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WEED CONTROL RESEARCH IN GUAR IN TEXAS AND OKLAHOMA 1961-72

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Cover photo

Pigweed (carelessweed) competes with guar grown without adequate chemical and cultural control methods—crop height and pod production are decreased, and harvesting losses are increased.

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Summary

To improve weed control technology and to stimulate interest in obtaining herbicide labels[1] for guar, preplant incorporated, preemergence and postemergence applications of herbicides were made in Western Oklahoma and the Panhandle area of Texas from 1961 to 1972. Soil types varied from loam to sand.

Dinitroanaline herbicides including trifluralin (Treflan), nitralin (Planavin), dinitramine (Cobex) and CGA 10832 (Tolban), applied prior to planting and incorporated with a tandem disk, safely controlled weeds in the crop when seed were planted in warm soil. Plantings in cold soil after application of trifluralin resulted in injury to the crop in one test. DCPA (Dacthal) and EPTC (Eptam) were very effective against weeds in Oklahoma tests but failed to give consistent results in Texas.

Herbicides applied preemergence at planting that controlled pigweed, sandbur or crabgrass without injuring the crop were DCPA, linuron (Lorox), chloramben (Amiben), alachlor (Lasso), diphenamid (Dymid or Enid), nitralin and diuron (Karmex).

Many herbicides were evaluated for postemergence use. Only MSMA and bentazone (Basagran) appear to have promise for this purpose in guar.

Herbicides did not affect gum content or protein percent of guar seed regardless of whether plants were injured or not.

CAUTION: The only herbicide labeled for use in guar is trifluralin (Treflan) which is to be incorporated prior to planting. Although other herbicides named in this report may appear to be safe on guar, they should not be so used unless a registration is specifically granted by state or federal authorities.

Weed Control Research in Guar in Texas and Oklahoma 1961-72

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New crops are of vital interest as alternatives in rotations, supplemental income, production on diverted acreage and stimulation of new jobs and industries. Guar [*Cyamopsis tetragonoloba* (L.) Taub.] is a warm-season legume that produces galactomannan gum. Guar gum is a binding agent with many industrial and foodstuff uses. Although guar is grown primarily for cash sale, yields of cotton and other crops have been increased when grown in rotation with guar. Lint yields of dryland cotton have been increased 60 pounds per acre due to rotation with guar, compared to continuous cotton production. This advantage probably is a result of nitrogen fixation by the leguminous crop (6).

Guar was probably first introduced into the United States in 1903 as a U.S. Department of Agriculture plant induction from India (4). Since then, the crop has been evaluated in several areas and found to be well suited for the Southwest due to the soils, long growing season, high temperatures and its drouth-tolerant characteristics.

Extensive research in guar improvement, diseases, cultural practices and genetics have been conducted in Texas (1). Research in Oklahoma and other areas has been summarized (4). Presently guar production is concentrated primarily in the Rolling Plains area in southwestern Oklahoma and West Texas where commercial processing facilities for guar are located. Guar acreage in the Texas-Oklahoma region in 1971 was estimated at 200,000 acres.

Successful production of any crop is highly dependent on economical control of other unwanted vegetation. Thus, commercial acceptance and production of guar depends on the reliability and cost of eliminating weed competition. Some of the first herbicide studies in guar were conducted by Elder, Matlock and Santelmann (2, 3) who found that naptalam (Alanap) and EPTC (Eptam) were safe on guar. McMurphy (5) showed that 2,4-DB (Butyrac or Butoxone) at 2 pounds per acre could be used as a postemergence treatment on guar. However, none of these chemicals have been registered for commercial use on guar due to the relatively small acreage in relation to costs and difficulties in obtaining a federally approved label.

Since 1965, guar acreage has expanded rapidly, increasing the potential market for herbicides. However trifluralin (Treflan), which was for preplant incorporation, is the only labeled herbicide for the crop. Some general observations and techniques for control of weeds in guar were summarized in relationship to common cultural and production practices for the crop (7). Frequently, guar is planted flat or furrow-planted, and the crop is cultivated to control weeds. However, low-set seed pods are difficult to harvest since soil that is ridged up in the row during cultivation hampers combining and increases harvest losses. Covering branches with soil during cultivation tends to promote southern leaf blight.

The objective of this research was to develop safe, effective herbicides for weed control that would help minimize production costs in guar. Weed research, conducted over a 12-year period at several locations in Texas and Oklahoma, is presented to summarize

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data for the guar industry and to stimulate interest in obtaining labels for herbicides for commercial use in guar.

MATERIALS AND METHODS

Preplant Treatments

Perkins, Oklahoma

Trifluralin (Treflan), DCPA (Dacthal) and EPTC (Eptam) (see Appendix 1 for a complete description) were investigated for weed control and guar tolerance for 4 years on Norge loam between 1961 and 1966. Chemicals were incorporated with a garden rototiller, and Groehler-2 or Brooks guar was planted. Plots were two rows by 25 feet or larger with three replications, and herbicides were applied in 30 gallons of water per acre. The plot area was infested with pigweed (carelessweed or *Amaranthus hybridus* L. or *A. albus*) or smooth crabgrass [*Digitaria ischaemum* (Schreb.) Muhl.].

Wellington, Texas

Preplant herbicide treatments were investigated in 1967 and 1969 on Amarillo fine sandy loam. Herbicides were applied in 40 gallons of water per acre, and plots were four rows by 30 or 35 feet with three replications. Trifluralin, nitralin (Planavin) and DCPA were incorporated twice with a tandem disk before soil was listed into beds. In 1967 chemicals were applied April 17, and Hall guar was planted the same day. Rainfall amounted to 0.8 inch within 17 days after planting. In 1969 treatments were applied May 23, and Hall guar was planted June 9. Rainfall totaled 2.5 inches within 11 days after planting. Injury to guar and control of pigweed were visually estimated in early July in both trials. Yields were obtained in 1969.

Lubbock, Texas

Preplant trials were conducted in 1971 and 1972 on Amarillo loam. Plots were four rows by 35 feet with three replications of treatments. Herbicides were applied in 15 gallons of water per acre with a tractor-mounted plot sprayer and were immediately incorporated twice with a tandem disk before soil was listed into beds. In 1971 trifluralin, nitralin and DCPA were applied in late April, and Brooks guar was planted in early June. Pigweed control, guar injury and seed yield of guar were evaluated.

In 1972 trifluralin, nitralin, dinitramine (Cobex) and CGA-10832 (Tolban) were applied in mid to late March in two experiments. Chemicals were incorporated twice with a tandem disk, and soil was bedded in mid to late March. Brooks guar was planted in mid July to evaluate crop tolerance. Only guar injury and stand were recorded since weeds were not present in plots. Since seed yields were low, fresh weights of guar plants were obtained to evaluate herbicide injury.

Preemergence Treatments

Perkins, Oklahoma

Preemergence weed control experiments in guar were conducted from 1961 to 1966 with the same conditions as previously described for preplant studies. Preemergence treatments were applied within 1 day after planting. In all instances, 0.7 to 1.0 inch of rainfall occurred within 3 to 10 days after planting, except in 1966. In 1966, 1.1 inches of rainfall occurred 1 month after planting. Injury to guar and control of pigweed and smooth crabgrass were visually estimated 3 to 4 weeks after planting. Seed yields of guar were obtained in 1961, 1962 and 1963 by hand harvesting plants and mechanically threshing seed.

Lubbock, Texas

Two preemergence trials were conducted on loam in 1971. Herbicides investigated were trifluralin, alachlor (Lasso), diuron (Karmex), prometryne (Caparol), dipropetryn (Sancap), terbutryn (Igran), ametryne (Evik) and cyanazine (Bladex). In experiment 1 Brooks guar was planted in early June, and herbicides were sprayed the following day. Rainfall was 0.4 inch within 4 days after planting. In experiment 2 herbicides were applied in late May, but guar had to be replanted 20 days later due to soil crusting, sand damage and light hail. Total rainfall was 2.2 inches within 10 days after herbicide application. All plots were four rows by 35 feet with three replications. Pigweed control and guar injury were visually estimated 4 weeks after planting, and plots were hand harvested and threshed to determine seed yields.

Brownfield, Texas

In 1971 Brooks guar was furrow-planted in Brownfield sand in late May but was replanted, with minimum soil disturbance, 11 days later after severe sand damage. In 1972 Brooks guar was planted in late May, and herbicides were applied the same day. In both years 0.5 inch or more rainfall occurred within 2 days after application. Sandbur (*Cenchrus* spp.) and pigweed control were evaluated in 1971 and 1972, respectively. Guar stand was determined both years, and yields were obtained in 1972.

Postemergence Treatments

Tolerance of guar to postemergence herbicide treatments was evaluated in two experiments on loam

TABLE 1. WEED CONTROL AND TOLERANCE OF GUAR TO PREPLANT HERBICIDE TREATMENTS ON LOAM NEAR PERKINS, OKLAHOMA[1]

Herbicide	Rate (lb./acre)	No. of years evaluated	Pigweed control (%)	Crabgrass control (%)	Guar injury (%)	Yield (lb./acre) 1962	Yield (lb./acre) 1963
Untreated control			15	18	0	210	560
Trifluralin	0.75	4	90	98	22		480
	1.5	4	90	95	18		400
EPTC	4.0	4	88	67	5	280	480

[1]Several experiments were conducted between 1961 and 1966; however, since all of the above treatments were not included in the same experiments, data were not statistically analyzed for this table.

in Lubbock, Texas, in 1971. In one experiment, Brooks guar was planted June 8, and herbicides were applied 1 month later when guar was 4 to 6 inches tall and pigweed was 1 inch tall. In a second experiment, Brooks guar was planted June 24 and was treated 1 month later when the weed-free guar crop was 10 inches tall. Plots were four rows by 35 feet with three replications. Treatments included MSMA, bromoxynil (Brominal or Buctril), bentazone (Basagran), chloroxuron (Tenoran or Norex), prometryne and methoxone (Probe). Chemicals were sprayed over the top of the crop in 15 gallons of water per acre containing 0.5-percent surfactant. Guar injury was visually estimated 3 weeks after treatment, and yields were obtained by hand harvesting 20 or more feet of row in mid-October.

A trial was conducted in 1972 based on chemicals that exhibited postemergence selectivity on guar the previous year. Brooks guar was planted in late May on sandy loam. MSMA, bromoxynil, bentazone and chloroxuron were applied over the top of guar at three dates (June 21, July 26 and August 9) to evaluate guar tolerance in relation to crop size and development. Guar injury was visually estimated 5 days after each application date, and yields were obtained in early October. Plots were two rows by 20 feet with three replications.

RESULTS AND DISCUSSION

Preplant Treatments

Perkins, Oklahoma

Trifluralin at 0.75 or 1.5 pounds per acre gave 90-percent control of pigweed and 95- to 98-percent control of crabgrass (Table 1). Weed control with EPTC was not as consistent as with trifluralin. In 1963 guar yields tended to be lower where either herbicide was applied.

Wellington and Lubbock, Texas

Trifluralin and nitralin were highly effective in controlling pigweed on two soil types, although some pigweed was not controlled at 0.5 pound per acre on fine sandy loam in 1967 (Table 2). Pigweed control with DCPA, EPTC or vernolate (Vernam) was not as high or consistent as with trifluralin or nitralin except in 1969 when all treatments were effective.

Guar seedlings were visibly injured by trifluralin on fine sandy loam and loam; however, yields tended to be lower only where the high rate of trifluralin was applied on loam (Table 2). EPTC or vernolate injured guar, but yields were not affected later. There was no indication that nitralin or DCPA affected guar.

TABLE 2. PIGWEED CONTROL AND GUAR RESPONSE TO PREPLANT HERBICIDE TREATMENTS ON FINE SANDY LOAM AND LOAM SOIL IN TEXAS[1]

Herbicide	Rate (lb./acre)	Pigweed control (%) Fine sandy loam 1967	Pigweed control (%) Fine sandy loam 1969	Pigweed control (%) Loam 1971	Guar injury (%)[2] Fine sandy loam, 1969	Guar injury (%)[2] Loam	Yield (lb./acre) Fine sandy loam, 1969	Yield (lb./acre) Loam
Untreated control		0^{c}	0^{b}	0^{b}	0^{c}	3^{b}	910^{ab}	420^{b}
Trifluralin	0.5	76^{ab}	100^{a}	100^{a}	43^{b}	33^{b}	735^{ab}	800^{a}
	1.0	93^{a}	100^{a}	97^{a}	67^{a}	87^{a}	1000^{ab}	240^{b}
Nitralin[3]	0.5	67^{ab}	96^{a}	100^{a}	3^{c}	17^{b}	1020^{a}	700^{a}
	1.0	93^{a}	97^{a}	100^{a}	3^{c}	13^{b}	972^{ab}	802^{a}
DCPA	6.0	67^{ab}	96^{a}		0^{c}		880^{ab}	
	10.0	76^{ab}	100^{a}	87^{a}	3^{c}	17^{b}	710^{b}	800^{a}
EPTC	4.0	10^{c}	100^{a}		27^{bc}		980^{ab}	
Vernolate	4.0	49^{bc}	98^{a}		37^{b}		870^{ab}	

[1]Fine sandy loam soil was at Wellington, and loam soil was at Lubbock. Means with the same letter are not different ($P<0.05$).
[2]No injury was observed on guar in 1967 on fine sandy loam.
[3]Nitralin was applied at 0.75 and 1.5 pounds per acre on loam at Lubbock.

Since some guar injury was observed from trifluralin, additional experiments were conducted in 1972 in which high rates of similar herbicides were applied, and guar was planted after soil was warm (data not shown). When trifluralin was applied at 0.5, 1.0 and 2.0 (four times the recommended rate) pounds per acre, there was no indication of injury to guar seedlings, and crop stand was not affected. Similar safety and guar tolerance were observed with nitralin at 1.5, dinitramine at 1.0 or CGA-10832 at 1.0 pounds per acre, all of which are similar to trifluralin in chemical structure, soil activity and mode of action. Consequently, where these herbicides (dinitroaniline chemicals) are disk incorporated, guar growth is comparable to or greater than in untreated controls when the crop is planted at the proper time in warm soil. This safety may be lacking when seed is planted in cool or wet soil, and chemicals tend to increase the usual stresses on seedlings as they emerge.

Preemergence Treatments

Perkins, Oklahoma

Control of pigweed and crabgrass with preemergence herbicides in Oklahoma was excellent with DCPA, linuron (Lorox), chloramben (Amibem) at 4 pounds per acre and diphenamid (Dymid or Enide) (Table 3). All of these treatments were evaluated for 2 to 5 years and consistently gave good to excellent weed control each year. Slight guar injury occurred from linuron at 2 pounds per acre or diphenamid, and in 1 out of 2 years yields tended to be lower than in untreated controls. Chloramben at 4 pounds per acre gave significant injury to guar, but yield was only slightly affected 1 out of 4 years. Although chlorpropham (Chloro IPC) or propachlor (Ramrod) were safe to use on guar, broadleaf and grass control was generally less than 80 percent under the warm dry conditions in southwestern Oklahoma.

Lubbock, Texas

In trials on loam soil, preemergence treatments were applied after guar was planted in one experiment, and in another experiment guar was replanted 20 days after the initial herbicide application (Table 4). Trifluralin, which is usually disk incorporated, gave 90-percent pigweed control when applied at 1 pound per acre. However, the herbicide was not effective at lower rates or when guar was replanted. Although slight crop injury was observed, preemergence application of trifluralin tended to enhance yields. Alachlor at 1 pound per acre gave 97-percent pigweed control, but weeds were not controlled where guar was replanted in alachlor-treated soil. Guar tolerance to alachlor was excellent, and yields were not affected in these trials. However, severe guar injury occurred in trials near Vernon, Texas, in 1973 (J. R. Mulkey, unpublished data), indicating that crop injury can occur under some conditions. Pigweed control with diuron was good to excellent, but the herbicide was not effective after replanting. Yields tended to be higher where diuron was applied, compared to untreated controls.

Several *s*-triazine herbicides (prometryne, dipropetryn, terbutryn, ametryne and cyanazine) consistently controlled pigweed and were still effective at the higher rates when guar was replanted. However, guar stand was reduced and/or seedlings were discolored from these *s*-triazines that have shown tolerance on several other agronomic crops. In all instances, yields were reduced in either the initial or replanted stands, further indicating the lack of guar tolerance to this herbicide group. SAN-9789 (Zorial), a new herbicide being developed for cotton, was effective on pigweed in the initial planting, but not when guar was replanted. Guar exhibited excellent tolerance to SAN-9789—yields were not affected in either the initial or replanted stands.

Brownfield, Texas

Preemergence herbicide treatments are consistently more phytotoxic on sandy soils than on heavier soil types with higher clay and organic matter contents. Consequently, preemergence herbicides were evaluated for 2 years on a Brownfield sand (Table 5).

TABLE 3. WEED CONTROL AND GUAR TOLERANCE TO PREEMERGENCE HERBICIDE TREATMENTS ON LOAM NEAR PERKINS, OKLAHOMA[1]

Herbicide	Rate (lb./acre)	No. of years evaluated	Pigweed control (%)	Crabgrass control (%)	Guar injury (%)	Yield (lb./acre)	
						1962	1963
Untreated control			15	18	0	210[a]	560[ab]
DCPA	8	3	96	93	3	405[a]	580[ab]
Linuron	1	2	90	80	0	340[a]	670[a]
	2	2	95	95	10	300[a]	330[c]
Chloramben	2	5	76	80	8	270[a]	620[ab]
	4	4	95	87	22	370[a]	480[bc]
Diphenamid	6	5	94	92	8	350[a]	450[bc]
Chlorpropham	4	3	76	80	3		570[ab]
Propachlor	5	3	80	86	6		

[1]Several experiments were conducted between 1961 and 1966; however, since all treatments were not included in the same experiments, data on weed control and guar injury were not statistically analyzed. Means of guar yields, followed by the same letter, are not significantly different ($P < 0.05$).

TABLE 4. GUAR INJURY AND STAND AND PIGWEED CONTROL AFTER PREEMERGENCE HERBICIDE APPLICATIONS ON LOAM NEAR LUBBOCK, TEXAS, IN 1971[1]

Herbicide	Rate (lb./acre)	Pigweed control (%)		Guar injury (%)		Yield (lb./acre)	
		Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2
Untreated control		0^{d}	0^{e}	7^{d}	0^{d}	670^{a}	620^{a-d}
Trifluralin	0.5	77^{bc}	43^{cd}	10^{cd}	7^{cd}	635^{a}	720^{ab}
	1.0	90^{ab}	57^{bc}	17^{cd}	13^{cd}	790^{a}	820^{a}
Alachlor	1.0	97^{a}	0^{e}	0^{d}	7^{cd}	680^{a}	840^{a}
	2.0	100^{a}	53^{c}	7^{d}	20^{bcd}	800^{a}	540^{bcd}
Diuron	0.5	73^{c}	0^{e}	3^{d}	0^{d}	830^{a}	700^{ab}
	1.0	87^{abc}	30^{cd}	20^{cd}	3^{cd}	750^{a}	790^{a}
Prometryne	1.0	100^{a}	63^{bc}	33^{cd}	27^{cd}	600^{ab}	450^{cd}
	2.0	100^{a}	93^{a}	80^{a}	87^{a}	100^{d}	220^{ef}
Dipropetryn	1.5	97^{a}	43^{cd}	7^{d}	37^{bcd}	540^{ab}	770^{ab}
	3.0	100^{a}	83^{ab}	33^{bc}	60^{ab}	320^{bcd}	460^{cd}
Terbutryn	1.6	97^{a}	60^{bc}	23^{cd}	47^{abc}	290^{cd}	690^{abc}
Ametryne	1.0	100^{a}	63^{bc}	53^{b}	53^{ab}	330^{bcd}	410^{de}
Cyanazine	1.0	93^{a}	37^{cd}	27^{c}	17^{cd}	730^{a}	650^{abc}
	2.0	100^{a}	87^{ab}	87^{a}	33^{bcd}	640^{a}	180^{e}
SAN-9789	1.0	90^{ab}	33^{cd}	0^{d}	0^{d}	680^{a}	710^{ab}

[1]In Experiment 1 guar was planted and treated June 8, and 0.4 inch of rainfall occurred within 10 days. In Experiment 2 herbicides were applied May 19; the original stand was damaged by hail, and after 2.8 inches of rainfall, guar was replanted 20 days later. Means with the same letter are not different ($P<0.05$).

All of the treatments completely eliminated pigweed. However, where guar was replanted in 1971, only nitralin and dipropetryn gave 70 percent or more control of sandbur. In both 1971 and 1972 guar exhibited excellent tolerance to alachlor and nitralin at rates commonly used in other crops on this soil type. Seedling stands and seed yields were comparable to those of untreated controls but tended to be lower when application rates of alachlor and nitralin were doubled.

The lack of guar tolerance to preemergence application of *s*-triazine herbicides observed on loam soil was confirmed in these trials. Dipropetryn, prometryne and terbutryn severely reduced the stand when guar was replanted in 1971 or after preemergence treatment in 1972.

TABLE 5. WEED CONTROL AND GUAR RESPONSE FROM PREEMERGENCE HERBICIDES ON SAND IN 1971 AND 1972 NEAR BROWNFIELD, TEXAS[1]

Herbicide	Rate (lb./acre)	Weed control (%) Sandbur (1971)	Weed control (%) Pigweed (1972)	Guar stand (No./10 ft) 1971	Guar stand (No./10 ft) 1972	Yield (lb./acre) 1972
Untreated control		33^{ab}	0^{b}	36^{a}	22^{a}	1020^{ab}
Alachlor	1.0	50^{ab}	100^{a}	29^{a}	13^{ab}	1030^{ab}
	2.0	10^{b}	100^{a}	34^{a}	15^{ab}	670^{bc}
Nitralin	0.5		100^{a}		19^{a}	1420^{a}
	1.0	70^{a}	100^{a}	20^{ab}	16^{ab}	600^{bc}
Dipropetryn	1.0	60^{ab}	100^{a}	3^{c}	20^{a}	
	2.0[2]	40^{ab}	100^{a}	4^{c}	4^{bc}	
	3.0	83^{a}	100^{a}	0^{c}	1^{c}	
Prometryne	1.0	47^{ab}	100^{a}	13^{bc}	1^{c}	
Terbutryn	1.0[3]	47^{ab}	100^{a}	4^{c}	7^{bc}	

[1]Herbicides were applied in late May. In 1971 guar was replanted 11 days later. Rainfall (0.5 inch or more) occurred within 2 days after treatment both years. Means followed by the same letter are not different ($P<0.05$).

[2]Applied at 1.5 lb./acre in 1971.

[3]Applied at 1.6 lb./acre in 1971.

Postemergence Treatments

Several herbicides that had exhibited selectivity in other broadleaf crops were evaluated on guar in two experiments at Lubbock, Texas, in 1971 (Table 6). Pigweed control was 70 percent or higher with MSMA at 4 pounds per acre and with prometryne and methoxone, each at 1 pound per acre. However, crop tolerance was the primary objective of the experiment. Visual injury to guar from MSMA was higher when larger guar was treated, but yield reductions appeared to be higher when smaller guar was treated. Guar tolerance to bromoxynil and bentazone was excellent, and yields were not adversely affected by either herbicide. Chloroxuron has effectively controlled weeds in soybeans, another legume crop. However, in one experiment, chloroxuron damage to guar was about equal to the degree of pigweed control. Prometryne and methoxone gave good to excellent pigweed control, but 6-inch guar was severely injured and yields were reduced.

In 1972 MSMA, bromoxynil, bentazone and chloroxuron were sprayed over the top of guar at three dates to evaluate crop tolerance at different growth stages (Table 7). Five days after guar in the cotyledon stage was sprayed, crop tolerance was good to excellent. But 3 weeks later, guar injury was severe (30 to 70 percent) in all plots except where MSMA or bentazone were applied. When the same treatments were applied in late July when guar had 7 to 10 leaves or in early August when pods were filling, injury to guar was more severe than when treated at the cotyledon stage. Only MSMA at 2 pounds per acre gave less than 20-percent injury at all application dates. All treatments at all application dates reduced yields except MSMA at 2 pounds per acre at the 7- to 10-leaf stage and bentazone at 1 pound per acre at the 7- to 10-leaf or pod-filling stages.

TABLE 6. PIGWEED CONTROL AND GUAR TOLERANCE TO POSTEMERGENCE HERBICIDES APPLIED WHEN GUAR WAS 6 OR 10 INCHES TALL IN 1971 NEAR LUBBOCK, TEXAS[1]

Herbicide	Rate (lb./acre)	Pigweed control (%)	Guar injury (%)		Yield (% reduction)	
			6 inches	10 inches	6 inches	10 inches
Untreated control		0^{c}	0^{c}	0^{b}	0^{b}	0^{c}
MSMA	2	27^{c}	7^{c}	20^{a}	92^{a}	23^{bc}
	4	70^{ab}	3^{c}	27^{a}	81^{a}	41^{b}
Bromoxynil	0.5	63^{b}	7^{c}	0^{b}	10^{b}	0^{c}
	1.0			3^{b}		0^{c}
Bentazone	1.0			0^{b}		0^{c}
Chloroxuron	1.0	23^{c}	17^{c}		18^{b}	
Prometryne	1.0	97^{a}	83^{a}	3^{b}	20^{b}	59^{a}
Methoxone	1.0	77^{ab}	63^{b}	30^{a}	62^{ab}	

[1]All treatments except MSMA were applied with 0.5% surfactant. Means with the same letters are not different ($P<0.05$).

TABLE 7. GUAR RESPONSE TO POSTEMERGENCE HERBICIDES APPLIED AT THREE DATES IN 1972[1]

Herbicide	Rate (lb./acre)	Time of treatment: Cotyledon	7 to 10 leaves	Early pod	Herbicide mean	Mid-July evaluation: % guar injury[2]	% weed control[3]
		% injury after 5 days[3]					
Untreated control		0	13	17	10^{b}	10^{b}	0^{b}
MSMA	2	10	20	20	17^{b}	23^{b}	73^{a}
	4	10	33	60	34^{a}	20^{b}	83^{a}
Bromoxynil	0.5	27	43	33	34^{a}	60^{a}	83^{a}
	1.0	20	47	30	32^{a}	73^{a}	93^{a}
Bentazone	1.0	0	27	10	12^{b}	17^{b}	70^{a}
Chloroxuron + S	1.0	10	40	50	33^{a}	47^{ab}	63^{a}
Time mean		11^{b}	32^{a}	31^{a}			
		Seed yield (lb./acre)					
Untreated control		69	42	199	103^{a}		
MSMA	2	25	42	110	59^{ab}		
	4	33	26	44	34^{b}		
Bromoxynil	0.5	23	22	57	34^{b}		
	1.0	20	6	94	40^{b}		
Bentazone	1.0	29	35	181	82^{ab}		
Chloroxuron + S	1.0	15	18	55	29^{b}		
Time mean		30^{b}	27^{b}	106^{a}			

[1]Guar was planted May 30. Treatments were applied June 21 — cotyledon to one true leaf, 1 inch tall; July 26 — seven to 10 leaves, 5 to 7 inches tall; August 9 — 70% bloom, early pod formation on lower part of plant. Plots were two rows by 20 feet with three replications in a split-plot design. Plots were cultivated July 21 and August 1, hoed July 22 and hand harvested and threshed October 6 (2 rows by 15 feet). Means with the same letters are not different ($P<0.05$).
[2]Interaction between herbicides and time of treatment was significant ($P<0.05$).
[3]Average of three stages of treatment.

Guar Quality

When gum content and protein were evaluated in beans from several preplant and preemergence treatments at Lubbock in 1971, there was no indication that trifluralin, nitralin, alachlor or diuron affected seed quality. Nor was quality of seed from plots treated with dipropetryn, an *s*-triazine which was phytotoxic to guar plants, adversely affected. In these experiments, gum content of seed ranged from 43 to 48 percent, and protein ranged from 26 to 30 percent on an oven-dried basis. Consequently, it appears likely that any herbicide that exhibits selectivity for guar will not affect the gum or protein content. These results also show that if guar plants are discolored or stunted by a herbicide or *s*-triazine residue in soil, yields might be reduced but seed quality will not be suppressed.

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APPENDIX 1

Description of Herbicides Used

Common name	Trade name	Manufacturer	Chemical name
Alachlor	Lasso	Monsanto	2-chloro-2′,6′-diethyl-*N*-(methoxymethyl) acetanilide
Ametryne	Evik	CIBA-Geigy	2-(ethylamino)-4-(isopropylamino)-6-(methylthio)-*s*-triazine
Bentazone	Basagran	BASF Corp.	3-isopropyl-1*H*-2,1,3-benzothiodiazin-(4)3*H*-one 2,2-dioxide
Bromoxynil	Brominal, Buctril	Amchem Products, Rhodia	3,5-dibromo-4-hydroxybenzonitrile
CGA-10832	Tolban	CIBA-Geigy	*N*-*n*-propyl-*N*-cyclopropylmethyl-4-trifluoromethyl-2,6-dinitroaniline
Chloramben	Amibem	Amchem Products	3-amino-2,5-dichlorobenzoic acid
Chloroxuron	Tenoran, Norex	CIBA-Geigy, Nor-Am	3-[*p*-(*p*-chlorophenoxy)phenyl]-1,1-dimethylurea
Chlorpropham	Chloro IPC	PPG Industries	isopropyl *m*-chlorocarbanilate
Cyanazine	Bladex	Shell	2-chloro-4-(1-cyano-1-methylethylamino)-6-ethylamino-*s*-triazine
DCPA	Dacthal	Diamond Shamrock	dimethyl tetrachloroterephthalate
Dinitramine	Cobex	U.S. Borax	N^4,N^4-diethyl-α,α,α-trifluoro-3,5-dinitrotoluene-2,4-diamine
Diphenamid	Dymid, Enide	Elanco, Upjohn	*N*,*N*-dimethyl-2,2-diphenylacetamide
Dipropetryn	Sancap	CIBA-Geigy	2-ethylthio-4,6-bis-isopropylamino-*s*-triazine
Diuron	Karmex	Dupont	3-(3,4-dichlorophenyl)-1,1-dimethylurea
EPTC	Eptam	Stauffer	*S*-ethyl dipropylthiocarbamate
Linuron	Lorox	Dupont	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
MSMA	Several	Several	monosodium methanearsonate
Nitralin	Planavin	Shell	4-(methylsulfonyl)-2,6-dinitro-*N*,*N*-dipropylaniline
Prometryne	Caparol	CIBA-Geigy	2,4-bis(isopropylamino)-6-(methylthio)-*s*-triazine
Propachlor	Ramrod	Monsanto	2-chloro-*N*-isopropylacetanilide
SAN-9789	Zorial	Sandoz-Wander	4-chloro-5-(methylamino)-2-(α,α,α-trifluoro-*m*-tolyl)-3(2*H*)-pyridazinone
Terbutryn	Igran	CIBA-Geigy	2-(*tert*-butylamino)-4-(ethylamino)-6-(methylthio)-*s*-triazine
Trifluralin	Treflan	Elanco	α,α,α-trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine
Methoxone	Probe	Velsicol	2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione
Vernolate	Vernam	Stauffer	*S*-propyl dipropylthiocarbamate

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