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Weed Control and Seedling Performance Using OUST, Velpar, and Velpar+OUST Impregnated Diammonium Phosphate

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WEED CONTROL AND SEEDLING PERFORMANCE USING OUST, VELPAR, AND VELPAR+OUST IMPREGNATED DIAMMONIUM PHOSPHATE

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Abstract—Technology that combines herbicide and fertilizer into one treatment thereby reducing application costs while enhancing growth is needed. Four clean and well-prepared sites in TX, MS, and AL were tested. Study objectives were to evaluate the effectiveness of diammonium phosphate (DAP) impregnated with Oust, Velpar, or Velpar+Oust for herbaceous weed control and newly planted loblolly pine (*Pinus taeda* L.) seedling growth. In 1999, treatments were applied early post weed-emergence to 60percent bare ground in East TX. Impregnated DAP provided about 38percent less competitor control than separate liquid and fertilizer applications at similar rates. Best seedling survival and growth resulted from liquid sprays of Oust and Velpar+Oust. Treatments in 2000 were applied to bare ground in TX, MS, and AL. Weed control for Oust-impregnated DAP, Velpar+Oust-impregnated DAP, Velpar impregnated on 250 pounds of DAP and liquid herbicide treatments was similar 120 days after treatment. Seedling survival and growth for impregnated DAP treatments was similar to that for conventional herbicide and DAP treatments. Growth trends are preliminary and will be followed. Drought probably influenced study results.

INTRODUCTION

Numerous studies spanning a variety of sites and conditions have demonstrated the effectiveness of vegetation management and fertilization at increasing loblolly pine growth. Consequently, the intensive culture of loblolly pine relies heavily on technologies of weed control and supplemental nutrition.

Currently, managers treat newly planted loblolly pine seedlings for herbaceous weed control and nutrient deficiencies in two separate applications and incur two application costs. Technology that combines multiple treatments, thereby reducing the number of passes and application costs per acre, is needed. The development of a weed-and-feed technology potentially combines two technologies, herbaceous weed control and fertilization, in a single application. The weed-and-feed approach has been tested in young pine stands less than three years old and other stands between ten and twenty-five years old (Shiver et al. 1999). Results suggest growth from the fertilizer impregnated with hexazinone (Velpar) was higher than either treatment separately as well as the untreated check. The usefulness of Oust, Velpar, and Velpar+Oust impregnated DAP applied over the top of newly planted seedlings needs to be tested. The purpose of this report is to present the weed control of liquid herbicide and herbicide impregnated DAP treatments and the resultant seedling growth. The objective of the 1999 test was to compare weed control and seedling performance among a post-emergence application of (1) conventional liquid herbicides, (2) the same conventional herbicides impregnated on 125 pounds of DAP, (3) 125 pounds of DAP only, and (4) neither herbicide nor DAP (Check). Specific rates of test treatments are presented in table 2. The objective of the 2000 study was to assess weed control and seedling performance among a pre-emergence application of (1) conventional liquid herbicides, (2) the same conventional herbicides impregnated on 125 or 250 pounds of DAP, (3) 125 pounds of DAP only, and (4) neither herbicide nor DAP (Check). Specific rates for test treatments are presented in tables 4 and 5.

METHODS

One location in 1999 and three locations in 2000 were tested. All four tests were clean of harvesting slash and free of established rootstocks. A summary of the sites is presented in table 1.

In TX, 1999 treatment plots were approximately 56 feet X 80 feet and consisted of seven trees in each of eight rows or 56 seedlings. In 2000, treatment plots were 64 feet X 80 feet with eight trees in each of eight rows or 64 seedlings. In MS and AL treatment plots were approximately 80 feet X 96 feet and spanned eight rows each with at least 10 seedlings. Treatment plots were surrounded by a 10 feet, untreated buffer strip.

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Table 1—A summary of test sites

Location	Beulah, TX	Diboll, TX	Picayune, MS	Whitfield, AL
Established	1999	2000	2000	2000
Physiography	UCP[a]	UCP[a]	LCP[a] flatwoods	LCP[a] interior flatwoods
Soil	silt loam	sandy loam	sandy clay loam	silty clay loam
Harvested	Dec-97	Sep-98	Dec-98	Aug-98
Site Prep1	9/98 Ars+Gar 4[b] 14oz+2qt	9/99 Ars+Gar 4[b] 16oz+2qt	10/99 shear & rake	12/98 burn
Site Prep2	10/98 burn	10/99 mulch	11/99 double bed	7/99 Chop+Esc+Acc[b] 40oz+1oz+1qt
Site Prep3	10/98 subsoil	10/99 subsoil	12/99 burn windrows	12/99 subsoil
Planted	Feb-99	Feb-00	Jan-00	Jan-00
Treated	22-Mar-99	9-Mar-00	16-Mar-00	3-Apr-00
Percent Cover	40	1	1	1
Treatments	Broadcast	Broadcast	Broadcast	Broadcast
Weed Emergence	Post	Pre	Pre	Pre

[a] UCP = upper coastal plain; LCP = lower coastal plain.
[b] Ars = Arsenal Ac; Gar 4 = Garlon 4; Chop = Chopper; Esc = Escort; Acc = Accord SP.

Measurement plots were internal to treatment plots. One row of buffer seedlings surrounded each measurement plot leaving 30 seedlings in 1999 and 36 seedlings in 2000 in each TX measurement plot. In MS and AL each measurement plot contained at least 50 measurement seedlings.

In 1999, all DAP treatments in TX were broadcast evenly by hand. In 2000, all DAP treatments in TX were applied with a cyclone seed sower. Plots were deliberately under-treated with the residual 15 percent applied by hand for a more even distribution.

Liquid treatments were applied with a “T” wand equipped with 4, 1101.5 TeeJet nozzles. Total application volume was 10 GPA.

Treatments were visually evaluated for percent control at 30, 60, 90 and 120 days after treatment (DAT). Control was expressed in 10 percent intervals with 0 = no control and 100 = total control. In 1999, individual species occupying at least 7 percent ground cover in all plots were evaluated separately. In 2000, diverse communities dominated plots. All herbaceous plants as a group were assessed for overall control.

For all sites, seedlings were assessed for survival (percent) and measured for height (cm) and ground line diameter (mm) prior to treatment and after one and two growing seasons. For analysis, height and ground line diameter data were converted to inches. Seedling volume was computed as volume index = $ht*gld^2$ and expressed in cubic inches.

The experimental design for all locations was a randomized complete block. The 1999 planting contained four blocks. All 2000 plantings had three blocks. An analysis of variance was conducted on survival, total height and volume index after one or two growing seasons. Duncan’s New Multiple Range test P = 0.05) was used to separate treatment means.

Drought was severe during 1999 and 2000. All four tests were subject to uncommonly high temperatures and an extreme lack of moisture from July through October of 1999 and 2000.

RESULTS

1999 Post-Emergence Treatments

Liquid sprays and impregnated DAP provided similar control of purple cudweed (*Gamochaeta purpurea* (L.)Cabrera), a winter broadleaf, through 30 DAT (table 2). Small changes in control were observed 60 DAT. By 120 DAT, only 4 ounces of Oust impregnated on DAP provided similar control as liquid sprays. Impregnated DAP treatment provided an average of 14 percent less control of purple cudweed than liquid treatments 120 DAT. Liquid and

impregnated treatments provided similar swamp sunflower (*Helianthus angustifolius* L.*)* control for 60 DAT; minor differences were detected 90 DAT. At 120 DAT, liquid spray exhibited more control than herbicide impregnated DAP treatments by an average of 24 percent. Differences in control of panicgrass (*Dichanthelium scoparium* (LAM.)Gould), *laxiflorum* (Lam.)Gould), and *acuminatum* (Sw.)Gould & C.A. Clark*)* and all species were detected 30 DAT and differences among treatment control continued to diverge with time. By 120 DAT, liquid sprays of Velpar+Oust and 4 ounces of Oust provided 43 percent better panicgrass control than 2 ounces of Oust and herbicides impregnated on DAP. Averaged across all species, herbicide-impregnated DAP provided 38 percent less control than liquid herbicides. Perhaps weed control could be improved with two modifications. First, a pre-emergence application activates herbicide in the soil for control of germinating weed seeds. Second, impregnating 250 rather than 125 pounds of DAP doubles the number of soil contact points for better coverage.

Major differences were detected in year-one seedling survival and growth (table 3). Best survival was achieved with liquid sprays of Velpar+Oust or Oust (4 ounces). Treatments of Oust alone (2 ounces) or herbicide impregnated DAP provided intermediate survival. Minor differences in total height were detected but all spray and impregnated DAP treatments provided similar seedling volume. Lowest survival and volume were recorded for the untreated check and DAP only plots. Fertilization without weed control resulted in lower survival than doing nothing (untreated check).

After two growing seasons, mean liquid and mean impregnated treatments exhibited 71 percent and 64 percent survival, respectively. Also, survival across all treatments had decreased an average of 7 percent below year one levels. Furthermore, seedling heights were commonly below 5 feet, illustrating the impact of two consecutive drought years. Volume index was greatest for liquid and impregnated treatments containing 2 ounces of Oust, both with and without Velpar. A fertilizer response was not detected although plots treated with DAP supported 66 cubic inches and unfertilized plots 56 cubic inches of volume - a difference of 10 cubic inches. This growth difference is expected to increase over time. Weed control provided 2.5 times more volume and fertilizer+weed control produced 2.9 times more volume than checks.

2000 Pre-Emergence Treatments

At all three sites, competitor control was similar for several liquid and impregnated treatments (table 4). Control was best 30 DAT and declined disproportionately by 120 DAT. For example, in TX, MS and AL, mean herbicidal control 30 DAT and 120 DAT was 97 and 95, 97 and 83, and 86 and 70 percent, respectively. Values reflect different weed pressure that may be related to soil moisture. Of the three sites, the TX site was the best drained (table 1), had the slowest weed re-invasion, and therefore the best long-term control. In contrast, the AL site had the poorest drainage, fastest weed re-invasion, and therefore the worst long-term control.

Seedling survival and growth for several herbicide-impregnated-DAP treatments was similar to conventional liquid and two-pass herbicide-fertilizer treatments at all three sites (table 5). Growth trends are very preliminary and will be followed over time.

All Four Sites

When considering all four sites, (1) 2 ounces of Oust followed with DAP (conventional two-pass treatments), (2) two ounces of Oust impregnated on 125 pounds of DAP, (3) two ounces of Oust impregnated on 250 pounds of DAP or 4 ounces of Oust impregnated on 125 pounds of DAP provided 89, 79, 83 and 83 percent control of weeds 120 DAT, respectively. Increasing the DAP rate from 125 to 250 pounds doubled the number of soil contact points and increased control 4 percent. Holding the DAP rate constant and increasing the Oust rate from 2 to 4 ounces increased control 4 percent. However, neither increasing the rate of DAP nor the rate of Oust significantly increase control. When comparing the Velpar+Oust mixture, the traditional liquid spray provided 91 percent and impregnated DAP 88 percent weed control 120 DAT. Velpar alone on 125 pounds of DAP provided 79 percent weed control, a level significantly less and 12 percent below the conventional liquid Velpar+Oust treatment. Increasing the number of contact points by impregnating 250 pounds of DAP increased weed control by 1 percent. The difference among the traditional liquid spray and Velpar impregnated on 250 pounds of DAP was 11 percent and not significant. Post-emergence liquid sprays of Velpar+Oust provided 85 percent weed control in contrast to 45 percent weed control for Velpar+Oust impregnated DAP. When the same treatments were applied pre-emergence, the conventional Velpar+Oust spray provided 90 and the impregnated DAP 89 percent control, a loss of 1 percent. Clean, well prepared sites promote product-soil contact and seed-originating competitors. For best results, managers contemplating this technology should commit to clean, well-prepared sites and early applications of impregnated DAP as a joint package.

CONCLUSIONS

On clean, well-prepared sites in TX, MS, and Al, pre-emergence applications of Oust, Velpar+Oust impregnated DAP, and Velpar impregnated on 250 pounds of DAP provided comparable herbaceous weed control 120 DAT as conventional liquid treatments of Oust or Velpar+Oust. Growth trends are very preliminary, with first- and second-year seedling survival and growth similar for liquid and herbicide-impregnated-DAP treatments and better than for checks. Managers interested in weeding-and-feeding seedlings at planting should consider levels of post-harvest biomass, intensive site preparation, and pre-emergence, herbicide-impregnated DAP treatments all part of an integrated package. Drought probably influenced study results.

Table 2—Control (percent) of unwanted herbaceous competitors with a March 22, 1999, early post-emergence application over the top of newly planted loblolly pine seedlings in East TX (Angelina County)

Treatments	Rate and formulation[a]		Days after treatment[b] 30	60	90	120
purple cudweed (*Gamochaeta purpurea* (L.)Cabrera)						
Velpar+Oust	1qt+2oz	S	100a	100a	100a	100a
V+O+DAP	1qt+2oz+125 lb	G	100a	95a	83ab	75b
Oust	4oz	S	100a	98a	98a	98a
Oust+DAP	4oz+125 lb	G	98a	97a	95a	95a
Oust	2oz	S	100a	97a	92ab	87ab
Oust+DAP	2oz+125 lb	G	90a	85b	75b	72b
DAP	125 lb	G	0c	0c	0c	0c
swamp sunflower (*Helianthus angustifolius* L.)						
Velpar+Oust	1qt+2oz	S	100a	100a	99a	99a
V+O+DAP	1qt+2oz+125 lb	G	93a	85a	83ab	63b
Oust	4oz	S	100a	100a	100a	99a
Oust+DAP	4oz+125 lb	G	99a	97a	85ab	85b
Oust	2oz	S	99a	98a	91a	91a
Oust+DAP	2oz+125 lb	G	83a	81a	70b	70b
DAP	125 lb	G	0b	0b	0c	0c
panicgrasses (*Dichanthelium* scoparium, *laxiflorum, acuminatum)*						
Velpar+Oust	1qt+2oz	S	100a	95a	95a	88a
V+O+DAP	1qt+2oz+125 lb	G	92b	85b	81b	38b
Oust	4oz	S	99a	96a	96a	92a
Oust+DAP	4oz+125 lb	G	92b	83bc	80bc	43b
Oust	2oz	S	98a	90a	83ab	60b
Oust+DAP	2oz+125 lb	G	85c	75c	73c	38b
DAP	125 lb	G	0d	0d	0d	0c
all species						
Velpar+Oust	1qt+2oz	S	95a	93a	89a	86a
V+O+DAP	1qt+2oz+125 lb	G	71bc	68b	46cd	45cd
Oust	4oz	S	86ab	80a	78ab	76b
Oust+DAP	4oz+125 lb	G	64c	60bc	38cd	36de
Oust	2oz	S	76bc	81a	60bc	55bc
Oust+DAP	2oz+125 lb	G	61c	50c	25d	21e
DAP	125 lb	G	0d	0d	0e	0f

[a] A single application of DAP. S = Liquid spray. G = Granule.

[b] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range test, P = 0.05 level).

Table 3—Treatments were applied near Beulah (Angelina County), TX on March 22, 1999 and loblolly pine seedling survival (S1, S2, pct), total height (H1, H2, inches) and total volume (V1, V2, in^3) determined after one and two growing seasons

Treatments[a]	Rate and formulation[b]		S1	H1	V1	S2	H2	V2
Velpar+Oust	1qt+2oz	S	87a	19.8ab	3.9a	79a	55.0ab	70.6a
V+O on DAP	1qt+2oz on 125 lb	G	73b	20.6a	3.8a	69abc	57.0a	76.0a
Oust	2oz	S	74b	18.0bc	3.7a	65bc	52.5ab	60.0ab
Oust on DAP	2oz on 125 lb	G	72b	21.5a	4.4a	65bc	55.9a	68.1ab
Oust	4oz	S	78ab	16.4c	3.1a	69ab	46.3d	40.1cd
Oust on DAP	4oz on 125 lb	G	68b	18.4bc	3.2a	58c	51.2bc	54.3bc
DAP	125 lb	G	28d	17.2c	1.6b	24e	47.2cd	25.8de
Check	None	-	40c	19.6ab	1.5b	38d	43.1d	22.6e

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

[b] A single application of DAP. S = Liquid spray. G = Granule.

Table 4—Control (pct) of herbaceous weeds 30-120 days after pre-emergence (99 percent bare ground) treatment (DAT)

Treatment[a]	Rate and formulation[b]		30&60 DAT	90 DAT	120 DAT
Diboll, TX — Treated 9-Mar-00					
Oust	2oz	S	99a	98a	98a
Oust Then DAP	2oz & 125 lb	S;G	98a	98a	98a
Oust on DAP	2oz on 125 lb	G	89c	89a	91ab
Oust on DAP	2oz on 250 lb	G	99a	98a	98a
Oust on DAP	4oz on 125 lb	G	99a	98a	98a
Velpar+Oust	1qt+2oz	S	99a	98a	98a
V+O on DAP	1qt+2oz on 125 lb	G	98ab	98a	98a
Velpar on DAP	1qt on 125 lb	G	92bc	83ab	83b
Check	none		40d	40c	37c
DAP	125 lb	G	50d	45c	40d
Picayune, MS — Treated 16-Mar-00					
Velpar+Oust	1qt+2oz	S	99a	99a	97a
V+O on DAP	1qt+2oz+125 lb	G	99a	99a	85ab
Velpar on DAP	1qt+125 lb	G	96a	96a	67b
Velpar on DAP	1qt+250 lb	G	97a	68a	90ab
Oust	2oz	S	98a	59b[c]	38c[c]
Oust Then DAP	2oz & 125 lb	S;G	97a	97a	88ab
Oust Then DAP	2oz & 250 lb	S;G	97a	98a	85ab
Oust on DAP	2oz+125 lb	G	96a	96a	75ab
Oust on DAP	2oz+250 lb	G	97a	98a	85ab
Oust on DAP	4oz+125 lb	G	98a	98a	75ab
Check	None		45c	45b	5d
DAP	125 lb	G	57b	50b	7d
Whitfield,AL — Treated 3-April-00					
Velpar+Oust	1qt+2oz	S	93a	83a	75ab
V+O on DAP	1qt+2oz+125 lb	G	93a	81ab	77a
Velpar on DAP	1qt+125 lb	G	79c	74ab	70abc
Velpar on DAP	1qt+250 lb	G	81bc	74ab	70abc
Oust	2oz	S	90ab	83a	66bc
Oust Then DAP	2oz & 125 lb	S;G	90ab	83a	75ab
Oust Then DAP	2oz & 250 lb	S;G	76c	72b	66bc
Oust on DAP	2oz+125 lb	G	79c	72b	62c
Oust on DAP	2oz+250 lb	G	85abc	74ab	65bc
Oust on DAP	4oz+125 lb	G	90ab	78ab	73ab
Check	none		42e	39d	37d
DAP	125 lb	G	58d	49c	45d

[a] A single application of DAP. S = Liquid spray. G = Granule.
[b] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range test, P = 0.05 level).
[c] Heavy rainfall within one-hour of application may have influenced this value.

Table 5—Loblolly pine seedling survival (S1, pct) and growth (Height = H1, inches), Volume Index = V1, cubic inches) after one growing season

Treatment[a]	Rate and formulation[b]		S1	H1	V1
Diboll, TX					
Oust	2oz	S	92ab	22.4abc	7.7bc
Oust then DAP	2oz & 125 lb	S;G	94a	24.3a	9.4ab
Oust on DAP	2oz on 125 lb	G	85abc	21.2bc	8.2b
Oust on DAP	4oz on 125 lb	G	88abc	23.7ab	10.9a
Oust on DAP	2oz on 250 lb	G	82bcd	20.7c	7.9bc
Velpar+Oust	1qt+2oz	S	92ab	19.9c	7.4bc
V+O on DAP	1qt+2oz on 125 lb	G	83bc	19.6c	7.3bc
V on DAP	1qt & 125 lb	G	79cd	21.7abc	5.6cd
DAP	125 lb	G	46e	17.0d	2.1e
Check	None		73d	20.2c	3.6de
Whitfield, AL					
Oust	2oz	S	59ab	15.0e	2.8cd
Oust then DAP	2oz & 125 lb	S;G	69a	18.4ab	3.8ab
Oust then DAP	2oz & 250 lb	S;G	67ab	19.4a	4.4a
Oust on DAP	2oz on 125 lb	G	66ab	16.9bcd	2.4cd
Oust on DAP	4oz on 125 lb	G	57b	16.8cd	3.2bc
Oust on DAP	2oz on 250 lb	G	67ab	19.6a	4.4a
Velpar+Oust	1qt+2oz	S	57b	18.8a	4.5a
V+O on DAP	1qt+2oz on 125 lb	G	58ab	17.0bcd	3.2bc
V on DAP	1qt on 125 lb	G	63ab	16.7cd	2.7cd
V on DAP	1qt on 250 lb	G	68ab	18.5ab	3.3bc
DAP	125 lb	G	67ab	18.3abc	3.0bc
Check	None		65ab	16.6d	2.0d
Picayune, MS					
Oust	2oz	S	100a	21.8e	10.2e
Oust then DAP	2oz & 125 lb	S;G	100a	31.1bc	32.9b
Oust then DAP	2oz & 250 lb	S;G	99a	32.2b	39.8a
Oust on DAP	2oz on 125 lb	G	100a	30.2c	33.8b
Oust on DAP	4oz on 125 lb	G	100a	31.8b	28.5c
Oust on DAP	4oz on 250 lb	G	100a	30.3c	29.2c
Velpar+Oust	1qt+2oz	S	100a	31.5c	24.6d
V+O on DAP	1qt+2oz on 125 lb	G	100a	33.5a	33.2b
V on DAP	1qt on 125 lb	G	100a	27.5d	21.6d
V on DAP	1qt on 250 lb	G	100a	32.2b	38.1a
DAP	125 lb	G	100a	21.1ef	8.6e
Check	None		98b	20.2f	5.1f

[a] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range test, P = 0.05 level).
[b] A single application of DAP. S = Liquid spray. G = Granule.

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