

# Encroachment of Bermudagrass into Bentgrass Greens

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**T**HE DEMAND FOR smoother, faster putting surfaces on golf course greens in the South has led to a significant increase in the use of bentgrass. Bentgrass greens are usually surrounded by bermudagrass collars and aprons, however, and encroachment of bermudagrass into the bentgrass can create a severe contamination problem that results in a poor putting surface and lower turf quality (Figure 1). Therefore, effective control of bermudagrass without concurrent bentgrass injury is a goal that has long been sought.

Several researchers have investigated bermudagrass control using Tupersan, and the results have varied from zero to 100% control. A researcher in Australia found that Tupersan at 40 pounds per acre (all chemical rates are reported as active ingredient per acre) in each of two applications 12 weeks apart in late summer controlled bermudagrass completely. Work in Texas produced similar results when the chemical was applied at 18 pounds per acre in two applications at 4- to 6-week intervals. However, additional applications may be required to prevent future bermudagrass encroachment. Others have reported a variety of effects with Tupersan, including suppressed bermudagrass growth, reduced stolon length into the treated area, or no effect at all on growth or control.

To identify the chemicals that prevent encroachment of bermudagrass into bentgrass greens, experiments were conducted with several chemicals to determine the tolerance of bentgrass to the materials, the effects of application



Figure 1. Encroachment of bermudagrass into bentgrass green.

Figure 2. Tifway bermudagrass planted into Paraquat-treated bentgrass.

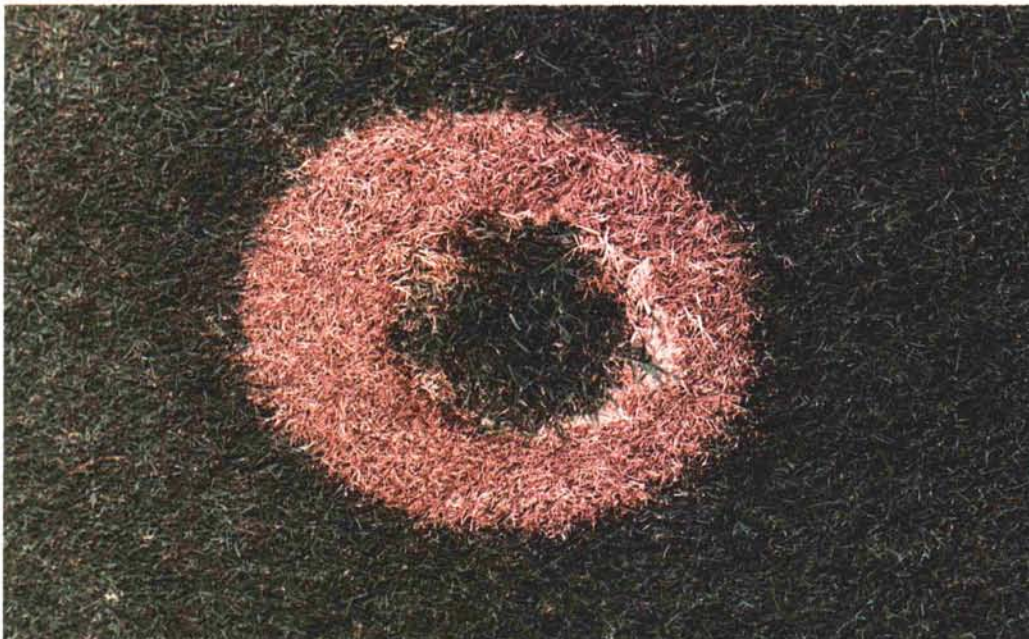


Figure 3. Moderate bentgrass injury from Prograss & Cutless applied April 19. Left, Prograss & Cutless at full rate (1.5 & 0.75 pounds per acre); right, untreated. Picture was made April 29.





**TABLE 1**  
**Dates and frequency of chemical treatments applied in**  
**fall-spring 1986-1988. Experiment I.**

Treatments	Applied	
	Sept. 30	April 15
	<i>pounds active ingredient per acre</i>	
Tupersan	48 —	48 48
Cutless	1.25 —	1.25 1.25
Tupersan & Cutless	48 + 0.75 —	48 + 0.75 48 + 0.75
Prograss & Cutless	1.5 + 0.75 —	1.5 + 0.75 1.5 + 0.75

**TABLE 2**  
**Dates and frequency of chemical treatments applied in**  
**spring and summer 1987-1988. Experiment II.**

Treatments	Applied		
	April 15	June 1	July 15
	<i>pounds active ingredient per acre</i>		
Cutless	1.25	—	—
	1.25	1.25	—
	1.25	0.63	—
	1.25	0.63	0.63
Tupersan & Cutless	48 + 0.75	—	—
	48 + 0.75	48 + 0.75	—
	48 + 0.75	24 + 0.38	—
	48 + 0.75	24 + 0.38	24 + 0.38
Prograss & Cutless	1.5 + 0.75	—	—
	1.5 + 0.75	1.5 + 0.75	—
	1.5 + 0.75	0.75 + 0.38	—
	1.5 + 0.75	0.75 + 0.38	0.75 + 0.38

dates and frequencies, and the effectiveness of the chemicals in controlling the encroachment of three bermudagrass cultivars (Tifway, Tifgreen, and common).

#### Procedures

Chemicals were applied alone or in combined treatments in three separate experiments at Griffin, Georgia, from 1986 to the present. The rates and fre-

quency of application are presented in Table 1 for Experiment I, Table 2 for Experiment II, and Table 3 for Experiment III. Experiment I has been completed, but the results from the other experiments are preliminary.

Plugs of Tifway, Tifgreen, and common bermudagrasses were planted (4 inches in diameter at a 4-inch depth) into a mature Penncross creeping bentgrass golf green. Prior to transplanting,

the bermudagrasses were grown on the same USGA green mix as the bentgrass and at the same mowing height (5/32-inch). During the summer prior to the fall or spring-summer treatments, each grass plug was transplanted to the center of an 8-inch diameter area previously treated with paraquat (Figure 2). All lateral stolons from each bermudagrass plug were removed back to the original size at treatment time.

#### Bentgrass Injury

Injury to bentgrass from chemical treatments of more than 30% would not be acceptable on most golf courses.

**Tupersan.** When Tupersan was applied in September, it injured the bentgrass more (28%) than when it was applied in April (16%). This occurred whether bentgrass was treated with Tupersan both in September and April, or only in April. However, when bentgrass was treated with Tupersan at 48 pounds per acre in either March or April and at monthly intervals through June at the same rate, the chemical caused moderate turfgrass discoloration and the injury was undesirable for two weeks.

**Cutless.** Cutless severely injured bentgrass (50%) when it was applied in September, and the injury was unacceptable for 6 weeks. However, bentgrass tolerated Cutless when the application was delayed until April (maximum injury 30%). Cutless applied in April at the full rate (1.25 pounds per acre) and repeated at one-half rate June 1, did not cause unacceptable injury any time during the spring and summer. However, bentgrass did not tolerate Cutless when applied at a full rate in April and again in June, or when one-half rates were applied June 1 and July 15 to plots treated at full rate in April.

**Tupersan and Cutless.** Bentgrass injury was unacceptable for 1 to 4 weeks when Tupersan and Cutless were applied in September or from multiple applications during spring and summer. Turf injury was slight when treated only in April.

**Prograss and Cutless.** The combination of Prograss and Cutless caused moderate bentgrass injury within 10 days after treatment with the full rate (1.5 and 0.75 pounds per acre) in April. However, the discoloration from the treatment shown in Figure 3 did not last longer than two weeks, and the bentgrass fully recovered. A similar pattern





Figure 4. Suppression of Tifway bermudagrass on June 9. Left, untreated; right, Tupersan & Cutless at full rate (48 & 0.75 pounds per acre) in mid-April.

occurred when bentgrass was treated again with the chemicals at one-half rate on June 1. In 1989, bentgrass injury was slightly higher than in previous years when the full rate was applied in March or April (40%), but repeated applications at one-fourth rates discolored bentgrass only slightly.

Bentgrass generally tolerated Prograss and Cutless treatments when applied at the full rate in April and one-half rate or less in June. However, severe bentgrass injury can occur when the chemicals are applied at full rates in the fall or during late spring and summer.

**Acclaim.** Preliminary results with Acclaim in 1989 indicate that bentgrass was severely injured (73% to 77%) when the chemical was applied in April at either 0.125 or 0.18 pounds per acre. Bentgrass injury was unacceptable for 8 weeks when 0.06 pounds per acre was applied at monthly intervals following either the 0.25 or 0.18 pounds-per-acre rates.

#### Bermudagrass Suppression

Generally, the suppression of Tifway, Tifgreen, and common bermudagrasses was similar from the chemical treat-

TABLE 3  
Dates and frequency of chemical treatments applied in spring-summer 1989. Experiment III.

Treatments	Rate	Date Applied
	<i>pounds active ingredient per acre</i>	
Tupersan	48	March 15/April 15/June 15/July 15/Aug.15
	48	April 15/June 15/July 15/Aug.15
Acclaim	0.18	April 15
	+ 0.06	May 15/June 15/July 15/Aug. 15
	0.125	April 15
	+ 0.06	May 15/June 15/July 15/Aug. 15
Tupersan & Cutless	48 + 0.75	March 15
	+ 12 + 0.19	May 1/ May 22/June 14/ July 3
	+ 12 + 0.19	May 1/ May 22/June 14/ July 3/ July 24
	48 + 0.75	April 15
	+ 12 + 0.19	June 1/ June 22/ July 14/ Aug. 3
Prograss & Cutless	1.5 + 0.75	March 15
	+ 0.38 + 0.19	May 1/ May 22/ June 14
	+ 0.38 + 0.19	May 1/ May 22/ June 14/ July 3
	1.5 + 0.75	April 15
	+ 0.38 + 0.19	June 1/ June 22
	+ 0.38 + 0.19	June 1/ June 22/ July 14
+ 0.38 + 0.19	June 1/ June 22/ July 14/ Aug. 3	



ments. The suppression ratings were based on a scale where 1 = dead and 10 = full growth. All chemicals suppressed bermudagrass growth to some degree throughout the spring and summer. However, it was decided that the suppression must be at least 70% or more to be acceptable, and the duration of the suppression should be at least several weeks. Tupersan applied in April provided acceptable suppression of bermudagrass growth until late May. When Tupersan was applied in March and repeated at monthly intervals, suppression was extended to mid-June.

Bermudagrass treated with Tupersan and Cutless in April also effectively suppressed growth until early June (Figure 4). When one-half rate was applied in early June to plots previously treated at full rate in April, the growth was suppressed until late June. Bentgrass was injured too severely in plots treated with two Tupersan and Cutless applications, however, so this treatment should not be used.

Prograss and Cutless effectively suppressed bermudagrass longer than any of the other treatments. A single treatment in April effectively suppressed bermudagrass growth until late May. When it was applied in April at full rate plus June 1 at one-half rate, growth was suppressed until mid-September. The degree of suppression from one and two applications is shown in Figure 5.

Cutless applied by itself did not suppress bermudagrass growth as

effectively as Prograss and Cutless. Bermudagrass growth was only slightly decreased when treated with Acclaim, Prograss, Tupersan and Embark, and Prograss and Embark.

#### Bermudagrass Stolon Growth

The bermudagrass growth ratings were based on the number of stolons from the outer edge of the 4-inch diameter plug. In most instances there was a direct relationship between bermudagrass suppression and number of bermudagrass stolons, but there were differences between bermudagrass cultivars in stolon growth from some of the chemical treatments. Tupersan applied alone in April suppressed the stolon count until late May, but when applied in March or April and at monthly intervals in 1989, it generally did not suppress the number of stolons in Tifway or Tifgreen when counts were made mid-June. Multiple Tupersan treatments, however, effectively suppressed the number of stolons of common bermudagrass during the same period.

Tupersan and Cutless applied in April suppressed the number of bermudagrass stolons until late May. Based upon the preliminary 1989 results, suppression continued until late June when the plots treated in April were treated again at one-fourth rates on May 30 and June 22. It is not known whether the reduced rates will effectively suppress stolon encroachment throughout the summer.

Prograss and Cutless applied at full rate in mid-April, followed by a one-half rate application on June 1, effectively suppressed stolon encroachment of Tifgreen until late July. Tifway and common bermudagrass were affected a month longer. Although foliar growth of Tifgreen treated with Prograss and Cutless was suppressed until mid-September, the number of stolons for Tifgreen was higher than for either Tifway or common.

From preliminary results in 1989, Acclaim did not effectively suppress stolon encroachment of Tifway or Tifgreen, but it suppressed common bermudagrass when counts were taken in late June.

#### Summary

Three bermudagrass cultivars growing in a bentgrass green were treated with Tupersan, Tupersan and Cutless, Cutless, Prograss and Cutless, and Acclaim. Prograss and Cutless applied during mid-April at a full rate (1.5 and 0.75 pounds per acre) and repeated at one-half rate June 1 suppressed bermudagrass foliar growth and reduced stolon encroachment throughout the spring and summer without an unacceptable level of injury to bentgrass. In some instances effective bermudagrass retardation was obtained for the same period with other treatments, but the rates and frequency of chemical application caused too much injury to the bentgrass.

Figure 5. Suppression of Tifway bermudagrass on September 12. Left, untreated; center, Prograss & Cutless applied on April 19 at full rate (1.5 & 0.75 pounds per acre); right, Prograss & Cutless applied on April 19 at one-half rate (1.5 & 0.75 pounds per acre) and on June 2 at one-half rate (0.75 & 0.38 pounds per acre).

