Chemical Control of Several Problem Annual Weeds of Cropland

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Contents

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A basic criteria in selecting a chemical for weed control is selectivity. Ideally a herbicide will control the unwanted weeds and not injure the crop. After several years of herbicide utilization in cropping systems it has become apparent that we find a high degree of selectivity in both crop and weed species. In Oklahoma we have found that five annual weed species are highly variable in susceptibility to the herbicides used to control weeds in our crops.

Texas panicum or Colorado grass *(Panicum texanum)* was one of the first weeds to be recognized as a type that was resistant to some of the herbicides used on cultivated cropland in Oklahoma. Considerable work has been conducted by the Oklahoma Agricultural Experiment Station on its growth characteristics and control (3).

The Texas panicum plant can be described as a branching annual with erect stems that root at the lower nodes, usually 25-75 inches tall, branches from the middle and lower nodes and is softly pubescent at least below the nodes and beneath the panicles. The leaves are 6-10 inches long and softly pubescent on both surfaces. The panicles are 3-8 inches long, the branches are short, and the axis and rachises are pubescent with long hairs intermixed. The seeds being numerous are 1/8 inch long and about 1/16 inch wide.

This grass is found from North Carolina to Florida and west to New Mexico (5). In Oklahoma it is found mainly in the peanut and cotton producing areas of the state. It has been shown that the species is resistant to many preplant and preemergence herbicides used for weed control in cotton and peanuts (3).

Brachiaria *(Brachiaria platyphylla),* also called broadleaf signal grass and armgrass, is described as a branching and spreading grass, with linear blades and terminal inflorescence consisting of 2-6 spreading

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racemes along a common axis. The spiklets are single spaced in 2 rows on one side of the winged rachis. The 1/8 inch long seeds are finely, pimply rough. This grass is found from North Carolina to Florida and west to Oklahoma (6). In Oklahoma it is found mainly in the eastern half of the state in the soybean producing areas.

Hop-hornbeam copperleaf (*Acalypha ostryaefolia* Ridd.), also called tea weed or three-seeded mercury, is described as a dark green, minutely pubescent plant. The stems are erect, rather stout, simple or branched and 1-2½ feet tall. The leaves are thick, oval in shape, 2½-4 inches long, with serrated edges, tapered to a gradual point at the end and the petioles are often as long as the blades. The male and female flowers are minute while the bractlets of the female flowers are conspicously lobed. The seed pod is much depressed, 3-lobed and spiny. The seeds are oval, 1/12 inch long and wrinkled (2). It is found from New Jersey to Kansas, and from Florida to Mexico (2). Hop-hornbeam copperleaf is a problem in sandy bottomlands in the southern half of Oklahoma where peanuts are grown.

Prickly sida *(Sida spinosa L.).* also sometimes called tea weed, has a taproot that is slender, branched and rather long, while the stems are erect, branching widely, softly hairy, bearing 2 to 3 short, blunt, spiny projections below each node. The leaves are alternate, simple, and oblong with toothed edges. The flowers have 5 pale yellow petals that are solitary or clustered in axils of leaves. The seed pods when ripe split into 5 one-seeded sections, each with 2 sharp, spreading spines at the top. The seeds are about 1/16 inch long, 3 angled, egg-shaped, and dull, dark reddish-brown in color (2). This annual broadleaf is found from New York to Florida and west to Texas. Prickly sida is a problem in sandy peanut and cotton fields in the southern half of Oklahoma. Baker (6) reports in Mississippi that, "Prickly sida has been present in cotton fields for many years without causing great concern. However, in recent years it has rapidly become very prevalent and is one of the annual weeds most difficult to control in cotton." The best preemergence treatment used was trifluralin incorporated plus fluometuron preemergence while MSMA plus dinoseb applied twice and MSMA plus fluometuron followed by linuron plus dinoseb were the two best postemergence treatments.

Prickly sida has also been on the increase in cotton fields in Louisiana (7). In field studies it was found that semi-directed postemergence application of prometryne at 0.6 pounds per acre (lb/A) gave adequate control of 4-inch weeds while diuron (0.4 lb/A) and fluometuron (0.8 lb/A) were less effective.

Small-flowered morningglory *(Ipomoea lacunosa* L.) is described as an annual with pubescent, sturdy stems twining or trailing up to 10

feet long. The leaves vary from heart shape to 3 lobed and are 2 to 4 inches long. The funnel shaped flowers arising from the leaf nodes are white in color. The fruits are 2 valved with 2-4 black seeds (2). It is found through the south central and southern United States. In Oklahoma it is mainly a problem in the soybean producing regions, with some problems in the peanut and cotton producing areas. In Georgia, vernolate preplant incorporated gave 25 percent control while alachlor applied preemergence gave no control at 1 and 1.5 lb/A and only 15% control at 2.0 lb/A. Alachlor applied preemergence at 2.0 lb/A plus alachlor and DNBP (1.5 + 3 lb/A) at ground cracking gave 68 percent control (4). Wilson and Cole (8) reported that *Ipomoea* species significantly reduced soybean yields and plant height, increased lodging and caused difficulty in harvesting. They found that control of morningglories was needed for 6 to 8 weeks from the date of soybean planting.

Field studies were conducted from 1967 through 1969 at several locations in order to determine the susceptibility of these weed species to herbicides used in Oklahoma.

Materials and Methods

The studies on prickly sida, morningglory, brachiaria and Texas panicum were located at the Agronomy Experiment Station, Stillwater, on a Port silty clay loam soil in 1967 and 1969. In 1968 they were located at the Agronomy Research Farm at Perkins on a Vanoss loam. The field plots, 40 inches wide and 20 feet long, were replicated four times in a randomized block design. Treatments were applied with an experimental plot tractor sprayer as broadcast treatments in 30 gallons of water per acre and incorporated to a depth of 1 to 2 inches with a tractor powered rotary tiller. The plant species were planted with a tractor planter across the plots in rows 20 inches apart.

The copperleaf studies were conducted on sandy loam soils located at Yuba, Oklahoma, in 1968 and at Atwood, Oklahoma, in 1969. The plots, five feet wide and 20 feet long, were replicated four times in a randomized block design. The treatments were applied with an experimental plot tractor sprayer as broadcast treatments in 30 gallons of water per acre and incorporated with a tandem disk to a depth of 2 inches. The stand of copperleaf resulted from natural infestations in productive peanut fields.

After the plots were established they were periodically visited and evaluated. Visual estimates were made of the weed control obtained as a result of the treatments applied to each plot. They were also evaluated by harvesting, drying and weighing plant samples collected from each plot. The area sampled varied among the various experiments and will be stated with the data later. At the time of application of the herbicides

notes were made as to the air and soil temperatures, wind velocity, degree of soil moisture and the growth stage of each species.

Many different herbicides were used in this series of experiments. They are designated by their "common" names or numbers. These differ from the "trade" or "product" names seen on the dealers shelf. Table 1 lists all the herbicides used by common name, chemical name and trade name.

Table 1. Common, Chemical and Product Names of the Herbicides Used

Common	Chemical	Registered Trade Name
Alachlor	2'-chloro-2,6-diethyl-N-(methoxymethyl) acetanilide	Lasso
Amiben	3-amino-2,5-dichlorobenzoic acid	Amiben
Atrazine	2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine	Aatrex
Benefin	N-butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine	Balan
Chloroxuron	3-[p-(p-chlorophenoxy)phenyl]-1,1-dimethylurea	Tenoran
C-6313	N-(4-bromo-3-chlorophenyl)-N'-methoxy-N'-methyl urea	Maloran
C-6989	2,4'-dinitro-4-trifluoromethyldiphenylether	Preforan
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide	Enide
Diuron	3, (3,4-dichlorophenyl)-1,1-dimethylurea	Karmax
Dinoseb	2-sec-butyl-4,6-dinitrophenol	Premerge
Fluometuron	1,1-dimethyl-3-(α,α,α-trifluoro-m-tolyl) urea	Cotoran
Linuron	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea	Lorox
MSMA	monosodium methanearsonate	Ansar 529
Nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropalaniline	Planavin
Naptalam	N-1-naphthylphthalamic acid	Alanap
Prometryne	2,4-bis(isoproplyamino)-6-(methylthia)-s-triaine	Caporal
Propachlor	2,chloro-N-isopropylacetanilide	Ramrod
Propazine	2-chloro-4,6-bis(isopropylamino)-s-trazine	Milogard
Trifluralin	α,α,α-trifluoro-2,6-dinitro-N,N-diprophyl-p-toluidine	Treflan
Vernolate	S-propyl dipropylthiocarbamate	Vernam
2,4-DEP	tris [2-(2,4-dichlorophenoxy) ethy] phosphite	Falone

Results and Discussion

Brachiaria

All treatments were applied under adequate soil moisture conditions. The soil and air temperatures at the time of application were 88°F in 1967 and 96°F and 92°F respectively in 1969. Postemergence treatments were applied when the plants were in the third true leaf stage or 1½ to 2 inches tall. The weed yields reported in Tables 2 and 3 are expressed in grams per plot and were obtained by averaging the harvest of 2-one foot samples from each plot over four replications.

Of the preplant treatments nitralin, trifluralin and benefin treatments resulted in good to excellent control of brachiaria while vernolate caused only poor control (Table 2). The higher rates of fluometuron, prometryne, alachlor and amiben were the most successful preemergence treatments. The rates of 3, 5, 3 and 4 lb/A, respectively, of the above herbicides could be too high for practical use in some crops, therefore, crop tolerance should be considered before using these high rates. The lower rates of the above materials provided good control. The higher

Table 2. The Influence of Preplant and Preemergence Herbicides on the Control and Forage Yield of Brachiaria, 1967 and 1969.

Herbicide	Rate	Percent Weed Control					Weed Yield (gm/plot)	
		1967		1969		Average		
	lb/A	32 Days	55 Days	22 Days	39 Days		1967	1969
PREPLANT INCORPORATED TREATMENTS								
Nitralin	½*	60	60	80	80	--	26	**4 e-l
Nitralin	1*	70	90	100	90	--	2	0 o
Trifluralin	½	80	40	100	100	--	14	0 o
Trifluralin	1*	100	100	100	100	--	0	0 o
Benefin	1	--	--	90	90	90	--	5 e-l
Benefin	2	--	--	100	100	100	--	0 o
Vernolate	2	60	0	--	--	30	47	--
Vernolate	4	30	20	--	--	25	55	--
PREPLANT INCORPORATED + PREEMERGENCE TREATMENTS								
Trifluralin + Prometryne	½ + 2½	--	--	100	100	100	--	0 o
Trifluralin + Alachlor	½ + 1½	--	--	100	100	100	--	0 o
PREEMERGENCE TREATMENTS								
Amiben	2	90	80	70	50	93	8	10 cd
Amiben	4	100	90	100	90	95	3	2 j-m
Fluometuron	1	--	--	70	50	60	--	5 e-j
Fluometuron	1½	80	80	--	--	80	31	--
Fluometuron	2	--	--	90	80	85	--	1 m-o
Fluometuron	3	90	100	--	--	95	1	--
Prometryne	2½	80	70	100	90	85	24	1 m-o
Prometryne	3½	--	--	90	80	85	--	1 m-o
Prometryne	5	90	100	--	--	95	2	--
Alachlor	1½	--	--	90	60	75	--	5 e-j
Alachlor	3	--	--	100	100	100	--	1 m-o
Propazine	1½	40	20	80	60	50	75	12 b
Propazine	3	60	50	80	70	65	53	3 e-j
Propachlor	3	--	--	70	50	60	--	4 f-m
Propachlor	4	100	90	70	60	80	3	2 i-n
Linuron	½	--	--	60	40	50	--	9 cd
Linuron	1	--	--	70	60	65	--	8 de
C-6303	3	50	20	90	90	63	66	1 m-o
C-6313	4	--	--	90	90	90	--	0 o
C-6989	3	40	0	70	60	43	61	7 d-g
C-6989	4	--	--	70	60	65	--	4 g-n
Check	-	0	0	0	0	0	68	22 a

*Both nitralin and trifluralin were used at ¾ and 1½ lb/A in 1967.
**Figures followed by the same letter are not significantly different.

rates of 4 lb/A of propachlor and C-6313 caused good control of brachiaria while the lower rates resulted in only fair control. Propazine, linuron and C-6989 provided only poor to fair control depending on the rate used.

The only postemergence treatment that provided adequate brachiaria control was linuron at 1 or 1½ lb/A (Table 3). This is probably at last partially due to the fact that the plants were over 1 inch tall. Subsequent experience has shown that annual grasses are more successfully controlled postemergence if less than 1 inch tall when treated.

Texas Panicum

Adequate soil moisture was present when the preplant and preemergence treatments were applied. Soil and air temperatures were 87° in 1967 and 96°F and 92°F respectively in 1969. Postemergence treatments were applied when the soil and air temperatures were 90°F in 1967, 78°F in 1968 and 97°F in 1969. Good soil moisture was present for postemergence treatments in 1967 and 1968 but the soil was dry in 1969. The Texas panicum plants were in the 3 to 4 true leaf stage or 1 to 2 inches tall when treated. The weed yields in Tables 4 and 5 were obtained by averaging the harvest of 2 one-foot row samples from each plot over four replications.

Table 3. The Influence of Postemergence Herbicides on the Control and Forage Yield of Brachiaria, 1967 and 1968.

Herbicide	Rate	Percent Weed Control				Weed Yield (gm/plot)	
		1967		1968	Average		
	lb/A	13 Days	36 Days	22 Days		1967	1968
Fluometuron + S*	1	40	10	30	27	38 bcd	3 bc
Fluometuron + S	2	40	10	30	27	27 cde	2 cd
Prometryne + S	¾	70	40	50	53	10 de	1 de
Prometryne + S	1	50	30	60	47	28 cde	2 cd
Chloroxuron + S	3	40	30	10	26	70 ab	4 b
Chloroxuron + S	4	10	10	70	30	52 abc	1 de
Dinoseb	2	--	--	30	30	--	4 b
Dinoseb	3	--	--	40	40	--	3 bc
2,4-DEP + Dinoseb	2+1½	10	10	--	10	28 cde	--
2,4-DEP + Dinoseb	4+1½	60	60	--	60	2 e	--
Linuron	1	--	--	90	90	--	1 de
Linuron	1½	--	--	100	100	--	0 f
Atrazine+S	1½	--	--	60	60	--	3 bc
Atrazine+S	2½	--	--	60	60	--	2 cd
MSMA+S	2½	10	10	--	10	37 abc	--
MSMA+S	4	20	0	--	20	23	--
Atrazine+Oil	1½	30	10	10	17	78 a	6 b
Atrazine+Oil	2½	--	--	10	10	--	5 b
Atrazine+Oil	3	50	10	--	20	54 abc	--
Check	--	0	0	0	0	68 ab	10 a

*The + S means surfactant added at ½% by volume.

Preplant treatments of benefin, nitralin and trifluralin provided good to excellent Texas panicum control. Vernolate was not as successful (Table 4). Several preemergence treatments that provided good control were amiben, prometryne, alachlor and fluometuron at the higher rates. However, they were not quite as successful as the preplant treatments. All other treatments resulted in only fair control.

Several postemergence treatments provided good control, although the results varied somewhat from year to year (Table 5). Control was

Table 4. The Influence of Preplant and Preemergence Herbicides on the Control and Forage Yield of Texas Panicum, 1967 and 1969.

Herbicide	Rate	Percent Weed Control				Weed Yield (gm/plot)		
		1967	1969		Average			
	lb/A	33 Days	22 Days	39 Days		1967	1969	Average
PREPLANT INCORPORATED TREATMENTS								
Nitralin	½*	30	80	80	--	27 i	11 g-k	--
Nitralin	1*	80	100	90	--	2 g	1 k	--
Trifluralin	½*	80	90	80	--	4 bcd	7 i-k	--
Trifluralin	1*	90	100	100	--	1 a	2 k	--
Benefin	1	--	90	80	85	--	5 jk	5
Benefin	2	--	100	90	95	--	1 k	1
Vernolate	2	40	--	--	40	8 ef	--	8
Vernolate	4	30	--	--	30	9 f	--	9
PREPLANT INCORPORATED + PREEMERGENCE TREATMENTS								
Trifluralin + Promteryne	½+2½	--	100	90	95	--	3 jk	3
Trifluralin + Alachlor	½+1½	--	100	100	100	--	0 k	0
PREEMERGENCE TREATMENTS								
Amiben	2	80	80	50	70	2 ab	15 g-k	9
Amiben	4	90	90	80	87	1 ab	10 g-k	6
Prometryne	2½	60	80	60	67	15 g	18 g-k	17
Prometryne	3½	--	60	50	55	--	18 g-k	18
Prometryne	5	80	--	--	80	5 d	--	5
Propazine	1½	30	20	10	20	24 h	51 b-e	38
Propazine	3	20	50	10	27	21 h	38 c-g	30
Propachlor	3	80	60	10	50	4 cd	47 b-f	26
Propachlor	4	--	60	10	35	--	37 c-h	37
C-6313	3	30	70	40	47	17 g	23 f-k	20
C-6313	4	--	80	60	70	--	26 e-k	26
C-6989	3	50	70	50	57	13 g	15 g-k	14
C-6989	4	--	70	30	50	--	16 g-k	16
Alachlor	1½	--	30	20	25	--	67 ab	67
Alachlor	3	--	90	60	80	--	13 g-k	13
Linuron	½	--	30	0	15	--	60 a-c	60
Linuron	1	--	60	20	40	--	36 c-i	36
Fluometuron	1	--	50	30	40	--	27 e-k	27
Fluometuron	1½	80	--	--	80	6 de	--	6
Fluometuron	2	--	90	70	80	--	10 g-k	10
Fluometuron	3	100	--	--	100	0 a	--	--
Check	--	0	0	0	0	51 j	82 a	67

* Both nitralin and trifluralin were used at ¾ and 1½ lb. in 1967.

generally poorer in 1969 when it was quite dry. Linuron, prometryne and fluometuron with surfactants, and 2,4-DEP with dinoseb, provided good control when there was adequate soil moisture.

Copperleaf

The soil moisture conditions were good to excellent for all copperleaf control treatments while the wind velocity varied from 0 to 7 mph. The soil and air temperatures in 1968 were 105°F and in 1969 were 99°F for the preplant and preemergence treatments. The postemergence treatments were applied when the soil and air temperatures were 96°F in

Table 5. The Influence of Postemergence Herbicides on the Control and Forage Yield of Texas Panicum.

Herbicide	Rate	Percent Weed Control			Weed Yield (gm/plot)		
		1967	1968	1969			
	lb/A	23 Days	30 Days	41 Days	1967	1968	Average
Fluometuron+S**	1	70	50	40	3 g	14 g	9
Fluometuron+S	2*	90	85	30	5 fg	2 kl	3
Prometryne+S	¾*	70	70	50	3 g	5 ij	4
Prometryne+S	1	80	80	60	2 g	1 l	2
MSMA+S	2	--	10	10	--	12 gh	12
MSMA+S	2½	40	--	--	8 efg	--	8
MSMA+S	3	--	10	10	--	14 fg	14
MSMA+S	4	60	--	--	4 g	--	4
Chloroxuron+S	3	10	10	10	25 abc	18 c-e	22
Chloroxuron+S	4	20	10	10	20 cde	20 c-e	20
Atrazine+Oil	1½+1 gpa	--	0	0	--	27 b	27
Atrazine+Oil	2½+1 gpa	--	0	10	--	20 c-e	20
2,4-DEP+ Dinoseb	2+1½	90	--	--	1 g	--	1
2,4-DEP + Dinoseb	4+1½	90	--	--	1 g	--	1
Dinoseb	2	--	5	--	--	21 cd	21
Dinoseb	3	--	30	0	--	17 ef	17
Linuron+S	½	--	80	20	--	2 kl	2
Linuron+S	1½	--	90	--	--	0 l	0
Diuron+S	1/5	--	55	0	--	10 h	10
Diuron+S	2/5	--	55	20	--	4 i-k	4
Atrazine+S	1½	--	0	10	--	19 c-e	19
Atrazine+S	2½	--	10	0	--	22 c	22
C-6313+S	1	--	--	30	--	--	--
C-6313+S	2	--	--	60	--	--	--
Dinoseb + Naptalam	1½	--	--	30	--	--	--
Norea + S	1	--	60	--	--	14 fg	14
Norea + S	2	--	70	--	--	3 kl	3
Dalapon	2	--	60	--	--	10 h	10
Dalapon	4	--	75	--	--	5 i	5
Check	--	0	0	0	32 a	32 a	32

*Fluometuron was used at 1½ lb in 1969 only, and prometryne at 1½ to 3 lb in 1969.
**The + S means surfactant added at ½% by volume.

1968 while in 1969 they were 88°F and 70°F. The copperleaf stand resulted from natural infestation with a stand of 90-100 plants per square foot in 1968 at Yuba, Oklahoma, and 25-30 plants per square foot at Atwood in 1969. The plant height, when treated in 1968, varied from ½ to 2 inches tall while in 1969 the average plant height was ½ inch tall. The weed yields in Tables 6 and 7 were obtained by averaging over four replications the harvest of two-foot squares from each plot.

All preplant treatments resulted in poor control of copperleaf. Of the preemergence treatments propazine at 1½ and 3 lb/A and prome-

Table 6. The Influence of Preplant and Preemergence Herbicides on the Control and Forage Yield of Hop-hornbeam Copperleaf, 1968 and 1969.

Herbicide	Rate	Percent Weed Control					Weed Yield (gm/plot)		
		1968		1969		Average			
	lb/A	14 Days	46 Days	14 Days	43 Days		1968	1969	Average
PREPLANT INCORPORATED TREATMENTS									
Nitralin	½	10	0	10	0	5	58 a	15 a-d	33
Nitralin	1	20	0	10	0	8	52 a-d	11 b-h	31
Trifluralin	½	10	0	0	10	5	56 ab	10 b-i	33
Trifluralin	1	20	10	10	10	13	42 a-f	11 b-h	27
Benefin	1	--	--	20	10	15	--	12 b-g	12
Benefin	2	--	--	30	20	25	--	7 d-l	7
PREPLANT INCORPORATED + PREEMERGENCE TREATMENTS									
Trifluralin + Prometryne	½+2½	70	100	--	--	85	0 k	--	0
Trifluralin + Fluometuron	½+1	40	70	--	--	55	28 e-h	--	28
Trifluralin + Alachlor	½+1½	40	10	--	--	25	41 b-f	--	41
PREEMERGENCE TREATMENTS									
Prometryne	2½	90	90	70	70	80	2 k	2 jkl	2
Prometryne	3½	90	100	80	80	88	0 k	1 l	1
Fluometuron	1	50	70	40	40	50	9 jk	7 e-l	8
Fluometuron	2	60	90	70	70	73	0 k	2 jkl	1
Alachlor	1½	60	20	70	30	45	24 ghi	10 b-j	17
Alachlor	3	70	30	80	50	58	18 hij	6 g-l	12
Amiben	2	40	10	80	30	40	31 e-h	6 g-l	19
Amiben	4	40	20	100	50	53	40 b-f	6 g-l	23
Linuron	½	50	10	60	40	40	39 c-g	11 b-h	25
Linuron	1	60	50	60	40	53	11 ijk	6 g-l	9
C-6313	3	--	--	60	50	55	--	3 i-l	3
C-6313	4	--	--	80	60	70	--	6 g-l	6
C-6989	3	--	--	80	40	60	--	12 b-g	12
C-6989	4	--	--	80	40	60	--	6 g-l	6
Propachlor	3	--	--	40	30	35	--	14 b-f	14
Propachlor	4	--	--	60	30	45	--	8 c-l	8
Propazine	1½	--	--	80	90	85	--	0 l	0
Propazine	3	--	--	70	90	80	--	1 l	1
Check	--	0	0	0	0	0	51 a-d	22 a	37

*The + S means surfactant added at ½% by volume.

Table 7. The Influence of Postemergence Herbicides on the Control and Forage Yield of Hop-hornbeam Copperleaf, 1968 and 1969.

Herbicide	Rate	Percent Weed Control				Weed Yield (gm/plot)		
		1968		1969				
	lb/A	10 Days	28 Days	13 Days	29 Days	1968	1969	Average
Linuron+S*	½	100	30	50	50	57	21 hi	1 f	11
Linuron+S	1	100	70	90	70	83	5 ij	1 f	3
Fluometuron+S	1	100	30	80	70	70	53 b-e	2 ef	27
Fluometuron+S	1½	90	60	80	80	78	29 fgh	1 f	15
Prometryne+S	1½	100	80	90	80	88	5 ij	1 f	3
Prometryne+S	3	100	90	90	90	93	1 j	0 f	1
Chloroxuron+S	3	90	20	70	60	60	29 fgh	4 de	17
Chloroxuron+S	5	90	20	80	50	60	27 fgh	3 ef	15
Dinoseb	1½	20	10	30	40	25	76 a	14 a	45
Dinoseb	3	40	10	30	40	30	65 abc	7 cd	36
Diuron+S	0.2	--	--	70	50	60	--	4 de	4
Diuron+S	0.4	100	30	70	50	63	26 gh	3 ef	15
MSMA+S	2	--	--	40	30	35	--	10 b	10
MSMA+S	3	--	--	20	20	20	--	10 b	10
C-6313	1	--	--	90	70	80	--	2 ef	2
C-6313	2	--	--	70	80	75	--	1 f	1
Atrazine+S	1½	--	--	70	90	80	--	0 f	0
Atrazine+S	2½	--	--	80	90	85	--	0 f	0
Atrazine+ Oil	1½+1 gpa	--	--	90	90	90	--	1 f	1
Atrazine+ Oil	2½+1 gpa	--	--	90	100	95	--	0 f	0
Norea+S	¾	80	10	--	--	45	43 d-h	--	43
Norea+S	1½	80	10	--	--	45	49 c-g	--	49
2,4-DEP+ Dinoseb	2+1½	360	10	--	--	35	50 c-f	--	50
Diphenamid+ Dinoseb	3+11½	80	10	--	--	45	63 a-d	--	63
Check	--	0	0	0	0	0	74 ab	12 a	43

*The + S means surfactant added at ½% by volume.

tryne at 2½ and 3½ lb/A provided the best control. Fluometuron at 2 lb/A, C-6313 at 4 lb/A and C-6989 at 3 and 4 lb/A resulted in fair control (Table 6) and were superior to the other preemergence treatments. Combined preplant trifluralin plus preemergence prometryne also provided good control.

Atrazine plus oil at 1½ or 2½ lb/A and prometryne at 1½ or 3 lb/A provided excellent postemergence control of young copperleaf plants (Table 7). Good early copperleaf control was obtained by postemergence use of atrazine, linuron, fluometuron, prometryne, chloroxuron or C-6313 with surfactants. Later in the season the weed reinvaded some of the plots. All other postemergence treatments provided only fair to poor control.

Prickly Sida

All preplant and preemergence treatments were applied under good to excellent soil moisture conditions with a wind velocity which varied

from 3 to 8 mph. In both 1968 and 1969 the air temperature was 92°F while the soil temperature was 94° to 96°. The postemergence treatments were applied under dry soil conditions with a wind velocity of 8-12 mph and soil and air temperatures of 100°F and 95°F respectively. The treatments were applid to prickly sida plants ½ to 1¼ inches tall while the plants were in the two leaf stage.

In general the preplant herbicides did not provide adequate control of prickly sida (Table 8). Good to excellent preemergence control was obtained with prometryne, fluometuron, alachlor, C-6313 and propazine. Amiben and linuron at the high rates were quite effective while C-6989 and propachlor gave only fair control at any rate used.

The best postemergence treatments based on only one years results were C-6313 at 2 lb/A and atrazine at 2½ lb/A with oil. Good to excellent control of sida was obtained with prometryne, linuron and

Table 8. The Influence of Herbicides on the Control of Prickly Sida, 1968 and 1969.

Herbicide	Rate lb/A	Percent Weed Control 1968	1969	Average
PREPLANT INCORPORATED TREATMENTS				
Nitralin	½	0	0	0
Nitralin	1	0	0	0
Trifluralin	½	10	0	5
Trifluralin	1	20	30	25
Benefin	1	--	0	0
Benefin	2	--	20	20
PREPLANT INCORPORATED + PREEMERGENCE TREATMENTS				
Trifluralin + Prometryne	½+2½	100	100	100
Trifluralin + Alachlor	½+1½	70	50	60
Trifluralin + Fluometuron	½+1	100	--	100
PREEMERGENCE TREATMENTS				
Prometryne	2½	80	100	90
Prometryne	3½	100	90	95
Fluometuron	1	90	80	85
Fluometuron	2	100	90	95
Alachlor	1½	90	80	85
Alachlor	3	100	90	95
Amiben	2	100	40	70
Amiben	4	100	80	90
Linuron	½	--	70	70
Linuron	1	--	80	80
C-6313	3	--	90	90
C-6313	4	--	90	90
C-6989	3	--	70	70
C-6989	4	--	70	70
Propachlor	3	--	60	60
Propachlor	4	--	70	70
Propazine	1½	--	90	90
Propazine	3	--	100	100
Check	--	0	0	0

Table 8 (Cont'd.)

Herbicide	Rate	Percent Weed Control 1969	
	lb/A	7 Days	40 Days
	POSTMERGENCE TREATMENTS		
Fluometuron + S*	1	10	0
Fluometuron + S	1½	10	10
Prometryne + S	1½	70	40
Prometryne + S	3	90	80
MSMA + S	2	10	0
MSMA + S	3	20	30
Dinoseb	1½	10	20
Dinoseb	3	50	30
Linuron + S	½	90	60
Linuron + S	1	90	70
Chloroxuron + S	3	100	90
Chloroxuron + S	5	100	90
C-6313 + S	1	100	80
C-6313 + S	2	100	100
Atrazine + S	1½	90	60
Atrazine + S	2½	90	90
Atrazine + Oil	1½+1 gpa	100	90
Atrazine + Oil	2½+1 gpa	100	100
Diuron + S	1/5	30	10
Diuron + S	2/5	50	10
Dinoseb + Naptalam	1½ gpa	10	0
Check	---	0	0

*The + S means surfactant added at ½% by volume.

atrazine at the higher rates of 3, 1 and 2½ lb/A respectively. Chloroxuron plus surfactant and atrazine plus oil all provided excellent control at all rates used. The rest of the treatments in Table 8 gave only fair to poor control.

Morningglory

The soil moisture conditions were good to excellent for all treatments applied. The soil and air temperatures for 1967 were 87°F while the soil temperatures for 1968 and 1969 were 92°F and 96°F and the air temperatures were 86°F and 92°F respectively. The wind velocity varied from 3 to 5 mph for all the postemergence treatments while the soil and air temperatures were 90°F in 1967, 76°F in 1968 and 95°F and 111°F in 1969. The morningglory plants were ½ to 1 inch tall or in the one true leaf stage when treated postemergence (Table 10). In 1969 a second postemergence study was applied to plants that were 1 to 1½ inches tall or in the 3 to 4 true leaf stage (Table 11). The weed yields in Tables 9, 10 and 11 were obtained by averaging 4 one-foot row samples from each plot over four replications.

Table 9. The Influence of Preplant-Preemergence Herbicides on the Control and Forage Yield of Morningglory, 1967, 1968 and 1969.

Herbicide	Rate	Percent Weed Control				Weed Yield (gm/plot)			
		1967	1968	1969	Average	1967	1968	1969	Average
	lb/A	33 Days	35 Days	39 Days					
PREPLANT INCORPORATED TREATMENTS									
Nitralin	½	10	40	0	17	35 a-d	23 f-j	14 b-f	25
Nitralin	1	10	60	10	27	21 d-i	22 h-k	10 d-k	18
Trifluralin	½	20	40	0	20	28 b-f	26 f-j	24 a	26
Trifluralin	1	50	60	10	40	5 j	14 ijk	12 b-h	10
Benefin	1	--	--	0	0	--	--	19 abc	19
Benefin	2	--	--	40	40	--	--	8 e-l	8
PREPLANT INCORPORATED + PREEMERGENCE TREATMENTS									
Trifluralin + Prometryne	½+2½	--	90	80	85	--	1 k	10 d-k	6
Trifluralin + Fluometuron	½+1	--	80	--	80	--	1 k	--	1
Trifluralin + Alachlor	½+1½	--	50	30	40	--	28 f-j	12 b-i	20
PREEMERGENCE TREATMENTS									
Amiben	2	10	0	0	3	47 a	68 abc	23 a	46
Amiben	4	10	0	0	3	37 a-d	63 bcd	20 ab	40
Linuron	½	--	10	0	10	--	77 ab	18 a-d	32
Linuron	1	--	10	20	15	--	46 d-g	16 a-e	21
Prometryne	2½	60	--	80	70	10 g-j	--	1 l	6
Prometryne	3½	80	--	80	80	5 j	--	1 l	3
C-6313	3	20	--	40	30	26 c-g	--	7 f-l	17
C-6313	4	--	--	50	50	--	--	8 e-l	8
Fluometuron	1*	80	90	60	70	4 j	1 k	3 i-l	2
Fluometuron	2*	100	100	80	90	0 j	1 k	3 i-l	2
C-6989	3	40	--	60	50	28 b-e	--	5 g-h	17
C-6989	4	--	--	70	70	23 d-h	--	4 h-l	14
Alachlor	1½	--	--	30	30	--	--	9 e-l	9
Alachlor	3	--	--	50	50	--	--	6 g-l	6
Propachlor	3	--	--	30	30	--	--	11 c-j	11
Propachlor	4	50	--	30	30	14 e-j	--	9 e-l	9
Propazine	1½	90	--	90	90	1 j	--	1 l	1
Propazine	3	100	--	100	100	1 j	--	0 l	1
Check	--	0	0	0	0	38 a	52 cde	13 b-g	34

*Fluometuron was used at 1½ to 3 lbs in 1967 only.

As shown in Table 9 adequate control was not obtained with any preplant treatments. However, the addition of a preemergence treatment to preplant trifluralin improved the control obtained. Prometryne, fluometuron and propazine preemergence treatments provided at least 80 percent control of morningglory. Propazine was particularly effective (Table 9). Most of the other preemergence treatments could not be considered to provide adequate control.

The postemergence treatment which provided the best control was atrazine at 1½ or 2½ lb/A plus 2 gpa of oil when the morningglory plants were ½ to 1 inch tall (Table 10). Prometryne at 3 lb/A, atrazine at 2½ lb/A with 1 gpa of oil and chloroxuron at 1 lb/A provided good

control of morningglory. All other treatments applied gave only fair to poor control.

Treatment of morningglory in the 3 to 4 true leaf stage or when the plant was 1 to 1½ inches tall was found to be relatively ineffective (Table 11). The failure to obtain control after the plant has passed the one inch stage shows the importance of applying the herbicides when the plants are small and in a susceptible stage.

Table 10. The Influence of Postemergence Herbicides on the Control and Forage Yield of Morningglory, ½ to 1 inch tall, 1967, 1968, and 1969.

Herbicide	Rate	Percent Weed Control				Weed Yield (gm/plot)			
		1967	1968	1969	Average				
	lb/A	23 Days	35 Days	39 Days		1967	1968	1969	Average
Fluometuron	1	60	10	30	33	11 c-f	32 e-i	9 b-e	17
Fluometuron	1½	--	--	30	30	--	--	8 b-f	8
Fluometuron	2	100	20	--	60	1 f	10 ijk	--	6
Linuron+S	½	--	30	50	40	--	32 e-i	12 a-d	22
Linuron+S	1	--	40	50	45	--	24 g-k	6 c-g	15
Chloroxuron +S	3	10	20	80	37	39 a	30 e-i	2 fg	24
Chloroxuron +S	4	30	--	--	30	22 bc	--	--	22
Chloroxuron +S	5	--	50	90	70	--	10 i-k	0 g	5
Diuron+S	1/5	--	--	60	60	--	--	2 fg	2
Diuron+S	2/5	--	60	70	65	--	11 ijk	3 e-g	7
Dinoseb	1½	--	10	60	35	--	38 e-h	2 e-g	20
Dinoseb	3	--	20	60	40	--	23 g-k	2 e-g	13
Atrazine+S	1½	--	--	50	50	--	--	6 c-g	6
Atrazine+S	2½	--	--	60	60	--	--	4 e-g	4
Atrazine+ Oil	1½+1 gpa	--	--	60	60	--	--	5 d-g	5
Atrazine+ Oil	1½+2 gpa	100	--	--	100	1 f	--	--	1
Atrazine+ Oil	2½+1 gpa	--	--	80	80	--	--	1 fg	1
Atrazine+ Oil	3+2 gpa	100	--	--	100	2 ef	--	--	2
Dinoseb+ Naptalam	1+2	--	--	60	60	--	--	4 e-g	4
Naptalam	3+1½	--	20	--	20	--	29 f-j	--	29
2,4-DEP+ Dinoseb	2+1½	70	30	--	50	6 def	21 h-k	--	14
Diphenamid+ Dinoseb	3+1½	--	20	--	20	--	30 f-j	--	30
Prometryne +S	¾	40	--	--	40	18 bcd	--	--	18
Prometryne +S	1	70	--	--	70	3 ef	--	--	3
Prometryne +S	1½	--	--	70	70	--	--	2 fg	2
Prometryne +S	3	--	--	80	80	--	--	0 g	0
Check	--	0	0	0	0	38 a	52 c-e	14 ab	35

Table 11. The Influence of Postemergence Herbicides on the Control and Forage Yield of Morningglory, 1-1½ Inches Tall, 1969.

Herbicide	Rate lb/A	Percent Weed Control 4 Days	18 Days	Weed Yield (gm/plot)
Fluometuron	1	10	30	8 a-h
Fluometuron	1½	20	30	8 a-h
Linuron+S*	½	20	40	7 b-h
Linuron+S	1	30	30	4 f-h
Chloroxuron+S	3	20	40	2 f-h
Chloroxuron+S	5	30	30	5 e-h
Diuron+S	1/5	20	0	12 a-d
Diuron+S	2/5	20	10	12 a-d
Dinoseb	1½	50	50	7 b-h
Dinoseb	3	90	60	2 gh
Atrazine+S	1½	20	20	9 a-g
Atrazine+S	2½	20	30	6 a-h
Atrazine+Oil	1½+1 gpa	30	40	6 d-h
Atrazine+Oil	2½+1 gpa	50	50	6 d-h
Dinoseb+Naptalam	1½ gpa	50	20	7 b-h
Prometryne+S	1½	40	40	10 a-f
Prometryne+S	3	60	60	5 e-h
Check	--	0	0	19 a

*The + S means surfactant added at ½% by volume.

Summary

Several herbicides were evaluated as to their effectiveness for controlling five annual weed species, brachiaria, Texas panicum (Colorado grass), prickly sida (tea weed), copperleaf and morningglory. The experiments were conducted in pure stands of the weeds, with no crops present. The herbicides were applied either as preplant incorporated, preemergence or postemergence treatment with some herbicides being applied at more than one stage of development. The degree of control of the various species varied from excellent to very little control depending upon the rate of herbicide used and the herbicide being used. For this reason in summarizing we will discuss the various chemicals for the control of each weed species in turn.

Brachiaria was more readily controlled with preplant and preemergence treatments than with postemergence, the only postemergence treatment giving excellent control being linuron. Trifluralin and benefin used either as preplant treatments or preplant in conjunction with a preemergence treatment provided excellent control of brachiaria. Preemergence applications of amiben, prometryne, fluometuron, alachlor, propachlor and C-6313 provided good to excellent control of brachiaria. Fair to good control was achieved with nitralin, propazine, linuron and C-6989. Prometryne and atrazine applied as postemergence treatments gave fair control but all other postemergence treatments were less successful.

As with brachiaria, the best control of Texas panicum was achieved with either the preplant or preemergence treatments. Trifluralin, benefin and nitralin as preplant treatments provided good to excellent control of the Texas panicum. The so-called "dual" treatments of incorporated trifluralin with preemergence prometryne or alachlor also provided excellent control of this grass. Amiben, alachlor, fluometuron and prometryne among the preemergence treatments provided good control of Texas panicum. Other preemergence treatments such as C-6989, propazine, propachlor, C-6313 and linuron provided only fair to poor control. Of the postemergence treatments again the linuron plus surfactant treatment was the most successful for controlling the Texas panicum. None of the other postemergence treatments was rated any better than fair for control of this annual grass.

The annual broadleaf species were generally much more resistant to preplant incorporated treatments than were the annual grasses. For instance, poor control of prickly sida was obtained from the preplant incorporated treatments. However, several preemergence treatments provided excellent control of prickly sida. Some of these were alachlor, propazine, fluometuron, prometryne and C-6313. Amiben, propachlor, linuron and C-6869 were evaluated as fair to good for the control of prickly sida as preemergence treatments. Several postemergence treatments provided excellent control of prickly sida, including C-6313, chloroxuron and atrazine with surfactant or with oil. Prometryne and linuron with surfactants added also provided good control. The other postemergence treatments were not as successful for prickly sida control.

The control of copperleaf was no better than fair with any of the preplant treatments. Propazine and prometryne used preemergence did provide good control and were probably more successful than any of the other preemergence treatments. Amiben, alachlor, fluometuron, C-6989, linuron and C-6313 provided only fair control of copperleaf as preemergence treatments. The most successful treatments were the copperleaf control obtained with prometryne with surfactant and atrazine with oil as postemergence treatments. Atrazine with surfactant was rated as good control. The other postemergence treatments were evaluated as providing only fair to poor control of copperleaf.

The preplant incorporated treatment also did not provide good control of morningglory unless they were used in combination with preemergence herbicides such as fluometuron or prometryne. Several preemergence treatments were quite successful, particularly propazine and fluometuron, with prometryne providing fairly good control of morningglory. Postemergence treatments used in these experiments were not particularly successful for the control of morningglory with the exception of the excellent control obtained with atrazine plus oil. All other post-

emergence treatments provided only fair control of morningglory. Some of these treatments were fluometuron, prometryne, chloroxuron, diuron and atrozine with surfactant.

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