Performance and Economic Benefit of Herbicides Used for Broadleaf Weed Control in Peanut

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ABSTRACT

Field experiments were conducted over two growing seasons (1995 and 1996) and at two locations (Jay, FL, and Headland, AL) to identify the most effective herbicide program for Florida beggarweed [*Desmodium tortuosum* (SW) D.C.] control in peanut (*Arachis hypogaea* L.). The most common herbicides used for Florida beggarweed control—including preemergence (PRE), early-postemergence (EPOST), mid-postemergence (MPOST) and late-postemergence (LPOST) applied treatments—were evaluated in a factorial treatment arrangement. All treatments had merit and could be assembled into programs that resulted in maximum weed control, crop yield, and net returns. However, at least two of the four treatment timings were required to reach this level. Four systems were consistently associated with the maximum statistical grouping for both yield and net returns, as well as acceptable Florida beggarweed control (≥81%). These systems were (a) paraquat + bentazon applied EPOST, followed by pyridate + 2,4-DB MPOST; (b) same as (a) only preceded by norflurazon applied PRE; (c) imazapic applied EPOST followed by pyridate + 2,4-DB MPOST; and (d) norflurazon applied PRE, followed by imazapic EPOST.

Key Words: Chlorimuron, 2,4-DB, imazapic, norflurazon, pyridate, weed control economics.

Florida beggarweed [*Desmodium tortuosum* (SW) D.C.] remains one of the most problematic weeds in southeastern peanut production. Peanut yield was reduced 20 to 40% by a Florida beggarweed density of 1 plant m^{-1} of row (Buchanan *et al.*, 1982; Hauser *et al.*, 1982). In an area-of-influence study, individual plants of five Florida beggarweed biotypes reduced peanut yield in 1 m of row from 10 to 24% (Cardina and Brecke, 1989). In addition to weed-crop competition for water, nutrients, and/or light, Florida beggarweed can impede fungicide applications (Royal *et al.*, 1997).

Several herbicides are registered for control of Florida beggarweed in peanuts. These herbicides vary in the time of application, type of activity (i.e., soil- vs. foliage-active), and overall effectiveness. Norflurazon {4-chloro-5-[methylamino-2-(trifluoromethyl) phenyl]-3(2*H*)-pyridazinone} is a soil-active herbicide that has preemergence activity against Florida beggarweed. McLean *et al.* (1995) reported that norflurazon applied alone at 1.3 kg ai/ha (registered rate) controlled Florida beggarweed 85%.

Imazapic {(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imadazol-2-yl]-5-methyl-3-pyridinecarboxylic acid} is an imidazolinone herbicide that was registered for use in peanut in 1996. It has both soil and foliar activity and is generally applied early postemergence (Richburg *et al.*, 1994). Imazapic is effective on a large number of broadleaf weeds that infest peanuts. Frequently, imazapic must be supplemented with other herbicides. Richburg *et al.* (1996) reported maximum control of sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby] and Florida beggarweed with either (a) a postemergence application of imazapic at 27 or 36 g ai/ha + tank mixed with bentazon [3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide] and paraquat (1,1'-dimethyl-4,4'-bipyridinium ion) or (b) bentazon + paraquat applied EPOST, followed by imazapic at either 36 or 53 g/ha applied POST. Although effective, control with imazapic can be variable. Brecke *et al.* (1995) reported that Florida beggarweed control with imazapic applied alone ranged from 40 to 80%. Similarly, Richburg *et al.* (1995) reported that Florida beggarweed control with imazapic applied alone at 72 g/ha ranged from 23 to 90%.

Paraquat is another effective early-postemergence treatment for control of both annual grasses and broadleaf weeds (Wilcut *et al.*, 1990; Wehtje *et al.*, 1992). Wilcut *et al.* (1996) reported that imazapic was generally more effective on a diverse group of weed species than two postemergence applications of tank-mixed paraquat with bentazon.

Pyridate [*O*-(6-chloro-3-phenyl-4-pyridazinyl)-S-octyl-carbonothioate] applied postemergence controls Florida beggarweed in peanut (Hicks *et al.*, 1990). Pyridate is typically tank mixed with 2,4-DB [4-(2,4-dichlorophenoxy)-butanoic acid]. This combination is synergistic with respect to sicklepod control and independent with respect to Florida beggarweed control and peanut tolerance (Hicks *et al.*, 1990).

Chlorimuron {2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino] carbonyl]amino]sulfonyl] benzoic acid} controls several broadleaf weed species, including Florida beggarweed, in peanut. Chlorimuron application is restricted to later than 60 d after peanut emergence due to crop tolerance. Chlorimuron absorption by peanut is relatively minimal during this period, and that which is absorbed is readily metabolized (Wilcut *et al.*, 1989). Unfortunately, peanut injury can occur even when correct application timing is observed. Chlorimuron was implicated in yield suppression in four out of 15 trials conducted across the peanut-production region (Brown *et*

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al., 1993). However, it was concluded that the risk of yield loss from Florida beggarweed competition was greater than that from chlorimuron-induced crop injury.

In attempting to achieve adequate Florida beggarweed control, growers must select one or more of the aforementioned herbicide treatment options. The intent of this study was to evaluate these treatments, both alone and in all possible combinations, in an attempt to identify the most effective system(s). In addition to the standard response variables of weed control and yield, data were subjected to an economic analysis to appraise treatment performance with respect to their costs.

Materials and Methods

General Information. Field experiments were conducted during 1995 and 1996 at the Wiregrass Substation of Auburn Univ. located at Headland, AL and at the West Florida Res. and Educ. Center of the Univ. of Florida located at Jay, FL. Selected test areas had heavy populations of Florida beggarweed. Soil at Headland was a Dothan loamy sand (fine-loamy, siliceous, thermic plinthic paleudults) with 1.3% organic matter and a pH of 6.5. Soil at Jay was a Red Bay sandy loam (fine-loamy, siliceous, thermic rhodic kandiudults) with 2.1% organic matter and pH of 5.8. Separate areas were used each year of the experiment. Test areas often had sufficient populations of sicklepod and bristly starbur (*Acanthospermum hispidum* D.C.) such that valid control ratings of these species could be taken also. Also these two species are encountered commonly in peanut production in the Southeast. Sicklepod and bristly starbur were prevalent both years at Headland, and bristly starbur was prevalent at Jay in 1996.

Experimental areas were moldboard plowed in the spring and a seed bed was prepared by disking. Annual grasses and small-seeded broadleaf weeds were controlled with a broadcast, preplant-incorporated application of pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitro-benzenamine] at 1.1 kg ai/ha. Peanut cv. Florunner was planted at 123 kg/ha during either the 4th wk of April or the 1st wk of May. Rows were spaced 91 cm apart. All other pest management decisions and other cultural practices were in accordance with recommendations of the Alabama and Florida Coop. Ext. Serv. for the Headland, AL and Jay, FL locations, respectively. Individual plots were four rows wide and 6.1 m long. All herbicide treatments were applied with a tractor-mounted compressed air sprayer equipped with flat fan nozzles and discharging 140 L/ha. A nonionic surfactant [X-77 (a mixture of alkylary-polyoxyethylene glycols, free fatty acids, and isopropanol), Loveland Industries, Greeley, CO] was included in all postemergence-applied treatments at 0.25% v/v.

Experimental Variables and Design. Treatment variables consisted of the aforementioned herbicide treatments, which are currently registered and recommended in our area for Florida beggarweed control in peanut. The PRE-applied treatments were within 1 d of planting. Postemergence-applied treatments were applied at either 1, 2.5, or 3.5 mo after planting—i.e., either early-, mid-, or late-postemergence (EPOST, MPOST, and LPOST, respectively). At 1 mo after planting the most mature weeds had three to four true leaves and did not exceed 8 cm in height; at 2.5 mo, plants had 10 to 12 leaves and were approximately 25 cm in height; and, at 3.5 mo, the Florida beggarweed had started to flower and extended above the crop canopy.

PRE-applied treatments evaluated were (a) norflurazon (1.3 kg ai/ha) or (b) none. EPOST treatments included (a) imazapic (71 g/ha); (b) paraquat + bentazon (0.14 + 0.28 kg/ha, respectively); and (c) none. The two MPOST treatments were (a) pyridate + 2,4-DB (1.05 kg/ha + 0.28 kg ae/ha, respectively) or (b) none. The two LPOST treatments were (a) chlorimuron (9.0 g/ha) or (b) none. Treatments consisted of a two (PRE) by three (EPOST) by two (MPOST) by two (LPOST) factorial arrangement, resulting in 24 individual treatments. A randomized complete block experimental design with four replications was used.

Data Collection and Analysis. Visual estimates of percent weed control by species, as compared to the nontreated check, were recorded within 2 wk of harvest. A scale was used where 0 and 100% represented no control to complete control, respectively.

The center two rows of each plot were harvested in early September using conventional harvesting equipment. Recorded peanut weights were adjusted to 11% moisture. Individual plot input and yield data were evaluated at the farm production scale level using the current enterprise budget developed by the Alabama Coop. Ext. Serv. for nonirrigated peanut production (unpubl. budgets for major row crops in Alabama in 1994). This spreadsheet-based budget was modified to calculate annual net returns to land, quota, and management for each observation across all herbicide treatments. Machinery and labor inputs for a typical peanut farm were determined for each operation. Herbicide costs, which were representative of our area and excluded application, were as follows: norflurazon $38.16/ha, imazapic $68.40/ha, paraquat + bentazon $16.20/ha, pyridate + 2,4-DB $52.28/ha, and chlorimuron $24.67/ha. Net returns were based upon the assumption that the crop would be marketed at a 3:1 ratio of quota to additional peanuts. Values for quota and additional peanut were $610 and $300/metric t, respectively. These values assumed the following average quality grade: 71% sound mature and/or sound split kernels, 2% other kernels, 3% loose shelled kernels, and 22% hulls. Random sampling confirmed that at three of the four year-location repetitions (Jay in 1996 and Headland in 1995 and 1996) this grading schedule was representative of the actual harvested peanuts. At Jay in 1995 the percentage of sound mature kernels was approximately 4% less than this, and net returns were adjusted accordingly. The overall poor crop performance at Jay during 1995 can attributed to unfavorable rainfall. While no rainfall was received between 3 and 30 June, excessive rainfall was received in July and August.

Data were subjected to analysis of variance and were pooled where appropriate. Initial statistical analysis addressed the factorial treatment arrangement, and the main effects of the treatment factors were determined. Means of the individual treatments were subsequently determined and compared.

Results and Discussion

Weed Control. Statistical analysis revealed that weed control data were consistent across years and locations. Consequently, these data could be pooled for further analysis and presentation.

Florida beggarweed control was influenced by the main effects of all four experimental variables. Furthermore, several of the two- and three-way interactions as well as the four-way interaction were significant (Table 1). Chlorimuron was active on Florida beggarweed, and control averaged across all other treatment variables was 93 and 74% with and without chlorimuron, respectively (Table 3). In general, chlorimuron had the greatest impact on Florida beggarweed control in the absence of norflurazon. Without norflurazon, the addition of chlorimuron increased Florida beggarweed control from 64 to 83%. With norflurazon, control increased from 80 to 90%. Excluding all treatments that included chlorimuron, = 88% control of Florida beggarweed was obtained with five treatments—(a) imazapic EPOST; (b) paraquat + bentazon EPOST, followed by pyridate + 2,4-DB MPOST; (c) norflurazon PRE, followed by paraquat + bentazon EPOST; (d) norflurazon PRE, followed by imazapic EPOST; and (e) norflurazon PRE, followed by imazapic EPOST and pyridate + 2,4-DB MPOST. With these five treatments, the addition of chlorimuron LPOST was of no value. Chlorimuron improved control for paraquat + bentazon EPOST (from 63 to 73%), pyridate + 2,4-DB MPOST (59 to 76%), norflurazon PRE followed by pyridate + 2,4-DB (65 to 86%), and norflurazon PRE followed by paraquat + bentazon EPOST and then by pyridate + 2,4-DB MPOST (81 to 97%).

Bristly starbur and sicklepod control was influenced by the main effects of the PRE, EPOST, and MPOST treatments; however, the main effect of the LPOST treatments was not significant (Table 1). The LPOST application did not impact control of either bristly starbur or sicklepod. Bristly starbur control averaged across all other experimental variables was 78 and 77% with and without chlorimuron, respectively (data not shown). Comparable values for sicklepod were 76 and 73%, respectively. Although the four-way interaction was significant for both bristly starbur and sicklepod, inspection of the data reveals that this interaction most likely can be attributed to the erratic and generally poor control of these two species with chlorimuron. Thus, we have chosen to present the data as pooled across the LPOST application.

Inspection of the data, as pooled across the LPOST treatments, reveals that four treatments consistently provided ≥ 90% control of both bristly starbur and sicklepod (Table 2). These treatments were (a) imazapic EPOST;

Table 2. Weed control in peanut with preemergence- and early and mid-postemergence-applied herbicide treatments.[a]

Preemergence	Postemergence Early	Postemergence Mid	Weed control[b] Bristly starbur	Weed control[b] Sicklepod
			-------- % --------	
None	None	None	0 e	0 g
None	Par + ben	None	46 d	44 f
None	Imaz	None	98 a	92 ab
None	None	Py + DB	73 c	65 e
None	Par + ben	Py + DB	74 bc	74 de
None	Imaz	Py + DB	97 a	96 a
Nor	None	None	80 b	77 d
Nor	Par + ben	None	93 a	90 abc
Nor	Imaz	None	82 b	81 cd
Nor	None	Py + DB	84 b	80 d
Nor	Par + ben	Py + DB	84 b	92 ab
Nor	Imaz	Py + DB	95 a	94 a

[a]Nor = norflorazon at 1.3 kg/ha, Par + ben = paraquat tank mixed with bentazon at 0.14 and 0.28 kg/ha, respectively; Imaz = imazapic at 71 g/ha, Py + DB = pyridate at 1.05 kg/ha tank mixed with 2,4-DB at 0.28 kg ae/ha.

[b]Data have been pooled over chlorimuron application. Means within a column followed by the same letter are not significantly different according to the appropriate LSD value at P = 0.05.

Table 1. Analysis of variance of selected herbicide treatments for the control of Florida beggarweed and other broadleaf weeds in peanut.

Experimental variable	Weed control: Bristly starbur	Weed control: Sicklepod	Weed control: Florida beggarweed	Yield: Headland, 1995	Yield: Jay, 1996	Yield: Headland, 1996 + Jay, 1995	Net return: Headland, 1995	Net return: Jay, 1996	Net return: Headland, 1996 + Jay, 1995
	probability								
Pre (A)	< 0.01	< 0.01	< 0.01	0.02	NS	NS	< 0.01	NS	NS
Early post (B)	< 0.01	< 0.01	< 0.01	NS	0.01	< 0.01	NS	< 0.01	< 0.01
Mid-post (C)	< 0.01	< 0.01	< 0.01	NS	NS	< 0.01	NS	NS	< 0.01
Late post (D)	NS	NS	< 0.01	NS	< 0.01	NS	< 0.01	< 0.01	NS
A×B	< 0.01	< 0.01	NS	NS	NS	NS	NS	< 0.01	NS
A×C	0.04	0.03	< 0.01	NS	NS	NS	NS	NS	NS
A×D	< 0.01	NS	NS	NS	NS	NS	NS	< 0.01	NS
B×C	0.04	< 0.01	NS	NS	NS	NS	NS	NS	NS
B×D	0.04	NS	NS	0.02	NS	NS	< 0.01	< 0.01	0.02
C×D	NS	NS	NS	NS	NS	NS	NS	NS	NS
A×B×C	< 0.01	< 0.01	< 0.01	NS	NS	NS	NS	0.02	NS
A×B×D	NS	NS	NS	NS	NS	NS	MS	NS	NS
A×C×D	< 0.01	< 0.01	< 0.01	NS	Ns	NS	NS	NS	NS
B×C×D	NS	0.04	0.01	NS	0.04	NS	0.03	< 0.01	NS
A×B×C×D	0.02	0.02	0.03	NS	NS	NS	NS	NS	NS

Table 3. Florida beggarweed control in peanut with preemergence- and early, mid-, and late postemergence applied herbicide treatments[a].

Preemergence	Postemergence Early	Mid	Late	Florida beggarweed control[b]
				%
None	None	None	None	0 h
None	Par + ben	None	None	63 g
None	Imaz	None	None	88 abc
None	None	Py + DB	None	59 g
None	Par + ben	Py + DB	None	89 abc
None	Imaz	Py + DB	None	85 bcd
Nor	None	None	None	73 ef
Nor	Par + ben	None	None	92 ab
Nor	Imaz	None	None	91 ab
Nor	None	Py + DB	None	65 fg
Nor	Par + ben	Py + DB	None	81 cd
Nor	Imaz	Py + DB	None	96 a
None	None	None	Chlor	60 g
None	Par + ben	None	Chlor	73 ef
None	Imaz	None	Chlor	88 abc
None	None	Py + DB	Chlor	76 de
None	Par + ben	Py + DB	Chlor	89 abc
None	Imaz	Py + DB	Chlor	94 ab
Nor	None	None	Chlor	73 ef
Nor	Par + ben	None	Chlor	96 a
Nor	Imaz	None	Chlor	94 ab
Nor	None	Py + DB	Chlor	86 bc
Nor	Par + ben	Py + DB	Chlor	97 a
Nor	Imaz	Py + DB	Chlor	90 abc

[a]Nor = norflorazon at 1.3 kg/ha, Par + ben = paraquat tank mixed with bentazon at 0.14 and 0.28 kg/ha, respectively; Imaz = imazapic at 71 g/ha, Py + DB = pyridate at 1.05 kg/ha tank mixed with 2,4-DB at 0.28 kg ae/ha; Chlor = chlorimuron at 9 g/ha.

[b]Data pooled over all four year-location replications. Means within a column followed by the same letter are not significantly different according to the appropriate LSD value at P = 0.05.

(b) imazapic EPOST, followed by pyridate + 2,4-DB MPOST; (c) norflurazon PRE, followed by paraquat + bentazon EPOST; and (d) norflurazon PRE, followed by paraquat + bentazon EPOST, and later by pyridate + 2,4-DB MPOST. It is interesting to note that, although norflurazon applied PRE improved weed control with paraquat + bentazon and pyridate + 2,4-DB, imazapic was less effective in controlling both bristly starbur and sicklepod when preceded with norflurazon PRE. Averaged across all other variables, preceding imazapic with norflurazon reduced sicklepod and bristly starbur control 12 and 15%, respectively (data not shown). Norflurazon may have delayed seedling emergence such that a portion of the target weed population had not reached a susceptible stage of development when the imazapic was applied. It has been established that foliar entry is more critical to imazapic activity than root entry (Wehtje *et al.*, 2000).

Yield. Treatment response was consistent only between the Headland, 1996 and Jay, 1995 data; thus, these data were pooled for analysis and presentation (Table 4). Yields from Headland, 1995 and Jay, 1996 are each presented separately (Table 4). Yield at Headland, 1995 was influenced by the main effects of the PRE treatments and by the EPOST-LPOST interaction (Table 1). Yield at Jay, 1996 was influenced by the main effects of the EPOST and LPOST treatments and by the EPOST-MPOST-LPOST interaction. Headland, 1996 and Jay, 1995 yield (pooled data) was influenced only the EPOST and MPOST main effects.

None of the treatments evaluated consistently resulted in maximum yield when used alone (Table 4). Maximum yield was consistently obtained with either of the two EPOST treatments provided they were supplemented with either (a) norflurazon PRE, (b) pyridate + 2,4-DB POST, or (c) norflurazon PRE and pyridate + 2,4-DB POST. The further addition of chlorimuron LPOST to these six treatments generally did not affect yield. However, in a few cases (most notably in Jay, 1996), yield was suppressed by the addition of chlorimuron. None of the chlorimuron-containing treatments consistently provided maximum yield across all three data sets. Main effect of chlorimuron was neither significant in Headland, 1995 nor in the pooled Headland, 1996/Jay, 1995 data. However, in Jay, 1996 chlorimuron reduced yield 14%, as averaged across all treatments. This detrimental effect may be attributable to moisture stress following application; only 1 cm of rainfall fell within 15 d of chlorimuron application.

Net Return. Interactions between location-year repetitions and treatments were identical to that of yield. Consequently, data were pooled in the same manner (Table 1). Net return at Headland in 1995 was influenced only by the main effects of the PRE and LPOST treatments and by the PRE-LPOST and the EPOST-MPOST-LPOST interactions. Net return at Jay in 1996 was influenced by the main effects of the EPOST and LPOST treatments and by several of the two- and three-way interactions. In Headland, 1996 and Jay, 1995 (pooled data), net returns were influenced by the main effects of the EPOST and MPOST treatments and by the EPOST-LPOST interaction.

Net return was similar to yield in that none of the treatments evaluated consistently resulted in maximum net returns when used alone (Table 5). Four treatments consistently resulted in maximum net returns across all years and locations. These treatments were (a) paraquat + bentazon EPOST, followed by pyridate + 2,4-DB MPOST; (b) imazapic EPOST, followed by pyridate + 2,4-DB MPOST; (c) norflurazon PRE, followed by imazapic EPOST; and (d) same as (c) but also including pyridate + 2,4-DB MPOST. The three imazapic-containing treatments controlled all three weed species ≥ 81%. Conversely, the one treatment that excluded imazapic (i.e., paraquat + bentazon EPOST, followed by pyridate + 2,4-DB MPOST) controlled all three species ≥ 74%. This treatment was less effective in terms of weed control but resulted in maximum net return. This probably can be attributed to its relative low cost compared to the imazapic-based systems and to its ability to provide adequate weed control during the critical crop fruiting period.

None of the chlorimuron-containing treatments consistently resulted in maximum net returns. Averaged over all other experimental variables, chlorimuron reduced net returns 15 and 21% in Headland, 1995 and Jay,

Table 4. Peanut yield with preemergence- and early, mid-, and late postemergence-applied herbicide treatments.[a]

Pre-emergence	Postemergence Early	Postemergence Mid-	Postemergence Late	Yield[b] Headland, 1995	Yield[b] Jay, 1996	Yield[b] Headland, 1996 + Jay, 1995
				kg/ha		
None	None	None	None	3500 bcd	3510 cd	2030 f
None	Par + ben	None	None	4610 ab	3750 cd	4000 a-d
None	Imaz	None	None	3520 bcd	4930 a	3500 cde
None	None	Py + DB	None	4250 a-d	3610cd	3320 cde
None	Par + ben	Py + DB	None	4560 abc	4780 ab	5000 a
None	Imaz	Py + DB	None	4430 a-d	4840 ab	4210 a-d
Nor	None	None	None	4260 a-d	4370 a-d	3220 cde
Nor	Par + ben	None	None	4770 a	4310 a-d	3830 a-d
Nor	Imaz	None	None	4600 ab	4890 ab	4160 a-d
Nor	None	Py + DB	None	4630 ab	4240 a-d	3490 cde
Nor	Par + ben	Py + DB	None	4670 a	4980 a	4890 ab
Nor	Imaz	Py + DB	None	4770 a	4980 a	4890 ab
None	None	None	Chlor	3350 d	3570 cd	2640 ef
None	Par + ben	None	Chlor	3440 cd	3870 bcd	3800 bcd
None	Imaz	None	Chlor	4600 ab	4150 a-d	3790 bcd
None	None	Py + DB	Chlor	3960 a-d	3430 d	3960 a-d
None	Par + ben	Py + DB	Chlor	3750 a-d	4090 a-d	4250 a-c
None	Imaz	Py + DB	Chlor	4300 a-d	4060 a-d	3880 a-d
Nor	None	None	Chlor	4110 a-d	3400 d	3030 def
Nor	Par + ben	None	Chlor	3860 a-d	4370 a-d	3830 a-d
Nor	Imaz	None	Chlor	4610 ab	3440 d	3680 cde
Nor	None	Py + DB	Chlor	4100 a-d	3610 cd	3940 a-d
Nor	Par + ben	Py + DB	Chlor	4530 abc	3610 cd	3950 a-d
Nor	Imaz	Py + DB	Chlor	4280 a-d	3750 cd	4250 abc

[a]Nor = norflorazon at 1.3 kg/ha, Par + ben = paraquat tank mixed with bentazon at 0.14 and 0.28 kg/ha, respectively; Imaz = imazapic at 71 g/ha; Py + DB = pyridate at 1.05 kg/ha tank mixed with 2,4-DB at 0.28 kg ae/ha; Chlor = chlorimuron at 9 g/ha.

[b]Data pooled over all four year-location replications. Means within a column followed by the same letter are not significantly different according to the appropriate LSD value at P = 0.05.

1996, respectively (data not shown). Florida beggarweed control as averaged over all other experimental variables, years, and locations was 86% with chlorimuron compared to 73% without chlorimuron (data not shown). Thus, it would appear that chlorimuron's propensity to reduce yields is more attributable to subtle crop injury than to limited weed control. However, it also must be noted that chlorimuron is applied relatively late and weed-induced yield loss from all forms of interference may have been realized already.

Results indicate that at least two weed-control inputs are required for maximum yield and net return. However, no one combination of these inputs can be identified as the single best option. While chlorimuron can be effective in controlling Florida beggarweed late season, this treatment does pose the risk of the reduction of both yield and net return, especially when adverse moisture conditions follow application.

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Table 5. Peanut net return resulting from preemergence- and early, mid- and late postemergence-applied herbicide treatments.[a]

Pre-emergence	Postemergence Early	Postemergence Mid	Postemergence Late	Net returns[b] Headland, 1995	Net returns[b] Jay, 1996	Net returns[b] Headland, 1996 + Jay, 1995
				----------$/ha----------		
None	None	None	None	900 efg	910 ghi	130 e
None	Par + ben	None	None	1490 ab	990 e-i	2470 abc
None	Imaz	None	None	780 fg	1540 a	1340 cd
None	None	Py + DB	None	1270 a-d	880 hi	1420 cd
None	Par + ben	Py + DB	None	1410 abc	1480 a	3150 a
None	Imaz	Py + DB	None	1280 a-d	1450 ab	2070 abc
Nor	None	None	None	1260 a-d	1190 b-f	1410 cd
Nor	Par + ben	None	None	1510 a	1170 e-g	2100 abc
Nor	Imaz	None	None	1360 abc	1480 a	2230 abc
Nor	None	Py + DB	None	1420 abc	960 e-g	1770 bcd
Nor	Par + ben	Py + DB	None	1480 ab	1480 a	2940 ab
Nor	Imaz	Py + DB	None	1060 c-g	1350 abc	2082 abc
None	None	None	Chlor	800 efg	900 g-i	750 abc
None	Par + ben	None	Chlor	730 g	1030 d-i	1980 abc
None	Imaz	None	Chlor	1380 abc	1200 c-e	2120 abc
None	None	Py + DB	Chlor	1060 c-g	850 hi	2180 abc
None	Par + ben	Py + DB	Chlor	880 efg	1180 c-f	2250 abc
None	Imaz	Py + DB	Chlor	1140 b-e	1110 c-h	2080 abc
Nor	None	None	Chlor	1150 a-e	800 i	1220 cd
Nor	Par + ben	None	Chlor	980 d-g	1270 a-d	1940 abc
Nor	Imaz	None	Chlor	1350 abc	800 i	1970 abc
Nor	None	Py + DB	Chlor	1090 c-f	880 hi	2040 abc
Nor	Par + ben	Py + DB	Chlor	1320 abc	830 hi	2130 abc
Nor	Imaz	Py + DB	Chlor	1110 c-f	910 f-i	2210 abc

[a]Nor = norflorazon at 1.3 kg/ha, Par + ben = paraquat tank mixed with bentazon at 0.14 and 0.28 kg/ha, respectively; Imaz = imazapic at 71 g/ha, Py + DB = pyridate at 1.05 kg/ha tank mixed with 2,4-DB at 0.28 kg ae/ha; Chlor = chlorimuron at 9 g/ha.

[b]Data pooled over all four year-location replications. Means within a column followed by the same letter are not significantly different according to the appropriate LSD value at P = 0.05.

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