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Influence of Dates and Frequency of Drive Treatments On Large Crabgrass Control in Tall Fescue Turf[1]

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Abstract

When postemergence (POST) herbicides are used to control large crabgrass [*Digitaria sanguinalis* (L.) Scop.] in turfgrasses, it is desirable to maintain a high level of control with minimum number of applications. A field experiment was conducted during 1992 and 1993 to determine the influence of timing and frequency of applications with Drive (quinclorac) on large crabgrass control in tall fescue (*Festuca arundinacea* Schreb.) turf. Drive (quinclorac) applied as a single application at 0.84 kg/ha (0.75 lb/A) on June 11 controlled 98% large crabgrass throughout the summer in tall fescue turf. The control was consistently higher than when the herbicide was applied earlier (April 12 or May 3) at the same rate. There was no increase in large crabgrass control with multiple Drive (quinclorac) applications, when compared to a single application made on June 11. Drive (quinclorac) applied on June 11 caused a maximum of 35% injury to tall fescue in 1992, but the turfgrass recovered to an acceptable level (<20%) within one week. Maximum turfgrass injury was only 13% when the herbicide was applied at the same date in 1993. Tall fescue treated with multiple applications of Drive (quinclorac) was injured similarly to that reported from a single application, but the turfgrass required a longer recovery period.

Index words: *Festuca arundinacea,* turfgrass injury, turfgrass density.

Herbicides used in this study: Drive (quinclorac), 3,7-dichloro-8-quinolinecarboxylic acid); Daconate (MSMA), monosodium salt of MAA.

Significance to the Nursery Industry

Drive (quinclorac) will effectively control large crabgrass throughout the summer from a single application. This will reduce labor costs and provide consistently higher weed control than when Daconate (MSMA) is used.

Introduction

Drive (quinclorac) is a herbicide in the olinecarboxylic acid family and is being evaluated to control both grass and broadleaf weeds in several agronomic crops and turfgrasses. The herbicide has the potential for late preemergence (PRE) and early postemergence (POST) use in established turfgrass for the control of crabgrass and broadleaf weeds. The herbicide is absorbed by the foliage and roots.

Crabgrass continues to be a problem in most turfgrass areas. However, it can be effectively controlled with timely PRE (11, 14, 16) and POST (5, 10) applications. Generally, PRE herbicides have little or no activity on emerged crabgrass seedlings and POST herbicides will not prevent emergence of new seedlings. Therefore, when PRE herbicides are not used for weed control, repeated POST applications are needed. This is true when organic arsenical herbicides are used for POST crabgrass control (10). A POST herbicide with longer residual activity to reduce application number would be useful.

Drive (quinclorac) applied PRE at 1.1 kg/ha (1.0 lb/A), controlled crabgrass for 10 to 16 weeks in New Jersey (8), but not in Maryland (4) or Georgia (11). However, when the herbicide was applied POST at ≥ 0.84 kg/ha (0.75 lb/A), crabgrass control ranged from poor (3, 6, 9, 15) to good (1, 2, 7, 9, 15). The variation in crabgrass control from POST treatments was related to plant size and time of treatment. In several experiments, crabgrass control was consistently higher when Drive (quinclorac) was applied early POST to 1 to 5 leaf plants (2, 8), than when applied after the plants have tillered (3, 6, 8). However, crabgrass control was consistently improved when the herbicide was applied in split applications (7, 15).

Drive (quinclorac) did not injure Kentucky bluegrass (*Poa pratensis* L.), perennial ryegrass (*Lolium perenne* L.) or tall fescue when applied as single treatments (2, 6, 8). Because Drive (quinclorac) has activity on crabgrass, research was initiated to determine timing and frequency of treatment for large crabgrass control and to determine effects of repeated herbicide applications on tall fescue.

Materials and Methods

Established tall fescue infested with large crabgrass was treated with single and multiple Drive (quinclorac) treatments during 1992 and 1993 at Griffin, GA. Single treatments at 0.84 kg/ha (0.75 lb/A) were applied on April 12, May 3, and June 11 ± 4 days. Sequential treatments of 0.84 plus 0.56 kg/ha (0.75 plus 0.5 lb/A) were made May 3 plus June 11 or June 11 plus July 30; 0.56 plus 0.56 kg/ha (0.5 plus 0.5 lb/A) were made on June 11 plus July 30; and 0.84 plus 0.56 plus 0.56 kg/ha (0.75 plus 0.5 plus 0.5 lb/A) were made on May 3 plus June 11 plus July 30. Daconate (MSMA) at 2.2 kg/ha (2.0 lb/A) was included as a chemical check and applied to separate plots on May 3 and June 11. An untreated check was included. Treatments were applied to separate, but adjacent sites each year. All herbicides were applied as a broadcast spray in 375 l/ha (40 gal/A) of water. A surfactant BAS 09002S was applied with Drive (quinclorac) at 0.25% v/v.

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Large crabgrass was uniform throughout the test site during 1992 and 1993 following overseeding at 10 kg/ha (lb/A) in January for two consecutive years before treatments. When final ratings were made in late August, large crabgrass in untreated plots was 60% cover in 1992 and 48% cover in 1993.

Tall fescue was fertilized each year with 50N-22P-42K kg/ha (45N-20P-38K lb/A) in early-September and again in mid-February. An additional 50 kg N/ha (45 lb/A) was applied in November and late-May. Actively growing tall fescue was mowed twice per week before and after herbicide treatments with a rotary mower at a height of 7 cm (2.8 in). Clippings were removed from time of first treatment until final ratings were made in late-August. The soil type was a Cecil sandy clay loam (clayey, kaolinitic, Thermic Typic Hapludults) with 2.1% organic matter, 55% sand, 18% silt, and 27% clay. The turfgrass area was irrigated as needed to maintain optimum growing conditions for the turfgrass.

Visual injury and density ratings for tall fescue turf were made from mid-April until late-August. Turfgrass injury ratings were based on 0 to 100 where 0 = no injury and 100 = complete kill. Turf density ratings were based on percent of untreated check where 1 = no turfgrass and 10 = complete uniform dense turfgrass. Large crabgrass control ratings were made in late-August and based on cover in untreated plots, where 0 = no control and 100 = complete control.

Herbicide treatments were arranged in a randomized complete block design with four replications. Plot size was 1.5 by 3.0 m (5 by 10 ft). Analysis of variance (ANOVA) using the Statistical Analysis System (General Linear Model Procedure) was carried out within and across years (13), and the means were separated by LSD at the 0.05 level. There were herbicide-by-year interactions and means are presented separately.

Results and Discussion

Large Crabgrass Control. Large crabgrass control in tall fescue with Drive (quinclorac) varied with application date (Table 1). When Drive (quinclorac) was applied at 0.84 kg/ha (0.75 lb/A) on June 11, large crabgrass control was 98% in late-August 1992 and 1993. The control was not as good when the herbicide was applied earlier (April 12 or May 3). The control in 1992 was 47 and 62% when the herbicide was applied April 12 and May 3, respectively. The control during the same period in 1993 was 75 and 81%, respectively. The poorer large crabgrass control from the April 12 treatment in 1992 (47%) than 1993 (75%) may be related to temperature. Large crabgrass seed probably do not germinate until mean air temperature maintains 12.8°C (55°F) for 14 days (12). The mean minimum-maximum air temperature for 14 days before treatment in 1992 was 10°C (51°F), compared to 13°C (56°F) in 1993. Since Drive (quinclorac) has poor PRE activity on large crabgrass in Georgia (11), more weeds emerged after the April 12 treatment in 1992 than 1993. This agrees with an earlier study conducted in Georgia (11), in which Drive (quinclorac) applied at 1.1 kg/ha (1.0 lb/A) on February 23, 1988 did not control large crabgrass as effectively (25%) as when treatment was applied on April 1, 1986 (99%). The mean air temperature 14 days before treatment in the earlier study was 5°C (41°F) for February 23 and 13°C (55°F) for April 1. In the present study, it is not known why Drive (quinclorac) applied on May 3 did not control large crabgrass as effectively in 1992 (62%) as in 1993 (81%).

Large crabgrass control was excellent ≥94% when Drive (quinclorac) was applied in two applications regardless of application dates or rates (Table 1). The complete large crabgrass control with two Drive (quinclorac) applications agree with those reported by Dernoeden and Krouse (7) and Sciarappa (15).

Daconate (MSMA) applied as a single application at 2.2 kg/ha (2.0 lb/A) controlled large crabgrass poorly (Table 1). The response with Daconate (MSMA) agrees with that obtained in an earlier study (10). These results indicate that a single application of Drive (quinclorac) at 0.84 kg/ha (0.75 lb/A) on June 11 controlled large crabgrass effectively. Large crabgrass control was consistently higher when Drive (quinclorac) at 0.84 kg/ha (0.75 lb/A) was applied on June 11 than in April or May. There was no advantage from mul-

Table 1. Effects of dates and frequency of Drive treatments on large crabgrass control in tall fescue, Griffin, GA.

Treatments[z]				Large crabgrass control[y]	
	Rate		Date		
Herbicide	kg/ha	lb ai/A	applied	1992	1993
				%	
Untreated	—	—	—	0	0
Daconate	2.2	2.0	May 3	20	0
	2.2	2.0	June 11	33	6
Drive	0.84	0.75	April 12	47	75
	0.84	0.75	May 3	62	81
	0.84	0.75	June 11	98	98
	0.84 + 0.56	0.75 + 0.5	May 3 + June 11	98	96
	0.84 + 0.56	0.75 + 0.5	June 11 + July 30	100	98
	0.56 + 0.56	0.5 + 0.5	June 11 + July 30	98	94
	0.84 + 0.56 + 0.56	0.75 + 0.5 + 0.5	May 3 + June 11 + July 30	98	96
LSD @ 0.05				23	9

[z]Herbicides were applied at the given dates ± 4 days during 1992 and 1993.

[y]Large crabgrass control ratings were made August 24 ± 1 day and were based on 0 to 100 where 0 = no control and 100 = complete control.

Table 2. Effects of dates and frequency of Drive treatments on injury of tall fescue turf. Griffin, GA.

Treatments[z]				Turfgrass injury[y]									
	Rate		Date	1992					1993				
Herbicide	kg/ha	lb ai/A	applied	Apr 20	May 5	June 18	Aug 3	Aug 10	Apr 28	May 20	June 21	June 28	Aug 9
				%									
Untreated	—	—	—	0	0	0	0	0	0	0	0	0	0
Daconate	2.2	2.0	May 3	—	15	6	3	2	—	18	1	0	0
	2.2	2.0	June 11	—	—	15	4	0	—	—	16	9	0
Drive	0.84	0.75	April 12	28	25	14	13	0	14	7	8	7	0
	0.84	0.75	May 3	—	27	18	13	0	—	7	7	13	1
	0.84	0.75	June 11	—	—	35	11	8	—	—	13	9	1
	0.84 + 0.56	0.75 + 0.5	May 3 + June 11	—	26	33[x]	16	5	—	8	21[x]	18	0
	0.84 + 0.56	0.75 + 0.5	June 11 + July 30	—	—	32	28[x]	29	—	—	13	11	0[x]
	0.56 + 0.56	0.5 + 0.5	June 11 + July 30	—	—	27	31[x]	36	—	—	14	8	0[x]
	0.84 + 0.56 + 0.56	0.75 + 0.5 + 0.5	May 3 + June 11 + July 30	—	27	36[x]	28[w]	35	—	8	13[x]	12	0[w]
LSD @ 0.05				3	6	11	10	9	5	4	10	9	NS

[z]Herbicides were applied at the given dates ± 4 days during 1992 and 1993.

[y]Turf injury ratings were based on 0 to 100 where 0 = no injury and 100 = complete kill.

[x]Indicates injury from a second herbicide application.

[w]Indicates injury from a third herbicide application.

tiple Drive (quinclorac) treatment, when compared with the June 11 treatment.

Turfgrass injury. The injury to tall fescue from Drive (quinclorac) treatments was higher during 1992 than 1993 (Table 2). In 1992, the injury from a single 0.84 kg/ha (0.75 lb/A) application ranged from 27 to 35% whether applied on April 12, May 3, or June 11. Turfgrass treated in April required a longer recovery period than when treated in May or June. For turfgrass to recover to <20% injury, 3 weeks were required for April treatment, while 1 and 2 weeks were required for May and June treatments, respectively, (data not given). These results differ from those reported in New Jersey (8) where Drive (quinclorac) did not injure tall fescue. The injury to tall fescue in the present study was probably related to additional heat stress that occurred in Georgia, but not in New Jersey. The injury to tall fescue was also higher during this period when treated with Drive (quinclorac) than when treated with Daconate (MSMA).

When Drive (quinclorac) was applied initially to tall fescue in May or June, and followed by a second application 5 to 6 weeks later, the injury was similar to that obtained from the first application (Table 2). However, turfgrass recovery from repeated applications required a longer period than from the initial application. Therefore, to avoid unnecessary injury to tall fescue, Drive (quinclorac) should be limited to a single application in mid-June which provided the highest large crabgrass control (Table 1).

Maximum injury to tall fescue treated with a single Drive (quinclorac) treatment in April, May, or June during 1993

Table 3. Effects of dates and frequency of Drive treatments on density of tall fescue. Griffin, GA.

Treatments[z]				Turf density[y]					
	Rate		Date	1992		1993			
Herbicide	kg/ha	lb ai/A	applied	June 24	Aug 3	June 1	June 28	July 5	July 26
				% untreated check					
Untreated	—	—	—	100	100	100	100	100	100
Daconate	2.2	2.0	May 3	98	104	94	100	100	100
	2.2	2.0	June 11	100	108	—	100	101	100
Drive	0.84	0.75	April 12	92	97	99	97	96	107
	0.84	0.75	May 3	96	101	94	93	93	104
	0.84	0.75	June 11	92	105	—	97	88	96
	0.84 + 0.56	0.75 + 0.5	May 3 + June 11	86	94	92	92	94	104
	0.84 + 0.56	0.75 + 0.5	June 11 + July 30	94	96	—	99	92	104
	0.56 + 0.56	0.5 + 0.5	June 11 + July 30	97	95	—	96	97	105
	0.84 + 0.56 + 0.56	0.75 + 0.5 + 0.5	May 3 + June 11 + July 30	90	105	93	93	90	99
LSD @ 0.05				7	NS	4	6	7	NS

[z]Herbicides were applied at the given dates ± 4 days during 1992 and 1993.

[y]Turf density ratings were based on percent of untreated check where 1 = no turf and 10 = complete uniform turf cover.

was 13 to 14% (Table 2). There was no difference in injury when Drive (quinclorac) was compared with Daconate (MSMA) during 1993. It is not known why the injury from the Drive (quinclorac) was higher during 1992 than 1993. The injury to tall fescue treated with multiple Drive (quinclorac) treatments during 1993 was within an acceptable range (≤21%).

Turfgrass density. Drive (quinclorac) reduced the density of tall fescue applied as a single or multiple application during 1992 and 1993 (Table 3). The maximum reduction from a single 0.84 kg/ha (0.75 lb/A) was 8 and 12% during 1992 and 1993, respectively. This was within an acceptable level, and the turfgrass recovered fully by early August 1992 and late July 1993. Repeated Drive (quinclorac) treatments did not reduce turfgrass density more than a single application.

These results indicate that 0.84 kg/ha (0.75 lb/A) of Drive (quinclorac) applied in mid-June controlled large crabgrass effectively in tall fescue turf throughout the summer. Tall fescue treated in mid-June was severely injured (35%) for one week following treatment in 1992, but injured only slightly (13%) during the same period in 1993. When injury occurred, it was for a short period with no permanent damage. Large crabgrass control was not consistent from April or May treatments. There was no advantage in control from multiple Drive (quinclorac) treatments, when compared with a single 0.84 kg/ha (0.75 lb/A) application in mid-June. Postemergence control of large crabgrass with a single Drive (quinclorac) application offers an advantage over Daconate (MSMA), which requires multiple application to maintain similar control.

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