Herbicides for Transition in Higher-Cut Rough Turf

K. Umeda and G. Towers

Abstract

The herbicides foramsulfuron, trifloxysulfuron, and sulfosulfuron applied in late April followed by a sequential application 2 weeks later in early May were more effective for removing ryegrass than when the sequential application was made 7 weeks later in June. Rimsulfuron at 0.013 lb a.i./A and flazasulfuron at 0.0078 lb a.i./A were highly effective in rapidly removing ryegrass with a single application. Minimal activity was observed for the herbicides at 7 or 9 days after application in April and early May. Ryegrass removal was enhanced when applications were made during warmer temperatures in late May and into June. Rate ranges of sulfosulfuron and flazasulfuron indicated a trend that higher rates may be slightly more effective than lower rates but ryegrass removal was achieved with all rates.

Introduction

Spring transition, the process of eliminating the overseeded winter turfgrass species from warm-season bermudagrass as it emerges from dormancy, can be aided and accelerated by using herbicides. Typically, perennial ryegrass is not heat tolerant and the spring/summer rising temperatures in the desert region cause the cool-season grass to be eliminated naturally when combined with cultural practices such as lowering mowing heights, vertical mowing, and reducing irrigation. However, cultivars of perennial ryegrass have been improved to tolerate more heat and compete well by effectively shading emerging bermudagrass in areas such as golf course roughs and greens surrounds when turf height of cut are not considerably reduced. A series of experiments were conducted to evaluate and determine the efficacy and degree of eliminating perennial ryegrass at low rates of herbicides applied during the late spring into early summer in higher-cut turfgrasses. The herbicides evaluated were foramsulfuron (Revolver*), rimsulfuron (TranXit*), trifloxysulfuron (Monument*), sulfosulfuron (Certainty*), and flazasulfuron.

Materials and Methods

Three small plot studies were conducted during the spring of 2006 to compare and determine the efficacy of several herbicides for removing perennial ryegrass during spring transition. At The Country Club at DC Ranch in Scottsdale, AZ, the treatment plots were established measuring 5 ft x 30 ft and replicated three times. Herbicide treatments were applied on the entire length of each 30 ft plot when the study was initiated on 24 April 2006. The early sequential application was applied on 08 May (A+M) at 2 weeks after the first treatment date. The sequential application was sprayed over the first 20 ft of the 30 ft plot area. The late sequential application was applied on 12 June (A+J) at 7 weeks after the first treatment date. The late sequential application was sprayed over the last 10 ft of the 30 ft plot area. All sprays were applied using a backpack CO_2 sprayer equipped with a hand-held boom with three 8003 flat-fan nozzles spaced 20 inches apart. The sprays were applied in 30 gpa water at 30 psi and all treatments included a non-ionic surfactant, Latron CS-7 at 0.25% v/v. On 24 April, at the time of the first sprays, the air temperature was 51°F, clear, and there was a very slight breeze. The soil temperature at 2 inch depth was 52°F and the driving range turf was just mowed at approximately 1.5 inch height. The second application timing on 08 May was clear with a light breeze and temperature at 72°F with the soil temperature at 60°F. The third application timing was 12 June with temperature at 68°F, clear, and calm with soil temperature at 60°F.

The small plot study at The Duke at Rancho El Dorado in Maricopa, AZ was established with plots measuring 5 ft x 20 ft and replicated three times. The single applications were made on 30 May 2006 when the air temperature was 72°F. The mowing height of the plot area was approximately 1.5 in. At the Whirlwind Golf Club in Chandler, AZ, the treatment plots measured 5 ft x 10 ft and replicated three times. The single applications were made on 01 June 2006 when the air temperature was 68°F, clear, calm, and soil temperature at 64°F. The mowing height of the plot area was approximately 1.5 in and was mowed on the following day. The sprays at The Duke and at Whirlwind were applied in the same manner as at DC Ranch by using a backpack sprayer. The percent perennial ryegrass removal was evaluated at intervals following each application at the three sites. Transition was evaluated by rating overall turfgrass quality but is not presented because the bermudagrass did not satisfactorily and uniformly re-fill the areas of the studies where ryegrass was effectively removed by the herbicide treatments.

Results and Discussion

DC Ranch study. The two treatments of foramsulfuron effectively removed better than 91% of the perennial ryegrass by the end of June (Table 1). Foramsulfuron A+J progressively removed ryegrass 22% at 23 days after treatment of the first application (DAT-1), 47% at 28 DAT-1, and 80% at 49 DAT-1. The second application resulted in removing 91% at 14 DAT-2. Foramsulfuron A+M removed 38% of the ryegrass at 9 DAT-2, 77% within 14 (DAT-2) on 22 May, and better than 93% in June. Foramsulfuron A+M removed better than three-fourths of the ryegrass about 3 weeks faster than a single application. The two early applications, A+M, were slightly more effective in nearly completely removing ryegrass compared to two applications, A+J, spaced 7 weeks apart.

A single application of rimsulfuron A slowly and progressively removed ryegrass 47% at 23 DAT-1, 67% at 28 DAT-1, 83% at 49 DAT-1, and 99% at 63 DAT-1. Rimsulfuron A+M was highly effective following the second application by removing 88% of the ryegrass within 2 weeks. The second application of rimsulfuron hastened ryegrass removal by 3 weeks versus the single application.

Trifloxysulfuron A+M progressively removed ryegrass effectively following the second application in early May. Ryegrass response to trifloxysulfuron A+M at 14 DAT-2 was less than that observed for the same timings of application of foramsulfuron and rimsulfuron. Trifloxysulfuron A+J removed 88% of the ryegrass at the end of June. The late second application did not greatly enhance ryegrass removal compared to the untreated check.

Sulfosulfuron at 0.059 and 0.117 lb a.i./A, A+M, exhibited comparable efficacy by gradually removing ryegrass and behaved similarly as foramsulfuron, rimsulfuron, and trifloxysulfuron to give near complete removal by late June. Sulfosulfuron at 0.059 lb a.i./A, A+J, was least effective in removing ryegrass at less than 70% at the end of June. However, sulfosulfuron at 0.117 lb a.i./A A+J exhibited near complete ryegrass removal within 14 DAT-2.

Flazasulfuron at 0.0078 lb a.i./A A performed similar to two applications at 0.00273 and 0.0039 lb a.i./A, A+M, by gradually removing ryegrass nearly completely. At a rate of 0.0078 lb a.i./A, A+M, flazasulfuron was similar to foramsulfuron and rimsulfuron to remove 83% ryegrass 3 weeks earlier than the lower rates or timings of applications. Flazasulfuron at less than 0.0039 lb a.i./A removed less than 45% ryegrass with a 24 April application and a sequential application on 12 June effectively removed 83 to 95% ryegrass within 2 WAT-2. The lowest rate of flazasulfuron at 0.00156 lb a.i./A was comparable to sulfosulfuron at 0.059 lb a.i./A at 28 DAT-1 and the June application proceeded to remove 83% ryegrass.

The Duke study. Foramsulfuron removed 80% of the ryegrass at 20 DAT and then progressed to 93% at 44 DAT on 13 July (Table 2). The untreated check underwent natural transition with only mowing and 85% of the ryegrass was eliminated. Near complete transition occurred with rimsulfuron removing 93% of the ryegrass at 20 DAT. Trifloxysulfuron was similar to foramsulfuron by removing almost 80% of the ryegrass at 20 DAT and then near total elimination at 44 DAT. Both rates of sulfosulfuron performed similarly as the foramsulfuron and trifloxysulfuron. The lower rate of sulfosulfuron removed slightly less ryegrass than the higher rate at 20 and 44 DAT. Flazasulfuron rates from 0.0016 to 0.0078 lb a.i./A were all effective in removing ryegrass at 44 DAT. At the first evaluation date on 06 June at 7 DAT, the highest rate of flazasulfuron exhibited the greatest degree of ryegrass removal at 30% and then progressed comparably as trifloxysulfuron to give near complete ryegrass removal.

Whirlwind study. At 14 DAT on 15 June, foramsulfuron removed nearly 50% of the ryegrass and progressed to 85% at 28 DAT (Table 3). Rimsulfuron was very active and eliminated 77% of the ryegrass at 14 DAT.

Trifloxysulfuron exhibited the least activity and was comparable to the untreated check at 14 DAT but activity improved to remove 72% of the ryegrass at 28 DAT. Sulfosulfuron showed a very slight rate response between the low and high rates but the low rate was just as effective as the high rate in removing all the ryegrass at 42 DAT. A similar rate response was observed for the range of flazasulfuron rates through 28 DAT but all ryegrass was gone at 42 DAT for all treatments. Flazasulfuron at 0.0039 lb a.i./A was comparable to the two rates of sulfosulfuron at 14 and 28 DAT. Rimsulfuron and flazasulfuron at 0.0078 lb a.i./A were the most active treatments and were nearly identical in performance to remove ryegrass. Flazasulfuron at 0.0016 and 0.0027 lb a.i./A removed ryegrass similar to foramsulfuron.

Summary. For the various intervals when ryegrass removal was rated, most herbicides showed that at 7 DAT, most of them reduced ryegrass less than 30% as shown at The Duke on 06 June. At 9 DAT-2 at DC Ranch, herbicide activity was very limited and ryegrass reduction since the previous evaluation date was also less than 30%. At Whirlwind, at 14 DAT, rimsulfuron, sulfosulfuron, and flazasulfuron gave greater than 60% ryegrass reduction. The same degree of ryegrass elimination was observed at 14 DAT-2 following two applications of foramsulfuron, rimsulfuron, sulfosulfuron, and flazasulfuron at DC Ranch. At DC Ranch, the April applications were initiated when air temperatures during the day were beginning to average 80°F. At 23 DAT-1, all of the herbicides gave less than 47% ryegrass reduction. In comparison, at The Duke when temperatures averaged 93°F in May and 103°F in June, foramsulfuron, rimsulfuron, trifloxysulfuron, and sulfosulfuron removed better than 72% of the ryegrass at 20 DAT. By 28 to 30 DAT, all of the herbicides demonstrated the ability to eliminate ryegrass better than 75% at The Duke and Whirlwind during June. In May at 28 DAT-1, the ryegrass at DC Ranch was removed 13 to 47% for foramsulfuron, trifloxysulfuron, and sulfosulfuron treatments while rimsulfuron and the high rate of flazasulfuron achieved slightly better than 60% elimination.

Minimal activity was observed for the herbicides at 7 DAT and also in early May at 9 DAT-2. Ryegrass removal was observable after 20 DAT and continued to improve until near complete removal was achieved after 42 DAT. Sequential applications initiated in late April followed by another application at 2 weeks offered a gradual elimination of ryegrass. Two applications spaced 7 weeks apart did not improve the degree of ryegrass reduction for foramsulfuron, trifloxysulfuron, and sulfosulfuron at 0.059 lb a.i./A. An early application of sulfosulfuron at 0.117 lb a.i./A, flazasulfuron at 0.00156, 0.00273, 0.0039 lb a.i./A plus sequential applications greatly improved ryegrass elimination.

Sulfosulfuron applied at either 0.059 or 0.117 lb a.i./A were not consistently significantly different following any applications. The degree of ryegrass removal appeared to be slightly faster soon after applications but total removal was somewhat similar at the end of transition in June and July. Flazasulfuron at the rate range being evaluated exhibited some significant differences between 0.00156 and 0.0078 lb a.i./A. There was a stair-stepping effect from low to high rates of flazasulfuron. The low rate of 0.00156 lb a.i./A was marginally acceptable while the high rate of 0.0078 rapidly and effectively removed ryegrass.

The herbicides applied in late April followed by a sequential application 2 weeks later in early May were more effective to remove ryegrass than when the sequential application was made 7 weeks later in June. Foramsulfuron, trifloxysulfuron, sulfosulfuron, and intermediate rates of flazasulfuron exhibited similar efficacy for removing ryegrass with single or sequential applications. Rimsulfuron at 0.013 lb a.i./A and flazasulfuron at 0.0078 lb a.i./A were highly effective in rapidly removing ryegrass with a single application.

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Table 1. Ryegrass removal at DC Ranch Golf Club in 2006

Treatment	Rate	Timing*	Ryegrass removed (%)			
	lb a.i./A		17-May	22-May	12-Jun	26-Jun
untreated check			3	0	33	86
foramsulfuron	0.013	A + M	38	77	93	98
foramsulfuron	0.013	A + J	22	47	80	91
rimsulfuron	0.016	A	47	67	83	99
rimsulfuron	0.016	A + M	53	88	93	99
trifloxysulfuron	0.0047	A + M	42	53	78	96
trifloxysulfuron	0.0047	A + J	22	23	73	88
sulfosulfuron	0.059	A + M	43	60	87	98
sulfosulfuron	0.059	A + J	15	20	52	68
sulfosulfuron	0.117	A + M	37	55	90	99
sulfosulfuron	0.117	A + J	17	27	40	98
flazasulfuron	0.00156	A + M	37	40	33	91
flazasulfuron	0.00156	A + J	17	13	30	83
flazasulfuron	0.00273	A + M	43	62	82	98
flazasulfuron	0.00273	A + J	27	23	25	93
flazasulfuron	0.0039	A + M	47	62	94	98
flazasulfuron	0.0039	A + J	33	23	45	95
flazasulfuron	0.0078	A	37	62	87	98
flazasulfuron	0.0078	A + M	40	83	96	99
LSD (p=0.05)			16.2	23.3	30.4	20.9

*Sequential applications: A=24 April 2006; A+M=24 April plus 08 May; A+J=24 April plus 12 June
17 May = 23 DAT-1 (A), 9 DAT-2 (A+M); 22 May = 28 DAT-1, 14 DAT-2;
12 June = 49 DAT-1, 35 DAT-2; 26 June = 63 DAT-1, 49 DAT-2 (A+M),
14 DAT-2 (A+J)

Table 2. Ryegrass removal at The Duke in 2006

Treatment	Rate	Ryegrass removed (%)			
	lb a.i./A	06-Jun	19-Jun	29-Jun	13-Jul
untreated check		7	38	62	85
foramsulfuron	0.013	27	83	80	93
rimsulfuron	0.016	22	93	95	98
trifloxysulfuron	0.0047	25	75	82	98
sulfosulfuron	0.059	18	72	88	93
sulfosulfuron	0.117	23	88	88	98
flazasulfuron	0.00156	10	50	67	88
flazasulfuron	0.00273	15	43	73	95
flazasulfuron	0.0039	17	50	65	93
flazasulfuron	0.0078	30	65	73	98
LSD (p=0.05)		12.3	28.5	24.5	10.8

Single applications made on 30 May 2006.
06 June = 7 DAT; 19 June = 20 DAT; 29 June = 31 DAT; 13 July = 44 DAT

Table 3. Ryegrass removal at the Whirlwind Golf Club in 2006

Treatment	Rate	Ryegrass removed (%)		
	lb a.i./A	15-Jun	29-Jun	13-Jul
untreated check		20	57	98
foramsulfuron	0.013	47	85	98
rimsulfuron	0.016	77	93	98
trifloxysulfuron	0.0047	27	72	98
sulfosulfuron	0.059	57	83	98
sulfosulfuron	0.117	67	88	98
flazasulfuron	0.00156	40	75	98
flazasulfuron	0.00273	43	83	98
flazasulfuron	0.0039	63	85	98
flazasulfuron	0.0078	77	92	98
LSD (p=0.05)		16.5	12.3	0

Applications made on 01 June 2006.
15 June = 14 DAT; 29 June = 28 DAT; 13 July = 42 DAT

Figure 1. Ryegrass removal at DC Ranch in 2006

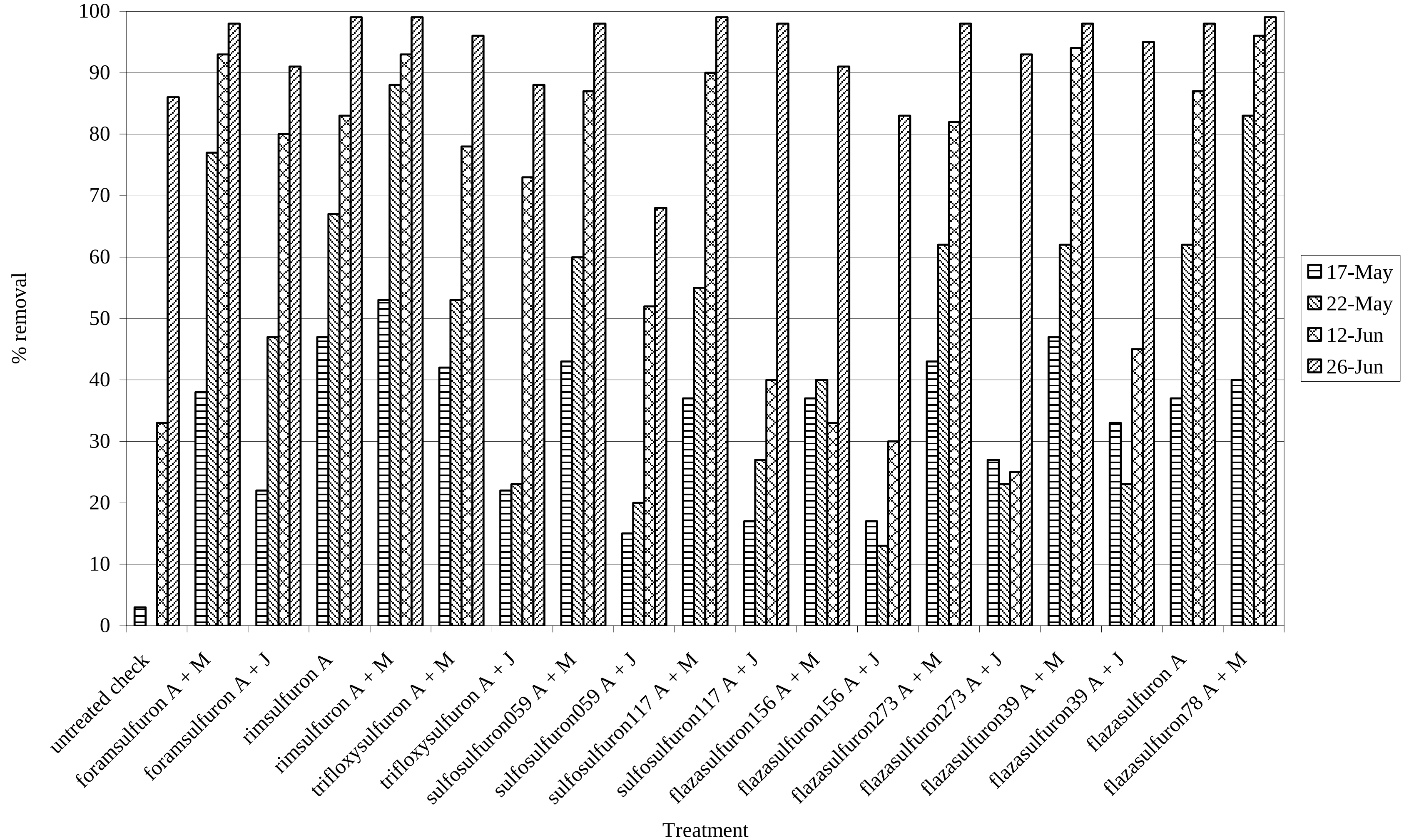

Figure 2. Ryegrass removal at The Duke in 2006

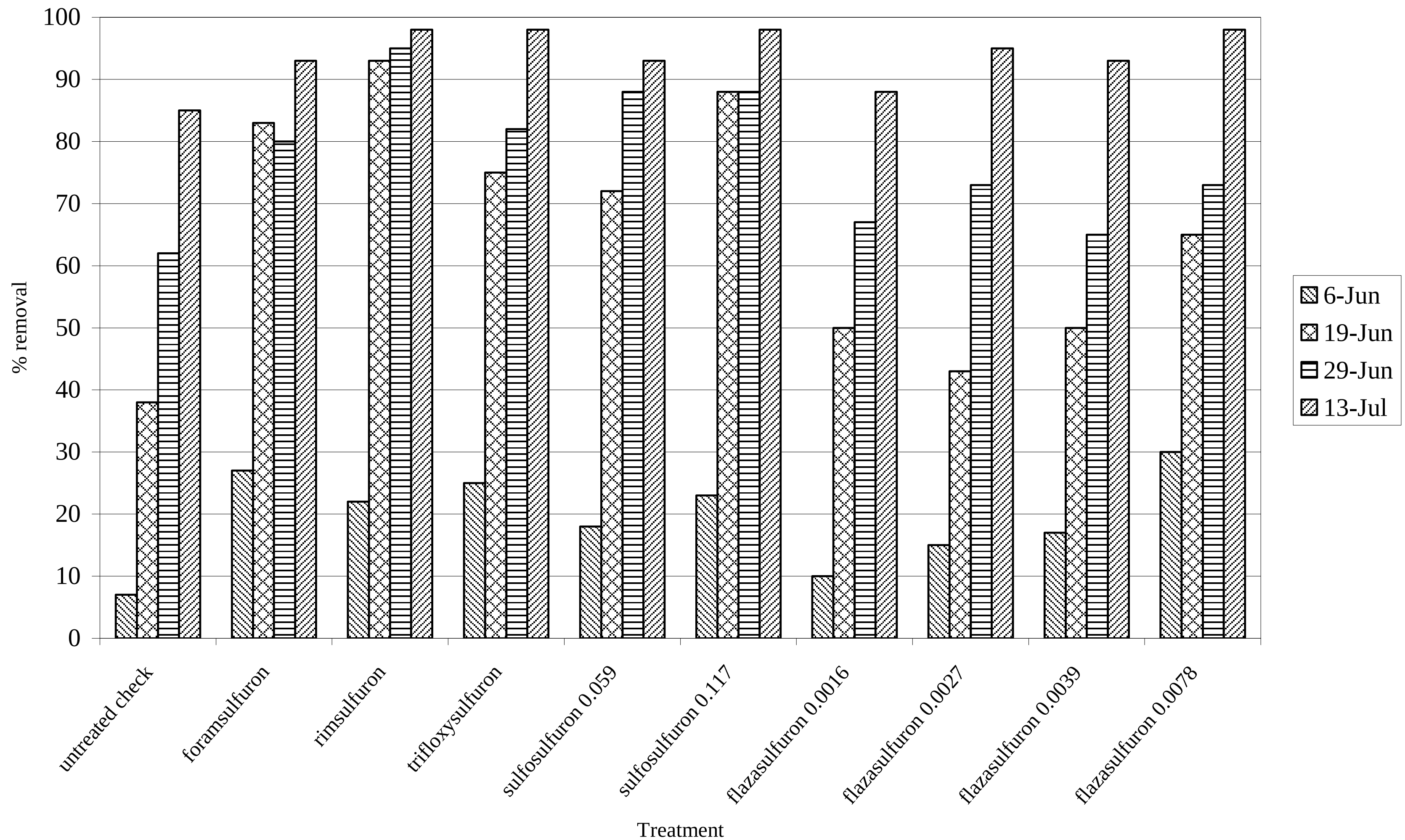

Figure 3. Ryegrass removal at Whirlwind Golf Club in 2006