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EFFECT OF PICLORAM AND TEBUTHIURON ON BROADLEAF WEEDS AND BERMUDAGRASS IN EAST-CENTRAL TEXAS PASTURES

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CONTENTS

SUMMARY

Pellet and spray formulations of picloram and tebuthiuron were applied side-by-side at rates of 0.37, 1.12, and 2.24 kg/ha to common bermudagrass (Cynodon dactylon (L.) Pers.) growing on a heavy clay site and a sandy site. Six replicate plots were treated at 6-week intervals between October 1974 and September 1975. Six months after the original treatment, half of the replicate plots were retreated with the same herbicides. A single application of most herbicides reduced weed cover on the sandy site for 1 year, but weed control was less than 1 year on the clay site. Results for double herbicide application were similar to single application, except that little residual herbicide activity was apparent on either the sandy or clay site 1 year after retreatment.

On the clay site, a single application of tebuthiuron spray in October 1974 at 2.24 kg/ha was the only treatment that resulted in significant increases in bermudagrass cover after 1 year. After 1 year on the sandy site, significant increases in bermudagrass cover occurred following single sprays of picloram at 2.24 kg/ha in November 1974 and March 1975 and tebuthiuron sprays of 1.12 kg/ha in March and May 1975. Picloram and tebuthiuron sprays at 2.24 kg/ha doubled bermudagrass cover when treated in January 1975 and retreated in July 1975 or treated in March 1975 and retreated in September 1976. Picloram pellets or sprays at 1.12 and 2.24 kg/ha applied in November 1974 and retreated in May 1975 also increased bermudagrass cover. Herbicide injury to bermudagrass on either the clay or sandy site was infrequent and temporary. Herbicide effectiveness on the clay site apparently was less than on the sandy site due to shorter term weed control and less response to increase in bermudagrass cover.

Effect of Picloram and Tebuthiuron on Broadleaf Weeds and Bermudagrass in East-Central Texas Pastures

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INTRODUCTION

Control of annual and perennial broadleaf weeds is a prerequisite for maxium grass production in established pastures. Use of herbicides is one of the most efficient ways to control weeds. In the past, the herbicide most frequently chosen for broadleaf weed control was 2,4,-D([2,4-dichlorophenoxy]acetic acid) (11). This herbicide is widely recommended for use in pasture and forage crops in Texas (20).

Unfortunately 2,4-D lacks persistence (16), and its success depends on application at a time when the weeds are young and actively growing (20). Consequently, several applications may be required for effective weed control. As application and chemical costs increase, a more persistent herbicide may become economically feasible.

In three of five experiments in central Texas, Mayeux (17) found that picloram was more effective as a spray than as pellets for control of pasture weeds. Tebuthiuron was more effective as a spray in one of two experiments, but none of the herbicides suppressed weeds during the second year after application. Kleingrass yields were increased by effective herbicide treatments during the growing season of application. In South Texas, Scifres and Mutz (21) found that forb production and diversity were decreased where 1 kg/ha or more tebuthiuron was applied but recovery of forbs was evident 3 years after treatment regardless of rate of application. The standing grass crops were significantly increased 1, 2, and 3 years after treatment.

When applied during dry periods, picloram reduced density and yield of Coastal bermudagrass on a Lufkin sandy loam soil (5). Baur et al. (2) found that picloram at 2.2 kg/ha reduced common bermudagrass production when applied in March but not when applied in April or June on a Lufkin fine sandy loam. In the same study, common bermudagrass tolerated applications of tebuthiuron at 2.2 kg/ha in March and April but not in June.

Picloram applied at 1.12 kg/ha to bare soil disappeared after 3 months but persisted for 6 months at 3.36 kg/ha in a lakeland sand (4). In a clay loam soil, picloram persisted at 0.03 ppm or less for 6 and 18 months from application of 1.12 and 3.36 kg/ha, respectively. Picloram was detected in the top 15 cm of the clay soil. Both experimental sites were near College Station, Texas. Merkle et al. (18) reported that picloram was more persistent in clay than in sandy soil because more picloram was removed by leaching from the sandy sites. Herr et al. (15) concluded that high organic content is essential to maintain phytotoxic levels of picloram in soils and that heavy and medium textured soils retained picloram near the soil surface, whereas the light-

textured soils were easily penetrated to a depth of more than 61 cm. Grover (14) also correlated the soil activity of picloram with pH and organic matter but not with cation exchange capacity or percentage of clay.

Bovey et al. (7) found that significant levels of tebuthiuron persisted in soil for 6 months after application of sprays or pellets at 2.2 kg/ha on a Bleiblerville clay (a member of the fine, montmorillonitic, thermic Udic Pellusterts) in a Coastal bermudagrass pasture. More tebuthiuron was present in the soil profile when the herbicide was applied as pellets than as sprays; however, the upper soil profile had the highest concentrations of tebuthiuron regardless of herbicide formulation. Bovey et al. (8) also found that tebuthiuron persisted even for 2 years after treatment of pellets at 2.2 kg/ha on an Axtell fine sandy loam (a member of the fine, montmorillonitic, thermic family of Udertic Paleustalfs). Garcia and Gontarek (13) indicated that tebuthiuron was readily adsorbed and/or absorbed by organic matter in the upper soil layer, retarding leaching to lower depths. Baur (1), however, showed that rate and extent of tebuthiuron leaching was inversely related to clay content of the soil. Chang and Stritzke (9) proposed that both organic matter and clay content were important because soil mobility of tebuthiuron was greatest in soil with low organic matter and low clay content. The importance of clay content in restricting tebuthiuron availability was shown by Fischer and Stritzke (12) in that the percentage of blackjack oak (Quercus marilandica Muench.) and post oak (Quereus stellata Wangenh.) killed decreased as clay content in the soil increased.

This study examines the effectiveness of the herbicides picloram (4-amino-3, 5,6,-trichloro-2-pyridinecarboxylic acid) and tebuthiuron (N-[5-(1,1-dimethyl-ethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea) on broadleaf weeds in bermudagrass pastures. These herbicides have persistence characteristics that have made them especially effective in controlling perennial woody vegetation (3,6,19).

Primary objectives of this research were to evaluate the date of application of picloram and tebuthiuron with regard to changes in weed and bermudagrass cover. Other objectives were to examine the above parameters as influenced by type of formulation (aqueous spray versus pelleted herbicide), soil type, and effects of retreatment 6 months after the initial treatment.

MATERIALS AND METHODS

Experimental Sites

Two sites for this study were chosen on the basis of soil type. A 0.8-ha bermudagrass pasture located in the Woody Plant Nursery maintained by the USDA-ARS, Grassland Protection Research Unit at the Texas A&M University Research and Extension Center, Bryan, Texas, was selected for the heavy clay site (hereafter referred to as the clay site). The soil was a Wilson clay loam (a member of the fine, montmorillonitic, thermic Vertic Albaqualfs). At the onset of the study, the major grass species at this site was common

bermudagrass, with minor concentrations of brownseed paspalum (Paspalum plicatulum Michx.), dallisgrass (Paspalum dilalatum Poir.), and johnsongrass (Sorghum halepense (L.) Pers.) plants.

The second study site was in a 2.0-ha common bermudagrass pasture near Wellborn, Texas. The soil at this site (hereafter referred to as the sandy site) is classified as Lufkin fine sandy loam (a member of the fine, montmorillonitic, thermic Udertic Paleustalfs). The major grass species at the onset of the study was common bermudagrass, with scattered plants of brownseed paspalum and dallisgrass.

The common and scientific names of the weeds generally distributed throughout the plots at both study sites are given in Table 1 (10).

Experimental Design

In September 1974, 294 plots (4.6 by 4.6 m each) were established at each site. Side-by-side comparisions of picloram and tebuthiuron were made by applying the same rate of each chemical in 1.5-m swaths to each plot. The sprays were applied with a tractor-mounted split-boom sprayer at 187 L/ha delivered at 210 kPa. Pellet formulations of both herbicides were broadcast by hand. The formulations examined were the potassium salt of picloram (240 g/L), 80% (ai) wettable powder of tebuthiuron, and 10% (ae or ai) pellet formulations of both herbicides. Extruded picloram and tebuthiuron pellets were 0.97 and 0.81 mm diameter, respectively.

Beginning in October 1974 (Table 2), six replicate plots at each site were treated with 0.37, 1.12, and 2.24 kg/ha of both herbicides. The herbicides were applied every 6 weeks through September 1975. Approximately 6 months after the first treatments were made, three of the original six replicate plots were retreated with the same herbicide and rate as used for the first treatment. Dates of treatment, retreatment, and treatment evaluation, are given in Table 2. Six plots were maintained as untreated controls.

Evaluation and Statistical Analysis

Immediately preceding each application date and 60, 180, and 365 days after treatment, the entire treated areas (plots) were visually evaluated for percentages of weed cover and bermudagrass cover and the presence of specific weed species. The weed species evaluation, strictly a present or not present rating, was made for the purpose of assessing population shifts that occurred either as a result of seasonal changes or herbicide treatment.

The individual cover ratings (weed and bermudagrass) for each treatment (or retreatment) were subjected to analysis of variance and Duncan's multiple-range test to determine the existence of differences resulting from treatment (22).

RESULTS AND DISCUSSION

Effect of Single Applications on Weed and Grass Cover

Clay Site

Weed cover: Percentages of weed cover on the clay site 60, 180, and 365 days after treatment are presented in Tables 3, 5, and 6. Sixty days after treatment, most herbicides, except for the low rates (0.37 kg/ha) of pelleted picloram and tebuthiuron, effectively reduced the weed cover on the clay site (Table 3). Sprays of picloram and tebuthiuron applied in October, November, and January were generally more effective than pellets of the same herbicides. Sufficient rainfall was received from October 1974 through January 1975 to activate the pelleted herbicides (Table 4). Treatments applied in May, July, August, and September showed few differences between herbicide sprays and pellets, possibly because weed cover was greatly reduced in summer. Picloram and tebuthiuron sprays at 1.12 and 2.24 kg/ha were highly effective in reducing weed cover regardless of date of application (Table 3).

After 180 days, picloram and tebuthiuron sprays of 1.12 and 2.24 kg/ha applied in January, May, July, and September 1975 significantly reduced weed cover (Table 5). Pelleted herbicides were effective in reducing weed cover at most rates of application in May, July, and September 1975 (months of highest rainfall) but were ineffective at other dates (below normal rainfall) of application (Table 4). The weed cover increased dramatically, compared with the untreated areas, at some dates of application by 180 days after treatment. Treatments showing the greatest weed recovery were tebuthiuron and picloram sprays and pellets applied at 0.37 kg/ha in October and November 1974 and picloram pellets applied at 1.12 kg/ha in October and November 1974 (Table 5).

After 1 year, with some exceptions, the residual activity of most herbicides was not apparent in reducing weed cover (data not shown). Some significant reductions in weed cover occurred in November 1974 and January and March 1975. In the November 1974 and January 1975 treatments, however, differences between the untreated and treated plots, although sometimes significant, were small. In the March 1975 treatment, reductions in weed cover occurred with tebuthiuron spray at 1.12 kg/ha and picloram pellets at 1.12 and 2.24 kg/ha.

Bermudagrass cover: None of the herbicides resulted in an increase in bermudagrass cover when evaluated 60 or 180 days after treatment.(data not shown). Reductions in bermudagrass cover occurred from sprays of picloram at 1.12 kg/ha applied in October 1974 and March 1975 and picloram pellets applied at 2.24 kg/ha in March 1975, 60 days after treatment (data not shown). After 180 days, sprays of tebuthiuron at 1.12 kg/ha applied in October and November 1974 and picloram at 1.12 kg/ha applied in October reduced bermudagrass cover. Reduction of grass cover occurred only from the May 1975 application after 1 year (Table 6). Picloram sprays applied at 1.12 kg/ha and all rates of picloram pellets reduced bermudagrass cover. Also tebuthiuron pellets at 0.37

and 2.24 kg/ha reduced bermudagrass cover when applied in May 1975. Thus, reduction of bermudagrass cover by herbicides regardless of time after application was infrequent. Bermudagrass cover increased after 1 year following spray of tebuthiuron at 2.24 kg/ha applied in October 1974. No other treatments produced significant increases in bermudagrass cover (Table 6).

Sandy Site

Weed cover: On the sandy site, most herbicide treatments were effective in reducing weed cover 60 days after treatment (Table 7). The most effective herbicides applied in October and November were sprays of picloram and tebuthiuron at 1.12 and 2.24 kg/ha. Pelleted picloram or tebuthiuron applied in October at 0.37 and 1.12 kg/ha were ineffective. Most treatments applied in January, March, May, July, August, and September were effective, but not all weed cover was eliminated especially in the pelleted herbicide treatments applied in the fall through early spring. The area receiving the lowest rate of pelleted picloram and tebuthiuron applied in March (limited rainfall) had more weed cover than the untreated areas. In general, herbicide sprays were more effective than pellets in reducing weed cover. However, the full effect of the pelleted herbicides may not have been realized at the 60-day evaluation, especially during the time when weeds were relatively dormant (fall and winter) and rainfall amounts were below normal.

After 180 days, most of the October and November treatments did not effectively control weeds (Table 8). All areas receiving herbicides in October had at least the same weed cover as the untreated areas. Tebuthiuron spray at 2.24 kg/ha was the only November treatment showing any residual weed control. Most herbicides controlled weeds when treated in January, March, May, July, August, and September (Table 8).

One year after treatment, weed cover was less in all herbicide treatments applied in October, November, January, March, and May (Table 9). No differences occurred between the untreated plots and those treated in July, August, and September.

Bermudagrass cover: After 60 days, October sprays of picloram at 1.12 and 2.24 kg/ha significantly reduced bermudagrass cover, compared with untreated areas, whereas all sprays of tebuthiuron and the pelleted formulations of picloram and tebuthiuron at 0.37 and 2.24 kg/ha increased grass cover (Table 10). When applied in November, picloram and tebuthiuron sprays at 1.12 and 2.24 kg/ha increased grass cover. January sprays of picloram at 0.37 and 2.24 kg/ha and tebuthiuron at 1.12 and 2.24 kg/ha had more bermudagrass cover than the untreated areas. Spray and pelleted picloram at 2.24 kg/ha applied in March reduced grass cover, but sprays of tebuthiuron at 0.37 and 1.12 kg/ha enhanced grass cover. May applications of picloram sprays at 0.37 kg/ha and sprays of tebuthiuron at 0.37 and 1.12 kg/ha resulted in more grass than in the untreated area. Herbicide treatments in July, August, or September had little effect on bermudagrass cover (Table 10).

After 180 days, treatments that produced increased bermudagrass cover included November applications of picloram spray at 2.24 kg/ha, tebuthiuron sprays at 1.12 and 2.24 kg/ha, and pellets of picloram and tebuthiuron at 2.24 kg/ha (Table 11). January sprays of picloram at 0.37 kg/ha, tebuthiuron sprays at all rates, and picloram pellets at 2.24 kg/ha also increased bermudagrass cover. Treatments in March, May, July, August, and September usually had no effect on bermudagrass cover compared to the untreated areas. After 1 year, November and March picloram sprays at 2.24 kg/ha and March and May tebuthiuron sprays at 1.12 kg/ha resulted in more bermudagrass than other treatments (data not shown). Other herbicide treatments or dates of application did not affect bermudagrass cover. Residual effects of the herbicides had essentially disappeared 1 year after treatment.

Effect of Double Application on Weed and Grass Cover

Clay Site

Weed cover: Sixty days after a retreatment applied 6 months after the original treatment, sprays of picloram or tebuthiuron usually reduced weed cover on areas retreated in May, September, and December 1975 and January and March 1976 (Table 12). However, sprays of tebuthiuron at 0.37 kg/ha retreated in March, July, September, and December did not reduce weed cover at 60 days after treatment. Pelleted picloram at 1.12 and 2.24 kg/ha also reduced weed cover when retreated in May, September, and December 1975, and January and March 1976. Pelleted tebuthiuron at 1.12 kg/ha retreated in September 1975 and January and March 1976 reduced weed cover as well as 2.24 kg/ha retreated in May, September, and December 1975, and January and March 1976 (Table 12).

After 180 days, all sprays of picloram and tebuthiuron retreated in May, September, and December 1975 reduced weed cover (Table 13). Picloram and tebuthiuron sprays at 1.12 and 2.24 kg/ha retreated in July 1975 also significantly reduced weed cover. After 180 days, all pelleted picloram rates retreated in May and December 1975 and picloram at 2.24 kg/ha retreated in July and September 1975 reduced weed cover. Pelleted tebuthiuron at 1.12 and 2.24 kg/ha effectively controlled weeds when retreated in May, July, September, and December 1975 (Table 13). After 1 year, most retreatments did not control weeds (data not shown).

Bermudagrass cover: None of the herbicides was consistently effective for increasing or decreasing the grass cover on the clay site 60, 180, or 365 days after retreatment (data not shown).

Sandy Site

Weed cover: Sprays of picloram and tebuthiuron at all rates and dates of retreatment significantly reduced weed cover after 60 days on the sandy site except tebuthiuron at 0.37 kg/ha retreated in March 1975 (Table 14). Pelleted picloram and tebuthiuron were also highly effective in reducing weed cover at most rates and dates when retreated in May, July, September, and December 1975,

and January and March 1976. Retreatment with pelleted tebuthiuron at 2.24 kg/ha was the only pelleted herbicide effective when applied in March 1975 (Table 14).

After 180 days, most herbicide retreatments were effective in reducing weed cover when applied in March, May, July, September, and December 1975 (Table 15). After 1 year, however, only picloram sprays at 1.12 and 2.24 kg/ha were effective as retreatments applied in March and May 1975 (data not shown). Results for tebuthiuron sprays 1 year after retreatment were erratic. Areas retreated after May 1975 had poor weed cover in treated and untreated areas, so differences between treatments were small.

Bermudagrass cover: After 60 days, grass cover increased where tebuthiuron spray was retreated at 0.37 kg/ha in March 1975, 1.12 kg/ha in May 1975, 0.37 and 1.12 kg/ha in July 1975, and 1.12 kg/ha in March 1976 (Table 16). Increases in grass cover also resulted from retreatment of tebuthiuron pellets at 2.24 kg/ha in May 1975 and at 1.12 kg/ha in March 1976.

After 180 days, tebuthiuron sprays at 2.24 kg/ha retreated in May 1975 and 1.12 kg/ha retreated in September and December 1975 were the only treatments that increased grass cover. Pelleted herbicides were ineffective (data not shown).

After 1 year, significant grass cover increases occurred in several retreatments made in May, July, and September 1975 (Table 17). Picloram and tebuthiuron applied as sprays at 2.24 kg/ha doubled grass cover when retreated in July and September 1975. Picloram and tebuthiuron retreated as sprays and pellets in July 1975 at 0.37 kg/ha also increased grass cover. Picloram sprays at 2.24 kg/ha retreated in May 1975 were also highly effective in increasing bermudagrass cover 1 year after retreatment.

Results of all Treatments on Weed Populations

Data on the effects of single and retreatment applications on the composition of the broadleaf weed population 1 year after the last application were grouped and evaluated on a seasonal basis. Examination of the data on this basis negated the natural effects of season on population composition. The seasons are designated spring (March through May) and winter (October through February). Composition data from the plots treated (and retreated) with the 1.12 and 2.24 kg/ha rate of both formulations (spray and pellet) of picloram and tebuthiuron are considered.

Spring application of 1.12 and 2.24 kg/ha of both formulations of tebuthiuron and picloram removed 12 species from the sandy site: burclover, white clover, evening primrose, false dandelion, milkweed, phacelia, poorjoe, rush spp., scarlet pimpernel, sedge spp., sida, and toadflax (Fig. 1). Similarly, 10 species were removed from the clay site: burclover, chickweed, crow poison, dichondra, false dandelion, indian paintbrush, smartweed, toadflax, vervain, and wild celery (Fig. 1). Horseweed and ragweed were

controlled by the two higher rates of picloram treatments on the sandy site, whereas on the clay site 2.24 kg/ha rate of both formulations was required to remove ragweed; horseweed was removed only by the high rate of picloram spray. The high rate of tebuthiuron pellets was necessary to remove horseweed from the sandy site, whereas all rates of both spray and pellets removed it from the clay site. The high rate of both formulations of tebuthiuron was necessary to remove ragweed from the clay site, whereas on the sandy site all rates of pellets and the high rate of spray were required. Geranium was controlled by both rates of sprays of picloram but not pelleted picloram at 1.12 kg/ha on the sandy site. Only the high rate of pelleted picloram controlled geranium on the clay site. Horsemint was controlled by the higher rates of picloram spray on the clay site and pellets on the sandy site. There were several instances where only the high rate (2.24 kg/ha) of pelleted picloram resulted in control: sensitive briar, scarlet pimpernel, white clover, and butterweed on the clay site and phlox, indian paintbrush, and dock on the sandy site.

Application of all treatments in the winter removed eight species from the sandy site: aster, burclover, curly dock, evening primrose, horsemint, ragweed, vervain, and winecup (Fig. 2). Similarly, three species were removed from the clay site: chervill, dichondra, and plantain. Dewberry and wood sorrel were removed from the sandy site by both rates of the spray formulation of both herbicides. Wood sorrel on the clay site was unaffected by tebuthiuron spray and 1.12 kg/ha tebuthiuron (Fig. 2). Ragweed was eliminated by all picloram treatments on both sites and by all tebuthiuron treatments on the sandy site. Tebuthiuron at 2.24 kg/ha as pellets or sprays killed all ragweed on the clay site. Vetch was eliminated on the sandy site by all treatments except tebuthiuron sprays at 1.12 kg/ha.

The major observation noted for the retreatment data for both sites (Fig. 3) is a rate effect. On the sandy site, control of curly dock, milkweed, phlox, and vervain occurred on all spring treatments. Evening primrose and indian paintbrush were controlled by all spring treatments of tebuthiuron and picloram, respectively. The remaining species were generally controlled by the 2.24 kg/ha rate of all treatments. A much greater degree of control was noted for all species on the clay site.

A strict numerical analysis of species controlled by a given formulation or herbicide reveals that picloram had a slight edge over tebuthiuron in percentage of spring species controlled on the sandy site (64 vs. 58 percent); the two herbicides were equivalent in control of spring species on the clay site (63 vs. 59 percent) and winter species on the sandy site (74 vs. 77 percent). Picloram was decidedly superior to tebuthiuron in control of winter species on the clay site (84 vs. 62 percent). Percentage of species controlled relative to formulation indicated that spray applications were slightly better than pellet applications.

The results of the plant surveys after application of herbicides indicated that a large number of species can be eliminated from the treated area, allowing a potential increase in grass production.

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SANDY SITE

PREDOMINANT SPECIES	TEBUTHIURON				PICLORAM			
	SPRAY		PELLET		SPRAY		PELLET	
	RATE (kg/ha)				RATE (kg/ha)			
	1.12	2.24	1.12	2.24	1.12	2.24	1.12	2.24
Blackeyed susan	▒	▒					▒	
Burclover								
Chickweed	▒	▒	▒	▒	▒	▒	▒	▒
Clover, white								
Crow poison		▒						▒
Dewberry	▒	▒	▒	▒	▒	▒	▒	▒
Dock, curly	▒	▒			▒		▒	
Evening primrose								
False dandelion								
Geranium	▒	▒	▒	▒			▒	
Horseweed			▒					
Horsemint	▒	▒	▒		▒	▒	▒	
Indian paintbrush				▒			▒	
Milkweed								
Phacelia								
Phlox			▒				▒	
Plantain		▒	▒	▒	▒	▒	▒	▒
Poorjoe								
Queen Anne's lace	▒	▒	▒	▒	▒	▒	▒	▒
Ragweed	▒							
Ragwort	▒	▒	▒	▒	▒	▒	▒	▒
Rush								
Scarlet pimpernel								
Sedge								
Sida								
Spring beauty	▒	▒	▒	▒	▒	▒		
Toadflax								
Vervain		▒	▒	▒				
Vetch	▒	▒	▒	▒	▒		▒	▒
Wild celery	▒	▒	▒	▒	▒	▒	▒	▒
Winecup		▒		▒		▒	▒	▒
Wood sorrel		▒		▒	▒	▒	▒	▒

CLAY SITE

PREDOMINANT SPECIES	TEBUTHIURON				PICLORAM			
	SPRAY		PELLET		SPRAY		PELLET	
	RATE (kg/ha)				RATE (kg/ha)			
	1.12	2.24	1.12	2.24	1.12	2.24	1.12	2.24
Blackeyed susan								▒
Burclover								
Butterweed	▒	▒	▒	▒	▒	▒	▒	
Chickweed								
Clover, white	▒	▒			▒	▒	▒	
Crow poison								
Dandelion	▒	▒	▒	▒	▒	▒	▒	▒
Dichondra								
Dock, curly	▒					▒		
Evening primrose	▒		▒	▒	▒	▒	▒	▒
False dandelion								
Geranium		▒	▒	▒	▒	▒	▒	
Horsemint	▒			▒				▒
Horseweed					▒			▒
Indian paintbrush								
Plantain	▒	▒	▒	▒		▒	▒	▒
Ragweed	▒		▒		▒		▒	
Scarlet pimpernel			▒		▒		▒	
Sensitive briar	▒	▒	▒				▒	
Smartweed								
Sow thistle	▒	▒	▒	▒	▒	▒	▒	▒
Sunflower	▒	▒	▒	▒	▒	▒	▒	▒
Tickseed				▒	▒			
Toadflax								
Vervain								
Wild celery								
Wood sorrel					▒	▒		

FIGURE 1. Spring evaluation of weed composition 1 year after a single application. All listed weeds occurred in control plots. Darkened areas indicate the occurrence of the noted species. Data for each species represents a composite of 12 replicate treated areas.

SANDY SITE

PREDOMINANT SPECIES	TEBUTHIURON				PICLORAM			
	SPRAY		PELLET		SPRAY		PELLET	
	RATE (kg/ha)				RATE (kg/ha)			
	1.12	2.24	1.12	2.24	1.12	2.24	1.12	2.24
Aster								
Burclover								
Dewberry			▒	▒			▒	▒
Dock, curly								
Evening primrose								
Geranium	▒	▒	▒	▒		▒	▒	▒
Horsemint								
Plantain	▒	▒	▒	▒	▒	▒	▒	▒
Ragweed								
Vervain								
Vetch	▒							
Wild celery	▒	▒	▒	▒	▒	▒	▒	▒
Winecup								
Wood sorrel				▒			▒	▒

CLAY SITE

PREDOMINANT SPECIES	TEBUTHIURON				PICLORAM			
	SPRAY		PELLET		SPRAY		PELLET	
	RATE (kg/ha)				RATE (kg/ha)			
	1.12	2.24	1.12	2.24	1.12	2.24	1.12	2.24
Chervil								
Croton, wooly			▒	▒	▒		▒	▒
Dichondra								
Evening primrose	▒	▒	▒	▒	▒		▒	▒
Geranium			▒					
Modiola	▒	▒						
Plantain								
Ragweed	▒		▒					
Wood sorrel	▒	▒	▒					

FIGURE 2. Winter evaluation of weed composition 1 year after a single application. All listed weeds occurred in control plots. Darkened areas indicate the occurrence of the noted species. Data for each species represents a composite of 18 replicate treated areas.

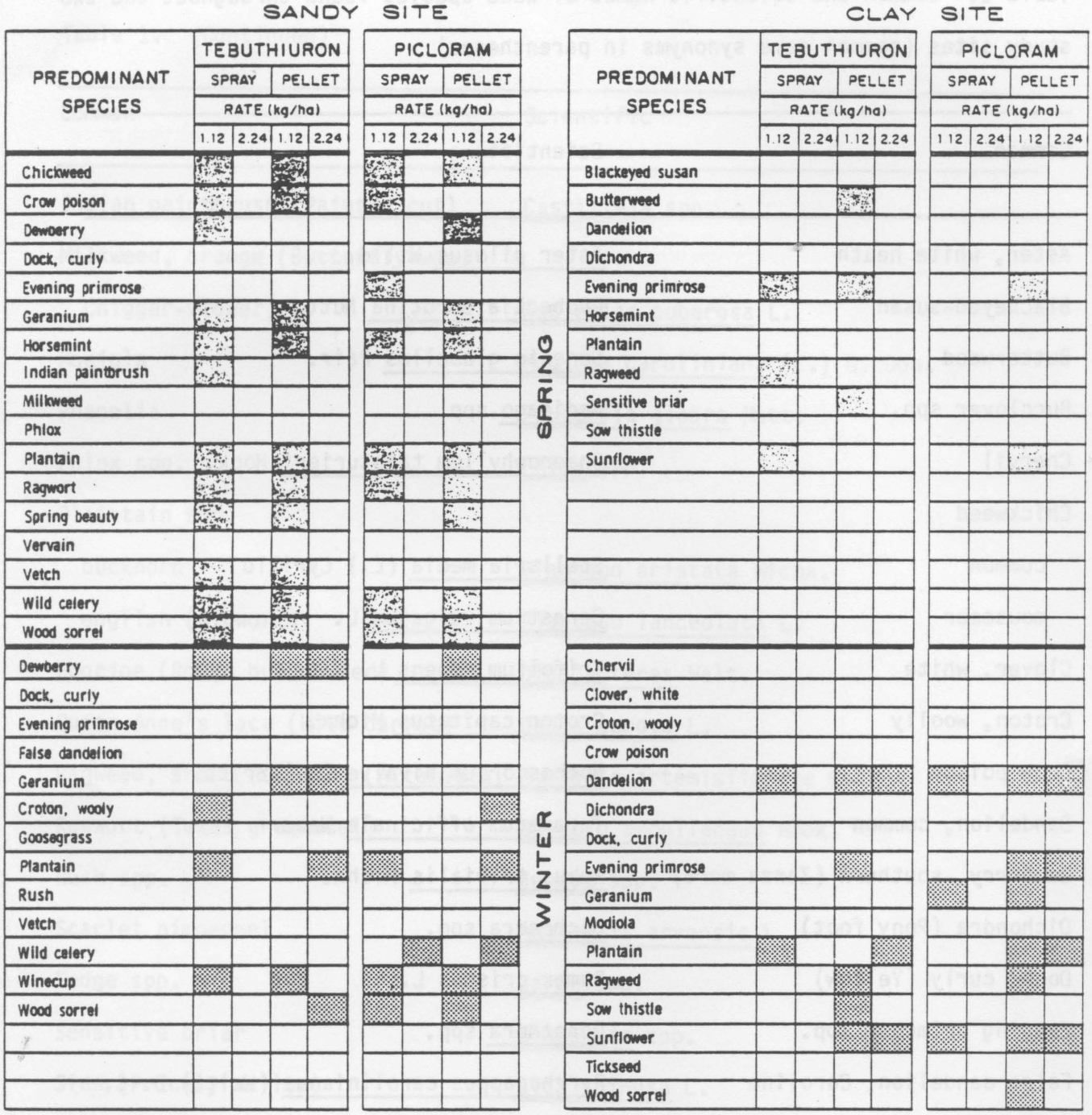

FIGURE 3. Spring and winter evaluations 1 year after a retreatment application. All listed weeds occurred in control plots. Darkened areas indicate the occurrence of the noted species. Data for each species represents a composite of nine replicate treated areas.

Table 1. Common and scientific names of weed species found throughout the two study sites (common name synonyms in parentheses)

Common	Scientific
Aster, white heath	Aster pilosus Willd.
Blackeyed-susan	Rudbeckia serotina Nutt.
Butterweed	Senecio glabellus Pair.
Burclover spp.	Medicago spp.
Chervil	Chaerophyllum tainturieri Hook.
Chickweed	
common	Stellaria media (L.) Cyrillo
mouseear	Cerastium vulgatum L.
Clover, white	Trifolium repens L.
Croton, woolly	Croton capitatus Michx.
Crow poison	Nothoscordum bivalve (L.) Britt.
Dandelion, common	Taraxacum officinale Weber
Dewberry, southern (Zarza mora)	Rubus trivialis Michx.
Dichondra (Pony foot)	Dichondra spp.
Dock, curly (Yellow)	Rumex crispus L.
Evening primrose spp.	Oenothera spp.
False dandelion, Carolina	Pyrrhopappus carolinianus (Walt.) D. C.
Geranium, Carolina	Geranium carolinianaum L.
Goosegrass	Eleusine indica (L.) Gaertn.
Horsemint (Spotted beebalm)	Monarda punctata L.
Horseweed (Marestail)	Conyza canadensis (L.) Cronq.

Table 1. (Continued)

Common	Scientific
Indian paintbrush (Painted cut)	Castilleja spp.
Milkweed, orange (Butterfly-weed Chigger-flower)	Asclepias tuberosa L.
Modiola	Modiola caroliniana (L.) G. Don.
Phacelia	Phyacelia glabra Nutt.
Phlox spp.	Phlox spp.
Plaintain spp.	
buckhorn	Plantago aristata Michx.
english (Ribwort)	Plantago lanceolata L.
Poorjoe (Rough buttonweed)	Diodia teres Walt.
Queen Anne's lace (Wild carrot)	Dacus carota L.
Ragweed, short (Common) (Altamisia)	Ambrosia artemisiifolia L.
Ragwort (Texas groundsel)	Senecio ampullaceus Hook.
Rush spp.	Juncus spp.
Scarlet pimpernel	Anagallis arvensis L.
Sedge spp.	Carex spp.
Sensitive briar	Schrankia spp.
Sida (Prickly mallow)	Sida spinusa L.
Smartweed, Pennsylvania	Polygunum pensylvanicum L.
Sow thistle	Sonchus spp.
Spring beauty	Claytonia virginica L.
Sunflower, common	Helianthus annuus L.

Table 1. (Continued)

Common	Scientific
Tickseed	Coris permum spp.
Toadflax, Texas	Linaria texana Scheele.
Vervain, blue	Verbena hastate L.
Vetch, narrowleaf	Vicia augustifolia L.
Wild celery	Apium graveolens L.
Winecup	Callirhoe digitata Nutt.
Woodsorrel, yellow	Oxalis priceae Small.

Names taken from Correll and Johnston (10).

Table 2. Dates of application of original treatments and retreatments and month when the 60-, 180-, or 365-day post-treatment or retreatment evaluations were made

Original treatment	Retreatment	Post-treatment evaluation (days) 60	180	365*
October 1, 1974		Dec	Apr	Oct
	March 17, 1975	May	Sep	Mar
November 20, 1974		Jan	May	Nov
	May 19, 1975	Jul	Nov	May
January 29, 1975		Mar	Jul	Jan
	July 29, 1975	Sep	Jan	Oct (446)
March 23, 1975		May	Sep	Mar
	September 23, 1975	Nov	Mar	Oct (396)
May 27, 1975		Jul	Nov	May
	December 3, 1975	Feb	Jun	Oct (328)
July 1, 1975		Sep	Dec	Oct (474)
	December 28, 1975	Feb		Nov (320)
August 1, 1975		Oct	Feb	Nov (443)
	January 1, 1976	Mar	Oct (261)	
September 17, 1975		Dec	Apr	Nov (396)
	March 18, 1976	May	Oct (210)	

*Exceptions in parentheses.

Table 3. Weed cover (percent) 60 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the clay site, Bryan, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment 10-1-74	11-20-74	1-29-75	3-2375	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	17cde	13ef	36de	3b	2c	1b	3cd	6b
Picloram	1.12	3e	6f	3g	0b	0c	0b	0d	2b
Picloram	2.24	0e	0f	0g	0b	0c	0b	0d	0b
Tebuthiuron	0.37	50ab	29de	39d	43a	8abc	3b	12abcd	3b
Tebuthiuron	1.12	11de	12ef	14fg	3b	1c	0b	4cd	3b
Tebuthiuron	2.24	0e	6f	9fg	0b	0c	0b	1d	0b
Pellet									
Picloram	0.37	47ab	64abc	70ab	58a	20a	16a	17ab	4b
Picloram	1.12	36bc	58bc	55bc	43a	3bc	3b	1cd	4b
Picloram	2.24	25cd	33de	22ef	14b	1c	3b	9bcd	3b
Tebuthiuron	0.37	50ab	83a	66ab	63a	16a	17a	21a	13a
Tebuthiuron	1.12	36bc	78ab	63b	42a	8abc	6b	4cd	5b
Tebuthiuron	2.24	11de	49cd	47cd	40a	9abc	0b	5cd	2b
Untreated		66a	75ab	81a	15b	15ab	21a	13abc	18a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 4. Rainfall (cm) near the experimental sites (College Station, Texas, Easterwood Airport) from January 1, 1974, to January 1, 1976

Month	1974		1975		1976	
	Rainfall	Dev. from normal	Rainfall	Dev. from normal	Rainfall	Dev. from normal
January	12.27	5.77	5.46	-1.04	3.00	-3.51
February	.25	-7.70	6.48	-1.47	2.97	-4.98
March	4.60	-1.96	3.68	-2.87	9.30	2.74
April	8.03	-2.51	7.95	-2.59	15.37	4.83
May	3.51	-6.32	24.79	13.69	15.09	3.99
June	2.51	-6.81	5.82	-3.43	7.04	-2.21
July	5.05	-1.45	10.92	4.42	9.65	3.15
August	27.00	20.32	5.13	-1.55	4.45	-2.24
September	25.20	14.55	11.05	.41	8.92	-1.73
October	15.19	7.52	9.86	2.18	14.27	6.60
November	15.21	7.21	2.57	-5.44	9.09	1.09
December	6.63	-1.57	2.82	-5.38	10.59	2.39
Total	126.72	27.13	96.52	-3.07	109.73	10.13

Taken from Climatological Data, U.S. Department of Commerce, National Climatic Center, Federal Building, Asheville, NC. (College Station, Texas, Easterwood Airport)

Table 5. Weed cover (percent) 180 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the clay site, Bryan, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment 10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	61ab	60abc	9ab	0c	2bc	3bc	4bc	33abc
Picloram	1.12	33cde	21d	2b	2c	1c	3bc	3bc	14de
Picloram	2.24	23def	15d	3b	0c	0c	1c	3bc	3e
Tebuthiuron	0.37	75a	49bcd	10ab	3c	0c	3bc	5bc	35ab
Tebuthiuron	1.12	23def	24cd	3b	0c	2bc	0c	4bc	14de
Tebuthiuron	2.24	6f	17d	1b	0c	2bc	1c	0c	0e
Pellet									
Picloram	0.37	71a	87a	10ab	25a	8b	66c	8abc	43a
Picloram	1.12	61ab	62ab	10ab	8abc	2bc	3bc	4bc	24bcd
Picloram	2.24	39cd	47bcd	11ab	2c	3bc	1c	3bc	20bcd
Tebuthiuron	0.37	71a	91a	11ab	22ab	6bc	7ab	14a	25bcd
Tebuthiuron	1.12	61ab	42bcd	16a	13abc	3bc	4bc	9ab	18cde
Tebuthiuron	2.24	45bc	28bcd	8ab	5bc	1c	1c	3bc	20bcd
Untreated		15ef	15d	15a	13abc	18a	11a	8bc	42a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 6. Bermudagrass cover (percent) 365 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the clay site, Bryan, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment 10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	*0.37*	*28c*	*70a*	*15a*	*40ab*	*35ab*	*52a*	*48a*	*50ab*
Picloram	1.12	18c	-	37a	37ab	18b	55a	30a	20ab
Picloram	2.24	75ab	77a	47a	22b	25ab	30a	42a	17ab
Tebuthiuron	*0.37*	*33c*	*75a*	*35a*	*42ab*	*38ab*	*50a*	*60a*	*53ab*
Tebuthiuron	1.12	15c	-	42a	50ab	33ab	57a	28a	28ab
Tebuthiuron	2.24	90a	55a	40a	47ab	22ab	30a	35a	10b
Pellet									
Picloram	0.37	45bc	53a	37a	40ab	12b	10a	20a	45ab
Picloram	1.12	45bc	57a	32a	77a	13b	23a	52a	43ab
Picloram	2.24	28c	40a	38a	42ab	7b	33a	65a	40ab
Tebuthiuron	0.37	52abc	63a	30a	58ab	13b	5a	30a	60a
Tebuthiuron	1.12	50bc	35a	18a	52ab	20ab	30a	62a	40ab
Tebuthiuron	2.24	43bc	55a	48a	45ab	12b	43a	65a	30ab
Untreated		49bc	66a	48a	53ab	55a	38a	38a	38ab

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 7. Weed cover (percent) 60 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment							
		10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	41bc	44de	25ef	10cd	1b	4bc	3bc	3bc
Picloram	1.12	12d	17f	26ef	8cd	2b	1c	3bc	3bc
Picloram	2.24	14d	11f	23f	2d	1b	2c	2bc	3bc
Tebuthiuron	0.37	39c	50cde	20f	18bcd	1b	3c	3bc	2bc
Tebuthiuron	1.12	34cd	30ef	25f	4d	3b	3c	3bc	3bc
Tebuthiuron	2.24	20cd	11f	14f	2d	6b	5bc	7b	0c
Pellet									
Picloram	0.37	72a	69bc	68b	58a	3b	5bc	4bc	3bc
Picloram	1.12	61ab	66bc	47cd	23bcd	3b	4bc	3bc	3bc
Picloram	2.24	39c	43de	31def	23bcd	1b	3c	0c	5b
Tebuthiuron	0.37	75a	72bc	72ab	67a	4b	9b	4bc	5b
Tebuthiuron	1.12	66a	75b	61bc	33bc	3b	7bc	3bc	3bc
Tebuthiuron	2.24	33cd	61bcd	45cde	9cd	3b	1c	4bc	3bc
Untreated		78a	96a	89a	35b	35a	22a	17a	13a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 8. Weed cover (percent) 180 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment							
		10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	58bcd	49abcd	3b	7bc	5bc	13b	13b	14cde
Picloram	1.12	41de	13ef	4b	2cd	2c	7b	10b	8e
Picloram	2.24	30ef	13ef	8b	5bcd	10ab	8b	9b	6c
Tebuthiuron	0.37	61bc	63abc	2b	7bc	3c	11b	12b	23bcd
Tebuthiuron	1.12	56cd	11ef	2b	0d	3c	6b	5b	13de
Tebuthiuron	2.24	22f	4f	1b	5bcd	3c	7b	5b	7e
Pellet									
Picloram	0.37	81a	68a	4b	7bc	6bc	13b	15b	28b
Picloram	1.12	69abc	66ab	3b	7bc	6bc	10b	12b	25bc
Picloram	2.24	69abc	26def	6b	5bcd	5bc	13b	7b	13de
Tebuthiuron	0.37	77ab	64ab	3b	7bc	4bc	14b	15b	33b
Tebuthiuron	1.12	66abc	38bcde	6b	8b	3c	10b	15b	27b
Tebuthiuron	2.24	66abc	13ef	6b	2cd	3c	9b	13b	13de
Untreated		35ef	35cde	35a	19a	13a	32a	28a	44a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 9. Weed cover (percent) 365 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment 10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	7bc	3bc	15b	27bc	40bc	8a	7a	8a
Picloram	1.12	3bc	0c	12b	15cd	43bc	5a	12a	8a
Picloram	2.24	7bc	0c	13b	11d	18d	5a	5a	5a
Tebuthiuron	0.37	10b	3bc	16b	28bc	43bc	8a	7a	8a
Tebuthiuron	1.12	2c	2c	10b	18bcd	33bcd	5a	8a	10a
Tebuthiuron	2.24	8bc	0c	12b	32b	50b	5a	5a	7a
Pellet									
Picloram	0.37	10b	2c	8b	30b	37bc	13a	5a	8a
Picloram	1.12	7bc	0c	12b	25bcd	43bc	7a	13a	8a
Picloram	2.24	5bc	2c	12b	25bcd	40bc	13a	8a	5a
Tebuthiuron	0.37	7bc	8b	10b	28bc	40bc	8a	7a	8a
Tebuthiuron	1.12	8bc	3bc	15b	27bc	30cd	5a	13a	7a
Tebuthiuron	2.24	7bc	3bc	8b	27bc	27cd	7a	7a	5a
Untreated		17a	14a	28a	44a	72a	9a	9a	9a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 10. Bermudagrass cover (percent) 60 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment 10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	60cde	63abc	58a	52bc	76a	53a	70ab	82a
Picloram	1.12	18g	79a	48abc	22de	64ab	55a	55bcd	78a
Picloram	2.24	32g	77ab	65a	8e	48b	45a	45cd	78a
Tebuthiuron	0.37	83abc	63abc	57ab	78a	76a	55a	78a	73a
Tebuthiuron	1.12	84ab	78ab	62a	73ab	77a	53a	58bcd	73a
Tebuthiuron	2.24	76abcd	80ab	67a	40cd	63ab	37a	44d	72a
Pellet									
Picloram	0.37	92a	57bc	46abc	42cd	51b	52a	63abc	77a
Picloram	1.12	54de	69abc	45abc	41cd	50b	48a	59bcd	78a
Picloram	2.24	67bcd	72abc	51abe	14e	47b	47a	62abcd	75a
Tebuthiuron	0.37	93a	58abc	28c	52bc	58ab	53a	64ab	75a
Tebuthiuron	1.12	58de	65abc	53ab	53bc	50b	48a	68ab	78a
Tebuthiuron	2.24	77abcd	73abc	49abc	48c	55ab	45a	80a	73a
Untreated		42ef	54c	33bc	44cd	44b	48a	63abc	73a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 11. Bermudagrass cover (percent) 180 days after a single application of spray or pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of treatment							
		10-1-74	11-20-74	1-29-75	3-23-75	5-27-75	7-1-75	8-1-75	9-1-75
Spray									
Picloram	0.37	28a	50cd	73ab	75a	79a	80a	68a	72a
Picloram	1.12	38a	63bcd	69abc	68a	74ab	73ab	58abc	62a
Picloram	2.24	23a	73abc	63abc	72a	59bc	83a	45cd	67a
Tebuthiuron	0.37	39a	43d	78ab	72a	78a	75ab	68a	66a
Tebuthiuron	1.12	41a	78ab	86a	88a	70ab	58bc	50bcd	62a
Tebuthiuron	2.24	33a	95a	85a	63a	78a	35d	35d	57a
Pellet									
Picloram	0.37	33a	52cd	68abc	88a	76ab	74ab	62abe	66a
Picloram	1.12	28a	43d	59abc	68a	73ab	80a	50abcd	63a
Picloram	2.24	32a	72abc	57b	57a	53c	72ab	60abc	57a
Tebuthiuron	0.37	31a	47cd	65abc	92a	78a	77a	52abc	58a
Tebuthiuron	1.12	26a	63bcd	63abc	63a	78a	72ab	50bcd	60a
Tebuthiuron	2.24	39a	79ab	61abc	62a	76ab	55c	48bcd	67a
Untreated		44a	44d	44c	63a	73ab	68abc	63ab	61a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 12. Weed cover (percent) 60 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the clay site, Bryan, Texas

Herbicide formulation	Rate (kg/ha)	Date of original treatment & retreatment: 10-1-74 3-17-75	11-20-74 5-19-75	1-29-75 7-29-75	3-23-75 9-23-75	5-27-75 12-3-75	7-1-75 12-28-75	8-1-75 1-1-75	9-1-75 3-18-75
Spray									
Picloram	0.37	2b	2d	0b	3b	0b	0b	2c	0c
Picloram	1.12	0b	0d	0b	2b	0b	10b	0c	0c
Picloram	2.24	0b	0d	0b	2b	0b	0b	0c	0c
Tebuthiuron	0.37	23b	3d	0b	17a	2ab	15ab	10c	5c
Tebuthiuron	1.12	0b	2d	0b	0b	0b	13b	0c	0c
Tebuthiuron	2.24	0b	2d	0b	0b	0b	0b	0c	0c
Pellet									
Picloram	0.37	67a	47a	5ab	5b	3ab	17ab	27b	43a
Picloram	1.12	18b	3d	18a	0b	2ab	7b	3c	2c
Picloram	2.24	15b	0d	12ab	0b	2ab	5b	2c	0c
Tebuthiuron	0.37	80a	27b	7ab	17a	8a	18ab	37ab	23b
Tebuthiuron	1.12	17b	12c	3ab	0b	5ab	17ab	12c	2c
Tebuthiuron	2.24	12b	0d	5ab	2b	0b	2b	0c	0c
Untreated		15b	15c	13ab	19a	8a	42a	42a	58a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 13. Weed cover (percent) 180 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the at the clay site, Bryan, Texas

		Date of original treatment & retreatment				
Herbicide formulation	Rate (kg/ha)	10-1-74 3-17-75	11-20-74 5-19-75	1-29-75 7-29-75	3-23-75 9-23-75	5-27-75 12-3-75
Spray						
Picloram	0.37	0c	2c	3a	15cd	0b
Picloram	1.12	8abc	0c	0b	17cd	0b
Picloram	2.24	2bc	0c	0b	0c	0b
Tebuthiuron	0.37	2bc	2c	3ab	18bcd	7b
Tebuthiuron	1.12	0c	2c	0b	3cd	0b
Tebuthiuron	2.24	0c	2c	0b	0d	0b
Pellet						
Picloram	0.37	15ab	7b	3ab	37ab	18b
Picloram	1.12	3bc	3c	3ab	23abc	13b
Picloram	2.24	12abc	0c	2b	10cd	2b
Tebuthiuron	0.37	20a	12ab	3ab	37ab	40a
Tebuthiuron	1.12	3bc	2c	2b	15cd	12b
Tebuthiuron	2.24	5bc	0c	0b	12cd	3b
Untreated		13abc	16a	8a	42a	58a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 14. Weed cover (percent) 60 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of original treatment & retreatment: 10-1-74 / 3-17-75	11-20-74 / 5-19-75	1-29-75 / 7-29-75	3-23-75 / 9-23-75	5-27-75 / 12-3-75	7-1-75 / 12-28-75	8-1-75 / 1-1-76	9-1-75 / 3-18-76
Spray									
Picloram	0.37	7c	3b	2c	2c	7bc	7de	2f	5bc
Picloram	1.12	5c	2b	3bc	0c	0c	3e	8ef	0c
Picloram	2.24	0c	0b	3bc	0c	0c	3e	2f	0c
Tebuthiuron	0.37	17bc	5b	2c	3bc	0c	17cde	17de	13bc
Tebuthiuron	1.12	3c	3b	0c	0c	2c	13cde	3f	2c
Tebuthiuron	2.24	5c	0b	0c	3bc	2c	10cde	2f	2c
Pellet									
Picloram	0.37	63a	5b	8b	5bc	15b	27bc	27bc	2c
Picloram	1.12	33b	3b	2c	5bc	12b	18cde	20cd	17b
Picloram	2.24	12bc	2b	5bc	3bc	12b	5de	10def	5bc
Tebuthiuron	0.37	63a	7b	7bc	8b	13b	37ab	33b	17b
Tebuthiuron	1.12	23bc	3b	3bc	3bc	12b	22bcd	32b	10bc
Tebuthiuron	2.24	8c	2b	3bc	3bc	7bc	3e	20cd	5bc
Untreated		35b	35a	17a	14a	28a	44a	44a	72a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 15. Weed cover (percent) 180 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the at the sandy site, Wellborn, Texas

Herbicide formulation	Rate (kg/ha)	Date of original treatment & retreatment 10-1-74 3-17-75	11-20-74 5-19-75	1-29-75 7-29-75	3-23-75 9-23-75	5-27-75 12-3-75
Spray						
Picloram	0.37	5b	3b	3bc	8efg	12cd
Picloram	1.12	3b	7b	8bc	0g	0d
Picloram	2.24	7b	0b	7bc	3fg	2d
Tebuthiuron	0.37	5b	2b	3bc	15def	17cd
Tebuthiuron	1.12	5b	2b	3bc	2fg	7d
Tebuthiuron	2.24	7b	0b	0c	5fg	0d
Pellet						
Picloram	0.37	3b	2b	10b	27bcd	50b
Picloram	1.12	7b	0b	3bc	28bc	12cd
Picloram	2.24	5b	3b	8bc	18cde	18cd
Tebuthiuron	0.37	3b	3b	10b	38ab	33bc
Tebuthiuron	1.12	10ab	3b	7bc	27bcd	15cd
Tebuthiuron	2.24	5b	3b	5bc	13efg	2d
Untreated		17a	14a	28a	44a	72a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 16. Bermudagrass cover (percent) 60 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

		Date of original treatment & retreatment							
Herbicide formulation	Rate (kg/ha)	10-1-74 3-17-75	11-20-74 5-19-75	1-29-75 7-29-75	3-23-75 9-23-75	5-27-75 12-3-75	7-1-75 12-28-75	8-1-75 1-1-76	9-1-75 3-18-76
Spray									
Picloram	0.37	37bcd	68ab	70abc	87ab	70a	63ab	60ab	35bc
Picloram	1.12	43bc	62ab	70abc	88a	63a	38abc	33ab	37bc
Picloram	2.24	2d	67ab	80abc	87ab	72a	27bc	35ab	38bc
Tebuthiuron	0.37	88a	73ab	95a	80ab	68a	73a	63ab	57ab
Tebuthiuron	1.12	65ab	83a	95a	78ab	68a	32bc	43ab	77a
Tebuthiuron	2.24	18cd	38b	85ab	73ab	65a	12c	17b	28bc
Pellet									
Picloram	0.37	37bcd	57ab	53c	73ab	60a	63ab	67a	17c
Picloram	1.12	33bcd	50ab	70abc	83ab	60a	72a	62ab	33bc
Picloram	2.24	18cd	65ab	58bc	78ab	60a	53ab	63ab	10c
Tebuthiuron	0.37	57abc	60ab	77abc	72b	57a	60ab	43ab	39bc
Tebuthiuron	1.12	60ab	60ab	75abc	80ab	57a	60ab	57ab	78a
Tebuthiuron	2.24	30bcd	80a	55bc	77ab	47a	30bc	60ab	28bc
Untreated	-	39bcd	43b	63bc	73ab	63a	61ab	61ab	27bc

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

Table 17. Bermudagrass cover (percent) 365 days after two applications 6 months apart of spray and pelleted picloram or tebuthiuron at three rates at the sandy site, Wellborn, Texas

		Date of original treatment & retreatment							
Herbicide formulation	Rate (kg/ha)	10-1-74 3-17-75	11-20-74 5-19-75	1-29-75 7-29-75	3-23-75 9-23-75	5-27-75 12-3-75	7-1-75 12-28-75	1-1-75 1-1-76*	9-1-75 3-18-76+
Spray									
Picloram	0.37	77a	30d	75b	63abc	53a	60a	60a	53a
Picloram	1.12	77a	50b	-	-	53a	57ab	47ab	63a
Picloram	2.24	68a	60a	85a	70ab	50a	47ab	25ab	70a
Tebuthiuron	0.37	77a	30d	65a	57abc	53a	53ab	53a	57a
Tebuthiuron	1.12	55ab	15e	-	-	43a	53ab	43ab	70a
Tebuthiuron	2.24	35b	30d	80ab	75a	60a	47ab	18b	50a
Pellet									
Picloram	0.37	67a	30d	50d	50abc	40a	37bc	57a	60a
Picloram	1.12	72a	40c	-	47abc	47a	47ab	53a	57a
Picloram	2.24	68a	37c	10f	63abc	47a	43ab	50ab	43a
Tebuthiuron	0.37	67a	30d	53d	43bc	40a	37bc	50ab	70a
Tebuthiuron	1.12	60a	25d	-	43bc	50a	43ab	47ab	60a
Tebuthiuron	2.24	57a	30d	40e	60abc	40a	23c	60a	40a
Untreated		61a	27d	37e	37c	37a	37bc	37ab	37a

Means within each column followed by the same letter do not differ significantly at the 5 percent level using Duncan's multiple-range test.

* Evaluated 261 days after treatment.

\+ Evaluated 210 days after treatment.