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Screening cut-stump control of Chinese tallowtree, sweetgum and yaupon with aminocyclopyrachlor

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SCREENING CUT-STUMP CONTROL OF CHINESE TALLOWTREE, SWEETGUM AND YAUPON WITH AMINOCYCLOPYRACHLOR

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ABSTRACT

Aminocyclopyrachlor (MAT28) was investigated for the potential control of unwanted woody rootstocks of Chinese tallowtree (Triadica sebifera), sweetgum (Liquidambar styraciflua), and yaupon (Ilex vomitoria). A cut-stump application of MAT28+Brush and Basal Oil by Helena was tested against standard treatments: (1) MAT28 2.5%, (2) MAT28 5%, (3) MAT28 10%, (4) MAT28 15%, (5) Garlon 4 Ultra 30%, (6) Garlon 4 Ultra+Stalker 20+1%, (7) MAT28+Stalker 10+1% and (8) untreated check. Herbicides were applied on February 4, 2009. Stems were severed with a chainsaw and herbicide applied immediately and sufficiently to thoroughly wet the surface, edges and top 2 inches of the stump. All rootstocks were free of sprouts 30 and 60 days after treatment (DAT). The total height of Chinese tallowtree checks averaged 8.8-feet initially and 7.5-feet 540 DAT. MAT28 (10%), MAT28+Stalker and Garlon Ultra mixtures all provided 100 percent control 540 DAT. For sweetgum, total height for check rootstocks averaged 11.8-feet initially and 5.9-feet 540 DAT. Least sprouting and best control occurred on rootstocks treated with Garlon Ultra alone. Sprouts averaged 2.4-feet 540 DAT. For yaupon, total height of checks averaged 11.1-feet initially and 4.8-feet 540 DAT. No sprouts (100 percent control) were detected 540 DAT on rootstocks treated with Garlon Ultra, Garlon Ultra+Stalker, or MAT28+Stalker. Cut-stump treatments of MAT28 show potential for reducing unwanted rootstocks of Chinese tallowtree, sweetgum and yaupon.

INTRODUCTION

Chinese tallowtree (*Triadica sebifera*), sweetgum (*Liquidambar styraciflua*), and yaupon (*Ilex vomitoria*) are unwanted competitors on many nonagricultural areas, non-crop producing areas, industrial sites, and natural areas in the South. Traditionally, herbicides containing triclopyr and imazapyr have been used for control of these unwanted woody plants (Tu and others 2001, Wilson and others 2006).

Society demands the introduction of less herbicide (both product and active ingredient) into the environment. Forest managers seek socially responsible and cost effective weed control. Recent advances in herbicide chemistry have yielded products requiring lower use rates while delivering greater human, environmental and wildlife safety as well as weed efficacy (DuPont 2009). Aminocyclopyrachlor, formulated as MAT28, is a new research herbicide that could potentially control Chinese tallowtree, sweetgum, and yaupon with less herbicide than currently required.

Broadcast foliar applications are commonly used during large-scale operations to control dense unwanted plants. Individual stem foliar sprays are more common where unwanted rootstocks are sparse, making an area treatment less practical. Enhanced selectivity and environmental protection are achieved with a herbicidal application directly to cut stumps. In research, results from foliar and cut-stump treatments may be assessed for a better understanding of herbicidal leaf penetration and movement down the stem or lack thereof.

DuPont's new herbicide, MAT28, has highly desirable human, environmental and wildlife safety properties (DuPont 2009) while potentially controlling unwanted woody plants at lower than standard use rates. In this study, a cut-stump treatment of MAT28 alone, tank mixtures of MAT28 plus leading competitor products, and industry checks were tested for the control of Chinese tallowtree, sweetgum and yaupon rootstocks on an unmanaged site supporting a natural stand of mixed pine-hardwood. This site is currently retired from production.

MATERIALS AND METHODS

SITE

The study site is in the hilly upper coastal plain near Timpson (Shelby County), TX. Soils are a sandy loam. The site was recently clearcut with substantial sprouting of Chinese tallowtree, sweetgum and yaupon, with numerous other woody species present. No planned regeneration followed timber harvest.

METHODS

Seven herbicide treatments and an untreated check were tested. Test treatments were: (1) MAT28 at 2.5%, (2) MAT28 at 5%, (3) MAT28 at 10%, (4) MAT28 at 15%, (5) Garlon 4 Ultra at 30%, (6) Garlon 4 Ultra+Stalker at 20%+1%, (7) MAT28+Stalker at 10%+1% and (8) untreated check (severed rootstock with no herbicide treatment). In each treatment plot, rootstocks of 7 Chinese tallowtrees, 10 sweetgums and 10 yaupons spaced at least 10-feet

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apart were equally assigned to 1-, 2- and 3-inch ground line diameter classes and balanced for all treatment-plot replicates. Each rootstock was treated with herbicide mixed with Brush and Basal Oil by Helena on February 4, 2009 in the following manor: 1) all stems within 1-feet radius of the dominate stem were severed with a chainsaw leaving a 4-inch stump and 2) a herbicide and basal oil mixture was immediately applied to the cut surface and top 2 inches of all the severed stems of the rootstock, using a CO_2-backpack sprayer with 5500 Adjustable Conejet Orifice 10 at 11PSI. The dominant stem of all rootstocks was measured for total height (feet) and ground line diameter (in) at the onset of the project. Dominant stems were assessed for sprouting and sprout total height at 30, 60, 90, 180, 360 and 540 days after treatment (DAT). Efficacy was determined by monitoring the number of sprouts, as well as the percent control of the dominant stem. Percent control was defined as initial height minus height at post-treatment evaluation, divided by the initial height times 100.

RESULTS

No sprouts occurred in any of the treatments 30 and 60 DAT. Sprouting were present in many of the treatments by 90 DAT, however sprout frequency, and thus herbicide efficacy varied greatly between treatments, therefore results will be discussed by species.

CHINESE TALLOWTREE

In the untreated check, virtually all rootstocks had sprouted (20 out of 21) by 90 DAT. The earliest sprouts in herbicide treatments were detected at 90 DAT with a few additional sprouts observed 180 DAT. Sprout number stabilized at 360 DAT and thereafter. Only the 2.5% MAT28 treatment exhibited new sprouts from 360-540 DAT. The maximum number of sprouts for any treatment was 7 out of 21. This occurred 360 DAT in the lowest MAT28 test rate (2.5%). No further sprouting was observed in any of the treatments after 360 days. No sprouting occurred at all for the following treatments: MAT28 10%, Garlon 4 Ultra and Garlon 4 Ultra +Stalker. A single sprout was recorded in the MAT28+Stalker treatment at 30 DAT, however this sprout subsequently died, effectively resulting in no sprouting for this treatment as well (Table 1).

The heights of the dominant stem in the untreated check rootstocks averaged 8.8 feet initially and 7.5 feet 540 DAT. Sprouts regrew 86 percent of their initial height. The heights of the dominant stem in the MAT28 treated rootstocks averaged 8.5 feet initially and 3.0 feet 540 DAT. Sprouts regrew 35 percent of their initial height. The height of the dominant stem in the Garlon treated rootstocks were 9.6 feet initially and without sprouts 540 DAT. Only the MAT (10%) and MAT28+Stalker treatments matched this performance (Table 2).

Rootstock control at 90 DAT and thereafter was similar and significantly greater on all herbicide treatments than checks. At 180, 360 and 540 DAT only the low rate of MAT28 (2.5%) had significantly less control than the other herbicide treatments and significantly greater control than the check.

SWEETGUM

All check rootstocks supported sprouts by 90 DAT. By this same time, sprouts were observed in all herbicide treatments except Garlon 4 Ultra (30%), for which there were no sprouts. In both Garlon 4 Ultra treatments sprouting stabilized 360 DAT resulting in only 3 total sprouts recorded at 540 DAT. Sprouting increased for all MAT28 rates and mixtures throughout all evaluations (Table 1).

The heights of the dominant stem in the untreated check rootstocks averaged 11.8 feet initially and 5.9 feet 540 DAT. Sprouts regrew 50 percent of their initial height. The heights of the dominant stem in the MAT28 treated rootstocks averaged 12.7 feet initially and 3.4 feet 540 DAT. Sprouts regrew 27 percent of their initial height. The height of the dominant stem in the Garlon treated rootstocks was 12.3 feet initially and 3.8 feet 540 DAT. Sprouts regrew 31 percent of their initial height (Table 2).

No significant differences in herbicidal control were noted until 180 DAT. Treatment ranks did not change for the evaluations 180, 365 and 540 DAT. At 540 DAT, treatments seemed to move towards groups. For example, Garlon 4 Ultra (30%) provided significantly best control. Stalker treatments were significantly better than the low rate of MAT28 (2.5%). Treatments of MAT28 (5%, 10%, 15%) alone and mixtures of Stalker were statistically similar as were MAT28 (2.5%, 5%, 10%, 15%) treatments.

YAUPON

By 90 DAT, all check rootstocks had sprouted. Only one sprout was recorded in all of the herbicide treatments (MAT28 10%). Virtually all sprouts had occurred by 180 DAT and by 540 DAT the greatest number of sprouts in any treatment was 3 (MAT28 2.5%). A total of 4 sprouts occurred for the MAT28 5%, 10% and 15% treatments collectively. No sprouts were found in either of the Garlon 4 treatments or the MAT28+Stalker treatment (Table 1).

The heights of the dominant stem in the untreated check rootstocks were 11.1 feet initially and 4.8 feet 540 DAT. Sprouts regrew 43 percent of their initial height. The height of the dominant stem in the MAT28 treated rootstocks was 13.1 feet initially and 3.5 feet 540 DAT. Sprouts regrew 27 percent of their initial height. The height of the dominant stem in the Garlon treated rootstocks was 13.4 feet initially and without sprouts 540 DAT. Only the MAT28+Stalker (10+1) mixture equaled the Garlon performance (Table 2).

For all evaluations, all herbicide treatments exhibited control that was statistically similar and greater than observed for checks.

DISCUSSION

MAT28 control of Chinese tallowtree, sweetgum and yaupon rootstocks varied by species. Results will be discussed for individual species.

CHINESE TALLOWTREE

Treatment-related sprouting was observed 90 and 180 DAT (Table 1). No new sprouts occurred on any treatment 360 DAT and thereafter. No sprouts were detected at any evaluation for treatments: MAT28 10%, Garlon 4 (30%), Garlon 4+Stalker and MAT28+Stalker.

Percent control was excellent at all evaluations for six treatments: three MAT28 (5%, 10%, 15%), two Stalker mixtures, and Garlon (30%) (Table 2). MAT28 (10%) and Garlon and Stalker treatments all exhibited no sprouting and therefore, 100 percent control 365 DAT and thereafter. It is hypothesized that over time the lack of sprouting and increased control of MAT28 10% and its mixtures will statistically separate from the other MAT28 treatments. Good MAT28 cut-stump control of Chinese tallowtree is consistent with results from foliar treatments (Ezell and Yeiser 2009). This product provides stand-alone control of Chinese tallowtree.

Sprouting frequency decreased as rate increased from 21 sprouts in the check, to 7 sprouts in the MAT28 2.5% treatment to 2 sprouts in the MAT28 5% and 15% treatments (no sprouts in the 10% treatment). Sprout average total height decreased significantly as rate increased up to a 5% MAT28 rate, then no significant decreases were noted at the higher rates.

MAT28 (15%) had more sprouts than the lower concentrations of MAT28. This result is counter-intuitive and may be explained. At the high concentration (15%), MAT28 was difficult to keep in solution and required significant agitation, something unnecessary for all other herbicidal treatments. Although frequent agitation was used, it is possible that some separation of product still occurred resulting in applicator error.

SWEETGUM

For sweetgum, sprout frequency 90 to 540 DAT varied by treatment (Table 1). Sprouting occurred in all treatments at 360 and 540 DAT. Garlon 4 treatments had the fewest sprouts.

Differences in percent control at 90 DAT were between treated and untreated (Table 2). Treatment differences increased with time. At 540 DAT, Garlon 4 (30%) was the best treatment with 99.4 percent control. The best performing MAT28 treatments were the 5%, 10% and 15% rates and the MAT28+Stalker (10%+1%). Test treatments of MAT28 (5%, 10%, 15%) provided less control than Garlon or MAT28 mixtures. Poor control of sweetgum with cut-stump applications parallels results from foliar application tests of MAT28.MAT28 does not provide stand-alone control of sweetgum.

YAUPON

There were no new yaupon sprouts 360 DAT and thereafter. No sprouting occurred in either of the Garlon 4 treatments. No statistical differences in sprout frequency or percent control were observed between any of the herbicide treatments. Although there were a few sprouts in the MAT28 treatments, for percent control, MAT28 performed as well as the Garlon treatments. It should be noted that control with the low rate of MAT28 (2.5%) was statistically and numerically similar with higher rates for yaupon control only (not Chinese tallowtree or sweetgum). Yaupon cut-stump control with MAT28 is good while foliar control is poor (Ezell and Yeiser 2009). This inconsistency suggests a different surfactant may be needed to better move MAT28 into the leaves or down the stem.

Additional research is currently underway that examines different formulations and rates of MAT28 for control of various other tree species using cut-stump and basal-bark applications. Preliminary results indicate MAT28 provides excellent control of winged elm (*Ulmus alata*), green ash (*Fraxinus pennsylvanica*) and sugarberry (*Celtis laevigata*) using both cut-stump and basal bark application methods. Collectively, these data suggest MAT28 provides broader-spectrum control than is evidenced in this one trial. More work is planned for trifoliate orange (*Poncirus trifoliate*) and honeylocust (*Gleditsia triacanthos*).

CONCLUSIONS

MAT28 control of unwanted woody plants varies with the species treated. MAT28 provided stand alone control of Chinese tallowtree and yaupon but will need a higher rate than tested here or a tank partner for sweetgum control. Yaupon susceptibility to MAT28 warrants further investigation into formulations and adjuvents to enhance foliar control. MAT28 can potentially provide effective control of numerous species occupying many nonagricultural areas, non-crop producing areas, industrial sites and natural areas in the South.

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Table 1—Sprouting frequencies of Chinese tallowtree (CT), sweetgum (SG) and yaupon (Y) rootstocks 90, 180, 360 and 540 days after treatment (DAT) following a February 4, 2009 cut-stump application of herbicide

	DAT	90			180			360			540		
TREATMENT	SPECIES	CT	SG	Y	CT	SG	Y	CT	SG	Y	CT	SG	Y
PRODUCT+BASAL OIL	N	21	30	30	21	30	30	21	30	30	21	30	30
MAT28 2.5%		1	6	0	2	23	4	7	24	3	7	26	3
MAT28 5.0%		0	2	0	2	14	1	2	15	2	2	18	2
MAT28 10.0%		0	2	1	0	9	2	0	14	1	0	16	1
MAT28 15.0%		1	2	0	2	17	1	2	20	1	2	22	1
Garlon 4 Ultra 30%		0	0	0	0	0	0	0	1	0	0	1	0
Garlon 4 Ultra+Stalker 20%+1%		0	2	0	0	5	0	0	2	0	0	2	0
MAT28+Stalker 10%+1%		1	2	0	0	14	0	0	15	1	0	18	0
Untreated Check (Chainsaw only)		20	30	30	21	30	30	21	29	30	21	29	30

Table 2—Mean rootstock initial height (feet) and percent control (%) at 90, 180, 360 and 540 days after treatment (DAT) with a cut-stump application of herbicide, applied Feb 4, 2009

SPECIES	TREATMENT (Product+(Basal Oil))	MEAN HT INITIAL	% 90DAT	% 180DAT	% 360DAT	% 540DAT
Chinese tallowtree						
	MAT28 2.5%	8.3	99.2a[1]	87.5b[1]	86.0b[1]	77.5b[1]
	MAT28 5.0%	8.1	100.0a	96.9a	95.0a	93.0a
	MAT28 10.0%	8.1	100.0a	100.0a	100.0a	100.0a
	MAT28 15.0%	9.9	99.7a	97.6a	96.6a	94.8a
	Garlon 4 Ultra 30%	9.1	100.0a	100.0a	100.0a	100.0a
	Garlon 4 Ultra+Stalker 20%+1%	10.1	100.0a	100.0a	100.0a	100.0a
	MAT28+Stalker 10%+1%	8.0	98.6a	100.0a	100.0a	100.0a
	Untreated Check (Chainsaw only)	8.8	83.7b	43.7c	27.3c	10.4c
Sweetgum						
	MAT28 2.5%	8.3	99.2a[1]	86.4c[1]	83.4d[1]	73.1c[1]
	MAT28 5.0%	8.1	99.8a	91.6bc	88.2cd	80.2bc
	MAT28 10.0%	8.1	99.6a	95.9ab	91.1c	81.7bc
	MAT28 15.0%	9.9	99.6a	91.9bc	91.2c	80.2bc
	Garlon 4 Ultra 30%	9.1	100.0a	100.0a	99.7a	99.4a
	Garlon 4 Ultra+Stalker 20%+1%	10.1	99.2a	96.5ab	97.8ab	96.9b
	MAT28+Stalker 10%+1%	8.0	99.7a	93.0b	92.6bc	83.1b
	Untreated Check (Chainsaw only)	8.8	89.9b	66.8d	63.2e	47.7d
Yaupon						
	MAT28 2.5%	13.2	100.0a[1]	98.7a[1]	98.5a[1]	96.8a[1]
	MAT28 5.0%	13.4	100.0a	99.3a	99.7a	98.0a
	MAT28 10.0%	14.2	99.5a	98.7a	98.4a	98.0a
	MAT28 15.0%	12.3	100.0a	99.6a	99.0a	99.0a
	Garlon 4 Ultra 30%	14.2	100.0a	100.0a	100.0a	100.0a
	Garlon 4 Ultra+Stalker 20%+1%	12.6	100.0a	100.0a	100.0a	100.0a
	MAT28+Stalker 10%+1%	12.4	100.0a	100.0a	99.2a	100.0a
	Untreated Check (Chainsaw only)	11.0	91.9b	70.5b	63.4b	52.6b

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