

Table 3. Woody stem control (percent change) in 1998 Novartis site preparation study – South Carolina

Treatment	Species				Total
	Black Cherry	Plum	Sweetgum		
	----- percent -----				
1	-50 a *	-56 ab	-94 a		-75 ab
2	-42 a	-90 a	0 b		-49 bc
3	-50 a	-19 bc	-50 ab		-39 cd
4	-33 a	-100 a	0 b		-60 abc
5	+33 a	-75 a	-100 a		-74 abc
6	-100 a	-96 a	-100 a		-87 a
7	-35 a	-71 a	-68 a		-59 abc
8	-39 a	-50 abc	-100 a		-13 de
9	-100 a	-100 a	-97 a		-91 a
10	0 a	0 c	-67 a		0 e

\* negative changes indicate a reduction in stems and values followed by the same letter in a column do not differ at P = 0.05

### EFFECTS OF APPLICATION TIMING ON WOODY STEM CONTROL USING DICAMBA TANK MIXTURES. L.R. Nelson and A.W. Ezell. Clemson University, Clemson, SC; and Mississippi State University, Starkville.

#### ABSTRACT

Herbicide treatments were installed during the 1998 growing season at two locations to evaluate effects of application timing on pine and hardwood control using dicamba (Vanquish®) mixed with either imazapyr (Arsenal Applicators Concentrate®), glyphosate (Accord®) or triclopyr (Garlon 4®). Study sites included a piedmont site near Starr, SC and an upper coastal plain site near Starkville, MS. Treatments included dicamba @ 2 qt + glyphosate @ 3 qt product/ac, dicamba @ 2 qt + triclopyr @ 2 qt product/ac and dicamba @ 2 qt + imazapyr @ 16 oz product/ac. Treatments were applied with a CO<sub>2</sub> pole sprayer in mid-June, mid-July and mid-August in South Carolina and at the same times plus a mid-September application in Mississippi. A complete randomized design with three replications was used at both sites. Dominant hardwood species were black cherry, red oak spp. and sweetgum in South Carolina and red maple, red oak spp., swamp chestnut oak and winged sumac in Mississippi. Evaluations were conducted 12 MAT. Reduction of the number of woody stems/ac by species was used as a measure of control.

Significant herbicide treatment and timing effects occurred on hardwoods in South Carolina. Vanquish @ 2 qt + Arsenal @ 16 oz resulted in a 55 % stem reduction of sweetgum compared to a 10 and -18 % reduction with Vanquish @ 2 qt + Accord @ 3 qt and Vanquish @ 2 qt + Garlon 4 @ 2 qt/ac, respectively. July and August applications resulted in approximately 30 % stem reduction of red oak species compared to 1 % with June applications. Effects on other species were not significant.

In Mississippi both treatment and timing effects were significant. Vanquish @ 2 qt + Garlon 4 @ 2 qt provided a 73 % stem reduction of loblolly pine compared to 19 and 21 % for the Arsenal and Accord mixtures, respectively. The Vanquish + Arsenal tank mixture provided 92 % stem reduction of red maple compared to 58 and 47 % for Vanquish mixed with either Accord or Garlon 4, respectively. Both the Arsenal and Accord mixtures provided better than 75 % control of red oak spp. compared to 33 % with the Garlon 4 mixture. Optimum application timing varied by species. June and August applications on loblolly pine were significantly better than July or September applications. June, August and September applications resulted in approximately 80% control of red maple compared to 57% with the July application. June and July applications resulted in 50 to 60 % control of red oaks while stem numbers increased following August and September applications.

**A COMPARISON OF BASAL BARK TREATMENTS USING GLYPHOSATE AND MON 59120.** J.L. Yeiser, Stephen F. Austin State University, Nacogdoches, TX 75962; L.R. Nelson, Clemson University, Clemson, S.C. 29634-1003; and A.W. Ezell, Mississippi State University, Mississippi State, MS39762.

#### ABSTRACT

Monsanto 59120 is a proprietary surfactant potentially providing the water solubility and bark penetration needed by Accord during low-volume, basal bark applications. Dormant and growing season, low-volume basal bark applications of Monsanto 59120+Accord were applied to a height of 14 in. without runoff and assessed for crown reduction of selected woody species in Arkansas, Mississippi, and South Carolina. After two growing seasons, crown reduction was greater for mixtures of Monsanto 59120+Accord than Accord alone. Monsanto 59120+Accord in a 50:50 mixture provided growing season control of pine and sweetgum comparable to the industry check, Garlon 4+vegetable oil (20%+80%). However, Garlon 4+vegetable oil (20%+80%) provided best overall dormant and growing season control across all test species.

## INTRODUCTION

Basal bark applications have long been a part of controlling unwanted woody species along utility rights-of-ways (1). Although tree injection has been the preferred individual stem treatment in forestry, basal treatments are used (2). Originally, basal applications were high volume. The lower 18 in. to 24 in. of bark on the unwanted tree was soaked with the herbicide mixture. Puddling around the base of the tree was a common feature of this method (1) and thought necessary for control of sprouts (3). Basal applications were labor intensive, costly and limited by tree size, terrain, brush and access (1).

For over 25 years prior to its suspension by the EPA in 1979, 2,4,5-T was the principle herbicide in basal treatments (4). About 1980, triclopyr was introduced (5). Since then, the Garlon 4E formulation of triclopyr has provided excellent control of numerous hardwood species (6,7,8,9,10). Basal treatments in forestry are used for pine release from hardwoods (6,7,8,10) and to a lesser extent for pine control (11,12).

The high volume of mixture used during basal applications greatly restricted the practical use of this technology. Studies were initiated to reduce the volume of mixture delivered to the unwanted tree. One new method was called low volume basal application. This technique was intended for stems too small to inject but too tall for foliar application with a hand-held sprayer. Low volume basal involves treating the lower 14 in. of trees less than 3 in. at dbh until bark is saturated but without puddling around the root collar (13). Another method was called "streamline" basal bark application (13). For this technique, a 2- to 4-in. band of mixture (10% Cide-Kick, 20% Garlon 4 and 70% diesel) was applied to one or two sides of unwanted stems (13,15). Applicators target the smooth bark of juvenile stems less than 2 in. in ground line diameter (13,15). Studies investigating equipment, timing of application, size of stems and different carriers have been completed (1,7,13,14,15).

Basal bark treatments have traditionally used diesel or kerosene as a carrier of herbicide through the bark to vascular tissues (3,4,7,8,16,17). Impurities, benzene and polycyclic aromatic hydrocarbons, sometimes found in diesel and kerosene have been linked to carcinogenicity in some studies. Concerns for applicator safety partly justified an investigation of prospective, high-quality oil carriers such as those used during food and medicinal preparation (16,17,18). Today, commercially available vegetable oil, an alternative to diesel and kerosene, provides comparable control and enhanced safety during basal applications for woody stem control (16,18,19).

Accord is a water-soluble formulation of glyphosate. Accord is currently not used in basal applications for control of woody plants, presumably due to poor bark penetration. Monsanto 59120 is a new, proprietary surfactant providing water solubility and penetration. Thus, mixtures of Monsanto 59120+Accord have potential for low-volume basal bark treatment of unwanted woody stems in southern forests and right-of-ways.

## OBJECTIVE

The objective of this study was to evaluate dormant and growing season basal bark applications of Accord and Monsanto 59120 combinations for crown reduction of unwanted woody stems occupying southern forests and utility right-of-ways.

## METHODS

A site in each of Arkansas, Mississippi and South Carolina was selected for testing. In Arkansas, test species were distributed along the margin of an even-aged stand of loblolly pine (*Pinus taeda* L.) in the Upper Coastal Plain near Monticello. Test species included sweetgum (*Liquidambar styraciflua* L.) and natural loblolly pine reproduction. A similar number of test stems was selected from the one-, two- and three-in. dbh classes for each species and treatment combination. The second test area was a bottomland creek terrace near Starkville Mississippi that supported mixed pine-hardwoods. Species selected for testing were mixed red oak (*Quercus nigra* L., *Q. phellos* L., *Q. falcata* Michx.), and hickory (*Carya* spp.). Test stems were predominantly in the two- and three-in. dbh classes. The third study area was an Upland Piedmont site near Pendleton, South Carolina. Sweetgum and water oak were the test species bordering a right-of-way and a mature hardwood stand. In South Carolina, 90% of the test stems were less than 1.5 in. in dbh. Treated stems were seemingly healthy and injury free. All stems in a rootstock were treated and only the dominant stem evaluated for crown reduction. Test trees ranged from about 8 ft. to 28 ft. in height.

Test treatments and season of applications are presented in Table 1. A CO<sub>2</sub> backpack sprayer and an adjustable cone jet nozzle (5500-X3) were used to apply treatments. Herbicide was applied with a smooth, continuous motion starting at the root collar and proceeding up the stem to a height of 14 in. Herbicide was applied until the bark was saturated but not to the point of runoff. Dormant and growing season applications of herbicides were applied in Arkansas, Mississippi, and South Carolina on February 13 and June 21, February 20 and May 19, and February 28 and June 6, respectively. Garlon 4 mixed with a generic, commercially available vegetable oil was the check.

For all three test sites, temperatures were near normal and soils were near field capacity at the time dormant season treatments were applied. Throughout the first growing season temperatures were generally above normal and soils droughty. Drought conditions occurred in Arkansas throughout the second growing season as well.

At all three test sites, treatments were randomly assigned to plots in each of three replications. Each plot contained 10 stems per test species. Treated stems were visually evaluated in 10% intervals for crown reduction. Dormant and growing season evaluations were taken in Arkansas, Mississippi, and South Carolina on August 10, July 24 and August 10, respectively.

Data were analyzed using a completely randomized design with three replications. An analysis of variance and Duncan's New Multiple Range test was used to conduct statistical tests at the  $p=0.05$  level.

## RESULTS

After two growing seasons, best and similar pine crown reduction in Arkansas were achieved with basal treatments of Garlon 4+vegetable oil (20%+80%) applied during growing and dormant seasons and Monsanto 59120+Accord (75%+25%, 50%+50%) applied in the growing season. Managers seeking the flexibility of growing or dormant season applications should select the Garlon 4 treatment instead of the Accord treatments. Managers interested in growing season treatments may select either the Garlon 4 or Monsanto 59120+Accord (75%+25%, 50%+50%) mixtures for pine control. Sweetgum in Arkansas was controlled best and similarly with Garlon 4+vegetable oil (20%+80%) applied during growing and dormant seasons and Monsanto 59120+Accord (50%+50%) applied in the growing season. Large red oaks (commonly 2-in. and 3-in. dbh) in Mississippi were similarly and best controlled with dormant season treatments of Garlon 4+oil (20%+80%) or the 50:50 and 25:75 mixtures of Monsanto 59120+Accord. Garlon 4+oil (20%+80%) remains the treatment of choice for dormant and growing season basal treatments of hickory in Mississippi. Small (90% < 1.5-in. dbh) oaks in South Carolina were controlled best and similarly with growing and dormant season treatments of Garlon 4+oil (20%+80%) or dormant season treatments the 50:50 and 75:25 mixtures of Monsanto 59120+Accord. South Carolina sweetgums were best and similarly controlled with Garlon 4+vegetable oil (20%+80%) applied during growing and dormant seasons and Monsanto 59120+Accord (50%+50%, 25%+75%) applied in the growing season.

When compared, sweetgum data from South Carolina and Arkansas suggested a rate effect exists. In South Carolina and Arkansas, increased penetrant was associated with increased sweetgum control that peaked with the 50:50 mixture and then decreased for the 75:25 (Monsanto 59120+Accord) mixture. The general magnitude of sweetgum control in Arkansas was lower than in South Carolina probably due to larger test-stems in Arkansas. When oak results were compared, we noted that the same growing season treatments providing best control of large red oaks in Mississippi also provided best growing season control of small oaks in South Carolina.

Previously reported first-year trends were similar to those reported here (12). Probably the largest difference in first- and second-growing season results existed in the excellent growing season control of pine in Arkansas by Monsanto 59120+Accord (75%+25%, 50%+50%). This was not observed by the end of the first-growing season.

## CONCLUSION

In conclusion, Garlon 4+vegetable oil (20%+80%) remains the best option for the dormant and growing season control across all test species. Monsanto 59120+Accord significantly increase basal control over that of Accord alone. Monsanto 59120+Accord in a 50:50 mixture provided growing season control of pine and sweetgum comparable to the industry check, Garlon 4+vegetable oil (20%+80%), and warrants further testing.

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Table 1. Mean percent crown reduction after two growing seasons for dormant and growing season basal bark applications.

Treatment <sup>1</sup>	Application	Arkansas <sup>2</sup>		Mississippi <sup>2</sup>		S. Carolina <sup>2</sup>	
		Pine	Sweetgum	Red Oak	Hickory	Oak	Sweetgum
G4 + VEG (20% + 80%)	Dormant <sup>3</sup>	90ab	89ab	72a	95a	90ab	100a
59120 + AC (25% + 75%)	Dormant	57de	28f	63b	26c	64bc	44cd
59120 + AC (50% + 50%)	Dormant	68cd	37ef	67ab	41bc	80ab	35d
59120 + AC (75% + 25%)	Dormant	16f	21f	72a	44bc	92ab	35d
AC (100%)	Dormant	8f	36ef	48c	25c	18de	29de
G4 + VEG (20% + 80%)	Growing <sup>4</sup>	95a	100a	54b	97a	100a	100a
59120 + AC (25% + 75%)	Growing	99a	51de	57b	31c	4e	65bc
59120 + AC (50% + 50%)	Growing	95a	80abc	58b	48b	36cd	94ab
59120 + AC (75% + 25%)	Growing	74bc	74bc	50bc	50b	42cd	84ab
AC (100%)	Growing	43e	62cd	40c	52b	22de	34d

<sup>1</sup> Treatments are: G4=Garlon 4E, VEG=Generic commercial grade of vegetable oil, AC=Accord, 59120=Monsanto 59120.

<sup>2</sup> Season of application by treatment means within a column sharing the same letter are not significantly different. (Duncan's New Multiple Range Test, p=0.05)

<sup>3</sup> Dormant season treatments were applied on February 13, February 20 and February 28, 1998 in Arkansas, Mississippi and South Carolina, respectively.

<sup>4</sup> Growing season treatments were applied on June 21 in Arkansas, on May 19 in Mississippi and June 6, 1998 in South Carolina. Uncommonly high temperatures and below average rainfall provided a south wide drought during most of the first growing season and again in Arkansas during the second growing-seasons.