EVALUATION OF VARIOUS HERBICIDES FOR SAW GREENBRIER [*Smilax bona-nox* L.] AND SOUTHERN DEWBERRY [*Rubus trivialis* Michx.] CONTROL AND BERMUDAGRASS [*Cynodon dactylon* (L.) Pers.] TOLERANCE

AND

SHARPPOD MORNINGGLORY [*Ipomoea trichocarpa var. trichocarpa* Ell.] CONTROL IN ROUNDUP READY FLEX® AND LIBERTYLINK® COTTON SYSTEMS

A Thesis

by

TRAVIS WAYNE JANAK

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2011

Major Subject: Agronomy

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Approved by:

Chair of Committee,	Paul A. Baumann
Committee Members,	Gaylon Morgan
	Monty Dozier
	Bastiaan Drees
	Robert Lemon
Head of Department,	David Baltensperger

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ABSTRACT

Evaluation of Various Herbicides for Saw Greenbrier [*Smilax bona-nox* L.] and Southern Dewberry [*Rubus trivialis* Michx.] Control and Bermudagrass [*Cynodon dactylon* (L.) Pers.] Tolerance

and

Sharppod Morningglory [*Ipomoea trichocarpa var. trichocarpa* Ell.] Control in Roundup Ready Flex® and LibertyLink® Cotton Systems. (December 2011)

Travis Wayne Janak, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Paul A. Baumann

Field studies were conducted during 2006 and 2007 to evaluate control of saw greenbriar and southern dewberry by various pasture herbicides and to assess forage tolerance of Tifton 85 bermudagrass to these herbicides. Herbicides evaluated in each study included triclopyr, picloram, 2,4-D, fluroxypyr, dicamba, aminopyralid, metsulfuron methyl and various combinations of the above. Visual ratings were taken on each herbicide efficacy experiment. Visual evaluations of phytotoxicity, measurements of dry matter yield, and forage quality were quantified for each of the bermudagrass tolerance trials.

Saw greenbriar was best controlled at approximately one year after treatment by triclopyr at 10.9% ae v/v with diesel as the carrier (88-98%), although the lower rate of triclopyr + diesel at 0.87% ae v/v + 5% v/v and triclopyr alone at 0.87% ae v/v provided

49 to 86% control. Triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v gave best control of southern dewberry in both years when applied as an individual plant treatment (IPT) six weeks after shredding. In general, shredding 45 days prior to herbicide application gave an advantage to southern dewberry control versus not shredding. In 2006, triclopyr + fluroxypyr (IPT) was the only treatment to decrease Tifton 85 dry matter yield at the first harvest, with no effect observed at the second harvest. In 2007, both broadcast treatments containing triclopyr + fluroxypyr and the IPT treatment of triclopyr decreased dry matter yield at the first harvest, with triclopyr (IPT) being the only treatment to lower dry matter yield at the second harvest.

Field studies were also conducted in 2006 and 2007 to assess sharppod morningglory control in Roundup Ready Flex® and LibertyLink® cotton systems. Herbicides evaluated included glyphosate, glufosinate, prometryn, fluometuron, and diuron. Visual ratings of percent weed control and sharppod morningglory plant counts were taken to assess control.

Prometryn at 1.8 kg ai ha^{-1} and fluometuron at 1.8 kg ai ha^{-1} provided significant preemergence control (33-81%) of seedling sharppod morningglory. All rates of glyphosate (1.06 and 1.54 kg ai ha^{-1}) and glufosinate (0.45 and 0.6 kg ai ha^{-1}) controlled sharppod morningglory from 55 to 100% at both application timings. The addition of diuron at 1.12 kg ai ha^{-1} to glyphosate and glufosinate at the late season application enhanced sharppod morningglory control by 3 to 16%. Additionally, in both years, no reduction in cotton yield was observed in the morningglory infested treatment when compared to the weed free treatment.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Greenbriar and dewberry species are among the most common and troublesome weeds in the southern states (Anonymous 2001). *Smilax* spp. (greenbriar) and *Rubus* spp. (dewberry) are listed as troublesome in forestry (Anonymous 2001), but are also a problem in the Post Oak Savannah physiographic province of East Central Texas (Scifres and Haas 1974). The Post Oak Savannah is historically recognized as a grassland interspersed with trees, but the control of natural fires by man and "reduced accumulation[s] of fine fuels" (Stritzke, Engle, and McCollum 1991) by livestock grazing, combined with overgrazing has "hastened the dominance of woody species" (Dyksterhuis 1957; Scifres and Haas 1974). This increasing presence of woody species closes the savannah, resulting in heavy thickets that almost eliminate forage production (Dyksterhuis 1957; Scifres and Haas,1974). Scifres and Haas (1974) note that where the range deteriorates, the overstory is composed of post oak and blackjack oak, while a secondary woody understory develops which is comprised of difficult-to-control species such as yaupon and winged elm, as well as shrubs and vines such as saw greenbriar (*Smilax bona-nox L.)* and southern dewberry (*Rubus trivialis Michx.*). Mechanical clearing or chemically treating these woody species to return the land to native grassland or improved pasture increases the occurrence and production of undesirable woody vines such as southern dewberry (Scifres and Haas 1974). Severe reduction in the prevalence

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This thesis follows the style of Weed Technology.

of herbaceous forages, especially those of the genera *Andropogon, Schizyachrium, Stipa,* and *Sporobolus*, coincided with the development of these dense growths of woody plants, leaving only shade tolerant species that are low forage producers (Scifres 1980a). Soils of the Post Oak Savannah typically consist of sandy loams or loamy sands over a claypan. These soils are capable of growing productive stands of forage grasses such as switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium* var. *frequens*), and Indiangrass (*Sorghastrum nutans*) if brush is effectively managed (Scifres 1982; Scifres and Haas 1974). Although research has been conducted for control of saw greenbriar and southern dewberry in the past, documented levels of control have been marginal at best. The goal of these experiments was to evaluate control provided by various herbicides on these two woody vines in a heavily infested setting.

Saw Greenbriar Control

Saw greenbriar (*Smilax bona-nox L.*) is a perennial vine native to the United States (Noble Foundation 2008b). It can be evergreen to semi-evergreen to deciduous, depending on location, and vine lengths have been measured up to 26 feet in length (Brown and Brown 1972; Daubenmire 1990; Fernald 1950; Godfrey 1988; Sullivan 1994). Saw greenbriar is extensively rhizomatous, having two distinct forms. The first is a thick, lignified, knotty tuber that measures two to six cm thick and occurs in clusters up to 20 cm across (Martin and Tucker 1985; Sullivan 1994). The latter is a more slender rhizome out of which erect stems form (Brown and Brown 1972; Fernald 1950; Godfrey 1988; Martin and Tucker 1985; Sullivan 1994). The inflorescence consists of an umbel borne on an axillary peduncle. Saw greenbriar reproduces both by rhizomes and seed, with the fruit consisting of a single seeded drupe (Radford, Ahles, and Bell 1968; Sullivan 1994). Flowering takes place from April to June in Texas (Sullivan 1994; Vines 1960) with fruit ripening from September to October and staying on the vine throughout the winter (Brown and Brown 1972; Hunter 1989; Stephens 1973; Sullivan 1994).

Saw greenbriar is adapted to a wide variety of habitats. It thrives in wet and dry woods and forests, and in disturbed sites such as fencerows, old fields, and roadsides. It tolerates a wide variety of soil textures and moisture regimes, from rocky soils to sands to saturated swamp soils that are high in organic matter (Brown and Brown 1972; Ewel 1990; Fernald 1950; Godfrey 1988; Stephens 1973; Vines 1960; Sullivan 1994). Saw greenbriar is often found in disturbed areas and is listed with other plants that are known to invade areas immediately following disturbance (Daubenmire 1990; Sullivan 1994). It was the most abundant vine in a three year old gravel pit in East Texas and was found in lower numbers in five and 47 year old gravel pits, and in a nearby undisturbed forest (Nixon 1975; Sullivan 1994). Saw greenbriar also occurred in 15, 30, and 50 year old unreclaimed lignite surface mines in Texas, although it was found most often in nearby undisturbed forest areas (Skousen, Call, and Knight 1990; Sullivan 1994). It also tends to form dense thickets that provide excellent cover for birds and small mammals, who also readily consume the fruits on the plant (Brown and Brown 1972; Stephens 1973; Sullivan 1994). White-tailed deer, goats and other livestock prefer saw greenbriar as a browse species (Noble Foundation 2008b), and one study showed that chemically treating saw greenbriar with triclopyr at 2.2 kg ha^{-1} increased crude protein content and in vitro dry matter digestibility compared to the control (Soper, Lochmiller, Leslie, and Engle 1993). It is also mentioned that people eat fresh or cooked young leaves, stems and tendrils of saw greenbriar (Noble Foundation 2008b).

Most all work on control of saw greenbriar appears to be part of studies whose initial and main goal was to discover methods of control for more problematic woody species. That said, there has been limited work performed specifically for the control of saw greenbriar. Elwell, et al. (1964) mention that phenoxy herbicides provided only fair control and that both foliage and basal stem sprays performed better than soil applications. Specifically, Smilax spp. were not effectively controlled by 2,4,5-T, 2,4-D, 2,4-D + dichlorprop, and 2,4,5-TP (rates not given). In a study by Miller, et al. (1999) in Georgia, glyphosate at 3.4 kg ae ha^{-1}, triclopyr at 4.4 kg ae ha^{-1}, picloram at 3.4 kg ae ha^{-1}, dicamba + 2,4-D at 4.5 kg ae ha^{-1} + 4.5 kg ae ha^{-1}, and hexazinone at 3.35 kg ai ha^{-1} were applied to harvested pine land with ample woody plant regrowth. Plots were burned four to five months after herbicide application and replanted with pine approximately nine months after herbicide application. Evaluations of woody plant regrowth were made 11 years after herbicide application, with mean importance values calculated for each treatment using summed relative frequency and relative percent cover of the weedy species. Relative frequency is calculated as the number of plots (out of 20) occupied by a species and divided by 20 (expressed as a percentage). No significant differences in mean importance values were found for saw greenbriar in any treatment when compared to the untreated area. McGinty, et al. (1997) recommended 1.5% dicamba + 3% 2,4-D in diesel carrier applied as a dormant stem treatment in winter for saw greenbriar control in Texas range. Meyer, et al. (1970), studying cut-over timberland at Livingston, TX, indicated saw greenbriar was not controlled by picloram, dicamba or 2,4,5-T, although picloram at 6.7 and 13.5 kg ha^{-1} killed all greenbriar at a site at Leggett, TX. Where saw greenbriar was one of six brush species at Livingston, TX, the soil sterilants bromacil and prometone at rates of 179 and 45 kg ha^{-1}, respectively, controlled 90-100% of the brush at 26 months after application (Bovey, et al. 1967).

In a study by Scifres (1982) evaluating hexazinone, saw greenbriar canopy reduction totaled 40% at 17 months after application of 2 and 4 kg ha^{-1} hexazinone, but by 27 months saw greenbriar had fully recovered from herbicide injury. These results are similar to those in studies conducted by Blake, et al. (1987) where saw greenbriar showed resistance to hexazinone at 1.1 kg ha^{-1}, and Meyer and Bovey (1980b), where hexazinone rates up to 9 kg ha^{-1} were ineffective on saw greenbriar at Caldwell, TX. However, in a study by Scifres and Mutz (1978), hexazinone pellets were applied to range in 1976 in a grid with deposition points 1.5, 2, or 3 meter apart to achieve applications of 0.5, 1, 2, and 4 kg ai ha^{-1}. Rates of less than 1 kg ha^{-1} with a 2 or 3 meter particle spacing reduced the canopy of saw greenbriar by 30-60%. At 2 kg ha^{-1} and a 3 meter spacing, saw greenbriar canopy reduction was no different from the lower hexazinone rates.

Tebuthiuron was investigated for its usefulness in controlling saw greenbriar by several authors, including Scifres, et al. (1981). Though leaf margins were necrotic following application of tebuthiuron up to 4.4 kg ha^{-1}, saw greenbriar was not controlled, with only 17% canopy reduction at the 12 month rating on a site near College Station, TX. Furthermore, saw greenbriar appeared to increase in abundance following tebuthiuron applications, possibly due to tebuthiuron providing adequate to excellent control of almost all other woody species in the study. In a study by Stritzke, et al. (1991) in the western Cross Timbers area of Oklahoma, tebuthiuron was aerially applied at 2.2 kg ai ha^{-1} and triclopyr ester at 2.2 kg ai ha^{-1} mixed with diesel in an oil-in-water emulsion. Treatments consisted of each herbicide applied alone and in conjunction with an annual late spring burn beginning two years after herbicide treatment and continuing for three years. In all treatments, saw greenbriar was present in the under and overstory of both the shallow and sandy savannah. Results from the study indicate that no treatment provided significant control of saw greenbriar when compared to the untreated area. Interestingly, Cadenhead (2005) recommends a tank-mix of 25% triclopyr and 75% diesel by volume applied to the basal stem during the winter for control of saw greenbriar.

In general, it is believed that fires and prescribed burning do not provide satisfactory control of saw greenbriar, with plants probably being top-killed and resprouting from rhizomes. In one study, decrease in plant height coincided with mortality of saw greenbriar ranging from 11-31% after burning, although the average number of stems per plant increased after burning (Stransky and Halls 1979). Scifres (1980b) mentions that although saw greenbriar is not adequately controlled by tebuthiuron, a system of prescribed burning in conjunction with tebuthiuron application may be applied to keep greenbrier to desired densities for wildlife habitat and to improve its browse value.

Southern Dewberry Control

Southern dewberry (*Rubus trivialis* Michx.) is a native, deciduous, perennial, trailing vine in the Rosaceae family (Noble Foundation 2008a; OU Biosurvey 1999). The prostrate stems are densely covered with weak and stout spines, have reddish glandular hairs, and often root at the nodes (Noble Foundation 2008a; OU Biosurvey 1999). Leaves are alternate, palmately compound with three to five leaflets. The leaflets are elliptic to narrow-ovate and twice as long as broad. They are also glabrous and spiny, acute to acuminate at the apex, with margins serrate to dentate. The inflorescence consists of a solitary flower on an armed and glandular pedicel and has a five-lobed calyx that is glandular and reflexed. There are five petals which are white to pink, many pistils inserted on hypanthium, and numerous stamens. The flowers appear from March to April in most of the southern U.S. The fruit is as aggregation of drupelets which is 0.64 to 2.54 cm in diameter and black. It matures in June to July (OU Biosurvey 1999).

Southern dewberry is distributed from Colorado east to Missouri and Pennsylvania. From there it extends south to Florida and west to Texas and Oklahoma. It is commonly found in old fields, woodland margins, and as understory growth in deteriorated range such as the Post Oak Savannah (OU Biosurvey 1999; Scifres and Haas 1974). Southern dewberry is also a vigorous invader of disturbed sites, increasing in density when woody plant overstory is controlled (Scifres and Haas 1974). Southern dewberry fruits are eaten by many species of birds and mammals, and are eaten raw or used in jams and jellies by people. *Rubus* is a complex genus where frequent hybridization and introgression make identification difficult, although several varieties of dewberry are available commercially (OU Biosurvey 1999). Interestingly, Soper, et al. (1993) showed that chemically treating blackberry (*Rubus* spp.) with triclopyr at 2.2 kg ha^{-1} increased crude protein content and in vitro dry matter digestibility of new leaf and stem growth compared to the control.

As with saw greenbriar, southern dewberry control information is often a byproduct of research concerning other weedy perennial plants in pasture and range. Blackberry (*Rubus* spp.) and dewberry are often mentioned together and interchangeably in research concerning woody plant control, therefore, control data for blackberry will also be considered here. Elwell, et al. (1964) mention that control of blackberry (*Rubus* spp.) with phenoxy herbicides has been fair to excellent if sprayed in May or June with 1.1 kg ha^{-1} 2,4,5-T ester applied in diesel as a basal (cane stem) treatment. Retreatment is also necessary the second and third year. Meyer, et al. (1970) showed that a treatment of 6.7

kg ha^{-1} 2,4,5-T + 1.7 kg ha^{-1} picloram evaluated 29 months after application provided about 80% control of woody plants at Leggett, TX, although dewberry plants were still alive. Hernandez (1966) demonstrated excellent control (no values given) of dewberry vine at a Houston, TX, test site from an April application of 4.5 kg ha^{-1} bromacil + 5.6 kg ha^{-1} DSMA followed by a June application of an additional 5.6 kg ha^{-1} DSMA + 9 kg ha^{-1} 2,4-D. At a Pine Bluff, Arkansas, test site, excellent dewberry control was accomplished with a May application of 2.7 kg ha^{-1} bromacil + 5.6 kg ha^{-1} DSMA + 9 kg ha^{-1} 2,4-D followed by an application of 5.6 kg ha^{-1} DSMA + 9 kg ha^{-1} 2,4-D in July. Similar results were achieved when the bromacil rate was increased to 3.6 kg ha^{-1} and both 2,4-D applications were reduced to 4.5 kg ha^{-1}. Hernandez (1966) concluded that the addition of 2,4-D at 4.5-9 kg ha^{-1} improved the control of perennial dewberry vines, and that in the Gulf Coast and Mid-South areas, two applications containing 2.7 kg ha^{-1} bromacil + 5.6 kg ha^{-1} DSMA + 4.5-9 kg ha^{-1} 2,4-D provides good control of perennial plants and vines.

Meyer and Bovey (1980a) demonstrated that one of the primary invaders of mechanically or chemically treated range areas in the Texas Coastal Prairie and Claypan areas is southern dewberry. Chemical treatments resulting in high levels of southern dewberry invasion one to three years after application included picloram, karbutilate, bromacil and tebuthiuron. Similar results were shown by Scifres and Haas (1974), where southern dewberry density increased when woody plant overstory was controlled. In a study by Miller, et al. (1999) in Georgia, glyphosate at 3.4 kg ae ha^{-1}, triclopyr at 4.4

kg ae ha^{-1}, picloram at 3.4 kg ae ha^{-1}, dicamba + 2,4-D at 4.5 kg ae ha^{-1} + 4.5 kg ae ha^{-1}, and hexazinone at an average of 3.35 kg ai ha^{-1} were applied to harvested pine land inhabited by ample woody plant regrowth. Plots were burned four to five months after herbicide application and replanted with pine approximately nine months after herbicide application. Evaluations of woody plant regrowth were made 11 years after herbicide application, with mean importance values calculated for each treatment by summing relative frequency and relative cover of the weedy species. No significant differences in mean importance values were found for *Rubus* spp. in any treatment when compared to the untreated area.

Scifres, et al. (1981) indicated that southern dewberry canopy reduction from 2.2 kg ha^{-1} of tebuthiuron at 36 months after application was only 25%, and the plants appeared healthy and were rapidly growing. Additionally, southern dewberry was shown not to be controlled by hexazinone at rates of 2.0 and 4.0 kg ha^{-1} (Scifres 1982). Blake, et al. (1987) confirmed that blackberry was not adequately controlled by a 1121 g ha^{-1} rate of hexazinone.

Bermudagrass Tolerance

Bermudagrass is the most important and widely used perennial forage grass in the southern United States (Mitich 1989; Redfearn and Nelson 2003). Tifton 85 bermudagrass was released in 1992 by the University of Georgia and USDA-ARS as a higher producing and more digestible hybrid than the previous Coastal bermudagrass

(Burton et al. 1993). Brooks et al. (1996) mentioned that in a previous study in 1994 by Baumann et al., Tifton 85 showed susceptibility to several herbicides that normally exhibit minimal injury to other grass forages in improved pastures and rangelands. It is important that herbicides used in pastures and rangeland provide adequate weed control and have minimal adverse effects on forage quality and production (Butler and Muir 2006). Coastal bermudagrass tolerance to recently registered herbicides and tank mixes is well known (Butler and Muir 2006) but there is little documentation of the effect these herbicides have on Tifton 85 bermudagrass. Additionally, forage tolerance studies rarely evaluate higher spray carrier volume individual plant treatment application methods, particularly with the more recently labeled herbicides.

Fluroxypyr has lately become available to producers for weed control in bermudagrass. Butler and Muir (2006) evaluated Coastal bermudagrass tolerance to picloram + fluroxypyr at 0.188 kg ai ha^{-1} + 0.188 kg ai ha^{-1} and triclopyr + fluroxypyr at 0.63 kg ai ha^{-1} + 0.21 kg ai ha^{-1}. In 2001, a below average rainfall year at the Stephenville, TX, site, picloram + fluroxypyr at the previously mentioned rate decreased bermudagrass dry matter yield by 50% at the first harvest, but not significantly during harvests two and three. In 2002, a year with near normal rainfall at Stephenville, TX, picloram + fluroxypyr at the same rate reduced dry matter yield at the first harvest by 49%, but not significantly at harvests two, three, and four. In 2001 and 2002, total (annual) dry matter yield was reduced by 17% and 22%, respectively, with picloram + fluroxypyr at 0.188 kg ai ha^{-1} + 0.188 kg ai ha^{-1}. Triclopyr + fluroxypyr at the 0.63 kg ai ha^{-1} + 0.21 kg ai ha^{-}

^{1} rate reduced bermudagrass dry matter yield at the first harvest in 2001 by 38% and at the first harvest in 2002 by 41%. Neither year exhibited a significant reduction in dry matter yield at harvests two, three, or four by the triclopyr + fluroxypyr treatment. Overall, in 2001 and 2002, total dry matter yield was reduced by 17% and 19%, respectively, with triclopyr + fluroxypyr at 0.63 kg ai ha^{-1} + 0.21 kg ai ha^{-1}.

Triclopyr applied alone at 1.68 kg ai ha^{-1} by Butler and Muir (2006) in the same study resulted in a 37% decrease in dry matter production at the first harvest in 2001, while a 41% reduction in dry matter yield was observed at the first harvest in 2002. No reduction in dry matter yield was observed in subsequent harvests in either year. No cumulative loss in total dry matter production occurred in 2001 or 2002 when triclopyr was applied at 1.68 kg ai ha^{-1}, 2,4-D amine + dicamba at 1.205 kg ai ha^{-1} + 0.42 kg ai ha^{-1}, and metsulfuron + 2,4-D amine + dicamba at 0.021 kg ai ha^{-1} + 0.080 kg ai ha^{-1} + 0.28 kg ai ha^{-1}. These treatments did not negatively affect bermudagrass dry matter yield at the first harvest in either year. Total dry matter yield was not significantly affected in either year by the two treatments. Therefore, metsulfuron at the 0.021 kg ai ha^{-1} rate did not decrease bermudagrass dry matter yield when applied as a tank mix with 2,4-D amine + dicamba. Eichhorn and Wells (1995) demonstrated that metsulfuron applied alone at 0.012 kg ai ha^{-1} and 0.017 kg ai ha^{-1} to Coastal bermudagrass did not exhibit any visual phytotoxicity and did not affect forage yield or quality. These tolerance results for Coastal bermudagrass provide insight into possible tolerance issues associated with applying these herbicides and tank mixes to Tifton 85 bermudagrass.

Sharppod Morningglory Control

Morningglory species are among the most common and troublesome weed species in the southern cotton producing states (Anonymous 2001). *Ipomoea* spp. account for the largest percentage (18.2%) of U.S. cotton crop lost due to weeds and are estimated to infest 500,000 acres of cotton in Texas (Byrd 1999). Although studies have been conducted to determine effective control of annual morningglory species, few deal with control of the perennial sharppod morningglory (*Ipomoea trichocarpa var. trichocarpa* Ell.). Furthermore, data is lacking for comparing sharppod morningglory control in two popular transgenic crop herbicide programs, Roundup Ready Flex®[1] and LibertyLink®[2] cottons. Research was conducted to determine the advantages of one herbicide program over the other while simultaneously evaluating control of sharppod morningglory by different treatments consisting of a combination of preemergence and postemergence herbicides.

Sharppod morningglory, a member of the Convolvulaceae family, is similar in physical and morphological characteristics to other *Ipomoea* spp. that have a twining growth habit. Leaf shape is variable, although usually cordate-ovate, and leaves are either entire, three, or five lobed. Leaf arrangement is alternate. Sharppod morningglory leaves and stems may be glabrous or pubescent with sepals that possess hispid-pilose pubescence, separating this species from the closely related cotton morningglory

[1] Roundup Ready Flex®, Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167

[2] LibertyLink®, Bayer Crop Science, P.O. Box 12014, Research Triangle Park, NC 27709

[*I. cordatotriloba var. torreyana* (Gray) D. Austin] (Steele 2004; Correll and Johnston 1979). Flower characteristics include a corolla that is funnelform, three to five cm in length, and a lavender to purple-rose color (Steele 2004; Mahler 1988).

Sharppod morningglory is a perennial vine, making this species more difficult to control than annual morningglory species. Dorneden (1986) showed that 100% of plants detopped 17 to 24 days after emergence regenerated from the cut main root, evidently due to development of multiple adventitious shoots. Sharppod morningglory seeds exhibit up to 39% germination and increase with scarification (Steele 2004; Dorneden 1986). The combination of seedling vigor along with the perennial growth habit of sharppod morningglory creates a difficult weed control scenario for cotton producers.

Two transgenic crop herbicide programs are being evaluated for control of sharppod morningglory in cotton. The Roundup Ready Flex® cotton system allows postemergence applications of glyphosate to transgenic (glyphosate resistant) cotton varieties. This broad spectrum herbicide provides postemergence control of annual and perennial grass, sedge, and broadleaf weeds (Thomas et al. 2006; Askew and Wilcut 1999; Askew et al. 2002; Franz et al. 1997; Wilcut et al. 1996). Postemergence applications of glyphosate may be made up to 7 days prior to harvest, allowing the producer to employ late-season treatments in a weed control program. Steele (2004) reported that glyphosate applied POST at 840 g ae ha^{-1} provided 68% control of 10- to 20-cm sharppod morningglory, which was not different than the best performing treatment of glyphosate + diuron at 840 g ae ha^{-1} + 560 kg ai ha^{-1}. Glyphosate applied alone at 840 g ae ha^{-1} controlled 58% of 30 to 60 cm sharppod morningglory. Culpepper et al. (2000) reported greater than 90% late-season control of tall morningglory [*Ipomoea purpurea* (L.) Roth], ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq], and entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula* Gray) when 1.12 kg/ha of glyphosate was applied to plants with six true leaves or less. However, in-season sequential applications of glyphosate are often needed to provide similar control of pitted morningglory (Koger et al. 2004; Norsworthy and Oliver 2002; Reddy and Whiting 2000; Webster et al. 1999). Although published work on sharppod morningglory control with glyphosate is limited, the previously mentioned research provides insight toward control of various morningglory species, both annual and perennial.

The second transgenic cotton herbicide program being evaluated is the LibertyLink® system. The LibertyLink® program allows for postemergence applications of Ignite 280 to glufosinate tolerant cotton up to 70 days prior to harvest. Glufosinate is a broad spectrum herbicide which provides control of grasses and broadleaves, although grass control has been shown to be comparatively less than that of glyphosate (Culpepper et al. 2000). Steele (2004) mentions that 10 to 20 cm sharppod morningglory control was significantly greater with glufosinate at 410 g ai ha^{-1} (82%) than glyphosate at 840 g ae ha^{-1} (68%). Glufosinate at 410 g ai ha^{-1} controlled 30- to 60-cm sharppod morningglory significantly better than glyphosate at 840 g ae ha^{-1}. Culpepper et al. (2000) reported that an early postemergence application of glufosinate was more effective in controlling entireleaf morningglory than glyphosate. Glufosinate applied at 400 g/ha achieved 90% control of entireleaf morningglory compared to 81% control by glyphosate at 840 g/ha. Regardless of application rate, glufosinate applied postemergence in the absence of preemergence herbicides provided greater control of tall morningglory than glyphosate (Culpepper et al. 2000). According to Corbett et al. (2004), several treatments (including glufosinate) applied to 8-10 cm tall ivyleaf, entireleaf, and pitted morningglory showed 96% or greater control except for a single application of glyphosate or sulfosate. Larger morningglory plants are more tolerant to glyphosate than smaller plants (Corbett et al. 2004; Jordan et al. 1997). This tolerance becomes apparent when considering the lower control of ivyleaf, entireleaf, or pitted morningglory provided by sequential treatments of glyphosate compared to any sequential treatment regime of glufosinate (Corbett et al. 2004). Although limited data is available concerning sharppod morningglory control with glufosinate, current research favors glufosinate over glyphosate for control of annual and perennial morningglory species.

In part due to its twining growth habit, sharppod morningglory can be competitive with agronomic crops such as cotton. Although limited data exists showing competition of sharppod morningglory in cotton, ample research has been performed to give an understanding of the competitiveness of annual *Ipomoea* spp. Tall morningglory populations of 16 plants 15 m^{-1} of row have reduced seed cotton yield up to 75% (Steele 2004; Buchanan and Burns 1971). Further research shows that only 4 morningglory 15

m^{-1} of row significantly reduces cotton yield compared to the control (Steele 2004; Crowley and Buchanan 1978). Recent studies also show that ivyleaf morningglory reduces yield up to 6% for every plant 10 m^{-1} row, up to 9 plants 10 m^{-1} row (Steele 2004; Rogers et al. 1996). Morningglory species not only reduce yield by competition with crops for resources, but also by impeding crop growth and harvest. Up to 24% reduction in harvest efficiency has been shown by 16 tall morningglory 15 m^{-1} of row, although neither pitted, ivy, nor entireleaf morningglory showed any reduction in harvest efficiency of mechanically picked cotton (Steele 2004; Crowley and Buchanan 1978). Further research showed that 10 ivyleaf morningglory 10 m^{-1} row prevented stripper harvest of cotton, although lower weed densities did not affect cotton harvest (Steele 2004; Wood et al. 1999).

CHAPTER II

SAW GREENBRIAR CONTROL

Materials and Methods

A field trial was conducted at the Texas A&M University Riverside Campus in Brazos County, TX. Plots were established on a Burleson clay soil (Fine, smectitic, thermic Udic Haplusterts) and arranged in a randomized complete block design with four replications. The entire study area was shredded and allowed to regrow for 22 weeks before herbicide application. All treatments were applied as individual plant treatments using a pump-up sprayer with a single nozzle hand wand in a spray-to-wet method, covering all foliage and stems of the target species until they glisten but not to the point of dripping (Ralphs et al. 1991; Texas AgriLife Extension 2011). Due to the dense saw greenbriar growth in the trial area, each plot had a continuous cover of saw greenbriar foliage and stems. Therefore, application as an individual plant treatment resulted in the entire plot area being sprayed with each treatment. This led to an application volume of 0.7 L to each 3 m x 6 m plot, equivalent to 374 L ha^{-1} on a per area basis. Treatments one and two were applied using water as the carrier and consisted of triclopyr at 0.87% ae v/v and triclopyr + diesel + emulsifier at 0.87% ae v/v + 5% v/v + 0.19% v/v (Table 1). Treatments four through seven were applied using water as the carrier with a non-ionic surfactant at 0.5% v/v and consisted of triclopyr + picloram + 2,4-D at 0.22% ae v/v + 0.11% ae v/v + 0.42% ae v/v (four), triclopyr + fluroxypyr at 0.36% ae v/v + 0.12% ae v/v (five), dicamba + 2,4-D at 0.26% ae v/v + 0.74% ae v/v (six), and aminopyralid at 0.42% ae v/v (seven).

Table 1. Herbicides applied as individual plant treatments (IPT) in saw greenbriar control studies conducted in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Rate % ae v/v
1	Triclopyr	0.87
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87
3	Triclopyr + Diesel (75%)	10.9
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42
5	Triclopyr + Fluroxypyr	0.36 + 0.12
6	Dicamba + 2,4-D	0.26 + 0.74
7	Aminopyralid	0.42
-	Untreated	-

Treatment three was applied using diesel as the carrier and included triclopyr at 10.9% ae v/v. An untreated control treatment was included as well. Several applications of clethodim were made throughout the year to control grass weeds as necessary and did not affect the greenbriar.

Data collection consisted of visual estimation of control as a function of visual biomass reduction and herbicide symptomology on treated plant tissues at a specific rating date, with 0% indicating no control of above ground biomass and 100% indicating complete control. It was decided that control data would not be arc sine transformed for this thesis, although could be for future publication. Data was subjected to analysis of variance (ANOVA) and means were separated using Duncan's new multiple range test at the 0.05 significance level. Bartlett's test for homogeneity of variance was used to determine if data could be combined across years and locations and, when possible, least squares means were used to compare the pooled data due to significant interaction effects. The research study was conducted at the same location for two consecutive years, repeated the second year in a previously untreated area. Treatments were also repeated sequentially over the same site and individual plots as the first year. This was an effort to give a more complete look at a program approach to control of saw greenbriar.

Results and Discussion

In the 2006 study, treatments one, two, three (containing triclopyr at 0.87% ae v/v or greater) and seven controlled at least 70% of saw greenbriar at 29 days after treatment (DAT) (Table 2). Treatment three showed the highest level of control at all evaluations in the first year, providing 88% control 355 DAT. Additionally, it was the only treatment that did not show a reduction in control from 29 to 355 DAT, providing 88% control 355 DAT (Appendix D). The 355 DAT rating is of particular importance, since evaluation of control of perennial and brush species are most valid in sequential years after treatment.

After sequential treatment of these plots in 2007, treatments one, two, and three showed greater control than all other treatments at 49 and 353 DAT (Table 2). At 353 DAT, these treatments were not different from each other and provided from 85 to 98% control of saw greenbriar. The overall main effect of a two year sequential application program showed greater control of greenbriar versus one application. However, the highest performing treatment (three) did not exhibit a significant increase in control with a sequential application versus one application (Table 3). The low performing treatments of six and seven also showed the same effect.

Table 2. Saw greenbriar control 29 and 355 d after treatment (DAT) in 2006 and 49 and 353 d after reapplication on same site in 2007. College Station, TX.

Trt.	Herbicide	Rate	2006		2007 reapplication	
			29 DAT	355 DAT	49 DAT	353 DAT
		% ae v/v	% Control			
1	Triclopyr	0.87	79 b[a]	49 c	86 b	85 a
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	83 b	66 b	86 b	86 a
3	Triclopyr + Diesel (75%)	10.9	95 a	88 a	100 a	98 a
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	68 c	8 de	60 c	24 c
5	Triclopyr + Fluroxypyr	0.36 + 0.12	69 c	18 d	68 c	55 b
6	Dicamba + 2,4-D	0.26 + 0.74	61 c	3 de	50 d	11 cd
7	Aminopyralid	0.42	81 b	43 c	70 c	45 b
-	Untreated	-	0 d	0 e	0 e	0 d
-	LSD	-	8	14	10	14

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

Table 3. Comparison of single vs. two sequential herbicide applications for saw greenbriar control in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Rate	Treatment LSMeans		
			Single App.	Seq. Apps.	Sig.
		% ae v/v	---------% Control---------		α
1	Triclopyr	0.87	48.75	85.00	<.0001[a]
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	66.25	86.25	.0045
3	Triclopyr + Diesel (75%)	10.9	87.50	98.25	.1154
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	7.50	23.75	.0193
5	Triclopyr + Fluroxypyr	0.36 + 0.12	17.50	55.00	<.0001
6	Dicamba + 2,4-D	0.26 + 0.74	2.50	11.25	.1979
7	Aminopyralid	0.42	42.50	45.00	.7106
-	Untreated	-	0.00	0.00	1.000

[a] Least squares means significant when $\alpha \leq 0.05$.

Table 4. Saw greenbriar control 49 and 353 d after treatment (DAT) at new site in 2007. College Station, TX.

Trt.	Herbicide	Rate	2007	
			49 DAT	353 DAT
		% ae v/v	----------% Control---------	
1	Triclopyr	0.87	96 a[a]	85 b
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	95 a	83 b
3	Triclopyr + Diesel (75%)	10.9	100 a	97 a
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	81 b	44 d
5	Triclopyr + Fluroxypyr	0.36 + 0.12	80 b	61 c
6	Dicamba + 2,4-D	0.26 + 0.74	55 d	13 e
7	Aminopyralid	0.42	73 c	50 d
-	Untreated	-	0 e	0 f
-	LSD	-	5	10

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

In 2007, all treatments were applied to a previously untreated adjacent site for evaluation. At 49 DAT, treatments one, two, and three showed greater control of saw greenbriar than all other treatments (Table 4). By 353 DAT, these treatments continued to provide better control (83 to 97%) than all other treatments. Treatment three was again the only treatment to not show a significant reduction in control from 49 to 353 DAT, delivering the highest level of control (97%) at 353 DAT (Appendix E). When comparing greenbriar control from the 2006 study to that from the non-sequential treatments in the 2007 study, all treatments provided greater control in 2007 except for treatments six and seven (Appendix F). This is likely attributed to varying environmental conditions from one year to the next.

Pooled data for the evaluation made at approximately one month after treatment in 2006 and the new site in 2007 reveal that across both years the treatments containing triclopyr provided the highest level of control, where treatment three delivered 98% control of saw greenbriar (Appendix G). Evaluations made at approximately one year after treatment in 2006 and those from the new site in 2007 could not be combined due to the data failing Bartlett's test for homogeneity of variance.

CHAPTER III

SOUTHERN DEWBERRY CONTROL

Materials and Methods

Field trials were conducted in 2006 and 2007 at the Texas A&M University Riverside Campus in Brazos County, TX to evaluate southern dewberry control. Plots were established on a Burleson clay soil (Fine, smectitic, thermic Udic Haplusterts) and arranged in a split plot design with two whole plot factors and 11 subplot factors replicated four times. Whole plot factors consisted of shredded and non-shredded dewberry plants while 10 herbicide treatments were applied to subplots that were three meters by six meters in size. Herbicide treatments were applied to the entire study six weeks after shredding, allowing the dewberry time to recover and flush out a substantial amount of new growth, similar to that present on the non-shredded plants. Treatments were applied either broadcast at 187 L ha^{-1} using a CO_2 backpack sprayer or applied as individual plant treatments (IPT) using a pump-up sprayer with a single nozzle hand wand in a spray-to-wet method (Ralphs et al. 1991; Texas AgriLife Extension 2011). Due to the dense southern dewberry growth in the trial area, each plot had a continuous cover of southern dewberry foliage and stems. Therefore, application as an individual plant treatment resulted in the entire plot area being sprayed with each treatment. This led to an application volume of 0.7 L to each 3 m x 6 m plot, equivalent to 374 L ha^{-1} on a per area basis.

Broadcast treatments one through seven consisted of picloram + fluroxypyr at 0.5 kg ai ha^{-1} + 0.404 kg ai ha^{-1} (one), picloram + fluroxypyr + metsulfuron methyl at 0.5 kg ai ha^{-1} + 0.404 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (two), triclopyr + fluroxypyr at 0.876 kg ai ha^{-1} + 0.302 kg ai ha^{-1} (three), triclopyr + fluroxypyr + metsulfuron methyl at 0.876 kg ai ha^{-1} + 0.302 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (four), triclopyr at 0.777 kg ai ha^{-1} (five), triclopyr + metsulfuron methyl at 0.777 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (six), and metsulfuron methyl + dicamba + 2,4-D at 0.021 kg ai ha^{-1} + 0.280 kg ai ha^{-1} + 0.805 kg ai ha^{-1} (seven). IPT treatments eight through ten included triclopyr at 0.308% ai v/v (eight), picloram + fluroxypyr at 0.132% ai v/v + 0.106% ai v/v (nine), and triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v (ten) (Table 5). An untreated control treatment was included as well. Several applications of clethodim were made throughout the year to control grass pressure as necessary, but did not harm dewberry growth.

Data collection consisted of visual estimation of control as a function of visual biomass reduction and herbicide symptomology on treated plant tissues at a specific rating date, with 0% indicating no control and 100% indicating complete control. It was decided that control data would not be arc sine transformed for this thesis, although could be for future publication. Data was subjected to analysis of variance (ANOVA) and means were separated using Duncan's new multiple range test at the 0.05 significance level. Bartlett's test for homogeneity of variance was used to determine if data could be combined across years and locations and, when possible, least squares means were used to compare the pooled data due to significant interaction effects. The research study was

Table 5. Herbicide treatments applied to both shredded and non-shredded plots in southern dewberry control studies conducted in 2006 and 2007. Study area mowed 45 d prior to treatment in 2006 with applications made using both broadcast and individual plant treatment (IPT) methods. College Station, TX.

Trt.	Herbicide - Broadcast	Rate kg ai ha^{-1}
1	Picloram + Fluroxypyr	0.5 + 0.404
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011
3	Triclopyr + Fluroxypyr	0.876 + 0.302
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011
5	Triclopyr	0.777
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805
	Herbicide - IPT	**Rate % ai v/v**
8	Triclopyr	0.308
9	Picloram + Fluroxypyr	0.132 + 0.106
10	Triclopyr + Fluroxypyr	0.25 + 0.086
-	Untreated	-

conducted at the same location for two consecutive years. The complete study was conducted the second year in a previously untreated area and was also established again with sequential treatments over the same site and plots as the first year. This was an effort to give a more complete look at a program approach to control southern dewberry, since none of the treatments applied in 2006 provided acceptable control.

Results and Discussion

In the 2006 study, all broadcast treatments that included metsulfuron showed less desiccation of dewberry foliage than those that did not at 28 DAT, except for treatment seven and treatment six (non-shredded treatment only) (Table 6). At 28 DAT all IPT treatments provided 100% desiccation of plant foliage. The best control of southern dewberry was achieved from treatment ten applied IPT in both shredded and non-shredded treatments at 155 DAT, although only significantly greater than the shredded treatments five, six, and seven. However, treatment ten (non-shredded) provided greater control than all other non-shredded treatments except for broadcast applied treatment seven at 155 DAT. At this same rating date, all non-shredded treatments showed less southern dewberry control than the shredded treatments with the exception of treatment ten.

At 356 DAT all shredded treatments provided greater control of southern dewberry than all non-shredded treatments except for the non-shredded treatment ten (Table 6). Therefore, the whole plot factor of shredding before herbicide application provided

Table 6. Southern dewberry control at 28, 155, and 356 d after treatment (DAT) in 2006 and 99 and 459 d after reapplication on same site in 2007. Study area mowed 45 d prior to treatment in 2006 with applications made using both broadcast and individual plant treatment (IPT) methods. College Station, TX.

Trt.	Herbicide	Rate	2006			2007 reapplication	
			28 DAT	155 DAT	356 DAT	99 DAT	459 DAT
	Shredded	kg ai ha^{-1}	---------------------------% Control-----------------------------				
1	Picloram + Fluroxypyr	0.5 + 0.404	100 a[a]	74 ab	51 b	78 abc	40 abc
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	91 c	71 abc	48 b	75 abc	30 bcd
3	Triclopyr + Fluroxypyr	0.876 + 0.302	100 a	75 ab	50 b	80 ab	38 a-d
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	92 c	73 abc	50 b	76 abc	25 b-e
5	Triclopyr	0.777	100 a	63 bcd	44 bc	70 c	21 b-e
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	91 c	60 cd	45 bc	69 c	14 de
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	86 d	65 bcd	43 bc	78 abc	45 ab
8	Triclopyr – IPT	0.308 % ai v/v	100 a	75 ab	55 ab	76 abc	45 ab
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	100 a	75 ab	53 ab	76 abc	36 a-d
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	100 a	83 a	66 a	81 a	56 a
-	Untreated	-	0 e	0 g	0 g	0 d	0 e

Table 6. Continued,

Trt.	Herbicide	Rate	2006			2007 reapplication	
			28 DAT	155 DAT	356 DAT	99 DAT	459 DAT
	Non-Shredded	kg ai ha^{-1}	---% Control---				
1	Picloram + Fluroxypyr	0.5 + 0.404	100 a	35 f	18 def	70 c	24 b-e
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	97 b	39 f	20 de	68 c	24 b-e
3	Triclopyr + Fluroxypyr	0.876 + 0.302	100 a	39 f	21 de	73 abc	26 bcd
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	96 b	41 f	24 de	71 bc	23 b-e
5	Triclopyr	0.777	100 a	36 f	23 de	68 c	20 b-e
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	98 ab	35 f	10 efg	68 c	18 cde
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	91 c	44 ef	14 efg	80 ab	41 abc
8	Triclopyr - IPT	0.308 % ai v/v	100 a	38 f	11 efg	69 c	38 a-d
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	100 a	34 f	4 fg	69 c	25 b-e
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	100 a	55 de	31 cd	71 bc	44 abc
-	Untreated	-	0 e	0 g	0 g	0 d	0 e
-	LSD	-	3	11	13	8	22

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

significantly ($P<0.001$) better overall control than not shredding. Treatment ten showed the highest numerical level of control 356 DAT among all shredded treatments, although not higher than the other two IPT applied treatments (eight and nine). Among the non-shredded treatments, treatment ten provided the greatest level of control, although not greater than treatments one through five.

Approximately one year after the initial herbicide application, sequential herbicide applications were made over the same plots that received the initial treatment. No shredding was performed prior to this second application. At 459 days after the sequential application, and 862 days after the initial application, treatment ten provided the highest numerical level of control in both shredded and non-shredded treatments (Table 6). Treatment ten (shredded) showed greater control of southern dewberry than treatments two, four, and six applied to shredded plots. There was no difference in control among treatments applied to non-shredded plots, although treatments three, seven, eight, and ten did provide greater control than the untreated plot. Additionally, no difference was observed between individual previously shredded and non-shredded treatments.

The overall main effect of control from a two year sequential herbicide application was not different from the single application in 2006 (Appendix H). The shredded treatments four, five, and six all exhibited a reduction in control from the initial treatment compared to control achieved after the sequential application, while the non-shredded treatments seven, eight, and nine showed an increase in control from the initial to after the sequential application (Appendix H).

In the 2007 study, treatments containing metsulfuron methyl showed numerically lower desiccation of southern dewberry plants compared to those treatments without at 33 DAT, although these differences are not significant in four out of six comparisons (Table 7). No difference in desiccation was observed when comparing shredded to non-shredded treatments of the same herbicide regime at 33 DAT (Table 7). By 123 DAT, treatment ten (shredded) provided greater control of southern dewberry than all other treatments. All shredded herbicide treatments showed greater control than the corresponding non-shredded herbicide treatment except for treatments two and seven.

At 483 DAT, treatment ten (shredded) provided greater control than all other treatments (Table 7). As in 2006, the whole plot factor of shredding before herbicide application provided significantly (P=0.008) better overall control than not shredding. The shredded treatments one, three, four, five, six, and nine were the only other treatments to provide control greater than the untreated treatment. When comparing dewberry control in 2006 to that achieved in 2007 on previously untreated sites, the shredded treatments two, seven, eight, and nine all showed a decrease in control from 2006 to 2007, while the non-shredded treatment nine of exhibited an increase in control (Appendix I). These differences were likely due to varying environmental conditions from one year to the next.

Table 7. Southern dewberry control 33, 123, and 483 d after treatment (DAT) at new site in 2007. Study area mowed 45 d prior to treatment in 2007 with applications made using both broadcast and individual plant treatment (IPT) methods. College Station, TX.

Trt.	Herbicide	Rate	2007		
			33 DAT	123 DAT	483 DAT
	Shredded	kg ai ha^{-1}	-----------% Control-----------		
1	Picloram + Fluroxypyr	0.5 + 0.404	99 ab[a]	76 b	38 bc
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	96 bcd	70 bcd	23 b-f
3	Triclopyr + Fluroxypyr	0.876 + 0.302	100 a	75 b	34 bcd
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	98 a-d	76 b	45 b
5	Triclopyr	0.777	100 a	69 bcd	29 b-e
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	95 d	69 bcd	28 b-e
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	90 e	71 bcd	23 b-f
8	Triclopyr - IPT	0.308 % ai v/v	99 ab	72 bcd	19 b-f
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	96 bcd	73 bc	28 b-e
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	100 a	91 a	83 a
-	Untreated	-	0 f	0 f	0 f

Table 7. Continued,

Trt.	Herbicide	Rate	2007		
			33 DAT	123 DAT	483 DAT
	Non-Shredded	kg ai ha^{-1}	-----------% Control-----------		
1	Picloram + Fluroxypyr	0.5 + 0.404	99 ab	53 e	24 b-f
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	96 cd	60 cde	6 ef
3	Triclopyr + Fluroxypyr	0.876 + 0.302	99 ab	61 cde	20 b-f
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	97 bcd	56 e	10 def
5	Triclopyr	0.777	97 a-d	51 e	23 b-f
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	95 d	56 e	8 def
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	88 e	59 de	10 def
8	Triclopyr - IPT	0.308 % ai v/v	99 ab	51 e	16 c-f
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	98 abc	53 e	25 b-f
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	100 a	71 bcd	28 b-e
-	Untreated	-	0 f	0 f	0 f
-	LSD	-	3	11	22

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).

Table 8. Pooled results of southern dewberry control (LSMeans) at approximately one year after treatment (YAT) on new sites in 2006 and 2007. Study area mowed 45 d prior to treatment in 2006 and 2007 with applications made using both broadcast and individual plant treatment (IPT) methods. College Station, TX.

Trt.	Herbicide	Rate	1 YAT
		kg ai ha^{-1}	-----% Control-----
	Shredded		
1	Picloram + Fluroxypyr	0.5 + 0.404	44 bc[a]
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	35 b-e
3	Triclopyr + Fluroxypyr	0.876 + 0.302	42 bcd
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	48 b
5	Triclopyr	0.777	36 bcd
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	36 bcd
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	33 c-f
8	Triclopyr - IPT	0.308 % ai v/v	37 bcd
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	40 bcd
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	74 a
-	Untreated	-	0 j

Table 8. Continued,

Trt.	Herbicide	Rate kg ai ha^{-1}	1 YAT -----% Control-----
	Non-Shredded		
1	Picloram + Fluroxypyr	0.5 + 0.404	21 f-i
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	13 hi
3	Triclopyr + Fluroxypyr	0.876 + 0.302	21 f-i
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	17 ghi
5	Triclopyr	0.777	23 e-h
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	9 ij
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	12 hij
8	Triclopyr - IPT	0.308 % ai v/v	14 hi
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	14 hi
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	29 d-g
-	Untreated	-	0 j

[a] Least squares means within a column followed by the same letter are not significantly different (α = 0.05).

Pooled data for the final evaluations in 2006 and the new site in 2007 reveal that across both years the whole plot effect of shredding provided better control than not shredding when evaluated the following growing season (Table 8). Treatment ten (shredded) showed greater control (74%) than all other treatments and was the only treatment above 50%.

CHAPTER IV

BERMUDAGRASS TOLERANCE

Materials and Methods

Forage tolerance trials were conducted during 2006 and 2007 to determine sensitivity to several herbicides and combinations. Plots were established near Thrall, TX, on a Burleson clay soil (Fine, smectitic, thermic Udic Haplusterts) in a randomized complete block design with four replications and an individual plot size of three by six meters. Herbicide applications were made to 15 cm tall actively growing bermudagrass, either broadcast at 187 L ha^{-1} using a CO_2 backpack sprayer or applied as individual plant treatments (IPT) using a pump-up sprayer with a single nozzle hand wand in a spray-to-wet method (Ralphs et al. 1991; Texas AgriLife Extension 2011). Individual plant treatments were applied in the same manner and application volume as those in the saw greenbriar and southern dewberry studies. Therefore, application as an individual plant treatment resulted in the entire plot area being sprayed with each treatment and led to an application volume of 0.7 L to each 3 m x 6 m plot, equivalent to 374 L ha^{-1} on a per area basis.

Broadcast treatments one through seven consisted of picloram + fluroxypyr at 0.5 kg ai ha^{-1} + 0.404 kg ai ha^{-1} (one), picloram + fluroxypyr + metsulfuron methyl at 0.5 kg ai ha^{-1} + 0.404 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (two), triclopyr + fluroxypyr at 0.876 kg ai ha^{-1} + 0.302 kg ai ha^{-1} (three), triclopyr + fluroxypyr + metsulfuron methyl at 0.876 kg ai ha^{-1} + 0.302 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (four), triclopyr at 0.777 kg ai ha^{-1} (five),

Table 9. Herbicide treatments applied to Tifton 85 bermudagrass tolerance studies conducted in 2006 and 2007. Applications made using broadcast and individual plant treatment (IPT) methods. Thrall, TX.

Trt.	Herbicide - Broadcast	Rate kg ai ha^{-1}
1	Picloram + Fluroxypyr	0.5 + 0.404
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011
3	Triclopyr + Fluroxypyr	0.876 + 0.302
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011
5	Triclopyr	0.777
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805
	Herbicide - IPT	**Rate % ai v/v**
8	Triclopyr - IPT	0.308
9	Picloram + Fluroxypyr - IPT	0.132 + 0.106
10	Triclopyr + Fluroxypyr - IPT	0.25 + 0.086
-	Untreated	-

triclopyr + metsulfuron methyl at 0.777 kg ai ha^{-1} + 0.011 kg ai ha^{-1} (six), and metsulfuron methyl + dicamba + 2,4-D at 0.021 kg ai ha^{-1} + 0.280 kg ai ha^{-1} + 0.805 kg ai ha^{-1} (seven) (Table 9). IPT treatments eight through ten were triclopyr at 0.308% ai v/v (eight), picloram + fluroxypyr at 0.132% ai v/v + 0.106% ai v/v (nine), and triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v (ten). An untreated control was included as well. All herbicide treatments using water as the carrier included 0.5% non-ionic surfactant (Activator 90®, Loveland Products). Visual forage injury evaluations including percent chlorosis, necrosis, and growth reduction were made at selected intervals. The 37 and 19 DAT ratings correspond to the harvest dates for 2006 and 2007, respectively. Two harvests were collected on a 0.91 by 6.1 m area of each plot with a Carter® flail harvester throughout the growing seasons to determine treatment effect on forage dry matter yield and quality. It was decided that injury data would not be arc sine transformed for this thesis, although could be for future publication. All data were subjected to analysis of variance (ANOVA) and means were separated using Duncan's new multiple range test at the 0.05 significance level. The research studies were conducted at the same location for two consecutive years at separate sites in the same field.

Results and Discussion

In the 2006 forage tolerance trial, all treatments exhibited significant chlorosis when compared to the untreated plots at 8 DAT (Appendix J). Treatment nine resulted in greater chlorosis than all other treatments except for treatment one. No chlorosis was

Table 10. Visual growth reduction of Tifton 85 bermudagrass at 37 d after treatment in 2006 and 7 and 19 d after treatment in 2007. Applications made using broadcast and individual plant treatment (IPT) methods. Thrall, TX.

Trt.	Herbicide	Rate	2006	2007	
			37 DAT	7 DAT	19 DAT
		kg ai ha^{-1}	-----------------------------%-----------------------------		
1	Picloram + Fluroxypyr	0.5 + 0.404	0.0 b[a]	5.0 b	11.3 c
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	0.0 b	5.0 b	10.0 c
3	Triclopyr + Fluroxypyr	0.876 + 0.302	0.0 b	5.0 b	20.0 ab
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	0.0 b	5.0 b	20.0 ab
5	Triclopyr	0.777	3.8 a	5.0 b	18.8 b
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	2.5 ab	5.0 b	13.8 c
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	0.0 b	0.0 c	0.0 d
8	Triclopyr – IPT	0.308 % ai v/v	0.0 b	6.3 b	23.8 a
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	0.0 b	5.0 b	11.3 c
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	5.0 a	10.0 a	18.8 b
-	Untreated	-	0.0 b	0.0 c	0.0 d
-	LSD	-	2	1	4

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).

observed at later rating dates from any of the treatments. By 37 DAT, growth reduction occurred with the treatments five and ten (Table 10). Visual growth reduction was not assessed earlier than 37 DAT due to excessively dry conditions after application. At this same date, treatment ten was the only treatment that caused lower dry matter yield than the untreated control (Table 11). Crude protein among all treatments varied a maximum of only 1.3% from the untreated treatment, however, treatments four, five, seven, eight, and ten exhibited lower crude protein than untreated plots (Appendix K). No differences were observed among acid detergent fiber (ADF) values, which are an indicator of forage digestibility (Appendix L). No differences were observed in dry matter yield, crude protein, or ADF at the second forage harvest which occurred at 95 DAT.

In the 2007 study, all treatments except for treatment seven showed visual growth reduction 7 DAT, with treatment ten providing greater growth reduction than all other treatments (Table 10). All treatments exhibited chlorosis when compared to the untreated control except for five and seven (Appendix J). No chlorosis was observed at later rating dates. Growth reduction was observed in 2007 at 7 and 19 DAT.

Table 11. Tifton 85 bermudagrass yield in 2006 and 2007. Applications made using broadcast and individual plant treatment (IPT) methods. Thrall, TX.

Trt.	Herbicide	Rate	2006		2007	
			Harvest 1	Harvest 2	Harvest 1	Harvest 2
		kg ai ha^{-1}	------------------------kg dry matter ha^{-1}-----------------------			
1	Picloram + Fluroxypyr	0.5 + 0.404	3288.9 a[a]	2781.7 a	6119.8 bcd	4468.0 a
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	3233.4 a	2811.8 a	6460.3 abc	3915.5 ab
3	Triclopyr + Fluroxypyr	0.876 + 0.302	3274.9 a	2449.7 a	5449.8 cd	3996.2 ab
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	2644.9 ab	2674.7 a	5473.1 cd	4110.8 ab
5	Triclopyr	0.777	2674.3 ab	2601.6 a	5686.0 bcd	4054.8 ab
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	3042.7 ab	2437.9 a	5775.6 bcd	4275.5 ab
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	2555.3 ab	2749.3 a	7259.0 a	4079.7 ab
8	Triclopyr - IPT	0.308 % ai v/v	2745.1 ab	2581.2 a	5122.1 d	3570.1 b
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	3242.3 a	2396.7 a	6293.4 abc	4053.5 ab
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	2222.1 b	2482.5 a	5599.1 bcd	4020.9 ab
-	Untreated	-	3278.9 a	2460.5 a	6635.6 ab	4417.1 a
-	LSD	-	822	655	923	648

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).

By 19 DAT, all treatments had manifested growth reduction compared to the untreated plots except for treatment seven. All triclopyr containing treatments except for number six showed greater reduction than other treatments. At this same date, all treatments exhibited increased levels of necrosis compared to the untreated control except for treatment seven (Appendix M).

At 32 DAT, the first forage harvest revealed that treatments three, four, and eight provided lower dry matter yield when compared to the untreated control (Table 11). No differences were observed in crude protein and ADF. At 77 DAT, the second forage harvest showed that only treatment eight reduced dry matter yield compared to the untreated plots. No differences were observed in crude protein and ADF values at this harvest (Appendices K and L).

CHAPTER V

SHARPPOD MORNINGGLORY CONTROL

Materials and Methods

Field trials were conducted in 2006 and 2007 at the Texas AgriLife Research Farm in Burleson County, TX. Experiments were established on a Belk clay soil (Fine, mixed, thermic Entic Hapluderts). Two trials were arranged in randomized complete block designs with 8 treatments and four replications in each. Plots were four 1 meter rows wide by 9.14 meters in length. DeltaPine 143 B2RF was planted in the Roundup Ready Flex® cotton experiment area while FiberMax 955 B2LL was planted in the LibertyLink® cotton experiment area. Both varieties were planted at 123,500 seeds ha^{-1} using a conventional double disk opener vacuum planter. The study was sidedressed with 84 kg ha^{-1} urea ammonium nitrate (32-0-0) at the fourth true leaf stage. Three treatments included for comparison in both experiment areas were an untreated, completely weed free, and one kept free of all weeds except sharppod morningglory (known as morningglory infested) (Table 12). The study area was oversprayed at planting (except the untreated plots) with pendimethalin at 1.60 kg ai ha^{-1} to control grasses and small seeded broadleaves, namely Palmer amaranth and common waterhemp, hereafter referred to as pigweed. All treatments were applied broadcast at 140 L ha^{-1} using a CO_2 backpack sprayer.

Treatments for the Roundup Ready Flex® cotton experiment consisted of preemergence, postemergence, and postemergence directed applications (Table 12). Both fluometuron and prometryn were applied preemergence (PRE) at 1.80 kg ai ha^{-1} to two separate treatments (one and two). These two applications were followed by early post (EPOST) and mid post (MPOST) applications of glyphosate at 1.06 kg ai ha^{-1}. The third treatment consisted of glyphosate at 1.06 kg ai ha^{-1} applied both EPOST and MPOST while a fourth treatment consisted of glyphosate at 1.54 kg ai ha^{-1} applied both EPOST and MPOST. A fifth treatment included EPOST and MPOST applications of glyphosate at 1.54 kg ai ha^{-1} followed by diuron applied post directed (PDIR) within 30 minutes following the MPOST application at 1.12 kg ai ha^{-1}.

Treatments for the LibertyLink® cotton included the same two preemergent herbicides, fluometuron and prometryn, applied at 1.80 kg ai ha^{-1} in two separate treatments (one and two) (Table 13). Both of these herbicide treatments were followed by EPOST and MPOST applications of glufosinate at 0.45 kg ai ha^{-1}. A third treatment consisted of glufosinate applied EPOST and MPOST at 0.45 kg ai ha^{-1} while a fourth treatment consisted of glufosinate applied both EPOST and MPOST at 0.60 kg ai ha^{-1}. A fifth treatment included glufosinate applied EPOST and MPOST at 0.60 kg ai ha^{-1} followed by diuron PDIR within 30 minutes following the MPOST application at 1.12 kg ai ha^{-1}.

Assessments to determine annual versus perennial sharppod morningglory plants were made at planting in the weed free plots (Appendices N and O). This was accomplished by noting the presence or absence of cotyledons and by digging up each morningglory

Table 12. Herbicide treatments applied in Roundup Ready Flex® Sharppod Morningglory study in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Application Timing[a]	Rate kg ai ha^{-1}
1	Pendimethalin + prometryn *fb*[b]	PRE	1.6 + 1.8 *fb*
	glyphosate *fb*	EPOST	1.06 *fb*
	glyphosate	MPOST	1.06
2	Pendimethalin + fluometuron *fb*	PRE	1.6 + 1.8 *fb*
	glyphosate *fb*	EPOST	1.06 *fb*
	glyphosate	MPOST	1.06
3	Pendimethalin *fb*	PRE	1.6 *fb*
	glyphosate *fb*	EPOST	1.06 *fb*
	glyphosate	MPOST	1.06
4	Pendimethalin *fb*	PRE	1.6 *fb*
	glyphosate *fb*	EPOST	1.54 *fb*
	glyphosate	MPOST	1.54
5	Pendimethalin *fb*	PRE	1.6 *fb*
	glyphosate *fb*	EPOST	1.54 *fb*
	glyphosate *fb*	MPOST	1.54 *fb*
	diuron	PDIR	1.12
-	Weed Free		
	pendimethalin	PRE	1.6
-	Morningglory Infested		
	pendimethalin	PRE	1.6
-	Untreated	-	-

[a] PRE – preemergence to cotton, EPOST – early postemergence to cotton, MPOST – mid postemergence to cotton, PDIR – postemergence directed to cotton.
[b] *fb*, followed by.

Table 13. Herbicide treatments applied in LibertyLink® Sharppod Morningglory study in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Application Timing[a]	Rate kg ai ha^{-1}
1	Pendimethalin + prometryn *fb*[b]	PRE	1.6 + 1.8 *fb*
	glufosinate *fb*	EPOST	0.45 *fb*
	glufosinate	MPOST	0.45
2	Pendimethalin + fluometuron *fb*	PRE	1.6 + 1.8 *fb*
	glufosinate *fb*	EPOST	0.45 *fb*
	glufosinate	MPOST	0.45
3	Pendimethalin *fb*	PRE	1.6 *fb*
	glufosinate *fb*	EPOST	0.45 *fb*
	glufosinate	MPOST	0.45
4	Pendimethalin *fb*	PRE	1.6 *fb*
	glufosinate *fb*	EPOST	0.6 *fb*
	glufosinate	MPOST	0.6
5	Pendimethalin *fb*	PRE	1.6 *fb*
	glufosinate *fb*	EPOST	0.6 *fb*
	glufosinate *fb*	MPOST	0.6 *fb*
	diuron	PDIR	1.12
-	Weed Free		
	pendimethalin	PRE	1.6
-	Morningglory Infested		
	pendimethalin	PRE	1.6
-	Untreated	-	-

[a] PRE – preemergence to cotton, EPOST – early postemergence to cotton, MPOST – mid postemergence to cotton, PDIR – postemergence directed to cotton.
[b] *fb*, followed by.

seedling to examine the root and determine if the plant was an annual or perennial. Plant counts were recorded for comparison at a later date. Visual sharppod morningglory control ratings were made two weeks after each herbicide application and at harvest.

Total morningglory plant counts in all plots were also documented at each morningglory control rating and assessment of annual versus perennial plants was taken again in the same plots at the beginning of the following season to help evaluate control of the perennial plants (Appendices P-V). A plant growth regulator was applied as needed during the season to the cotton to keep plants at a manageable height. As the cotton plants reached approximately 80% open bolls, a defoliation treatment of thidiazuron at 0.08 kg ai ha^{-1}plus diuron at 0.01 kg ai ha^{-1} was applied to aid in plant desiccation for harvest. After evaluating the condition of the plots, a second defoliant application of carfentrazone-ethyl at 0.28 kg ai ha^{-1} was required in the morningglory infested plots to accomplish mechanical harvest. It was established that sequential applications of harvest aids should have no influence on crop yield (R. Lemon, personal communication). The cotton was mechanically picked with a two row spindle picker and plot weights were taken. Lint yield was determined using a 10 saw laboratory gin and lint samples from each plot were analyzed for fiber quality at the International Textile Center in Lubbock, TX.

Visual sharppod morningglory control rating data, morningglory plant counts, cotton lint yields, and cotton fiber quality were subjected to analysis of variance (ANOVA) and means were separated using Duncan's new multiple range test at the 0.05 significance level. It was decided that control data would not be arc sine transformed for this thesis, although could be for future publication. Bartlett's test for homogeneity of variance was used to determine if data could be combined across years and locations and, when possible, least squares means were used to compare the pooled data due to significant interaction effects. The research study was conducted at the same location for two consecutive years with the second year employed on a previously unstudied area (Site B). Treatments were also repeated over the exact same site and individual plots as the first year (Site A). This was in effort to give a more complete look at a program approach for controlling perennial sharppod morningglory.

Results and Discussion

In the 2006 Roundup Ready Flex® experiment, all preemergence herbicide treatments provided control of sharppod morningglory when compared to the untreated control 25 days after the preemergence application (DA-PRE) (Appendix W). Fluometuron and prometryn provided greater control (73-75%) than preemergence treatments of pendimethalin at 1.60 kg ai ha^{-1} (21-30%). At 18 DA-EPOST, pigweed control was 99% or greater in all EPOST treated plots (data not shown). Sharppod morningglory control ranged from 82-88% after the EPOST treatments, with no differences between treatments. Counts of morningglory plants less than 10 cm in diameter indicated that treatments one and five had a higher number of these size plants per plot (77 and 95) versus the morningglory infested treatment (34), although there was no statistical difference between herbicide treatments (Appendix P). No difference was found within herbicide treatments when plants larger than 10 cm in diameter were counted, but all EPOST treatments showed a lower number of these size plants (3-6) compared to the morningglory infested plot (75) (Appendix P). Although the EPOST glyphosate treatments reduced numbers of sharppod morningglory larger than 10 cm, it also allowed a flush of new growth/regrowth represented by smaller than 10 cm plants in the treated plots. Morningglory plant counts were not taken in the untreated plots because of the competition created by uncontrolled pigweed which would have compromised morningglory count comparisons with the other treatments.

At 39 DA-EPOST, all treatments provided 55 to 61% control of sharppod morningglory (Appendix X). Fifteen days after the MPOST and PDIR applications, treatment five (EPOST followed by MPOST applications of glyphosate followed by diuron applied PDIR) provided greater control than all other treatments due to the addition of diuron. Treatment three, EPOST followed by MPOST applications of glyphosate at 1.06 kg ai ha^{-1}, exhibited lower control than all treatments except for treatment one (Appendix Y). Plant counts corresponded with these visual control ratings at 15 DA-MPOST and PDIR (Appendix P). At 36 days after the MPOST and PDIR applications, treatment five provided greater control (94%) than all other treatments. Treatments that included preemergence applications of fluometuron and prometryn did not provide any numerical or statistical advantage in sharppod morningglory control compared to the same glyphosate rate without these PRE herbicides. It should be noted that plant counts in the weed free plots at the beginning of the season 25 days after application of pendimethalin at 1.60 kg ai ha^{-1} found that perennial sharppod morningglory plants outnumbered annual plants 2:1 (Appendix N). By ninety-nine days after the MPOST and PDIR applications there was no difference in sharppod morningglory control among any of the herbicide treatments (data not shown).

Lint yield did not statistically differ within the herbicide treatments, nor did the herbicide treatments differ from the weed free treatment and morningglory infested treatment (Table 14). This is significant, since the morningglory infested treatment was densely populated with sharppod morningglory (Appendix P). The untreated control yielded significantly lower than all treatments, likely due to the competition from both morningglory and pigweed. No appreciable differences were observed in staple, length, uniformity or strength when comparing between herbicide treatments or when comparing herbicide treatments to the weed free and morningglory infested treatments. A micronaire value (measure of fiber fineness and maturity) of 3.85 from the morningglory infested treatment was higher than the 3.59 returned from the weed free treatment (Appendix Z). Leaf grade was similar for all treatments, even the morningglory infested plot returned a leaf grade that was not different from any other treatment except for treatment two, which had the lowest numerical leaf grade. An evaluation of live morningglory plants in April 2007, 284 days after the MPOST and PDIR applications were made, revealed no statistical difference in number of sharppod morningglory plants when comparing all five herbicide treatments (Appendix P).

Table 14. Cotton yield in Roundup Ready Flex® experiments in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Rate	2006 Site A	2007 Site A	2007 Site B
		kg ai ha^{-1}	-------------------kg lint ha^{-1}	------------------	
1	Pendimethalin + prometryn *fb*[b] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	693 a[a]	884 a	987 a
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	722 a	948 a	964 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	832 a	866 a	772 a
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	721 a	949 a	1011 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	708 a	998 a	977 a
-	Weed Free pendimethalin	1.6	699 a	1076 a	961 a
-	Morningglory Inf. pendimethalin	1.6	664 a	874 a	773 a
-	Untreated	-	228 b	94 b	143 b
-	LSD	-	177	353	355

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).
[b] *fb*, followed by.

In the 2006 LibertyLink® herbicide experiment, all preemergence herbicide treatments provided control of sharppod morningglory 25 DA-PRE. The two treatments of fluometuron and prometryn provided greater control (69-70%) than the other preemergence treatments where pendimethalin was applied alone at 1.60 kg ai ha^{-1} (13-24%) (Appendix AA).

At 18 DA-EPOST, all treatments showed 98-100% control of pigweed and 89-93% control of sharppod morningglory, with no differences among treatments (data not shown). By 39 DA-EPOST, all treatments exhibited 58 to 64% control of sharppod morningglory. Evaluations made at 15 DA-MPOST and PDIR, indicated that treatment five resulted in greater control than treatments one and three, although only 9% control separated them from treatment five (Appendix AB). By 36 DA-MPOST and PDIR treatments were applied, treatment five provided greater sharppod morningglory control than all other treatments, although evaluations made 99 DA-MPOST and PDIR applications indicated control from treatment five differed from treatment three by only 6%. No difference in plant counts (smaller than 10 cm) was observed between the morningglory infested treatment or the five EPOST herbicide treatments (Appendix Q). Counts of plants larger than 10 cm in diameter revealed no difference between EPOST treatments, although all EPOST treatments had a lower number of these plants (1-3) compared to the morningglory infested treatment (110). At this date, all herbicide treatments had lower plant numbers (25-61) than the morningglory infested treatment (274). At 39 DA-EPOST, treatment five (glufosinate at 0.60 kg ai ha-1) was the only treatment to have a higher number of plants per plot compared to the morningglory infested treatment.

Lint yield was not statistically different between any of the five herbicide treatments and the morningglory infested treatment (Table 15). The weed free treatment yielded more than treatments two and three, but was not different from the morningglory infested treatment. All treatments yielded more than the untreated control. No appreciable difference was observed for staple length, uniformity, and strength among herbicide treatments (Appendix AC). Micronaire of the morningglory infested treatment was 4.18, which is higher than 3.88 from the weed free treatment. Leaf grade for the morningglory infested treatment was greater than all other treatments, including the untreated control. This is attributed to the large amount of desiccated sharppod morningglory leaves and vine present at harvest time in the morningglory infested plots. No differences in leaf grade were observed among herbicide treatments. No difference in sharppod morningglory plant numbers was observed between herbicide treatments in April 2007, 284 days after the MPOST and PDIR applications were made (Appendix Q).

In 2007, the studies (both Roundup Ready Flex® and LibertyLink®) were repeated over the same individual plots that were treated the previous year (Site A). At 35 days after the preemergence application in the Roundup Ready Flex® experiment, all herbicide treatments provided greater control than the untreated, with treatment two showing the best control at 81% (Appendix W). Treatment two also showed greater control of

Table 15. Cotton yield in LibertyLink® experiments in 2006 and 2007. College Station, TX.

Trt.	Herbicide	Rate	2006 Site A	2007 Site A	2007 Site B
		kg ai ha^{-1}	-------------------kg lint ha^{-1}------------------		
1	Pendimethalin + prometryn *fb*[b] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	768 ab[a]	1044 a	1099 a
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	650 b	1170 a	1000 ab
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	650 b	1138 a	960 abc
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	682 ab	1117 a	937 abc
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	716 ab	1083 a	913 abc
-	Weed Free pendimethalin	1.6	889 a	1058 a	696 bc
-	Morningglory Inf. pendimethalin	1.6	692 ab	920 a	638 c
-	Untreated	-	122 c	43 b	153 d
-	LSD	-	219	341	346

[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[b] *fb*, followed by.

pigweed than all other treatments except for the morningglory infested. Twenty-nine DA-EPOST, all treatments controlled sharppod morningglory from 83 to 91 percent, with treatment two providing greater control than treatment five (Appendix X). This difference between treatments two and five is also evident in plant counts made on the same date (Appendix R). At 44 DA-EPOST, control ranged from 74 to 83 percent, with treatment two again being significantly greater than treatment five (Appendix X). At 15 DA-MPOST and PDIR treatments were applied, treatment five showed greater control of sharppod morningglory (97%) than all other treatments, with the remaining treatments showing 81 to 88 percent control. Plant counts made on this date also clearly indicate these statistical differences (Appendix R). Treatment three at this date was the only treatment that did not demonstrate a reduction in plant numbers compared to the morningglory infested plot. By 33 DA-MPOST and PDIR, treatment five continued to deliver 97% control, greater than all other treatments. Remaining treatments ranged from 85 to 90 percent. All treatments yielded more cotton lint than the untreated control, with no statistical differences evident between any of the herbicide treatments, weed free, or morningglory infested treatments (Table 14). At 303 DA-MPOST and PDIR applications where made, there was no difference in the number of annual sharppod morningglory plants between any treatment (Appendix R). All treatments (including the morningglory infested treatment) except treatment three showed a reduction in number of perennial plants compared to the untreated control.

In the 2007 LibertyLink® experiment (Site A), treatment two provided greater control of sharppod morningglory and Palmer amaranth than all other treatments at 35 DA-PRE (Appendix AA). At 29 DA-EPOST, all herbicide treatments resulted in 84 to 93 percent control, with treatment two (93%) providing greater control than treatment five. At 33 DA-MPOST and PDIR, treatment five continued to provide the greatest level of control (99%), although similar to treatment two (96%). At 44 DA-EPOST, treatment two continued to show greater control (88%) than all other treatments (Appendix AD). By 15 DA-MPOST and PDIR, treatment five provided greater control of sharppod morningglory (98%) than all other treatments, which ranged from 86 to 91 percent (Appendix AB). Sharppod morningglory plant counts recorded at 29 DA-EPOST revealed no statistical difference in numbers between any herbicide treatment, including the morningglory infested treatment (Appendix S). Plant counts taken at 15 DA-MPOST and PDIR applications revealed no difference between treatments two and five, although all herbicide treatments showed lower plant numbers than the morningglory infested treatment. When evaluated at 303 DA-MPOST and PDIR treatments were applied, treatment two was the only one to lower the number of annual sharppod morningglory plants compared to the untreated control, although all treatments except treatment five lowered numbers of annual plants compared to the morningglory infested treatment. Treatments one through five lowered numbers of perennial sharppod morningglory plants compared to the untreated control, although they were not different from the morningglory infested treatment. All treatments yielded significantly greater than the untreated control, with no statistical differences evident between any of the herbicide treatments, weed free, or morningglory infested treatments (Table 15).

In 2007, both experiments (Roundup Ready Flex® and LibertyLink®) were conducted at a previously unstudied area (Site B). In the Roundup Ready Flex® experiment, no difference in sharppod morningglory and tall waterhemp control was evident between any treatments 48 days after the preemergence herbicide applications (Appendix W). At 14 DA-EPOST, there was no difference in sharppod morningglory control between herbicide treatments, although all herbicide treatments controlled sharppod morningglory better than the morningglory infested treatment (Appendix AE). By 28 DA-EPOST, no difference in control was evident among herbicide treatments. At 14 DA-MPOST and PDIR, treatment five provided greater control (99%) than all other treatments, which ranged from 89 to 95 percent (Appendix AF). At 30 DA-MPOST and PDIR, treatments two, four, and five provided comparable control of sharppod morningglory from 97 to 100 percent. Control by treatments one and three was 93 and 94 percent, respectively. Plant counts 14 DA-EPOST treatments were applied revealed no difference in number of sharppod morningglory plants per plot between any of the herbicide treatments and the morningglory infested treatment (Appendix T). Plant counts taken 14 DA-MPOST and PDIR applications revealed no difference in numbers of plants per plot between treatments two, four, and five. At 303 DA-MPOST and PDIR, no difference was observed in numbers of annual sharppod morningglory plants between any of the treatments. Treatments one through five lowered numbers of perennial plants compared to the untreated control, although only treatments two and four had lower numbers compared to the morningglory infested treatment. All treatments yielded greater than the untreated control, with no differences evident between any of the herbicide treatments, weed free, or morningglory infested treatments.

When yield data from the Roundup Ready Flex® experiments in 2006 (Site A) and 2007 (Site B) was combined it showed that lint yield did not differ within the herbicide treatments, nor did the herbicide treatments differ from the weed free treatment and morningglory infested treatment (Table 16). This is significant, since the morningglory infested treatment was densely populated with sharppod morningglory. The untreated control yielded lower than all treatments.

In the 2007 LibertyLink® experiment (Site B), treatments one and two showed greater control of sharppod morningglory than all other preemergence treatments at 48 days after application (Appendix AA). At 14 DA-EPOST applications, all herbicide treatments provided 97 to 100 percent control, all greater than the morningglory infested treatment (Appendix AG). Control remained between 91 and 94 percent at 28 DA-EPOST (Appendix AG). By 14 DA-MPOST and PDIR, treatment five exhibited the greatest numerical control of sharppod morningglory (99%), although not significantly greater than treatment two (Appendix AH). At 30 DA-MPOST and PDIR, no difference was evident between treatments one, two, and five, ranging

Table 16. Effect of herbicide treatments on combined cotton yield (LSMeans) in Roundup Ready Flex® experiments in 2006 (Site A) and 2007 (Site B). College Station, TX.

Trt.	Herbicide	Rate	Yield
		kg ai ha^{-1}	---kg lint ha^{-1}---
1	Pendimethalin + prometryn *fb*[b] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	750 a[a]
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	753 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	716 a
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	774 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	752 a
-	Weed Free pendimethalin	1.6	741 a
-	Morningglory Infested pendimethalin	1.6	642 a
-	Untreated	-	177 b

[a] Least squares means within a column followed by the same letter are not significantly different (α = 0.05).
[b] *fb*, followed by.

Table 17. Effect of herbicide treatments on combined cotton yield (LSMeans) in LibertyLink® experiments in 2006 (Site A) and 2007 (Site B). College Station, TX.

Trt.	Herbicide	Rate	Yield
		kg ai ha^{-1}	---kg lint ha^{-1}---
1	Pendimethalin + prometryn *fb*[b] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	833 a[a]
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	737 ab
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	719 ab
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	723 ab
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	727 ab
-	Weed Free pendimethalin	1.6	708 ab
-	Morningglory Infested pendimethalin	1.6	594 b
-	Untreated	-	123 c

[a] Least squares means within a column followed by the same letter are not significantly different (α = 0.05).
[b] *fb*, followed by.

from 97 to 99 percent (Appendix AH). The lowest control at this date was 92 percent, shown by treatment four. No difference in yield was observed between any of the five herbicide treatments, although treatments one and two yielded more than the morningglory infested treatment (Table 15). Plant counts taken 48 DA-PRE showed no difference between all treatments (Appendix U). Plant counts taken 14 DA-EPOST applications showed no difference in sharppod morningglory plant numbers between any herbicide treatment and the morningglory infested treatment (Appendix U). All treatments had fewer morningglory plants than the morningglory infested treatment 14 DA-MPOST and PDIR. At 303 DA-MPOST and PDIR, no difference was observed in numbers of annual sharppod morningglory plants between any of the treatments. Treatments one, two, four, and five lowered the number of perennial plants compared to the untreated control, although only treatments one, two, and five lowered the number of perennial plants compared to the morningglory infested treatment.

When yield data from the LibertyLink® experiments in 2006 (Site A) and 2007 (Site B) was combined it showed no difference in yield between any of the five herbicide treatments, with treatment one being the only herbicide treatment to yield significantly greater than the morningglory infested treatment (Table 17). The untreated control yielded lower than all treatments.

CHAPTER VI

CONCLUSIONS

Saw Greenbriar Control

In the saw greenbriar control studies, treatments containing triclopyr at 0.87% ae v/v or greater provided the best control in both years. Initially, using diesel as the sole carrier was necessary in 2006 to achieve a satisfactory kill at 355 DAT. After retreatment of these plots again in 2007, any of the three treatments containing triclopyr at 0.87% ae v/v or greater provided 85% or greater control of saw greenbriar at 353 days after the second application. The increase in control shown by the overall main effect of a two year sequential application program versus one year is expected for hard to kill woody plants such as greenbriar. However, it is important to note that the treatment of triclopyr at 10.9% ae v/v with diesel as the carrier was the only treatment to provide the same high level of control with just one application compared to two sequential applications. This gives merit to the superior efficacy of this treatment. In the 2007 study on a new site, triclopyr at 10.9% ae v/v with diesel as the carrier again provided the highest level of control at 353 DAT. However, the other two treatments containing triclopyr at 0.87% ae v/v or greater achieved satisfactory control of saw greenbriar (83% and 85%) at expectedly lower treatment costs. This might be of significance to a forage producer that is concerned about forage injury, which would be remediated by these treatments. However, if one was more intent on achieving greenbriar control, the triclopyr at 10.9% ae v/v with diesel as the carrier treatment would be the one of choice.

Southern Dewberry Control

In the southern dewberry control studies, the treatment of triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v applied IPT consistently returned the highest level of control. At 356 DAT in the 2006 study, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v provided the highest numerical level of control, although not greater than the other two IPT applied treatments. Among the non-shredded treatments, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v again returned the highest numerical level of control, although only greater than four out of ten treatments. Interestingly, all other treatments except triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v provided greater control of southern dewberry when applied to shredded plants versus those not shredded. Therefore, the whole plot factor of shredding before herbicide application provided better overall control than not shredding, demonstrating that shredding prior to herbicide application and allowing for new vegetation to flush out for 45 days was beneficial to control.

After re-application of treatments to the 2006 study, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v continued to provide the highest level of control in both shredded and non-shredded treatments at 459 DAT. Among the shredded treatments, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v controlled southern dewberry better than four out of ten treatments. All treatments containing metsulfuron methyl provided lower control than triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v except for metsulfuron methyl + dicamba + 2,4-D at 0.021 kg ai ha^{-1} + 0.280 kg ae ha^{-1} + 0.805 kg ae ha^{-1}. No difference was observed among any of the non-shredded treatments, and no differences were observed for any herbicide treatment when comparing shredding versus not shredding prior to herbicide application. The overall main effect of control from a two year sequential herbicide application was not different from the single application in 2006. Interestingly, three shredded herbicide treatments showed a reduction in control from 2006 to after the 2007 sequential application, and three non-shredded treatments showed an increase in control during this same time period. This may have been due to the reduced amount of foliage present in the shredded plots and the comparatively larger leaf area present in the non-shredded plots at the time of the sequential application in 2007.

At 483 DAT in the 2007 study, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v (shredded) provided greater control than all other treatments, and was the only non-shredded treatment to provide greater control than the untreated control. As in 2006, the whole plot factor of shredding before herbicide application provided better overall control than not shredding. The level of control achieved by the treatment of triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v seems in large part due to the application method. Although triclopyr + fluroxypyr was shown to be an effective herbicide for southern dewberry control throughout this study, application as an individual plant treatment allowed an application volume of 374 L ha^{-1} versus the broadcast application volume of 187 L ha^{-1}. Analyzing the IPT treatment of triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v at 374 L ha^{-1} on a per area basis shows that application of active ingredient[1] was triclopyr + fluroxypyr at 0.931 kg ai ha^{-1} + 0.321 kg ai ha^{-1}. This rate is not much different from the broadcast treatment rate of triclopyr + fluroxypyr at 0.876 kg ai ha^{-1} + 0.302 kg ai ha^{-1}, applied at 187 L ha^{-1}, though there are several instances of statistical differences in control between these two treatments. This illustrates the positive effect higher application volumes have on weed control.

Pooled data for the final evaluations in 2006 and the new site in 2007 reveal that across both years the whole plot effect of shredding provided better control than not shredding when evaluated the following growing season. The treatment of triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v (shredded) showed greater control (74%) than all other treatments and was the only treatment above 50% at the final evaluations. With regard to a single application scenario, shredding prior to an application of triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v has been shown to consistently deliver the highest level of control of southern dewberry. The substantial increase in control observed for the shredded treatments justifies the added expense of the shredding practice in the opinion of this researcher. In addition, forage quality and availability to grazing animals would logically be improved.

[1] PastureGard® (Dow AgroSciences) applied IPT at 1% product v/v. Spray volume of 374 L ha^{-1} multiplied by 1% product, multiplied by kg ai L^{-1} of product (triclopyr 0.249 kg ai L^{-1}, fluroxypyr 0.0856 kg ai L^{-1}) equals 0.931 kg ai triclopyr ha^{-1}, 0.321 kg ai fluroxypyr ha^{-1}.

Bermudagrass Tolerance

In the 2006 forage tolerance trial, all treatments exhibited low levels of chlorosis, with the greatest levels present in treatments containing picloram + fluroxypyr. At 37 DAT, growth reduction was caused by two of the four triclopyr containing treatments, with triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v being the only treatment to lower dry matter yield at the first harvest compared to the untreated control. Crude protein values were lowered at the first harvest by five treatments; four of these treatments included triclopyr. The second harvest, at 95 DAT, showed no differences in any harvest parameters.

In the 2007 trial, triclopyr + fluroxypyr at 0.25% ai v/v + 0.086% ai v/v exhibited the highest level of growth reduction at 7 DAT, and all triclopyr containing treatments except one provided greater growth reduction at 19 DAT when compared to the other treatments. All three treatments that reduced dry matter yield at the first harvest included triclopyr as part or all of the treatment. By the second harvest at 77 DAT, triclopyr at 0.308% ai v/v was the only treatment to reduce dry matter yield. This recurring bermudagrass stunting and yield reduction by triclopyr is consistent with previous forage tolerance research (Koger, Stritzke, Taliaferro, and Phillips 1997). Interestingly, metsulfuron methyl + dicamba + 2,4-D at 0.021 kg ai ha^{-1} + 0.280 kg ai ha^{-1} + 0.805 kg ai ha^{-1} was the only treatment that did not exhibit any chlorosis, necrosis, stunting, or yield reduction at any time.

Sharppod Morningglory Control

In both years of the Roundup Ready Flex® experiment, preemergence applications of fluometuron and prometryn provided significant early season control of sharppod morningglory seedlings, with fluometuron generally providing better control than prometryn. Early postemergence applications of glyphosate all provided satisfactory control (83 to 95%) at two to four weeks after treatment, with no consistent differences between rates at any evaluation date. These visual ratings were verified in morningglory plant counts made after the EPOST applications. The addition of diuron applied PDIR to glyphosate treatments later in the season clearly provided an increase in sharppod morningglory control across both years and locations. Only on Site B in 2007 did the increase in control from the addition of diuron not persist to 30 days after application.

Plant counts made after the MPOST and PDIR applications show the addition of diuron to treatment five (EPOST followed by MPOST applications of glyphosate followed by diuron applied PDIR) provided a decrease in number of plants present compared to the other herbicide treatments at Site A in 2006 and 2007. Plant counts at Site B in 2007 showed a numerically lower number of plants present in treatment five, although this difference was not significant, as reflected in the visual control ratings. All treatments yielded greater than the untreated control. It is important to note that no difference in lint yield was observed among treatments (excluding the untreated), especially when comparing the treated and weed free plots to the morningglory infested treatment. When sufficiently defoliated with two applications of a harvest aid, sharppod morningglory vines were desiccated enough to allow successful harvest with a mechanical picker. One possible explanation for the lack of yield reduction in the morningglory infested treatment is that vines tend to remain on the ground and do not climb up into the cotton plant canopy until later in the season when competition with the plant is not as critical. However, to minimize sharppod morningglory seed production and achieve more effective control, early elimination of morningglory plants is the preferable strategy.

In both years of the LibertyLink® study, preemergence applications of prometryn and fluometuron clearly provided a benefit for control of sharppod morningglory over pendimethalin alone, with fluometuron showing an advantage in control over prometryn in 2007 on Site B. Evaluation of control from the early postemergence applications of glufosinate showed acceptable control from all treatments, with no advantage to the high rate (0.6 kg ai ha^{-1}) of glufosinate. Morningglory plant count numbers confirm these visual evaluations of early postemergence control in both years at both sites. The addition of diuron to the late season herbicide application again provided an advantage to control compared to the same rate of glufosinate without diuron, ranging from 88 to 99 percent.

Plant counts made after the MPOST and PDIR applications verified these ratings with lower numbers of plants present in the treatment with diuron in both years and at both sites. Reduction in plant numbers with the addition of diuron was observed in 2006 and in 2007 at Site A, but not at Site B. At harvest time in 2006, the addition of diuron provided the highest level of control, although not greater than three of the four remaining treatments. For the 2006 and 2007 studies on Site A, lint yield was not different among any of the treatments, including the morningglory infested treatment. All treatments yielded greater than the untreated control in both years and locations due to the dense population of pigweed present in the untreated plots. In 2007 on Site B, the two treatments containing fluometuron and prometryn yielded greater than the morningglory infested treatment, although not greater than any other herbicide treatment.

From these studies, the practical conclusion would be to advise cotton producers to maintain sharppod morningglory control throughout the growing season with the most effective methods discussed. However, this research also confirms that if sharppod morningglory becomes unmanageable for whatever reason, application(s) of harvest aids would alleviate yield loss.

LITERATURE CITED

Anonymous. 2001. Weed survey-southern states, broadleaf crops subsection. Pages 244-259 in Proceedings of the Southern Weed Science Society. 54.

Askew, S. D., W. A. Bailey, G. H. Scott, and J. W. Wilcut. 2002. Economic assessment of weed management for transgenic and nontransgenic cotton in tilled and nontilled systems. Weed Sci. 50:512-520.

Askew, S. D. and J. W. Wilcut. 1999. Cost and weed management with herbicide programs in glyphosate-resistant cotton (*Gossypium hirsutum*). Weed Technol. 13:308-313.

Blake, P. M., G. A. Hurst, and T. A. Terry. 1987. Response of vegetation and deer forage following application of hexazinone. South. J. of Appl. For. 11:176-180.

Brooks, J. R., P. A. Baumann, and G. D. Morgan. 1996. Phytotoxicity of postemergence herbicides to Tifton 85, Jiggs, and Coastal bermudagrass (*Cynodon dactylon*). Page 59 in Proceedings of the Southern Weed Science Society. 49.

Bovey, R. W., R. E. Meyer, F. S. Davis, M. G. Merkle, and H. L. Morton. 1967. Control of woody and herbaceous vegetation with soil sterilants. Weeds 15:327-330.

Buchanan, G. A. and E. R. Burns. 1971. Weed competition in cotton. I. Sicklepod and tall morningglory. Weed Sci. 19:576-579.

Burton, G.W., R.N. Gates, and G.M. Hill. 1993. Registration of Tifton 85 bermudagrass. Crop Sci. 33:644–645.

Butler, T.J., and J.P. Muir. 2006. Coastal bermudagrass (Cynodon dactylon) yield response to various herbicides. Weed Technol. 20:95–100.

Byrd, J. D. Jr. 1999. Report of the 1998 cotton weed loss committee. Pages 727-730 in Proceedings of the 1999 Beltwide Cotton Conferences. 1.

Cadenhead, J. F. 2005. How to take the green out of greenbriar. College Station, TX: Texas Cooperative Extension. Publ. L-5466.

Corbett, J. L., S. D. Askew, W. E. Thomas, and J. W. Wilcut. 2004. Weed efficacy evaluations for bromoxynil, glufosinate, glyphosate, pyrithiobac, and sulfosate. Weed Technol. 18:443-453.

Correll, D.S. and M.C. Johnston. 1979. Manual of the Vascular Plants of Texas. Richardson, TX. The University of Texas-Dallas. Pp. 1247-1253.

Crowley, R. H. and G. A. Buchanan. 1978. Competition of four morningglory (*Ipomoea* spp.) species with cotton (*Gossypium hirsutum*). Weed Sci. 26:484-488.

Culpepper, A. S., A. C. York, R. B. Batts, and K. M. Jennings. 2000. Weed management in glufosinate- and glyphosate-resistant soybean (*Glycine max*). Weed Technol. 14:77-88.

Dorneden, D. J. 1986. Biology and control of sharppod morningglory (*Ipomoea trichocarpa var trichocarpa* Ell.) M.S. Thesis College Station: Texas A&M University. 85p.

Dyksterhuis, E. J. 1957. The savannah concept and its use. Ecology 38:435-442.

Eichhorn, M. M. and J. W. Wells. 1995. Effect of post-emergence weed control herbicides on Coastal bermudagrass. Page 90 in Proceedings of the Southern Weed Science Society. 48.

Elwell, H. M., P. W. Santelmann, J. F. Stritzke, and H. Greer. 1964. Brush control research in Oklahoma. Brush Control Research. Stillwater, OK.

Franz, J. E., M. K. Mao, and J. A. Sikorski. 1997. Toxicology and environmental properties of glyphosate. Pages 103-137 *in* Glyphosate: A Unique Global Herbicide. Am. Chem. Soc. Monogr. 189. Washington DC: American Chemical Society.

Hernandez, T. J. 1966. Use of bromacil and diuron in combination with other herbicides. Pages 333-335 in Proceedings of the Southern Weed Conference. 19.

Jordan, D. L., A. C. York, J. L. Griffin, P.A. Clay, P. R. Vidrine, and D. B. Reynolds. 1997. Influence of application variables on efficacy of glyphosate. Weed Technol. 11:354-362.

Koger, C. H., D. H. Poston, and K. N. Reddy. 2004. Effect of glyphosate spray coverage on control of pitted morningglory (*Ipomoea lacunosa*). Weed Technol. 18:124-130.

Koger, T. H., J. F. Stritzke, C. M. Taliaferro, and W. A. Phillips. 1997. Bermudagrass tolerance to postemergence herbicides. Pages 83-86 in Proceedings of the American Forage and Grasslands Council.

Mahler, W. F. 1988. Shinners' Manual of the North Central Texas Flora. Fort Worth: Botanical Research Institute of Texas, Inc.

McGinty, A., J. Ansley, J. F. Cadenhead, W. Hamilton, W. C. Hanselka, C. Hart, and D. N. Ueckert. 1997. Chemical weed and brush control suggestions for rangeland. College Station, TX. Texas Agricultural Experiment Station. Publ. B-1466.

Meyer, R. E. and R. W. Bovey. 1980a. Control of live oak *(Quercus virginiana)* and understory vegetation with soil-applied herbicides. Weed Sci. 28:51-58.

Meyer, R. E. and R. W. Bovey. 1980b. Hexazinone and other herbicides on Texas woody plants. Weed Sci. 28:358-362.

Meyer, R. E., H. L. Morton, M. G. Merkle, R. W. Bovey, and F. S. Davis. 1970. Brush control on forest-rangelands in east Texas. J. Range Manage. 23:129-132.

Miller, J. H., R. S. Boyd, and M. B. Edwards. 1999. Floristic diversity, stand structure, and composition 11 years after herbicide site preparation. Can. J. For. Res. 29:1073-1083.

Mitich, L. W. 1989. Bermudagrass, intriguing world of weeds. Weed Technol. 3:433–435

Noble Foundation. 2008a. Dewberry. http://www.noble.org/WebApps/PlantImageGallery/Plant.aspx?PlantID=38&IndexType=CommonName&PlantMainName=Dewberry&PlantTypeID=3. Accessed September 27, 2007.

Noble Foundation. 2008b. Greenbriar. http://www.noble.org/WebApps/PlantImageGallery/PrinterFriendly.aspx?PlantID=50&PlantTypeID=3. Accessed: October 4, 2007.

Norsworthy, J. K. and L. R. Oliver. 2002. Effect of irrigation, soybean (*Glycine max*) density, and glyphosate on hemp sesbania (*Sesbania exaltata*) and pitted morningglory (*Ipomoea lacunosa*) interference with soybean. Weed Technol. 16:7-17.

Oklahoma Biological Survey. 1999. *Rubus trivialis*, Southern dewberry. Stillwater: Oklahoma University. http://biosurvey.ou.edu/shrub/rubu-tri.htm. Accessed 27 Sept. 2007.

Ralphs, M.H., L.V. Mickelson, J.O. Evans, and S.A. Dewey. 1991. Selective application of glyphosate for control of larkspurs (*Delphinium* spp.). Weed Technol. 5:229-231.

Reddy, K. N. and K. Whitting. 2000. Weed control and economic comparisons of glyphosate-resistant, sulfonylurea-tolerant, and conventional soybean (*Glycine max*) systems. Weed Technol. 14:204-211.

Redfearn, D. D. and C. J. Nelson. 2003. Grasses for Southern Areas.Pages 149-169 *in* R. F. Barnes, C. J. Nelson, M. Collins, and K. J. Moore, eds. Forages An Introduction to Grassland Agriculture. Vol. I. Ames, IA: Iowa State University Press.

Rogers, J. B., D. S. Murray, L. M. Verhalen, and P. L. Claypool. 1996. Ivyleaf morningglory (*Ipomoea hederacea*) interference with cotton (*Gossypium hirsutum*). Weed Technol. 10:107-114.

Scifres, C. J. 1980a. Brush management: Principles and practices for Texas and the southwest. College Station, TX: Texas A&M University Press. 360 p.

Scifres, C. J. 1980b. Integration of prescribed burning with other practices in brush management systems. Pages 65-69 *in* C. W. Hanselka (ed). Proc. of a Symposium. Kingsville, Texas.

Scifres, C. J. 1982. Woody plant control in the post oak savannah of Texas with hexazinone. J. Range Manage. 35:401-404.

Scifres, C. J. and R. H. Haas. 1974. Vegetation changes in a post oak savannah following woody plant control. College Station: Texas A&M University Press. Publ. MP-1136.

Scifres, C. J. and J. L. Mutz. 1978. Response of oaks and associated woody species to velpar. Page 214 in Proceedings of the Southern Weed Science Society.

Scifres, C. J., J. W. Stuth, and R. W. Bovey. 1981. Control of oaks (*Quercus* spp.) and associated woody species on rangeland with tebuthiuron. Weed Sci. 29:270-275.

Soper, R. B., R. L. Lochmiller, D. M. Leslie, Jr., and D. M. Engle. 1993. Nutritional quality of browse after brush management on cross timbers rangeland. J. Range Manage. 46:399-410.

Steele, G. 2004. Interference and control of sharppod morningglory (*Ipomoea cordatotriloba* Dennstedt) in glyphosate-resistant cotton. PhD. Dissertation College Station: Texas A&M University. 108p.

Stransky, J. J. and L. K. Halls. 1979. Effect of a winter fire on fruit yields of woody plants. J. Wildl. Manage. 43:1007-1010.

Stritzke, J. F., D. M. Engle, and F. T. McCollum. 1987. Brush management on the Cross Timbers Experimental Range: I. Brush problems and the responses to herbicides. Animal Sci. Research Report. Stillwater, OK. p. 99-102.

Stritzke, J. F., D. M. Engle, and F. T. McCollum. 1991. Vegetation management in the cross timbers: Response of woody species to herbicides and burning. Weed Technol. 5:400-405.

Sullivan, J. 1994. *Smilax bona-nox*. *In:* Fire effects information system. U.S. Department of Agriculture, Forest Service. http://www.fs.fed.us/database/feis/. Accessed: September 10, 2007.

Texas AgriLife Extension. 2011. Brush busters huisache leaf spray method. Texas AgriLife Extension. http://texnat.tamu.edu/about/brush-busters/huisache/leaf-spray-method/. Accessed: September 14, 2011.

Texas AgriLife Research. 2006. Texas AgriLife Research Farm Weather Station. http://researchfarm.tamu.edu/test.txt. Accessed: September 14, 2011.

Texas AgriLife Research and Extension Center at Corpus Christi. 2006. Crop Weather Program. http://cwp.tamu.edu/cgi-bin/htmlos.cgi/62744.4.057419532869711968. Accessed: September 14, 2011.

Texas Parks and Wildlife Department. 2004. TPWD: Texas plant information database. http://tpid.tpwd.state.tx.us/species_report.asp?species=222. Accessed: September 11, 2007.

Thomas, W. E., T. T. Britton, S. B. Clewis, S. D. Askew, and J. W. Wilcut. 2006. Glyphosate-resistant cotton (*Gossypium hirsutum*) response and weed management with trifloxysulfuron, glyphosate, prometryn, and MSMA. Weed Technol. 20:6-13.

Weather Underground. 2006a. History for College Station, TX. http://www.wunderground.com/history/airport/KCLL/2006/1/1/CustomHistory.html. Accessed: September 14, 2011.

Weather Underground. 2006b. History for KTXTAYLO3. http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KTXTAYLO3. Accessed: September 14, 2011.

Webster, E. P., K. J. Bryant, and L. D. Earnest. 1999. Weed control and economics in nontransgenic and glyphosate-resistant soybean (*Glycine max*). Weed Technol. 13:586-593.

Wilcut, J. W., H. D. Coble, A. C. York, and D. W. Monks. 1996. The niche for herbicide-resistant crops in U.S. agriculture. Pages 213-230 *in* S. O. Duke, ed. Herbicide-Resistant Crops: Agricultural, Environmental, Economic, Regulatory, and Technical Aspects. Boca Raton, FL: CRC.

Wood, M. L., D. S. Murray, R. B. Westerman, L. M. Verhalen, and P. L. Claypool. 1999. Full-season interference of *Ipomoea hederacea* with *Gossypium hirsutum*. Weed Sci. 47: 693-696.

APPENDIX A

2006 AND 2007 PRECIPITATION DATA[a] FOR GREENBRIAR AND SOUTHERN DEWBERRY EXPERIMENTAL SITE – COLLEGE STATION, TX

Month	2006[b]	2007[b]
January	66.8	126.5
February	94.0	2.0
March	121.9	171.2
April	62.5	78.0
May	67.3	102.1
June	85.6	113.8
July	148.8	116.3
August	37.1	35.3
September	68.3	36.8
October	327.2	68.1
November	16.3	98.9
December	116.1	97.5
Total	1211.8	1041.9

[a] Weather Underground 2006a.
[b] Data in mm.

APPENDIX B

2006 AND 2007 PRECIPITATION DATA[a] FOR TIFTON 85 EXPERIMENTAL SITE – THRALL, TX

Month	2006[b]	2007[b]
January	N/A	138
February	29	2
March	61	161
April	47	39
May	52	251
June	88	116
July	15	216
August	14	27
September	68	20
October	147	40
November	18	59
December	92	23
Total	632	1087

[a] Texas AgriLife Research and Extension Center at Corpus Christi 2006.
Weather Underground 2006b.
[b] Data in mm.

APPENDIX C

2006 AND 2007 PRECIPITATION DATA FOR SHARPPOD MORNINGGLORY EXPERIMENTAL SITE – COLLEGE STATION, TX

Month	2006[b]	2007[b]
January	26.2	137.2
February	87.6	3.0
March	81.5	180.1
April	52.8	44.5
May	58.2	91.9
June	103.1	43.4
July	38.6	160.8
August	103.4	57.9
September	84.8	78.5
October	343.4	81.3
November	25.7	94.2
December	116.3	94.2
Total	1121.6	1066.9

[a] Texas AgriLife Research 2006.
[b] Data in mm.

APPENDIX D

2006 GREENBRIAR CONTROL – COLLEGE STATION, TX

COMPARISON OF 29 AND 355 DAYS AFTER TREATMENT (DAT) EVALUATIONS

Trt.	Herbicide[a]	Rate	Treatment LSMeans		
			29 DAT	355 DAT	Sig.
		% ae v/v	---------% Control[b]-----		α
1	Triclopyr	0.87	78.75	48.75	.000[c]
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	82.50	66.25	.007
3	Triclopyr + Diesel (75%)	10.9	95.00	87.50	.199
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	67.50	7.50	.000
5	Triclopyr + Fluroxypyr	0.36 + 0.12	68.75	17.50	.000
6	Dicamba + 2,4-D	0.26 + 0.74	61.25	2.50	.000
7	Aminopyralid	0.42	81.25	42.5	.000
-	Untreated	-	0	0	1.00

[a] Applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[b] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[c] Least squares means significantly different when $\alpha \leq 0.05$.

APPENDIX E

2007 GREENBRIAR CONTROL – COLLEGE STATION, TX

COMPARISON OF 49 AND 353 DAYS AFTER TREATMENT (DAT) EVALUATIONS

Trt.	Herbicide[a]	Rate	Treatment LSMeans		
			49 DAT	353 DAT	Sig.
		% ae v/v	-------% Control[b]-------		α
1	Triclopyr	0.87	96.25	85.00	.009[c]
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	95.00	82.50	.004
3	Triclopyr + Diesel (75%)	10.9	100.00	97.25	.511
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	81.25	43.75	.000
5	Triclopyr + Fluroxypyr	0.36 + 0.12	80.00	61.25	.000
6	Dicamba + 2,4-D	0.26 + 0.74	55.00	12.50	.000
7	Aminopyralid	0.42	72.50	50.00	.000
-	Untreated	-	0	0	1.00

[a] Applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[b] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[c] Least squares means significantly different $\alpha \leq 0.05$.

APPENDIX F

GREENBRIAR CONTROL – COLLEGE STATION, TX

COMPARISON OF 2006 AND 2007 SINGLE APPLICATIONS – 355 DAT[a]

Trt.	Herbicide[b]	Rate	Treatment LSMeans		
			2006	2007	Sig.
		% ae v/v	----% Control[c]----		α
1	Triclopyr	0.87	48.75	85.00	.013[d]
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	66.25	82.50	.014
3	Triclopyr + Diesel (75%)	10.9	87.50	97.25	.016
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	7.50	43.75	.007
5	Triclopyr + Fluroxypyr	0.36 + 0.12	17.50	61.25	.002
6	Dicamba + 2,4-D	0.26 + 0.74	2.50	12.50	.066
7	Aminopyralid	0.42	42.50	50.00	.678
-	Untreated	-	0	0	1.00

[a] Days after treatment.
[b] Applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[d] Least squares means significantly different when $\alpha \leq 0.05$.

APPENDIX G

GREENBRIAR CONTROL – COLLEGE STATION, TX

COMBINED DATA FOR NEW SITES IN 2006 AND 2007

Trt.	Herbicide[b]	Rate	LSMeans
			1 MAT[a]
		% ae v/v	------% Control[c]----
1	Triclopyr	0.87	88 b[d]
2	Triclopyr + Diesel (5%) + Emulsifier (0.19%)	0.87	89 b
3	Triclopyr + Diesel (75%)	10.9	98 a
4	Triclopyr + Picloram + 2,4-D	0.22 + 0.11 + 0.42	74 c
5	Triclopyr + Fluroxypyr	0.36 + 0.12	74 c
6	Dicamba + 2,4-D	0.26 + 0.74	58 d
7	Aminopyralid	0.42	77 c
-	Untreated	-	0 e

[a] Month(s) after treatment.
[b] Applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[b] Least squares means within a column followed by the same letter are not significantly different ($\alpha = 0.05$).

APPENDIX H

SOUTHERN DEWBERRY CONTROL – COLLEGE STATION, TX

SINGLE VS. TWO SEQUENTIAL APPLICATIONS – 1 YAT[a]

Trt.	Herbicide[b]	Rate	Treatment LSMeans		
			Single App.	Seq. Apps.	Sig.
		kg ai ha^{-1}	------% Control[d]------		α
	Shredded				
1	Picloram + Fluroxypyr	0.5 + 0.404	51	40	.2085[d]
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	48	30	.0514
3	Triclopyr + Fluroxypyr	0.876 + 0.302	50	38	.1626
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	50	25	.0058
5	Triclopyr	0.777	44	21	.0127
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	45	14	.0006
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	43	45	.7792
8	Triclopyr - IPT	0.308 % ai v/v	55	45	.2633
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	53	36	.0702
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	66	56	.2633
-	Untreated	-	0	0	1.000

Trt.	Herbicide	Rate	Treatment LSMeans		
			Single App.	Seq. Apps.	Sig.
		kg ai ha^{-1}	------% Control------		α
	Non-Shredded				
1	Picloram + Fluroxypyr	0.5 + 0.404	18	24	.4838
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	20	24	.6742
3	Triclopyr + Fluroxypyr	0.876 + 0.302	21	26	.5752
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	24	23	.8885
5	Triclopyr	0.777	23	20	.7792
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	10	18	.4009
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	14	41	.0025
8	Triclopyr - IPT	0.308 % ai v/v	11	38	.0038
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	4	25	.0184
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	31	43	.1626
-	Untreated	-	0	0	1.000

[a] Year after treatment.
[b] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[d] Least squares means significantly different when α ≤ 0.05.

APPENDIX I

SOUTHERN DEWBERRY CONTROL – COLLEGE STATION, TX

COMPARISON OF 2006 AND 2007 SINGLE APPLICATIONS – 1 YAT[a]

Trt.	Herbicide[b]	Rate	Treatment LSMeans		
			2006	2007	Sig.
		kg ai ha^{-1}	----% Control[c]----		α
	Shredded				
1	Picloram + Fluroxypyr	0.5 + 0.404	51	38	.1218[d]
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	48	23	.0062
3	Triclopyr + Fluroxypyr	0.876 + 0.302	50	34	.0727
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	50	45	.5785
5	Triclopyr	0.777	44	29	.0972
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	45	28	.0535
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	43	23	.0277
8	Triclopyr – IPT	0.308 % ai v/v	55	19	<.0001
9	Picloram + Fluroxypyr – IPT	0.132 % ai v/v + 0.106 %ai v/v	53	28	.0062
10	Triclopyr + Fluroxypyr – IPT	0.25 % ai v/v + 0.086 % ai v/v	66	83	.0727
-	Untreated	-	0	0	1.000

Trt.	Herbicide	Rate	Treatment LSMeans		
			2006	2007	Sig.
		kg ai ha^{-1}	----% Control----		α
	Non-Shredded				
1	Picloram + Fluroxypyr	0.5 + 0.404	18	24	.4876
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	20	6	.1281
3	Triclopyr + Fluroxypyr	0.876 + 0.302	21	20	.8895
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	24	10	.1281
5	Triclopyr	0.777	23	23	1.000
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	10	8	.7811
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	14	10	.6769
8	Triclopyr - IPT	0.308 % ai v/v	11	16	.5785
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	4	25	.0195
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	31	28	.6769
-	Untreated	-	0	0	1.000

[a] Year after treatment.
[b] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues. Plots replicated four times.
[d] Least squares means significantly different when α ≤ 0.05.

APPENDIX J

TIFTON 85 BERMUDAGRASS INJURY – THRALL, TX

Trt.	Herbicide[b]	Rate	2006	2007
			8 DAT[a]	7 DAT
		kg ai ha^{-1}	------% Chlorosis[c]-----	
1	Picloram + Fluroxypyr	0.5 + 0.404	11.0 ab[d]	8.8 a
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	10.5 b	6.3 abc
3	Triclopyr + Fluroxypyr	0.354 + 0.122	7.3 c	5.0 bcd
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	6.5 cd	5.0 bcd
5	Triclopyr	0.777	5.0 d	2.5 de
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	5.0 d	3.8 cd
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	5.0 d	0.0 e
8	Triclopyr - IPT	0.308 % ai v/v	5.0 d	5.0 bcd
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	12.0 a	7.5 ab
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	9.8 b	5.0 bcd
-	Untreated	-	0.0 e	0.0 e
-	LSD	-	1.4	1.1

[a] Days after treatment.
[b] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent chlorosis as yellowing of treated plant tissues. Plots replicated four times.
[b] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).

APPENDIX K

TIFTON 85 BERMUDAGRASS CRUDE PROTEIN – THRALL, TX

Trt.	Herbicide[a]	Rate	2006		2007	
			Harvest 1	Harvest 2	Harvest 1	Harvest 2
		kg ai ha^{-1}	% Crude Protein[b]			
1	Picloram + Fluroxypyr	0.5 + 0.404	8.0 ab[c]	17.3 a	9.3 ab	11.1 ab
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	7.7 abc	17.0 a	9.4 ab	11.8 ab
3	Triclopyr + Fluroxypyr	0.354 + 0.122	7.8 abc	17.2 a	9.5 ab	11.5 ab
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	7.0 c	17.0 a	9.2 ab	10.7 b
5	Triclopyr	0.777	7.3 bc	17.1 a	9.5 ab	10.6 b
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	7.4 abc	17.9 a	9.0 ab	11.9 ab
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	7.1 bc	17.6 a	8.6 b	10.6 b
8	Triclopyr - IPT	0.308 % ai v/v	7.2 bc	17.2 a	10.2 a	11.9 ab
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	7.7 abc	18.1 a	9.0 ab	11.4 ab
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	7.3 bc	17.8 a	9.4 ab	13.6 a
-	Untreated	-	8.3 a	17.3 a	9.6 ab	11.6 ab
-	LSD	-	0.8	1.8	1.4	2.3

[a] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[b] Percent crude protein determined by near infrared reflectance spectroscopy (NIRS). Plots replicated four times.
[c] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

APPENDIX L

TIFTON 85 BERMUDAGRASS ACID DETERGENT FIBER (ADF) – THRALL, TX

Trt.	Herbicide[a]	Rate	2006		2007	
			Harvest 1	Harvest 2	Harvest 1	Harvest 2
		kg ai ha^{-1}	% ADF[b]			
1	Picloram + Fluroxypyr	0.5 + 0.404	43.9 a[c]	30.3 a	42.3 a	42.9 a
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	44.4 a	31.0 a	41.9 a	41.6 a
3	Triclopyr + Fluroxypyr	0.354 + 0.122	45.1 a	30.5 a	41.8 a	42.1 a
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	45.3 a	30.4 a	42.6 a	43.4 a
5	Triclopyr	0.777	44.7 a	30.2 a	42.5 a	42.6 a
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	44.7 a	29.2 a	42.2 a	42.0 a
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	45.6 a	30.1 a	42.5 a	43.3 a
8	Triclopyr - IPT	0.308 % ai v/v	45.4 a	31.1 a	40.9 a	41.0 a
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	45.0 a	30.0 a	42.3 a	41.7 a
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	44.8 a	29.2 a	42.2 a	39.8 a
-	Untreated	-	45.2 a	30.3 a	42.7 a	42.6 a
-	LSD	-	2.0	2.6	1.8	3.2

[a] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[b] Percent acid detergent fiber determined by near infrared reflectance spectroscopy (NIRS). Plots replicated four times.
[c] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

APPENDIX M

TIFTON 85 BERMUDAGRASS INJURY – THRALL, TX

Trt.	Herbicide[b]	Rate	2006	2007
			37 DAT[a]	19 DAT
		kg ai ha^{-1}	-----% Necrosis[c]-----	
1	Picloram + Fluroxypyr	0.5 + 0.404	0 a[d]	9 bcd
2	Picloram + Fluroxypyr + Metsulfuron Methyl	0.5 + 0.404 + 0.011	0 a	8 cd
3	Triclopyr + Fluroxypyr	0.354 + 0.122	0 a	14 a
4	Triclopyr + Fluroxypyr + Metsulfuron Methyl	0.876 + 0.302 + 0.011	0 a	10 bc
5	Triclopyr	0.777	0 a	8 cd
6	Triclopyr + Metsulfuron Methyl	0.777 + 0.011	0 a	8 cd
7	Metsulfuron Methyl + Dicamba + 2,4-D	0.021 + 0.280 + 0.805	0 a	0 e
8	Triclopyr - IPT	0.308 % ai v/v	0 a	9 bcd
9	Picloram + Fluroxypyr - IPT	0.132 % ai v/v + 0.106 %ai v/v	0 a	6 d
10	Triclopyr + Fluroxypyr - IPT	0.25 % ai v/v + 0.086 % ai v/v	0 a	11 ab
-	Untreated	-	0 a	0 e
-	LSD	-	0	3.3

[a] Days after treatment.
[b] Treatments 1-7 applied broadcast at 187 L ha^{-1}, 8-10 applied as individual plant treatment (IPT) using 0.7 L to each 3 by 6 m plot.
[c] Percent necrosis as desiccation/death of treated plant tissues. Plots replicated four times.
[a] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).

APPENDIX N

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

2006 SHARPPOD MORNINGGLORY PLANT COUNTS

Herbicide[a]	Rate	25 DA-PRE[b]	
	kg ai ha^{-1}	Annual[c]	Perennial
Weed Free pendimethalin	1.6	110	226

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-PRE, days after preemergence application.
[c] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.

APPENDIX O

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

2006 SHARPPOD MORNINGGLORY PLANT COUNTS

Herbicide[a]	Rate	25 DA-PRE[b]	
	kg ai ha^{-1}	Annual[c]	Perennial
Weed Free pendimethalin	1.6	99	115

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-PRE, days after preemergence application.
[c] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.

APPENDIX P

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

2006 SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	18 DA-EPOST[b]		15 DA-MPOST & PDIR[c]	284 DA-MPOST & PDIR
		kg ai ha^{-1}	<10 cm Plants	>10 cm Plants	Total Plants	Total Plants
1	Pendimethalin + prometryn *fb*[e] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	95 a[d]	4 b	213 b	51 a
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	68 ab	3 b	132 d	53 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	65 ab	4 b	202 bc	49 a
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	73 ab	6 b	159 cd	61 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	77 a	3 b	60 e	73 a
-	Morningglory Inf. pendimethalin	1.6	34 b	75 a	349 a	27 a
-	LSD	-	39	25	49	44.5

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX Q

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

2006 SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	18 DA-EPOST[b]		39 DA-EPOST	15 DA-MPOST & PDIR[c]	284 DA-MPOST & PDIR
		kg ai ha^{-1}	<10 cm Plants	>10 cm Plants	Total Plants	Total Plants	Total Plants
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	31 a[d]	2 b	293 b	50 b	59 a
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	43 a	3 b	248 b	37 bc	54 a
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	26 a	1 b	313 ab	43 bc	54 a
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	33 a	3 b	358 ab	61 b	62 a
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	39 a	3 b	419 a	25 c	60 a
-	Morningglory Inf. pendimethalin	1.6	41 a	110 a	249 b	274 a	57 a
-	LSD	-	22	18	125	25	39

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX R

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

2007 SITE A SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	29 DA-EPOST[b]	15 DA-MPOST & PDIR[c]	303 DA-MPOST & PDIR	
		kg ai ha^{-1}	Total Plants	Total Plants	Annual Plants[d]	Perenn. Plants
1	Pendimethalin + prometryn *fb*[f] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	125 ab[e]	42 b	12 a	25 b
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	106 b	40 b	8 a	22 b
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	135 ab	61 a	15 a	32 ab
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	138 ab	46 b	9 a	25 b
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	172 a	5 c	16 a	25 b
-	Weed Free pendimethalin	1.6	-	-	15 a	21 b
-	Morningglory Inf. pendimethalin	1.6	95 b	62 a	10 a	22 b
-	Untreated	-	-	-	16 a	39 a
-	LSD	-	62	15	8	12

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[d] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.
[e] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).
[f] *fb*, followed by.

APPENDIX S

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

2007 SITE A SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	29 DA-EPOST[b]	15 DA-MPOST & PDIR[c]	303 DA-MPOST & PDIR	
		kg ai ha^{-1}	Total Plants	Total Plants	Annual Plants[d]	Perenn. Plants
1	Pendimethalin + prometryn *fb*[f] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	120 a[e]	26 b	15 bc	18 b
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	125 a	13 cd	9 c	16 b
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	123 a	26 bc	13 bc	16 b
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	107 a	25 bc	10 bc	24 b
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	135 a	3 d	18 abc	12 b
-	Weed Free pendimethalin	1.6	-	-	19 abc	20 b
-	Morningglory Inf. pendimethalin	1.6	128 a	72 a	27 a	27 ab
-	Untreated	-	-	-	21 ab	42 a
-	LSD	-	43	13	10	16

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[d] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.
[e] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[f] *fb*, followed by.

APPENDIX T

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

2007 SITE B SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	14 DA-EPOST[b]	14 DA-MPOST & PDIR[c]	303 DA-MPOST & PDIR	
		kg ai ha^{-1}	Total Plants	Total Plants	Annual Plants[d]	Perenn. Plants
1	Pendimethalin + prometryn *fb*[f] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	73 a[e]	21 b	9 a	20 bc
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	76 a	11 bc	6 a	14 c
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	77 a	20 b	5 a	23 bc
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	62 a	13 bc	5 a	16 c
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	95 a	4 c	9 a	20 bc
-	Weed Free pendimethalin	1.6	-	-	7 a	29 bc
-	Morningglory Inf. pendimethalin	1.6	89 a	44 a	11 a	50 ab
-	Untreated	-	-	-	8 a	65 a
-	LSD	-	75	12	9	28

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[d] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.
[e] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[f] *fb*, followed by.

APPENDIX U

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

2007 SITE B SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	48 DA-PRE[b]	14 DA-EPOST[c]
		kg ai ha^{-1}	Total Plants	Total Plants
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	201 a[d]	60 a
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	188 a	78 a
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	235 a	96 a
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	252 a	86 a
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	180 a	73 a
-	Weed Free pendimethalin	 1.6	-	-
-	Morningglory Inf. pendimethalin	 1.6	221 a	93 a
-	Untreated	-	242 a	-
-	LSD	-	113	71

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-PRE, days after preemergence application.
[c] DA-EPOST, days after early postemergence application.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX V

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

2007 SITE B SHARPPOD MORNINGGLORY PLANT COUNTS

Trt.	Herbicide[a]	Rate	14 DA-MPOST & PDIR[b]	303 DA-MPOST & PDIR	
		kg ai ha^{-1}	Total Plants	Annual Plants[c]	Perenn. Plants
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	13 b[d]	15 a	19 c
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	10 bc	6 a	18 c
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	12 b	13 a	30 abc
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	10 bc	10 a	23 bc
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	3 c	8 a	17 c
-	Weed Free pendimethalin	1.6	-	8 a	13 c
-	Morningglory Inf. pendimethalin	1.6	59 a	10 a	54 ab
-	Untreated	-	-	10 a	56 a
-	LSD	-	7	11	30

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-MPOST & PDIR, days after mid postemergence and post directed application.
[c] Annual vs. perennial plants determined by presence or absence of cotyledon leaves and examination of root structure.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX W

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

PREEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2006 Site A	2007 Site A	2007 Site B
			25 DA-PRE[b]	35 DA-PRE	48 DA-PRE
		kg ai ha^{-1}	--------------------% Control[c]--------------------		
1	Pendimethalin + prometryn *fb*[d] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	75 a[e]	60 ab	55 a
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	74 a	81 a	68 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	30 b	46 bc	43 a
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	26 b	31 c	63 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	21 b	36 bc	38 ab
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	-	30 c	38 ab
-	Untreated	-	0 c	0 d	0 b
-	LSD	-	10	28	38

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-PRE, days after preemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX X

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

EARLY-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2006 Site A	2007 Site A	2007 Site A
			39 DA-EPOST[b]	29 DA-EPOST	44 DA-EPOST
		kg ai ha^{-1}	-----------------------% Control[c]-----------------------		
1	Pendimethalin + prometryn *fb*[e] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	61 a[d]	85 ab	78 ab
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	61 a	91 a	83 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	58 ab	85 ab	76 ab
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	55 b	85 ab	78 ab
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	58 ab	83 b	74 b
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	0 c	18 c	0 c
-	Untreated	-	0 c	0 d	0 c
-	LSD	-	6	7	7

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX Y

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

MID-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2006 Site A 15 DA-MPOST & PDIR[b]	2006 Site A 36 DA-MPOST & PDIR	2007 Site A 33 DA-MPOST & PDIR
		kg ai ha^{-1}	----------------------% Control[c]----------------------		
1	Pendimethalin + prometryn *fb*[e] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	64 bc[d]	81 c	89 c
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	68 b	84 c	93 b
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	61 c	88 b	85 d
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	68 b	89 b	90 bc
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	84 a	94 a	97 a
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	0 d	0 d	0 e
-	Untreated	-	0 d	0 d	0 e
-	LSD	-	6	3	3

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-MPOST & PDIR, days after mid-postemergence and post directed application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX Z

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

COTTON QUALITY GRADES

Trt.	Herbicide[a]	Rate	Micronaire	Length	Uniformity	Strength	Leaf
		kg ai ha^{-1}	2006 Site A				
1	Pendimethalin + prometryn *fb*[c] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	3.65 ab[b]	1.14 b	79.98 a	25.38 a	5.50 ab
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	3.63 ab	1.16 ab	80.18 a	25.35 a	5.00 b
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	3.73 ab	1.16 ab	79.75 a	25.78 a	6.00 ab
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	3.65 ab	1.15 ab	79.33 a	25.23 a	5.50 ab
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	3.78 ab	1.14 b	79.85 a	26.15 a	6.25 a
-	Weed Free pendimethalin	1.6	3.59 b	1.14 b	79.82 a	26.81 a	5.73 ab
-	Morningglory Inf. pendimethalin	1.6	3.85 a	1.16 ab	79.93 a	26.15 a	6.25 a
-	Untreated	-	3.54 b	1.18 a	79.86 a	26.37 a	5.18 ab
-	LSD	-	0.25	0.04	1.51	1.81	1.1

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[c] *fb*, followed by.

APPENDIX AA

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

PREEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2006 Site A	2007 Site A	2007 Site B
			25 DA-PRE[b]	35 DA-PRE	48 DA-PRE
		kg ai ha^{-1}	-------------------% Control[c]-------------------		
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	69 a[d]	33 b	56 a
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	70 a	75 a	75 a
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	24 b	13 bc	26 b
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	14 b	31 b	9 b
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	14 b	13 bc	28 b
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	-	29 b	24 b
-	Untreated	-	0 c	0 c	0 b
-	LSD	-	12	24	28

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-PRE, days after preemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AB

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

MID-POSTEMERGENCE CONTROL OF SHARPPOD MORNINGGLORY

Trt.	Herbicide[a]	Rate	2006 Site A	2006 Site A	2007 Site A
			15 DA-MPOST & PDIR[b]	36 DA-MPOST & PDIR	15 DA-MPOST & PDIR
		kg ai ha^{-1}	----------------------% Control[c]----------------------		
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	84 b[d]	90 b	89 bc
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	86 ab	88 b	91 b
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	81 b	90 b	86 c
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	85 ab	88 b	88 c
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	90 a	95 a	98 a
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	0 c	0 c	0 d
-	Untreated	-	0 c	0 c	0 d
-	LSD	-	5	4	3

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-MPOST & PDIR, days after mid-postemergence and post directed application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AC

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

COTTON QUALITY GRADES

Trt.	Herbicide[a]	Rate	Micronaire	Length	Uniformity	Strength	Leaf
		kg ai ha^{-1}	2006 Site A				
1	Pendimethalin + prometryn *fb*[c] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	3.93 abc[b]	1.15 bc	81.40 ab	26.70 ab	5.67 b
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	3.90 bc	1.16 abc	80.90 b	26.18 b	5.25 b
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	3.75 c	1.15 bc	81.10 b	26.55 ab	5.25 b
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	4.00 ab	1.15 c	81.63 ab	27.15 ab	5.25 b
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	3.80 bc	1.15 bc	80.85 b	27.48 ab	5.50 b
-	Weed Free pendimethalin	1.6	3.88 bc	1.17 ab	82.33 a	27.93 a	6.00 b
-	Morningglory Inf. pendimethalin	1.6	4.18 a	1.18 a	81.45 ab	27.08 ab	7.25 a
-	Untreated	-	3.95 abc	1.19 a	81.45 ab	27.55 ab	6.00 b
-	LSD	-	0.25	0.03	1.13	1.58	1.14

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[c] *fb*, followed by.

APPENDIX AD

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

EARLY-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2006 Site A	2007 Site A	2007 Site A
			39 DA-EPOST[b]	29 DA-EPOST	44 DA-EPOST
		kg ai ha^{-1}	----------------------% Control[c]----------------------		
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	60 ab[d]	89 ab	83 b
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	64 a	93 a	88 a
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	58 b	86 ab	80 b
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	59 ab	88 ab	79 b
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	60 ab	84 b	80 b
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	0 c	4 c	0 c
-	Untreated	-	0 c	0 c	0 c
-	LSD	-	6	7	4

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, α = 0.05).
[e] *fb*, followed by.

APPENDIX AE

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

EARLY-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2007 Site B	2007 Site B
			14 DA-EPOST[b]	28 DA-EPOST
		kg ai ha^{-1}	--------------------% Control[c]---------------------	
1	Pendimethalin + prometryn *fb*[e] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	88 a[d]	88 a
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	94 a	88 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	84 a	85 a
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	95 a	89 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	90 a	86 a
-	Weed Free pendimethalin	 1.6	-	-
-	Morningglory Inf. pendimethalin	 1.6	23 b	0 b
-	Untreated	-	0 c	0 b
-	LSD	-	17	9

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AF

ROUNDUP READY FLEX® EXPERIMENT – COLLEGE STATION, TX

MID-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2007 Site B	2007 Site B
			14 DA-MPOST & PDIR[b]	30 DA-MPOST & PDIR
		kg ai ha-	-------------------% Control[c]-------------------	
1	Pendimethalin + prometryn *fb*[e] glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	89 c[d]	93 b
2	Pendimethalin + fluometuron *fb* glyphosate *fb* glyphosate	1.6 + 1.8 *fb* 1.06 *fb* 1.06	95 b	98 a
3	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.06 *fb* 1.06	86 c	94 b
4	Pendimethalin *fb* glyphosate *fb* glyphosate	1.6 *fb* 1.54 *fb* 1.54	90 c	97 a
5	Pendimethalin *fb* glyphosate *fb* glyphosate *fb* diuron	1.6 *fb* 1.54 *fb* 1.54 *fb* 1.12	99 a	100 a
-	Weed Free pendimethalin	1.6	-	-
-	Morningglory Inf. pendimethalin	1.6	0 d	0 c
-	Untreated	-	0 d	0 c
-	LSD	-	5	4

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-MPOST & PDIR, days after mid-postemergence and post directed application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AG

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

EARLY-POSTEMERGENCE SHARPPOD MORNINGGLORY CONTROL

Trt.	Herbicide[a]	Rate	2007 Site B	2007 Site B
			14 DA-EPOST[b]	28 DA-EPOST
		kg ai ha^{-1}	-------------------% Control[c]	-------------------
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	99 a[d]	93 a
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	98 a	93 a
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	100 a	94 a
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	97 a	91 a
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	98 a	91 a
-	Weed Free pendimethalin	1.6	-	-
-	Morningglory Inf. pendimethalin	1.6	18 b	0 b
-	Untreated	-	0 b	0 b
-	LSD	-	20	5

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-EPOST, days after early postemergence application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AH

LIBERTYLINK® EXPERIMENT – COLLEGE STATION, TX

MID-POSTEMERGENCE CONTROL OF SHARPPOD MORNINGGLORY

Trt.	Herbicide[a]	Rate	2007 Site A	2007 Site B	2007 Site B
			33 DA-MPOST & PDIR[b]	14 DA-MPOST & PDIR	30 DA-MPOST & PDIR
		kg ai ha^{-1}	------------------------% Control[c]------------------------		
1	Pendimethalin + prometryn *fb*[e] glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	93 bc[d]	92 c	97 ab
2	Pendimethalin + fluometuron *fb* glufosinate *fb* glufosinate	1.6 + 1.8 *fb* 0.45 *fb* 0.45	96 ab	97 ab	98 ab
3	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.45 *fb* 0.45	91 c	95 bc	95 bc
4	Pendimethalin *fb* glufosinate *fb* glufosinate	1.6 *fb* 0.6 *fb* 0.6	89 c	93 bc	92 c
5	Pendimethalin *fb* glufosinate *fb* glufosinate *fb* diuron	1.6 *fb* 0.6 *fb* 0.6 *fb* 1.12	99 a	99 a	99 a
-	Weed Free pendimethalin	1.6	-	-	-
-	Morningglory Inf. pendimethalin	1.6	0 d	0 d	0 d
-	Untreated	-	0 d	0 d	0 d
-	LSD	-	4	3	4

[a] Treatments applied broadcast at 140 L ha^{-1} to four replications.
[b] DA-MPOST & PDIR, days after mid-postemergence and post directed application.
[c] Percent control a function of visual biomass reduction and herbicide symptomology on treated plant tissues.
[d] Means within a column followed by the same letter are not significantly different (Duncan's New MRT, $\alpha = 0.05$).
[e] *fb*, followed by.

APPENDIX AI

TREATMENT TRADE NAMES AND COMPANIES

Active Ingredient	Trade Name	Company
picloram + fluroxypyr	Surmount®	Dow AgroSciences[a]
triclopyr + fluroxypyr	PastureGard®	Dow AgroSciences
triclopyr	Remedy®	Dow AgroSciences
picloram + 2,4-D	Grazon P+D®	Dow AgroSciences
aminopyralid	Milestone®	Dow AgroSciences
dicamba + 2,4-D	Weedmaster®	Nufarm Agricultural Products[b]
metsulfuron methyl	Cimarron®	DuPont Crop Protection[c]
metsulfuron methyl + dicamba + 2,4-D	Cimarron Max®	DuPont Crop Protection
diuron	Direx®	DuPont Crop Protection
pendimethalin	Prowl H_2O®	BASF Ag Products[d]
prometryn	Caparol®	Syngenta Crop Protection[e]
fluometuron	Cotoran®	Makhteshim Agan of North America[f]
glyphosate	Roundup WeatherMax®	Monsanto[g]
glufosinate	Ignite®	Bayer CropScience[h]
thidiazuron	Dropp®	Bayer CropScience
thidiazuron + diuron	Ginstar®	Bayer CropScience
carfentrazone ethyl	Aim®	FMC Agricultural Products Group[i]

[a] Dow AgroSciences, 9330 Zionsville Road, Indianapolis, IN 46268.
[b] Nufarm Inc., 150 Harvester Ridge, Burr Ridge, IL 60527.
[c] E. I. du Pont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[d] BASF Co. Ag Products, P.O. Box 13528, Research Triangle Park, NC 27709.
[e] Syngenta Crop Protection, Inc., P.O. Box 18300, Greensboro, NC 27419.
[f] Makhteshim Agan of North America, 4515 Falls of Neuse Rd. Suite 300, Raleigh, NC 27609.
[g] Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167.
[h] Bayer CropScience, P.O. Box 12014, Research Triangle Park, NC 27709.
[I] FMC Agricultural Products Group, 1735 Market Street, Philadelphia, PA 19103.

VITA

Name: Travis Wayne Janak

Address: Department of Soil and Crop Sciences, 352 HEEP,
2474 TAMU
College Station, TX 77843-2474

Email Address: tjanak@ag.tamu.edu

Education: B.S., Agronomy, Texas A&M University, 2006
M.S., Agronomy, Texas A&M University, 2011