Interaction of Prohexadione Calcium with Agrichemicals Applied to Peanut (*Arachis hypogaea* L.)

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ABSTRACT

A variety of pesticides and foliar fertilizers are applied to emerged peanut. Defining interactions among these agrichemicals is important when formulating pest management and production strategies. Research was conducted in North Carolina during 1999 and 2000 to evaluate interactions among prohexadione calcium at 140 g ai/ha applied with various commercially available fungicides, insecticides, herbicides, and foliar fertilizers. Agrichemical mixtures were applied when peanut vines reached 50% row closure. Prohexadione calcium alone was applied approximately 2 wk later. Twenty-eight percent urea ammonium nitrate was included with prohexadione calcium. In a second set of experiments, control of pitted morningglory (*Ipomoea lacunosa* L.) and yellow nutsedge (*Cyperus esculentus* L.) by imazapic plus 2,4-DB, acifluorfen plus bentazon plus 2, 4-DB, bentazon plus 2, 4-DB, acifluorfen plus 2, 4-DB, pyridate plus 2,4-DB, and 2,4-DB applied alone or with prohexadione calcium were evaluated. Large crabgrass [*Digitaria sanguinalis* (L.) Scop.] control by sethoxydim and clethodim alone or with prohexadione calcium was evaluated also. Fungicides, insecticides, and foliar fertilizers did not affect efficacy of prohexadione calcium with respect to visible injury to peanut, row visibility, or maintenance of short stems. Slightly higher injury was noted when acifluorfen, acifluorfen plus bentazon, bentazon, and pyridate were applied with prohexadione calcium. Minor increases in pitted morningglory control and peanut injury were noted when herbicides were applied with prohexadione calcium, most likely due to presence of urea ammonium nitrate. However, prohexadione calcium did not affect large crabgrass control by sethoxydim or clethodim. Collectively, these data suggest that prohexadione calcium and the majority of agrichemicals applied to peanut are compatible.

Key Words: Pesticide interaction, pesticide compatibility.

Prohexadione calcium (calcium salt of 3,5-dioxo-4-propionylcyclohexanecarboxylic acid) has been shown to effectively regulate vegetative growth of apples (*Malus* spp.), rice (*Oryza sativa* L.), tomato (*Lycopersicon esculentum* Mill.), grain sorghum [*Sorghum bicolor* (L.) Moench], wheat (*Triticum aestivum* L.), and oilseed rape (*Brassica napus* L.) (Yamaji *et al.*, 1991; Nakayama *et al.*, 1992; Grossman *et al.*, 1994; Lee *et al.*, 1998; Byers and Yoder, 1999). Prohexadione calcium inhibits gibberellin biosynthesis by blocking kaurene oxidase and also increases the level of abscisic acid and cytokinins in responsive species (Grossman *et al.*, 1994). *In vivo*, the primary mode of action of prohexadione calcium is inhibition of 3β-hydroxylation of GA_{20} to GA_1 (Nakayama *et al.*, 1992). Prohexadione calcium improved peanut row visibility, increased pod yield, and improved market

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grade characteristics when applied at 50% row closure and repeated approximately 2 wk later (Mitchem *et al.*, 1996; Culpepper *et al.*, 1997; Jordan *et al.*, 2000). However, a favorable yield response did not always occur, and the magnitude of response was variable.

Compatibility of agrichemicals is an important factor in developing production and pest management strategies (Hatzios and Penner, 1985). Growers prefer to mix agrichemicals when timing of application of two or more agrichemicals coincides in order to increase efficacy, reduce application costs, save time, or increase convenience. However, efficacy of agrichemicals can be affected when applied in combination (Hatzios and Penner, 1985; Minton *et al.*, 1989; Vidrine, 1989). Potential interactions of prohexadione calcium and commercially available herbicides, insecticides, fungicides, and foliar fertilizers have not been thoroughly evaluated.

Weeds often escape herbicide treatments applied to peanut early in the season and require additional postemergence herbicides for season-long control. Growers in the Virginia-Carolina production region routinely spray fungicides on a 14-d interval for leaf spot (*Cercosporidium personatum* Berk. & M.A. Curtis or *Cercospora arachidicola* Hori) and southern stem rot (*Sclerotium rolfsii* Sacc.) control (Bailey, 2001). Insecticides and foliar fertilizers also are applied later in the season. Defining potential interactions of prohexadione calcium with agrichemicals will be useful in effective utilization of prohexadione calcium in peanut. Research was conducted to determine if the efficacy of prohexadione calcium is affected when applied with agrichemicals and to determine if prohexadione calcium adversely affects weed control when mixed with postemergence herbicides.

Table 1. Common name, trade name, classification, and use rate of agrichemicals applied in the experiments evaluating the influence of agrichemicals on efficacy of prohexadione calcium.

Common name	Trade name	Classification	Rate
			kg ai/ha
Clethodim	Select	Herbicide	0.09
Sethoxydim	Poast Plus	Herbicide	0.21
Acifluorfen + bentazon	Storm	Herbicide	0.28 +0.56
Bentazon	Basagran	Herbicide	1.12
Acifluorfen	Blazer	Herbicide	0.28
Pyridate	Tough	Herbicide	1.05
2,4-DB	Butyrac 200	Herbicide	0.28
Carbaryl	Sevin XLR	Insecticide	0.84
Acephate	Orthene	Insecticide	1.09
Malathion	Malathion	Insecticide	2.52
Lambda -cyhalothrin	Karate	Insecticide	0.051
Fenpropathrin	Danitol	Insecticide	0.27
Propargite	Comite	Insecticide	1.83
Sodium borate	Solubor	Foliar fertilizer	2.8
Manganese sulfate	Super Mangro	Foliar fertilizer	2.8
Manganese lignosulfonates	Liquid Mn	Foliar fertilizer	0.15
Sodium borate	N-Boron	Foliar fertilizer	0.09
Chlorothalonil	Bravo Weather Stik	Fungicide	1.26
Copper hydroxide	Kocide	Fungicide	1.26
Copper hydroxide + mancozeb	Mankocide	Fungicide	2.06 +0.67
Tebuconazole	Folicur	Fungicide	0.20
Iprodione	Rovral	Fungicide	1.12
Azoxystrobin	Abound	Fungicide	0.44
Chlorothalonil + propiconazole	Bravo Weather Stik + Tilt	Fungicide	0.84 +.063
Fluazinam	Omega 500	Fungicide	0.56

Materials and Methods

Influence of Agrichemicals on Efficacy of Prohexadione Calcium. Experiments were conducted at the Peanut Belt Res. Sta. located near Lewiston, NC in 1999 and 2000. Soil was a Norfolk sandy loam (fine-loamy, siliceous, thermic, Aquic Paleudults). The cultivars NC 9 (1999) and NC 12C (2000) were planted in conventionally prepared seedbeds spaced 91 cm apart in early May at a seeding rate of 130 kg/ha. Plot size was 1.8 by 3 m with one nontreated border row between plots. Production and pest management practices other than combinations of prohexadione calcium and other agichemicals were held constant over the entire experiment.

Prohexadione calcium (Baseline™) (BASF Corp., Research Triangle Park, NC) at 140 g/ha was applied alone or with the manufacturer's suggested use rate of agrichemicals that are often applied in peanut (Table 1). Herbicides included clethodim {(*E,E*)-(±)-2-[1-[[(3-chloro-2-propenyl) oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one}, sethoxydim {2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one}, acifluorfen {5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid} plus bentazon [3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide], bentazon, acifluorfen, pyridate [*O*-(6-chloro-3-phenyl-4-pyridazinyl) *S*-octyl carbonothioate], and 2,4-DB [4-(2,4-dichlorophenoxy)butanoic acid]. Insecticides included carbaryl (1-naphthyl *N*-methylcarbamate), acephate (*O,S*-dimethyl acetylphosphoramidothioate), malathion (*O-O*-dimethyl phosphorodithioate of diethyl mercapotosuccinate), lambda-cyhalothrin {[1α(*S**),3 α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopanecarboxylate}, fenpropathrin (α-cyano-3-phenoxybenzl 2,2,3,3-tetramethylcyclopropanecarboxylate), and propargite {sulfurous acid, 2-[4-(1,1-dimethyl-ethyl) phenoxy] cyclohexyl-2-propynyl ester}. Fungicides included chlorothanil (tetrachloroisophthalonitrile), copper hydroxide (metallic copper equivalent 35%), copper hydroxide plus mancozeb (manganese, zinc, and ethylenebisdithiocarbamate ion), tebuconazole {α-[2-(4-chlorophenyl)ethyl]- α-(1,1-dimethyl)-1 *H*-1,2,4-triazole-1-ethanol}, iprodione [3-(3,5-dichlorophenyl)-*N*-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide], azoxystrobin {methyl (*E*)-2-[2-[6-(2-cyanophenoxy) pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate}, chlorothalonil plus propiconazole {1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole}, and fluazinam [3-chloro-*N*-(3-chloro-5-trifluoromethyl-2-pyridyl)-2,2,2-trifluoro-2,6-dinitro-*p*-toluidine]. Foliar fertilizers included the commercial products Solubor (sodium borate), Super Mangro (manganese sulfate), Liquid Mn (manganese lignosulfonates), and N-Boron (sodium borate).

Four separate experiments were established to evaluate interactions of prohexadione calcium with the above-mentioned herbicides, fungicides, insecticides, or foliar fertilizers. Prohexadione calcium alone and in combination with the other agrichemicals was applied when peanut vines reached 50% row closure (50% of vines from adjacent rows were touching). Agrichemicals were applied also without prohexadione calcium. Prohexadione calcium also was applied alone 2 wk after the first application. Two applications of prohexadione calcium are generally needed to establish row visibility that will remain until harvest (Mitchem *et al.*, 1996). Urea ammonium nitrate (UAN) at 2.3 L/ha was applied with prohexadione calcium alone or when mixed with agrichemicals. Maximum efficacy of prohexadione calcium is obtained when UAN is included with prohexadione calcium (Jordan *et al.*, 2000). Adjuvants were applied with the agrichemicals alone or with agrichemicals plus prohexadione calcium when specified by the agrichemical label. Urea ammonium nitrate was the only adjuvant applied with prohexadione calcium alone. Agrichemicals were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 140 L/ha at 207 kPa using 8002 flat fan nozzles (Spraying Systems Co., Wheaton, IL).

Row visibility was estimated visually using a scale of 1 (flat canopy with indistinguishable rows) to 10 (triangular-shaped rows with no vines from adjacent rows touching in the row middles) in mid-September (1999) or late August (2000). Height of three plants selected at random within each plot from the soil surface to the top of the main stems was recorded during these times. Average height of the three plants was considered the experimental unit. Visual estimates of percent peanut injury consisting of foliar chlorosis, necrosis, and stunting were recorded 1 and 2 wk after the first prohexadione calcium application using a scale of 0 to 100 where 0 = no injury and 100 = plant death.

The design for each experiment was a randomized complete block with treatments replicated four times. Data were analyzed as a prohexadione calcium rate by agrichemical factorial treatment arrangement for each group of agrichemicals. Means of significant main effects and interactions were separated using Fisher's Protected LSD Test at $P \leq 0.05$.

Influence of Prohexadione Calcium on Herbicide Efficacy. One set of experiments was conducted in a field at the Peanut Belt Res. Sta. located near Lewiston, NC in 2000 on a Norfolk sandy loam soil. The experiment was repeated three times over a 10-d period in different areas of the field. The peanut cultivar NC 12C was planted in 91-cm rows in early May in conventionally prepared seedbeds. Plot size was 1.8 by 3 m.

Herbicides treatments were imazapic {(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5oxo-1*H*-imidazol-2-yl)]-5-methyl-3-pyridinecarboxylic acid} plus 2,4-DB (0.071 + 0.28 kg ai/ha), acifluorfen plus bentazon plus 2,4-DB (0.28 + 0.56 + 0.28 kg ai/ha), bentazon plus 2,4-DB (1.12 + 0.28 kg ai/ha), acifluorfen plus 2,4-DB (0.28 + 0.28 kg ai/ha), pyridate plus 2,4-DB (1.05 + 0.28 kg ai/ha), and 2,4-DB (0.28 kg/ha). Herbicides were applied alone or mixed with prohexadione calcium at 140 g/ha using a CO_2-pressurized backpack sprayer calibrated to deliver 140 L/ha at 207 kPa using 8002 regular flat fan nozzles (Spraying Systems Co., Wheaton, IL). Urea ammonium nitrate at 2.3 L/ha and a nonionic surfactant (Induce™, Helena Chemical Co., Memphis, TN) at 0.25% (v/v) were included. Prohexadione calcium plus UAN also was applied alone. Test areas were infested with natural populations of yellow nutsedge (*Cyperus esculentus* L.) and pitted morningglory (*Ipomoea lacunosa* L.). Yellow nutsedge height ranged from 10 to 25 cm. Pitted morningglory had five to 15 leaves. Density of pitted morningglory and yellow nutsedge ranged from 5 to 15 plants/m^2.

In a second set of experiments conducted in a different area of the same field, large crabgrass [*Digitaria sanguinalis* (L.) Scop.] control by clethodim and sethoxydim applied alone or with prohexadione calcium was evaluated. A crop oil concentrate (Agri-Dex™, Helena Chemical Co., Memphis, TN) at 1.0% (v/v) was applied with all treatments. Herbicides were applied as described previously when the height of large crabgrass was 5 to 10 cm at the time of application. Density ranged from 10 to 30 plants/m^2. The experiment was conducted twice.

In a third set of experiments, efficacy of imazethapyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imdazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid}, pyridate plus 2,4-DB, 2,4-DB, acifluorfen plus 2,4-DB, bentazon, acifluofen plus imazethapyr, and acifluorfen plus bentazon plus 2,4-DB was evaluated in separate experiments when applied alone or with prohexadione calcium at 140 g/ha. A nontreated control also was included. Weed species treated with specific herbicides are listed in (Table 2). Soils were sandy loam to loam located throughout northeastern North Carolina. Experiments were conducted in peanut or fallow areas with uniform weed populations.

In all experiments, visual estimates of percent weed control and peanut injury were recorded 2 wk after treatment using a scale of 0 to 100% where 0 = no control or injury and 100 = complete control or peanut death. The experimental design was a randomized complete block with treatments replicated three times. Data for the visual estimates of percent weed control were subjected to analysis of variance with partitioning appropriate for the factorial treatment arrangement in the first two sets of experiments. Appropriate Fisher's Protected LSD Test at $P \leq 0.05$ separated means. In the third set of experiments, significance between herbicides alone or with prohexadione calcium were separated using Fisher's Protected LSD Test at $P \leq 0.05$.

Results and Discussion

Influence of Agrichemicals on Efficacy of Prohexadione Calcium. Prohexadione calcium by agrichemical or year by agrichemical by prohexadione calcium interactions were not significant for foliar fertilizers or fungicides, indicating that these agrichemicals did not affect efficacy of prohexadione calcium for row visibility or main stem height (data not presented). However, main effects of prohexadione calcium were significant for main stem height and row visibility. When pooled over years and foliar fertilizers or fungicides, main stem height was 42 cm with prohexadione calcium compared with 47 cm for nontreated peanut (data not presented). Prohexadione calcium increased row visibility regardless of foliar fertilizer or fungicide treatment (3.4 versus 1.6 with foliar fertilizers and 3.8 versus 2.0 with fungicides) (data not presented). Peanut was not

Table 2. Common names of herbicides and weed species included in the multi-site experiment evaluating compatibility of postemergence herbicides and prohexadione calcium.

Herbicides	Common name	Species
Imazethapyr	Johnsongrass	*Sorghum halepense* L. Pers.
Imazethapyr	Entireleaf morningglory	*Ipomoea hederacea* var. *integriuscula* Gray
Imazethapyr	Smooth pigweed	*Amaranthus hybridus* L.
Pyridate + 2,4-DB	Common lambsquarters	*Chenopodium album* L.
Pyridate + 2,4-DB	Smooth pigweed	*A. hybridus*
2,4-DB	Sicklepod	*Senna obtusifolia* (L.) Irwin and Barnaby
2,4-DB	Palmer amaranth	*A. palmeri*
2,4-DB	Common cocklebur	*Xanthium strumarium* L.
2,4-DB	Smooth pigweed	*A. hybridus*
Acifluorfen + bentazon + 2,4-DB	Palmer amaranth	*A. palmeri*
Acifluorfen + bentazon + 2,4-DB	Sicklepod	*S. obtusifolia*
Acifluorfen + bentazon + 2,4-DB	Common cocklebur	*X. strumarium*
Acifluorfen + bentazon + 2,4-DB	Pitted morningglory	*I. lacunosa*
Acifluorfen + bentazon + 2,4-DB	Yellow nutsedge	*Cyperus esculentus* L.
Acifluorfen	Smooth pigweed	*A. hybridus*
Imazethapyr + acifluorfen	Smooth pigweed	*A. hybridus*
Bentazon	Yellow nutsedge	*C. esculentus*

injured regardless of the fungicide or foliar fertilizer applied with prohexadione calcium (data not presented). Previous research (Mitchem *et al.*, 1996; Jordan *et al.*, 2000) suggested that prohexadione calcium limits main stem height.

Insecticides did not affect peanut response to prohexadione calcium as measured by main stem height (data not presented). When pooled over years and insecticides, main stem height of prohexadione calcium-treated peanut averaged 42 cm compared with 51 cm for nontreated peanut (data not shown).

Unlike the experiments evaluating foliar fertilizers and fungicides, differences in row visibility among combinations of prohexadione calcium and insecticides depended upon the year. In 1999, the interaction of insecticide by prohexadione calcium was not significant. Row visibility increased from 1.1 to 2.7 when prohexadione calcium was applied (data not shown). However, the interaction of insecticide by prohexadione calcium was significant in 2000. Although prohexadione calcium increased row visibility regardless of insecticides, differences in the increase were noted among some of the insecticide treatments (Table 3). Malathion mixed with prohexadione calcium had the highest rating for row visibility, while row visibility following acephate and fenpropathrin did not differ from the no-insecticide treatment. There were no significant interactions for peanut injury 1 wk after treatment (data not presented). However, a significant interaction of insecticide by year was noted for peanut injury 2 wk after treatment. Propargite injured peanut 7% in 1999 (Table 3), but other insecticides did not injury peanut in 1999. Prohexadione calcium alone or with insecticides did not injure peanut in 2000.

Table 3. Effect of insecticides and prohexadione calcium on row visibility and peanut injury 2 wk after treatment.

	Row visibility[a] Prohexadione calcium rate (g/ha)		Peanut injury[b]	
Insecticide	0	140	1999	2000
	---------% ---------		-----------% --------	
Nontreated	2 d	4 c	0 b	1 a
Carbaryl	1 d	5 ab	1 b	0 a
Acephate	2 d	4 c	0 b	0 a
Malathion	1 d	6 a	0 b	0 a
Lambda-cyhalothrin	2 d	5 ab	0 b	1 a
Fenpropathrin	2 d	4 c	0 b	0 a
Propargite	2 d	5 ab	7 a	0 a

[a] Means for row visibility followed by the same letter for the interaction of insecticide by prohexadione calcium rate are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$. Row visibility was estimated visually using a scale of 1 (flat canopy with indistinguishable rows) to 10 (triangular-shaped rows with no vines from adjacent rows touching in the row middles).

[b] Means for peanut injury within a year followed by the same letter are not significantly different at $P \leq 0.05$. Data are pooled over prohexadione calcium treatments.

A year by prohexadione calcium interaction was noted for main stem height in the herbicide experiment. In 1999, main stem height was 45 cm for nontreated peanut and 39 cm when prohexadione calcium was applied (data not presented). In 2000, main stem height was 51 cm for nontreated peanut compared with 42 cm for prohexadione calcium-treated peanut. Likewise, a year by prohexadione calcium interaction was noted for row visibility. Prohexadione calcium increased row visibility from 1 to 3 in 1999 and from 2 to 5 in 2000 (data not presented).

The interaction of year by herbicide was noted for peanut injury 1 wk after treatment. Peanut injury was generally greater 1 wk after treatment compared with injury noted later. In 1999, acifluorfen injured peanut 31%, and this level of injury exceeded that by the other herbicides (Table 4). Injury by bentazon and acifluorfen plus bentazon was 10 and 18%, respectively. In 2000, acifluorfen and sethoxydim injured peanut more than pyridate, acifluorfen plus bentazon, clethodim, or bentazon, and injury was similar to 2,4-DB (Table 4). However, injury in 2000 was less than 8%.

The interaction of year by prohexadione calcium by herbicide was significant 2 wk after treatment. In 1999,

Table 4. Effect of herbicides and prohexadione calcium on peanut injury 1 and 2 wk after herbicide treatment.

			2 WAT[b] (2000)	
	1 WAT[a]		Prohexadione calcium rate (g/ha)	
Herbicide treatment	1999	2000	0	140
	--------%	--------	-------%	----------
Nontreated	0 d	0 d	0 d	0 d
Clethodim	0 d	2 cd	2 cd	2 cd
Sethoxydim	0 d	7 a	3 bc	5 b
Acifluorfen + bentazon	18 b	3 bc	0 d	5 b
Bentazon	10 c	2 cd	0 d	5 b
Acifluorfen	31 a	8 a	3 bc	8 a
Pyridate	1 d	1 cd	2 cd	5 b
2,4-DB	2 d	6 ab	0 d	0 d

[a] Means within a year followed by the same letter are not significantly different according to the appropriate Fisher's Protected LSD Test at $P \leq 0.05$. Data are pooled over prohexadione calcium treatments.

[b] Means for the interaction of herbicide by prohexadione rate followed by the same letter are not significantly different at $P \leq 0.05$.

there were no differences in injury among herbicides (data not shown). In 2000, acifluorfen plus prohexadione calcium caused the greatest injury to peanut (8%) (Table 4). Bentazon, pyridate, and acifluorfen plus bentazon injured peanut more when prohexadione calcium was included in the mixture. Increased injury was most likely due to the UAN applied with the prohexadione calcium. Urea ammonium nitrate was not applied when herbicides were applied alone. Fielding and Stoller (1990) reported that UAN increased thifensulfuron {methyl 3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-amino]carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid} injury to soybean [*Glycine max* (L.) Merr].

Influence of Prohexadione Calcium on Herbicide Efficacy. The interaction of experiment by herbicide and the main effect of prohexadione calcium were significant for pitted morningglory control. Acifluorfen plus bentazon plus 2,4-DB controlled pitted morningglory more effectively than imazapic plus 2,4-DB, pyridate plus 2, 4-DB, or 2,4-DB in Experiment 1 (Table 5). In Experiment 2, control by imazapic plus 2,4-DB, acifluorfen plus 2,4-DB, and acifluorfen plus bentazon plus 2,4-DB was similar. Control by imazapic plus 2,4-DB was greater than bentazon plus 2,4-DB, pyridate plus 2, 4-DB, or 2,4-DB. In Experiment 3, all herbicide mixtures controlled pitted morningglory more than 2,4-DB alone. Wilcut (1991) reported at least 90% control of pitted morningglory with acifluorfen plus 2,4-DB or acifluorfen plus bentazon plus 2,4-DB. Richburg *et al.* (1996) reported that imazapic controlled *Ipomoea* morningglory species at least 90%.

When pooled over herbicides and experiments, pitted morningglory control was 7% greater when prohexadione calcium was included with herbicides (73 versus 66%) (data not presented). Although it is possible that prohexadione calcium increased efficacy, the most likely increase in control resulted from the UAN applied with the mixture of prohexadione calcium and herbicides. Urea ammonium nitrate was not included when herbicides were applied alone. Previous research (Bruce *et al.*, 1996) suggested that UAN increases efficacy of nicosulfuron{2-[[[[(4,6-dimethyl-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-*N,N*-dimethyl-3-pyridinecarboxamide} and primisulfuron {methyl 2-[[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]-amino]carbonyl]amino]sulfonyl]benzoate} by increasing herbicide absorption. Additionally, Jordan and York (1989) reported increased control of large crabgrass when sethoxydim was applied with crop oil concentrate and UAN compared with crop oil concentrate only.

The experiment by herbicide interaction also was significant for yellow nutsedge control. Imazapic plus 2,4-DB controlled yellow nutsedge more effectively than the other herbicides (Table 5). Hurt and Vencill (1994) reported 61% yellow nutsedge control by imazapic, while Richburg *et al.* (1996) reported at least 81% control of yellow nutsedge with this herbicide. Jordan and York (2001) reported 80 to 90% control of yellow nutsedge by imazapic or bentazon plus 2,4-DB.

Interactions of prohexadione calcium by herbicide and experiment by prohexadione calcium by herbicide were not significant for peanut injury. When pooled over experiments and prohexadione calcium treatment, imazapic plus 2,4-DB was the most injurious herbicide treatment (13%) (Table 5). No differences in injury were noted among the other herbicides, although injury exceeded that of the no-herbicide control. Prohexadione calcium increased peanut injury from 6 to 8% when pooled over herbicides and experiments (data not presented). The most plausible explanation for increased injury is presence of UAN. Fielding and Stoller (1990) reported that the addition of UAN to thifensulfuron resulted in greater injury to soybean compared to thifensulfuron applied alone.

In the study evaluating efficacy of sethoxydim and clethodim, large crabgrass was controlled at least 92% when graminicides were applied. Prohexadione calcium did not affect efficacy of clethodim or sethoxydim (data not presented). Although not observed in these experi-

Table 5. Pitted morningglory and yellow nutsedge control and peanut injury by postemergence herbicides.

	Control						
	Pitted morningglory[a]			Yellow nutsedge[a]			
Herbicides	Exp. 1	Exp. 2	Exp. 3	Exp. 1	Exp. 2	Exp. 3	Peanut injury[b]
	%			%			%
No-herbicide	9 e[c]	0 d	3 c	3 c	0 c	0 b	3 c
Imazapic + 2,4-DB	67 c	96 a	89 a	61 a	35 a	48 a	13 a
Acifluorfen + bentazon + 2,4-DB	86 a	89 ab	100 a	40 b	8 b	10 b	6 b
Bentazon + 2,4-DB	82 ab	79 bc	100 a	42 b	5 b	11 b	6 b
Acifluorfen + 2,4-DB	81 ab	90 ab	93 a	18 c	7 b	13 b	7 b
Pyridate + 2,4-DB	69 bc	74 c	97 a	36 b	8 b	10 b	7 b
2,4-DB	48 d	68 c	39 b	3 cd	5 b	6 b	8 b

[a]Data are pooled over prohexadione calcium treatments.

[b]Data are pooled over prohexadione calcium treatment and experiments.

[c]Means within a weed species and experiment or for peanut injury followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$.

ments, UAN can increase efficacy of sethoxydim (Jordan and York, 1989).

In the studies evaluating johnsongrass [*Sorghum halepense* (L.) Pers.], entireleaf morningglory [*Ipomoea hederacea* var. *integriuscula* Gray], and smooth pigweed (*Amaranthus hybridus* L.) control by imazethapyr; common lambsquarters (*Chenopodium album* L.) and smooth pigweed control by pyridate plus 2,4-DB; sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby], Palmer amaranth (*Amaranthus palmeri* L.), common cocklebur (*Xanthium strumarium* L.), and smooth pigweed control by 2,4-DB; and smooth pigweed control by acifluorfen, addition of prohexadione calcium did not affect weed control (Table 6). However, in the study evaluating yellow nutsedge control by bentazon, prohexadione calcium decreased control from 55 to 45% (Table 6). Additionally, sicklepod control by acifluorfen plus bentazon plus 2,4-DB was reduced by prohexadione calcium, while Palmer amaranth, common cocklebur, pitted morningglory, and yellow nutsedge control were not affected by adding prohexadione calcium to this herbicide combination.

Prohexadione calcium affected efficacy of some but not all postemergence herbicides evaluated in these studies. Slight increases in peanut injury and weed control were noted when prohexadione calcium was applied with herbicides, and this was most likely due to UAN rather than prohexadione calcium. Foliar fertilizers, fungicides, insecticides, and herbicides did not affect improvements of row visibility caused by prohexadione calcium. Collectively, these data suggest that prohexadione calcium is compatible with the agrichemicals most often applied to peanut. However, the effect of prohexadione calcium on disease and insect control and peanut response to foliar fertilizers needs to be determined.

Table 6. Effect of prohexadione calcium on weed control when mixed with selected herbicides.

		Weed control	
		Prohexadione calcium rate (g/ha)	
Herbicides	Weed species	0	140
		%	
Imazethapyr	Johnsongrass	85 a[a]	73 a
Imazethapyr	Entireleaf morningglory	82 a	68 a
Imazethapyr	Smooth pigweed	75 a	83 a
Pyridate + 2,4-DB	Common lambsquarters	97 a	98 a
Pyridate + 2,4-DB	Smooth pigweed	99 a	99 a
2,4-DB	Sicklepod	40 a	43 a
2,4-DB	Palmer amaranth	28 a	25 a
2,4-DB	Common cocklebur	100 a	100 a
2,4-DB	Smooth pigweed	40 a	38 a
Acifluorfen + bentazon + 2,4-DB	Palmer amaranth	48 a	42 a
Acifluorfen + bentazon + 2,4-DB	Sicklepod	68 a	63 b
Acifluorfen + bentazon + 2,4-DB	Common cocklebur	93 a	82 a
Acifluorfen + bentazon + 2,4-DB	Pitted morningglory	53 a	43 a
Acifluorfen + bentazon + 2,4-DB	Yellow nutsedge	45 a	58 a
Acifluorfen	Smooth pigweed	58 a	42 a
Imazethapyr + acifluorfen	Smooth pigweed	70 a	87 a
Bentazon	Yellow nutsedge	55 a	45 b

[a]Means followed by the same letter within each weed species/herbicide combination are not significantly different at $P \leq 0.05$.

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