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Introduction

Perennial vines are serious weed pests of cultivated crops in Mississippi (5). Two common perennial vines found in the Delta and elsewhere in the state are redvine (*Brunnichia ovata* (Walt.) Shinners) and trumpetcreeper (*Campsis radicans* (L.) Seem.) (4). Less common but also present are honeyvine milkweed (*Ampalamus albidus* (Nutt.) Britt.), maypop passionflower (*passiflora incarnata* L.), and redberry moonseed (*Cocculus carolinus* (L.) DC). These are all dicots in different families, but with many common features as weeds in our crops. Each is deciduous, woody, and capable of regeneration from deeply positioned rootstocks in cultivated fields. Redvine (see drawing on page 6) seems to be confined mainly to fine-textured soils (4, 8), but trumpetcreeper (see drawing page 5 and cover) and other perennial vines apparently are not restricted to soil type for their habitat. They occur in all crops and situations in cultivated agriculture in Mississippi, although flooding may limit interference in rice.

These perennial weeds, when present, may not measurably interfere with crop yield to any large extent (8). In a 3-year study on redvine in cotton, Hurst et al. (8) were not able to show an effect on cotton yield. Others (2, 9, 10, 12) have reported on efforts to control these vines but have not reported the interference effect of these vines. The implication of their reports is that they do interfere with cultural practices and harvest operations.

Herbicides and techniques for control of these perennial vines are limited (2, 3, 8, 9, 10, 11, 12, 13). Few methods or herbicides have been found that will control the weeds, and even fewer have sufficient selectivity to be used in a crop situation. The phenoxys and dicamba (3) have some activity on these plants, but are lacking in crop selectivity at the rate required for control. Glyphosate (10, 14) has also been found to be effective on these weeds, but has virtually no crop selectivity.

A method that has been suggested to achieve control without consequent crop injury is to apply the herbicide (dicamba or glyphosate) to a fallowed field or other situation when the crop is not present or will not be harmed (2, 3, 8). In such a scheme, the herbicide (dicamba or glyphosate) is applied after harvest, or, in the case of cotton (*Gossypium hirsutum* L.) (8), after defoliation but before a killing frost has occurred. In soybean, however, harvest of the crop removes most of the weed foliage and there is little left for the herbicide to interact with. Unless there is time for the vegetation to regrow between harvest and frost, such a scheme has little chance of success in soybean. Applying the herbicide to mature soybean is not labeled. Preplant applications of dicamba result in crop injury, while application of glyphosate to these weeds in the spring is generally not successful (10).

Our objective was to determine if a natural population of perennial vines, including redvine, trumpetcreeper, redberry moonseed, maypop passionflower, and honeyvine milkweek, could be controlled using potential technology (dicamba in the fall), and, if so, if the control would have any effect on crop yield.

Materials and Methods

General

The study was conducted during 1983-1987 on a Tunica clay (clayey over loamy, montmorillonitic, nonacid, thermic, Vertic Haplaquept) near Stoneville, MS. Two adjacent areas were designated for the dual experiment; one for dryland, non-irrigated production, and one for irrigated production. All plots were eight 40-inch rows, 100 feet long. The design was a split-plot with three treatments and four replicates in both the irrigated and non-irrigated experiments. Data for each crop were analyzed separately for each year and each irrigation regime.

The main plots were three rotation cropping schemes, while the sub-plot was with or without dicamba. The three rotations were continuous cycles of (1) wheat-soybean doublecropping; (2) corn followed by wheat-soybean doublecropping; and (3) grain sorghum followed by wheat-soybean doublecropping. The experiment began Oct. 7, 1983, when dicamba was applied at 2.0 pound ai/acre for control of a natural population of perennial vines consisting of redvine, trumpetcreeper, honeyvine milkweed, redberry moonseed, and maypop passionflower. Ten days after treatment, the land was prepared for planting. Corn and sorghum plots were bedded and left over winter. Southern Belle wheat was planted Oct. 18, 1983, at 90 pounds/acre in the wheat-soybean doublecropping treatment. Only the untreated wheat plots were harvested since this rate of dicamba adversely affects wheat.

Conventionally accepted cultural practices that promote high production expectations were utilized for each crop each year. Cultivar selection, seeding rate, fertilization, and pest control were applied as required for high yields. The only essential difference between the two experiments was the use of irrigation in the irrigated experiment. A full weed control program was effectively used, but the herbicides generally do not have an effect on the perennial vines. Table 1 lists the herbicides used each year.

The cultivars used were: corn, Pioneer 3160 in 1984 and Pioneer 3147 in 1986; sorghum, Funk's G-522DR in 1984 and Pioneer 8333 in 1986; soybean, Centennial in 1984 and 1985, Braxton in 1986, and Asgrow 5980 in 1987; wheat, Southern Belle in 1983, Coker 916 in 1984, and Florida 302 in 1985 and 1986.

Weed sampling

Weeds were sampled in each plot prior to harvest, and sampling was similar to previous efforts (6). A visual estimate by species of percentage ground cover was obtained by randomly locating twenty 5.4 ft^2 quadrates in each plot. If a species was in the plot but not in any quadrate, then it was listed as present but no ground cover value was assigned. No weed estimates were obtained for the wheat crop.

Statistical analysis

Analyses for weed cover of the perennial vines were combined where appropriate. The standard error of the mean (SE) for each measured variable was calculated.

A combined analysis of variance over years was computed which considered the two experiments as separate locations. Since the plot assignment remained intact for the duration of the experiment, years are simply repeated measurements in the same experiment. As in separate locations, no statistical test can be made of the location (irrigation) effect. However, interaction effects involving irrigation are subject to F Test.

Results and Discussion

A combined analysis over years for the weed cover of perennial vines showed no effect of years or any interaction of any effect with years. Therefore, the data in Table 2 are presented as the mean over years of the combined experiments. Dicamba applied once in the fall of 1983 suppressed perennial vines for 4 years (Table 2). The suppression was not complete, nor was it equal in all crops. Soybeans with full canopies from irrigation or suitable dryland conditions had less perennial vine ground cover. In corn, there were more perennial vines, especially in the non-irrigated experi-

Table 1. Herbicide application to the three wheat-soybean rotation crops.

	Cropping System[a]		
Input	**Wheat-soybean**	**Corn, wheat-soybean**	**Sorghum, wheat-soybean**
		1984 Crop Year	
Preemergence	Metribuzin plus metolachlor	Atrazine plus alachlor	metolachlor plus cyanazine
Postemergence	Bentazon plus acifluorfen, fluazifop (spot) 2,4-DB plus linuron layby)	None	None
		1985 Crop Year	
Preemergence	Metribuzin plus metolachlor	Metribuzin plus metolachlor	Metribuzin plus metolachlor
Postemergence	As in 1984	As in 1984 (Soy)	As in 1984 (Soy)
		1986 Crop Year	
Preemergence	Metribuzin plus metolachlor	Atrazine plus alachlor	Metolachlor plus cyanazine
Postemergence	fluazifop (spot), 2, 4-DB plus linuron (layby)	None	None
		1987 Crop Year	
Preemergence	Metribuzin plus metolachlor	Metribuzin plus metolachlor	Metribuzin plus metolachlor
Postemergence	As in 1986	As in 1986 (Soy)	As in 1986 (Soy)

[a]All herbicides were used at the recommended label rate for the given crop and soil type.

Table 2. Effect of dicamba on total weeds and perennial vines in the irrigated and non-irrigated experiments in the three crop systems averaged over 4 years.

Irrigation	Dicamba[b]	Cropping System[a]					
		W-S[c]		C, W-S		S, W-S	
		Total[d]	PV	Total	PV	Total	PV
		(% ground cover)					
With	With	2.6	0.6	7.6	1.2	4.1	0.8
	Without	3.5	1.9	19.2	11.9	14.4	10.4
Without	With	5.7	3.3	15.2	9.7	9.2	4.6
	Without	21.3	19.5	41.3	32.9	28.0	25.1

[a]Cropping Systems are: W-S = wheat-soybean doublecropping; C,W-S = corn followed by W-S; S, W-S = sorghum W-S.
[b]LSD for the difference between two dicamba means within a cropping system treatment and irrigation is 2.5 and 2.1 for total and PV, respectively.
[c]LSD for the difference between two treatment means within a dicamba treatment and irrigation is 3.0 and 2.5 for total and PV, respectively.
[d]Total is the total weed cover, PV is the perennial vine weed cover.

ment. This is probably related to the open canopy structure of the crop since a wide (40-inch) row spacing was used. Values for perennial vine ground cover in sorghum were intermediate between those for corn when irrigation was used.

Ground cover from the total weed spectrum (including the perennial vines) was different between dicamba treatments and among crops (Table 2), but this was totally a reflection of the dicamba effect on the perennial vines (data not presented). Corn had significantly more weeds than the other two crops, as was noted for the perennial vines in Table 2. These weed cover values were taken just prior to harvest and may not accurately reflect the interference value for corn. Many of the perennial weeds in corn were reaching their full effect at corn harvest time (mid-August), while the other crops were still green and fully canopied. There was no suggestion that the dicamba had a residual effect on weed control other than its effect on the perennial vines noted in Table 2.

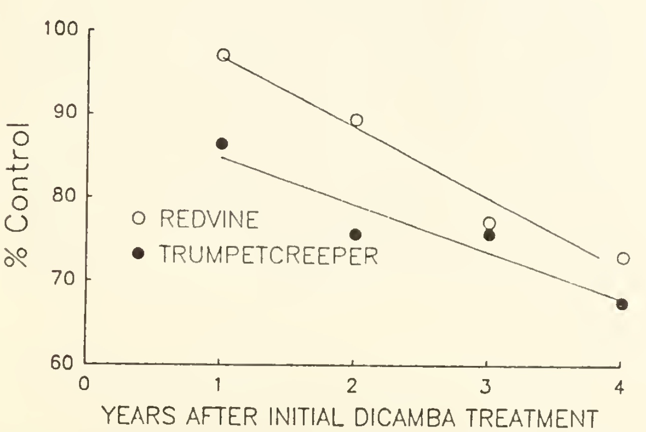

Figure 1. Comparison of vine suppression achieved for 4 years following application of dicamba for control of redvine and trumpetcreeper.

Dicamba was not equally effective on vine species (Figure 1). Redvine was apparently reduced more (but not significantly) than trumpetcreeper. Since this was a natural population, the distribution of the vines was not uniform over the study area. However, redvine was more prevalent over the whole study than the other vine species. Perennial weeds tend to grow in small concentrated areas making statistical calculations and conclusions difficult. Even so, the data are conclusive that dicamba can effectively result in vine suppression.

In 1984, there was no effect of dicamba treatment on yield of any crop (Table 3). In 1985, when all rotations were in the soybean sequence, there was an apparent advantage for the dicamba treatment, especially in the irrigated and non-irrigated corn, wheat-soybean system. Without irrigation the average advantage was 5 bushels/acre and with irrigation it was 4 bushels/acre. In 1986, only yield of corn was affected by the dicamba application, with 7 and 11 bushels/acre increases in the non-irrigated and irrigated experiments, respectively. In 1987, a soybean sequence year, the dicamba-treated plots had higher yields than the untreated plots by 1.5 bushels/acre in the non-irrigated and 6.5 bushels/acre in the irrigated experiments. Interestingly, the soybean yield differences in the continuous wheat-soybean doublecrop treatment are lower than those in the rotated treatment in either the irrigated or non-irrigated experiments of any year. This suggests that in order to more efficiently determine yield differences, the system should not be under any other yield limiting factor. Rotations, early planting, and irrigation are known to improve soybean yield (7).

Cultivar and hybrid selection varied throughout the experiment from year to year in each of the crops. These results were not intended to compare years with each other, but rather to develop agronomic performance information with the best possible current-

Table 3. Yield of crops in three rotation systems in irrigated and non-irrigated experiments as affected by dicamba application.

			Cropping System[a]				
			W-S	C, W-S		S, W-S	
Irrigation	Year	Dicamba	Soybean	Corn	Soybean	Sorghum	Soybean
			bu/ac				
With	1984	With	38	100		110	
		Without	38	101		103	
	1985	With	38		43		42[d]
		Without	36		38		39[e]
	1986	With	31	128[c]		_[b]	
		Without	32	117[c]		_[b]	
	1987	With	21		37		36
		Without	20		30		30
Without	1984	With	9	43		78	
		Without	9	43		80	
	1985	With	21		29		31
		Without	18		23		29
	1986	With	1	83[c]		_[b]	
		Without	1	76[c]		_[b]	
	1987	With	2		7		7
		Without	1		4		7

[a]Yield of the wheat crop is not reported. S = soybean in W-S and in 1985 and 1987 all yields are soybean. In 1984 and 1986 the yields are for corn and sorghum in their respective rotations.

[b]Yield not determined because of Midge damage to sorghum.

[c]SE for these corn means is 3.0 bu/acre. The other corn and sorghum NS.

[d]LSD for dicamba effect on soybean yield within a cropping system and irrigation in 1985 is 2.1 and in 1987 is 1.0 bu/acre.

[e]LSD for cropping system effect on soybean yield within a dicamba and irrigation treatment is 2.5 in 1985 and 1.2 bu/acre in 1987.

selections. We feel that any comparisons of treatment effect would be valid with any high performing cultivar or hybrid. We have no information to suggest that cultivar or hybrid selection had any effect on the yield performance comparison between dicamba-treated plots in any year. The corn hybrid was changed to get a better selection for the clay soil, and to get the most current hybrid possible. This was also true for the sorghum hybrid and wheat cultivar selections.

For the soybeans in 1984, 1985, and 1986, we used Maturity Group VI cultivars since this was the conventional practice. Soybeans planted after wheat require a late maturing cultivar to develop sufficiently to produce a good yield. We used different cultivars, but they were within the same maturity group. In 1987, we changed to a Maturity Group V cultivar. Our thinking was that this would allow us the time in the fall to harvest the soybeans and plant wheat or prepare a seedbed for the corn or sorghum. Also, the performance of the chosen cultivar was adequate for this situation. Again, our results are not to be compared over years but within a year.

These results suggest that any effect that the vines have on crop growth and yield is not consistent over time even with the similar levels of vine presence. This has been the finding of others who have investigated the effect of perennial vine presence on crop yield (8). Any recommendation concerning the use of this herbicide for control of the vines should be mindful of the apparent inconsistencies in yield response. However, the cost of having the vines present and the effect on harvest efficiency and quality of the harvested product (foreign matter or moisture) has not been documented. Lack of documentation has not deterred producers, however. Vine presence does adversely affect field operations. We have experienced vine-clogged combines and difficulties in cultivating as well, but have no data on any of these factors. Vines in fields are unsightly, can affect field operations to an unknown extent, and can affect yields, especially in soybeans that have a high yield potential, such as following corn or sorghum with irrigation. All of these factors should be considered when contemplating an attempt to control these weeds.

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Drawing of redvine (*Brunnichia ovata* (Walt.) Shinners].

Drawing of trumpetcreeper [*Campsis radicans* (L.) Seem].

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