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FIFTH-YEAR PINE GROWTH RESPONSE TO WOODY RELEASE TREATMENTS IN YOUNG LOBLOLLY PLANTATIONS

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Abstract—The efficacy of adding Oust® XP to woody release treatments was evaluated on second-year pine plantations in Texas, Mississippi, and South Carolina. Overall, the residual control of herbaceous weeds on these sites was excellent the growing season following application. Pine height and diameter growth was evaluated for 5 years following application. Generally, the treatments of high rates of Arsenal AC alone and all treatments with Oust® XP resulted in significantly improved height and diameter growth.

INTRODUCTION

Across the South, many forest land managers may opt to use mechanical site preparation, especially when soil treatments are deemed appropriate. While these mechanical treatments may be highly effective at addressing a particular soil problem or debris issue, they are typically less effective at control of competing vegetation. In these scenarios where pines are planted, a woody release treatment using herbicides is usually applied at the end of either the first or second growing season. The purpose of these applications is to provide long-term control of the woody competitors with typically short-term control of any herbaceous species on the site.

For years, OUST® XP has been added to site preparation tank mixtures to provide residual control of herbaceous weeds the growing season following application. This addition has proven to be very effective in controlling herbaceous competition and promoting growth of the planted pine seedlings. The objectives of this study were (1) to determine if Oust® XP could provide herbaceous weed control during the growing season following a fall release application and (2) to evaluate the pine growth response to the various treatments.

STUDY SITES

Three study sites were utilized in the project. The sites were located in Texas, Mississippi, and South Carolina. In Texas, the study was located on Temple-Inland forest land near Alcoa, TX. The soil was a sandy loam with a pH = 5.2. The previous stand had been a mixed pine-hardwood composition which was harvested in 1999. The site received mechanical site preparation in 1999 and was planted with loblolly pine (*Pinus taeda* L.) seedlings in January 2000.

In Mississippi, the study was located on Weyerhaeuser Company land near Bradley, MS. The soil was a silt loam with a pH = 5.2. The previous stand had been a mixed pine-hardwood composition which was harvested in 1998. The site received mechanical site preparation in 1999 and was planted with loblolly pine in January 2000.

In South Carolina, the study was installed on Clemson school forest land near Central, SC. The soil was a clay loam with a

pH = 5.3. The previous stand had been mixed pine-hardwood composition which was harvested in 1998. The site received chemical treatment and burning in 1999 and was planted in January 2000.

TREATMENTS

A complete list of treatments is found in table 1. Six of the treatments were applied on all three sites. Two of the treatments (#7 and #8) were applied in Mississippi only. Generally, the treatments were comparing two rates of Arsenal AC with or without the addition of Escort® XP or Oust XP®. The Eagre® in treatments 7 and 8 was a glyphosate product with 4 pounds active ingredient per gallon. A crop oil concentrate or nonionic surfactant was added to each treatment as noted in the table.

All treatments were applied during the period September 1–8, 2001 (date varied by site). The treatments were applied using a CO₂-powered backpack sprayer with a pole extension and KLC-9 nozzle. Total spray volume was 10 g/acre. This equipment simulates an aerial application.

EXPERIMENTAL DESIGN

The treatments were applied to rectangular plots 30 feet wide and 100 feet long. All treatments were replicated three times on all sites in a randomized complete block design.

EVALUATIONS

Prior to treatment application, all hardwoods in the sample area of each plot (10- by 80-foot area centered in each plot) were recorded by species and height class. At this same pretreatment timing, the heights and groundline diameters (GLD) of all planted pines in the sample area were recorded.

Herbaceous weed control was evaluated in April, May, June, July, August, and September of 2002. This was accomplished using ocular estimates of the percent ground cover of the major vegetation categories (grass/sedge, broadleaf forbs, and vines).

Hardwoods were recorded by species and height again in November 2002. Pine heights and diameter at breast height

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Table 1—List of treatments in 2001 DuPont fall Oust® pine release study

Treatment no.	Herbicide and rate per acre
1	Untreated
2	Arsenal AC (16 oz) + COC (3.2 oz)
3	Arsenal AC (12 oz) + COC (3.2 oz)
4	Arsenal AC (12 oz) + Escort® XP (1 oz) + COC (3.2 oz)
5	Arsenal AC (12 oz) + Escort® XP (1 oz) + Oust® XP (2 oz) + COC (3.2 oz)
6	Arsenal AC (12 oz) + Eagre (12.8 oz) + Oust® XP (2 oz) + Escort® XP (1 oz) + Entry II (10 oz)
7 ^a	Eagre (25.6 oz) + Escort XP® (2 oz) + Oust® XP (2 oz) + Entry II (10 oz)
8 ^a	Eagre (25.6 oz) + Escort XP® (4 oz) + Oust® XP (2 oz) + Entry II (10 oz)

oz = ounces; COC = Timbersurf 90.

^a Mississippi only.

(d.b.h.) were remeasured in December 2002, December 2003, December 2004, and November 2006.

DATA ANALYSIS

Hardwood control was based on a percent reduction of stems and cumulative heights by species. Pine height and GLD data were subjected to analysis of variance and means separation using Duncan's new multiple range test (DNMRT) to test for significant differences among treatments. Herbaceous coverage data were averaged by treatment, subjected to arcsine transformation, with means separated using DNMRT.

RESULTS

Grass Control

With the exception of *Andropogon* in Mississippi, the addition of Oust® XP provided excellent grass control. Grass coverage was significantly less in all treatments that had Oust® XP in the mixture.

Forb Control

With the exception of wooly croton (*Croton capitatus*) in Texas, the addition of Oust® XP provided excellent broadleaf control. Again broadleaf coverage was significantly less in areas treated with mixtures containing Oust® XP.

Overall Control

All treatments resulted in >90 percent control of hardwoods. The addition of Oust® XP provided excellent results, especially in Mississippi and South Carolina. Wooly croton grew aggressively in treated areas in Texas. The results were comparable to the excellent response obtained from

adding Oust® XP to site preparation applications. If *Rubus* is a problem on the site, Oust® Extra may be a better product for adding to the application.

Pine Height Growth

Average pine heights for the Texas and Mississippi sites at five growing seasons after treatment (5 GSAT) are found in table 2. Data for the South Carolina site are not available. Generally, release treatments resulted in greater total heights than untreated areas (table 2). The high rate (16 ounces per acre) of Arsenal AC alone or all the two-way and three-way mixes resulted in heights which were significantly greater than the average height in the untreated plots.

Diameter growth followed a similar pattern to height growth at 5 GSAT. All treatments resulted in trees with significantly larger diameters as compared to those in untreated areas (table 3). In Mississippi, the treatments with the high rate of Arsenal AC and those with Oust® XP added resulted in significantly greater average diameters as compared to the low rate of Arsenal AC alone or untreated. In Texas, there was no statistical separation of the treatments except treated vs. untreated. The reason for the lack of treatment separation is thought to be due to the effect of wooly croton competition.

Overall, the inclusion of Oust® XP in the release treatments provided excellent residual herbaceous control and pine growth response. Isolated species which are not controlled by Oust® XP can eliminate treatment differences, but sulfometuron methyl (Oust® XP) had a very broad spectrum of control, and loblolly pines should respond very favorably to its addition to any tank containing release treatments.

Table 2—Average total height at 5GSAT in fall Oust® release study, Mississippi and Texas (average all reps)

Treatment ^a	Height, 5 GSAT	
	Mississippi	Texas
	----- <i>feet</i> -----	
Untreated	24.05 c	28.95 b
A (12 oz)	23.68 c	29.38 ab
A (16 oz)	27.19 a	29.76 a
A + E (12 oz + 1 oz)	25.10 b	29.64 a
A + E + O (12 oz + 1 oz + 2 oz)	25.58 ab	29.98 a
A + G + E + O (12 oz + 12 oz + 1 oz + 2 oz)	25.66 ab	30.97 a
G + E + O (25 oz + 2 oz + 2 oz)	25.26 ab	—
G + E + O (25 oz + 4 oz + 2 oz)	28.25 a	—

GSAT = growing seasons after treatment; oz = ounces.

^a Herbicide—A = Arsenal AC; E = Escort® XP; O = Oust® XP; G = glyphosate (Eagre).

Values in a column followed by the same letter do not differ at $\alpha = 0.05$.

Table 3—Average d.b.h. at 5GSAT by treatment and time of observation in fall Oust® release study, Mississippi and Texas (avg. all reps)

Treatment ^a	D.b.h., 5 GSAT	
	Mississippi	Texas
	----- <i>inches</i> -----	
Untreated	4.06 c	4.76 b
A (12 oz)	4.92 b	5.61 a
A (16 oz)	5.67 a	5.88 a
A + E (12 oz + 1 oz)	4.85 b	5.72 a
A + E + O (12 oz + 1 oz + 2 oz)	5.04 ab	5.95 a
A + G + E + O (12 oz + 12 oz + 1 oz + 2 oz)	5.31 a	5.69 a
G + E + O (25 oz + 2 oz + 2 oz)	5.37 a	—
G + E + O (25 oz + 4 oz + 2 oz)	5.42 a	—

GSAT = growing seasons after treatment; oz = ounces.

^a Herbicide—A = Arsenal AC; E = Escort® XP; O = Oust® XP; G = glyphosate (Eagre).

Values in a column followed by the same letter do not differ at $\alpha = 0.05$.