Flumioxazin for Weed Control in Texas Peanuts (*Arachis hypogaea* L.)[1]

W. James Grichar* and A. Edwin Colburn[2]

ABSTRACT

Field experiments were conducted in 1991 and 1993 to evaluate flumioxazin alone and in various herbicide programs for weed control in peanut. Flumioxazin alone provided inconsistent control of annual grasses, while the addition of pendimethalin or trifluralin improved control considerably. Pitted morningglory (*Ipomoea lacunosa* L.) and ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.] control was >75% when flumioxazin was used alone. Flumioxazin caused early season peanut stunting with some recovery within 4 to 6 wk. Postemergence applications of imazethapyr or lactofen increased peanut stunting.

Key Words: Texas panicum, *Panicum texanum*, ivyleaf morningglory, pitted morningglory, peanut injury, V-53482, eclipta, *Eclipta prostrata*, yellow nutsedge, *Cyperus esculentus*, citronmelon, *Citrullus lanatus* var. *citroides*.

Weeds continue to plague many peanut growers in Texas. Weed competition not only reduces peanut yield but can also reduce harvesting efficiency as the peanut fruit can become embedded in the weed root system and stripped from the vine during digging (1).

Generally, control of annual grasses and broadleaf weeds in Texas can be achieved with a preplant incorporated application of a dinitroaniline herbicide such as trifluralin [2,6-dinitro-*N*,*N*-dipropyl-4-(trifluoromethyl)benzenamine], pendimethalin [*N*-(1-ethyl-propyl)-3,4-dimethyl-2,6-dinitrobenzenamine], or ethalfluralin [*N*-ethyl-*N*-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine] (1, 13, 14). However, some weeds such as Texas panicum (*Panicum texanum* Buckl.) and pigweed spp. (*Amaranthus* spp.) escape control. This may be due to extremely high weed populations, improper soil incorporation, and/or an inadequate herbicide rate (authors' personal observations).

Flumioxazin {2-[7-fluoro-4-(2-propynyl)-2*H*-1,4-benzoxazine-3-one-6-yl]-4,5,6,7-tetrahydro-2*H*-isoindole-1,3-dione} is a *N*-phenyl phthalimide herbicide and is currently being evaluated for soil-applied control of several weeds in peanut (2, 3, 5, 9, 16). Grey *et al.* (3) reported that flumioxazin controls morningglory spp. (*Ipomoea* spp.), Florida beggarweed (*Desmodium tortuosum* (Sw) DC., and prickly sida (*Sida spinosa* L.). Eastin *et al.* (2) and Zorn *et al.* (16) found no activity with

[1]This research was supported in part by grants from the Texas Peanut Producers Board and Valent USA.

[2]Res. Scien., Texas Agric. Exp. Stn., Yoakum, TX 77995 and former Ext. Agron., Texas Agric. Ext. Serv., College Station, TX 77843. Current address of A. E. Colburn: Southeast Res. and Ext. Ctr., Univ. of Arkansas, Monticello, AR 71656.

*Corresponding author.

flumioxazin on either yellow nutsedge (*Cyperus esculentus* L.) or sicklepod (*Cassia obtusifolia* L.).

Field experiments were conducted in different peanut growing areas of Texas with the following objectives: (a) to determine the feasibility of using flumioxazin applied either preplant incorporated (PPI) or preemergence (PRE) for weed control in peanut, (b) to determine peanut tolerance to flumioxazin, and (c) to compare peanut yield when using flumioxazin with standard herbicide treatments.

Materials and Methods

Three field studies were conducted in 1991 near Dilley (Frio Co.), Fredonia (McCulloch Co.), and Yoakum (Lavaca Co.); and in 1993 four studies near Pearsall (Frio Co.), Yoakum (Lavaca Co.), and Charlotte (Atascosa Co.) were conducted to evaluate flumioxazin in peanut. Two locations near Pearsall were selected in 1993 and will be designated as Location 1 for the earlier planting date and Location 2 for the later planting date. Seeds of Florunner peanut were planted at all locations, and organic matter was <1% at each location. A schedule of events and other specifics about the various locations are described in Table 1.

All locations except for Dilley were irrigated. Only 5.3 cm of rainfall fell at the Dilley location during the first 2 mo of the growing season. Supplemental irrigation was applied at all other locations as needed. Extremely heavy rains fell at all locations in late April, May, and early June of 1993. As a result, Location 1 near Pearsall received approximately 635 mm of rainfall by the middle of June. The experimental design was a randomized complete block with four replications. Plots consisted of two rows 7.6 m long and spaced on 90-to 97-cm centers. All field plots were naturally infested with moderate to high populations (15 to 30 plants per m^2) of the various weed species.

For all locations except Charlotte, herbicides were applied with a compressed-air bicycle sprayer that delivered a spray volume of 190 L ha^{-1} at 180 kPa using 11002 flat-fan nozzles (Spraying Systems Co., Wheaton, IL). At Charlotte, treatments were applied with a CO_2-pressurized backpack sprayer using 8003 flat-fan nozzles which delivered a spray volume of 140 L ha^{-1} at 160 kPa.

PPI treatments were incorporated 6 cm deep immediately after application with a tractor-driven, vertical-action power tiller. PRE herbicides were applied immediately after planting while postemergence (POST) treatments to broadleaf weeds were applied when weeds were at the cotyledon to 10-leaf stage. Yellow nutsedge was 15 to 20 cm tall and Texas panicum was 10 to 15 cm tall when treated with clethodim {(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(etylthio)propyl]-3-hydroxy-

Table 1. Schedule of events for conducting flumioxazin studies in peanut.

	Treatment years and location						
	1991			1993			
Events	Dilley	Fredonia	Yoakum	Pearsall 1	Pearsall 2	Yoakum	Charlotte
PPI trts. applied and incorporated	21 March	15 May	22 May	26 April	1 June	7 June	20 July
PRE trts. applied	21 March	15 May	22 May	26 April	1 June	7 June	20 July
Planting	21 March	15 May	22 May	26 April	1 June	7 June	20 July
Soil pH	6.9	7.0	7.1	7.2	7.3	7.0	7.1
Seed rate (kg ha^{-1})	100	100	112	112	112	112	100
Irrigation	None	Yes	Yes	Yes	Yes	Yes	Yes
Application:							
Volume	190 L ha^{-1}	190 L ha^{-1}	190 L ha^{-1}	190 L ha^{-1}	190 L ha^{-1}	190 L ha^{-1}	140 L ha^{-1}
Pressure	180 kPa	180 kPa	180 kPa	180 kPa	180 kPa	180 kPa	160 kPa
Nozzles	11002	11002	11002	11002	11002	11002	8003
Data collected:							
Weeds evaluated	TX panicum	Ivyleaf morningglory	Pitted morningglory, TX panicum	Citronmelon, TX panicum	Pal. amaranth, TX panicum	Sou. crabgrass, Eclipta	Br. panicum, Pigweed spp.
Crop injury	No	Yes	Yes	Yes	Yes	Yes	No
Crop yield	Yes	No	Yes	Yes	Yes	Yes	No
Soil type[a]	Dilley loamy fine sand	Nimrod fine sand	Tremona loamy fine sand	Duval very fine sandy loam	Duval very fine sandy loam	Tremona loamy fine sand	Poth loamy fine sand

[a]Dilley loamy fine sand = loamy, mixed, hyperthermic shallow Ustalfic Haplargids; Nimrod fine sand = loamy, siliceous, thermic Aquic Arenic Palenstalf; Tremona loamy fine sand = thermic Aquic Arenic Palenstalfs; Duval very fine sandy loam = fine-loamy, mixed, hyperthermic Aridic Haplustalfs; Poth loamy fine sand = clayey, mixed, hyperthermic Arenic Palenstalfs.

2-cyclohexen-1-one}. All POST lactofen {±2-ethoxy-1-methyl-2-oxoethyl-5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate} treatments included the nonphytotoxic crop oil concentrate (an 83% paraffin base petroleum oil with 17% polyoxyethylated polyol fatty ester and polyol fatty acid ester produced by Helena Chemical Co., Memphis, TN) at 2.3 L ha^{-1}. POST imazethaphyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid} included the nonionic surfactant (mixture of alkylarylpolyoxyethylene glycols, free fatty acids, isopropanol; Valent USA Corp., Walnut Creek, CA) at 0.25% (v/v).

Visual ratings of crop injury and weed control were recorded 3 to 4 wk after planting and every 4 wk afterward until harvest. Ratings were based on a scale of 0 = no control or peanut injury to 100 = complete control or death of the peanuts, relative to the untreated check. Peanut yields were determined by digging the pods, air-drying in the field for 4 to 6 d, and harvesting individual plots with a combine. Weights were recorded after soil and trash were removed from the samples. Peanuts were not harvested for yield in 1991 near Fredonia or 1993 near Charlotte. The Fredonia location was not harvested because of heavy rains which occurred for several days after digging, while the Charlotte location was not harvested because of record-setting freezing temperatures which occurred the last week of October. Rating and yield data were subjected to an analysis of variance and means were separated by LSD at the 5% level of significance. Since treatments and weed populations varied over locations and years, only the Texas panicum control data for the two Pearsall locations in 1993 were pooled.

Results and Discussion

Weed Control

Texas Panicum. Under nonirrigated conditions (Dilley location), flumioxazin alone failed to provide adequate season-long control of Texas panicum (Table 2). Flumioxazin applied PPI alone at 0.1 kg ha^{-1} provided good control (81-88%) for up to 4 wk after PPI treatment (WAT); however, at 8 WAT, control was 41% less than the commercial standard of pendimethalin. Method of flumioxazin application had no effect on control at 4 and 8 WAT. At 2 WAT, the PPI application controlled 12% more Texas panicum than the same rate of flumioxazin applied PRE. Rainfall during the first 4 wk after the PPI application was 4.8 cm and during the 4-8 wk period after application, rainfall was 0.5 cm.

Texas panicum control was 85% or better at all rating dates when pendimethalin PPI was included in the herbicide systems. Pendimethalin is a dinitroaniline herbicide, and this group of herbicides are the only soil-applied herbicides registered for use in peanuts which consistently provide season-long control of Texas panicum (1, 13). Wilcut *et al.* (12) reported that pendimethalin applied PRE controlled <65% Texas panicum, compared with ≥90% for PPI applications in a conventional tillage system. They attributed this lack of control to the ability of the larger seed of Texas panicum to germinate from greater soil depths. Due to the lack of rainfall during the early portion of the growing season and the high population of Texas panicum, a uniform stand of broadleaf weeds did not develop at Dilley.

Table 2. Influence of flumioxazin on Texas panicum control and peanut yield under nonirrigated conditions at Dilley, TX, 1991.

Herbicide system[a]			Wk after trt. of TX panicum			Peanut
PPI	PRE	POST	2	4	8	yield
--------kg ha^{-1}---------			---%---			kg ha^{-1}
-	-	-	0	0	0	340
Flu (0.10)	-	-	81	88	53	810
-	Flu (0.07)	-	77	81	48	750
-	Flu (0.10)	-	69	77	58	820
Pend (0.84)	Flu (0.07)	-	89	94	92	1670
Pend (0.84)	Flu (0.10)	-	89	95	88	1540
Pend (0.84)+ Flu (0.07)	-	-	89	90	85	1140
Pend (0.84)	Flu (0.07)	Imaz (0.07)	95	99	100	1730
Pend (0.84)	Flu (0.10)	Imaz (0.07)	91	100	99	1280
Pend (0.84)	Flu (0.07)	Lac (0.22) + DB (0.28)	100	99	95	1790
Pend (0.84)	Flu (0.10)	Lac (0.22)+ DB (0.28)	96	97	98	1540
Pend (0.84)	-	DB (0.28)	86	93	94	1250
LSD (0.05)			17	11	16	600

[a]Flu = flumioxazin; Pend = pendimethalin; Imaz = imazethapyr; Lac = lactofen, and DB = 2,4-DB.

Under irrigated conditions, flumioxazin alone controlled ≥80% Texas panicum (Table 3). At 3 wk after treatment (WAT), flumioxazin control was less than pendimethalin, but at 13 WAT, no differences in Texas panicum control was noted between pendimethalin and flumioxazin alone.

Pendimethalin PPI followed by (fb) flumioxazin PRE controlled greater than 95% Texas panicum (Table 3). When pendimethalin and flumioxazin at 0.1 kg ha^{-1} were tank-mixed and applied PPI, control at 13 WAT was less than separate applications of pendimethalin and flumioxazin.

In 1993, the two locations near Pearsall were characterized as having above average rainfall during the early part of the growing season through the middle of June. Control of Texas panicum with flumioxazin systems was greater than 90% (Table 4). Imazethapyr + metolachlor (2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide) was less effective than either flumioxazin + clethodim or the trifluralin + flumioxazin systems. Clethodim provides excellent control of annual grasses in peanut and other broadleaf crops (4, 14, 15).

Pitted Morningglory. Early season pitted morningglory control with flumioxazin applied either PPI or PRE at 0.07 kg ha^{-1} was 9 to 17% less than the standard treatment of pendimethalin (Table 3). However, the high rate of flumioxazin PRE (0.1 kg ha^{-1}) provided >95% early season control. At 13 WAT, the PPI application of pendimethalin + flumioxazin and flumioxazin PRE at 0.1 kg ha^{-1} resulted in less morningglory control than systems including either imazethapyr or lactofen + 2,4-DB.

Ivyleaf Morningglory. Control with trifluralin PPI fb flumioxazin PRE was significantly better than the

Table 3. Influence of flumioxazin on Texas panicum control, pitted morningglory control, peanut injury, and peanut yield under irrigation at Yoakum, TX, 1991.

Herbicide system[a]			Wk after PPI treatment					
			Texas panicum		Pitted morningglory		Peanut stunt	Peanut
PPI	PRE	POST	3	13	3	13	3	yield
kg ha^{-1}			%					kg ha^{-1}
-	-	-	0	0	0	0	0	1620
Flu (0.10)	-	-	87	80	78	92	0	2190
-	Flu (0.07)	-	93	91	86	92	0	2610
-	Flu (0.10)	-	93	88	96	88	0	2260
Pend (0.84)	Flu (0.07)	-	99	96	98	92	0	2670
Pend (0.84)	Flu (0.10)	-	100	99	99	98	1	2790
Pend (0.84)+Flu (0.10)	-	-	94	84	93	87	0	2320
Pend (0.84)	Flu (0.07)	Imaz (0.07)	100	98	99	100	5	2930
Pend (0.84)	Flu (0.10)	Imaz (0.07)	100	99	98	99	11	2800
Pend (0.84)	Flu (0.07)	Lac (0.22)+DB (0.28)	100	95	100	98	6	2410
Pend (0.84)	Flu (0.10)	Lac (0.22)+DB (0.28)	100	99	100	98	11	2790
Pend (0.84)	-	DB (0.28)	98	83	95	97	0	2370
LSD (0.05)			4	10	8	9	4	550

[a]Flu = flumioxazin; Pend =pendimethalin; Imaz = imazethapyr; Lac = lactofen; and DB = 2,4-DB.

standard treatment of trifluralin PPI when rated 3 WAT (Table 5). However, by 9 WAT, the standard treatment of trifluralin, with 2-4DB applied approximately 5 wk after the PPI application, provided complete control. At 13 WAT, trifluralin + flumioxazin resulted in less than 80% ivyleaf morningglory control. Herbicide systems which included either imazethapyr, 2,4-DB, or lactofen + 2,4-DB resulted in a minimum of 88% control (Table 5). Jordan *et al.* (8) found that in the Southeast, the greatest control of *Ipomoea* spp. was obtained with systems that used two applications of lactofen either with or without alachlor [2-chloro-*N*-2,6-diethylphenyl)-*N*-(methoxy-methyl)-acetamide] or a single late post (LPOST) application of either acifluorfen {5-[2-chloro-4-(trifluromethyl)-1*H*-2,1,3-benzothiadiazon-4(3*H*)2,2-dioxide} + bentazon{3-(1-methyl-ethyl)-1*H*-2,1,3-benzothiadiazon-4(3*H*)2,2-dioxide} or lactofen. Acifluorfen is considered to be a better postemergence-applied herbicide for *Ipomoea* spp. control than lactofen (7). In Texas, 2,4-DB controls morningglory better than lactofen (authors' personal observations).

Southern Crabgrass. Late season southern crabgrass control with flumioxazin alone was less effective when compared with metolachlor + imazethapyr systems

Table 4. Influence of flumioxazin on late season weed control, peanut injury, and peanut yield under irrigation at two locations near Pearsall, TX, 1993.

Herbicide system[a]			Control[b]			Peanut stunt[c]		Peanut
PPI	PRE	POST	Texas panicum	Citronmelon	Palmer amaranth	2 WAT	4 WAT	yield
kg ha^{-1}			%					kg ha^{-1}
-	-	-	0	0	0	0	0	2060
-	Flu (0.07)	Clet (0.11)	100	100	60	10	0	2430
-	Flu (0.10)	Clet (0.11)	99	98	33	19	10	2920
-	Met (1.7)+Flu (0.07)	-	92	98	98	6	1	2500
-	Met (1.7)+Flu (0.10)	-	92	100	99	24	1	2750
Trif (0.6)	Flu (0.07)	-	99	99	63	6	3	2660
Trif (0.6)	Flu (0.10)	-	95	100	83	20	4	2250
-	Met (1.7)+Imaz (0.07)	-	86	89	99	0	0	2620
LSD (0.05)			9	7	22	10	9	720

[a]Flu = flumioxazin; Clet = clethodim; Met = metolachlor; Trif = trifluralin; Imaz = imazethapyr.

[b]Texas panicum was present at both locations, citronmelon was present at Location 1 while Palmer amaranth was present at Location 2.

[c]WAT = weeks after PPI treatment; no peanut stunting observed at Location 1.

(Table 6). Late season control of southern crabgrass with flumioxazin alone was less than 60%. Metolachlor + flumioxazin systems controlled less than 85% southern crabgrass while metolachlor + imazethapyr controlled 98%. Earlier research had shown that metolachlor does not control the large seeded annual grasses (1, 11). Other annual grass species, such as crowfootgrass [*Dactyloctenium aegyptium* (L.) Willd], goosegrass [*Eleusine indica* (L.) Gaertn.], and the *Digitaria* spp. can be controlled with metolachlor (1). However, control of these annual grasses is only achieved if they are PRE activated by rainfall soon after application and before grass weed emergence (14).

Brown-Top Panicum. Metolachlor + imazethapyr controlled brown-top panicum (*Panicum fasciculatum* Sw.) better than all flumioxazin-containing systems except for metolachlor + flumioxazin at 0.07 kg ha^{-1} (Table 7). The low rate of flumioxazin provided the least brown-top panicum control.

Table 5. Influence of flumioxazin on ivyleaf morningglory control and peanut injury under irrigation at Fredonia, TX, 1991.

Herbicide system[a]			Wk after trt. of Ivy. morningglory			Peanut
PPI	PRE	POST	3	9	13	stunt
kg ha^{-1}			%			
-	-	-	0	0	0	0
Trif (0.6)	Flu (0.07)	-	97	90	76	16
Trif (0.6)	Flu (0.10)	-	98	77	79	9
Trif (0.6)	Flu (0.07)	Imaz (0.07)	88	99	89	13
Trif (0.6)	Flu (0.10)	Imaz (0.07)	100	100	97	15
Trif (0.6)	Flu (0.07)	Lac (0.22)+ DB (0.28)	93	73	100	9
Trif (0.6)	Flu (0.10)	Lac (0.22)+ DB (0.28)	96	96	100	13
Trif (0.6)	-	DB	59	100	96	0
LSD (0.05)			20	13	13	10

[a]Flu = flumioxazin; Trif = trifluralin; Imaz = imazethapyr; Lac = lactofen; and DB = 2,4-DB.

Eclipta. Excellent early season control of eclipta was obtained with flumioxazin alone, in combination with metolachlor, or metolachlor + imazethapyr (Table 6). Late season control of eclipta with flumioxazin alone was rate dependent while metolachlor + flumioxazin alone controlled 65 to 70% eclipta. Perfect eclipta control was achieved with herbicide systems which included lactofen POST. Previous research also had shown excellent control of eclipta with lactofen (8, 10).

Citronmelon. Citronmelon [*Citrullus lanatus* var. *citroides* (Bailey) Mansf.] control was ≥98% with flumioxazin systems (Table 5). Flumioxazin alone controlled citronmelon as well as any of the combinations with flumioxazin and better than metolachlor + imazethapyr.

Palmer Amaranth. Palmer amaranth (*Amaranthus palmeri* S. Wats.) control with flumioxazin alone was less than 65% while metolachlor + flumioxazin systems controlled better than 95% (Table 4). Metolachlor + imazethapyr controlled 99% Palmer amaranth while trifluralin + flumioxazin at 0.07 kg ha^{-1} controlled 36% less amaranth. At another location (Table 7), all herbicide treatments provided ≥95% control of the mixed stand of pigweed which included Palmer amaranth, redroot pigweed (*A. retroflexus* L., and tumble pigweed (*A. allus* L.).

Crop Response

Peanut Injury. Some peanut injury in the form of stunting was noted at most locations. Using a dinitroaniline herbicide in a system with flumioxazin or imazethapyr or lactofen POST increased the amount of peanut stunting. In 1991 at Yoakum, peanut stunting was evident at 3 wk after application with pendimethalin + flumioxazin systems which included either imazethapyr or lactofen + 2,4-DB (Table 3). Rate effects of flumioxazin which included either imazethapyr or lactofen were apparent on peanut stunting. No peanut stunting was noted after 6-8 wk (data not shown). At Fredonia, 5 WAT, stunting of peanuts was evident with several flumioxazin treatments (Table 5). Flumioxazin at 0.07 kg

Table 6. Influence of flumioxazin on weed control, peanut injury, and peanut yield under irrgation at Yoakum, TX, 1993.

Herbicide system[a]		Wk after PPI treatment: Southern crabgrass		Eclipta		Peanut stunt		
PRE	POST	4	15	4	15	2	6	Peanut yield
kg ha^{-1}		%						kg ha^{-1}
-	-	0	0	0	0	0	0	570
Flu (0.07)	-	94	43	96	77	11	4	1060
Flu (0.10)	-	94	59	98	91	8	3	1220
Met (1.7)+Flu (0.07)	-	100	80	94	65	18	3	900
Met (1.7)+Flu (0.10)	-	100	68	96	70	15	3	810
Met (1.7)+Flu (0.07)	Lac (0.28)	98	59	97	100	15	11	570
Met (1.7)+Flu (0.10)	Lac (0.28)	99	83	97	100	20	13	810
Met (1.7)+Imaz (0.07)	-	99	98	91	33	3	4	1060
LSD (0.05)		2	18	8	25	8	9	390

[a]Flu = flumioxazin; Met = metolachlor; Lac = lactofen; Imaz = imazethapyr.

Table 7. Influrence of flumioxazin on late season control of browntop panicum and mixed pigweed species at Charlotte, TX, 1993.

Herbicide system[a]		Control	
PRE	POST	Browntop panicum	Pigweed spp.[b]
--------- kg ha^{-1} ---------		--------- % ---------	
-	-	0	0
Flu (0.07)	-	80	95
Flu (0.10)	-	84	96
Met (1.7)+Flu (0.07)	-	94	96
Met (1.7)+Flu (0.10)	-	86	100
Met (1.7)+Flu (0.07)	Lac (0.28)	87	100
Met (1.7)+Flu (0.10)	Lac (0.28)	86	100
Met (1.7)+Imaz (0.07)	-	95	96
LSD (0.05)		7	8

[a]Flu = flumioxazin; Met = metolachlor; Lac = lactofen; Imaz = imazethapyr.

[b]Pigweed spp. consisted of a complex of Palmer amaranth, redroot, and tumble pigweed.

ha^{-1} in combination with trifluralin and imazethapyr, or flumioxazin at 0.1 kg ha^{-1} in combination with trifluralin, imazethapyr, and lactofen + 2,4-DB reduced peanut plant growth 13 to 16%.

In 1993 at Pearsall, no stunting was apparent at Location 1 which was planted early in the season. At Location 2, peanut stunting was apparent with flumioxazin alone and the high rate of flumioxazin + metolachlor or trifluralin when rated 2 WAT (Table 4). Four weeks after treatment, peanut stunting was still evident with the high rate of flumioxazin.

At Yoakum, significant peanut stunting was apparent with all of the flumioxazin systems when rated 2 wk after PRE application (Table 6). When rated 4 wk later, only the flumioxazin systems which included lactofen were still causing a significant peanut stunting. Previous research indicated good peanut tolerance to lactofen (6, 8, 10).

No peanut stunt was noted in the test at Charlotte (data not shown). Although this test area was irrigated, virtually no rain fell from planting (20 July 1993) until early October, and the producer was never able to maintain adequate soil moisture. This may have contributed to lack of any peanut stunting with flumioxazin.

Peanut Yield. Peanut yields reflect the competitive nature of Texas panicum (Table 2). Not only does Texas panicum compete with the peanut plant for nutrients, moisture, and sunlight, but it also reduces harvesting efficiency as peanut fruits become embedded in its extensive root system (1). Under nonirrigated conditions, the use of pendimethalin in a herbicide system resulted in a greater than fivefold increase in peanut yield over the untreated check (Table 2).

At Yoakum in 1991, all herbicide systems increased peanut yield over the untreated check by at least 35% (Table 3). The highest peanut yields were obtained with herbicide systems which included imazethapyr.

At Pearsall in 1993, peanut yields with the various herbicide systems were increased 9 to 42% over the untreated check (Table 4). Although the high rate of flumioxazin resulted in significant peanut stunt early in the season, this herbicide system produced the highest yield.

At Yoakum in 1993, peanut yields were extremely low because of record-setting freezing temperatures which occurred the last week of October in Yoakum. Although all herbicide systems resulted in numerically higher yields than the untreated check only three systems were statistically superior (Table 6). Maximum yields were obtained from the flumioxazin alone or the metolachlor + imazethapyr treatments.

Summary

These data indicated that flumioxazin alone failed to provide adequate season-long control of annual grasses. Control of pitted morningglory was excellent while pigweed and eclipta control was variable with flumioxazin alone. The addition either of a dinitroaniline herbicide (pendimethalin or trifluralin) or a chloroacetamide herbicide (metolachlor) improved weed control considerably. Long-term stunting of peanut plants was noted where imazethapyr or lactofen was applied POST following flumioxazin PRE especially under heavy rainfall conditions.

The potential for peanut injury with flumioxazin is a cause for concern and additional research in needed to identify factors which contribute to this problem.

Acknowledgments

We wish to thank Doris Yost, Kevin Brewer, Marvin Kresta, Randy Russell, and Michael Dolle for their assistance in this project.

Literature Cited

1. Buchanan, G. A., D. S. Murray, and E. W. Hauser. 1983. Weeds and their control in peanuts, pp. 206-249. *In* H. E. Pattee and C. T. Young (eds.) Peanut Science and Technology. Amer. Peanut Res. Educ. Soc., Yoakum, TX.
2. Eastin, E. F., J. W. Wilcut, J. S. Richburg III, and T. V. Hicks. 1993. V-53482 and Zorial systems for weed control in Georgia peanut. Proc. Amer. Peanut Res. Educ. Soc. 25:84 (abstr.).
3. Grey, T. L., J. W. Wilcut, and E. F. Eastin. 1993. V-53482 and Cadre systems for Georgia peanut (*Arachis hypogaea*). Proc. South. Weed Sci. Soc. 46:377 (abstr.).
4. Grichar, W. J. 1991. Control of Texas panicum (*Panicum texanum*) and southern crabgrass (*Digitaria ciliaris*) in peanuts (*Arachis hypogaea*) with postemergence herbicides. Peanut Sci. 18:6-9.
5. Grichar, W. J., and P. S. Boyd-Robertson. 1992. Weed control in Texas peanuts with V-53482. Proc. Amer. Peanut Res. Educ. Soc. 24:48 (abstr.).
6. Grichar, W. J., and A. E. Colburn. 1994. Eclipta (*Eclipta prostrata*) management in Texas peanut. Proc. South. Weed Sci. Soc. 47:34 (abstr.).
7. Higgins, J. M., T. Whitnell, E. C. Murdock, and J. E. Toler. Recovery of pitted morningglory (*Ipomoea lacunosa*) and ivyleaf morningglory (*Ipomoea hederaceae*) following applications of acifluorfen, fomesafen, and lactofen. Weed Sci. 36:345-353.
8. Jordan, D. L., J. W. Wilcut, and C. W. Swann. 1994. Application timing of lactofen for broadleaf weed control in peanut (*Arachis hypogaea*). Peanut Sci. 20:129-131.
9. Wilcut, J. W., J. S. Richburg III, and T. V. Hicks. 1994. V-53482 systems with bentazon + paraquat or AC263,222 for Georgia peanut. Proc. South. Weed Sci. Soc. 47:32 (abstr.).
10. Wilcut, J. W., C. W. Swann, and H. B. Hagwood. 1990. Lactofen systems for broadleaf weed control in peanuts (*Arachis hypogaea*).

Weed Technol. 4:819-823.
11. Wilcut, J. W., G. R. Wehtje, T. A. Cole, T. V. Hicks, and J. A. McGuire. 1989. Postemergence weed control systems without dinoseb for peanuts (*Arachis hypogaea*). Weed Sci. 37:385-391.
12. Wilcut, J. W., G. R. Wehtje, and T. V. Hicks. 1990. Evaluation of herbicide systems in minimum- and conventional-tillage peanuts (*Arachis hypogaea*). Weed Sci. 38:243-248.
13. Wilcut, J. W., G. R. Wehtje, and M. G. Patterson. 1987. Economic assessment of weed control systems for peanuts (*Arachis hypogaea*). Weed Sci. 35:433-437.
14. Wilcut, J. W., A. C. York, and G. R. Wehtje. 1993. The control and interaction of weeds in peanut (*Arachis hypogaea*). Rev. Weed Sci. 6:177-205.
15. Winton-Daniels, K., R. E. Frans, and M. McClelland. 1990. Herbicide systems for johnsongrass (*Sorghum halepense*) control in soybeans (*Glycine max*). Weed Technol. 4:115-122.
16. Zorn, C. J., J. W. Wilcut, J. S. Richburg III, and M. G. Patterson. 1993. V-53482 systems for weed control in Georgia peanut. Proc. Amer. Peanut Res. Educ. Soc. 25:21 (abstr.).

Accepted 23 February 1996