Tolerance of Peanut (*Arachis hypogaea* L.) to Herbicides Applied Postemergence

David L. Jordan*, Janet F. Spears, and John W. Wilcut[1]

ABSTRACT

Experiments were conducted from 1999 through 2001 in North Carolina to determine peanut response under weed-free conditions to applications of postemergence herbicides. In one set of experiments, peanut tolerance to acifluorfen plus bentazon or acifluorfen plus bentazon plus 2,4-DB applied alone or with diclosulam, dimethenamid, flumioxazin, or metolachlor 6 to 8 wk after peanut emergence was evaluated. In a second set of experiments, paraquat plus bentazon was applied alone or with diclosulam, dimethenamid, flumioxazin, imazethapyr, or metolachlor 2 wk after peanut emergence. In a third set of experiments, imazapic was applied alone or with diclosulam or flumioxazin 3 to 4 wk after peanut emergence. In the fourth experiment, 2,4-DB was applied approximately 7, 5, or 3 wk before digging and inversion of vines. Flumioxazin applied alone or with aciflurofen plus bentazon (with or without 2,4-DB) injured peanut more than diclosulam, dimethenamid, or metolachlor applied alone or with acifluorfen plus bentazon or aciflurofen plus bentazon plus 2,4-DB. Flumioxazin reduced pod yield 620 kg/ha when compared to non-treated peanut. Additionally, acifluorfen plus bentazon and acifluorfen plus bentazon plus 2,4-DB reduced yield by 200 and 150 kg/ha, respectively, when compared with non-treated peanut. Flumioxazin applied with paraquat plus bentazon was more injurious than diclosulam, dimethenamid, imazethapyr, or metolachlor applied with paraquat plus bentazon. There was no difference in peanut injury when paraquat plus bentazon was applied alone or with diclosulam. Dimethenamid or metolachlor increased injury by paraquat plus bentazon. Although diclosulam did not affect peanut injury from imazapic, injury increased when imazapic was applied with flumioxazin. When pooled over nine sites, 2,4-DB did not adversely affect pod yield, gross economic value, or percent seed germination when applied 7, 5, or 3 wk before vine inversion.

Key Words: Crop injury.

Peanut (*Arachis hypogaea* L.) producers in the U. S. apply herbicides at planting and throughout the growing season to control a variety of weeds (Wilcut *et al.*, 1995). The relatively poor competitive ability of peanut with weeds and the need to dig and invert peanut vines require season-long weed control to optimize production and harvest efficiency (Wilcut *et al.*, 1995).

Herbicides applied preplant incorporated or preemergence seldom provide season-long weed control in peanut. Herbicides such as imazapic{(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5oxo-1*H*-imidazol-2-yl)]-5-methyl-3-pyridinecarboxylic acid} and imazethapyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid} are applied postemergence to control escaped weeds (Wilcut *et al.*, 1995). Since both herbicides provide residual control, they can prevent reinfestation. However, herbicides such as acifluorfen {5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid}, bentazon [3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide], and paraquat (1,1'-dimethyl-4,4'-bipyrdinium ion) do not provide residual weed control (Wilcut *et al.*, 1995; Richburg *et al.*, 1996; Wehtje *et al.*, 2000). Growers often apply residual herbicides such as metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide] and dimethenamid {2-chloro-*N*-[(1-methyl-2-methoxy)ethyl]-*N*-(2,4-dimethyl-thien-3-yl)-acetamide} with these contact herbicides to control emerged weeds and provide residual weed control (Wilcut *et al.*, 1995; Grichar *et al.*, 2000). Recently, diclosulam [*N*-(2,6-dichlorophenyl)-5-ethoxy-7-fluorol(1,2,4)triazolo(1,5-*c*)pyrimidine-2-sulfonamide] and flumioxazin {2-[7-fluoro-3,4-duhydro-3-oxo-4-(2-propynyl)-2*H*-1,4-benzoxazin-6-yl]-4,5,6,7-tetrahydro-1*H*-isoindole-1,3(2H)-dione} received registrations for use in peanut. These herbicides provide residual weed control (Grichar and Colburn, 1996; Askew *et al.*, 1999; Bailey *et al.*, 1999; Grey *et al.*, 2002). Although current label restrictions prohibit application of these herbicides after peanut emergence, research (Wilcut *et al.*, 1997; Dotray *et al.*, 1999) suggests that early postemergence applications of diclosulam do not injure peanut. In contrast, postemergence applications of flumioxazin can severely injure peanut (Prostko *et al.*, 2002). Determining compatibility of these herbicides with acifluorfen, bentazon, and paraquat may provide additional options for weed management in peanut, especially with respect to diclosulam.

Peanut producers often apply 2,4-DB [2,4-(dichlorophenoxy)butanoic acid] to control escaped broadleaf weeds such as common cocklebur (*Xanthium strumarium* L.) and sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby] (Wilcut *et al.*, 1995). Current label restrictions for 2,4-DB specify that applications not be made within 45 d prior to digging and inverting vines (Butyrac 200 product label, Rhone Poulenc Ag. Co., Research Triangle Park, NC). Ketchersid *et al.* (1978) reported decreased pod development when 2,4-DB was applied at 0.95 kg ai/ha. They also reported no yield reduction when 2,4-DB was applied sequentially at 0.45 kg/ha during pod fill. These studies were conducted with the spanish market type cultivar Starr, with 2,4-DB applied up to 62 d after planting. Grichar *et al.* (1997) reported that 2,4-DB did not adversely affect pod

[1]Assoc. Prof., Prof., and Prof., Dept. Crop Sci., Box 7620, North Carolina State Univ., Raleigh, NC 27695.

*Corresponding author (e-mail: david_jordan@ncsu.edu).

yield and market grade characteristics of runner market type peanut. Baughman *et al.* (2002) reported that 2,4-DB at 0.45 kg/ha applied up to 120 d after planting did not affect virginia market type peanut. Weeds can emerge closer to harvest than 45 d, and determining if 2,4-DB can be applied closer to harvest without adversely affecting peanut may allow more effective late-season weed management which could improve harvest efficiency.

Peanut growers and their advisors question peanut tolerance of contact herbicides such as acifluorfen and bentazon when applied late in the season. Swann and Herbert (1999) reported that sequential applications of acifluorfen plus bentazon reduced peanut yield under weed-free conditions. Questions also exist relative to the impact of residual herbicides on peanut tolerance of contact herbicides, especially considering the recently released residual herbicides diclusolam and flumioxazin. Therefore, research was conducted from 1999 through 2001 to determine peanut response to 1) acifluorfen plus bentazon alone and with 2,4-DB applied with diclosulam, dimethenamid, flumioxazin, or metolachlor, 2) paraquat plus bentazon applied alone and with diclosulam, dimethenamid, flumioxazin, imazethapyr, or metolachlor, 3) imazapic applied alone and with diclosulam or flumioxazin, and 4) applications of 2,4-DB 3, 5, and 7 wk before harvest.

Materials and Methods

Acifluorfen plus bentazon with residual herbicides. The experiment was conducted in North Carolina at two locations in 1999 and at one location each in 2000 and 2001. In 1999, the experiment was conducted at the Upper Coastal Plain Res. Sta. located near Rocky Mount on a Goldsboro loamy sand soil (fine-loamy, siliceous, subactive, thermic Aquic Paleudults) and on a private farm located near Edenton on a Roanoke silt loam soil (clayey, mixed, thermic, Typic Ochraquepts). The experiment was also conducted at the Peanut Belt Res. Sta. located near Lewiston on a Norfolk sandy loam soil (fine-loamy, siliceous, thermic Typic Kandiudults) in 2000 and 2001. Peanut was planted in conventionally tilled seedbeds. Peanut cultivars in 1999 were NC 7 (Rocky Mount) and NC V-11 (Edenton). The peanut cultivars in 2000 and 2001 were NC 7 and NC 12C, respectively. The cultivars NC-V 11 and NC 12C are among the most popular virginia market type cultivars planted in North Carolina (Spears, 2002). Plot size was two rows (96-cm spacing) by 12 m.

The entire test area during each year at all locations was treated with pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzeneamine] at 1.12 kg ai/ha preplant incorporated followed by metolachlor at 1.4 kg ai/ha applied preemergence to minimize weed interference. At Edenton, paraquat at 0.14 kg ai/ha plus bentazon at 0.23 kg ai/ha were applied 1 wk after peanut emergence. At Lewiston, acifluorfen plus bentazon (0.56 plus 0.28 kg ai/ha) were applied 3 wk after peanut emergence. Additional herbicides applied to the entire test area at Lewiston included 2,4-DB at 0.28 kg ai/ha applied 10 wk after peanut emergence. These herbicides are standard for commercial weed management systems in North Carolina and were needed to maintain plots free of weeds (Jordan and York, 2002). Postemergence herbicides were not needed at Rocky Mount. Standard cultural and pest management practices to control disease and insects were implemented over the entire test area.

Treatments consisted of a factorial arrangement of three contact herbicide levels (no contact herbicide, acifluorfen plus bentazon, acifluorfen plus bentazon plus 2,4-DB) and five residual herbicide levels (no residual herbicide, diclosulam, dimethenamid, flumioxazin, metolachlor) applied 6 to 8 wk after peanut emergence (flowering and pegging stages of peanut growth and development). Herbicide rates for acifluorfen, bentazon, diclosulam, dimethenamid, flumioxazin, metolachlor, and 2,4-DB were 0.28, 0.56, 0.013, 1.12, 0.05, 0.94, and 0.14 kg ai/ha, respectively. A nonionic surfactant (Induce, Helena Chemical Co., Memphis, TN) was included at 0.25% (v/v) with all treatments. Herbicides were applied using CO_2-pressurized sprayers delivering 140 L/ha using regular flat fan nozzles (Spraying Systems Co., Wheaton, IL). A non-treated control was also included.

Visual estimates of percent peanut injury (foliar chlorosis, necrosis, stunting) were recorded 2 and 4 wk after treatment using a scale of 0 to 100 where 0 = no injury and 100 = plant death. Peanut was harvested in early October using small-plot equipment and pod yields were determined. The experimental design was a randomized complete block with four replications. Data were subjected to analyses of variance for a four (experiment) by three (contact herbicide) by five (residual herbicide) factorial treatment arrangement. Means of significant main effects and interactions were separated using Fisher's Protected LSD Test at $P \leq 0.05$.

Paraquat plus bentazon with residual herbicides. This experiment was conducted at the Upper Coastal Plain Research Station (Rocky Mount, NC) in 2000 and at the Peanut Belt Research Station (Lewiston, NC) during 2000 and 2001 on soils described previously. Plot size and seedbed preparation were also the same as described previously. Cultivars at Rocky Mount and Lewiston were VA 98R and NC 12C, respectively. Plot size was two rows of 96-cm by 12 m.

Treatments consisted of paraquat alone (0.14 kg ai/ha), paraquat plus bentazon (0.14 + 0.23 kg ai/ha), and combinations of paraquat plus bentazon (0.14 + 0.23 kg ai/ha) with diclosulam (0.027 kg ai/ha), dimethenamid (0.84 kg ai/ha), flumioxazin (0.11 kg ai/ha), imazethapyr (0.071 kg ai/ha), or metolachlor (1.4 kg ai/ha) applied 2 wk after peanut emergence. A nonionic surfactant (Induce) at 0.125% (v/v) was applied with all treatments. Herbicides were applied using the equipment described previously. A non-treated control was included.

Visual estimates of percent peanut injury were recorded 1 and 3 wk after herbicide application using the scale described previously. Data were subjected to analyses of variance and means separated using Fisher's Protected LSD test at $P \leq 0.05$.

Imazapic with diclosulam and flumioxazin. The experiment was conducted in 1999, 2000, and 2001 at the Upper Coastal Plain Experiment Station (Rocky Mount, NC) and in 2001 at the Peanut Belt Research Station

(Lewiston, NC) on soils described previously. Cultivars at Rocky Mount were NC 7 (Rocky Mount and Lewiston in 1999), VA 98R (Rocky Mount in 2001), and NC 12C (Lewiston in 2001). Plot size was four rows (96-cm by 12 m).

Pendimethalin at 1.12 kg/ha was applied preplant incorporated in 1999 over the entire test area but was not applied in 2000 or 2001. Treatments consisted of imazapic at 0.07 kg ai/ha applied alone or with diclosulam (0.013 kg/ha) or flumioxazin (0.05 kg/ha) 3 to 4 wk after peanut emergence. A nonionic surfactant (Induce) at 0.25% (v/v) was included with all treatments. Visual estimates of percent peanut injury were recorded 2 and 5 wk after application using the scale described previously. Peanut was not harvested in these experiments. Data for percent peanut injury were subjected to analyses of variance and means separated using Fisher's Protected LSD Test at $P \leq 0.05$.

Late-season applications of 2,4-DB. The experiment was conducted at seven sites during 2000 and two sites during 2001 throughout the peanut area of North Carolina on sandy to loamy sand soils. Cultivars in 2000 were NC-V 11 (six sites) and NC 7 (one site). In 2001, the cultivars VA 98R and NC 12C were present at one site each. Plot size was four rows (96-cm spacing) and 9 to 15 m in length.

Herbicide programs prior to late-season applications of 2,4-DB varied by site. Peanut was weed-free at the time of 2,4-DB applications which were made 7, 5, or 3 wk before vine inversion. The rate of 2,4-DB was 0.28 kg/ha and an adjuvant was not included as specified on the herbicide label (Jordan and York, 2002). Herbicide was applied using the equipment described previously.

Visual estimates of percent peanut injury were not recorded in this experiment. However, pod yield and gross economic value were determined. Market grade for each treatment was determined by collecting a 0.5 kg random sample from harvested pods from two of four replications. Economic value ($/kg) was calculated using USDA grading criteria. Gross economic value ($/ha) was calculated as the product of economic value and pod yield. Additionally, a standard germination test was performed on seed from removed from the market grade samples. Seed was stored in a plastic bag at 12 C until germination. Prior to standard germination evaluation, seed was treated with a fungicide combination consisting of 45% captan (*N*-trichloromethylthio-4-cyclohexene-1,2-dicarboxamide), 15% PCNB (pentachloronitrobenzene), and 10% carboxin (5,6-dihydro-2-methyl-N-phenyl-1,4-oxathin-3-carboxamide). Standard germination tests were performed on two, 25-seed subsamples in rolled towels at alternating 20/30 C with 16 hr at 20 C. Seedlings were evaluated 8 d after initiation according to standard procedures (Association of Official Seed Analysts, 1999). Only those seed with normal development were considered germinated.

Data for pod yield, gross economic value, and percent seed germination were subjected to analyses of variance for a nine (sites) by four (2,4-DB) factorial treatment arrangement. Means were separated using the appropriate Fisher's Protected LSD Test at $P \leq 0.05$.

Results and Discussion

Acifluorfen plus bentazon with residual herbicides. Interactions of experiment by contact herbicides and experiment by residual herbicides were significant for peanut injury 2 wk after application. The interaction of contact herbicides by residual herbicides was also significant 2 wk after treatment. However, the interaction of experiment by contact herbicide by residual herbicide was not significant for either evaluation. When pooled over residual herbicides, aciflurofen plus bentazon alone or with 2,4-DB did not increase injury at Rocky Mount or at Lewiston in 2000 (Table 1). In contrast, at Lewiston in 2001, peanut injury with acifluorfen plus bentazon alone or with 2,4-DB was 20% compared with 14% when postemergence herbicides were not applied (Table 1). At Edenton, acifuorfen plus bentazon alone or with 2,4-DB injured peanut 7 and 4% more, respectively, than with no postemergence herbicides. Injury with acifluorofen plus bentazon was higher than with acifluorfen plus bentazon plus 2,4-DB.

Peanut injury also varied by experiment and residual herbicide treatment (Table 1). When pooled over contact herbicides, flumioxazin was the most injurious residual herbicide at all sites, with injury ranging from 35 to 62% 2 wk after application. With the exception of metolachlor in 2001, which injured peanut more than diclosulam or dimethenamid, there were no observed differences in peanut injury among residual herbicide treatments. With the exception of flumioxazin, the level of injury caused by these herbicides has not been shown to reduce peanut yield (Wehtje *et al.*, 1988).

When rated 4 wk after application, peanut injury by flumioxazin ranged from 20 to 59% when pooled over contact herbicides (Table 1). Few differences were noted among the other residual herbicides, with injury of 8% or less. The interaction of contact herbicides by residual herbicides was not significant in this evaluation. However, the main effect of contact herbicide was significant 4 wk after application, and applying acifluorfen plus bentazon and acifluorfen plus bentazon plus 2,4-DB increased injury from 8% to 12 and 11%, respectively, when pooled over all locations (data not shown).

Flumioxazin was also the most injurious residual herbicide when applied with acifluorfen plus bentazon alone or with 2,4-DB (Table 2). When pooled over experiments, acifluorfen plus bentazon or acifluorfen plus bentazon plus 2,4-DB injured peanut 6% at 2 wk after application. Metolachlor was the only residual herbicide other than flumioxazin that increased injury by contact herbicides.

Main effects of contact herbicides and residual herbicides were significant for pod yield. However, the interaction of these factors was not significant. Additionally, experiment by treatment factor interactions were not significant. When pooled over experiments and residual herbicides, pod yield was reduced from 4040 kg/ha when contact herbicides were not applied to 3840 kg/ha (acifluorfen plus bentazon) and 3900 kg/ha (acifluorfen plus bentazon plus 2,4-DB) (data not presented). Swann and Herbert (1999) reported that sequential applications

Table 1. Peanut injury 2 and 4 wk following postemergence herbicides applied 6 to 8 wk after peanut emergence.[a]

	Peanut injury							
	2 wks after application				4 wks after application			
			Lewiston				Lewiston	
Herbicide	Rocky Mount	Edenton	2000	2001	Rocky Mount	Edenton	2000	2001
	%							
Contact herbicides[b]								
None	10 a	13 c	8 a	14 b	-	-	-	-
Acifluorfen + bentazon	11 a	20 a	8 a	20 a	-	-	-	-
Acifluorfen + bentazon + 2,4-DB	12 a	17 b	7 a	20 a	-	-	-	-
Residual herbicides[c]								
None	3 bc	5 b	0 b	7 c	4 b	5 b	1 d	2 d
Diclosulam	1 c	5 b	0 b	8 c	3 b	5 b	3 b	5 c
Dimethenamid	6 b	5 b	1 b	9 c	2 b	6 b	3 b	7 bc
Flumioxazin	38 a	62 a	35 a	52 a	27 a	59 a	20 a	45 a
Metolachlor	6 b	5 b	0 b	15 b	3 b	5 b	1 b	8 b

[a]Means within a column or herbicide category (contact or residual herbicide) followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$.
[b]Data are pooled over levels of residual herbicide. Acifluorfen, bentazon, and 2,4-DB applied at 0.28, 0.56, and 0.14 kg ai/ha, respectively.
[c]Data are pooled over levels of contact herbicide. Diclosulam, dimethenamid, flumioxazin, and metolachlor applied at 0.013, 1.12, 0.05, and 0.94 kg ai/ha, respectively.

of acifluorfen plus bentazon reduced pod yield, and concluded that use of contact herbicides should be reassessed due to injury potential. Flumioxazin reduced pod yield by 620 kg/ha compared to yield without residual herbicides when data were pooled over experiments and contact herbicides (Table 2). There was no difference in pod yield when diclosulam, dimethenamid, and metolachlor were applied compared with the no-residual herbicide control.

Paraquat plus bentazon with residual herbicides. The interaction of experiment by herbicide was not significant for peanut injury 1 or 3 wk after application. When pooled over experiments, the combination of paraquat plus bentazon plus flumioxazin injured peanut 81 and 66% at 1 and 3 wk after application, respectively (Table 3). When evaluated 1 wk after application, paraquat alone injured peanut 33% while including paraquat plus bentazon injured peanut 18%. Previous research (Wehtje *et al.*, 1992) demonstrated that bentazon reduces paraquat-induced injury to peanut by reducing paraquat absorption by peanut foliage. While diclosulam and imazethapyr did not increase injury caused by paraquat plus bentazon, dimethenamid and metolachlor did increase injury.

Peanut injury from all herbicides decreased by 3 wk after application (Table 3). While bentazon reduced

Table 2. Influence of contact and residual herbicides on peanut injury 2 wk after treatment and pod yield.[a]

	Contact herbicides[b]			
Residual herbicides[b]	None	Acifluorfen + bentazon	Acifluorfen + bentazon + 2,4-DB	Pod yield[c]
	%			kg/ha
None	0 g	6 cde	6 cde	4020 ab
Diclosulam	3 efg	3 efg	4 def	4180 a
Dimethenamid	4 def	7 cd	5 c-f	3990 ab
Flumioxazin	47 a	46 a	47 a	3400 c
Metolachlor	2 fg	11 b	8 bc	3990 ab

[a]Data are pooled over locations. Means followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's Protected LSD Test.
[b]Diclosulam, dimethenamid, flumioxazin, metolachlor, acifluorfen, bentazon, and 2,4-DB applied at 0.013, 1.12, 0.05, 0.94, 0.28, 0.56, and 0.14 kg/ha, respectively.
[c]Data are pooled over contact herbicides and sites.

Table 3. Peanut injury at 1 and 3 wk after treatment with paraquat plus bentazon alone or in combination with residual herbicides applied 2 wk after peanut emergence.[a]

Herbicides[b]	Peanut injury (after application) 1 wk	3 wk
	---------%--------	
Paraquat	33 b	9 b
Paraquat + bentazon	18 e	2 c
Paraquat + bentazon + diclosulam	22 de	6 bc
Paraquat + bentazon + dimethenamid	24 cd	7 b
Paraquat + bentazon + flumioxazin	81 a	66 a
Paraquat + bentazon + imazethapyr	20 de	5 bc
Paraquat + bentazon + metolachlor	28 c	8 b

[a]Data are pooled over locations. Means within a rating interval followed by the same letter are not significantly different according to Fisher's Protected LSD Test at P ≤ 0.05.

[b]Paraquat, bentazon, diclosulam, dimethenamid, flumioxazin, imazethapyr, and metolachlor applied at 0.14, 0.28, 0.027, 0.84, 0.11, 0.07, and 1.4 kg/ha, respectively.

Table 4. Peanut injury 2 and 5 wk after application of imazapic alone or in combination with diclosulam or flumioxazin.[a]

	Peanut injury			
	Rocky Mount		Lewiston	
Herbicides[b]	1999	2001	1999	2001
	%		%	
2 wk after application				
Imazapic	17 b	12 b	20 b	0 b
Imazapic + diclosulam	17 b	13 b	11 b	0 b
Imazapic + flumioxazin	47 a	68 a	45 a	57 a
5 wk after application				
Imazapic	-	0 b	5 b	0 b
Imazapic + diclosulam	-	0 b	0 b	0 b
Imazapic + flumioxazin	-	38 a	28 a	16 a

[a]Means within a location, year, and rating interval followed by the same letter are not significantly different according to Fisher's Protected LSD Test at P ≤ 0.05.

[b]Imazapic, diclosulam, and flumioxazin applied at 0.07, 0.013, and 0.05 kg/ha, respectively.

injury by paraquat compared with injury by paraquat alone, residual herbicides, other than flumioxazon, injured peanut equal to paraquat alone or when applied in combination with bentazon. Injury following application of herbicides was 2 to 9% except for flumioxazin (66%).

Imazapic with diclosulam and flumioxazin. The interaction of experiment by herbicide was significant for peanut injury 2 and 5 wk after application. Imazapic alone or in combination with diclosulam injured peanut up to 20% at 2 wk after treatment, and diclosulam did not increase injury by imazapic over imazapic alone (Table 4). However, flumioxazin increased injury by 25 to 57% over imazapic alone 2 wk after treatment. Injury with flumioxazin consisted of necrotic foliage and stunting. Injury with imazapic alone or in combination with diclosulam was primarily stunting.

By 5 wk after application, little to no injury was noted when imazapic was applied alone or in combination with diclosulam (Table 4). However, injury following application of imazapic plus flumioxazin still exceeded that by imazapic alone or in combination with diclosulam. Stunting of peanut following imazapic application was reported previously (Richburg *et al.*, 1995, 1996; Wehtje *et al.*, 2000).

Late-season applications of 2,4-DB. The interaction of site by 2,4-DB treatment was not significant for pod yield, gross economic value, or percent seed germination. Additionally, the main effect of 2,4-DB treatment was not significant for these parameters. There was no difference in pod yield, gross economic value, or percent seed germination regardless of timing of 2,4-DB application compared with non-treated peanut (data not shown). When pooled over sites, pod yield and gross economic value ranged from 3790 to 4000 kg/ha and 1222 and 1304 $/ha, respectively (data not presented). Percent seed germination ranged from 89 to 91% (data not shown).

Collectively, these data suggest that flumioxazin applied postemergence can cause significant peanut injury when applied alone or in combination with acifluorfen plus bentazon (with or without 2,4-DB) and paraquat plus bentazon. Results from this research also document excessive peanut injury following postemergence applications of flumioxazin with imazapic. In contrast, diclosulam in combination with acifluorfen plus bentazon, imazapic, or paraquat plus bentazon did not increase injury, suggesting that diclosulam may be a possible residual compliment with postemergence herbicides currently applied to peanut. Results from these studies also suggest that acifluorfen plus bentazon can reduce peanut yield under weed-free conditions. Yield reductions were not exacerbated by the chloroacetamide herbicides dimethenamid or metolachlor. Although these data illustrate potential for yield loss from acifluorfen plus bentazon alone or in combination with 2,4-DB, these herbicides control a wide range of broadleaf weeds that infest peanut, and in some cases they are the only herbicide option to minimize weed interference. Consistent with other research (Ketchersid *et al.*, 1978; Grichar *et al.*, 1997; Baughman *et al.*, 2002), late-season applications of 2,4-DB at rates within label recommendations do not appear to adversely affect peanut.

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