 20 feet above the ground. These higher volumes and increased boom height were used to ensure adequate cover in these dense stands. The skidder traveled the harvested rows for access and sprayed a swath approximately 50 feet wide. Four adjacent spray swaths, each 350 feet long, constituted a treated plot. Treatments for both sites were applied October 15, 2002. Control treatment plots were also present in each block.

**Table 2—Herbicide tank-mixes applied to control competing vegetation at the loblolly and slash pine sites in Allen Parish, LA**

	Treatment no.	Herbicide and rate ( <i>per acre</i> )
Loblolly	1	2 qt Garlon4 + 16 oz Arsenal
	2	3 qt Garlon4 + 12 oz Arsenal
	3	5 qt Garlon4
	4	2 qt Garlon4 + 48 oz Chopper
	5	Untreated
Slash	1	2 qt Garlon4 + 32 oz Chopper
	2	Untreated

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Within each plot, three permanent 0.1-acre measurement plots were established. All pine trees were tagged and measured for d.b.h. and height prior to treatment application. Visual assessments for competing vegetation (percent cover by species and average height of species) were recorded prior to treatment application and each year thereafter. After treatment application, percent control of competing vegetation was recorded each year. Analysis of variance and Duncan's New Multiple Range Test ( $P < 0.05$ ) were used to test statistical significance of the results. This paper reports data for the period 2 years after treatment application.

## RESULTS AND DISCUSSION

### Loblolly Pine Site

Two years after treatment, diameter growth ranged from 0.52 inches for the untreated plot to 0.62 inches for the 2 quarts Garlon® 4 + 48 ounces Chopper® treatment (table 3). Height growth varied from 4.5 feet for the untreated plot to 5.7 feet for the 3 quarts Garlon® 4 + 12 ounces Arsenal® treatment. All treatments were statistically different from the untreated plot in terms of volume growth. An additional 68 cubic feet per acre of volume was gained on the 2 quarts Garlon® 4 + 48 ounces Chopper® treatment when compared to the untreated plot (table 4). This was the greatest volume response of any of the herbicide treatments.

Prior to any treatment application, yaupon cover levels averaged fifty percent or more across all plots (table 4). One year after treatment, all tank mixes were effective in reducing percent yaupon levels. The 5 quarts Garlon® 4 and the 2 quarts Garlon® 4 + 48 ounces Chopper® rate reduced yaupon to 10 percent cover while the 2 quarts Garlon® 4 + 16 ounces

Arsenal rate reduced yaupon percent cover to 18 percent. Even with the higher spray volumes per acre and increased boom height, not all yaupon was controlled regardless of the treatment. Individual plants were occasionally over topped by foliage and did not receive adequate spray. Two years after treatment, yaupon percent cover ranged from a high of 31 percent for 5 quarts Garlon® 4 to a low of 14 percent for the 2 quarts Garlon® + 48 ounces Chopper® treatment. Apparently, the better efficacy of the 2 quarts Garlon® + 48 ounces Chopper® treatment on yaupon resulted in greater volume response for loblolly pine.

### Slash Pine Site

Diameter growth, 2 years after treatment, ranged from 0.63 inches for the untreated plot to 0.70 inches for the 2 quarts Garlon® 4 + 32 ounces Chopper® treatment (table 3). Height growth for slash pine ranged from 5.2 feet for the untreated plot to 5.8 feet for the 2 quarts Garlon® 4 + 32 ounces Chopper® treatment. Although there was 31 cubic feet per acre volume gain from the treated plot, this was not statistically significant ( $P < 0.05$ ).

Initial understory competition for percent control was somewhat equally distributed among yaupon, waxmyrtle, and sweetgum (table 1). Two years after treatment, the 2 quarts Garlon® 4 + 32 ounces Chopper® treatment reduced percent cover for yaupon, waxmyrtle, and sweetgum 12, 8, and 6 percentage points, respectively (table 5). This reduction in competing vegetation was not enough to elicit a volume response from slash pine. Over the last 2 years, percent cover for yaupon and waxmyrtle on the untreated plot has remained relatively unchanged. However, for the same time period, sweetgum percent cover has increased from 13 to 25 percent.

**Table 3—Loblolly and slash pine growth 2 years after treatments were applied to control competition**

Species	Treatment	d.b.h. <i>in</i>	Height <i>ft</i>	Volume <i>ft<sup>3</sup></i>
Loblolly	2 qt Garlon4 + 16 oz Arsenal	0.56	5.0	627
	3 qt Garlon4 + 12 oz Arsenal	0.58	5.7	652
	5 qt Garlon4	0.57	5.2	669
	2 qt Garlon4 + 48 oz Chopper	0.62	5.5	678
	Untreated	0.52	4.5	610
Slash	2 qt Garlon4 + 32 oz Chopper	0.70	5.8	705
	Untreated	0.63	5.2	674

**Table 4—Percent yaupon cover on the loblolly pine site, before and after treatment, in Allen Parish, LA**

Treatment	Initial	1 year after treatment	2 years after treatment
2 qt Garlon4 + 16 oz Arsenal	52	18	29
3 qt Garlon4 + 12 oz Arsenal	52	12	26
5 qt Garlon4	50	10	31
2 qt Garlon4 + 48 oz Chopper	50	10	14
Untreated	56	59	50

**Table 5—Percent cover and height of major understory competition on the slash pine site 2 years after treatment in Allen Parish, LA**

Species	Cover		Height	
	Untreated	2 qt Garlon4 + 32 oz Chopper	Untreated	2 qt Garlon4 + 32 oz Chopper
	----- % -----		----- ft -----	
Yaupon	22	7	14	10
Waxmyrtle	16	12	7	5
Sweetgum	25	7	24	16

### CONCLUSIONS

Two years after treatment, a tank mix of 2 quarts Garlon® 4 + 48 ounces Chopper® reduced understory competing vegetation which significantly increased loblolly pine volume. Over the same time period, slash pine did not respond to release from understory competition when 2 quarts Garlon® 4 + 32 ounces Chopper® was used. It will be important to monitor these studies in the future since additional responses may be measured.

### ACKNOWLEDGMENTS

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### LITERATURE CITED

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