Control of Texas Panicum (*Panicum texanum*) and Southern Crabgrass (*Digitaria ciliaris*) in Peanuts (*Arachis hypogaea*) with Postemergence Herbicides[1]

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ABSTRACT

Clethodim, cycloxydim, haloxyfop, fluazifop-P, fenoxaprop, and quizalofop were applied early or late postemergence to Texas panicum (Panicum texanum Buckl.) and southern crabgrass (*Digitaria ciliaris* (Retz.) Koel.) in peanuts (*Arachis hypogaea* L.). Clethodim at 0.11 and 0.14 kg/ha, cycloxydim at 0.11 and 0.17, and fluazifop-P at 0.17 and 0.21 kg/ha provided excellent Texas panicum control. Fluazifop-P provided erratic southern crabgrass control, while clethodim, cycloxydim, haloxyfop, fenoxaprop at 0.22 kg/ha, and quizalofop at 0.14 kg/ha provided excellent southern crabgrass control. Yields of peanuts were usually higher following early postemergence application, thus indicating the timing of application is important in improving yields.

Key Words: Clethodim, cycloxydim, haloxyfop, fluazifop-P, fenoxaprop, quizalofop, annual grasses, Texas panicum, southern crabgrass, peanuts, postemergence.

Many peanut (*Arachis hypogaea* L.) fields in Texas are infested with the annual grasses, Texas panicum (*Panicum texanum* Buckl.) and southern crabgrass (*Digitaria ciliaris* (Retz.) Koel.). Texas panicum ranks as the most common weed and one of the ten most troublesome weeds to control in Texas (9). Competition of Texas panicum and/or southern crabgrass with peanuts not only reduces peanut yield but can also reduce harvesting efficiency as the peanut fruit can become embedded in the annual grasses extensive root system and stripped from the vine during digging (4).

Generally, control of annual grasses can be achieved with a preplant-incorporated application of a dinitroaniline herbicide such as trifluralin [2, 6-dinitro-*N*, *N*-dipropyl-4-(trifluoromethyl) benzenamine], benefin [*N*-butyl-*N*-ethyl-2,6-dinitro-4-(trifluoromethyl)benzenamine], or pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine]. However, escapes occur due to extremely high weed populations, improper soil incorporation, and/or an inadequate herbicide rate.

In addition, the increased use of metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] or alachlor [2-chloro-*N*-(2,6-diethylphenyl)-*N*-(methoxymethyl)acetamide] for control of yellow nutsedge (*Cyperus esculentus* L.) has resulted in a proliferation of the large seeded annual grasses such as Texas panicum due to the inability of these chloroacetanilide herbicides to provide adequate control (4, 20, 21). Therefore, the application of a postemergence grass herbicide is often a necessity to improve season long weed control. Although much work has been reported on the use of postemergence grass selective herbicides in other crops (1, 2, 3, 6, 15, 16, 17, 18), little research has been reported in peanuts (12, 13, 22).

The objectives of this study were to: a) evaluate postemergence grass herbicides for control of Texas panicum and southern crabgrass in peanuts and b) determine optimum timing of application for best control and highest peanut yield.

Materials and Methods

These experiments were conducted at the Texas Agricultural Experiment Station near Yoakum, TX, in 1986 and 1987 and on a producer's farm near Poth, TX, in 1986. The soils near Yoakum are a Tremona loamy fine sand (clayey, mixed, thermic, Aquic Aranic Paleustalfs) with less than 1% organic matter, while those near Poth are a Miguel fine sandy loam (fine, mixed, hyperthermic, Udic paleustalfs) with 1 to 3% organic matter. The experimental design was a randomized complete block with 5 replications at Yoakum and 4 replications at Poth. Plots at both locations consisted of two rows 7.6 m long, spaced on 97 cm centers. All field plots at Yoakum were naturally infested with high populations of Texas panicum and southern crabgrass while plots at Poth were infested with Texas panicum. Yellow nutsedge and Palmer amaranth (*Amaranthus palmeri* S. Wats.) were scattered throughout the area and were controlled with postemergence applications of bentazon [3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide] at 1.12 kg/ha, and 2,4-DB [4-(2,4-dichlorophenoxy) butanoic acid] at 0.3 kg/ha, respectively.

Peanuts were planted at Poth on June 25, 1986, and at Yoakum on May 23, 1986, and May 19, 1987. Early postemergence treatments were applied 3 to 5 weeks after planting (July 24, 1986, at Poth and June 30, 1986, and June 24, 1987, at Yoakum). At this early application, the grass was 3 to 10 cm tall at Yoakum and 7 to 15 cm at Poth. Late postemergence treatments were applied 6 to 8 weeks after planting (Aug. 6, 1986 at Poth when grass was 30 to 46 cm tall, and July 21, 1986 and July 13, 1987 at Yoakum when grass was 15 to 25 cm tall). All plants were growing actively at the time of herbicide application. Herbicides were applied with a compressed-air pressurized bicycle sprayer which delivered a spray volume of 190 L/ha at 195 kPa with 11002 flat fan nozzles.[3] All herbicide treatments except fenoxaprop included a non-phytotoxic crop oil[4] at 2.3 L/ha.

Treatments applied at Yoakum in 1986 were clethodim [(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one]at 0.07, 0.11 (EP only), and 0.14 kg ai/ha, cycloxydim [2-[1-(ethoxyimino)-butyl]-3-hydroxy-5-(2*H*-tetrahydrothiopyran-3-yl)-2-cyclohexene-1-one] at 0.11 and 0.17 kg ai/ha, fluazifop-P [(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]-phenoxy]propanoic acid] at 0.17 and 0.21 kg ai/ha, fenoxaprop [(±)-2-[4[(6-chloro-2-benzoxazolyl)oxy]phenoxy]propanoic acid] at 0.22 kg ai/ha, haloxyfop [2-[4-[[3-chloro-5-(trifluormethyl)-2-pyridinyl]oxy]-phenoxy]propanoic acid] at 0.14 kg/ha, quizalofop [(±)-2-[4[(6-chloro-2-quinoxaliny)oxy]phenoxy]propanoic acid] at 0.09 and 0.14 kg ai/ha, and sethoxydim [2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexene-1-one] at 0.34 kg ai/ha. The same treatments were applied at Poth except clethodim at 0.11 kg ai/ha, quizalofop at 0.14 kg ai/ha, and cycloxydim at 0.17 kg ai/ha were omitted. Treatments in 1987 included clethodim at 0.11 and 0.14 kg ai/ha, cycloxydim at 0.11 and 0.17 kg ai/ha, haloxyfop at 0.14 kg ai/ha, fluazifop-P at 0.17 and 0.21 kg ai/ha, fenoxaprop at 0.22 kg ai/ha, and quizalofop at 0.14 kg ai/ha. Sethoxydim at 0.34 kg ai/ha was included in each test as a standard treatment since its activity had been previously reported (12, 13) and is registered for use on peanuts. An unsprayed treatment was included in each test as a check.

Visual ratings of crop injury, as well as Texas panicum and southern crabgrass control were recorded throughout the growing season with the last rating taken approximately 4 weeks before harvest of the peanuts. Ratings were based on a scale of 0=no control of weeds or peanut injury to 100= complete control of weeds or death of the peanuts, relative to untreated plots.

Peanuts were dug Oct. 10, 1986, at Yoakum and Nov. 17, 1986, at Poth, while in 1987, the digging date was Oct. 9. After digging, the peanuts were allowed to air dry in the field 4 to 6 days after which individual plots were

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[3]Teejet, Spraying Systems Co., North Ave., Wheaton, IL 60188.

[4]Agridex contains 83% paraffin base petroleum oil and 17% polyoxyethylated polyol fatty acid ester and polyol fatty acid ester, produced by Helena Chem. Co., 5100 Poplar Avenue, Memphis, TN 38137.

[5]ICI Americas, Inc., Wilmington, DE. Fusilade 2000 IE product label.

harvested with a combine. Weights were recorded after soil and trash were removed from the samples. Ratings and yields were subjected to an analysis of variance within years, and differences between means were determined using Duncan's multiple range test.

Results and Discussion

Texas panicum control

Clethodim at 0.11 kg/ha or above, cycloxydim, haloxyfop at 0.14 kg/ha, and fluizfop consistently provided greater than 75% control of Texas panicum when rated 4 weeks prior to peanut harvest (Table 1). The early postemergence (EP) applications were not significantly more effective than late postemergence (LP) applications for most of the herbicides. Exceptions were the low rate of cycloxydim in 1987 and sethoxydim in both 1986 and 1987 at Yoakum which resulted in significantly less Texas panicum control when applied LP compared to EP. This agrees with research by Weise et al. (19), who found that fluazifop-P, fenoxaprop, quizalofop, cycloxydim, and clethodim provided excellent control of barnyardgrass [*Echinochloa crus-galli*(L.) Beauv.] which ranged in size from 4 to 41 cm tall.

Previous work with the butyl ester of fluazifop (12, 13, 20) resulted in control of Texas panicum at rates of 0.28 to 0.40 kg/ha. The fluazifop formulation used in the earlier research contained the racemic mixture of the R and S enantiomers. The new formulation of fluazifop (fluazifop-P) used in this study contained only the R enantiomer, the actual phytotoxic ingredient in fluazifop[5]. This new formulation utilizes lower application rates and also seemed to improve the efficacy on Texas panicum (22).

Quizalofop provided poor control of Texas panicum. The higher rate of quizalofop increased control approximately 10 to 20%. However, Texas panicum control was not as consistent as with clethodim, cycloxydim and fluazifop. These results disagree with those of Hammes (15) who stated that large seeded annuals such as Texas panicum, red rice (*Oryza sativa* L.) and broadleaf signalgrass [*Brachiaria platyphylla* (Grisel.) Nash] could be controlled with rates of 0.08 to 0.11 kg/ha. He did state that an early application to these grasses no taller than 10cm was recommended for optimum control.

Sethoxydim at 0.34 kg/ha has provided excellent annual grass control (12, 13) in the past but, for some unexplained reason, poor control was obtained at the Poth location with the EP application. Fenoxaprop, and clethodim at 0.07 kg/ha also resulted in less than adequate control at Poth. This could be as the result of the large grass size at treatment time which has been reported to be a factor in reduced control (11, 12, 13, 14) with several postemergence herbicides. This response may also be related to species (8), environmental conditions (11, 14), and application rate (5). Although grass growth was good at both application timings, soil moisture at Poth was less, compared to Yoakum where applications followed irrigation by 1 to 2 days. This may have resulted in less translocation of postemergence herbicides into the plant according to work by Fawcett et al. (10) and Chernicky et al. (7) who found greater herbicidal activity with sethoxydim when moisture levels were high.

Southern crabgrass control

The timing of application affected herbicide activity on southern crabgrass more in 1986 than 1987 (Table 2). In 1986, all herbicides except for fluazifop-P provided significantly better southern crabgrass control when applied EP than LP. Previous work (12, 13) indicated that early application of sethoxydim or butyl ester of fluazifop was critical for effective large crabgrass [*Digitaria sanguinalis* (L.) Scop] control.

In 1987, southern crabgrass control was greater with EP than with LP application for fluazifop-P at 0.21 kg/ha, quizalofop at 0.14 kg/ha and sethoxydim at 0.34 kg/ha. No differences were noted for the other herbicide treatments. Since weed height and soil mositure at time of application were virtually identical in both years, no explanation can be

Table 1. Texas panicum control with several postemergence herbicides applied at two growth stages in 1986 and 1987 when rated four weeks before harvest.

Treatments	Rate	Timing of Application[b]	Control[a] Yoakum 1986	Control[a] Yoakum 1987	Control[a] Poth 1986
	(kg ai/ha)		(%)		
Check	...	...	0 e	0 a	0 e
Clethodim	0.07	EP	90 ab	...	56 cd
		LP	93 ab	...	65 bcd
Clethodim	0.11	EP	96 a	91 ab	...
Clethodim	0.14	EP	85 abc	92 ab	88 ab
		LP	89 abc	83 bcde	83 ab
Cycloxydim	0.11	EP	92 ab	91 ab	80 abc
		LP	86 ab	78 cde	77 abcd
Cycloxydim	0.17	EP	96 a	97 a	...
		LP	92 ab	94 ab	...
Haloxyfop	0.14	EP	93 ab	96 ab	76 abcd
		LP	85 abc	...	94 a
Fluazifop-P	0.17	EP	93 ab	92 ab	85 ab
		LP	84 abc	84 abcde	84 ab
Fluazifop-P	0.21	EP	96 a	95 ab	88 ab
		LP	85 abc	93 ab	95 a
Fenoxaprop	0.22	EP	85 abc	92 ab	57 cd
		LP	79 bcd	86 abcde	56 cd
Quizalofop	0.09	EP	66 d	...	53 d
		LP	80 bcd	...	77 abcd
Quizalofop	0.14	EP	85 abc	73 ef	...
		LP	90 ab	64 f	...
Sethoxydim	0.34	EP	96 a	90 abc	66 bcd
		LP	79 bcd	76 de	87 ab

[a]Means within a column and followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

[b]EP=early postemergence; LP=late postemergence.

Table 2. Southern crabgrass control at Yoakum with several postemergence herbicides applied at two growth stages when rated four weeks prior to harvest.

Treatments	Rate	Timing of Application[b]	Control[a] 1986	Control[a] 1987
	(kg ai/ha)		(%)	
Check	....	...	0 d	0 f
Clethodim	0.11	EP	87 a	97 ab
Clethodim	0.14	EP	87 a	98 ab
		LP	51 c	95 ab
Cycloxydim	0.11	EP	92 a	98 ab
		LP	43 c	87 abcd
Cycloxydim	0.17	EP	99 a	99 a
		LP	51 c	97 ab
Haloxyfop	0.14	EP	86 a	99 a
		LP	61 bc	...
Fluazifop-P	0.17	EP	56 c	92 abc
		LP	46 c	82 cd
Fluazifop-P	0.21	EP	57 c	97 ab
		LP	43 c	80 cd
Fenoxaprop	0.22	EP	80 ab	96 ab
		LP	44 c	85 bcd
Quizalofop	0.14	EP	84 a	97 ab
		LP	55 c	63 e
Sethoxydim	0.34	EP	92 a	95 ab
		LP	63 bc	76 d

[a]Means within a column and followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

[b]EP=early postemergence; LP=late postemergence.

given for lack of differences between EP and LP herbicide treatments in 1987.

Clethodim, cycloxydim, haloxyfop, fenxoprop, quizalofop, and sethoxydim all provided 80% or better control of southern crabgrass when applied EP. Numerically, cycloxydim at 0.17 kg/ha provided virtually perfect control in both years. The use of fluazifop resulted in inconsistent southern crabgrass control with very poor results in 1986 while in 1987 control increased by approximately 40%.

This data agrees with previously reported research by Hammes (15) in which he stated that rates of quizalofop as low as 0.06 kg/ha would provide effective control of *Digitaria* spp. when applications were made to grass from 5 to 15 cm in height. Therefore, it is possible that the rate of quizalofop could be reduced by 50% and still maintain effective control.

Peanut response and yields

No visual peanut injury was aparent with any of the hebicides applied (data not shown). Furthermore, these herbicides did not exhibit any growth inhibitiong properties.

Clethodim at 0.07, 0.11, or 0.14 kg/ha, cycloxydim at 0.11 and 0.17 kg/ha, and fenoxaprop at 0.22 kg/ha, all of which were applied EP, consistently provided significantly higher yields.

Peanut yields at Yoakum strongly reflected the influence of timing of application (Table 3). Although differences were not always statistically significant, peanut yield trends from plots treated at the earlier stage of growth were numerically greater than yields from treatments applied at the later stage of growth.

The results at Yoakum indicate that herbicides must be applied early to grasses less than 10 cm tall to obtain adequate control of annual grasses. Application to taller grasses were generally less effective and higher rates were required for adequate control.

Only at Poth did peanuts not show a yield increase in response to annual grass control. While yields were not significantly greater with EP applications, a numerical trend to this effect was evident. These postemergence herbicides allow producers additional flexibility in controlling grass weeds in peanuts.

Table 3. Peanut yields at Yoakum and Poth, TX in 1986 and 1987 as affected by postemergence grass herbicides.

			Yield[a]		
		Timing of	Yoakum		Poth
Treatments	Rate	Application[b]	1986	1987	1986
	(kg ai/ha)		(kg/ha)		
Check	....	...	1163 gh	1760 e	2855 bcd
Clethodim	0.07	EP	2265 abcd	...	3205 abcd
		LP	1605 efgh	...	2864 bcd
Clethodim	0.11	EP	2240 abcd	2704 ab	...
Clethodim	0.14	EP	2506 ab	2871 a	3820 ab
		LP	1233 fgh	2264 bcde	3097 abcd
Cycloxydim	0.11	EP	2877 a	2803 ab	3864 a
		LP	1356 fgh	2068 cde	3258 abcd
Cycloxydim	0.17	EP	2555 ab	2468 abcd	...
		LP	1564 efgh	2640 ab	...
Haloxyfop	0.14	EP	2111 bcde	2483 abcd	3493 abcd
		LP	1417 fgh	...	3096 abcd
Fluazifop-P	0.17	EP	1807 cdefg	2763 ab	3838 a
		LP	1216 fgh	2246 bcde	3365 abcd
Fluazifop-P	0.21	EP	1724 defgh	2462 abcd	3647 abc
		LP	1177 gh	2371 abcd	3382 abcd
Fenoxaprop	0.22	EP	2551 ab	2668 ab	3142 abcd
		LP	1130 h	2600 abc	2600 d
Quizalofop	0.09	EP	1852 cdef	...	3572 abc
		LP	1083 h	...	2829 cd
Quizalofop	0.14	EP	2417 abc	2456 abcd	...
		LP	1379 fgh	1960 de	...d
Sethoxydim	0.34	EP	2737 ab	2645 ab	3253 abcd
		LP	1482 efgh	2368 abcd	3431 abcd

[a]Means within a column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

[b]EP=early postemergence; LP=late postemergence.

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