

Postemergence Control of Eclipta (*Eclipta prostrata* L.) in Peanuts (*Arachis hypogaea* L.)

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ABSTRACT

Field studies were conducted in South and Central Texas from 1992 through 1994 to evaluate eight postemergence broadleaf herbicides used alone and in combination to control eclipta. Cadre, Buctril, Butoxone and Pursuit failed to control eclipta. Cobra, Blazer alone, or in combination with Butoxone, provided intermediate control. Tough alone, or in combination with Butoxone, provided the most consistent control of eclipta. Effective eclipta control increased peanut yields up to 98% compared to the untreated check.

KEYWORDS: groundnut, weed control

Broadleaf weeds, especially eclipta (*Eclipta prostrata* L.), are a continuing problem in peanuts (*Arachis hypogaea* L.) because of limited effective herbicide options. Eclipta is a herbaceous plant which is a native of Asia (Holm et al., 1991). It is a member of the Asteraceae Family and is reported to be a weed in seventeen crops in thirty-five countries around the world (Holm et al., 1991). The distribution in North America is primarily in the southern United States, midwest and along the east coast of the U.S. (Steyermark, 1981).

Eclipta can be a troublesome weed in peanuts, rice (*Oryza sativa* L.), soybeans [*Glycine max* (L.) Merrill] and ornamentals (Berchielli-Robertson et al., 1989; Sharma and Amritphale, 1988; Altom and Murray, 1992; Crawford and Leake, 1992; Smith, 1988; Wilcut et al., 1991; York and Worsham, 1992). It is often found in poorly drained wet areas, along streams and ditches in marshes and on dikes of rice paddies. However, it is also common in lawns and upland conditions where rainfall exceeds 48 inches.

Once introduced into a field, eclipta spreads quickly and becomes a severe weed problem. Melouk et al. (1992) reported that eclipta serves as a host for Sclerotinia blight (*Sclerotinia minor* Jagger). Sclerotinia blight infects approximately 25% of Oklahoma peanut fields and can reduce yields 25 to 50% (Jackson et al, 1993). Therefore, eclipta can be important as both a weed and as a disease host.

In Oklahoma, eclipta infects about 10,000 acres of irrigated peanuts (Melouk et al., 1992) and infestations are observed frequently after heavy rains. Similar observations have been reported in Georgia (Anonymous, 1992). In Texas, eclipta

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has gradually worked its way south from the Red River area of North Texas. Eclipta has become a serious problem in Central Texas and can now be found in areas of South, East and Northwest Texas (author's personal observation).

In the southeast, eclipta control was more consistent with Lasso or Dual applied preemergence when followed with a postemergence application of Blazer, Blazer plus Basagran or with a timely Gramoxone application (Wilcut et al., 1991a). Pursuit applied preplant incorporated or preemergence provided good control at 0.1 lb ai acre⁻¹, but at the registered rate of 0.063 lb ai acre⁻¹ control was inconsistent (Wilcut et al., 1991b).

The objectives of this study were to (i) evaluate various postemergence applied herbicides for control of eclipta in peanuts, and (ii) determine the effect of eclipta control on peanut yield.

MATERIALS AND METHODS

Studies were conducted in 1992 through 1994 in producers' fields in Eastland County near Rising Star, Texas, or in Wilson County near Floresville, Texas in 1993. These fields had natural populations of eclipta. Soil type in Eastland County was a Windthorst, loamy, fine sand (fine, mixed, thermic Udic Paleustalfs) with less than 1% organic matter. The soil type in Wilson County was a Poth, loamy, fine sand (clayey, mixed, hyperthermic Arenic Paleustalfs) with 1% organic matter.

The experimental design was a randomized complete block with three replications. Plots consisted of two 15 to 25 ft long rows with row spacing of 36 to 38 inches. In 1992, the eclipta population in Eastland County was light to moderate (1 to 2 plants ft⁻²), while field plots in Eastland and Wilson Counties in 1993 and 1994 were infested with high populations of eclipta (5 to 6 plants ft⁻²). Poast was used postemergence to control Texas panicum (*Panicum texanum* Buckl.) and southern crabgrass [*Digitaria ciliaris* (Retz.) Koel].

Herbicide treatments included Blazer alone at 0.5 lb ai acre⁻¹; Butril alone at 0.25 lb ai acre⁻¹; Butoxone alone at 0.25 lb ai acre⁻¹, or in combination with Blazer at 0.375 lb ai acre⁻¹, Cadre at 0.063 lb ai acre⁻¹, Pursuit at 0.063 lb ai acre⁻¹, Flair at 0.75 lb ai acre⁻¹, or Tough at 0.9 lb ai acre⁻¹; Cadre alone at 0.032, 0.048, 0.55 and 0.063 lb ai acre⁻¹, or in combination with Flair at 0.75 lb ai acre⁻¹ or Tough at 0.45 lb ai acre⁻¹; Cobra alone at 0.25 lb ai acre⁻¹; Pursuit alone at 0.063 lb ai acre⁻¹, or in combination with Flair at 0.75 lb ai acre⁻¹ or Tough at 0.45 lb ai acre⁻¹; Tough alone at 0.9 lb ai acre⁻¹; or Storm alone at 0.75 lb ai acre⁻¹ (A gallon of Storm 4E contains 2.67 lb Basagran and 1.33 lb Blazer; therefore, a herbicide treatment at 0.75 lb ai acre⁻¹ of Storm includes 0.5 lb acre⁻¹ Basagran and 0.25 lb ai acre⁻¹ Blazer).

Sprinkler irrigation was applied as needed throughout the growing season. Herbicides were applied with a compressed-air bicycle sprayer using Teejet 11002 flat fan nozzles (Spraying Systems Co., Wheaton, IL) which delivered a spray volume of 20 gal acre⁻¹ at 26 psi. Eclipta size varied at the time of herbicide application. Most of the eclipta was approximately 4 inches tall, but plant height ranged from less than 1 inch up to 6 inches.

'Florunner' peanuts were planted at all locations. Peanuts were not harvested in Eastland County in 1993 because of an early freeze in late October that destroyed the crop. In 1992 and 1994, the peanuts at this location were dug, but not harvested

because of rain for 4 continuous weeks. Peanuts were dug early in Wilson County because of grower concerns about spreading eclipa seed.

Data collected included visual estimates of weed control on a scale of 0% (no control) to 100% (complete control) relative to the untreated check. Weed control was estimated early-, mid- and late-season during each year of the study. Only late-season ratings taken 2 to 3 weeks prior to digging of peanuts are presented.

Peanut yields were determined by digging the pods, allowing them to air-dry in the field for 4 to 6 days and harvesting individual plots with a combine. Peanut weights were determined after soil and trash were removed from the samples.

Weed control ratings and peanut yields were subjected to an analysis of variance over years and differences among means were determined by Fisher's Protected LSD Test at the 5% probability level.

RESULTS AND DISCUSSION

The 1993 growing season had above average rainfall in the spring and extremely heavy rainfall at peanut harvest. The 1992 and 1994 growing seasons had below average rainfall early in the growing season and normal to above average rainfall during the latter part of the growing season.

Eclipta control

Blazer controlled eclipta effectively (100%) at only one location (Table 1). At the other locations, eclipta control was $\leq 70\%$ with Blazer. Blazer, when applied to common lambsquarters (*Chenopodium album* L.) that were ≤ 2.5 inches in height, provided $> 80\%$ control. When applied to lambsquarters > 2.5 inches tall, control was unacceptable (Wilson and Hines, 1987). Eclipta, like common lambsquarters, germinates early in the season and grows rapidly (Ogg and Dawson, 1984; Williams, 1963); therefore, an early herbicide application is essential.

Blazer does not control eclipta if the weed height is greater than 2 inches (authors personal observation). Timing of application is critical in many instances for maximum efficacy (Wilcut et al., 1990; Wilcut and Swann, 1990; Buchanan et al., 1982). Research in Virginia (Wilcut and Swann, 1990) indicated that delaying the initial Paraquat application until 2 weeks after peanut emergence reduced control of common ragweed (*Ambrosia artemisiifolia* L.) by 35%, reduced yield by about 1200 lb acre⁻¹ and resulted in a net loss of \$350 acre⁻¹, compared with a peanut emergence application.

Buctril controlled eclipta effectively ($> 80\%$) in one of three years (Table 1). Buctril provided postemergence control of eclipta in Oklahoma (Ron Sholar, personal communication). Buctril has shown promise for control of triazine-resistant kochia [*Kochia scoparia* (L.) Schrad.] in sorghum [*Sorghum bicolor* (L.) Moench] (Wicks et al., 1994).

Cadre alone provided inconsistent eclipta control. Only in 1992 (under light-to-moderate pressure) did Cadre provide excellent control ($\geq 85\%$). In the other trials, eclipta control was inconsistent (30-88%). The dramatic increase in eclipta control with Cadre in 1992 may be due to the small eclipta size (0.5 inch) at the time of herbicide application as well as low eclipta plant numbers (authors personal observation). Wilcut and Richburg (1992) stated that Cadre has a longer period of

Table 1. Eclipta control with postemergence herbicides and effect on peanut yield.

Treatment [‡]	Rate	Control Index [†]			Wilson County 1993	Peanut Yield 1993
		Eastland County				
		1992	1993	1994		
	lb ai acre ⁻¹					lb acre ⁻¹
Check		0	0	0	0	242
Blazer	0.5	100	65	65	70	665
Blazer	0.375	98	47	82	38	565
+Butoxone	+0.25					
Buctril	0.25	-	83	52	35	524
Butoxone	0.25	87	75	50	42	1089
Cadre	0.032	87	63	83	30	484
Cadre	0.048	88	65	58	38	423
Cadre	0.055	96	65	60	57	423
Cadre	0.063	85	67	88	67	403
Cadre	0.063	100	79	61	68	1069
+Butoxone	+0.25					
Cobra	0.25	97	63	82	47	746
Flair	0.75	100	81	-	45	182
+Pursuit	+0.063					
Flair	0.75	-	80	-	72	645
+Cadre	+0.063					
Flair	0.75	100	57	-	13	182
+Butoxone	+0.3					
Pursuit	0.063	78	40	70	0	363
Pursuit	0.063	89	57	-	47	726
+Butoxone	+0.25					
Storm	0.75	100	77	77	72	504
Tough	0.9	100	96	93	80	645
Tough	0.9	100	96	97	57	363
+Butoxone	+0.25					
Tough	0.45	98	63	-	82	484
+Pursuit	0.063					
Tough	0.45	100	67	75	82	968
+Cadre	0.048					
LSD (0.05)		15	27	32	40	355

†Control index: 0=no control; 100=complete control.

‡Blazer, Butoxone, Storm and Tough included a crop oil concentrate (Agridex) at the rate of 1 qt acre⁻¹; Cobra included Agridex at 1 pt acre⁻¹; Cadre, Flair and Pursuit included a non-ionic surfactant (Kinetic) at the rate of 4 oz acre⁻¹; Buctril required no additive.

effectiveness when applied postemergence than Pursuit. However, applications of Cadre at peanut emergence and late postemergence controlled eclipta up to 70% (Wilcut and Richburg, 1992).

Cobra controlled eclipta greater than 80% at two of four locations. A split-application of Cobra at 0.25 lb acre⁻¹, applied at peanut emergence, followed by an early postemergence application of Cobra at 0.2 lb acre⁻¹, provided the most consistent eclipta control (data not shown). Jordan et al. (1993) reported that postemergence systems that included a minimum of one application of Cobra provided $\geq 99\%$ eclipta control.

Flair in combination with Cadre controlled eclipta 72 to 80%, while Flair in combination with Pursuit controlled eclipta 45 to 100%. When Butoxone was added to Flair, control varied from 13 to 100%. Flair, a herbicide similar to Paraquat, is registered for use in alfalfa (*Medicago sativa* L.) and clover (*Trifolium* spp.) as a desiccant, in cotton (*Gossypium hirsutum* L.) as a harvest aid, in sugar beets (*Beta vulgaris* L.) for broadleaf weed control and in aquatic situations for control of aquatic weeds and algae (Anonymous, 1994).

Flair only recently has been investigated for weed control in peanuts (Colvin and Johnson, 1992; Brecke and Colvin, 1994; Johnson and Colvin, 1992a; Johnson and Colvin, 1992b). Peanut injury in the Southeast with Flair has ranged from 10 to 50%, according to time of application after peanut emergence (Colvin and Johnson, 1992; Johnson, et al., 1994). The authors concluded that the level of phytotoxicity with Flair was similar to that observed from Basagran plus Paraquat (Johnson and Colvin, 1992a; Johnson and Colvin, 1992b). Brecke and Colvin (1994) reported tall morningglory (*Ipomoea purpurea* (L.) Roth) control was variable with Flair, but they speculated this may be due to differences in tall morningglory size at treatment. They concluded that Flair applications must be made after the initial flush of weeds have emerged, but before the largest weeds exceed 6 inches (Brecke and Colvin, 1994). Flair does not have any residual activity and only effects the plant tissue which it comes in contact (authors personal observation).

In the Southwest, very little Paraquat is used to control weeds in peanuts (authors personal observation). Therefore, Flair may not be used much in Texas peanuts because of severe peanut injury under the hot conditions early in the growing season.

Pursuit control ranged from 0 to 78%. No eclipta control was observed in Wilson County in 1993 due to extremely heavy eclipta pressure. Previous research noted inconsistent eclipta control with Pursuit. Wilcut et al. (1991b) reported that eclipta control with Pursuit at 0.063 lb acre⁻¹ ranged from 67 to 75% when applied preplant incorporated, preemergence or after peanut emergence. They stated the 0.09 lb acre⁻¹ of Pursuit was necessary to provide good eclipta control.

Storm provided perfect control (100%) in 1992 in Eastland County and 72 to 77% at the other locations. Storm is a commercial prepackaged mixture of Blazer plus Basagran. Previous research has reported excellent eclipta control with Blazer + Basagran (Wilcut et al., 1991b).

Tough alone or in combination with Butoxone provided the most consistent eclipta control. These treatments provided excellent eclipta control ($\geq 93\%$) at the Eastland County trials, while in Wilson County control ranged from 57 to 80% (Table 1). Tough has been found to control other hard-to-control weeds in the southeast. Hicks et al. (1990) reported Tough controlled Florida beggarweed [*Desmodium tortuosum* (SW.) DC] which had 4 to 6 true leaves. They concluded Tough would provide growers a more flexible postemergence option for control of Florida beggarweed.

The combination of Tough and Cadre at 0.048 lb ai acre⁻¹ improved eclipta control over the 0.048 lb ai acre⁻¹ rate of Cadre in one of four years (Table 1). The addition of Tough to Pursuit improved eclipta control over Pursuit alone in two of three years. Pursuit and Cadre provide control of weeds that Tough does not control. These combinations would offer growers a more broad spectrum weed control program for peanuts.

Butoxone failed to provide consistent eclipta control (Table 1). Under extremely high populations (Wilson County), Butoxone controlled <50% eclipta, while in Eastland County, eclipta control varied from 87% in 1992 (light pressure) to less than 80% in 1993 and 1994 (moderate to heavy pressure). Butoxone is commonly mixed with other postemergence broadleaf herbicides (Wilcut et al., 1993). Butoxone helps increase control of many broadleaf species, particularly if the broadleaf weeds are larger than the recommended size for treatment with herbicides such as Blazer and Basagran (Buchanan et al., 1982). However, in our study Butoxone did not result in improved eclipta control when mixed with Blazer, Cadre or Tough.

The addition of Butoxone to Cadre at 0.063 lb acre⁻¹ improved eclipta control over Cadre alone in one of four trials while the addition of Butoxone to Pursuit over Pursuit alone did not result in any improved eclipta control. Since Pursuit and Cadre control many of the same weeds as Butoxone, these combinations would not result in an increase in weed spectrum, but only added cost to the grower.

Peanut yield

Effective eclipta control resulted in up to a 4-fold increase in peanut yield over the untreated check (Table 1). Peanut plots treated with Butoxone alone and Cadre plus Butoxone resulted in the highest yielding peanuts. Under heavy eclipta pressure, the tight fibrous root system of eclipta became entwined with the peanut plant. When this occurred, many peanuts were stripped from the vine during digging operations. Therefore, peanuts that become detached from the plant remained unharvested in or on the soil (Buchanan et al., 1982).

CONCLUSION

Effective control of eclipta with postemergence herbicides is possible when eclipta is ≤ 2 inches in height at the time of treatment. The variability of eclipta control at the test locations with some of the herbicide treatments may be due in part to the varying height at the time of treatment. At the time of herbicide application, eclipta plant size varied from < 1 inch to 6 inches, with most of the eclipta about 4 inches tall.

Eclipta can also greatly reduce peanut yield. Yields in the untreated check were reduced up to 450% when compared with some of the higher yielding herbicide treatments. Tough provided the most effective control of eclipta. Tough offers the added benefit of providing effective yellow nutsedge control with multiple applications (Grichar, 1992).

Also, in 1992, at the Eastland County location, the eclipta population was light to moderate, while at the other locations in 1993 and 1994, the eclipta populations were high. In Wilson County during the early portion of the growing season, from

planting (May 18) until the middle of June, rainfall was approximately 20 inches. This amount of rainfall is about two-thirds of the expected annual rainfall for that area. These wet conditions were favorable for excessive eclipta growth (Holm et al., 1991).

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