SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

OUST EXTRA COMBINATIONS FOR HERBACEOUS WEED CONTROL AND LOBLOLLY PINE SEEDLING PERFORMANCE. J.L. Yeiser, Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University, Nacogdoches, TX 75962 and A.W. Ezell, Department of Forestry, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Oust Extra is a new, pre-mix blend of Oust XP and Escort XP for use on forestry sites. The objective of this study was to compare weed control, crop tolerance, and pine growth resulting from treatments of Oust XP+Escort XP (Oust Extra) alone, in combination with common tank partners, with Arsenal AC alone, and with untreated checks. In Texas, when compared to Arsenal AC alone, the addition of 2.25+.75 oz of Oust XP+Escort XP (3 oz Oust Extra) enhanced age two ground line diameter while the 3+1 oz rate of Oust XP+Escort XP (4 oz Oust Extra) enhanced both total height and ground line diameter. In both Texas and Mississippi, three-way Arsenal AC+Oust XP+Escort XP mixtures provided numerically more and Arsenal AC alone treatments numerically less weed control and seedling growth than other treatments. In Texas, Oust XP+Escort XP performed better than Velpar DF+Oust XP; in Mississippi the reverse was true. Differences in rank at the two sites may be attributed to common ragweed, wooly croton, horseweed, and Rubus control. Arsenal AC did not control Rubus and common ragweed. Velpar DF+Oust XP did not control wooly croton and Rubus. Escort XP controlled horseweed and Rubus. Oust Extra mixed easily and stayed in suspension. No herbicide damage was observed on pines.

INTRODUCTION

The impact of herbaceous competition on loblolly pine (Pinus taeda L.) seedlings performance is well documented. As a result, herbaceous weed control is a standard part of loblolly pine plantation establishment and justifies the continued refinement of product rates and combinations. The objective of this study was to compare Oust XP+Escort XP alone (Oust Extra) and in combination with common tank partners, Arsenal AC alone, and industry checks (Oustar) for weed control, and newly planted loblolly pine seedling tolerance and performance. The Oust XP+Escort XP mixtures tested here are now commercially available as a pre-mixed blend called Oust Extra.

METHODS

Two sites were tested--one near Sturgis, MS and one near Nacogdoches, TX. Table 1 summarizes site conditions, major competitors, herbicide applications, and plot layout. At both sites, plots were visually evaluated for efficacy at 30-120 days after treatment (DAT). In Mississippi, an additional evaluation was conducted 150 DAT and in Texas 180 DAT. Seedlings were assessed for survival (%) and measured for total height (H-ft) and ground line diameter (D-in) after one and two growing seasons.

Treatments were assigned to a randomized complete block design with 12 treatments per block. Each test site had four blocks. Analyses of variance were conducted on weed control and seedling parameters after one and two growing seasons. In Texas, a factorial analysis of Arsenal AC (4, 6oz) without and with Oust XP+Escort XP (3+1; 2.25+.75oz) was also conducted. Duncan's New Multiple Range test (DNMRT α=0.05) was used to separate treatment means. Because of space limits, only selected analyses are presented.

RESULTS

Weed Control

Weed control in Texas was excellent (Table 2). All herbicide treatments provided more weed free space 30 and 60 DAT than checks. Statistical differences between treatments were difficult to interpret. Numerically, 30 DAT, Velpar DF+Oust XP and Arsenal AC+Oust XP+Escort XP (6+3+1oz) treatments provided 74-81% bare ground. This was followed by Arsenal AC+Oust XP+Escort XP (6+2.25+.75, 4+3+1oz) and Arsenal AC (6oz) at 60-69%, Oust XP+Escort XP and Arsenal AC+Oust XP+Escort XP (4+2.25+.75oz) with 54-56%, then Arsenal AC (4oz) with 46% and last checks with 26% bare ground. When weed control at 30 DAT was compared to 60 DAT, differences were observed. Changes in treatment rank resulted from differences in forb (common ragweed, wooly

croton) and Rubus control. For example, Arsenal AC+Oust XP+Escort XP provided best forb and Rubus control. Velpar DF+Oust XP mixtures provided early forb control but failed to provide wooly croton and Rubus control. Oust XP+Escort XP mixtures provided excellent Rubus and moderate forb control. Arsenal AC treatments controlled neither common ragweed nor Rubus. Patterns in weed control first observed 60 DAT were still present 180 DAT.

The factorial analysis of Arsenal AC alone and mixed with Oust XP+Escort XP revealed no statistical differences in bare ground, and grass, forb, and Rubus cover for rate of Arsenal AC (4, 6oz) at 30-180 DAT (data not presented). The addition of Oust XP+Escort XP to the Arsenal AC tank did not enhance grass control over that of Arsenal AC alone (data not presented). Forb cover 30 and 60 DAT was less with Arsenal AC+Oust XP+Escort XP mixtures than for Arsenal AC alone (data not presented). After 60 DAT, forb cover on Arsenal AC plots > Arsenal AC+Oust XP+Escort XP (2.25+.75oz) > Arsenal AC+ Oust XP+Escort XP (3+1oz). Rubus cover 30 DAT for Arsenal AC alone=Arsenal AC+Oust XP+Escort XP (2.25+.75oz) > Arsenal AC+Oust XP+Escort XP (3+1oz) (data not presented). Thereafter, Rubus cover on Arsenal AC plots was greater than when either rate of Oust XP+Escort XP was mixed with Arsenal AC.

In Mississippi, weed control was excellent and statistical differences were detected (Table 3). For bare ground 30 DAT, tank mixtures provided 93% > Arsenal AC 80% > checks 18%. At 60 DAT, bare ground for tank mixtures was 95% > Arsenal AC 49% > checks 5%. By 90 DAT, bare ground for Arsenal AC+ Oust XP+Escort XP mixtures was 97%, Oust XP+Escort XP mixtures 88%, and Velpar DF+Oust XP (21.33+2oz) > Velpar DF+Oust XP mixtures (56%) > Arsenal AC (18%) > checks (1%). At 150 DAT, Arsenal AC+ Oust XP+Escort XP mixtures provided 67% bare ground > Oust XP+Escort XP mixtures 47% > Velpar DF+Oust XP mixtures 26% > Arsenal AC 4% > checks 0%. Arsenal AC did not control common ragweed. Escort XP containing mixtures were very efficacious on horseweed. Grasses were readily controlled by all herbicide treatments.

Seedling Performance

Texas seedling survival was excellent (Table 4). After two growing seasons, all treatments exhibited more than 92% survival. Minor differences in survival were detected and considered not treatment related. Generally, age one total H and D were numerically largest for mixtures of Arsenal AC+Oust XP+Escort XP (4+3+1, 6+2.25+.75, 6+3+1oz) and Velpar DF+Oust XP (Oustar 13; 10.67+1, 21.33+2oz). Nine of twelve treatments produced tallest age two seedlings. The same nine treatments producing the tallest also produced the largest seedlings in D. More treatments produced seedling of comparable size at age two than age one. Increased similarity in age-two growth may be weather related as 9 of 10 months of recorded rainfall in 2004 were above the 30-year mean.

From the factorial analysis of Texas data, rate of Arsenal AC did not influence age one seedling performance (S1, S2, H1, D1) (data not presented). For age two, mixing Arsenal AC with Oust XP+Escort XP enhanced seedling growth. For example, for D Arsenal alone < Oust XP+Escort XP 2.25+.75oz < Oust XP+Escort XP 3+1oz; for total H Arsenal AC alone < Oust XP+Escort XP (3+1; 2.25+.75oz) and Oust XP+Escort XP 2.25+.75oz= Oust XP+Escort XP 3+1oz (data not presented).

In Mississippi, minor treatment differences in S1 and S2 were detected and considered not related to treatments (Table 4). Much of the seedling mortality was thought to be due to excessive soil moisture. Statistically, many age-one treatments produced seedlings similar in total H. Largest D occurred on 3-of-4 Arsenal AC+Oust XP+Escort XP mixtures. Numerically, Arsenal AC+Oust XP+Escort XP mixtures produced tallest and largest seedlings at ages one and two. At age two, check seedlings were statistically the shortest and smallest and Arsenal AC+Oust XP+Escort XP seedlings were tallest and largest.

In summary, in Texas the most numerical weed control and numerical seedling growth was achieved with Arsenal AC+Oust XP+Escort XP mixtures, followed by Velpar DF+Oust treatments followed by Oust XP+Escort XP, Arsenal AC, and last, checks. In Mississippi, the most numerical weed control and numerical seedling growth resulted from Arsenal AC+Oust XP+Escort XP, followed by Oust XP+Escort XP, followed by Velpar DF+Oust treatments and last checks. Differences in rank (Oust XP+Escort XP better than Velpar DF+Oust XP in Mississippi; in Texas the reverse) may be attributed to product control of common ragweed, wooly croton, horseweed, and Rubus at respective sites.

Table 1. Description of study sites, major competitors, application dates and equipment, and plot layout.

Location	Sturgis, MS	Nacogdoches, TX
Physiography	Hilly Upper Coastal Plain	Hilly Upper Coastal Plain

Soil	Ruston Fine Sandy Loam pH 5.3	Sandy Clay Loam (1st 6") pH 5.0
Harvest	Natural pine hardwood; Clearcut 2001	Pine plantation; Clearcut Dec-2000
Site Prep #1	April 2002 ULW rate 4.67lb	May 2002; Single Chop
Site Prep #2	September 2002 burned	June 2002; Arsenal+Accord+ Rebound 16+64+32oz @ 10 GPA
Planted	January 2003; Hand; Bare root	December 2002; Machine; Bare root
Bare Ground	<50%	60%
Forbs+Grasses	35% Common ragweed, horseweed, late boneset; panicgrasses, broomsedge	15%+8% Common ragweed, wooly croton, late boneset; panicgrasses
Major trees	15% sweetgum and oaks	<1% sweetgum and oaks
Shrubs	American beautyberry	0%
Brambles	<1% Rubus	15% Rubus
Application day	April, 13, 2003	April 8, 2003
Equipment	CO_2 backpack; a single KLC 9 nozzle; 10 GPA	CO_2 backpack; T-boom with 4, 8002 nozzles; 10 GPA
Treatment Plot	30-ft x 100-ft	5-ft x 130-ft; 16 seedlings per row
Measurement Plot	Middle 10-ft of the plot; >10 seedlings	Middle 12 seedlings

Table 2. Bare ground (%) and vegetation cover (%) for early post-emergence treatments applied near Nacogdoches, TX on April 8, 2003 for herbaceous release of newly planted loblolly pine seedlings.

	Rate[1]	Days After Treatment							
Herbicide	oz/ac	30	60	90	180	30	60	90	180
		Bare ground[2]				Grass cover[2]			
Check	none	26f	24g	4d	2e	28a	28a	31a	39a
Oustar	13	83a	74bcdef	28c	24bcd	3c	4b	5cd	8d
V+O	21.33+2	76ab	76bcde	31bc	23bcd	7bc	6b	10cd	14cd
V+O	10.67+1	74abc	61f	26c	18bcde	5bc	7b	16bc	20bcd
Ar	6	60cde	66ef	18cd	10de	8bc	5b	7cd	10cd
Ar	4	46e	70cdef	18cd	13cde	6bc	3b	4cd	9d
O+E	3+1	54de	74bcdef	23c	19bcde	15b	10b	23ab	30ab
O+E	2.25+.75	56de	69def	21c	19bcde	10bc	7b	15bc	24bc
Ar+O+E	6+3+1	81a	94a	66a	44a	7bc	2b	2d	6d
Ar+O+E	6+2.25+.75	69bcd	83ab	45b	32abc	9bc	4b	6cd	13cd
Ar+O+E	4+3+1	65bcd	86abc	45b	36ab	10bc	6b	8cd	16cd
Ar+O+E	4+2.25+.75	56de	80bcd	28c	19bcde	6bc	3b	8cd	16cd
		Forb cover[2]				Rubus cover[2]			
Check	none	36a	40a	58a	51ab	11abc	11b	13a	15abc
Oustar	13	7bc	13bc	54a	48ab	9c	11bc	13a	23a
V+O	21.33+2	8bc	10bc	39ab	35b	8c	8bcd	16a	24a
V+O	10.67+1	14bc	20b	44ab	44ab	9c	10bcd	13a	18ab
Ar	6	14bc	19b	59a	60a	11bc	11b	14a	20a
Ar	4	19b	18bc	59a	51ab	21a	21a	19a	25a
O+E	3+1	16bc	16bc	51a	45ab	12abc	1e	3b	6c
O+E	2.25+.75	15bc	20b	61a	50ab	12abc	3de	3b	5c
Ar+O+E	6+3+1	7bc	4c	26b	34b	7c	1e	2b	5c
Ar+O+E	6+2.25+.75	7bc	5c	39ab	41ab	12abc	3cde	4b	7bc
Ar+O+E	4+3+1	7bc	10bc	43ab	39b	12abc	3de	3b	6bc
Ar+O+E	4+2.25+.75	12bc	9bc	54a	50ab	20ab	4bcde	4b	8bc

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=Velpar DF.

[2] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test, α=0.05).

Table 3. Bare ground (%) and vegetation cover (%) for early post-emergence treatments applied near Sturgis, MS on April 13, 2003 over the top of newly planted loblolly pine seedlings.

Herbicide[1]	Rate[1] oz/ac	Days After Treatment							
		30	60	90	150	30	60	90	150
		Bare ground				Grass			
Check	none	18c	5c	1d	0e	21b	15b	12ab	13ab
Oustar	13	91a	93a	58b	23d	4a	1a	1a	9a
V+O	21.33+2	92a	96a	83a	30d	5a	2a	2ab	10ab
V+O	10.67+1	90a	90a	54b	26d	5a	2a	2ab	9ab
A	6	84b	49b	19c	2e	5a	1a	1b	9b
A	4	76b	49b	17c	6e	3a	2a	2b	7b
O+E	3+1	94a	95a	87a	44c	3a	2a	2ab	19b
O+E	2.25+.75	94a	96a	89a	49c	4a	1a	1ab	20a
A+O+E	6+3+1	90a	97a	93a	82a	6a	1a	1ab	9a
A+O+E	6+2.25+.75	94a	96a	92a	51bc	4a	1a	1ab	8a
A+O+E	4+3+1	92a	97a	93a	67b	3a	1a	1a	15a
A+O+E	4+2.25+.75	94a	97a	92a	69b	3a	1a	1a	11a
		Forbs							
Check	none	53c	85c	90c	94d				
Oustar	13	7a	6a	36b	69c				
V+O	21.33+2	5a	2a	14a	60c				
V+O	10.67+1	6a	8a	41b	65c				
A	6	13b	50b	78c	90d				
A	4	21b	49b	80c	88d				
O+E	3+1	4a	4a	8a	38b				
O+E	2.25+.75	3a	3a	3a	31b				
A+O+E	6+3+1	4a	2a	5a	10a				
A+O+E	6+2.25+.75	4a	4a	6a	35b				
A+O+E	4+3+1	4a	2a	2a	18ab				
A+O+E	4+2.25+.75	4a	3a	5a	20ab				

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=Velpar DF.
[2] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test, α=0.05).

Table 4. Seedling performance after one and two growing seasons for survival (S1 %; S2 %), total height (H1 ft; H2 ft) and ground line diameter (D1 in; D2 in).

Herbicide	Rate	S1	S2	H1	H2	D1	D2
Texas							
Ar[1]+O+E	4+3+1	100a	100a	1.84ab	5.32ab	.41ab	1.36a
Ar+O+E	6+2.25+.75	98ab	98a	1.75abc	4.86abc	.40abc	1.24abc
Ar+O+E	6+3+1	100a	100a	1.75abc	5.03abc	.42a	1.31ab
Ar+O+E	4+2.25+.75	96ab	94a	1.60cde	4.70abcd	.35ef	1.09abcd
Oustar	13	98ab	98a	1.93a	5.32a	.41abc	1.36a
V+O	10.67+1	98ab	96a	1.77abc	5.08abc	.37bcd	1.19abc
V+O	21.33+2	96ab	96a	1.72bc	4.95abc	.38abcd	1.24abc
O+E	3+1	92b	92a	1.44e	4.30bcd	.33ef	1.01bcd
O+E	2.25+.75	100a	94a	1.63cde	4.57abcd	.36cde	1.14abc
Ar	6	96ab	96a	1.66bcd	4.48abcd	.35de	1.06abcd
Ar	4	100a	100a	1.47de	4.07cd	.29f	0.96cd
Check	none	100a	100a	1.43e	3.72d	.29f	0.80d

Table 4. Seedling performance after one and two growing seasons for survival (S1 %; S2 %), total height (H1 ft; H2 ft) and ground line diameter (D1 in; D2 in).—continued.

Herbicide	Rate	S1	S2	H1	H2	D1	D2

Mississippi							
Ar[1]+O+E	4+3+1	78b	78b	1.84a	5.30a	.53a	1.34a
Ar+O+E	6+2.25+.75	83b	83b	1.73ab	4.90ab	.37c	1.22a
Ar+O+E	6+3+1	95a	93a	1.75ab	5.05a	.51a	1.32a
Ar+O+E	4+2.25+.75	83b	83b	1.73ab	5.13a	.52a	1.24a
Oustar	13	95a	90a	1.84a	4.76b	.43b	1.12b
V+O	10.67+1	83b	83b	1.70ab	4.78b	.38c	1.06b
V+O	21.33+2	80b	80b	1.52b	4.33c	.36c	1.03b
O+E	3+1	93a	93a	1.60b	4.57bc	.42b	1.11b
O+E	2.25+.75	85b	85ab	1.69ab	4.78b	.43b	1.09b
Ar	6	80b	80b	1.61b	4.21c	.36c	.91b
Ar	4	75b	75b	1.63b	4.51bc	.41b	.99b
Check	none	83b	80b	1.55b	3.97c	.32d	.75c

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=Velpar DF. All rates are in ounces of product per acre.
[2] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test, α=0.05).