Chapter III

CGA 362622 Plus Pyrithiobac Combinations for Broadleaf Weed Control in Cotton (*Gossypium hirsutum*)

Abstract: Studies were conducted in 1999, 2000, and 2001 to evaluate broadleaf weed control in cotton from postemergence applications of CGA 362622 plus pyrithiobac. CGA 362622 was applied at 2.5, 3.8, 5, and 7.5 g ai/ha and pyrithiobac was applied at 0, 17, and 35 g ai/ha. Cotton injury at 7 days after treatment (DAT) over the three years averaged 20 to 24% from CGA 362622 when pooled over pyrithiobac rates. Injury at 28 DAT was 7 to 9% and neither CGA 362622 rate nor pyrithiobac rate differentially influenced crop response. Broadleaf weed control from combinations of the herbicides was generally good. Timely applications of CGA 362622 at 5 and 7.5 g/ha controlled common ragweed, common lambsquarters, annual morningglory species, and common cocklebur at 56 DAT when pooled over pyrithiobac rates. The combination of pyrithiobac plus CGA 362622 controlled velvetleaf, spurred anoda, and jimsonweed at 56 DAT. Control of annual morningglory species at 56 DAT in 2001 was low due to weed size at application. Cotton yield generally reflected weed control. Applications of CGA 362622 plus pyrithiobac can provide valuable broadleaf weed control but should be utilized in a complete weed control program to be of maximum benefit.

Nomenclature: CGA 362622 (proposed common name trifloxysulfuron sodium), N-[(4,6-dimethoxy-2-pyrimidinyl)carbamoyl]-3-(2,2,2-trifluoroethoxy)-pyridin-2-sulfonamide sodium salt; pyrithiobac; annual morningglory species, *Ipomoea* spp.; common cocklebur, *Xanthium strumarium* L. #[1] XANST; common lambsquarters, *Chenopodium album* L. # CHEAL; common ragweed, *Ambrosia artemisiifolia* L # AMBEL; jimsonweed, *Datura stramonium* L. # DATST; spurred anoda, *Anoda cristata* (L.) Schlecht. # ANVCR; velvetleaf, *Abutilon theophrasti* Medicus # ABUTH; cotton, *Gossypium hirsutum* L.

[1] Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

Additional index words: Ivy-leaf morningglory, *Ipomoea hederacea* (L.) Jacq.; pitted morningglory, *I. lacunosa* L.; tall morningglory, *I. purpurea* (L.) Roth.

Abbreviations: ALS, acetolactate synthase enzyme (EC 4.1.3.18); DAT, days after treatment; POSD, post-directed; POST, postemergence; PRE, preemergence.

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) must be kept free from weeds to prevent yield reduction from weed competition and to obtain uncontaminated, clean fiber (Wilcut et al. 1995). While weed control options are greater today than just five years ago, current herbicides for cotton do not control all weed species over the entire growing season. As a result, today's cotton weed management programs often include several herbicides applied with multiple application timings. Many of the herbicides currently registered for cotton must be applied at specific growth stages or as post-directed (POSD) sprays to avoid or minimize cotton injury. In addition, the registration of the standard POSD herbicide, cyanazine, is being phased out as a result of a Special Review initiated by the Environmental Protection Agency on November 23, 1994 (Jones 2000).

In 1996, pyrithiobac became the first herbicide available for postemergence (POST) application over-the-top of non-transgenic cotton varieties without significant crop injury. Pyrithiobac is still the only herbicide for broad-spectrum broadleaf weed control in non-transgenic cotton varieties, and may be applied preemergence (PRE) or POST to both non-transgenic and transgenic crop varieties. Pyrithiobac is classified in the pyrimidynylthiobenzoate family (Heap 2001) and functions by inhibiting the acetolactate synthase enzyme (ALS, EC 4.1.3.18) (Shimzu et al. 1994a). Like other ALS-inhibiting herbicides, pyrithiobac inhibits formation of the branched-chain amino acids valine, leucine, and isoleucine (Shimzu et al. 1994a).

POST applications of pyrithiobac generally cause no lasting effects to cotton while controlling many important weeds. Jordan et al. (1993a) reported less than 11% cotton injury from POST pyrithiobac treatments with no effect on cotton yield or fiber characteristics. Likewise, other researchers have reported low initial injury from various POST pyrithiobac treatments, also with no effects on fruiting characteristics, yield, or fiber quality (Jordan et al. 1993a; Keeling et al. 1993; Shankle et al. 1996; Culpepper and York 1997; Webster et al. 2000). POST applications of pyrithiobac are very effective on pigweeds (*Amaranthus* spp.), jimsonweed (*Datura stramonium* L.), spurred anoda [*Anoda cristata* (L.) Schlecht.], and velvetleaf (*Abutilon theophrasti* Medicus). Additionally, timely applications of pyrithiobac can also control hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A.W.Hill], prickly sida (*Sida spinosa* L.), Pennsylvania smartweed (*Polygonum pensylvanicum* L.) entireleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], pitted morningglory (*I. lacunosa* L.), palmleaf morningglory (*I. wrightii* Gray), and smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.] (Jordan et al. 1993b, 1993c; Sunderland and Coble 1994; Smith et al. 1996; Culpepper and York 1997; Tredaway et al. 1997; Swann and Wilson 2001).

Pyrithiobac, however, cannot provide complete weed control in cotton. Sicklepod (*Cassia obtusifolia* L.), tall morningglory [*Ipomoea purpurea* (L.) Roth], common ragweed (*Ambrosia artemisiifolia* L.), and common lambsquarters (*Chenopodium album* L.) are generally tolerant to pyrithiobac application (Jordan et al. 1993b; Sunderland and Coble 1994; Culpepper and York 1997). In addition, pitted morningglory and palmleaf morningglory are controlled only when applications are made to weeds less than 5 cm in height (Jordan et al. 1993b). Yellow (*Cyperus esculentus* L.) and purple nutsedge (*Cyperus rotundus* L.) can be controlled with PRE applications of pyrithiobac, but control from POST applications is generally unacceptable (Wilcut 1998).

CGA 362622 is an experimental sulfonylurea herbicide that, like pyrithiobac, inhibits the ALS enzyme. CGA 362622 has low toxicological properties, a favorable environmental profile, and low use rates; CGA 362622 will also control many broadleaf weeds (Hudetz et al. 2000). This herbicide is being evaluated for weed control in cotton, sugarcane (*Saccharum officinarum* L.), and several minor crops (Hudetz et al. 2000). POST applications of CGA 362622 generally result in transient cotton injury. Results of studies conducted in Louisiana demonstrated no visible cotton response to CGA 362622 (Vidrine and Miller 2001). However, reports of early crop injury are more common. Symptoms of chlorosis or stunting with rapid crop recovery and no effect on yield have been reported in multiple locations (Brecke et al. 2000; Faircloth et al. 2001). In North Carolina, injury up to 40% has been observed although symptoms were also transient (Wilcut et al. 2000).

In previous research, CGA 362622 POST controlled many weeds including common lambsquarters, sicklepod (*Cassia obtusifolia* L.), palmer amaranth (*Amaranthus palmeri* S. Wats.), slender amaranth (*A. gracilis* Desf.), smooth pigweed (*A. hybridus* L.), entireleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], pitted morningglory, and tall morningglory (Porterfield et al. 2000; Wilcut et al. 2000). In addition, CGA 362622 application may suppress other troublesome weeds such as purple nutsedge (*Cyperus rotundus* L.) and johnsongrass [*Sorghum halepense* (L.) Pers.] (Hudetz et al. 2000). However, CGA 362622 will not control smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], prickly sida (*Sida spinosa* L.), or spurred anoda (Brecke et al. 2000; Faircloth et al. 2001).

Determining effective CGA 362622 use rates and appropriate herbicide combinations with CGA 362622 for POST broadleaf weed control are necessary prerequisites for the development of effective control systems in cotton. Preliminary observations have indicated that CGA 362622 may not consistently control some solanaceous and malvaceous weeds that are controlled with pyrithiobac. The objective of this research was to determine effective tank-mix combinations of CGA 362622 with pyrithiobac for control of troublesome weed species in cotton. Therefore, studies were conducted in the absence of other broadleaf herbicides that could mask weed control from CGA 362622 or pyrithiobac.

MATERIALS AND METHODS

Experiments were conducted in 1999, 2000, and 2001 at the Eastern Shore Agricultural Research and Extension Center near Painter, VA. The soil type was a Bojac sandy loam (Typic Hapludults) with 1% organic matter and a pH of 6.2. Seedbed preparation consisted of chisel plowing once followed by tandem disking twice. A field cultivator with double rolling baskets and S-tine harrows prepared the final seedbed. Cotton variety 'Sure Grow 125' was seeded 1.2

cm deep on May 19, 1999, May 25, 2000, and May 10, 2001. Seeding rate was 12 seed/m with a row spacing of 0.9 m. Fertilizer was applied with two applications according to Virginia Polytechnic Institute and State University recommendations (Donohue and Heckendorn 1994). Pendimethalin was broadcast over the entire study PRE at 0.7 kg ai/ha for annual grass control. Rainfall over the growing season is presented in Table 2.1. On May 6, 1999, a supplemental 1.3 cm of irrigation was provided.

Four-row plots measuring 2.5 by 6 m were established for herbicide treatments with a 0.9 m buffer between plots. Field applications were made to the two center rows of each plot with a tractor-mounted plot sprayer delivering 240 L/ha at 210 kPa through flat fan spray tips[2]. POST applications were made on June 8, 1999, June 20, 2000, and June 11, 2001, to cotton at two- to four-leaf stage of growth. Weed heights at application are presented in Table 3.1. Factorial treatments were arranged in a randomized complete block design with three replications. The four by three factorial treatment arrangement included CGA 362622[3] rates at 2.5, 3.8, 5, and 7.6 g/ha and pyrithiobac rates at 0, 17, and 35 g/ha. Comparison treatments included pyrithiobac at 72 g/ha and a control that was untreated POST. Non-ionic surfactant[4] (0.25 % v/v) was included with all treatments. Clethodim (140 g ai/ha) was applied as needed in each year for johnsongrass control and cultivations were made 21 DAT in 1999 and 2000. In 2001, weeds were too large for cultivation of all plots, so a remedial application of 3.8 g/ha CGA 362622 plus 35 g/ha pyrithiobac was broadcast over the entire experimental area at 30 DAT.

Data collected during the growing season included visual ratings of crop injury and weed control. Visible injury was rated 7 and 28 DAT while weed control was rated 56 DAT. Ratings were based on a 0 to 100% scale with 0 equal to no plant response and 100% equal to complete

[2] Teejet 8003 flat fan nozzle. Spraying Systems Company, North Avenue, Wheaton, IL 60188.

[3] CGA 362622, formulated product with 75% active ingredient. Supplied by Syngenta Crop Protection, Inc., P.O. Box 18300, Greensboro, NC 27409.

[4] Induce, non-ionic low foam wetter/spreader adjuvant with 90% principal functioning agents as a blend of alkyl aryl polyoxylkane ether free fatty acids. Helena Chemical Company, 5100 Poplar Avenue, Memphis, TN 38137.

weed control or crop death. All weed control ratings were estimated relative to weed pressure in untreated control plots. Cotton yield was determined by harvesting plots with a commercial two-row picker modified for small plot use. Plots with extreme weed pressure were considered not harvestable. Cotton was ginned to determine lint percentage, and fiber samples were sent to the USDA Agricultural Marketing Service[5] for strength, length, and micronaire determinations in 2000 and 2001.

In greenhouse studies, weed seeds were obtained from a commercial source[6] and planted into 43- by 53-cm greenhouse flats[7] containing a commercial potting mix[8]. Emerged seedlings were allowed to develop a single true leaf before being transplanted into 9.5 by 9.5-cm[9] pots filled with the same potting mix. Four seedlings with a visible true leaf were transplanted into each pot to establish an even plant size for all treatments. Herbicide treatments were applied with a moving nozzle[10], compressed-air sprayer calibrated to deliver 220 L ha^{-1} at 210 kPa. Weed control was visually rated 21 and 28 DAT, and plants were harvested at 28 DAT and dried for 7-d at 65 C for dry weight determination. Pots were arranged in a randomized complete block design with four replications and each test was repeated. Pots were maintained under natural sunlight and watered and fertilized[11] as needed.

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[5] United States Department of Agriculture, Agricultural Marketing Service, Florence South Carolina Classing Office, 1725 Range Way, Florence, SC 29501.

[6] Azlin Seed Service, P. O. Box 914 Leland, MS 38756.

[7] Sutton universal greenhouse flat. Inside dimensions 51 cm by 40 cm by 5.7 cm. Wetzel, Inc., 1345 Diamond Springs Road, Virginia Beach, VA 23455.

[8] Pro-Mix BX. Premier Horticulture, Inc., Red Hill, PA 18076.

[9] T. O. Plastics 4" Fill Pots. Inside dimensions 9.5 by 9.5 by 8.1 cm. Wetzel, Inc., 1345 Diamond Springs Road, Virginia Beach, VA 23455.

[10] Teejet 8002 EVS flat fan spray tip. Spraying Systems Company, North Avenue, Wheaton, IL 60188.

[11] Excel All Purpose 21-5-50. Wetzel, Inc., 1345 Diamond Springs Road, Virginia Beach, VA 23455.

All data were subjected to analyses of variance and means were compared by Fisher's Protected LSD test (P = 0.05). Comparison treatments from the field were not included in statistical analyses. Field data are presented separately by years in instances in which a treatment by year interaction was observed. Greenhouse data are presented separately by repetition in instances where there is a treatment by repetition interaction.

RESULTS AND DISCUSSION

Precipitation varied by year, with highest rainfall occurring in 2000 (Table 2.1). Rainfall was similar in June of each year when POST treatments were applied, and yearly differences in rainfall do not appear to have affected weed control from POST applications in any year. Herbicide applications were delayed in 2001 due to cool early-season temperatures that slowed cotton growth. As a result, weed heights were greatest in 2001 and were as tall as 35-cm for common cocklebur and annual morningglory species (Table 3.1). Weed size in 2001 likely increased herbicide tolerance of common ragweed and annual morningglory species.

Cotton response. Cotton injury to herbicide application occurred in each year, but crop recovery was generally rapid. Cotton injury at 7 DAT from CGA 362622 was 20 to 24% over the 3-yr period when pooled across pyrithiobac rates (Table 3.2). At 28 DAT, cotton injury was 7 to 9% with CGA 362622 averaged over pyrithiobac rates. Increased rates of CGA 362622 or pyrithiobac did not increase cotton injury at 7 DAT or at 28 DAT over the three-year period. Cotton injury with the comparison treatment of 72 g/ha pyrithiobac was 7 to 23% at 7 DAT and 0 to 16% at 28 DAT over all years (data not presented).

Weed control. No treatment by year interactions were observed for control of spurred anoda, common lambsquarters, annual morningglory species, and common cocklebur; therefore, data for each species were averaged over years (data not presented). Due to treatment by year interactions, however, common ragweed control in 1999 and control of velvetleaf and jimsonweed are presented by years (data not presented). No CGA 362622 rate by pyrithiobac rate interactions were observed, so only main effects are presented (Tables 3.3 and 3.4).

Velvetleaf. Control of velvetleaf in 2000 and 2001 was greater than 90% from pyrithiobac rates pooled across CGA 362622 rates (Table 3.5). In 2000, the average control from CGA 362622 rates without pyrithiobac was only 48%. CGA 362622 at 5 or 7.5 g/ha provided better control of velvetleaf than 2.5 g/ha CGA 362622 when averaged over pyrithiobac rates in 2000. Control of velvetleaf in 2001 was good from all treatments, presumably as a result of the additional application of CGA 362622 plus pyrithiobac at 30 DAT. Pyrithiobac at 72 g/ha controlled 98 to 99% of velvetleaf in all years and rating intervals (data not presented).

Common ragweed. In 1999, common ragweed control was 94% with CGA 362622 rates alone and 97 to 98% with CGA 362622 plus pyrithiobac (Table 3.5). CGA 362622 at rates of 3.8 to 7.5 g/ha plus pyrithiobac controlled 97 to 99% of common ragweed. In 2000 and 2001, common ragweed control was 70% with CGA 362622 alone, and the addition of pyrithiobac did not increase control. CGA 362622 at 7.5 g/ha controlled common ragweed better than 2.5 g/ha CGA 362622 in all years when pooled over pyrithiobac rates. Lower control in 2000 and 2001 is likely due to larger common ragweed heights at application (Table 3.1). As previously reported (York and Culpepper 1997), pyrithiobac alone failed to control common ragweed. Control of common ragweed from 72 g/ha pyrithiobac was 50 to 60% at 28 DAT and 21 to 63% from 1999 through 2001 (data not presented). However, common ragweed was generally controlled by CGA 362622 in this study, which is similar to results of Porterfield et al. (2000).

Spurred anoda. Pyrithiobac controlled 95 to 97% of spurred anoda when pooled over CGA 362622 rates, while CGA 362622 alone controlled only 34% of spurred anoda (Table 3.5). In a previous study, CGA 362622 also failed to control spurred anoda (Faircloth et al. 2001). Increased CGA 362622 rates above 2.5 g/ha slightly increased spurred anoda control to 75 to 76% when pooled over pyrithiobac rates. The comparison treatment of 72 g/ha pyrithiobac controlled spurred anoda greater than 94% in 1999 and 2000 (data not presented).

Common lambsquarters. Neither increased CGA 362622 rate nor increased pyrithiobac rate improved common lambsquarters control (Table 3.4). Control was 91 to 93% with CGA 362622 pooled over pyrithiobac rates (Table 3.5). Control of common lambsquarters with 72 g/ha pyrithiobac was 80 to 86% in 2000 and 2001, but only 67% in 1999 (data not presented).

Common lambsquarters control with pyrithiobac alone in this study was generally better than results from York and Culpepper (1997). In the previous study, pendimethalin followed by pyrithobac failed to control common lambsquarters, although pendimethalin plus fluometuron PRE provided adequate control (York and Culpepper 1997). Similar control of common lambsquarters by CGA 362622, however, has been previously reported by Wilcut et al. (2000).

Jimsonweed. Jimsonweed control was generally low with CGA 362622 applied alone, and markedly different from results of Wilcut et al. (2000), in which greater than 95% control of jimsonweed was reported. Jimsonweed control was influenced only by pyrithiobac rate in 2000 (Table 3.5). In both 2000 and 2001, pyrithiobac controlled 97 to 99% of jimsonweed when averaged over CGA 362622 rates, while CGA 362622 alone provided only 18% control in 2000. Control of jimsonweed in 2001 was undoubtedly influenced by the application 35 g/ha pyrithiobac at 30 DAT. Jimsonweed was controlled 98% or greater with 72 g/ha pyrithiobac (data not presented).

Annual morningglory species. Control of annual morningglory species over all years was 65 to 80% (Table 3.5). Annual morningglory control was 70% with CGA 362622 alone over all years. The combination of pyrithiobac plus CGA 362622 did not improve control over CGA 362622 alone. CGA 362622 at 2.5 g/ha controlled annual morningglory species 65% when pooled over pyrithiobac rates. Better control was provided by 7.5 g/ha CGA 362622 when averaged over pyrithiobac rates. Annual morningglory control was lowest in 2001, when weeds were relatively large at application. Pyrithiobac at 72 g/ha controlled annual morningglory species 72% in 1999, 68% in 2000, and 20% in 2001. Pyrithiobac typically does not control tall morningglory as well as other annual morningglory species due to the ability of tall morningglory to metabolize pyrithiobac more quickly (Sunderland et al. 1995). CGA 362622, however, has been previously reported to control several *Ipomoea* species (Porterfield et al. 2000; Wilcut et al. 2000; Vidrine and Miller 2001).

Common cocklebur. CGA 362622 rate influenced control of common cocklebur at 56 DAT, but control was not influenced by pyrithiobac rate (Table 3.4). Control of common cocklebur was 93 to 98% with CGA 362622 rates pooled over pyrithiobac rates (Tables 3.5 and 3.7). CGA

362622 at 5 or 7.5 g/ha controlled common cocklebur 98%, which was slightly greater than control with 2.5 g/ha CGA 362622. Good control of common cocklebur by CGA 362622 has been previously reported (Wells et al. 2001). Common cocklebur was controlled 66 to 77% by 72 g/ha pyrithiobac at 28 DAT in all years, but control was only 31 to 40% at 56 DAT in 1999 and 2001 (data not presented).

Cotton lint yield and fiber characteristics. Treatment by year and CGA 362622 rate by pyrithiobac rate interactions were not observed for cotton lint yield or fiber quality characteristics (data not presented). Therefore, data were pooled over years, and the main effects of CGA 362622 rate and pyrithiobac rate on lint yield and fiber characteristics are presented (Table 3.6). Cotton in the untreated control and cotton treated with 72 g/ha pyrithiobac were not harvestable in any year due to weed interference. Combination treatments of CGA 362622 plus pyrithiobac at 17 or 35 g/ha resulted in cotton yields of 649 and 663 kg/ha, which were greater than the yield of cotton treated with CGA 362622 alone at 469 kg/ha (Table 3.6). Pooled over pyrithiobac rates, cotton yields were greater with application of CGA 362622 at 3.8 to 7.5 g/ha than from cotton treated with 2.5 g/ha CGA 362622. Cotton treated with the highest CGA 362622 rate (7.5 g/ha) produced 674 kg/ha of lint yield, but this did not differ from yields of cotton treated with 3.8 and 5 g/ha CGA 362622 when pooled over pyrithiobac rates. Cotton yields were generally low due to a lack of season long weed control and possible interference from weeds in the buffer area between plots. Neither CGA 362622 rate, nor pyrithiobac rate, affected cotton fiber quality. Fiber quality characteristics for micronaire, length, and strength would be classified as fine, long, and average, respectively.

Greenhouse studies. 2-5, 5-8,Jimsonweed control with CGA 362622 was less than 48% in both greenhouse studies (Table 3.7). Pyrithiobac, however, provided at least 70% control, and at 28 DAT jimsonweed control was 94 to 98% with 35 g/ha of pyrithiobac. Dry weights of CGA 362622 treated plants were 37 to 65% of the untreated control and heights were 62 to 84% of untreated control heights. Pyrithiobac treatment reduced dry weights to only 2 to 14% of the untreated control weights.

Velvetleaf control in the greenhouse was 87% or greater for all CGA 362622 rates in the second repetition (Table 3.8). In the first repetition, however, only CGA 362622 rates of 7.5 g/ha or greater controlled velvetleaf at least 80%. Pyrithiobac controlled velvetleaf greater than 77% with rates of at least 21 g/ha in the first repetition and with all rates in the second repetition. Dry weights of velvetleaf generally reflected visual observations.

CGA 362622 did not adequately control spurred anoda in the greenhouse. Control of spurred anoda with CGA 362622 did not exceed 38% (Table 3.9). Pyrithiobac, however, controlled at least 74% of spurred anoda. Dry weights of CGA 362622 treated plants were 77 to 89% of the untreated control, while dry weights of spurred anoda treated with pyrithiobac were only 15 to 20% of the untreated control.

In these studies, applications of CGA 362622 plus pyrithiobac controlled several broadleaf weed species. CGA 362622 at 5 and 7.5 g/ha generally controlled common ragweed, common lambsquarters, annual morningglory species, and common cocklebur when pooled over pyrithiobac rates. CGA 362622 plus 35 g/ha of pyrithiobac consistently controlled velvetleaf, spurred anoda, and jimsonweed, thereby improving control of these species over control obtained from CGA 362622 alone. However, the residual activity of the two compounds was not adequate for season-long control of all broadleaf weeds as reflected by generally low yields. Therefore, applications of these two herbicides should be part of a complete integrated weed management program.

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Table 3.1. Height of weed species from 1999, 2000, and 2001 measured at time of herbicide application near Painter, VA.

	Weed height		
Weed species	1999	2000	2001
	cm		
Annual morningglory species	6	5 to 17	10 to 35
Common cocklebur	7 to 8	5 to 20	10 to 35
Common lambsquarters	5 to 8	5 to 8	5 to 15
Common ragweed	5 to 8	5 to 15	10 to 20
Jimsonweed	5 to 8	5 to 8	10 to 15
Spurred anoda	5 to 8	5 to 8	5 to 10
Velvetleaf	5 to 8	5 to 8	5 to 10

Table 3.2. Effect of CGA 362622 rate and pyrithiobac rate applied postemergence on cotton injury pooled over 1999, 2000, and 2001 near Painter, VA.[a]

Herbicide	Rate[c]	Cotton injury[b] 7 DAT	Cotton injury[b] 28 DAT
	(g ai/ha)	%	%
CGA 362622[d]	2.5	21	8
	3.8	22	7
	5	22	8
	7.5	24	9
LSD (0.05)		NS	NS
Pyrithiobac[e]	0	21	8
	17	22	7
	35	23	8
LSD (0.05)		NS	NS

[a] Abbreviation: DAT, days after treatment; NS = Not significant.

[b] Cotton injury rated on 0 to 100% scale; 0% = no plant response and 100% = complete control.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments.

[d] CGA 362622 rates pooled over pyrithiobac rates.

[e] Pyrithiobac rates pooled over CGA 362622 rates.

Table 3.3. Analysis of main and interaction effects of CGA 362622 rate and pyrithiobac rate on control of velvetleaf, common ragweed, and jimsonweed at 56 days after treatment from 1999, 2000, and 2001 near Painter, VA.

Year Factor[b]	Weed control[a]		
	ABUTH	AMBEL	DATST
	Significance[c]		
1999			
Main effect of CGA 362622 rate	--	NS	--
Main effect of pyrithiobac rate	--	NS	--
Interaction of CGA 362622 rate by pyrithiobac rate	--	NS	--
2000			
Main effect of CGA 362622 rate	**	**	NS
Main effect of pyrithiobac rate	**	**	**
Interaction of CGA 362622 rate by pyrithiobac rate	NS	NS	NS
2001			
Main effect of CGA 362622 rate	NS	**	NS
Main effect of pyrithiobac rate	NS	**	NS
Interaction of CGA 362622 rate by pyrithiobac rate	NS	NS	NS

[a] Abbreviations: ABUTH, velvetleaf; AMBEL, common ragweed; DATST, jimsonweed; DAT, days after treatment.

[b] Non-ionic surfactant at 0.25% v/v included with all treatments. CGA 362622 applied at 2.5, 3.8, 5, and 7.5 g/ha. Pyrithiobac applied at 0, 17, and 35 g/ha. In 1999 and 2000, cultivations were made at 21 DAT. In 2001, an additional 3.8 g/ha CGA 362622 plus 35 g/ha pyrithiobac was broadcast over all plots at 30 DAT.

[c] NS = Not significant at P value of 0.05; and ** = P value of 0.05 level of significance by Fisher's Protected LSD test. -- = No data.

Table 3.4. Analysis of main and interaction effects of CGA 362622 rate and pyrithiobac rate on control of spurred anoda, common lambsquarters, annual morningglory species, and common cocklebur at 56 days after treatment from 1999, 2000, and 2001 near Painter, VA.[a]

	Weed control[b]			
Factor[c]	ANVCR	CHEAL	IPOSP	XANST
	Significance[d]			
Main effect of CGA 362622 rate	**	NS	NS	**
Main effect of pyrithiobac rate	**	NS	NS	NS
Interaction of CGA 362622 rate by pyrithiobac rate	NS	NS	NS	NS

[a] Abbreviations: ANVCR, spurred anoda; CHEAL, common lambsquarters; IPOSP, annual morningglory species; XANST, common cocklebur; DAT, days after treatment.

[b] Common ragweed, common lambsquarters, annual morningglory species, and common cocklebur control pooled over 1999, 2000, and 2001; spurred anoda control pooled over 1999 and 2000.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments. CGA 362622 applied at 2.5, 3.8, 5, and 7.5 g/ha. Pyrithiobac applied at 0, 17, and 35 g/ha. In 1999 and 2000, cultivations were made at 21 DAT. In 2001, 3.8 g/ha CGA 362622 plus 35 g/ha pyrithiobac was broadcast over all plots at 30 DAT.

[d] NS = Not significant at P value of 0.05; and ** = P value of 0.05 level of significance by Fisher's Protected LSD test.

Table 3.5. Effect of CGA 362622 rate and pyrithiobac rate applied postemergence on weed control 56 days after treatment from 1999, 2000, and 2001 near Painter, VA.[a]

		Weed control[b]									
		ABUTH		AMBEL		ANVCR	CHEAL	DATST		IPOSP	XANST
Herbicide	Rate[c]	2000	2001	1999	'00 to '01	'99 to '00	'99 to '01	2000	2001	'99 to '01	'99 to '01
	(g ai/ha)	%									
CGA 362622[d]	2.5	61	97	93	58	71	91	59	97	65	93
	3.8	72	98	97	72	76	91	73	98	70	95
	5	82	98	97	75	75	92	58	98	74	98
	7.5	85	98	99	85	76	93	71	98	80	98
LSD (0.05)		13	NS	4	13	3	NS	NS	NS	14	3
Pyrithiobac[e]	0	48	97	94	70	34	92	18	97	70	97
	17	91	98	97	71	95	92	97	98	72	96
	35	98	98	98	77	97	91	99	98	75	95
LSD (0.05)		12	NS	3	NS	3	NS	8	NS	NS	NS

[a] Abbreviations: ABUTH, velvetleaf; AMBEL, common ragweed; ANVCR, spurred anoda; CHEAL, common lambsquarters; DATST, jimsonweed; IPOSP, annual morningglory species; XANST, common cocklebur; NS = Not significant at P value of 0.05; DAT, days after treatment.

[b] Weed control rated on 0 to 100% scale; 0% = no plant response and 100% = complete control.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments. In 1999 and 2000, cultivations were made at 21 DAT. In 2001, an additional 3.8 g/ha CGA 362622 plus 35 g/ha pyrithiobac was broadcast over all plots at 30 DAT.

[d] CGA 362622 rates pooled over pyrithiobac rates.

[e] Pyrithiobac rates pooled over CGA 362622 rates.

Table 3.6. Effect of CGA 362622 rate and pyrithiobac rate applied postemergence on cotton lint yield and fiber quality in 2000 and 2001 near Painter, VA.[a]

			Fiber quality		
Herbicide	Rate[b]	Lint yield	Micronaire	Length	Strength
	(g ai/ha)	kg/ha	index	mm	g/tex
CGA 362622[c]	2.5	451	28	29.5	26
	3.8	620	28	29.2	26
	5	630	28	29.0	26
	7.5	674	27	29.2	25
LSD (0.05)		149	NS	NS	NS
Pyrithiobac[d]	0	469	28	29.2	26
	17	649	27	29.2	26
	35	663	27	29.2	26
LSD (0.05)		129	NS	NS	NS

[a] Cotton lint yield and fiber characteristics averaged over years.

[b] Non-ionic surfactant at 0.25% v/v included with all treatments. In 1999 and 2000, cultivations were made at 21 days after treatment. In 2001, 3.8 g/ha CGA 362622 plus 35 g/ha pyrithiobac was broadcast over all plots at 30 days after treatment.

[c] CGA 362622 rates pooled over pyrithiobac rates.

[d] Pyrithiobac rates pooled over CGA 362622 rates.

Table 3.7. Control of jimsonweed in the greenhouse with postemergence applications of CGA 362622 or pyrithiobac.[a]

		Visual control[b]						
			28 DAT		Dry weight		Height	
Herbicide	Rate[c]	21 DAT	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
	(g ai/ha)	%			% of control			
CGA 362622	3.8	36	15	29	65	47	78	66
	7.5	38	16	33	55	50	76	66
	11.3	39	25	34	62	46	84	70
	15	47	29	33	44	43	65	70
	18.8	46	26	38	56	37	74	62
Pyrithiobac	7	70	87	65	5	14	22	38
	14	80	92	78	3	8	19	35
	21	84	97	84	2	8	23	29
	28	86	98	88	2	7	16	28
	35	92	98	94	2	5	15	25
LSD (0.05)		5	11	8	17	6	12	11

[a] Abbreviation: DAT, days after treatment.

[b] Weed control rated on 0 to 100% scale; 0% = no plant response and 100% = complete control.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments.

Table 3.8. Control of velvetleaf in the greenhouse with postemergence applications of CGA 362622 or pyrithiobac.[a]

		Visual control[b]					
		21 DAT		28 DAT		Dry weight	
Herbicide	Rate[c]	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
	(g ai/ha)	%				% of control	
CGA 362622	3.8	59	90	50	87	52	8
	7.5	82	99	89	99	12	2
	11.3	90	99	91	99	10	1
	15	91	98	94	99	9	1
	18.8	94	98	97	99	7	1
Pyrithiobac	7	69	81	66	78	30	15
	14	75	92	71	92	24	4
	21	78	98	78	98	18	2
	28	84	99	89	99	13	2
	35	90	99	91	99	13	1
LSD (0.05)		7	7	8	7	7	5

[a] Abbreviation: DAT, days after treatment.

[b] Weed control rated on 0 to 100% scale; 0% = no plant response and 100% = complete control.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments.

Table 3.9. Control of spurred anoda in the greenhouse with postemergence applications of CGA 362622 or pyrithiobac.[a]

		Visual control[b]			
			28 DAT		
Herbicide	Rate[c]	21 DAT	Test 1	Test 2	Dry weight
	(g ai/ha)		%		% of control
CGA 362622	3.8	24	6	14	89
	7.5	28	5	16	90
	11.3	34	18	18	91
	15	38	27	34	66
	18.8	34	27	18	77
Pyrithiobac	7	75	87	74	20
	14	82	93	82	12
	21	85	95	84	12
	28	82	95	82	16
	35	83	95	79	15
LSD (0.05)		9	7	9	16

[a] Abbreviation: DAT, days after treatment.

[b] Weed control rated on 0 to 100% scale; 0% = no plant response and 100% = complete control.

[c] Non-ionic surfactant at 0.25% v/v included with all treatments.