EVALUATION OF HERBICIDES ON WEEDS AND SUNFLOWERS IN GEORGIA

By

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Sunflower acreage in the South and Southeastern United States is small compared with that of other commercial crops, however, the acreage is expected to increase because sunflowers appear to be a crop that will fit into a double cropping system.

Growing sunflowers in this area for the first time required information that was not available. Therefore, various studies were initiated on sunflowers at the Georgia Station of the University of Georgia, College of Agriculture in 1969. The objectives of these studies were: (a) to evaluate the performace of herbicides on sunflowers; (b) to determine the system of weed control best adapted for sunflowers; and (c) to determine the effects of weed competition on sunflowers.

It is important to note that all of the data reported in this paper is preliminary, and additional data will be needed before final conclusions can be made.

Herbicide Performance

Preemergence -- Herbicides applied as preemergence to sunflowers on April 11 and June 13 to evaluate crop tolerance and weed control. These two applications in one year evaluated herbicides when both cool and hot weather conditions followed chemical applications.

Sunflower tolerance to several herbicides was good at each application date (Table 1). Most of the treatments controlled goosegrass (Eleusine indica (L.) Gaertn) and crabgrass (Digitaria sanguinalis (L.) Scop.) almost completely, but not morningglories (Ipomoea purpurea (L.) Roth and Ipomoea hederacea Jacq.) and sicklepods (Cassia obtusifolia L.).

Alachlor (2.24 kg/ha) applied in combination with either prometryne (1.12 kg/ha) or chlorpropham (3.36 kg/ha) controlled the highest percentage of broadleaf weeds in both the early and late applications (Table 1). Alachlor + chlorpropham controlled 93% of the broadleaf weeds at the early date and 77% at the late date. Alachlor + prometryne controlled 94% of the weeds at the early date and 86% at the late date. These ratings were made 47 and 32 days after planting for the early and late applications, respectively.

Tolerance of sunflowers to several herbicide treatments differed at the two dates of application (Table 1). C-6313 (3.36 kg/ha) injured sunflowers only slightly when applied in April compared with 94% injury when applied in June. Linuron at 1.40 kg/ha applied alone or 1.12 kg/ha in

combination with chlorpropham at 3.36 kg/ha resulted in 28 and 41% injury at the early application date compared with 79 and 71% injury, respectively, from the late date. When plant injury varies from dates of herbicide application it is usually the amount of rainfall within a three week period following application that is responsible for the damage. In this study injury to sunflowers was less in the early planting from 8.7 cm of rainfall within 7 days than in the late planting from 0.3 cm of rainfall within 7 days, with an additional 1.8 cm from 7 to 14 days for a total of only 4.4 cm of rain within 21 days after the late application. Therefore, the increase in plant injury was probably due to the higher temperature (mean 27°C) at the late planting date compared with lower temperature (mean 17°C) at the earlier application date.

Preplant - EPTC was the only herbicide that adequately controlled broadleaf weeds when incorporated into the soil prior to planting compared with trifluralin and nitralin (Table 2). EPTC injured sunflower plants more than trifluralin or nitralin. However, there was no plant injury when EPTC was injected at the same rate.

Postemergence -- Linuron at 0.56 kg/ha, dinoseb at 1.68 kg/ha, prometryne at 1.12 kg/ha, and C-6313 at 1.12 kg/ha controlled both grasses and broadleaf weeds almost completely and caused no plant injury when applied as a postemergence to 20-to 30- cm plants (Table 3). These herbicides must be directed away from the foliage. If spray comes in contact with the foliage, then that part of the plant will be killed.

Systems of Weed Control

In a study to determine the method of weed control best suited for sunflowers the following treatments were evaluated as a split plot Latin square with three replications. Main plots were untreated check, trifluralin at 0.84 kg/ha, and alachlor + prometryne 2.24 + 1.12 kg/ha; and subplots were uncultivated check, one cultivation, two cultivations, early postemergence of RP17623 at 1.12 kg/ha, early postemergence (RP17623 at 1.12 kg/ha) plus one cultivation, and early postemergence (RP17623 at 1.12 kg/ha) plus late and layby postemergence treatments of linuron at 0.56 kg/ha.

Control of grasses was excellent for all systems of weed control 63 days after planting with the exception of 77% from the early postemergence treatment alone (Table 4). The picture changes for controlling broadleaf weeds at the same time (Table 4). Alachlor + prometryne controlled 78% of the weeds compared with 77% control with one cultivation. Two cultivations controlled 88% of weeds; RP17623 plus late and layby treatments of linuron controlled 90%; and 98% of weeds were controlled when three postemergence treatments were applied to the plot previously treated with alachlor + prometryne. These results indicate that controlling weeds in sunflowers can be satisfactorily obtained with either cultivation or herbicide treatments.

Injury to sunflower plants in plots treated with early postemergence of RP17623 alone or from additional postemergence treatments of linuron was small (Table 4). However, the injury increased when these postemergence treatments were applied to previously treated plots of alachlor + prometryne. This appears to be synergistic as the injury was greater from the combination than from the additive effects from each treatment alone. Combination of trifluralin with these postemergence treatments did not

increase plant injury compared with postemergence treatments alone. Treatments of alachlor + prometryne or trifluralin did not cause any plant injury when applied alone.

There were no interactions in seed yields from the combination of preemergence herbicides with postemergence treatments. When preemergence treatments were disregarded seed yields were as good from plots that received one cultivation (1671 kg/ha) compared with yields from plots that received two cultivations (1699 kg/ha) or early postemergence treatment (RP 17623) plus one cultivation (1499 kg/ha). Yields were also higher from plots that received one cultivation compared with untreated plots (1079 kg/ha) or plots treated with early postemergence alone (1145 kg/ha) or early postemergence plus late and layby postemergence treatments with linuron (1267 kg/ha). The reduction in yields was due to weed competition or plant injury resulting from herbicide treatments.

Weed Competition

Seed of Peredovik variety of sunflowers were planted April 11 and June 13 in a study to determine how competitive sunflowers are with weed species (crabgrass, goosegrass, sicklepod, morningglory, pigweed (Amarathus retroflexus L.), ragweed (Ambrosia artemisufolia L.), and ironweed (Vernonia sp.) in our area. Seed yields from April 11 planting were as good from plots that received one cultivation as from plots that received more than one cultivation (Table 5). This cultivation could be done anytime from 2 to 6 weeks after planting. When planting was delayed until June 13, two cultivations were required for maximum seed yields. Cultivations could be done either at 2 and 4 weeks or 4 and 6 weeks after planting. Since the weed population was approximately the same for both planting dates, these results indicate that sunflowers were more adapted to cool weather conditions than the annual summer weeds grown in our area. Therefore, sunflowers grown in cool to warm weather have a greater ability to compete with weeds than those grown in hot weather.

Summary

The data presented are a progress report and their interpretation may change with additional experimentation. However, the preliminary findings in this report are:

1. Alachlor applied in combination with either chlorpropham or prometryne as preemergence treatments resulting in good weed control with no injury to sunflowers.
2. Sunflower injury from various preemergence herbicide treatments was higher when applied on June 13 than on April 11.
3. Linuron, dinoseb, C-6313, or prometryne can be applied as a directed postemergence to 20- cm sunflower plants, provided the spray is directed away from the foliage.
4. Weeds in sunflowers can be adequately controlled with either cultivation or herbicide treatments.
5. Sunflowers grown in cool to warm weather competed with weeds more than those grown in hot weather.

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Table 1. Effects of preemergence herbicides on weeds and sunflowers at Experiment, Georgia. 1969.

Herbicide		Weed control[1]				Plant injury[2]	
		Grass		Broadleaf			
Treatments	Rates	April 11	June 13	April 11	June 13	April 11	June 13
		%		%		%	
Untreated check	--	0	0	0	0	0	0
Alachlor + chlorpropham	2.24 + 3.36	98	100	93	77	18	0
Alachlor + prometryne	2.24 + 1.12	97	100	94	86	3	6
Alachlor	2.24	97	99	77	69	5	0
DCPA	11.20	97	100	64	46	19	3
DCPA + linuron	6.72 + 1.12	97	98	58	78	33	41
Linuron	1.40	92	93	75	79	28	79
Chlorpropham + linuron	3.36 + 1.12	95	93	85	87	41	71
Prometryne + chloramben	2.24 + 1.68	97	90	71	80	40	0
Linuron + chloramben	1.12 + 1.68	94	97	74	83	40	46
Chloramben	3.36	96	88	63	0	5	4
C-6313	1.68	66	92	50	75	0	33
C-6313	3.36	88	97	70	77	10	94
RP17623	1.12	78	99	71	38	0	3
RP17623	2.24	94	98	89	67	1	3
Diphenamid + dinoseb	2.24 + 1.68	96	94	60	60	8	9
DCPA+prometryne	6.72 + 1.12	96	99	59	79	3	1

1/ Percentage weed control ratings were based on an estimate of total weed population in untreated checks, which consisted approximately 51% sicklepod, 28% morningglory, and 21% goosegrass and crabgrass 47 days after planting on April 11; 53% sicklepod, 21% crabgrass, 15% pigweed, and 11% morningglory 32 days after planting on June 13 where 0 is no control and 100 is complete control.

2/ Sunflower injury ratings were made from a visual estimate of total injury in each plot 47 days after planting on April 11 and 32 days after planting on June 13 where 0 is no injury and 100 is complete kill.

Table 2. Effects of preplant herbicides on weeds and sunflowers at Experiment, Georgia. 1969.

Herbicide Treatments	Rates	Method of application[1/]	Weed control[2/] Grass	Weed control[2/] Broadleaf	Plant injury[3/]
	kg/ha		%	%	%
Untreated check	-	-	0	0	0
Trifluralin	0.84	PDRT	99	66	0
Nitralin	0.84	PDRT	95	68	0
EPTC	3.36	PDRT	96	87	16
EPTC	3.36	Injected	91	87	0
EPTC	2.24	Injected	74	83	0

1/ PDRT was preplant incorporation at 5 cm deep with power driven rotary tiller and injection was applied at planting at 5 cm deep and in 7.6 cm bands.

2/ Percentage weed control ratings were based on an estimate of total weed population in untreated check 42 days after planting, which consisted approximately 34% sicklepod, 37% morningglory, and 29% crabgrass where 0 is no control and 100 is complete control.

3/ Sunflower injury ratings were made from a visual estimate of total injury in each plot 42 days after planting where 0 is no injury and 100 is complete kill.

Table 3. Effects of postemergence herbicides on weeds and sunflowers at Experiment, Georgia. 1969.

Herbicide[1/] Treatments	Rates	Weed control[2/] Grass	Weed control[2/] Broadleaf	Plant injury[3/]
	kg/ha	%	%	%
Untreated check	-	0	0	0
C-6313	0.56	98	86	0
C-6313	1.12	99	93	4
Chloroxuron	1.12	98	81	0
Linuron	0.56	99	96	0
Linuron	1.12	100	96	0
Dinoseb	1.68	99	95	1
GS 16068	0.56	98	71	0
GS 16068	1.12	99	78	0
RP17623	0.56	98	81	0
RP17623	1.12	100	86	0
Prometryne	1.12	99	93	0
Prometryne	2.24	99	96	0

1/ Surfactant added with each herbicide at the rate of 0.5% by volume. Herbicides applied as directed postemergence when sunflowers were 20 to 30 cm.

2/ Percentage weed control ratings were based on an estimate of total weed in untreated check 8 days after postemergence treatment, which consisted approximately 56% crabgrass, 29% sicklepod, 10% morningglory, and 4% pigweed where 0 is no control and 100 is complete control.

3/ Sunflower injury ratings were made from a visual estimate of total injury in each plot 8 days after postemergence treatment where 0 is no injury and 100 is complete kill.

Table 4. Effects of systems of weed control on weeds and sunflowers at Experiment, Georgia. 1969.

Systems			Weed control[3]		
Components	Rates	Days after planting	Grass	Broadleaf	injury[4]
	kg/ha		- - - % - - - - -		%
Untreated check	-	-	0	0	0
1 cultivation	-	18	90	77	0
2 cultivations	-	13 + 28	90	88	0
RP17623	1.12	13			
+ linuron	0.56	24			
+ linuron	0.56	39	92	90	18
RP17623	1.12	13	77	40	12
RP17623	1.12	13			
+ 1 cultivation	-	28	97	88	5
Trifluralin	0.84	1/	100	7	0
" + 1 cultivation	-	18	100	81	0
" + 2 cultivations	-	13 + 28	100	82	0
" + RP17623	1.12	13			
+ linuron	0.56	24			
+ linuron	0.56	39	100	87	17
" + RP17623	1.12	13	100	40	13
" + RP17623	1.12	13			
+ 1 cultivation	-	28	100	85	3
Alachlor + prometryne	2.24 + 1.12	2/	98	78	0
" + 1 cultivation	-	18	100	82	0
" + 2 cultivations	-	13 + 28	99	95	0
" + RP17623	1.12	13			
+ linuron	0.56	24			
+ linuron	0.56	39	100	98	28
" + RP17623	1.12	13	100	79	23
" + RP17623	1.12	13			
+ 1 cultivation	-	28	100	95	5

1/ Trifluralin applied as preplant prior to planting.

2/ Alachlor + prometryne applied as preemergence just after planting.

3/ Percentage weed control ratings were based on an estimate of total weed population in untreated check 63 days after planting, which consisted approximately 47% crabgrass, 41% sicklepod, 7% ironweed, 3% morningglory, and 2% ragweed where 0 is no control and 100 is complete control.

4/ Sunflower injury ratings were made from a visual estimate of total injury in each plot 63 days after planting where 0 is no injury and 100 is complete kill.

Table 5. Effects of weed competition on sunflower yields at Experiment, Georgia. 1969.

Weeded after planting	Planting dates	
	April 11	June 13
weeks	Seed yield kg/ha	
2+4+6+8	1384a[1/]	1109a
2+4	1336a	1045a
4+6	1328a	1068a
2	1361a	801 b
6	1173ab	749 b
8	962 bc	430 c
0	645 c	329 c

1/ Significance based on Duncans Multiple Range Test at 5% level. Mean values with a common letter are not significantly different.

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