

THREE-YEAR GROWTH OF LOBLOLLY PINE SEEDLINGS FOLLOWING HERBACEOUS WEED CONTROL APPLICATIONS OF SULFOMETURON, IMAZAPYR, HEXAZINONE, AND INDAZIFLAM

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ABSTRACT

A total of 10 treatments (including an untreated check) were used to evaluate herbaceous weed control, survival, and 3-year growth in a newly established loblolly pine plantation. All treatments were replicated three times in a randomized complete block design. The treatments of (1) Oust XP + Velpar L or (2) Oust XP + Velpar L + Esplanade SC (5 ounces) provided the best overall results in herbaceous weed control, survival, height growth, and groundline diameter growth. Indaziflam demonstrated potential for future use in such applications over loblolly pine seedlings.

INTRODUCTION

For more than 30 years, herbaceous weed control (HWC) has been a standard practice in the establishment of pine plantations in the South. Through the years, a variety of herbicides have been used in these applications. Currently, a combination of sulfometuron methyl and imazapyr is the most widely utilized application for loblolly pine seedlings. Indaziflam has demonstrated efficacy in tank mixtures for such applications and there is some evidence that indaziflam can provide residual weed control into the next year after application. Such residual control could provide additional growth in recently planted loblolly pine seedlings.

OBJECTIVES

The primary objective of this study was to compare survival and growth of loblolly pine seedlings over a 3-year period following HWC applications. Of particular interest was to determine if treatments using Esplanade SC® (indaziflam) produced better growth than those without the material.

METHODS

Study Site

The study was installed on Weyerhaeuser land in Choctaw County, Mississippi. The site was harvested in 2016, received

a combination plow treatment in the summer of 2017, chemical site prep in September 2017, and was planted in January 2018. Shortly after planting, extreme cold temperatures damaged many seedlings. For that reason, the original seedlings were removed from the research area and new Weyerhaeuser loblolly pine seedlings were planted on February 28, 2018.

Plot Layout

All plots consisted of an area 5 feet x 100 feet with the planted pine seedlings along the midline of the plot. Of the 15 to 16 total seedlings which occurred in each plot, 10 were marked with pin flags as sample trees prior to treatment application.

Experimental Design

A randomized complete block design was utilized in the study due to the slight elevational difference that occurred across the site. Blocks were arranged across this gradient. Three replications of each treatment were installed.

Treatments

A complete list of treatments is presented in table 1. Please note that the Arsenal® used in the study is a 2-pound active ingredient (AI) imazapyr product while the Arsenal AC® in Treatment 10 is a 4-pound AI imazapyr product.

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Table 1—List of treatments in 2018 Bayer HWC study (product amounts are per-acre rates)

1. Untreated check
2. Oust XP (2 ounces) + Arsenal (8 ounces)
3. Oust XP (2 ounces) + Velpar L (32 ounces)
4. Oust XP (2 ounces) + Arsenal (8 ounces) + Esplanade SC (3 ounces)
5. Oust XP (2 ounces) + Velpar L (32 ounces) + Esplanade SC (3 ounces)
6. Oust XP (2 ounces) + Arsenal (8 ounces) + Esplanade SC (5 ounces)
7. Oust XP (2 ounces) + Velpar L (32 ounces) + Esplanade SC (5 ounces)
8. Oust XP (2 ounces) + Arsenal (8 ounces) + Esplanade SC (7 ounces)
9. Oust XP (2 ounces) + Velpar L (32 ounces) + Esplanade SC (7 ounces)
10. Oust XP (2 ounces) + Arsenal AC (4 ounces)

Application

All treatments were applied on March 9, 2018, using a CO₂-powered backpack sprayer with a hand-held wand and TK 2.5 Floodjet nozzle. Total spray volume was 20 gallons per acre. Treatments were applied in a 5-foot swath over the top of the planted seedlings with the seedlings serving as the midpoint of the spray swath.

Evaluation

Herbaceous weed control and crop tolerance of the planted seedlings were evaluated by ocular estimates in June, July, and September 2018. HWC was recorded by vegetation classes and any signs of phytotoxicity were recorded by type (e.g., necrosis, epinasty, rosetting). Survival was recorded in June and September 2018; October 2019; and October 2020. Seedling height and groundline diameter (GLD) were recorded in March 2018; October 2018; October 2019; and October 2020.

RESULTS

Competition Control

All herbicide treatments except Treatment 2 had 70 percent or more bare ground in June 2018 (table 2). No apparent rate response was evident from the addition of Esplanade SC® at either the June or September evaluations. Treatments continued to provide an average of 16.7-48.3 percent bare ground in September 2018 (table 3). Treatments with Velpar L®, both with Esplanade® (Treatment 7) and without (Treatment 3) provided the most bare ground in the September evaluations. It should be noted that retention of 20+ percent bare ground in September is considered to be very good or excellent results in the South.

Table 2—Average coverage by treatment and vegetation class, June 2018 (average all replications)

Treatment	Grass	Forbs	Bare
-----percent-----			
Untreated	40.0	50.0	20.3
O + A	8.7	53.3	38.3
O + V	2.7	15.0	82.3
O + A + E(3)	1.0	10.0	90.0
O + V + E(3)	5.3	25.0	70.0
O + A + E(5)	0.3	25.0	75.0
O + V + E(5)	2.0	8.3	90.0
O + A + E(7)	1.0	13.3	86.7
O + V + E(7)	6.7	10.0	78.3
O + AC	4.0	16.7	80.0

A = Arsenal; O = Oust XP; V = Velpar; E = Esplanade.

Table 3—Average coverage by treatment and vegetation class—September 2018 (average all replications)

Treatment	Grass	Forbs	Bare
-----percent-----			
Untreated	56.7	60.0	0.0
O + A	33.3	41.7	25.0
O + V	33.3	26.7	40.0
O + A + E(3)	26.7	40.0	32.3
O + V + E(3)	56.7	26.7	16.7
O + A + E(5)	40.0	36.7	23.3
O + V + E(5)	10.0	41.7	48.3
O + A + E(7)	31.7	43.3	25.0
O + V + E(7)	40.0	31.7	28.3
O + AC	63.3	16.7	20.0

A = Arsenal; O = Oust XP; V = Velpar; E = Esplanade.

Crop Tolerance

No symptoms of injury were observed in any treatment plots. Loblolly pine tolerance to indaziflam had been evaluated previously, but not in all the mixtures in this study.

Survival

Survival among the treatments ranged from an average of 80.0 percent to 100 percent (table 4). Overall survival in the study was 93.0 percent after three growing seasons which would be considered excellent for a loblolly pine plantation. Overall survival after the first growing season was 93.7 percent, again demonstrating that the vast majority of mortality usually occurs in the first growing season.

Table 4—Average survival, height, and groundline diameter (GLD) by treatment after three growing seasons (average all replications)

Treatment	Survival	Height	GLD
	<i>-percent-</i>	<i>-feet-</i>	<i>-mm-</i>
Untreated	93.3a ^a	6.86d	38.7e
O + A	100.0a	8.63ab	54.0a
O + V	96.7a	9.07a	54.9a
O + A + E(3)	80.0b	7.53c	44.7d
O + V + E(3)	100.0a	8.30b	53.6ab
O + A + E(5)	93.3a	8.03b	49.9c
O + V + E(5)	90.0a	9.40a	54.5a
O + A + E(7)	86.7ab	8.53ab	50.7c
O + V + E(7)	100.0a	8.93a	52.9b
O + AC	90.0a	8.00b	48.5c

A = Arsenal; O = Oust XP; V = Velpar; E = Esplanade.

^aValues in a column followed by the same letter do not differ at alpha = 0.05.

Height

There was notable variation in total tree height among the blocks. As might be expected, the lower elevation area had taller trees which is attributed to soil moisture availability during the growing season. After three growing seasons, 9 of 10 treatments had the highest averages in the lowest elevation block. While the difference in elevation was not great, it seemingly was sufficient to result in a growth difference. While HWC did not result in a statistical difference when herbicide treatments were compared to untreated plots for survival, it did result in a significant difference in average total height after 3 years (table 4). The same treatments that produced the most bare ground during the first growing season (Oust XP® + Velpar L® and Oust XP® + Velpar L® + Esplanade SC® -5 ounces per acre) also resulted in the greatest average heights. Generally, increasing the rate of Esplanade SC® from 3 to 5 ounces per acre resulted in increased height, but additional increases to 7 ounces per acre did not always produce greater heights.

Groundline Diameter

While average GLD was greater in the lowest elevation block in 8 of the 10 treatments, GLD was more consistent among blocks than heights. Again, herbicide treatments all resulted in significantly greater growth as compared to the untreated plots (table 4). The same treatments that resulted in the greatest average heights (treatments 3 and 7) also resulted in the greatest average GLD. It is consistent that these two treatments which provided the best HWC results also had the greatest average height and GLD.

SUMMARY

Survival in this study was excellent. The results of this study reflect that the study site is very well suited for the growth of loblolly pine. Grass control from the treatments was very good except for *Andropogon* later in the growing season and none of the treatments were expected to control that genus. Forb control was also very good except for fireweed or American burnweed (*Erechtites*). The addition of indaziflam generally provided additional competition control. Rate response from the addition of indaziflam was not strong, but 5 ounces per acre appears to provide the best results of the rates tested. The addition of indaziflam to Oust XP® + Velpar L® consistently provided better results than the same additions to Oust XP® + Arsenal®. After three growing seasons, the best growth in this study resulted from two treatments—Oust XP® + Velpar L® (Treatment 3) and Oust XP® + Velpar® + Esplanade SC®-5 ounces (Treatment 7).