Herbicide Systems for Golden Crownbeard (*Verbesina encelioides*) Control in Peanut[1]

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ABSTRACT

Field studies were conducted in south Texas in 1994 and 1995 to evaluate various soil-applied herbicides alone and in combination with postemergence herbicides for golden crownbeard control. Ethalfluralin preplant incorporated (PPI) followed by imazapic or lactofen postemergence (POST) provided 100% golden crownbeard control. Ethalfluralin PPI followed by oxyfluorfen applied preemergence (PRE) or metolachlor + imazethapyr provided 90% control. Dimethenamid, ethalfluralin, and metolachlor alone failed to adequately control golden crownbeard. Golden crownbeard control was most effective when combination treatments were used (PPI or PRE followed by POST). Effective golden crownbeard control increased peanut yields up to 53% over that of the untreated check.

Key Words: Groundnut, weed control, yellowtop.

Broadleaf weeds, such as golden crownbeard [*Verbesina encelioides* (Cav.) Benth. & Hook. f. ex. A. Gray], are a continuing problem in peanut (*Arachis hypogaea* L.) because of limited effective herbicide options. Golden crownbeard, also known as yellowtop, is a native to tropical America (Correll and Johnston, 1979). It is a summer annual that grows up to 1 m tall with much-branched grayish green leaves. It can be found in the south, central, and portions of the east Texas peanut-growing region (author's pers. observation). Golden crownbeard also can be found in parts of the Oklahoma peanut-growing region (R. Sholar, pers. commun.).

In south Texas, golden crownbeard can be seen growing along roadsides and in fallow fields throughout most of the year. Golden crownbeard begins to germinate any time after a prolonged warm period in the spring and anytime thereafter when moisture is available. Since this weed can survive almost year-round, golden crownbeard may be part of the epidemiology of spotted wilt by serving as a host for tomato spotted wilt virus (TSWV) and thrips vectors. TSWV is a tospovirus, a group vectored by at least nine species of thrips (German *et al.*, 1992; Hunter *et al.*, 1995). Two of these, *Franklinella fusca* Hinds (tobacco thrips) and *F. occidentalis* Pergande (western flower thrips), are the primary species associated with south Texas peanut (Mitchell *et al.*, 1990).

Postemergence herbicides have provided good to excellent golden crownbeard control. Grichar and Sestak (1998) reported that bentazon [3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one-2,2-dioxide] and 2,4-DB [4-(2,4-dichlorophenoxy)butanoic acid] alone controlled ≥ 90% golden crownbeard while acifluorfen {5-[2-chloro-4(trifluoromethyl)phenoxy]-2-nitrobenzoic acid} at 0.42 kg/ha and pyridate [O-(6-chloro-3-phenyl-4-pyridazinyl)-S-octyl carbonothioate] provided ≥ 80% control. However, imazapic {(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-methyl-3-pyridine carboxylic acid} or imazethapyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid} provided inconsistent golden crownbeard control, especially under variable moisture conditions and large weed size at the time of herbicide application.

Limited information exists relative to the control of golden crownbeard in peanut with soil-applied herbicides and the influence of golden crownbeard on peanut yield. Golden crownbeard can be controlled to some extent with the soil-applied herbicides registered for use on peanut (pers. observation). However, very little information is available on the extent of control and the use of herbicide combinations for effective control. Therefore, research was conducted to evaluate weed management strategies in peanut for the control of golden crownbeard.

Materials and Methods

Field experiments were conducted in a grower's field located near Pearsall (Frio County) in 1995 and Charlotte, TX (Atascosa County) in 1994 and 1995. Soils at the Pearsall location were a Duval loamy fine sand (fine-loamy, mixed hyperthermic Aridic Haplustalfs) with less than 1% organic matter and a pH of 6.8. Soils at the Charlotte location were a Nueces loamy fine sand (loamy, mixed, hyperthermic Aquic Arenic Palenstalfs) with less than 1% organic matter and a pH of 7.0 to 7.2. A schedule of events for conducting this study is shown in Table 1.

The experimental design was a randomized complete block with three to four replications. Each plot contained two rows, 97 cm apart and 7.6 m long. Each year the test areas were infested with a natural population of golden crownbeard. The Atascosa County site in 1994 and the Frio County site in 1995 were infested with heavy golden crownbeard popu-

Table 1. Schedule of events for conducting the yellowtop control study in peanut (cv. GK-7).

	Treatment years and location		
	Atascosa County		Frio County
Events	1994	1995	1995
Peanuts planted	28 June	19 June	19 May
PPI treatments applied	28 June	19 June	19 May
PRE treatments applied	28 June	19 June	19 May
POST treatments applied	20 July	13 July	12 June
Peanuts dug	15 Nov.	1 Nov.	7 Oct.

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lations (> 10 plants/m^2) while the Atascosa County site in 1995 had variable golden crownbeard populations (three to six plants/m^2).

The test sites also were infested with natural populations of yellow nutsedge (*Cyperus esculentus* L.), Palmer amaranth (*Amaranthus palmeri* S. Wats), and Texas panicum (*Panicum texanum* Buckl.). These weed populations were quite low and variable, therefore, it was deemed that an assessment of the herbicide activity against these weeds would not be accurate.

Peanut cv. GK-7 was planted in all studies at 95 kg/ha, 5-cm deep on a raised seedbed using conventional equipment. Preplant incorporated (PPI) herbicides were applied prior to peanut planting and incorporated 5 to 7 cm deep with tractor-driven vertical-action power tiller. Preemergence (PRE) herbicides were applied immediately after planting. Postemergence (POST) herbicides were applied approximately 3 wk after peanut planting. Golden crownbeard was no larger than 15 cm tall and was at the 12- to 20-leaf stage at the time of the POST applications. Sprinkler irrigation was applied on a 10- to 14-d schedule as needed throughout the growing season.

Herbicide treatments included dimethenamid alone at 1.4 kg/ha applied PRE, ethalfluralin alone at 0.84 or 1.25 kg/ha applied PPI, ethalfluralin at 0.84 and 1.25 kg/ha + imazethapyr at 0.07 kg/ha applied PPI, ethalfluralin at 0.84 kg/ha + imazethapyr at 0.07 kg/ha applied PPI followed by (fb) acifluorfen at 0.28 kg/ha + 2,4-DB at 0.28 kg/ha applied POST, ethalfluralin at 0.84 kg/ha applied PPI fb imazethapyr or imazapic at 0.07 kg/ha or lactofen at 0.22 kg/ha applied POST, ethalfluralin at 0.84 kg/ha applied PPI fb oxyfluorfen at 0.44 kg/ha applied PRE, imazethapyr alone at 0.07 kg/ha applied PPI, metolachlor alone at 1.7 kg/ha applied PRE, metolachlor at 1.7 kg/ha + imazethapyr at 0.07 kg/ha applied PRE, and metolachlor at 1.7 kg/ha applied PRE fb imazethapyr at 0.07 kg/ha applied POST.

Imazapic and imazethapyr were applied with a nonionic surfactant (X-77®, Valent USA, Walnut Creek, CA) at 0.25% (v/v) of the spray. Acifluorfen + 2,4-DB was applied with a crop oil concentrate (Agridex®, Helena Chemical Co., Memphis, TN) at 2.3 L/ha. Lactofen was applied with a crop oil concentrate at 1.2 L/ha.

Herbicides were applied with a compressed-air bicycle sprayer through Teejet 11002® flat fan nozzles (Spraying Systems, Co., Wheaton, IL) which delivered a spray volume of 190 L/ha at 180 kPa. Data collected included visual estimates of crop injury and golden crownbeard control on a scale of 0% (no control or peanut injury) to 100% (complete control or death of the peanuts) relative to the untreated check, and peanut yield. Golden crownbeard control and peanut injury were visually estimated approximately 3 wk prior to harvest.

Peanut yields were obtained by digging each plot separately, air-drying in the field for 5 to 8 d, and harvesting peanut pods from each plot with a combine. Weights were recorded after soil and foreign material were removed from the plot samples. Visible weed control data were subjected to arsine transformation prior to analysis of variance. Original data were used for presentation. Data were subjected to analysis of variance, and significant differences among means for weed control data and peanut yield were determined using Fisher's Protected least significant difference test at P = 0.05. A treatment-by-location interaction was not significant for golden crownbeard control or peanut yield. Therefore, data are pooled over locations.

Results and Discussion

Ethalfluralin PPI fb imazapic or lactofen POST controlled golden crownbeard 100% (Table 2). Grichar and Sestak (1998) reported that lactofen POST provided > 90% control of golden crownbeard at four of five south Texas locations. Lactofen is currently registered for use in soybean [*Glycine max* (L.) Merr.] (Anonymous, 1999a) and controls horse purslane (*Trianthema protulacastrum* L.), Amaranth species (*Amaranthus* spp.), and other broadleaf weed species (Moore *et al.*, 1990; Wilcut *et al.*, 1990a; Grichar, 1993, 1994).

Imazapic POST following PPI application of ethalfluralin provided complete golden crownbeard control. Previous research suggests that imazapic and imazethapyr alone provided inconsistent golden crownbeard control (Grichar and Sestak, 1998), and they attributed poor control with imazapic and imazethapyr to the amount and frequency of rainfall soon after application and weed size at the time of herbicide application. Richburg *et al.* (1993, 1994) noted that under low rainfall amounts less yellow nutsedge (*Cyperus esculentus* L.) root absorption of imazapic and imazethapyr occurred, resulting in less yellow nutsedge control. Richburg *et al.* (1995) also reported that application of imazapic and imazethapyr to bristly starbur (*Acanthospermum hispidum* DC.) plants taller than 4 cm killed only the terminal stem and the plant recovered rapidly.

Table 2. Golden crownbeard control and peanut yield from two south Texas locations combined over years.

Treatment	Rate	Appl. timing[a]	Control	Yield
	kg/ha		%	kg/ha
Check	-	-	0	1923
Dimethenamid	1.4	PRE	71	2277
Ethalfluralin	0.84	PPI	77	2395
Ethalfluralin	1.25	PPI	71	2200
Ethalfluralin+imazethapyr	0.84+0.07	PPI	88	2610
Ethalfluralin+imazethapyr	1.25+0.07	PPI	80	2730
Ethalfluralin+imazethapyr	0.84+0.07	PPI	85	2177
+acifluorfen+2,4-DB	0.28+0.28	POST		
Ethalfluralin/imazethapyr	0.84/0.07	PPI/POST	73	2940
Ethalfluralin/imazapic	0.84/0.07	PPI/POST	100	2660
Ethalfluralin/lactofen	0.84/0.22	PPI/POST	100	2523
Ethalfluralin/oxyfluorfen	0.84/0.44	PPI/PRE	90	2460
Imazethapyr	0.07	PPI	86	2623
Metolachlor	1.7	PRE	60	2030
Metolachlor+imazethapyr	1.7+0.07	PRE	90	2470
Metolachlor/imazethapyr	1.7/0.07	PRE/POST	78	2250
LSD (0.05)			21	753

[a] PPI = preplant incorporated; PRE = preemergence; POST = postemergence.

Ethalfluralin + imazethapyr PPI controlled 80 to 88% golden crownbeard while imazethapyr PPI alone controlled 86%. The addition of a POST application of acifluorfen + 2,4-DB following ethalfluralin + imazethapyr PPI did not improve control over ethalfluralin + imazethapyr alone. Imazethapyr PPI or PRE controls many troublesome weeds found in peanut (Wilcut *et al.*, 1991a,b, 1994; Grichar *et al.*, 1992; Grichar, 1997a,b). Common lambsquarters (*Chenopodium album* L.) control with imazethapyr is better and more consistent with PPI or PRE applications than POST applications (Wilcut *et al.*, 1991b).

Dimethenamid, ethalfluralin, and metolachlor alone controlled crownbeard less than 80%. Imazethapyr applied in combination with metolachlor improved golden crownbeard control over metolachlor alone but metolachlor fb imazethapyr POST did not.

Ethalfluralin PPI fb oxyfluorfen PRE controlled 90% golden crownbeard. Oxyfluorfen is registered for use in coffee (*Coffea arabica* L.), cotton (*Gossypium hirsutum* L.), and several vegetable crops (Anonymous, 1999b). Oxyfluorfen is particularly useful on cabbage (*Brassica oleracea* L.) because it controls many grass and broadleaf weeds and few herbicides are labeled for that crop (Farnham and Harrison, 1995).

Ethalfluralin + imazethapyr PPI and ethalfluralin PPI fb imazethapyr POST increased peanut yields over 40% when compared to the untreated check (Table 2). Although ethalfluralin fb imazethapyr controlled only 73% golden crownbeard, this herbicide treatment provided the highest peanut yield. The improved yield with imazethapyr may be attributed partially to superior yellow nutsedge and Palmer amaranth control (Grichar, 1992, 1997b). Poor golden crownbeard control with dimethenamid, ethalfluralin, or metolachlor alone resulted in only slightly higher peanut yield than the untreated check. When weeds are not controlled, the weed biomass slows field curing of peanut vines and pods, increasing the likelihood of exposure to bad weather which can increase harvesting losses (Young *et al.*, 1982; Brecke and Colvin, 1991; Wilcut *et al.*, 1995). Similarly, the fibrous root system is extremely difficult to separate from peanut pods (Wilcut *et al.*, 1993, 1995). During digging and combining operations, peanut pods become detached from the peanut vines and are left on the soil surface. These detached peanut pods cannot be recovered with current mechanized harvesting equipment (Wilcut *et al.*, 1995).

Although it was beyond the scope of this study, effective control of golden crownbeard may be useful in the management of spotted wilt. Controlling golden crownbeard will remove an alternate host of TSWV and thrips vectors, possibly reducing incidence of spotted wilt.

These field studies suggest that weed management systems containing imazapic, imazethapyr, lactofen, or oxyfluorfen following soil-applied herbicides can provide effective golden crownbeard control. Successful and consistent control of this weed requires a multifaceted system using PPI/PRE herbicides fb POST herbicides. Relying on only one herbicide will leave peanut producers vulnerable to poor golden crownbeard control.

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