Control of Hophornbeam Copperleaf (*Acalypha ostryifolia* Riddell) and Ivyleaf Morningglory (*Ipomoea hederacea* L. Jacq.) in Peanut (*Arachis hypogaea* L.)

W. James Grichar*
Texas Agricultural Experiment Station, Box 755, Yoakum, TX 77995

ABSTRACT

Copperleaf control in peanut was difficult to obtain with either soil-applied or postemergence herbicides. Control was most consistent with RH-1658 or Dual plus Cobra applied at peanut emergence and followed by Cobra postemergence. Cobra applied postemergence controlled ≥98% copperleaf while Cadre control was inconsistent. The lack of consistent control with Cadre may be due to the size of copperleaf (4 to 6 inches tall) at the time of herbicide application. Ivyleaf morningglory control with soil-applied herbicides was most consistent with Sonalan plus Pursuit applied preplant incorporated. Butyrac and Cadre applied postemergence controlled ≥90% ivyleaf morningglory while Blazer, Pursuit, and Storm controlled >80% ivyleaf morningglory. Tough control of morningglory was inconsistent.

Some broadleaf weeds such as Hophornbeam copperleaf (*Acalypha ostryifolia* Riddell) and ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.] are a continuing problem in certain areas of the state. Dowler (1995) ranks hophornbeam copperleaf and morningglory spp. among the ten most troublesome weeds and morningglory spp. among the ten most common weeds in Texas peanuts. Copperleaf is a problem in peanuts along the Red River area of Texas as well as in certain areas of central Texas (author's personal observation). It can be found in Texas from Cooke and Grayson Counties west to Nolan County and south to Medina, San Patricio, and Harris Counties (Correll and Johnston, 1979).

Ivyleaf morningglory is found in peanut fields mostly in south and central Texas (author's personal observation). It is commonly found from east Texas west to the west Cross Timbers area of the state, south to the Rio Grande (Correll and Johnston, 1979).

In the past, most research has focused on the control of annual morninglories encompassing many species. Only in recent years have researchers evaluated the competitiveness and control of individual morningglory species and determined that they vary in competitiveness (Cordes et al., 1984; Higgins et al., 1988) and response to herbicides (Barker et al., 1984; Wilcut et al., 1991a,b; Wilcut et al., 1994b).

The herbicide, 2,4-DB, is used for controlling *Ipomoea* morningglory species (Buchanan et al., 1982). Smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.] is more tolerant of 2,4-DB than *Ipomoea* morningglory species (Wilcut et al., 1994c). Pitted morningglory (*Ipomoea lacunosa* L.) is the most 2,4-DB-tolerant

Accepted 24 Mar 1997. The author thanks Kevin Brewer for technical assistance and Doris Yost for manuscript preparation. This research was supported in part by the Texas Peanut Producers Board. *Corresponding author.

Ipomoea morningglory species (Barker et al., 1984).

Pursuit provides excellent full-season control (greater than 90%) of *Ipomoea* morningglory species (Wilcut et al., 1991a,b; Wilcut et al., 1994b). Research in the southeast noted that the greatest control of *Ipomoea* spp. was obtained with systems that used two applications of Cobra either with or without Lasso, or with a single late postemergence (LPOST) application of either Blazer + Basagran or Cobra (Jordan et al., 1993). However, in one year of the study, Blazer + Basagran LPOST controlled the *Ipomoea* spp. better than one application of Cobra POST (Jordan et al., 1993). Blazer is considered to be a better POST herbicide for *Ipomoea* spp. control than Cobra (Higgins et al., 1988).

Cadre was cleared for use in peanuts during the spring of 1996. Cadre in soybeans (*Glycine max* L.) controlled sicklepod (*Cassia obtusifolia* L.) and *Ipomoea* morningglory species (Griffin et al., 1993; Wixson et al., 1991). Wilcut et al. (1994b) reported that Cadre controlled the *Ipomoea* morningglories which included ivyleaf morningglory at least 91%. Cadre was more effective than Pursuit applied preplant incorporated (PPI), preemergence (PRE), or early postemergence (EPOST). Although Pursuit controls *Ipomoea* morningglories applied either PPI, PRE, EPOST, or POST (Wilcut et al., 1991a,b), maximum control is obtained with EPOST applications on small *Ipomoea* morningglories (Klingman et al., 1992). Cobra and Tough also are effective against small *Ipomoea* morningglories (Jordan et al., 1993; Wilcut, 1991; Wilcut et al., 1994c).

Soil-applied herbicides provide little or no *Ipomoea* morningglory control (Richburg et al., 1995). Dual does not control the *Ipomoea* morningglories (Richburg et al., 1995). Pursuit applied PPI alone has partially controlled the *Ipomoea* morningglories (Richburg et al., 1995).

Little information is available on the control of hophornbeam copperleaf and ivyleaf morningglory in peanut in the southwestern U.S. This research was undertaken to identify herbicides which have efficacy against copperleaf and ivyleaf morningglory when soil-applied or POST applied.

MATERIALS AND METHODS

Two separate studies were conducted in 1993 and 1994 in a producer's field in Comanche County near Comyn, Texas, to determine the most effective control of hophornbeam copperleaf and ivyleaf morningglory with soil-applied and postemergence herbicides. These fields had naturally high populations of copperleaf and ivyleaf morningglory.

The experimental design was a randomized complete block with three replications. Plots consisted of two 15 to 20 feet long rows with a row spacing of 36 inches. Copperleaf and morningglory populations were moderate to heavy (3 to 4 plants ft^{-2}). To prevent annual grasses from interfering with the copperleaf and morningglory growth and development, Poast (sethoxydim) was used to control Texas panicum (*Panicum texanum* Buckl.) and southern crabgrass [*Digitaria ciliaris* (Retz.) Koel].

Soil-applied study

Herbicide treatments included Dual (metolachlor) alone at 1.5 lb ai $acre^{-1}$ applied PRE, Frontier (dimethenamid) alone at 1.0 lb ai $acre^{-1}$ applied PRE or 1.25

lb ai acre^{-1} applied PPI or PRE, Prowl (pendimethalin) alone at 0.75 lb ai acre^{-1} applied PPI, RH-1658 at 0.067 lb ai acre^{-1} applied PRE, Sonalan (ethalfluralin) alone at 1.12 lb ai acre^{-1} applied preplant incorporated (PPI), Pursuit (imazethapyr) alone at 0.063 lb ai acre^{-1} applied PRE, Dual at 1.5 lb ai acre^{-1} in combination with Cobra (lactofen) at 0.25 lb ai acre^{-1} applied at peanut emergence (EMERGENCE) followed by Cobra at 0.20 lb ai acre^{-1} applied postemergence (POST), Dual at 1.5 lb ai acre^{-1} in combination with Cobra applied at EMERGENCE followed by Cobra at 0.2 lb ai acre^{-1} in combination with Butyrac at 0.25 lb ai acre^{-1} applied POST, Dual at 1.5 lb ai acre^{-1} in combination with Pursuit at 0.063 lb ai acre^{-1} applied PRE, Prowl at 1.0 lb ai acre^{-1} in combination with Dual at 1.5 lb ai acre^{-1} applied PPI, Prowl at 0.75 lb ai acre^{-1} applied PPI followed by Dual at 1.5 lb ai acre^{-1} applied PRE, Prowl at 0.75 or 1.0 lb ai acre^{-1} in combination with Pursuit at 0.063 lb ai acre^{-1} applied PPI, and Sonalan at 0.75 or 1.12 lb ai acre^{-1} in combination with Pursuit at 0.063 lb ai acre^{-1} applied PPI.

Postemergence study

Treatments included Blazer (acifluorfen) at 0.5 lb ai acre^{-1}, Butyrac (2,4-DB) at 0.3 lb ai acre^{-1}, Cadre (imazameth) at 0.032, 0.048, 0.055 and 0.063 lb ai acre^{-1}, Cobra at 0.25 lb ai acre^{-1}, Pursuit at 0.063 lb ai acre^{-1}, Storm (bentazon + acifluorfen) at 0.75 lb ai acre^{-1}, Tough (pyridate) at 0.9 lb ai acre^{-1}, Blazer at 0.375 lb ai acre^{-1} in combination with Butyrac at 0.25 lb ai acre^{-1}, Cadre at 0.063 lb ai acre^{-1} in combination with Butyrac at 0.25 lb ai acre^{-1}, Cadre at 0.063 lb ai acre^{-1} in combination with Blazer at 0.5 lb ai acre^{-1}, Cadre at 0.063 lb ai acre^{-1} in combination with Tough at 0.45 lb ai acre^{-1}, Tough at 0.9 lb ai acre^{-1} in combination with Butyrac at 0.25 lb ai acre^{-1}, and Tough at 0.75 lb ai acre^{-1} in combination with Butyrac at 0.25 lb ai acre^{-1}.

Herbicides were applied with a compressed-air bicycle sprayer using Teejet 11002 flat fan nozzles (Spraying Systems Co., Wheaton, IL 60188) which delivered a spray volume of 20 gal acre^{-1} at 26 psi. Preplant incorporated herbicides were applied and immediately incorporated to a 2 inch depth with a tractor-driven power tiller. PRE herbicides were applied immediately after peanuts were planted. EMERGENCE herbicide treatments were applied approximately 7 days after planting when the peanut cotyledon was emerging from the ground. Sprinkler irrigation was applied as needed throughout the growing season.

'Florunner' peanuts were planted both years of the study at 90 lb acre^{-1}. Visual ratings of weed control were recorded at various intervals throughout the growing season. However, only ratings taken prior to peanut digging are presented. In both years of the study, the peanuts were dug, but not harvested because of rain for 2 to 3 continuous weeks. In the weedy plots, soil remained attached to the roots and the peanut pods never were able to dry and fell off, therefore many of the pods could not be harvested which prevented an accurate assessment of yield.

Weed control ratings were subjected to an analysis of variance and differences among means were determined by Fisher's Protected LSD Test at the 5% probability level. Copperleaf and ivyleaf morningglory size varied at the time of POST herbicide application. Most of the copperleaf was approximately 4 inches tall but plant height ranged from less than 2 inches up to 6 inches. Pursuit and Cadre treatments included X-77, a nonionic surfactant (Valent USA, San Francisco, CA) at 0.25% v/v while Tough, Butyrac, Blazer, and Storm included Agridex (Helena

Chemical Co.), a nonphytotoxic petroleum oil based adjuvant at 1 qt acre^{-1}. Cobra included Agridex at 1 pt acre^{-1}.

RESULTS AND DISCUSSION

Soil-applied herbicides

Ivyleaf morningglory control was most consistent (≥95%) with Sonalan at 1.12 lb ai acre^{-1} plus Pursuit at 0.063 lb ai acre^{-1} applied PPI (Table 1). Sonalan alone at 1.12 lb ai acre^{-1} controlled at least 82% ivyleaf morningglory while Pursuit alone controlled ≥70% ivyleaf morningglory (Table 1). Wilcut et al. (1994c) reported that the *Ipomoea* species did not exhibit a differential response to Pursuit. Although Pursuit controls *Ipomoea* morningglories applied either PPI, PRE, EPOST or POST (Wilcut et al., 1991a,b), maximum control is obtained with EPOST applications on small *Ipomoea* morningglories (Klingman et al., 1992).

Overall, ivyleaf morningglory control was much better in 1993 than 1994. This may be due in part to a reduction in the overall copperleaf populations in 1994 which reduced competition. In 1993, only one herbicide treatment controlled less than 80% morningglory while in 1994 only two treatments controlled >95% morningglory (Table 1).

Copperleaf control was most consistent with RH-1658 or Dual plus Cobra applied at peanut emergence and followed by Cobra POST (Table 1). Little is known about the chemistry of RH-1658, but it does have good activity against Palmer amaranth (*Amaranthus palmeri* S. Wats) and eclipta (*Eclipta prostrata* L.) as well as yellow nutsedge (*Cyperus esculentus* L.) (author's personal observation). Jordan et al. (1993), reported that a herbicide system which included sequential applications of Cobra at EMERGENCE followed by EPOST was the most effective herbicide system for control of broadleaf weeds. They stated that this system provided superior control of prickly sida (*Sida spinosa* L.) and common lambsquarters (*Chenopodium album* L.) than the standard of Blazer + Basagran. This system was the only system to yield as high as the weed-free checks. Frontier, which has shown to have excellent eclipta activity (Grichar and Colburn, 1996; Blum et al., 1996) provided poor copperleaf control in 1993 (<65%) but excellent control in 1994 (≥87%).

Sonalan plus Pursuit controlled 63 to 87% copperleaf while Prowl plus Pursuit controlled 65 to 100% copperleaf. Sonalan or pendimethalin alone does not have appreciable activity on large seeded broadleaf weed species (Wilcut et al., 1994c).

Postemergence herbicides

Cadre alone or in combination with Tough, Blazer, or Butyrac and Butyrac alone controlled ≥89% ivyleaf morningglory in both years (Table 2). Peanut is tolerant of Butyrac applied POST for broadleaf weed control (Buchanan et al., 1982). Smallflower morningglory is more tolerant of Butyrac than *Ipomoea* morningglory species (Wilcut et al, 1994c). Pitted morningglory is the most 2,4-DB-tolerant *Ipomoea* morningglory species (Barker et al., 1984).

Blazer, Pursuit, and Storm controlled >80% morningglory. Blazer applied POST is widely used in the Virginia-North Carolina and southwestern peanut regions of the U.S. (Wilcut et al., 1995). Blazer controls *Amaranthus* species, common

Table 1. Ivyleaf morningglory and copperleaf control with soil-applied herbicides.

Treatment	Rate	Application Timing†	Control			
			1993		1994	
			Ivyleaf	Copperleaf	Ivyleaf	Copperleaf
	(lb ai acre^{-1})		%			
Check	-	-	0	0	0	0
Dual	1.5	PRE	80	60	60	77
Frontier	1.0	PRE	75	23	23	87
Frontier	1.25	PPI	97	53	7	100
Frontier	1.25	PRE	87	62	37	87
Prowl	0.75	PPI	80	72	53	63
RH-1658	0.07	PRE	90	92	60	87
Sonalan	1.12	PPI	82	63	100	100
Pursuit	1.5	PRE	97	40	73	53
Dual	1.5	EMERGENCE/	88	88	17	100
+Cobra/	0.25	POST/				
Cobra	0.2	POST				
Dual	1.5	EMERGENCE/	90	98	47	77
+Cobra/	+0.25					
Cobra	0.20	POST				
+Butyrac	+0.25					
Dual	1.5	PRE	96	58	63	100
+Pursuit	+0.063					
Prowl	1.0	PPI	83	72	73	100
+Dual	+1.5					
Prowl	0.75	PPI	99	79	73	100
+Pursuit	+0.063					
Prowl	1.0	PPI	97	65	73	100
+Pursuit	+0.063					
Sonalan	0.75	PPI	93	63	77	87
+Pursuit	+0.063					
Sonalan	1.12	PPI	95	73	100	77
+Pursuit	+0.063					
LSD (0.05)			16	29	48	33

†PPI=preplant incorporated; PRE=preemergence; EMERGENCE=peanut emergence; POST=postemergence.

Table 2. Ivyleaf morningglory and copperleaf control with postemergence herbicides.

Treatment	Rate	Control			
		1993		1994	
		Ivyleaf	Copperleaf	Ivyleaf	Copperleaf
	(lb ai acre^{-1})	%			
Check					
Blazer	0.5	90	95	82	77
Butyrac	0.3	95	70	94	43
Cadre	0.032	89	67	92	62
Cadre	0.048	93	65	96	80
Cadre	0.055	92	83	99	69
Cadre	0.063	95	67	99	77
Cobra	0.25	80	100	70	98
Pursuit	0.063	85	55	88	67
Storm	0.75	82	89	87	57
Tough	0.9	73	80	83	83
Blazer+Butyrac	0.375 + 0.25	93	88	88	60
Cadre+Blazer	0.063 + 0.5	92	95	96	88
Cadre+Butyrac	0.063 + 0.25	97	95	93	75
Tough+Cadre	0.45 + 0.063	92	93	97	83
Tough + Butyrac	0.75 + 0.25	80	98	85	63
Tough + Butyrac	0.9 + 0.25	77	88	73	88
LSD (0.05)		16	23	18	23

lambsquarters, common ragweed (*Ambrosia artemisiifolia* L.), eclipta, horse purslane (*Trianthema portulacastrum* L.), jimsonweed (*Datura stramonium* L.), smartweed (*Polygonum pensylvanicum* L.), and tropic croton (*Croton glandulosus* Muell. Arg.) (Buchanan et al., 1982; Wilcut et al., 1990; Wilcut, 1991; Grichar et al., 1993; Wilcut et al., 1994c).

The addition of Butyrac to Tough, Cadre, or Blazer did not improve ivyleaf morningglory control over any of those herbicides alone (Table 2). Many POST broadleaf herbicides are applied in mixture with Butyrac which helps improve control of many broadleaf species, particularly if the weeds are larger than recommended size for treatment (Wilcut et al., 1995). In the southeast, Butyrac is commonly applied with foliar fungicides to reduce the expense of making two separate applications (Wilcut et al., 1995).

Cobra POST provided $\geq$98% copperleaf control in both years. Cobra has shown promise for control of eclipta (*Eclipta prostrata* L.) in Texas peanuts (Grichar and Colburn, 1996). Cobra is not as efficacious as Blazer on *Ipomoea* morningglory species (Higgins et al., 1988) but provides better control of common ragweed, prickly sida (*Sida spinosa* L.), and spurred anoda [*Anoda cristata* (L.) Schlecht.] (Wilcut et al., 1990). Jordan et al., (1993) reported that POST systems which included a minimum of one application of Cobra provided $\geq$99% eclipta control.

Cadre control of copperleaf was inconsistent with control ranging from 62 to 83% (Table 2). The erratic control of copperleaf may be due to the size of the copperleaf at the time of Cadre application (4 to 6 inches tall). Copperleaf treated with Cadre in an adjacent field when the copperleaf plants were no larger than 2 inches in height provided better than 90% control (author's personal observations).

Tough and Blazer controlled 77 to 95% copperleaf (Table 2). The addition of Butyrac to Tough or Blazer did not improve copperleaf control over Tough or Blazer alone while the addition of Butyrac to Cadre at 0.063 lb ai acre^{-1} resulted in a 28% increase in control in 1993 and a 2% reduction in control in 1994 over Cadre alone at 0.063 lb ai acre^{-1}.

CONCLUSION

Effective control of copperleaf and ivyleaf morningglory is possible; however, a single application of a herbicide may not be enough in most instances to provide season-long control. The use of a dinitroaniline herbicide in combination with Pursuit followed by Blazer or Cobra should provide control. Cadre may be an option if applied to copperleaf $\leq$2 inches in height.

REFERENCES

Barker, M.A., L. Thompson, Jr., and F.M. Godley. 1984. Control of annual morninglories (*Ipomoea* spp.) in soybeans (Glycine *max*). Weed Sci. 32:813-818.

Blum, R.R., J.W. Wilcut, and A.C. York. 1996. Frontier systems for weed management in North Carolina peanuts. Proc. South Weed Sci. Soc. 49:16.

Buchanan, G.A., D.S. Murray, and E.W. Hauser. 1982. Weeds and their control in peanuts. p. 209-249. In H.E. Pattee and C.T. Young (eds.) Peanut science

and technology. Amer. Peanut Res. Educ. Soc., Yoakum, TX.
Cordes, R.C., and T.T. Bauman. 1984. Field competition between ivyleaf morningglory (*Ipomoea hederacea*) and soybeans (*Glycine max*). Weed Sci. 32:364-370.
Correll, D.S., and M.C. Johnston. 1979. Manual of the vascular plants of Texas. The University of Texas at Dallas, Richardson, TX.
Dowler, C.C. 1992. Weed survey-southern states. Proc. South. Weed Sci. Soc. 48:295-297.
Grichar, W.J., and A.E. Colburn. 1996. Eclipta (*Eclipta prostrata* L.) control in peanuts (*Arachis hypogaea* L.) with soil-applied herbicides. Tex. J. of Agr. Nat. Resour. 9:97-104.
Grichar, W.J., R.G. Lemon, and K.L. Smith. 1996. Use of SAN 582 in a weed control program. Proc. South Weed Sci. Soc. 49:10.
Griffin, J.L., D.B. Reynolds, P.R. Vidrine, and S.A. Bruff. 1993. Soybean (*Glycine max*) tolerance and sicklepod (*Cassia obtusifolia*) control with AC 263,222. Weed Technol. 7:331-336.
Higgins, J.M., T. Whitwell, E.C. Murdock, and J.E. Toler. 1988. Recovery of pitted morningglory (*Ipomoea lacunosa*) and ivyleaf morningglory (*Ipomoea hederacea*) following applications of acifluorfen, fomesafen, and lactofen. Weed Sci. 36:345-353.
Jordan, D.L., J.W. Wilcut, and C.W. Swann. 1993. Application timing of lactofen for broadleaf weed control in peanut (*Arachis hypogaea*). Peanut Sci. 20:129-131.
Klingman, T.E., C.A. King, and L.R. Oliver. 1992. Effect of application rate, weed species, and weed stage of growth on imazethapyr activity. Weed Sci. 40:227-232.
Richburg III, J.S., J.W. Wilcut, and E.F. Eastin. 1995. Weed management in peanut (*Arachis hypogaea*) with imazethapyr and metolachlor. Weed Technol. 9:807-812.
Wilcut, J.W. 1991. Economic yield response of peanut (*Arachis hypogaea*) to postemergence herbicides. Weed Technol. 5:416-420.
Wilcut, J.W., J.S. Richburg III, E.F. Eastin, G.R. Wiley, F.R. Walls Jr., and S. Newell. 1994a. Imazethapyr and paraquat systems for weed management in peanut (*Arachis hypogaea*). Weed Sci. 42:601-607.
Wilcut, J.W., J.S. Richburg III, G. Wiley, F.R. Walls Jr., S.R. Jones, and M.J. Iverson. 1994b. Imidazolinone herbicide systems for peanut (*Arachis hypogaea* L.). Peanut Sci. 21:23-28.
Wilcut, J.W., C.W. Swann, and H.B. Hagwood. 1990. Lactofen systems for broadleaf weed control in peanuts (*Arachis hypogaea*). Peanut Sci. 18:26-30.
Wilcut, J.W., F.R. Walls Jr., and D.N. Horton. 1991a. Imazethapyr for broadleaf weed control in peanuts (*Arachis hypogaea*). Peanut Sci. 18:26-30.
Wilcut, J.W., F.R. Walls Jr., and D.N. Horton. 1991b. Weed control, yield, and net returns using imazethapyr in peanuts (*Arachis hypogaea*). Weed Sci. 39:238-242.
Wilcut, J.W., A.C. York, W.J. Grichar, and G.R. Wehtje. 1995. The biology and management of weeds in peanut (*Arachis hypogaea*). p. 207-244. In H.E. Pattee and H.T. Stalker (eds.) Peanut Science and Technology. Amer. Peanut Res. Educ. Soc., Stillwater, OK.
Wilcut, J.W., A.C. York, and G.R. Wehtje. 1994c. The control and interaction of weeds in peanut (*Arachis hypogaea*). Rev. Weed Sci. 6:177-205.

Wixson, M.B., and D.R. Shaw. 1991. Use of AC 263,222 for sicklepod (*Cassia obtusifolia*) control in soybean. Weed Technol. 5:434-438.