FIRST-YEAR WOODY PLANT CONTROL FOLLOWING SEVERAL FORMULATIONS AND TIMINGS OF GLYPHOSATE WITH OR WITHOUT IMAZAPYR. T.B. Harrington, A.W. Ezell, J.L. Yeiser, and J.O. Cobb; University of Georgia, Athens, GA 30602, Mississippi State University, Starkville, MS 39762, Stephen. F. Austin State University, Nacogdoches, TX 75962, and Dow AgroSciences, Auburn, AL 36830.[1]

ABSTRACT

Several formulations of glyphosate were applied with or without imazapyr in June and October 2000 at sites located in Georgia, Mississippi, and Texas. The objective of the research was to compare control of woody species between experimental and conventional formulations of glyphosate with or without imazapyr. Percentage change in total length of woody stems was evaluated immediately before treatment and one year following treatment. In general, the experimental formulations of glyphosate provided similar levels of woody control as that observed for Accord® SP or generic glyphosate. Woody control from Accord® SP was often greater than that observed from generic glyphosate, especially at the Georgia site.

INTRODUCTION

In 2000, several new formulations of glyphosate were being developed by the Monsanto Corporation prior to their sale of the Accord® line of products to Dow AgroSciences. In this study, three new formulations of glyphosate with or without imazapyr were compared to currently labeled products applied at the same rate, including combinations of Accord® SP and generic glyphosate applied with or without Chopper® or Arsenal® AC.

METHODS AND MATERIALS

The study was conducted at three study sites in the southeastern U.S.: Oglethorpe County GA, Winston County MS, and Angelina County TX. Soil types include a sandy clay loam in Georgia, a silty clay loam in Mississippi, and a sandy loam in Texas. Pine or mixed pine-hardwood stands were harvested at each site one to two years prior to study initiation resulting in a relatively uniform coverage of hardwood and shrub sprouts. At each site, 48 plots of dimension 30' x 100' were permanently marked. Seven herbicide treatments (Table 1) and an untreated check applied at each of two timings (June and October 2000) were randomly assigned to plots according to either a completely randomized design (Georgia) or a randomized complete block design (Mississippi and Texas) with three replications of each treatment. Treatments were applied with a CO_2 backpack-pole sprayer fitted with a KLC9 nozzle to apply a uniform spray swath approximately 30' wide. Spray volume was 15 gallons per acre.

Immediately before and one year following treatment, total length of woody stems was assessed for each woody species within a centrally located 10'- x-80' area in each plot. Stems were counted according to each of seven 1-ft. height classes between 1.5' and 9.5'. Total stem length was calculated per species by multiplying each stem frequency by its respective height-class midpoint and summing these products for each plot. Percentage change in total stem length (hereafter referred to as stem reduction) was calculated as 100*(T01-T00)/T00, where T00 and T01are total stem lengths in 2000 and 2001, respectively, for a given plot and species.

For each species having adequate representation among treatments, data were subjected to analysis of variance to determine if stem reduction varied significantly (α=0.05) among months and treatments. Duncan's Multiple Range Test was used to conduct multiple comparisons of treatment means.

RESULTS AND DISCUSSION

Woody plant responses to the herbicide treatments varied considerably among the study sites. Woody plant control was excellent for most of the herbicide treatments at the Georgia and Mississippi sites, especially for the October treatments (Tables 2-3). At the Georgia site, stem reduction for sweetgum (*Liquidambar styraciflua*) was greater for October treatments than for June treatments, while the reverse trend was true for black cherry (*Prunus serotina*). At

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the Texas site, stem reduction of yaupon (*Ilex vomitoria*) was greater for June treatments than for October treatments (Table 4). No clear timing differences were detected at the Mississippi site.

In general, the dry ammonium salt of glyphosate (MON78015) plus Chopper® provided an equivalent level of stem reduction as Accord®SP plus Chopper® (treatment 2 versus treatment 1). Stem reduction from Accord®SP was often greater than that observed from generic glyphosate plus X-77® surfactant (treatment 3 versus treatment 6), especially at the Georgia site. The glyphosate and imazapyr blend (MON78229) provided similar or slightly better control of woody stems as the generic glyphosate plus Arsenal®AC treatment (treatment 4 versus treatment 5). The ether amine formulation of glyphosate (MON78128) provided similar to slightly lower levels of control as that observed for generic glyphosate (treatment 7 versus treatment 5).

Results indicate that woody stem control from the new formulations of glyphosate do not differ markedly from that observed from conventional combinations of Accord®SP, Chopper®, or Arsenal®AC. In addition, Accord®SP may provide a higher level of woody control as generic glyphosate plus X-77® surfactant on specific sites.

TABLES

Table 1. Formulations and rates of herbicides and surfactant applied in June and October 2000 to control woody vegetation at study sites in Georgia, Mississippi, and Texas.

Trmt .no.	Glyphosate formulation[2]	Glyphosate rate	Imazapyr formulation	Imazapyr rate	Surfactant	Surfactant rate
1	Accord®SP	5 lbs. a.i./acre	Chopper®	0.31 lbs. a.i./acre		
2	MON78015	5 lbs. a.i./acre	Chopper®	0.31 lbs. a.i./acre		
3	Accord®SP	8 lbs. a.i./acre				
4	MON78229	6 lbs. a.i./acre				
5	Generic	6 lbs. a.i./acre	Arsenal®AC	0.19 lbs. a.i./acre	X-77®	2.5% by vol.
6	Generic	8 lbs. a.i./acre			X-77®	2.5% by vol.
7	MON78128	6 lbs. a.i./acre	Arsenal®AC	0.19 lbs. a.i./acre		

[2]MON78015 is a dry ammonium salt of glyphosate. MON78229 is a glyphosate and imazapyr blend with the same rates of active ingredients as found in treatment 5. Generic glyphosate is a product that is 54% active ingredient. MON78128 is an ether amine salt of glyphosate plus surfactant.

Table 2. Percentage change in total stem length of several hardwood species one year following seven herbicide treatments and an untreated check at the Georgia study site. For each timing, means within a column followed by the same letter(s) do not differ significantly (P>0.05).

Timing	Treatment number	Species				
		red maple	sweetgum	black cherry	white oak	water oak
		% change in total stem length				
June	1	-100.0c	-93.6a	-100.0b	-100.0b	-95.3cde
	2	-100.0c	-96.2a	-100.0b	-100.0b	-100.0e
	3	-99.7c	+18.1a	-100.0b	-100.0b	-62.6bc
	4	-100.0c	-87.9a	-100.0b	-100.0b	-97.8de
	5	-98.4c	-34.8a	-100.0b	-100.0b	-74.4bc
	6	-61.0ab	+164.5a	-100.0b	-85.2a	+42.2ab
	7	-85.9b	-77.4a	-100.0b	-100.0b	-90.5cd
	untreated check	-13.0a	+192.7a	-45.1a	-13.4a	+306.3a
October	1	-97.2b	-96.3b	-72.2a	-100.0b	-97.9b
	2	-100.0b	-98.5b	-100.0a	-100.0b	-100.0b
	3	-100.0b	-96.4b	-96.4a	-100.0b	-99.2b
	4	-100.0b	-98.1b	-97.3a	-100.0b	-97.1b
	5	-100.0b	-97.9b	-100.0a	-100.0b	-97.9b
	6	-95.5b	-97.2b	-96.9a	-100.0b	-96.7b
	7	-100.0b	-91.3b	-95.0a	-100.0b	-89.9b
	untreated check	+62.1a	+62.9a	-71.4a	-79.8a	+134.3a

Table 3. Percentage change in total stem length of several hardwood species one year following seven herbicide treatments and an untreated check at the Mississippi study site. Means within a column followed by the same letter(s) do not differ significantly (P>0.05).

Timing	Treatment number	Species				all species combined
		sweetgum	red maple	post oak	black gum	
		% change in total stem length				
June	1	-93.0a	-93.3a	-87.5a	-100.0a	-84.0a
	2	-64.3b	-100.0a	-100.0a	-100.0a	-93.0a
	3	-97.0a	-100.0a	*	-80.0ab	-85.3a
	4	-100.0a	-96.3a	-100.0a	-85.7a	-92.3a
	5	-100.0a	-94.7a	-97.0a	*	-87.3a
	6	-92.7a	-97.0a	-91.3a	-80.0ab	-81.3ab
	7	-100.0a	-94.0a	-87.7a	*	-78.3b
October	1	-62.7b	-78.0a	-100.0a	-100.0a	-89.7a
	2	-98.0a	-87.7a	-100.0a	-100.0a	-94.0a
	3	-100.0a	-90.0a	-100.0a	-60.9b	-76.3b
	4	-100.0a	-83.3a	-100.0a	-100.0a	-90.3a
	5	-97.3a	-66.7ab	-100.0a	-100.0a	-89.0a
	6	-98.3a	-72.0ab	-100.0a	-5.0c	-70.7b
	7	-98.7a	-66.7ab	-100.0a	-81.3a	-84.3a
	untreated check	-18.0c	-53.3b	-25.0c	*	+25.3c

Table 4. Percentage change in total stem length of several hardwood species one year following seven herbicide treatments and an untreated check at the Texas study site. For each timing, means within a column followed by the same letter(s) do not differ significantly (P>0.05).

Timing	Treatment number	Species		
		yaupon	southern red oak	sweetgum
		% change in total stem length		
June	1	-87.0a	-11.0ab	-3.0b
	2	-42.0b	-12.0ab	-10.0b
	3	-40.0b	-2.0b	-4.0b
	4	-65.0ab	-5.0ab	-10.0b
	5	-62.0ab	-19.0ab	0.0b
	6	-57.0ab	-35.0a	-27.0a
	7	-73.0ab	-29.0ab	-15.0ab
	untreated check	+6.0	-41.0	-8.0
October	1	-49.0ab	-17.0b	-12.0a
	2	-44.0ab	-64.0a	-6.0a
	3	-73.0a	-15.0b	-3.0a
	4	-72.0a	-18.0b	-8.0a
	5	-29.0b	-12.0b	-18.0a
	6	-30.0b	-19.0b	-12.0a
	7	-26.0b	-16.0b	0.0a
	untreated check	+6.0	-40.0	-10.0