EFFECT OF TWO PREEMERGENCE HERBICIDES ON THE GERMINATION AND GROWTH OF FOUR SEEDED BERMUDAGRASSES (*CYNODON DACTYLON* (L.) PERS.)

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CHAPTER I

INTRODUCTION

In the construction or renovation of highways there is a need to protect the exposed soil from erosion. Using present construction methods, commonly the soil in high areas is removed or "cut" and moved to the adjacent low areas.

One problem arising from this construction is the establishment of erosion-resistant ground covers on steeply sloped sections of highway rights-of-way. The problem is not only one of establishment, but also one of maintenance. Slopes of bare soil are extremely susceptible to erosion. Thus if maintenance of sloped rights-of-way is to be achieved, then some protection against erosion must be provided.

For large areas the most economical protection generally is the establishment of a vegetative ground cover. Good ground covers should be both rapid in establishment and have a low habit of growth. On sites where it is well adapted, bermudagrass (<u>Cynodon</u> <u>dactylon</u> (L.) Pers.) fits these specifications well. In the past, however, bermudagrass was established by vegetative sprigs. This method is expensive and the sprigs, as mulch sod, are becoming more difficult to obtain. The use of seed in stand establishment would be more advantageous, and probably more economical.

Weeds competing for both moisture and nutrients, have seriously reduced seeded bermudagrass stands. Therefore, weed competition must be eliminated if at all possible to insure a full, quick cover of bermudagrass.

The objectives of this study are (1) to evaluate preemergence herbicide materials for their phytotoxicity toward each type of seeded bermudagrass, (2) to determine if the selected herbicides significantly control weeds in a stand of seedling bermuda, and (3) to determine the extent of resistance if any, to weed invasion by any of the seeded bermudagrasses.

CHAPTER II

REVIEW OF LITERATURE

An excellent job is being done in stabilizing and beautifying interstate and primary highways Turelle (1972) stated. Much remains to be done on secondary roads, however. This is in addition to the usual roadside development needed after completion of highway construction. Turelle found 12,000 miles of secondary roads that needed some erosion control work in one state and 9,000 miles in another state that needed treatment. Huffine et al. have determined that over $4 million are spent each year in Oklahoma for highway erosion control. The cost per mile for the erosion control increased approximately 45 percent from 1965 to 1966. These costs continue to rise from year to year.

The need for soil stabilization practices is well illustrated by damage caused in a single storm. Diseker and Richardson (1962) measured a 62 percent runoff from bare soil and soil losses of almost 85 cubic yards per acre from a single storm of 27 inches of intensive rainfall on a highway cut slope. The slope was 2.5:1.

An increase of 2 percent in slope steepness, that is from 6 to 8 percent more than doubles the soil losses according to Krusekopf (1953). He also concluded that cover is the most important factor affecting runoff and erosion. Regardless of the degree or length of a slope and the duration or intensity of rainfall, soil and water losses was lowest whenever the ground was covered with vegetation.

On slopes 90 feet long, which were continuously cropped to corn, Krusekopf measured soil losses for 10 years. The average soil loss on the 6.0 percent slopes was 70.88 tons per acre per annum, while the 8.48 percent slopes showed an annual average loss of 123.3 tons per acre.

Length of slope was probably the least significant of factors affecting runoff and erosion. This is most apparent under conditions of good ground cover.

Characteristics that are required of good ground cover materials have been developed by several researchers. According to Jackobs et al. (1967), grass and legume species are suitable for roadside turf if they meet the following criteria: 1) they establish rapidly to prevent undue erosion, 2) possess the ability to maintain themselves, 3) have growth habits and other characteristics which permit ease in mowing, 4) show no evidence of weed-like characteristics, and 5) demonstrate an ability to grow on poor soils. Cut slopes often have exposed C and D soil horizons which are similar to badly eroded soils where B horizons with unfavorable physical and chemical characteristics are exposed.

Some of these characteristics and others were listed as necessary for ground covers, by Astrup (1951). In his opinion to provide good soil protection, the following conditions must be met: 1) plants must have the ability to thrive under the existing conditions of soil, moisture, and exposure; 2) mat forming plants, or those that spread from suckers or shoots, should be given preference as they are normally more effective in holding the soil in place; 3) rapid growing species should be chosen since they provide earlier protection; 4) plants producing the most litter are most effective in controlling erosion; 5) when woody herbaceous plants are desired, evergreens or plants with bushy, dense foliage should be chosen since they afford the greatest protection against both wind and rain; 6) resistance to fire or an ability to recover after burning or cutting are valuable attributes; 7) plants should be resistant to insect diseases; 8) those plants with conspicuous flowers or fruits are susceptible to vandalism and should be avoided; 9) plants which may be so vigorous as to crowd out more desirable species, or become a weed to agricultural crops, should be avoided; 10) those plants which are secondary host to economically important diseases or insects are not acceptable; and 11) such plants which are toxic to man or animal should not be used.

Bieber et al. (1969) recommended common bermudagrass (Cynodon dactylon), bahiagrass and weeping lovegrass (Eragrostis curvula) for use on Mississippi highways. Both weeping lovegrass and bahiagrass do well in low maintenance areas while bermudagrass needs periodic nitrogen fertilization to maintain a good stand. Recommended seeding rates are 20 pounds per acre for either bermudagrass or lovegrass and 50 pounds per acre for bahiagrass. When bermudagrass is sprigged, a rate of 80 bushels per acre is recommended. Sprigged bermudagrass, however, seems to be used when seeded bermudagrass would do as well with less cost involved, they reported. In the past, sprigged bermuda has succeeded when seeded bermudagrass has failed but this success is generally associated with better seedbed preparation, irrigation and a higher level of maintenance according to Bieber et al. The seeded bermudagrass was planted, then forgotten, they said. Contractors seem to take more care with sprigs since more cost is involved with resprigging (Buber et al. 1969).

Huffine et al. (1974) found bermudagrass responded to the warmer temperatures of south facing cut slopes in northcentral Oklahoma and provided slightly more protection from soil erosion the year after seeding then did weeping lovegrass. Bermudagrass on north facing slopes, however, showed a decline in plant population while weeping lovegrass increased more than 55 percent. It was concluded that bermudagrass is best adapted for use east of U.S. 81 in Oklahoma on south, east or west facing slopes on clayey, shallow to very shallow, basic soils.

Numerous investigations have been initiated to determine optimum seeding rates and dates for bermudagrass. Tabor (1962) recommends seeding common bermudagrass or weeping lovegrass in the spring with a heavy application of fertilizer. Duell (1968) found spring seeding better than fall in areas where bermudagrass is adapted.

In an experiment to determine the stand establishment ability of various bermudagrasses, Ahring et al. (1975) observed that stands of common bermudagrass established from seed produced good top growth and cover the first year, but winter-kill was extremely high and the plants were slow to recover in the spring. Visual estimates of percent cover taken approximately 1 year after establishment showed significant differences for date of planting, strain, and strain-by-date effects on survival. Plots from planting dates of April 5, May 9 and 25, and June 8 showed approximately 80 percent ground cover for common bermudagrass, while another bermuda, A-9945, achieved 100 percent cover. Plots from plantings on July 6 and 21 showed a ground cover of 40 and 5 percent respectively for common, while A-9945 provided 95 and 90 percent ground cover.

In another experiment, Ahring et al. (1974) crossed 7 strains of bermudagrass with an Oklahoma common identified as Guymon, to measure the seed yields of the resulting F_1 hybrids. Seed yields fell into 3 groups low, medium, and high. Hybrids of strains 10978, 9945, and 9959, yielded more seed than the other hybrids. The mean seed yields in kilograms per hectare (kg/ha) were 559 for 1971 and 247 for 1972. Hybrids, Guymon X 9945, Guymon X 9959, and Guymon X 10978 yielded 795, 1089, and 794 kg/ha for 1971, respectively and 628, 466, and 179 for 1972.

As of this time, there have been few herbicide materials tested for preemergence weed control on seeded bermudagrass. In other agronomic crops, however, this is not the case. In cases where bermudagrass sprigs or established bermudagrass turf was treated the degree of herbicide phytotoxicity was indicated (Johnson, 1976; Peeper and Santelmann, 1969).

In a greenhouse study, Bingham (1967) grew bermudagrass sprigs in pots. When the stolons were long enough, they were layed across flats of treated soil that were placed next to the pot. The fresh weights of stolons and roots harvested from flats of untreated soil were 21.7 and 16.0 grams per pot, respectively. Flats treated with siduron at 9 pounds per acre, however, only produce 5.8 grams per pot of stolons and had less than 0.1 grams of roots.

Dunn et al. (1972) sprayed eight experimental selections of bermudagrass with siduron at the rate of 12 pounds per acre. This spraying was done two days after plugs were planted on one foot centers in 5 by 10 plots. After 50 days the siduron treated plots had only half the cover of the check plots. This injury was judged moderate to severe. Although some of the treated plots did not overwinter well, they recovered completely by the following fall.

To determine if climate affected the phytotoxicity of siduron, DeMur et al. (1973) grew bermudagrass in nutrient solutions containing 0, 1, and 5 ppm of siduron. These were then placed in environmental control chambers under two light intensities and two temperature regimes. Growth was reduced in all siduron concentrations at all light intensities and temperatures. Shoots were reduced more than roots. Only at the higher concentrations of siduron were roots significantly inhibited.

Younger et al. (1974) controlled bermudagrass seedlings in cool season turf at relatively low rates of siduron. The control of established bermudagrass, however, required higher rates which can be toxic to cool season turf.

Oxadiazon at 3.4 and 4.5 (kg/ha) was applied to established bermudagrass plots for four consecutive years. In this study Johnson (1976) found both rates delayed "green-up" one spring, but not in any of the other years. Turf quality and density was not affected by either rate for any of the four years.

In May, 1972, McCall (1973) applied siduron at 0.5 and 1.0 pound active ingredient per acre (lb ai/acre) to sown bermudagrass seed. After 90 days the mean count of plants showed no differences between the 0.5 pound rate and the untreated control. The 1.0 pound rate had only one half as many plants as the check.

Talbert and Frans (1971) on a Taloka silt loam, applied Bay 94337 (metribuzin) at 0.5 and 1 lb ai/acre, preemergent to soybeans. Selective control of barnyardgrass (Echinochloa crusgalli), giant foxtail (Setaria faberii), goosegrass (Eleusine indica), large crabgrass (Digitaria sanguinalis), and seeded johnsongrass (Sorghum halepense) was shown at the 0.5 pound rate. The one pound rate, however, severely damaged the soybeans.

Bay 94337 (metribuzin) was used for three years in potatoes at 1.0 pound per acre on clay loam and silt loam soils, both of which had less than one percent organic matter. Timdahl (1971) observed 90 to 100 percent control of all annual broadleaf and grassy weeds including black nightshade (Solanum nigrum L.). There was no apparent toxicity to the potatoes.

Aitken and Arnold (1972) found significant control of bermudagrass at 11 and 23 weeks when metribuzin was applied at 6.0 pounds per acre. The application was to established bermudagrass in a pecan orchard.

In 1976, Johnson applied metribuzin at 2.0 pounds per acre and oxadizon at 3.0 pounds per acre on four dates to bermudagrass turf in two locations. Plots were evaluated for crabgrass control (Digitaria sanguinalis (L.) Scop.). Excellent crabgrass control was obtained at both locations and at all dates with oxidiazon. Metribuzin, however, showed consistantly poor control for all plots.

Metribuzin at 1.1 kilogram per hectare applied preemergent in soybeans by McWhorter and Anderson (1976) gave 80% cocklebur control as compared to the check.

Savage (1977) reported that metribuzin is degraded rapidly in soil, with a rapid initial rate, followed by a less rapid rate after 3 to 4 weeks. The half-life values as tested by bioassy ranged from 25 days for a Bosket sandy loam to 17 days for Sharkey clay. Microbiological activity appears to play a significant role in the degradation.

On an Arkansas Taloka silt loam, Frans et al. (1965) treated cotton and soybeans with a preemergence application of GS-14260 (terbutryn). Rates of 2, 3, and 4 pounds active ingredient per acre were used. All plots were rated on a scale of 1 to 10, with 10 designating total weed control. All rates in cotton had scores of 9.7 or better for both broadleaf and grass weeds. Severe cotton injury was seen at the 3 and 4 pound rates. Ratings of 9.8 or better were given for both broadleaf and grass weed control in soybeans at all rates. Little or no injury occurred to the soybeans.

Peeper and Santelmann (1969) in an experiment conducted in a greenhouse, planted rhizomes of two forage-type bermudagrasses in pots of sandy loam soil. After planting, but before the initiation of any new growth, GS-14260 (terbutryn) was applied at rates of 1.5 and 3 pounds per acre. Results were determined by visual ratings of 0 to 10 with total kill being 10, and dry weight yields of stolon growth. Crop injury was rated at 0 and 2 for the 1.5 and 3 pound rates, respectively, and neither rate had a significant change in yield when compared with an untreated check.

To evaluate several herbicides for their ability to control fall panicum (Panicum dichotomiflorum) in corn, Pruss (1969) applied Igran (terbutryn) three days after planting. Rates of 2 and 4 pounds per acre were applied to a site that was plowed and disked. Heavy rains the day of planting created wet soil conditions. There were some early signs of toxicity to corn at the four pound rate, but the yield showed no net effect. On a scale of 0 to 10 to evaluate weed control, the two pound rate had a mean score of 9.0, while the four pound mean was 9.7.

To control annual weeds in wheat fallow, Kukas et al. (1972) applied Igran (terbutryn) at one and two pounds per acre and Sencor (metribuzin) at one and three pounds per acre. The weeds present were kochia (*Kochia scoparia* (L.) Roth), tumbling mustard (*Sisymbruim altissimum* L.), redroot pigweed (*Amaranthus retroflexus* L.), wild oats (*Avena fatua* L.), and downy bromegrass. Three months later the weeds were harvested from all plots and weighed for comparison. The check plots contained an average of 2180 pounds of weeds per acre. Igran at one pound averaged 1860 pounds and 1093 pounds for the two pound rate. Sencor had a mean of 1420 and 50 pounds of weeds per acre for the one and three pound rates, respectively.

McHenry et al. (1972) used terbutryn in an evaluation of soil-active herbicides for short term weed control in non-crop situations. Rates of one, two, and three pounds per acre were applied preemergence in a recently tilled housing lot. Only the three pound rate showed any significant weed control.

CHAPTER III

METHODS AND MATERIALS

Greenhouse Study

A preliminary screening of several herbicide materials was conducted at the Agronomy Research Station at Stillwater, Oklahoma. Four herbicides, each at four concentrations were applied to three bermudagrass hybrids (*Cynodon dactylon* (L.) Pers.) in two soil types. Untreated hybrids in each soil type were included in the experiment to be used as a standard.

The herbicides, chemical names, formulations, and rates expressed as kilograms of active ingredient per hectare (kg ai/ha) and pounds per acre (lb ai/acre) used as shown in Table I. The bermudagrass seed used were F_1 generation hybrids of crosses between an Oklahoma common strain locally referred to as "Guymon", and three introduced strains, 9959, 9945, and 10978. They originated in Yugoslavia, Turkey and Israel, respectively. Percent germination for Guymon X 9959, Guymon X 9945, and Guymon X 10978 seed was 66, 57, and 70 percent, respectively. Soil types used in this study were a silt loam with a pH of 6.1, and a loamy sand with a pH of 6.3 and 0.3 percent organic matter.

Four inch waxed paper cups with an opening of 67 mm were three quarters filled with soil. On February 24, 1977, 25 bermudagrass seeds were placed on the surface and covered with one quarter inch of soil.

TABLE I

HERBICIDES, CHEMICAL NAMES, FORMULATIONS, AND RATES USED TO DETERMINE PHYTOTOXICITY ON THREE BERMUDAGRASS HYBRIDS ON TWO SOIL TYPES

Herbicide	Chemical Name	Formulation*	Application Rates	
			kg ai/ha	lb ai/a
Metribuzin	4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)one	50 WP	2.26,3.73,5.20,6.78	2.0,3.3,4.6,6.0
Oxadizon	2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-1,3,4-oxadizolin-5-one	25 EC	0.79,2.03,3.28,4.52	0.7,1.8,2.9,4.0
Siduron	1-(2-methylcyclohexyl)-3-phenylurea	50 WP	0.23,0.34,0.45,0.57	0.2,0.3,0.4,0.5
Terbutryn	2-(tert-butylamino)-4-(ethylamino)-6-methylthio)-s-triazine	80 WP	0.90,1.47,2.03,2.71	0.8,1.3,1.8,2.4
Check	- - -	- - -		

*WP - wettable powder; EC - emulsifiable concentrate

Herbicides were immediately applied in water at the rate of 40 gallons per acre in a single nozzle spraying chamber. An 8004 nozzle tip was used to apply the herbicide at two miles per hour and a pressure of 20 pounds per square inch.

All cups were placed on wire screens suspended approximately three feet off the floor. A randomized complete - block design with four replications was used. All replications were bordered with one row of soil filled cups. Water was applied from the top with caution to avoid splashing soil. This watering occurred daily until the treatments were evaluated.

On March 15, 1977, the number of seeds that had germinated and were growing was recorded.

Field Experiment

A site for the field experiment was selected from an area of recent highway construction. The experiment was located on State Highway 51, on a south facing cut slope, approximately 5.7 miles west of Stillwater. The slope grade averages 14 degrees. The soil is a Stephensville-Darnell eight approx. complex, with a sandy loam texture. Tilling operations consisted of chiseling, and then disking the top four inches of soil.

A split plot design was used with three replications. Main plots were bermudagrasses in plots 45 feet wide and ran from the top to the bottom of the slope. This averaged 58 feet. Sub-plots were herbicides in plots nine feet by approximately 58 feet. The treatments and rates of both main and sub-plots are shown in Table II. All plots were

TABLE II

RATE OF SEEDING, AND GERMINATION PERCENTAGE OF FOUR BERMUDAGRASS USED TO EVALUATE PHYTOTOXICITY OF TWO HERBICIDES, EACH APPLIED AT TWO RATES

MAIN PLOTS Bermudagrasses	Percent Germination	Bulk Planting Rate lbs/Acre
Guymon X 9959	66	18.5
Guymon X 9945	57	18.5
Guymon X 10978	70	18.5
Common Bermudagrass	89	18.5

SUB-PLOTS			Application Rates	
Herbicide	Chemical Name	Formulation	kg ai/ha	lb ai/a
Terbutryn	2-(tert-butylamino)-4-(ethylamino)-6-methylthio)-s-triazine	80 WP	1.36,2.71	1.2,2.4
Metribuzin	4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)one	50 WP	.212,.424	0.188,0.375
Check	- - -	- - -	- - - - -	- - - - -

seeded on May 3, 1977, with a three and a half foot "Gandy" drop-type spreader. Seeding was done across the slope.

Herbicides were applied on May 7, 1977, with a three nozzle boom sprayer, mounted on an International Harvester "A" tractor, traveling at 1.5 miles per hour. A rate of 40 gallons per acre was achieved with TKSS3 flood tips and pressure of 22 pounds per square inch. The direction of spraying was up the slope.

All the moisture the plots received was from rainfall. Appendix Table XIV shows the daily precipitation from data collected two miles from the site, at the Stillwater Hydraulic Laboratory.

To evaluate any possible phytotoxic effects, seedling counts were taken on June 14, 1977. A one-quarter square foot quadrant was randomly placed in each plot, and the enclosed bermudagrass seedlings were counted. This procedure was replicated ten times for each plot. Phytotoxic effects were further evaluated on July 20, 1977, and August 17, 1977, however, at these dates the sub-plots in each replication were ranked from one to twenty by visual estimation. The number one plot had the least dense cover and number 20 was the most dense. This change in procedure was necessary because individual bermudagrass plants were indistinguishable.

An evaluation of weed control was also made on July 20, 1977, and August 17, 1977. A one square foot quadrant was randomly placed in each sub-plot and a count of grassy weeds and broadleaf weeds was taken. This procedure was replicated ten times for each sub-plot.

Weed species present were identified and are listed in Appendix Table XV.

CHAPTER IV

RESULTS AND DISCUSSION

Greenhouse Experiment

The data collected on March 15, 1977, was statistically analyzed as a four factor factorial experiment in a randomized complete block design. Herbicides used, their concentrations, soil types, and bermudagrass hybrids were the four factors.

The seedling counts for the untreated checks were analyzed separately. Appendix Table XX shows the analysis of variance for check plots. Significant differences, at a the 5 percent level, in seedling numbers were found among bermudagrass hybrids. Guymon X 10978 had a mean of 7.125 seedlings per cup, while the means for Guymon X 9945 and Guymon X 9959 were 3.125 and 3.374, respectively.

The analysis of variance on seedling counts for herbicide treatments is shown in Appendix Table XXI. Seedling count means for herbicides, soil types, bermudagrass hybrids, and herbicide x soil type interactions had significant differences.

Herbicide treatment means and mean comparisons using the least significant differences at a 5 percent level are shown in Table III. The number of bermudagrass seedlings observed in the siduron treatments was significantly lower than terbutryn.

All counts involving oxadizon treatments were deleted from the analysis because of almost complete seedling phytotoxicity. Out of a possible 2400 seedlings only two seeds germinated. Oxadizon, therefore, was considered too toxic for further evaluation.

TABLE III

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BERMUDAGRASS SEEDLING COUNTS FOR HERBICIDE TREATMENTS IN THE GREENHOUSE EXPERIMENT

MEANS	Metribuzin 4.31	Siduron 2.84	Terbutryn 5.58
Metribuzin 4.31	X	1.47	1.27
Siduron 2.84	1.47	X	2.74*
Terbutryn 5.58	1.27	2.74*	X

*Exceeds 5% Level of Significance

$LSD_{.05}$			1.67

A comparison of soil type effect on seedling means by the LSD was not necessary since there were only two means. The silt loam mean was higher than the loamy sand mean.

The analyses of herbicide treatment x soil type interaction on seedling count means showed several significant differences. These means are listed on Table IV. The siduron x loamy sand seedling count means were significantly lower than metribuzin x silt loam, terbutryn x loamy sand, and terbutryn x silt loam means. Metribuzin on a loamy sand resulted in significantly lower seedling count means than either metribuzin x silt loam or terbutryn x silt loam.

Bermudagrass hybrid seedling means are listed in Table V. Guymon X 10978 had significantly higher germinations than either Guymon X 9959 or Guymon X 9945.

An average germination for each cup containing an untreated hybrid was 18 percent. The best hybrid-soil combination was not much better with an average germination of 35 percent. This was a relatively poor stand with seed germination tested in water averaging 65 percent. Germination for herbicide treated cups, however, averaged 17 percent. This was not much lower than the germination found in the untreated checks.

Field Experiment

The statistical analyses of the field experiment data were split into two portions to help clarify the results. Possible phytotoxic effects and weed control ability compose these two portions. In either case the data was analyzed separate for each date of collection. The weed control data was then combined and an analysis of variance was determined.

Due to the change in methods of evaluating phytotoxic effects[1/] two statistical analyses of variance tables for the June 14, 1977 data

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[1/] Refer to Methods and Materials page 16.

TABLE IV

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BERMUDAGRASS SEEDLING COUNTS FOR HERBICIDE X SOIL TYPE INTERACTIONS IN THE GREENHOUSE EXPERIMENT

MEANS	Metribuzin x Silt Loam 5.50	Metribuzin x Loamy Sand 3.12	Siduron x Silt Loam 3.35	Siduron x Loamy Sand 2.33	Terbutryn x Silt Loam 5.71	Terbutryn x Loamy Sand 5.46
Metribuzin x Silt Loam 5.50	X	2.38*	2.15	3.17*	0.21	0.04
Metribuzin x Loamy Sand 3.12	2.38*	X	0.23	0.79	2.59*	2.34
Siduron x Silt Loam 3.35	2.15	0.23	X	1.02	2.36	2.11
Siduron x Loamy Sand 2.33	3.17*	0.79	1.02	X	3.38*	3.13*
Terbutryn x Silt Loam 5.71	0.21	2.59*	2.36	3.38*	X	0.25
Terbutryn x Loamy Sand 5.46	0.04	2.34	2.11	3.13*	0.25	X

*Exceeds 5% Level of Significance

LSD$_{.05}$ 2.37

TABLE V

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BERMUDAGRASS SEEDLING COUNT FOR BERMUDAGRASS HYBRIDS IN THE GREENHOUSE EXPERIMENT

MEANS	Guymon X 9959 2.55	Guymon X 9945 3.77	Guymon X 10978 6.42
Guymon x 9959 2.55	X	1.22	3.87*
Guymon x 9945 3.77	1.22	X	2.65*
Guymon x 10978 6.42	3.87*	2.65*	X
	*Exceeds 5% Level of Significance		
LDS$_{.05}$			1.67

are presented. Appendix Table XXII shows the number of bermudagrass seedlings contained in each randomly placed one quarter foot square quadrant, the total of these ten counts, and a ranking from lowest to highest of this total for each replication.

The analysis of variance presented in Appendix Table XXIII was computed using the totals for each subplot. Significant differences among bermudagrass-type means were found, and highly significant differences were found for both herbicide treatments and bermudagrass type x treatment interactions. A comparison of bermudagrass-type seedling means by a least significant difference test at the 5 percent level (Table VI) shows a significant difference between common bermudagrass and any of the hybrids. There was no difference between the hybrids, however. Herbicide treatment means were compared for any significant differences at the 5 percent level for each bermudagrass type. These comparisons are shown on Table VII. Germination of Guymon X 9959 was significantly lower for terbutryn at 2.4 lb ai/A than terbutryn at 1.2 lb ai/ha, metribuzin at 0.375 lb ai/A, and the check.

The mean seedling count for Guymon X 10978 the terbutryn at 2.4 lb ai/a was significantly lower than either metribuzin treatments. Again, terbutryn at 2.4 lb ai/A was significantly lower than both metribuzin treatments and the check for common bermudagrass. No differences were found among Guymon X 9945 treatment means.

A second analysis of variance Appendix Table XXIV was constructed from this data using the mean rank for each subplot. Since these means are of a non-parametric character, the mean squares were also tested by Friedmans' T test. This was done to help support any differences found by a F test. This second analysis of variance also indicated significant differences between bermudagrass types, treatments, and bermudagrass type x treatment interaction for both the F and Friedman's T tests.

This same method of analysis was applied to the data collected on July 20, 1977, and August 17, 1977. The July 20, 1977, analysis of variance Appendix (Table XXV) showed significant differences among both bermudagrass types and treatments. A Friedman's T test supported

TABLE VI

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BERMUDAGRASS SEEDLING COUNTS OF BERMUDAGRASS TYPES TAKEN ON JUNE 14, 1977

MEANS	Guymon X 9959 17.80	Guymon X 9945 10.07	Guymon X 10978 15.13	Common 26.47
Guymon x 9959 17.80	X	7.73	2.67	8.67*
Guymon x 9945 10.07	7.73	X	5.06	16.40*
Guymon x 10978 15.13	2.67	5.06	X	11.34*
Common 26.47	8.67*	16.40*	11.34*	X

*Exceeds 5% Level of Significance

$LSD_{.05}$ 8.15

these differences among bermudagrass types but not among treatments. A comparison of bermudagrass type seedling means (Table VIII) with the exception of Guymon X 9959 and Guymon X 9945, found significant differences between all combinations. The treatment means for Guymon X 9959 were consistant with the June 14, 1977, data. Significant differences in rank were found between terbutryn at 2.4 lb ai/A and terbutryn at 1.2 lb ai/A, metribuzin at 0.375 lb ai/A, and the check plot. Common

TABLE VII

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BERMUDAGRASS SEEDLING COUNTS OF HERBICIDE TREATMENTS WITHIN EACH BERMUDAGRASS TYPE ON JUNE 14, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai1A 21.00	Terbutryn 2.4 lbs ai/A 8.33	Metribuzin 0.188 lbs ai/A 17.67	Metribuzin 0.375 lbs ai/A 19.67	Check 22.33
Terbutryn 1.2 lbs ai/A 21.00	X	12.67*	3.33	1.33	1.33
Terbutryn 2.4 lbs ai/A 8.33	12.67*	X	9.34	11.34*	14.00*
Metribuzin 0.188 lbs ai/A 17.67	3.33	9.34	X	2.00	4.66
Metribuzin 0.375 lbs ai/A 19.67	1.33	11.34*	2.00	X	2.66
Check 22.33	1.33	14.00*	4.66	2.66	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 13.00	Terbutryn 2.4 lbs ai/A 4.33	Metribuzin 0.188 lbs ai/A 10.00	Metribuzin 0.375 lbs ai/A 12.33	Check 10.67
Terbutryn 1.2 lbs ai/A 13.00	X	8.67	3.00	0.67	2.33
Terbutryn 2.4 lbs ai/A 4.33	8.67	X	5.67	8.00	6.34

TABLE VII (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 13.00	Terbutryn 2.4 lbs ai/A 4.33	Metribuzin 0.188 lbs ai/A 10.00	Metribuzin 0.375 lbs ai/A 12.33	Check 10.67
Metribuzin 0.188 lbs ai/A 10.00	3.00	5.67	X	2.33	0.67
Metribuzin 0.375 lbs ai/A 12.33	0.67	8.00	2.33	X	1.66
Check 10.67	2.33	6.34	0.67	1.66	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 11.67	Terbutryn 2.4 lbs ai/A 4.33	Metribuzin 0.188 lbs ai/A 17.33	Metribuzin 0.375 lbs ai/A 30.33	Check 12.00
Terbutryn 1.2 lbs ai/A 11.67	X	7.34	5.66	18.66*	0.33
Terbutryn 2.4 lbs ai/A 4.33	7.34	X	13.00*	26.00*	7.67
Metribuzin 0.188 lbs ai/A 17.33	5.66	13.00*	X	13.00*	5.33
Metribuzin 0.375 lbs ai/A 30.33	18.66*	26.00*	13.00*	X	18.33*
Check 12.00	0.33	7.67	5.33	18.33*	X

TABLE VII (Continued)

	COMMON				
MEANS	Terbutryn 1.2 lbs ai/A 16.00	Terbutryn 2.4 lbs ai/A 7.67	Metribuzin 0.188 lbs ai/A 29.67	Metribuzin 0.375 lbs ai/A 37.33	Check 41.67
Terbutryn 1.2 lbs ai/A 16.00	X	8.33	13.67*	21.33*	25.67*
Terbutryn 2.4 lbs ai/A 7.67	8.33	X	22.00*	29.66*	34.00*
Metribuzin 0.188 lbs ai/A 29.67	13.67*	22.00*	X	7.66	12.00*
Metribuzin 0.375 lbs ai/A 37.33	21.33*	29.66*	7.66	X	4.34
Check 41.67	25.67*	34.00*	12.00*	4.34	
LSD$_{.05}$					11.16

*Exceeds 5% Level of Significance

TABLE VIII

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN RANK BY DENSITY OF BERMUDAGRASS COVER FOR BERMUDAGRASS TYPE ON JULY 20, 1977

MEANS	Guymon X 9959 11.27	Guymon X 9945 9.47	Guymon X 10978 4.73	Common 16.53
Guymon x 9959 11.27	X	1.80	6.54*	5.26*
Guymon x 9945 9.47	1.80	X	4.74*	7.06*
Guymon x 10978 4.73	6.54*	4.74*	X	11.80*
Common 16.53	5.26*	7.06*	11.80*	X
	*Exceeds 5% Level of Significance			
$LSD_{.05}$				3.88

bermudagrass responses was also similar to the previous data with significant differences between terbutryn at 2.4 lb ai/A and any of the other treatments. The other two hybrids changed from the first evaluation. Significant differences between metribuzin at 0.188 lb ai/A and the check were found for Guymon X 9945. Guymon X 10978 showed no differences. These treatment mean comparisons are shown in Table IX.

TABLE IX

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN RANK BY DENSITY OF BERMUDAGRASS COVER FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES FOR JULY 20, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai/A 13.33	Terbutryn 2.4 lbs ai/A 5.67	Metribuzin 0.188 lbs ai/A 10.33	Metribuzin 0.375 lbs ai/A 14.33	Check 12.67
Terbutryn 1.2 lbs ai/A 13.33	X	7.66*	3.00	1.00	0.66
Terbutryn 2.4 lbs ai/A 5.67	7.66*	X	4.66	8.66*	7.00*
Metribuzin 0.188 lbs ai/A 10.33	3.00	4.66	X	4.00	2.34
Metribuzin 0.375 lbs ai/A 14.33	1.00	8.66*	4.00	X	1.66
Check 12.67	0.66	7.00*	2.34	1.66	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 10.00	Terbutryn 2.4 lbs ai/A 7.33	Metribuzin 0.188 lbs ai/A 6.67	Metribuzin 0.375 lbs ai/A 10.33	Check 13.00
Terbutryn 1.2 lbs ai/A 10.00	X	2.67	3.33	0.33	3.00
Terbutryn 2.4 lbs ai/A 7.33	2.67	X	0.66	3.00	5.67

TABLE IX (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 10.00	Terbutryn 2.4 lbs ai/A 7.33	Metribuzin 0.188 lbs ai/A 6.67	Metribuzin 0.375 lbs ai/A 10.33	Check 13.00
Metribuzin 0.188 lbs ai/A 6.67	3.33	0.66	X	3.66	6.33*
Metribuzin 0.375 lbs ai/A 10.33	0.33	3.00	3.66	X	2.67
Check 13.00	3.00	5.67	6.33*	2.67	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 3.00	Terbutryn 2.4 lbs ai/A 2.67	Metribuzin 0.188 lbs ai/A 6.00	Metribuzin 0.375 lbs ai/A 6.00	Check 6.00
Terbutryn 1.2 lbs ai/A 3.00	X	0.33	3.00	3.00	3.00
Terbutryn 2.4 lbs ai/A 2.67	0.33	X	3.33	3.33	3.33
Metribuzin 0.188 lbs ai/A 6.00	3.00	3.33	X	0.00	0.00
Metribuzin 0.375 lbs ai/A 6.00	3.00	3.33	0.00	X	0.00
Check 6.00	3.00	3.33	0.00	0.00	X

TABLE IX (Continued)

MEANS	COMMON				
	Terbutryn 1.2 lbs ai/A 18.33	Terbutryn 2.4 lbs ai/A 11.00	Metribuzin 0.188 lbs ai/A 17.67	Metribuzin 0.375 lbs ai/A 18.33	Check 17.33
Terbutryn 1.2 lbs ai/A 18.33	X	7.33*	0.66	0.00	1.00
Terbutryn 2.4 lbs ai/A 11.00	7.33*	X	6.67*	7.33*	6.33*
Metribuzin 0.188 lbs ai/A 17.67	0.66	6.67*	X	0.66	0.34
Metribuzin 0.375 lbs ai/A 18.33	0.00	7.33*	0.66	X	1.00
Check 17.33	1.00	6.33*	0.34	1.00	X

*Exceeds 5% Level of Significance

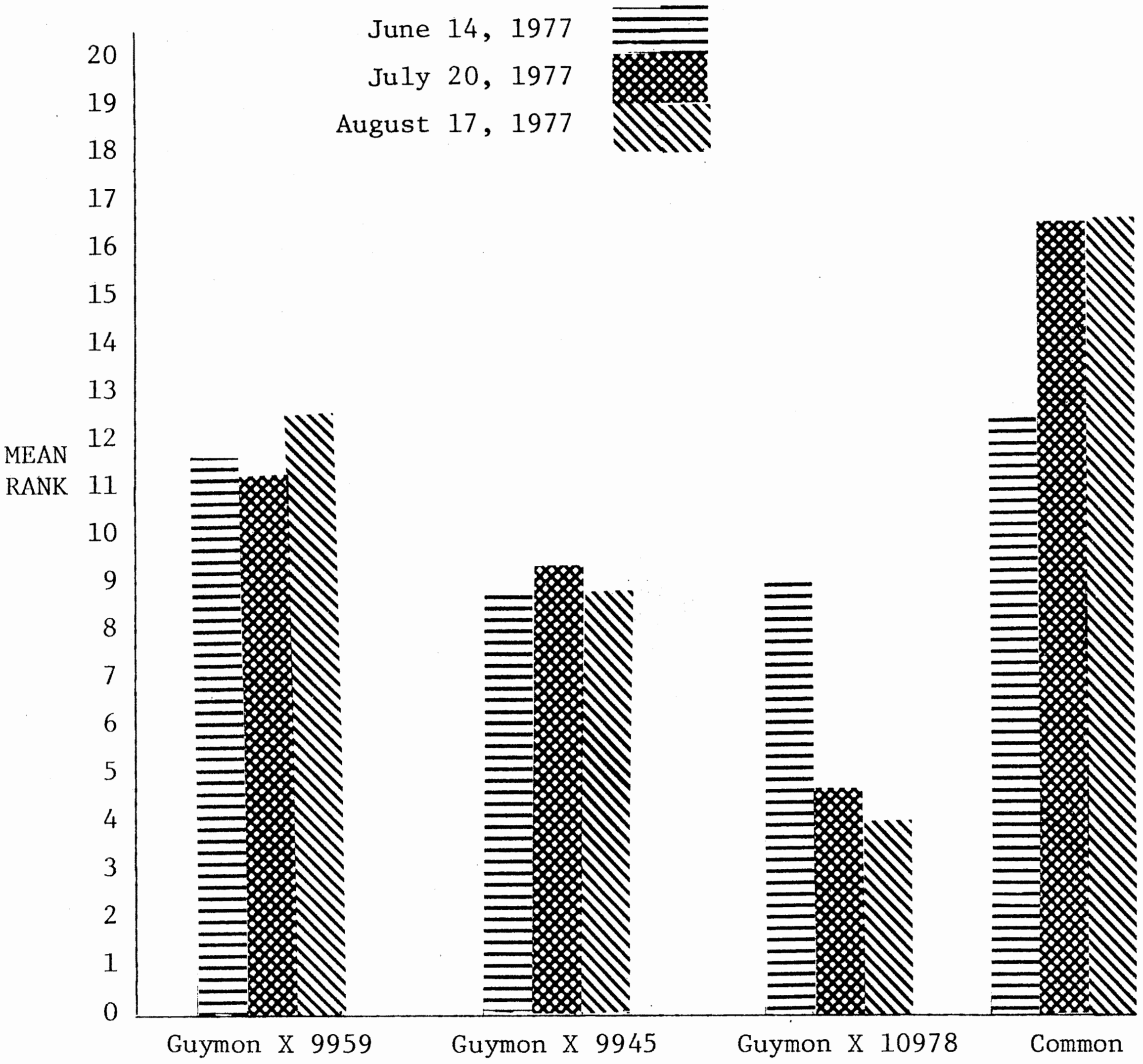
LSD$_{.05}$					6.15

The final evaluation on August 17, 1977, was similar to the July 20, 1977 scoring. The analysis of variance of these data (Appendix Table XXVI) also showed significant differences among bermuda types and treatments. Significant differences were also found among bermudagrass types when tested by Freidman's T. Although the order of magnitude of bermudagrass type means remained the same as the previous evaluation, differences among these means changed (Table X, page 37). Common bermudagrass was ranked significantly higher than both Guymon X 9945 and Guymon X 10978.

Both Guymon X 9959, and Guymon X 9945 showed a change in treatment ranking. Metribuzin at 0.375 lb ai/A was now ranked significantly higher than either terbutryn at 2.4 lb ai/A or metribuzin at 0.188 lb ai/A in the case of Guymon X 9959. For Guymon X 9945 terbutryn at 2.4 lb ai/A was ranked significantly lower than either terbutryn at 1.2 lb ai/A or metribuzin at 0.188 lb ai/A. Guymon X 10978 remained the same as before showing no significant differences among treatments. Common bermudagrass was consistant over all three evaluations with terbutryn at 2.4 lb ai/A resulting in significantly lower seedling numbers than all other treatments except metribuzin at 0.375 lb ai/A. These treatment means are shown in Table XI.

Comparison of bermudagrass type means for phytotoxic effects is illustrated graphically in Figure 1. Graphs of treatment means within each bermudagrass type are shown on Figures 2, 3, 4, and 5.

Appendix Table XXVII contains the analyses of variance for the grass weeds, broadleaf weeds, and total weeds counted for each subplot on July 20, 1977. No significant differences among bermudagrass type means were found for any of the three categories on this date.



BERMUDAGRASS TYPE

Figure 1. Mean Ranks of Bermudagrass Types Evaluated for Density of Cover on Three Dates

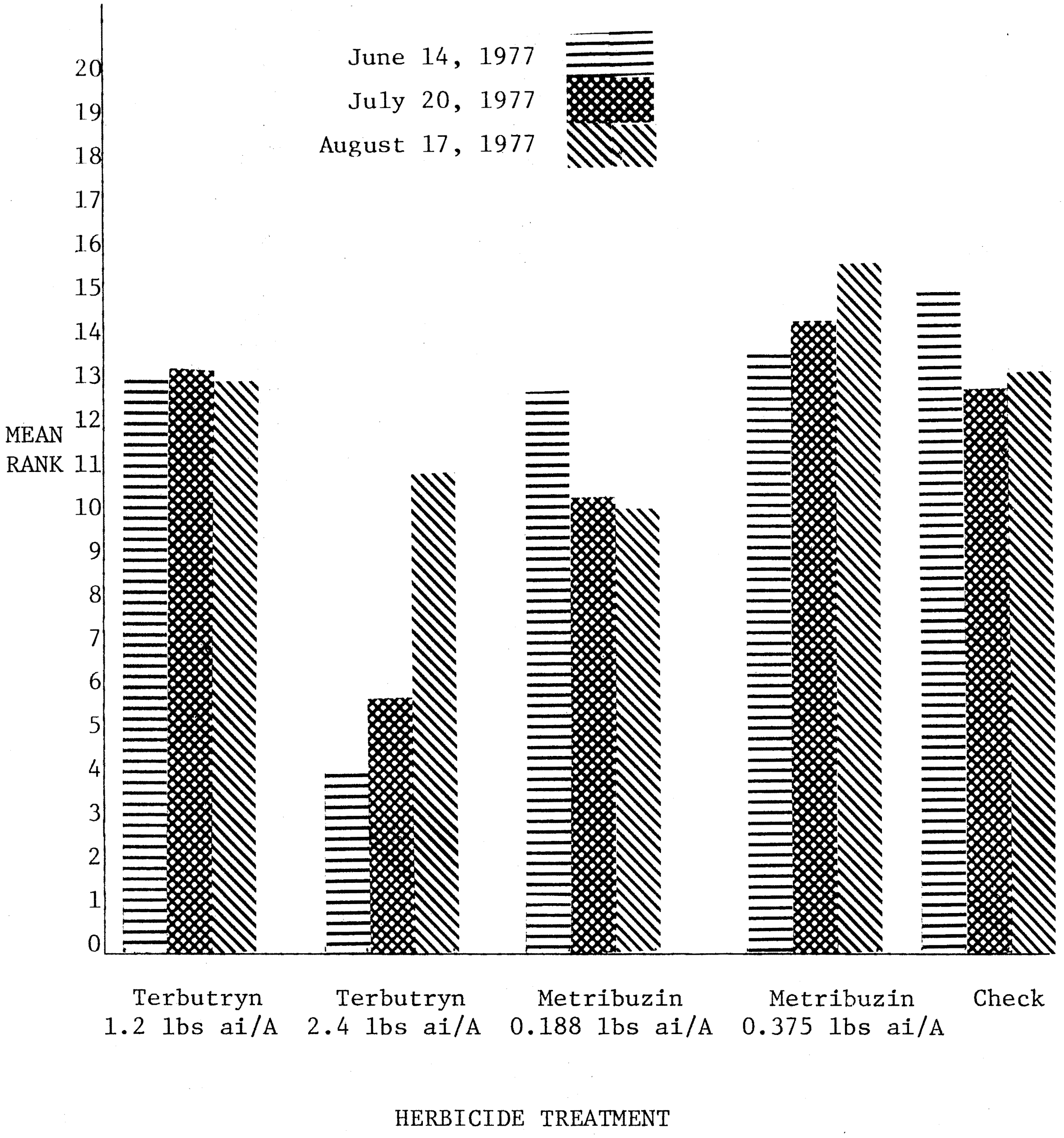
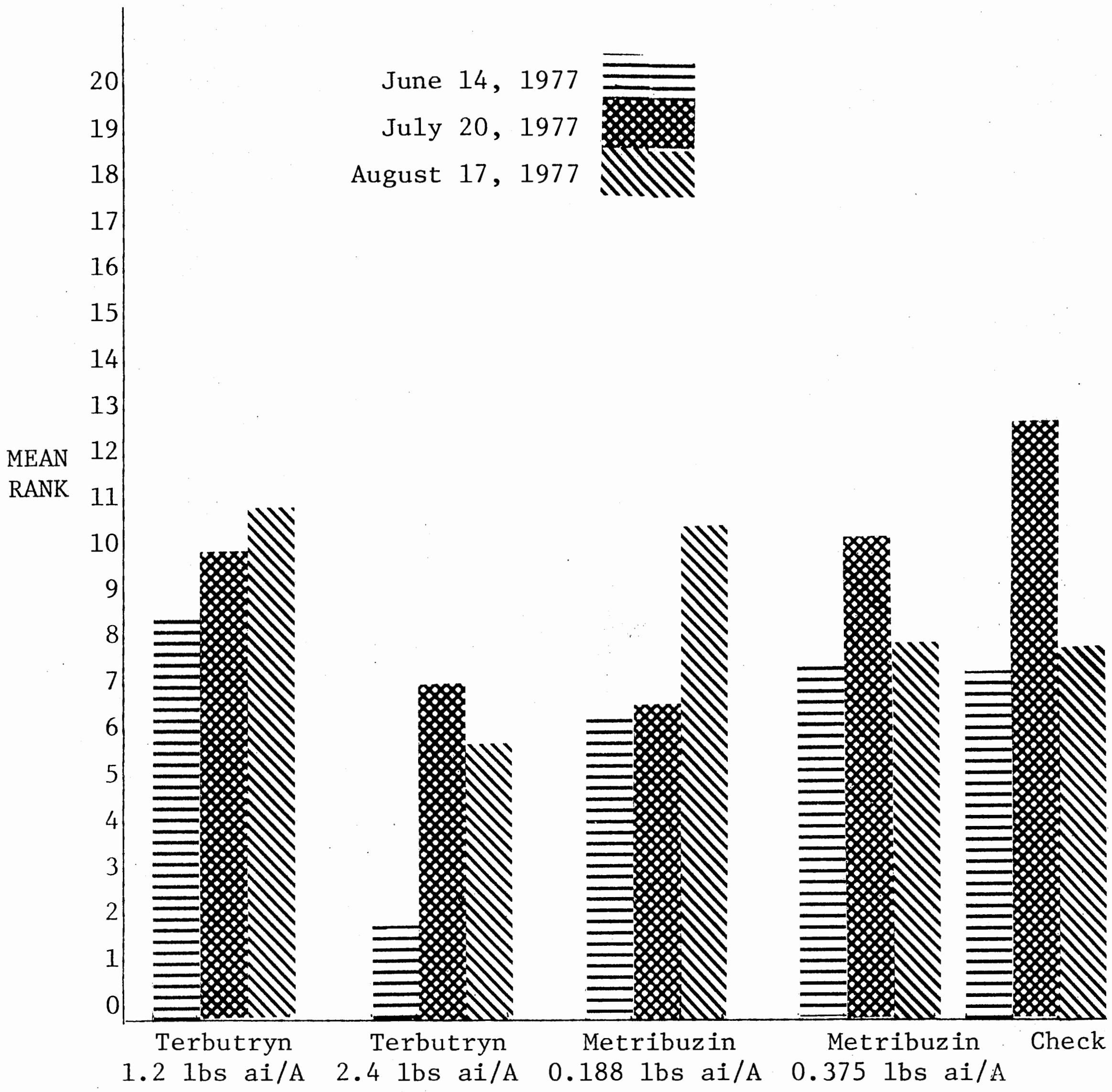
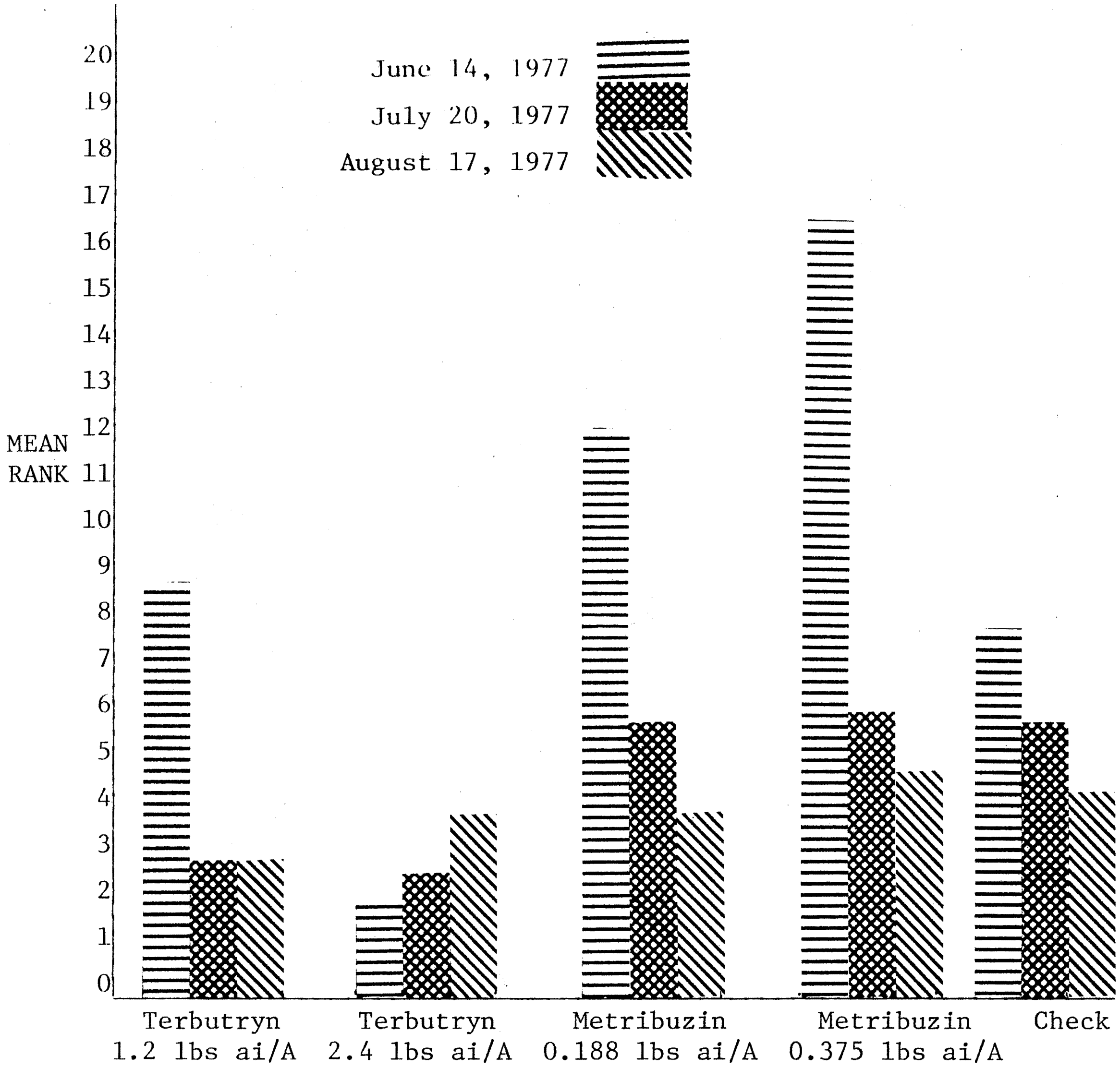


Figure 2. Mean Ranks of Herbicide Treatments on Guymon X 9959 Evaluated for Density of Cover Three Dates



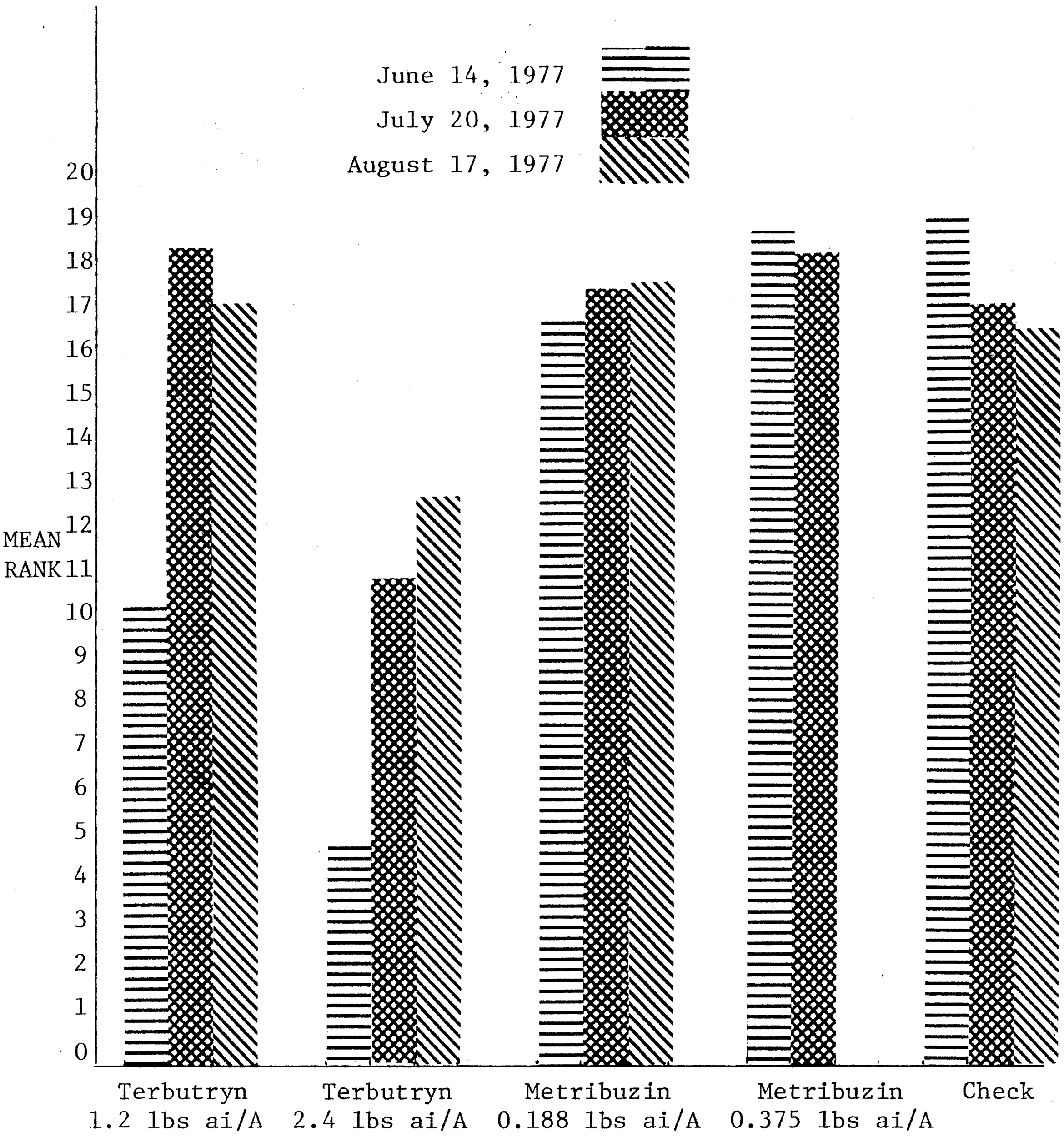
HERBICIDE TREATMENT

Figure 3. Mean Ranks of Herbicide Treatments on Guymon X 9945 Evaluated for Density of Cover on Three Dates



HERBICIDE TREATMENT

Figure 4. Mean Ranks of Herbicide Treatments on Guymon X 10978 Evaluated for Density of Cover on Three Dates



HERBICIDE TREATMENT

Figure 5. Mean Ranks of Herbicide Treatments on Common Bermudagrass Evaluated for Density of Cover on Three Dates

TABLE X

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN RANK BY DENSITY OF BERMUDAGRASS COVER FOR BERMUDAGRASS TYPE ON AUGUST 17, 1977

MEANS	Guymon X 9959 12.60	Guymon X 9945 8.80	Guymon X 10978 4.07	Common 16.53
Guymon x 9959 12.60	X	3.80	8.53*	3.93
Guymon x 9945 8.80	3.80	X	4.73	7.73*
Guymon x 10978 4.07	8.53*	4.73	X	12.46*
Common 16.53	3.93	7.73*	12.46*	X

*Exceeds 5% Level of Significance

$LSD_{.05}$ 6.58

Treatment means within each bermudagrass type were compared to determine any significant differences. For the grass weed data no significant differences were found among Guymon X 9959 treatment means. Terbutryn at 1.2 lb ai/A had significantly fewer grass weeds than metribuzin at 0.375 lb ai/A for Guymon X 9945. Guymon X 10978 was a bit more complicated. The untreated plot was significantly higher in grass weed counts than terbutryn at 2.4 lb ai/A. Significantly more

TABLE XI

LEAST SIGNIFICANT DIFFERENCE TEST OF RANK BY DENSITY OF BERMUDAGRASS COVER FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPE ON AUGUST 17, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai/A 13.00	Terbutryn 2.4 lbs ai/A 11.00	Metribuzin 0.188 lbs ai/A 10.00	Metribuzin 0.375 lbs ai/A 15.67	Check 13.33
Terbutryn 1.2 lbs ai/A 13.00	X	2.00	3.00	2.67	0.33
Terbutryn 2.4 lbs ai/A 11.00	2.00	X	1.00	4.67*	2.33
Metribuzin 0.188 lbs ai/A 10.00	3.00	1.00	X	5.67*	3.33
Metribuzin 0.375 lbs ai/A 15.67	2.67	4.67*	5.67*	X	2.34
Check 13.33	0.33	2.33	3.33	2.34	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 11.00	Terbutryn 2.4 lbs ai/A 6.00	Metribuzin 0.188 lbs ai/A 10.67	Metribuzin 0.375 lbs ai/A 8.33	Check 8.00
Terbutryn 1.2 lbs ai/A 11.00	X	5.00*	0.33	1.67	3.00
Terbutryn 2.4 lbs ai/A 6.00	5.00*	X	4.67*	2.33	2.00

TABLE XI (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 11.00	Terbutryn 2.4 lbs ai/A 6.00	Metribuzin 0.188 lbs ai/A 10.67	Metribuzin 0.375 lbs ai/A 8.33	Check 8.00
Metribuzin 0.188 lbs ai/A 10.67	0.33	4.67*	X	2.34	2.67
Metribuzin 0.375 lbs ai/A 8.33	1.67	2.33	2.34	X	0.33
Check 8.00	3.00	2.00	2.67	0.33	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 3.00	Terbutryn 2.4 lbs ai/A 4.00	Metribuzin 0.188 lbs ai/A 4.00	Metribuzin 0.375 lbs ai/A 5.00	Check 4.33
Terbutryn 1.2 lbs ai/A 3.00	X	1.00	1.00	2.00	1.33
Terbutryn 2.4 lbs ai/A 4.00	1.00	X	0.00	1.00	0.33
Metribuzin 0.188 lbs ai/A 4.00	1.00	0.00	X	1.00	0.33
Metribuzin 0.375 lbs ai/A 5.00	2.00	1.00	1.00	X	0.67
Check 4.33	1.33	0.33	0.33	0.67	X

TABLE XI (Continued)

MEANS			COMMON		
	Terbutryn 1.2 lbs ai/A 17.33	Terbutryn 2.4 lbs ai/A 12.67	Metribuzin 0.188 lbs ai/A 17.67	Metribuzin 0.375 lbs ai/A 16.67	Check 18.33
Terbutryn 1.2 lbs ai/A 17.33	X	4.66*	0.34	0.66	1.00
Terbutryn 2.4 lbs ai/A 12.67	4.66*	X	5.00*	4.00	5.66*
Metribuzin 0.188 lbs ai/A 17.67	0.34	5.00*	X	1.00	1.34
Metribuzin 0.375 lbs ai/A 16.67	0.66	4.00	1.00	X	2.34
Check 18.33	1.00	5.66*	1.34	2.34	X
$LSD_{.05}$					4.33

*Exceeds 5% Level of Significance

grass weeds was observed in those plots treated with metribuzin at 0.188 lb ai/A than at 0.375 lb ai/A and both rates of terbutryn. Both terbutryn at 1.2 lb ai/A and the check had significantly more grass weeds than metribuzin at 0.375 lb ai/A in the common bermudagrass plots.

The treatment means for the July 20, 1977, grass weed counts are listed in Table XII.

Broadleaf weeds were also counted and comparisons of count means for herbicide treatments within bermudagrass types are listed in Table XIII. No significant differences between means of broadleaf weed counts for treatments within bermudagrass types were found for this date.

The broadleaf and grass weed counts for July 20, 1977, were combined into a total weed count. Treatment means within each bermudagrass type were again compared by the LSD at the 5 percent level. Guymon X 9959 showed no significant differences in treatment means. However, Guymon X 9945 treated with terbutryn at 1.2 lb ai/A was found to have significantly fewer total weeds than that counted in either metribuzin at 0.375 lb ai/A or the check plots. Means of total weed counts within treatments of terbutryn at 2.4 lb ai/A and metribuzin at 0.375 lb ai/A were significantly lower than those of metribuzin at 0.188 lb ai/A and the check within Guymon X 10978. In the common bermudagrass plots, metribuzin at 0.375 lb ai/A was significantly lower in the number of weeds counted than terbutryn at 1.2 pounds and the check. Means of the total weed counts in all herbicide treatments are presented in Table XIV.

TABLE XII

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN GRASS WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON JULY 20, 1977

MEANS	GUYMON X 9959				
	Terbutryn 1.2 lbs ai/A 2.67	Terbutryn 2.4 lbs ai/A 2.67	Metribuzin 0.188 lbs ai/A 7.33	Metribuzin 0.375 lbs ai/A 5.67	Check 4.33
Terbutryn 1.2 lbs ai/A 2.67	X	0.00	4.66*	3.00	1.66
Terbutryn 2.4 lbs ai/A 2.67	0.00	X	4.66*	3.00	1.66
Metribuzin 0.188 lbs ai/A 7.33	4.66*	4.66*	X	1.66	3.00
Metribuzin 0.375 lbs ai/A 5.67	3.00	3.00	1.66	X	1.34
Check 4.33	1.66	1.66	3.00	1.34	X

MEANS	GUYMON X 9945				
	Terbutryn 1.2 lbs ai/A 3.33	Terbutryn 2.4 lbs ai/A 7.33	Metribuzin 0.188 lbs ai/A 5.33	Metribuzin 0.375 lbs ai/A 8.33	Check 6.00
Terbutryn 1.2 lbs ai/A 3.33	X	4.00	2.00	5.00*	2.67
Terbutryn 2.4 lbs ai/A 7.33	4.00	X	2.00	1.00	1.33

TABLE XII (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 3.33	Terbutryn 2.4 lbs ai/A 7.33	Metribuzin 0.188 lbs ai/A 5.33	Metribuzin 0.375 lbs ai/A 8.33	Check 6.00
Metribuzin 0.188 lbs ai/A 5.33	2.00	2.00	X	3.00	1.33
Metribuzin 0.375 lbs ai/A 8.33	5.00*	1.00	3.00	X	2.33
Check 6.00	2.67	1.33	1.33	2.33	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 5.67	Terbutryn 2.4 lbs ai/A 4.33	Metribuzin 0.188 lbs ai/A 11.67	Metribuzin 0.375 lbs ai/A 5.67	Check 9.00
Terbutryn 1.2 lbs ai/A 5.67	X	1.34	6.00*	0.00	3.33
Terbutryn 2.4 lbs ai/A 4.33	1.34	X	7.34*	1.34	4.67*
Metribuzin 0.188 lbs ai/A 11.67	6.00*	7.34*	X	6.00*	2.67
Metribuzin 0.375 lbs ai/A 5.67	0.00	1.34	6.00*	X	3.33
Check 9.00	3.33	4.67*	2.67	3.33	X

TABLE XII (Continued)

MEANS	COMMON				
	Terbutryn 1.2 lbs ai/A 5.67	Terbutryn 2.4 lbs ai/A 10.00	Metribuzin 0.188 lbs ai/A 6.67	Metribuzin 0.375 lbs ai/A 3.00	Check 7.67
Terubtryn 1.2 lbs ai/A 5.67	X	4.33	1.00	2.67	2.00
Terbutryn 2.4 lbs ai/A 10.00	4.33	X	3.33	7.00*	2.33
Metribuzin 0.188 lbs ai/A 6.67	1.00	3.33	X	3.67	1.00
Metribuzin 0.375 lbs ai/A 3.00	2.67	7.00*	3.67	X	4.67*
Check 7.67	2.00	2.33	1.00	4.67*	X
$\text{LSD}_{.05}$					4.59

*Exceeds 5% Level of Significance

TABLE XIII

LEAST SIGNIFICANT DIFFERENCE OF MEAN BROADLEAF WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON JULY 20, 1977

	GUYMON X9959				
MEANS	Terbutryn 1.2 lbs ai/A 6.33	Terbutryn 2.4 lbs ai/A 5.00	Metribuzin 0.188 lbs ai/A 4.67	Metribuzin 0.375 lbs ai/A 4.00	Check 7.00
Terbutryn 1.2 lbs ai/A 6.33	X	1.33	1.66	2.33	0.67
Terbutryn 2.4 lbs ai/A 5.00	1.33	X	0.33	1.00	2.00
Metribuzin 0.188 lbs ai/A 4.67	1.66	0.33	X	0.67	2.33
Metribuzin 0.375 lbs ai/A 4.00	2.33	1.00	0.67	X	3.00
Check 7.00	0.67	2.00	2.33	3.00	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 3.67	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 4.00	Metribuzin 0.375 lbs ai/A 4.00	Check 7.67
Terbutryn 1.2 lbs ai/A 3.67	X	0.34	0.33	0.33	4.00
Terbutryn 2.4 lbs ai/A 3.33	0.34	X	0.67	0.67	4.34

TABLE XIII (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 3.67	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 4.00	Metribuzin 0.375 lbs ai/A 4.00	Check 7.67
Metribuzin 0.188 lbs ai/A 4.00	0.33	0.67	X	0.00	3.67
Metribuzin 0.375 lbs ai/A 4.00	0.33	0.67	0.00	X	3.67
Check 7.67	4.00	4.34	3.67	3.67	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 6.33	Terbutryn 2.4 lbs ai/A 4.33	Metribuzin 0.188 lbs ai/A 6.67	Metribuzin 0.375 lbs ai/A 5.00	Check 8.00
Terbutryn 1.2 lbs ai/A 6.33	X	2.00	0.34	1.34	1.69
Terbutryn 2.4 lbs ai/A 4.33	2.00	X	2.34	0.67	3.67
Metribuzin 0.188 lbs ai/A 6.67	0.34	2.34	X	1.67	1.33
Metribuzin 0.375 lbs ai/A 5.00	1.33	0.67	1.67	X	3.00
Check 8.00	1.67	3.67	1.33	3.00	X

TABLE XIII (Continued)

MEANS	COMMON				
	Terbutryn 1.2 lbs ai/A 5.00	Terbutryn 2.4 lbs ai/A 3.67	Metribuzin 0.188 lbs ai/A 4.00	Metribuzin 0.375 lbs ai/A 4.00	Check 7.33
Terbutryn 1.2 lbs ai/A 5.00	X	1.33	1.00	1.00	2.33
Terbutryn 2.4 lbs ai/A 3.67	1.33	X	0.33	0.33	3.66
Metribuzin 0.188 lbs ai/A 4.00	1.00	0.33	X	0.00	3.33
Metribuzin 0.375 lbs ai/A 4.00	1.00	0.33	0.00	X	3.33
Check 7.33	2.33	3.66	3.33	3.33	X

*Exceeds 5% Level of Significance

LSD$_{.05}$ 4.62

TABLE XIV

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN TOTAL WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON JULY 20, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai/A 9.00	Terbutryn 2.4 lbs ai/A 7.67	Metribuzin 0.188 lbs ai/A 12.00	Metribuzin 0.375 lbs ai/A 9.67	Check 11.33
Terbutryn 1.2 lbs ai/A 9.00	X	1.33	3.00	0.67	2.33
Terbutryn 2.4 lbs ai/A 7.67	1.33	X	4.33	2.00	3.66
Metribuzin 0.188 lbs ai/A 12.00	3.00	4.33	X	2.33	0.66
Metribuzin 0.375 lbs ai/A 9.67	0.67	2.00	2.33	X	1.66
Check 11.33	2.33	3.66	0.67	1.66	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 7.00	Terbutryn 2.4 lbs ai/A 10.67	Metribuzin 0.188 lbs ai/A 9.33	Metribuzin 0.375 lbs ai/A 12.33	Check 13.67
Terbutryn 1.2 lbs ai/A 7.00	X	3.67	2.33	5.33*	6.67
Terbutryn 2.4 lbs ai/A 10.67	3.67	X	1.34	1.66	3.67

TABLE XIV (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 7.00	Terbutryn 2.4 lbs ai/A 10.67	Metribuzin 0.188 lbs ai/A 9.33	Metribuzin 0.375 lbs ai/A 12.33	Check 13.67
Metribuzin 0.188 lbs ai/A 9.33	2.33	1.34	X	3.00	4.34
Metribuzin 0.375 lbs ai/A 12.33	5.33*	1.66	3.00	X	2.34
Check 13.67	6.67*	3.67	4.34	2.34	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 12.00	Terbutryn 2.4 lbs ai/A 8.67	Metribuzin 0.188 lbs ai/A 18.33	Metribuzin 0.375 lbs ai/A 10.67	Check 17.00
Terbutryn 1.2 lbs ai/A 12.00	X	1.33	6.33*	1.33	5.00
Terbutryn 2.4 lbs ai/A 8.67	1.33	X	9.66*	2.00	8.33*
Metribuzin 0.188 lbs ai/A 18.33	6.33*	9.66*	X	7.66*	1.33
Metribuzin 0.375 lbs ai/A 10.67	1.33	2.00	7.66*	X	6.33*
Check 17.00	5.00	8.33*	1.33	6.33*	X

TABLE XIV (Continued)

MEANS	COMMON				
	Terbutryn 1.2 lbs ai/A 10.67	Terbutryn 2.4 lbs ai/A 13.67	Metribuzin 0.188 lbs ai/A 10.67	Metribuzin 0.375 lbs ai/A 7.00	Check 15.00
Terbutryn 1.2 lbs ai/A 10.67	X	3.00	0.00	3.67	4.33
Terbutryn 2.4 lbs ai/A 13.67	3.00	X	3.00	6.67*	1.33
Metribuzin 0.188 lbs ai/A 10.67	0.00	3.00	X	3.67	4.33
Metribuzin 0.375 lbs ai/A 7.00	3.67	6.67*	3.67	X	8.00*
Check 15.00	4.33	1.33	4.33	8.00*	X

*Exceeds 5% Level of Significance

LSD$_{.05}$					5.19

The analyses of variance for grass, broadleaf, and total weed counts taken on August 17, 1977, are listed in Appendix Table XXVIII. Just as the July counts indicated, no significant differences were found in total weed numbers among bermudagrass types on August 17, 1977.

Grass weed counts for this date showed no significant differences between treatment means for either Guymon X 9959 or common bermudagrass. Terbutryn at 1.2 lb ai/A had significantly fewer grass weeds than metribuzin at 0.188 lb ai/A in the Guymon X 9945 plots. In the Guymon X 10978 plots terbutryn at 2.4 lb ai/A had significantly fewer grass weeds than either metribuzin rates. Grass weed counts in all herbicide treatments and their comparisons are listed in Table XV.

Broadleaf weed counts showed no significant differences between treatment means for either Guymon X 9945 or common bermudagrass. The untreated Guymon X 9959 plot had significantly more broadleaf weeds than either rate of terbutryn. In the Guymon X 10978, terbutryn at 2.4 lb ai/A had significantly fewer broadleaf weeds than the check. These treatment means are presented in Table XVI.

Total weed count means on August 17, 1977 showed no significant differences between treatments for either Guymon X 9945 or common bermudagrass. In the Guymon X 9959 plots terbutryn at 2.4 lb ai/A had significantly fewer total weeds than metribuzin at 0.188 lb ai/A. In the Guymon X 10978 plots, terbutryn at 2.4 lb ai/A had significantly fewer total weeds than either rate of metribuzin. Total weed count means are shown in Table XVII.

The analyses of variance for the weed counts of both dates are presented in Appendix Table XXIX. A third factor, the overall weed

TABLE XV

LEAST SIGNIFICANT DIFFERENCES OF MEAN GRASS WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON AUGUST 17, 1977

MEANS	GUYMON X 9959				
	Terbutryn 1.2 lbs ai/A 1.33	Terbutryn 2.4 lbs ai/A 0.33	Metribuzin 0.188 lbs ai/A 6.33	Metribuzin 0.375 lbs ai/A 4.67	Check 1.67
Terbutryn 1.2 lbs ai/A 1.33	X	1.00	5.00	3.34	0.34
Terbutryn 2.4 lbs ai/A 0.33	1.00	X	4.67	3.01	0.01
Metribuzin 0.188 lbs ai/A 6.33	5.00	4.67	X	1.66	4.66
Metribuzin 0.375 lbs ai/A 4.67	3.34	3.01	1.66	X	3.00
Check 1.67	0.34	0.01	4.66	3.00	X

MEANS	GUYMON X 9945				
	Terbutryn 1.2 lbs ai/A 2.00	Terbutryn 2.4 lbs ai/A 3.67	Metribuzin 0.188 lbs ai/A 10.33	Metribuzin 0.375 lbs ai/A 4.00	Check 5.33
Terbutryn 1.2 lbs ai/A 2.00	X	1.67	8.33*	2.00	3.33

TABLE XV (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 2.00	Terbutryn 2.4 lbs ai/A 3.67	Metribuzin 0.188 lbs ai/A 10.33	Metribuzin 0.375 lbs ai/A 4.00	Check 5.33
Terbutryn 2.4 lbs ai/A 3.67	1.67	X	4.66	1.67	0.34
Metribuzin 0.188 lbs ai/A 10.33	8.33*	4.66	X	6.33	5.00
Metribuzin 0.375 lbs ai/A 4.00	2.00	1.67	6.33	X	1.33
Check 5.33	3.33	0.34	5.00	1.33	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 7.00	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 10.67	Metribuzin 0.375 lbs ai/A 10.67	Check 4.67
Terbutryn 1.2 lbs ai/A 7.00	X	3.67	3.67	3.67	2.33
Terbutryn 2.4 lbs ai/A 3.33	3.67	X	7.34*	7.34*	1.34
Metribuzin 0.188 lbs ai/A 10.67	3.67	7.34*	X	1.34	6.00
Metribuzin 0.375 lbs ai/A 10.67	3.67	7.34*	0.00	X	6.00

TABLE XV (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 7.00	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 10.67	Metribuzin 0.375 lbs ai/A 10.67	Check 4.67
Check 4.67	2.33	1.34	6.00	6.00	X

COMMON

MEANS	Terbutryn 1.2 lbs ai/A 1.00	Terbutryn 2.4 lbs ai/A 4.67	Metribuzin 0.188 lbs ai/A 4.00	Metribuzin 0.375 lbs ai/A 2.00	Check 4.67
Terbutryn 1.2 lbs ai/A 1.00	X	3.67	3.00	1.00	3.67
Terbutryn 2.4 lbs ai/A 4.67	3.67	X	0.67	2.67	0.00
Metribuzin 0.188 lbs ai/A 4.00	3.00	0.67	X	2.00	0.67
Metribuzin 0.375 lbs ai/A 2.00	1.00	2.67	2.00	X	2.67
Check 4.67	3.67	0.00	0.67	2.67	X

*Exceeds 5% Level of Significance

LSD$_{.05}$ 6.92

TABLE XVI

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN BROADLEAF WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON AUGUST 17, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai/A 2.33	Terbutryn 2.4 lbs ai/A 2.33	Metribuzin 0.188 lbs ai/A 6.00	Metribuzin 0.375 lbs ai/A 3.33	Check 7.67
Terbutryn 1.2 lbs ai/A 2.33	X	0.00	2.67	1.00	5.34*
Terbutryn 2.4 lbs ai/A 2.33	0.00	X	3.67	1.00	5.34*
Metribuzin 0.188 lbs ai/A 6.00	2.67	3.67	X	2.67	1.67
Metribuzin 0.375 lbs ai/A 3.33	1.00	1.00	2.67	X	4.34
Check 7.67	5.34*	5.34*	1.67	4.34	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 4.00	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 3.00	Metribuzin 0.375 lbs ai/A 4.33	Check 4.33
Terbutryn 1.2 lbs ai/A 4.00	X	0.67	1.00	0.33	0.33
Terbutryn 2.4 lbs ai/A 3.33	0.67	X	0.33	1.00	1.00

TABLE XVI (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 4.00	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 3.00	Metribuzin 0.375 lbs ai/A 4.33	Check 4.33
Metribuzin 0.188 lbs ai/A 3.00	1.00	0.33	X	1.00	1.33
Metribuzin 0.375 lbs ai/A 4.33	0.33	1.00	1.33	X	0.00
Check 4.33	0.33	1.00	1.33	0.00	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 4.67	Terbutryn 2.4 lbs ai/A 3.33	Metribuzin 0.188 lbs ai/A 7.00	Metribuzin 0.375 lbs ai/A 7.33	Check 8.33
Terbutryn 1.2 lbs ai/A 4.67	X	1.34	2.33	2.66	3.66
Terbutryn 2.4 lbs ai/A 3.33	1.34	X	3.67	4.00	5.00*
Metribuzin 0.188 lbs ai/A 7.00	2.33	3.67	X	0.33	1.33
Metribuzin 0.375 lbs ai/A 7.33	2.66	4.00	0.33	X	1.00
Check 8.33	3.66	5.00*	1.33	1.00	X

TABLE XVI (Continued)

MEANS	COMMON				
	Terbutryn 1.2 lbs ai/A 3.00	Terbutryn 2.4 lbs ai/A 5.00	Metribuzin 0.188 lbs ai/A 2.67	Metribuzin 0.375 lbs ai/A 4.00	Check 7.00
Terbutryn 1.2 lbs ai/A 3.00	X	2.00	0.33	1.00	4.00
Terbutryn 2.4 lbs ai/A 5.00	2.00	X	2.33	3.00	2.00
Metribuzin 0.188 lbs ai/A 2.67	0.33	2.33	X	1.33	4.33
Metribuzin 0.375 lbs ai/A 4.00	1.00	3.00	1.33	X	3.00
Check 7.00	4.00	2.00	4.33	3.00	X

*Exceeds 5% Level of Significance

LSD$_{.05}$ 4.85

TABLE XVII

LEAST SIGNIFICANT DIFFERENCE TEST OF MEAN TOTAL WEED COUNTS FOR HERBICIDE TREATMENTS WITHIN BERMUDAGRASS TYPES ON AUGUST 17, 1977

	GUYMON X 9959				
MEANS	Terbutryn 1.2 lbs ai/A 3.67	Terbutryn 2.4 lbs ai/A 2.67	Metribuzin 0.188 lbs ai/A 12.33	Metribuzin 0.375 lbs ai/A 8.00	Check 9.33
Terbutryn 1.2 lbs ai/A 3.67	X	1.00	8.66	4.33	5.66
Terbutryn 2.4 lbs ai/A 2.67	1.00	X	9.66*	5.33	6.66
Metribuzin 0.188 lbs ai/A 12.33	8.66	9.66*	X	4.33	3.00
Metribuzin 0.375 lbs ai/A 8.00	4.33	5.33	4.33	X	1.33
Check 9.33	5.66	6.66	3.00	1.33	X

	GUYMON X 9945				
MEANS	Terbutryn 1.2 lbs ai/A 6.00	Terbutryn 2.4 lbs ai/A 7.00	Metribuzin 0.188 lbs ai/A 13.33	Metribuzin 0.375 lbs ai/A 8.33	Check 9.67
Terbutryn 1.2 lbs ai/A 6.00	X	1.00	7.33	2.33	3.67
Terbutryn 2.4 lbs ai/A 7.00	1.00	X	6.33	1.33	2.67

TABLE XVII (Continued)

MEANS	Terbutryn 1.2 lbs ai/A 6.00	Terbutryn 2.4 lbs ai/A 7.00	Metribuzin 0.188 lbs ai/A 13.33	Metribuzin 0.375 lbs ai/A 8.33	Check 9.67
Metribuzin 0.188 lbs ai/A 13.33	7.33	6.33	X	5.00	3.66
Metribuzin 0.375 lbs ai/A 8.33	2.33	1.33	5.00	X	1.34
Check 9.67	3.67	2.67	3.66	1.34	X

GUYMON X 10978

MEANS	Terbutryn 1.2 lbs ai/A 11.67	Terbutryn 2.4 lbs ai/A 6.67	Metribuzin 0.188 lbs ai/A 17.67	Metribuzin 0.375 lbs ai/A 18.00	Check 13.00
Terbutryn 1.2 lbs ai/A 11.67	X	5.00	6.00	6.33	1.33
Terbutryn 2.4 lbs ai/A 6.67	5.00	X	11.00*	11.33*	6.33
Metribuzin 0.188 lbs ai/A 17.67	6.00	11.00*	X	0.33	4.67
Metribuzin 0.375 lbs ai/A 18.00	6.33	11.33*	0.33	X	5.00
Check 13.00	1.33	6.33	4.67	5.00	X

TABLE XVII (Continued)

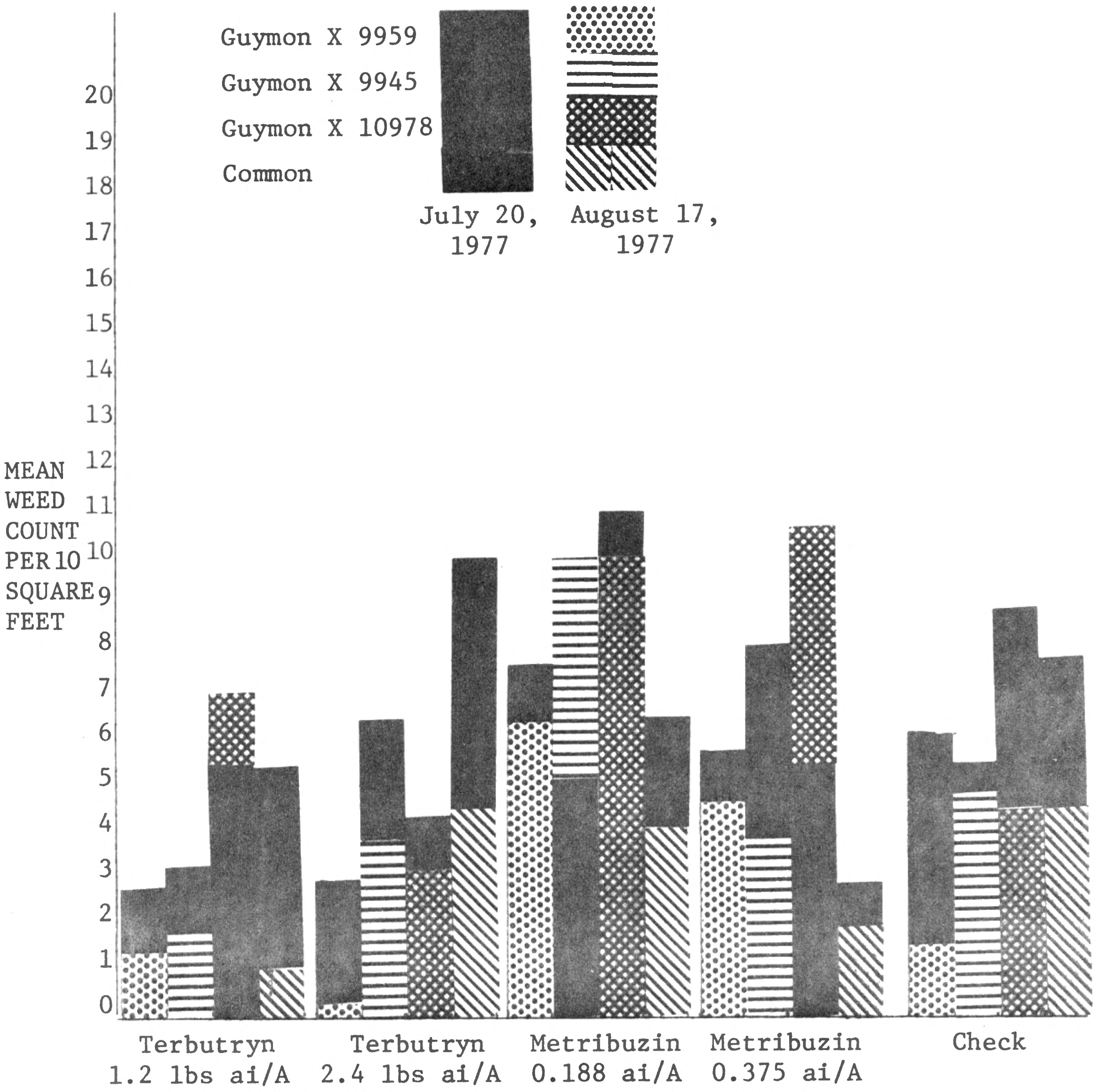
	COMMON				
MEANS	Terbutryn 1.2 lbs ai/A 4.00	Terbutryn 2.4 lbs ai/A 9.67	Metribuzin 0.188 lbs ai/A 6.67	Metribuzin 0.375 lbs ai/A 6.00	Check 11.67
Terbutryn 1.2 lbs ai/A 4.00	X	5.67	2.67	2.00	7.67
Terbutryn 2.4 lbs ai/A 9.67	5.67	X	2.00	3.67	2.00
Metribuzin 0.188 lbs ai/A 6.67	2.67	3.00	X	0.67	5.00
Metribuzin 0.375 lbs ai/A 6.00	2.00	3.67	0.67	X	5.67
Check 11.67	7.67	2.00	5.00	5.67	X

*Exceeds 5 % Level of Significance

$\text{LSD}_{.05}$ 9.00

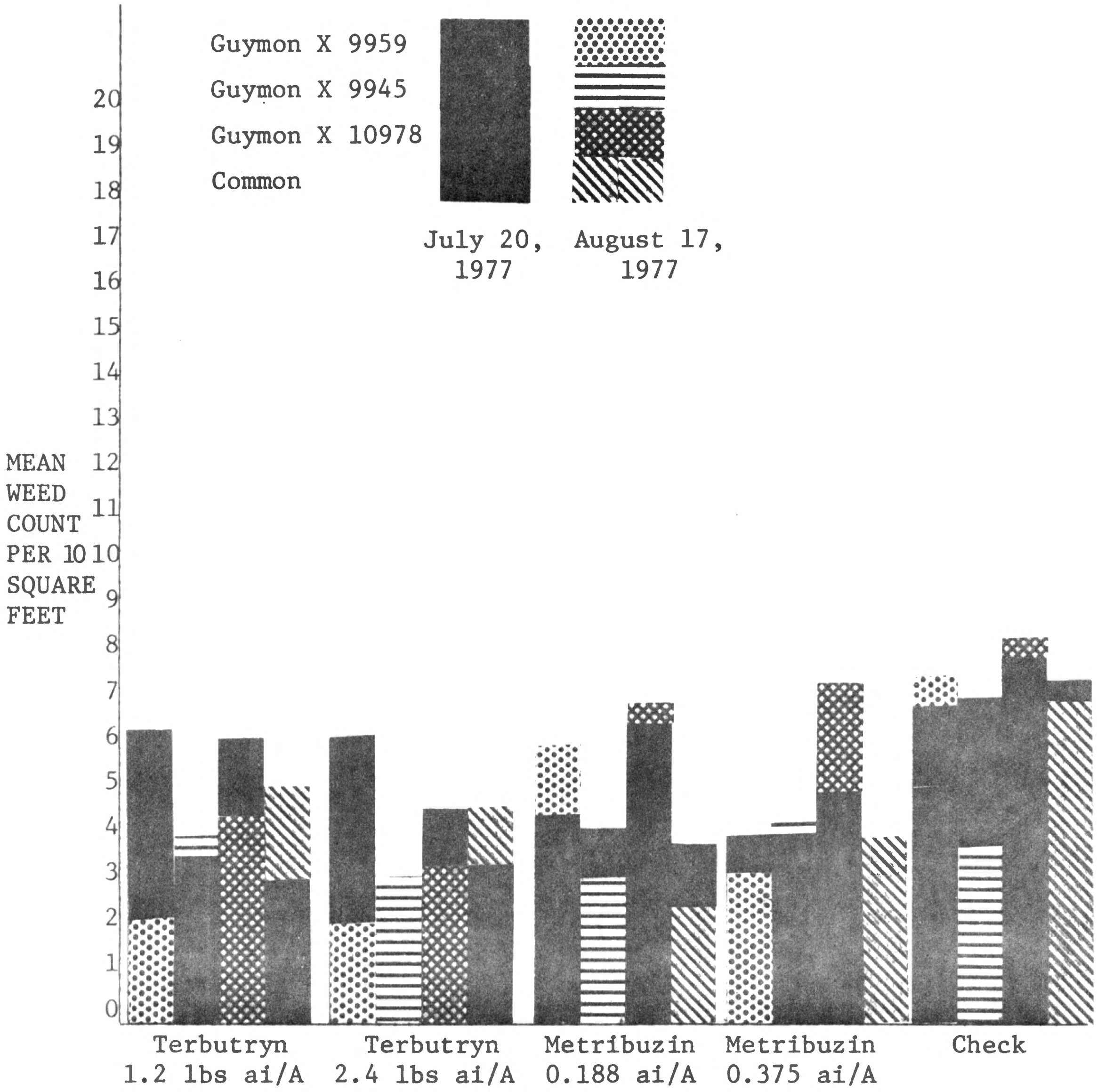
count mean for each date, was added to each analysis. Significant differences between dates were found for both grass and total weed count means.

It is interesting to note that when treatment means for July are compared to those in August, both rates of metribuzin show a stable or slight increase in weed populations. Terbutryn at both rates and the untreated plots, however, consistantly showed a decrease in weed populations from July to August. This decrease was probably due to a greater activity of terbutryn and/or the increase in bermudagrass density. The unchanged or slight increase in weed population observed in the metribuzin treated plots probably resulted from a stable or slight decrease in bermudagrass density. Grass, broadleaf, and total weed count means are graphically illustrated in Figures 6, 7, and 8.



HERBICIDE TREATMENTS

Figure 6. Mean Grass Weed Counts for Two Herbicides Applied to Four Bermudagrasses on Two Dates



HERBICIDE TREATMENTS

Figure 7. Mean Broadleaf Weed Counts for Two Herbicides Applied to Four Bermudagrasses on Two Dates

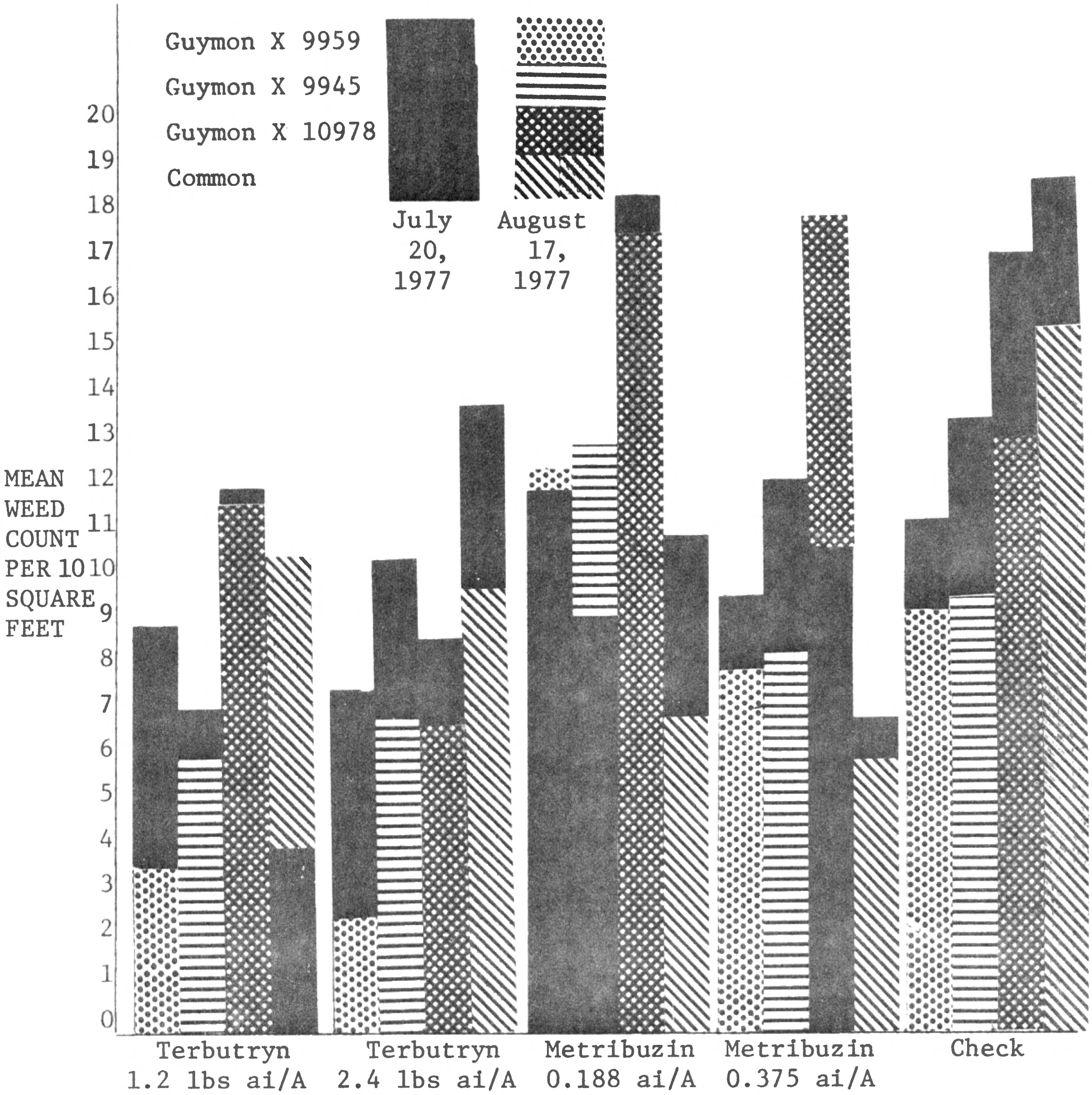


Figure 8. Mean Total Weed Counts for Two Herbicides Applied to Four Bermudagrasses on Two Dates

CHAPTER V

SUMMARY AND CONCLUSIONS

Greenhouse Experiment

Four herbicides, each at four rates, were applied to three bermudagrass hybrids on two soil types. One herbicide, Oxadizon, was extremely toxic to all the hybrids on either soil type. Oxadizon, therefore, was not considered for use in the field experiment. Siduron was not selected because it exhibited greater toxicity to all three hybrids on either soil type than metribuzin or terbutryn. Of the remaining three herbicides, metribuzin and terbutryn were selected for use in the field experiment.

No significant differences in seedling counts were found among different rates of any of the herbicides. Perhaps a greater difference in seedling counts have been found at higher concentrations.

Soil types, however, did produce a significantly different effect. Greater germination was found in the silt loam soil than in the loamy sand soil for all herbicide and hybrid combinations.

Although Guymon X 10978 had significantly higher germination than the other hybrids in the herbicide treated cups, it should not be concluded that it has a greater degree of resistance to herbicide damage. Guymon X 10978 also had significantly higher germination than the other hybrids in the untreated cups. This would indicate perhaps that it was better adapted to the greenhouse environment or the fastest to germinate of the hybrids.

Field Experiment

Common bermudagrass germinated fastest and had the most dense cover throughout the year of establishment of all bermudagrass types. Guymon X 10978, unlike the greenhouse experiment, had the poorest germination and growth.

Terbutryn at 2.4 lb ai/A was the most phytotoxic treatment to all bermudagrasses and consistantly resulted in poorer germination and growth than the untreated plots. Although there were little differences in germination between plots treated with terbutryn at 1.2 lb ai/A and either rate of metribuzin, the 0.375 lb ai/A rate of metribuzin allowed consistantly better growth and cover than the 0.188 lb ai/A rate of metribuzin. Whether this was the result of less weed competition for the higher rate of metribuzin or its stimulation of growth is not known.

The response to herbicide treatments was similar for each bermudagrass type except Guymon X 10978 which showed no significant differences in weed counts between treatments.

No bermudagrass type had significantly higher weed counts than another. Guymon X 10978, however, consistantly had the highest weed counts.

Terbutryn showed little difference in weed control between its two rates. Also there was little difference between grass or broadleaf weed control with terbutryn. Significant differences, however, were found between weed counts for terbutryn and metribuzin treated plots with those treated with terbutryn having less weeds. Metribuzin also showed little, if any, control of broadleaf weeds.

Terbutryn at 1.2 lb ai/A was concluded to be the most effective treatment showing only slight phytotoxicity to bermudagrass and with relatively good weed control.

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APPENDIX

TABLE XVIII

PRECIPITATION RECORD FOR THE MONTHS OF MAY, JUNE, JULY, AND AUGUST, 1977 AT THE STILLWATER HYDRAULIC LABORATORY

May, 1977		June, 1977		July, 1977		August, 1977	
Precipitation		Precipitation		Precipitation		Precipitation	
Day	Inches	Day	Inches	Day	Inches	Day	Inches
1	0.08	1		1	1.60	1	
2		2		2		2	0.08
3		3		3		3	
4		4		4		4	
5	1.04	5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13	0.23	13		13		13	0.78
14		14		14		14	
15		15		15		15	
16	0.95	16		16		16	0.10
17	0.18	17		17		17	0.15
18		18		18		18	
19	0.66	19		19		19	0.14
20	3.42	20		20		20	
21	0.48	21		21		21	
22		22		22	0.28	22	
23	0.89	23	0.23	23		23	
24		24	0.13	24		24	
25		25	0.62	25		25	
26	0.13	26		26		26	
27	0.72	27		27		27	
28		28		28		28	1.07
29		29	0.02	29		29	
30	0.05	30	0.05	30	0.08	30	
31	0.39			31	1.26	31	
TOTAL	9.22		1.07		3.22		2.32

TABLE XIX

COMMON AND SCIENTIFIC NAMES OF WEEDS PRESENT IN THE FIELD EXPERIMENT

Scientific	Type	Common
Psoralea tennuifolia	Broadleaf	- - -
Cyperus ovularis	Grassy	- - -
Cassia fasiculata	Broadleaf	Partridge Pea
Phytolacca americana	Broadleaf	Pokeweed
Andropogon scoparius	Grassy	Little Bluestem
Lactuca scariola	Broadleaf	Wild Lettuce
Euphorbia deutata	Broadleaf	Toothed Spurge
Tragopogon major	Broadleaf	Goat's-beard
Sourgham halepense	Grassy	Johnson Grass
Melilotus officinalis	Broadleaf	Yellow Sweet Clover
Cyperus rotundus	Grassy	Yellow Nut Sedge
Acalypha gracilens	Broadleaf	Three-seeded Mercury
Leptochloa uninervia	Grassy	Sprangletop
Solidago sp.	Broadleaf	Goldenrod
Paspalum setaceum	Grassy	- - -
Cirsium sp.	Broadleaf	Thistles
Panicum capillare	Grassy	Witchgrass
Croton capitatus	Broadleaf	Woolly Croton
Amaranthus retroflexus	Broadleaf	Red Root Pigweed
Kallstroemia intermedia	Broadleaf	- - -
Physalis pubescens	Broadleaf	Hairy Groundcherry
Panicum malacophyllum	Grassy	- - -

TABLE XX

ANALYSIS OF VARIANCE OF BERMUDAGRASS SEEDLING COUNTS FOR UNTREATED CUPS IN THE GREENHOUSE EXPERIMENT

Source	Degrees of Freedom	Mean Square	F
Replication	3	8.8194	
Soil Type	1	22.0417	2.6283
Bermudagrass Hybrid	2	40.1667	4.7897*
Soil Type X Bermudagrass Hybrid	2	2.6667	0.3180
Error	15	8.3861	
Corrected Total	23	11.3025	

*Exceeds 5% Level of Significance

TABLE XXI

ANALYSIS OF VARIANCE OF BERMUDAGRASS SEEDLING COUNTS FOR HERBICIDE TREATED CUPS IN THE GREENHOUSE EXPERIMENT

Source	Degrees of Freedom	Mean Square	F
Replications	3	41.9201	
Herbicide Treatments	2	180.4410	24.8203**
Soil Types	1	106.3368	14.6270**
Bermudagrass Hybrids	2	374.7326	51.5457**
Herbicide Treatments x Soil Types	2	27.7743	3.8204*
Herbicide Treatments x Bermudagrass Hybrids	4	5.9983	0.8251
Soil Types x Bermudagrass Hybrids	2	14.8368	2.0408
Herbicide Treatments x Soil Type x Bermudagrass Hybrids	4	8.9149	1.2263
Herbicide Rates	9	10.6840	1.4696
Soil Types x Herbicide Rates	9	4.3136	0.5934
Bermudagrass Hybrids x Herbicide Rates	18	10.1736	1.3994
Soil Type x Herbicide Rate x Bermudagrass Hybrids	18	5.1990	0.7151
Error	213	7.2700	
Corrected Total	287	12.0121	

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXII

BERMUDAGRASS SEEDLING COUNTS FOR HERBICIDE TREATMENT TOTALS, AND RANK OF HERBICIDE TREATMENTS WITHIN REPLICATIONS ON JUNE 14, 1977

Rep.	Bermuda Type	Herbicide Treatment	Count* 1	Count 2	Count 3	Count 4	Count 5	Count 6	Count 7	Count 8	Count 9	Count 10	Total	Rank+
1	1	1	0	0	9	1	1	1	7	1	2	9	31	16.0
	1	1	2	0	1	0	0	0	2	1	0	0	6	5.5
1	1	3	1	0	1	0	1	1	0	5	0	0	9	10.0
	1	4	0	4	1	0	1	1	1	2	5	1	16	13.0
1	1	5	0	3	1	5	0	3	1	3	1	2	19	14.0
	2	1	0	0	0	0	0	1	1	0	1	0	3	2.0
1	2	2	0	0	0	0	0	0	2	0	0	0	2	1.0
	2	3	2	0	1	1	0	0	0	0	2	1	7	7.0
1	2	4	0	0	0	1	1	0	0	0	0	3	5	4.0
	2	5	0	2	0	2	0	3	1	0	0	0	8	8.5
1	3	1	1	0	0	2	1	1	6	0	1	1	13	12.0
	3	2	0	1	1	0	0	1	0	1	0	0	4	3.0
1	3	3	1	0	1	0	1	2	1	2	2	0	10	11.0
	3	4	3	8	5	4	2	1	0	6	3	2	34	17.0
1	3	5	1	1	1	0	2	0	2	1	0	0	8	8.5
	4	1	1	0	1	1	1	4	2	5	2	4	21	15.0
1	4	2	0	2	0	2	0	0	1	0	0	1	6	5.5
	4	3	3	3	3	3	7	4	5	4	3	4	39	18.0
1	4	4	2	8	2	4	5	5	9	4	4	7	50	20.0
	4	5	2	3	8	4	5	5	3	4	7	5	46	19.0

TABLE XXII (Continued)

Rep.	Bermuda Type	Herbicide Treatment	Count* 1	Count 2	Count 3	Count 4	Count 5	Count 6	Count 7	Count 8	Count 9	Count 10	Total	Rank[+]
2	1	1	1	1	2	2	2	5	3	1	2	0	19	14.0
	1	2	0	0	1	1	1	6	0	1	3	0	13	5.5
2	1	3	2	0	0	2	0	3	3	0	4	3	17	12.0
	1	4	1	4	1	10	0	1	1	4	0	1	23	15.0
2	1	5	3	1	3	5	2	9	2	0	1	1	27	16.0
	2	1	0	4	0	0	2	2	2	5	0	0	15	10.0
2	2	2	0	1	0	1	0	0	0	0	1	0	3	1.5
	2	3	2	1	1	1	1	2	2	0	1	3	14	8.0
2	2	4	1	6	0	5	0	1	1	0	0	0	14	8.0
	2	5	1	1	3	1	1	5	0	1	1	0	14	8.0
2	3	1	1	0	1	0	2	1	3	1	0	7	16	11.0
	3	2	0	2	0	0	1	0	0	0	0	0	3	1.5
2	3	3	1	3	6	1	1	1	2	1	5	10	31	18.0
	3	4	2	2	0	2	4	3	2	0	2	1	18	13.0
2	3	5	2	1	1	1	0	2	2	0	3	1	13	5.5
	4	1	0	0	0	2	1	1	1	1	1	1	8	4.0
2	4	2	1	0	1	0	0	0	3	1	0	1	7	3.0
	4	3	2	3	2	3	4	2	2	5	1	5	29	17.0
2	4	4	4	2	2	5	3	5	3	3	4	2	33	19.0
	4	5	5	1	4	7	6	5	5	3	4	5	45	20.0
3	1	1	1	0	2	2	0	1	1	0	5	2	1.3	9.0
	1	2	1	0	0	0	2	0	0	0	3	0	6	2.0
	1	3	0	0	3	8	3	1	0	11	0	1	27	17.0

TABLE XXII (Continued)

Rep.	Bermuda Type	Herbicide Treatment	Count* 1	Count 2	Count 3	Count 4	Count 5	Count 6	Count 7	Count 8	Count 9	Count 10	Total	Rank+
3	1	4	0	0	2	1	3	2	4	3	0	5	20	13.0
	1	5	2	3	3	1	2	0	1	0	1	8	21	15.0
3	2	1	3	1	0	1	2	4	3	0	4	3	21	15.0
	2	2	4	0	1	0	0	1	1	0	0	1	8	4.0
3	2	3	1	1	1	0	3	0	0	2	1	0	9	5.0
	2	4	2	7	0	2	1	2	0	0	3	1	18	11.0
	2	5	2	2	1	2	1	0	0	0	2	0	10	6.5
3	3	1	0	0	0	2	2	0	0	0	0	2	6	2.0
	3	2	0	1	0	0	4	1	0	0	0	0	6	2.0
3	3	3	0	2	2	0	1	0	3	0	1	2	11	8.0
	3	4	1	0	0	1	6	3	5	7	1	15	39	20.0
3	3	5	3	2	1	2	1	1	3	0	0	2	15	10.0
	4	1	2	3	1	1	2	0	4	4	1	1	19	12.0
3	4	2	2	1	0	2	0	0	0	1	3	1	10	6.5
	4	3	1	2	4	1	2	2	4	2	2	1	21	15.0
3	4	4	4	3	3	2	2	4	3	3	2	3	29	18.0
	4	5	4	3	4	8	3	2	4	3	3	0	34	19.0

*Number of seedlings per ¼ square foot
+Average rank is given for ties

TABLE XXIII

ANALYSIS OF VARIANCE OF BERMUDAGRASS SEEDLING COUNT TOTALS FOR THE EFFECT OF TWO HERBICIDES ON FOUR BERMUDAGRASSES ON JUNE 14, 1977

Source	Degrees of Freedom	Mean Square	F
Replication	2	8.5167	
Bermudagrass Type	3	706.3778	8.4805*
Error a	6	83.2944	
Herbicide Treatments	4	619.2750	13.7693**
Bermudagrass Type x Herbicide Treatment	12	135.4750	3.0122**
Error b	32	44.9750	
Corrected Total	59	138.6090	

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXIV

ANALYSIS OF VARIANCE OF BERMUDAGRASS SEEDLING COUNT RANKS FOR THE EFFECT OF TWO HERBICIDES ON FOUR BERMUDAGRASSES ON JUNE 14, 1977

Source	Degrees of Freedom	Mean Square	F	Freidman's T
Replication	2	0.0000		
Bermudagrass Type	3	151.8111	12.5176**	13.0137**
Error a	6	12.1278		
Herbicide Treatment	4	213.3750	19.9125**	24.3857**
Bermudagrass Type x Herbicide Treatment	12	21.8250	2.0420*	7.4828
Error b	32	10.71562		
Corrected Total	59	33.6694		

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXV

ANALYSIS OF VARIANCE OF RANKINGS BY DENSITY OF COVER OF FOUR BERMUDAGRASSES TREATED WITH TWO HERBICIDES ON JULY 20, 1977

Source	Degrees of Freedom	Mean Square	F	Freidman's T
Replication	2	0.0000		
Bermudagrass Type	3	356.5556	18.9433**	30.5619**
Error a	6	18.8222		
Herbicide Treatment	4	64.1250	4.6878**	7.3286
Bermudagrass Type x Herbicide Treatment	12	9.8472	0.7199	3.3761
Error b	32	13.6791		
Corrected Total	59	33.8136		

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXVI

ANALYSIS OF VARIANCE OF RANKINGS BY DENSITY OF COVER OF FOUR BERMUDAGRASSES TREATED WITH TWO HERBICIDES ON AUGUST 17, 1977

Source	Degrees of Freedom	Mean Square	F	Freidman's T
Replication	2	0.0000		
Bermudagrass Type	3	425.4444	7.8335*	36.4666**
Error a	6	54.3111		
Herbicide Treatment	4	17.3333	2.5584	
Bermudagrass Type x Herbicide Treatment	12	8.8889	1.3120	
Error b	32	6.770		
Corrected Total	59	33.8136		

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXVII

ANALYSIS OF VARIANCE OF GRASS, BROADLEAF, AND TOTAL WEED COUNTS FOR THE EFFECT OF TWO HERBICIDES ON FOUR BERMUDAGRASSES ON JULY 20, 1977

Source	Degrees of Freedom	Grass Weeds		Broadleaf Weeds		Total Weeds	
		Mean Square	F	Mean Square	F	Mean Square	F
Replication	2	288.8167		57.1500		590.6167	
Bermudagrass Type	3	20.3278	0.6559	6.9778	1.0475	32.5056	1.1904
Error a	6	30.9944		6.6611		27.3056	
Herbicide Treatments	4	19.3583	2.5485	22.7750	2.9578*	48.6417	4.9953**
Bermudagrass Types x Herbicide Treatments	12	16.9250	2.2282	1.4083	0.1829	20.5194	2.1073*
Error b	32	7.5958		7.7000		9.7375	
Corrected Total	59	22.8506		8.9762		37.2031	

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXVIII

ANALYSIS OF VARIANCE OF GRASS, BROADLEAF, AND TOTAL WEED WEED COUNTS FOR THE EFFECT OF TWO HERBICIDES ON FOUR BERMUDAGRASSES ON AUGUST 17, 1977

	Degrees of Freedom	Grass Weeds		Broadleaf Weeds		Total Weeds	
Source		Mean Square	F	Mean Square	F	Mean Square	F
Replication	2	149.2667		65.1500		410.7167	
Bermudagrass Type	3	60.5500	1.2391	15.6167	4.3990	121.4667	1.7440
Error a	6	48.8667		3.5500		69.6500	
Herbicide Treatments	4	50.8167	2.9373*	22.2667	2.6158	90.3083	3.0897*
Bermudagrass Types x Herbicide Treatments	12	13.6611	0.7896	5.9778	0.7022	25.2583	0.8708
Error b	32	17.30000		8.5125		29.2292	
Corrected Total	59	28.7150		10.7059		54.3345	

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

TABLE XXIX

ANALYSIS OF VARIANCE OF GRASS, BROADLEAF, AND TOTAL WEED COUNTS FOR THE EFFECT OF TWO HERBICIDES ON FOUR BERMUDAGRASSES ON TWO DATES

Source	Degrees of Freedom	Grass Weeds		Broadleaf Weeds		Total Weeds	
		Mean Square	F	Mean Square	F	Mean Square	F
Replication	2	426.6583		120.6250		992.0333	
Bermudagrass Type	3	66.1556	1.4740	20.8750	5.4575*	133.6972	2.3162
Error a	6	44.8806		3.8250		57.7222	
Herbicide Treatments	4	58.5708	3.3091*	40.6750	3.8646*	116.9167	4.8155**
Bermudagrass Types x Herbicide Treatments	12	19.9264	1.1258	3.1250	0.2969	33.1833	1.3667
Error b	32	17.7000		10.5250		24.2792	
Date	1	67.5000	5.8315*	9.0750	1.6230	126.0750	6.9655*
Bermudagrass Type x Date	3	14.7222	1.2719	1.7194	0.3076	20.2750	1.1202
Herbicide Treatment x Date	4	11.6042	1.0025	4.3667	0.7809	22.0333	1.2173
Herbicide Treatment x Bermudagrass Type x Date	12	10.6597	0.9209	4.2611	0.7620	12.7889	0.7066
Error c	40	11.5750		5.5917		18.1000	
Corrected Total	119	26.1333		9.8347		46.4436	

*Exceeds 5% Level of Significance
**Exceeds 1% Level of Significance

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Master of Science

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