

SIDURON FOR CONTROL OF
BERMUDAGRASS IN TALL FESCUE
by
A. LARRY JISKRA
B.S., UNIVERSITY OF NEBRASKA, 1966

A MASTER'S REPORT

submitted in partial fulfillment of the
requirements for the degree

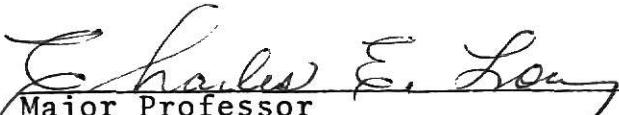
MASTER OF SCIENCE

Department of Horticulture and Forestry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1980

Approved by:


Major Professor

Spec. Coll.
LD
2668
.R4
1980
J57
c.2

ACKNOWLEDGEMENTS

The author wishes to thank his advisor Dr. Charles Long; members of his committee, Dr. Robert Carrow and Dr. Loren Moshier; and friends Mark Wagner, Dr. and Mrs. George Kennedy, and Dr. Robert Campbell for their time, guidance, assistance and encouragement.

A special note of thanks is extended to the author's wife, Ellen, for her continued moral support, patience, and sacrifices in permitting her husband to complete this portion of his education.

INTRODUCTION

Tall fescue (Festuca arundinacea Schreb. 'Kentucky 31') is a popular turfgrass for the transition zone (9) in Kansas. Tall fescue requires less maintenance than other cool-season grasses because it is a naturalized eastern Kansas grass. (Figure 1) (1). Bermudagrass (Cynodon dactylon L.), another naturalized Kansas grass (Figure 2) (15) and a potential problem weed in tall fescue turf, can establish by seed, sprigs or stolons (16) carried into the turf. Because of its fine texture, prostrate growth habit, and dormancy during cool weather, bermudagrass disrupts the uniformity of a tall fescue turf.

This disruption is augmented by certain tall fescue turf management requirements: taller mowing heights which allow rapid invasion by bermudagrass, and late-spring fertilization which enhances the growth of bermudagrass (12). In the past, elimination of bermudagrass necessitated a total kill of the invaded turf. A more desirable method for controlling invasion would be to use a selective herbicide that would not harm the tall fescue but would eliminate the bermudagrass. Research (5) has indicated that such a chemical might be siduron.

Siduron, 1-(2-methylcyclohexyl)-3-phenylurea, is a herbicide registered for preemergence control of certain annual grassy weeds in newly seeded or established plantings of some cool-season grasses (7) at rates of 2.2 to 6.7 kg/ha for new seedlings and 10 to 13.4 kg/ha for established turf. Kerr (10) reported that tall fescue was not adversely affected by siduron at 13.4 kg/ha. Although tall fescue shoot growth decreased from its maximum at 2.8 kg/ha with increasing siduron dose, tolerance was great even at the high dose of 11.2 kg/ha. Yields still exceeded untreated lots possibly because of reduced nutrient loss by microbial growth. In sod studies (4) siduron at 22 kg/ha produced no significant injury on tall fescue. Furthermore, field studies in California confirmed bermudagrass injury at rates of 20.2 to 33.6 kg/ha.

Seed is the most prevalent source of common bermudagrass contamination of cool-season grasses (16). In one study (11) common bermudagrass seed did not germinate when 4.5 kg/ha of siduron was applied. But in California field tests (16) when siduron was applied to 7.6 kg/ha in March, May and July and common bermudagrass was seeded following the July application, a few weak bermudagrass plants survived. With application rates of 22.9 kg/ha of siduron and higher, no bermudagrass plants were present.

However, control of vegetative growth is more difficult. Common bermudagrass sprigs were not killed by a single application of siduron at 13.4 kg/ha although many did not root within four weeks and roots that did form were stunted with darkened tips (16). In another variety, Tifgreen 328 bermudagrass, stolons did not root at 10.1 kg/ha. They had a few lateral branches but a longer main stolon at 60 days (3) which would indicate the possible attempt to grow out of the siduron treated turf. The total growth of Tifgreen 328 was retarded even at 4.8 kg/ha up to three months.

In other studies on bermudagrass, siduron reduced shoot growth more than root growth (3,7,13,16). Vegetative losses up to 96% on bermudagrass sod were shown (6,8). According to Table 1 (6) maximum sod loss is apparent three weeks after date of application. Bermudagrass recovery was taking place four weeks later which indicates that further applications would be necessary. With repeated applications of siduron 100% control of bermudagrass may be obtained (8,14).

Bermudagrass cultivars vary in susceptibility to siduron. For example, Tiffine-127 and common bermudagrass are the most tolerant and show the least injury (8) from siduron application. Santa Ana (7), Tifgreen 328 (4,7,11), and Tifdwarf (14) show increasing susceptibility, respectively. Cultivars with less tolerance to siduron are darker green, have a higher shoot density, minimal seed head formation, and are more prone to smog

damage (2). Such characteristics are not similar to the common bermudagrass found in tall fescue turf.

From the literature examined the following questions remain unanswered:

1. Would an excessively high rate of siduron application kill bermudagrass?
2. Would this amount harm tall fescue?
3. What rate of siduron would effectively control bermudagrass and result in minimum damage to tall fescue?
4. Would controlled time intervals and the amount of siduron application reduce bermudagrass growth?

These questions are the subject of the research report that follows.

METHOD AND PROCEDURES

Greenhouse study. A study of siduron effect on 'Kentucky 31' tall fescue and common bermudagrass was initiated in the greenhouse on January 5, 1978 in a randomized block study with four blocks. Metal cans, measuring 30 cm high by 15 cm diameter, were filled with a mixture of 87% sand, 10% silty-clay loam and 3% sphagnum peat moss.

Tall fescue was seeded in 50 cans at 2 to 3 seeds/cm² and five 2-node stolons of bermudagrass were planted in each. After three weeks the bare spots in nine tall fescue cans were reseeded. All bermudagrass cans had at least five plants within one month. The grasses were maintained for three months - including a weekly

mowing at 7 cm height and three applications of water-soluble fertilizer at the rate of 200 ppm of N-P-K. Siduron was then applied with 200 ml of water per pot using a bottle sprinkler. The lowest rate was applied first with increasingly higher rates in sequence. The total plant material of each can was dried. The top growth was then removed and weighed.

Field study. A field study was conducted on established 'Kentucky 31' tall fescue turf on a Chase silty-loam soil at Rocky Ford, Kansas State University research facilities near Manhattan, Kansas. A randomized block design with four blocks was used. 'Midiron' bermudagrass was plugged into plots measuring 1.22 m by 1.22 m during the first week in June. Five plugs of 5-cm size were planted in an X design. Siduron was applied July 8, 1977 and August 11, 1977 with Hudson hand sprayer and 473 ml of water per plot. Also a split treatment was used so that 50% of the rate was applied on July 8 and 50% on August 11. The lowest rate of siduron was applied first and the highest rate last.

Irrigation was provided to keep the turf growing. Nitrogen (33-0-0) was applied at 5 g/m² per month during June, July and August. The turf was mowed weekly at 7.6 cm with all clippings removed. The tall fescue was killed with glyphosate in March 1978 so that the bermudagrass top growth could be collected June 12, 1978. All top growth from one plot was then dried and weighed.

Siduron treatment caused a significant reduction in common bermudagrass top growth under greenhouse conditions (Table 2). Increasing rates of siduron application resulted in a corresponding decrease in top growth although results in amounts above 33.6 kg/ha were erratic. The greatest suppression was observable at 80.6 kg/ha; however, effective control of 50% bermudagrass top growth or more could be maintained at 26.9 kg/ha. Increasing siduron also resulted in a corresponding reduction of tall fescue top growth. Suppression occurred on all applications of siduron to tall fescue but no significant reduction was evident until 107.5 kg/ha was applied. Therefore siduron could be used to control bermudagrass without significant damage to tall fescue.

Data from the field study (Table 3) shows the relationship between the time of treatment and the amount of siduron applied. Treatments showed the greatest suppression of bermudagrass top growth when made in two equal portions one month apart. This significant reduction of 'Midiron' bermudagrass top growth resulted at 26.9 kg/ha regardless of treatment time. Consequently the field study supports findings from the greenhouse study.

SUMMARY

Siduron suppresses growth of bermudagrass and may be a valuable tool in managing tall fescue turf. Siduron should be

applied in warm weather (26°C) when bermudagrass is at optimum growth (2) with a total of at least 26.9 kg/ha preferably in two equal treatments one month apart. Rates exceeding 33 kg/ha may not increase bermudagrass control and may increase injury to tall fescue. Further studies are suggested to determine the effect of siduron application of 18 to 50 kg/ha on established tall fescue turf under other control conditions, i.e., spring application, fall fertilization and vertical mowing.

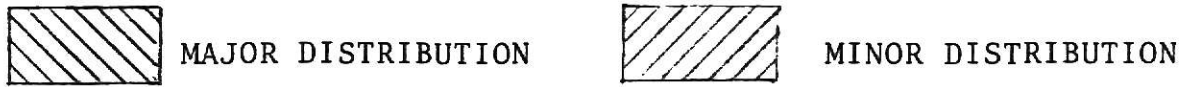
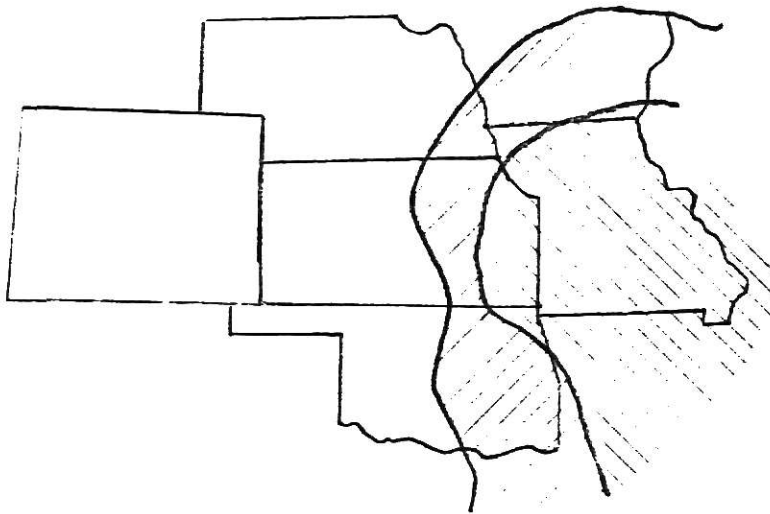


FIGURE 1. Tall fescue distribution and adaptation.

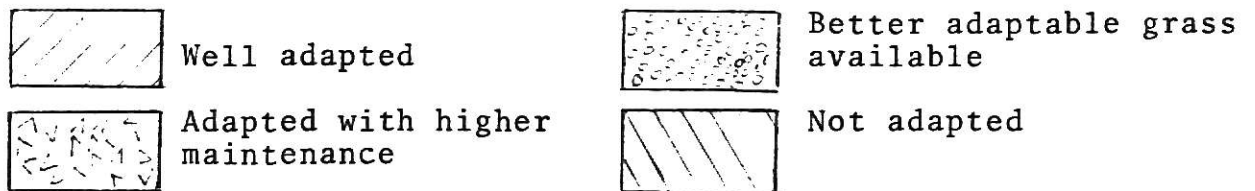
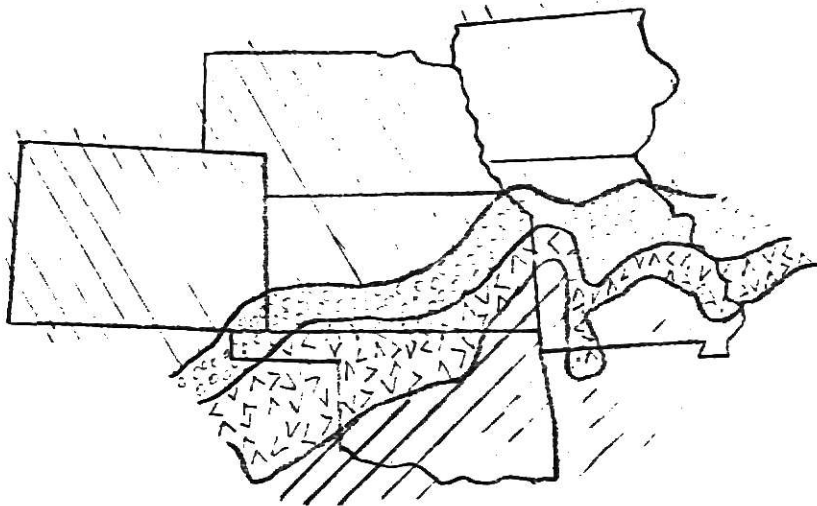


FIGURE 2. Adaptation of bermudagrass to climatic and physiographic regions of Kansas.

Table 1. (6) Percent sod loss of a 'tifgreen' bermudagrass green following siduron treatment and repeated for three years.

Treatment Dates	Siduron Rates (kg/ha)	Bermudagrass Sod loss (%)						
		1968					1969	
		7/22	8/1	8/19	9/3	10/1	5/19	7/14
July 15, 1968	8.9	0	0	5	22	7	0	0
	17.9	0	0	23	68	48	0	0
Check		0	0	0	0	0	0	0
Dunnett's d ^a				1.1	2.7	2.6		
		1969					1970	
		7/21	7/31	8/18	9/1	10/1	6/19	7/13
July 15, 1969	8.9	0	87	75	52	17	0	0
	17.9	0	96	93	87	45	7	0
Check		0	0	0	0	0	0	0
Dunnett's d			8.1	8.9	5.1	2.4	2.4	
		1970				1971 ^b		
		7/22	8/3	9/1	9/29	6/15	7/16	
July 14, 1970	8.9	0	77	47	12	0	0	
	17.9	0	95	53	23	2	0	
Check		0	0	0	0	0	0	
Dunnett's d			9.3	3.9	3.9	3.7		

^a Differences required between check and another treatment for significance at the 5% level for one-sided comparisons according to Dunnett's test.

^b No siduron application was made in 1971. Siduron showed no persisting foliage injury or sod loss in 1971 on 8/15, 9/15, or 10/4; and in 1972 on 5/29, 6/27 or 7/17.

Table 2. The weight of common bermudagrass and 'Kentucky 31' tall fescue top growth in the greenhouse as affected by siduron*.

Siduron kg/ha	Dried top growth average weight in grams	
	Bermudagrass	Tall fescue
0	3.69 a	5.17 a
13.4	2.14 bcd	4.63 ab
20.2	2.35 bc	4.34 ab
26.9	1.64 cd	4.60 ab
33.6	1.66 cd	4.21 ab
40.3	1.93 bcd	4.86 ab
47.0	1.87 cd	4.23 ab
53.8	2.70 b	4.22 ab
60.5	1.69 cd	4.72 ab
67.2	2.00 bcd	3.97 ab
80.6	1.43 d	4.10 ab
94.1	1.76 cd	4.14 ab
107.5	1.72 cd	3.51 b

*Values within columns followed by the same letter do not differ at the 0.05 level using Duncan's multiple range test.

Table 3. The weight in grams/plug of the top growth of 'Midiron' bermudagrass in an established 'Kentucky 31' tall fescue turf treated with siduron.

Siduron kg/ha	Treatment Time				Average of all Times
	Control	July 8	August 11	Application Split 50% July 8 50% Aug. 1	
0	.615	-	-	-	.615*
13.2	-	.466	.639	.465	.523
20.2	-	.845	.570	.295	.570
26.7	-	.303	.326	.211	.280*
33.6	-	.365	.811	.501	.559

*A difference of .303 grams is significant at the 5% level.

LITERATURE CITED

1. Atkins, M. D., and J. E. Smith. 1967. Grass Seed Production and Harvest in the Great Plains. USDA Farmers' Bulletin No. 2226 p. 3.
2. Beard, J. B. 1973. Turfgrass: Science and Culture. Prentice-Hall, Inc., Englewood Cliffs, N. J. pp. 133-142.
3. Bingham, S. W. 1967. Influence of herbicides on root development of bermudagrass. Weeds 15:363-365.
4. _____. 1973. Influence of herbicides on rooting of turfgrass sod. Proc. of the Second International Turfgrass Research Conference. E. C. Roberts, editor. American Society of Agronomy and the Crop Sc. Soc. of Am., Madison, Wis. pp. 372-377.
5. Callahan, L. M. 1966. Select herbicides carefully...turfgrass tolerances do differ. Weeds, Trees & Turf. 5(11):6-7.
6. _____. 1976. Phytotoxicity of herbicides to Tifgreen bermudagrass green. Weed Sci. 24:92-98.
7. Demur, A. R., V. B. Younger, and J. R. Gooden. 1973. Siduron toxicity to turfgrasses as affected by several climatic factors. Agron. J. 65:730-732.
8. Duple, R. L. 1974. Bentgrass greens in the hot humid south. The Golf Superintendent. March: pp. 36-38.
9. Johnson, B. J. 1976. Timing of Glyphosate for conversion of bermudagrass turf to tall fescue. Crop Science. 16:598-599.
10. Kerr, H. D. 1969. Selective grass control with siduron. Weed Science 17:181-186.
11. Lewis, W. M., and W. B. Gilbert. 1966. The effect of siduron on crabgrass and goosegrass control and the establishment of five warm-season and three cool-season turfgrasses. Proc. S. Weed Conf. 19:150-154.
12. Madison, J. H. 1961. The effect of management practices on invasion of lawn turf by bermudagrass. Am. Soc. Hort. Sci. 80:559-564.

13. Mazur, A. R., J. A. Jagschitz, and C. R. Skogley. 1969. Bioassay for Bensulide, DCPA, and siduron in turfgrass. *Weed Science*. 17:31-34.
14. Moncrief, J. B. 1971. Instant bentgrass greens. *USGA Green Section Record*. November.
15. Ward, C. Y. 1969. Climate and Adaptation. *Turfgrass Science*. Agronomy No. 14. Edited by A. A. Hanson and F. V. Juska. *Am. Soc. of Agron., Inc., Madison, Wis.* p. 35.
16. Younger, V. B., J. Van Dam, and S. E. Spauldings, 1974. Siduron control of bermudagrass in cool-season turfgrasses. *California Turfgrass Culture*. 24(1):1-2.

SIDURON FOR CONTROL OF
BERMUDAGRASS IN TALL FESCUE

by

A. LARRY JISKRA

B.S., UNIVERSITY OF NEBRASKA, 1966

AN ABSTRACT OF
A MASTER'S REPORT

submitted in partial fulfillment of the
requirements for the degree

MASTER OF SCIENCE

Department of Horticulture and Forestry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1980

ABSTRACT

Siduron, 1-(2-methylcyclohexyl)-3-phenylurea, a preemergence herbicide, reduced top growth on common bermudagrass (Cynodon dactylon L.) at 13.4 kg/ha in the greenhouse and on 'Midiron' bermudagrass in tall fescue (Festuca arundinacea Schreb. 'Kentucky 31') turf at 26.7 kg/ha. However, tall fescue top growth was not significantly reduced until 107.5 kg/ha of siduron was applied. Therefore siduron could be used in a tall fescue turf management program.