



Optimizing spring transition of perennial ryegrass

Using a selective herbicide and appropriate cultural practices can alleviate some of the agony of spring transition to bermudagrass.

Warm-season golf courses often overseed bermudagrass with a cool-season species such as perennial ryegrass (*Lolium perenne* L.) (5,6,8) to hide dormant brown bermudagrass and improve winter playability.

The greater heat tolerance and improved shoot density of the newer perennial ryegrass cultivars provide them with the potential to become short-lived perennials in southern climates (9). However, prolonged overseeding cover can reduce bermudagrass stands (1,3,4,7) because overseeding shades the bermudagrass (*Cynodon* species) base, keeping soil temperatures cooler and often delaying bermudagrass spring green-up.

If the climate is not conducive to a natural spring transition, cultural treatments alone will not effectively or consistently aid in providing a desirable spring transition (1,3,4,7). In

recent years, the sulfonylurea class of herbicides has become more popular for spring transition aids than Kerb (pronamide, Dow AgroSciences), which is slower and less consistent (1).

Experience indicates a smooth or gradual spring transition is not satisfactorily obtained with herbicides alone. It appears necessary to merge cultural and chemical controls to achieve a desirable transition without unacceptable turf quality. The objective of this research was to evaluate combinations of mowing height, fertilizer rate and application timing and rate of Monument (trifloxysulfuron, Syngenta), a sulfonylurea herbicide, to determine which cultural and chemical practices would produce a seamless spring transition from the overseeded perennial ryegrass to the permanent bermudagrass base.

Methods

A 12-week study was conducted from mid-April to July 2006 and repeated in 2007 on the Clemson University athletic department's soccer practice fields in Clemson, S.C. The experiment was on an established stand of Tifway 419 hybrid bermudagrass overseeded in early October with Barenbrug Turf Star Brand Perennial Ryegrass blend at 7 pounds/1,000 square feet (342 kilograms/hectare) pure live seed.

Before the experiment was initiated, routine maintenance typical for fairways was followed, including mowing three times weekly at 0.75 inch (1.9 centimeters) with clippings returned, irrigating as needed to prevent wilt, and fertilizing yearly with a total of 8.0 pounds nitrogen, 5.0 pounds phosphorus and 5.0 pounds potassium/1,000 square feet (391 kilograms nitrogen, 244 kilograms phosphorus, 244 kilograms potas-



An example of an unacceptable spring transition. **Left**, The overseeded perennial ryegrass abruptly transitioned, exposing a weak and unsightly bermudagrass base. **Right**, Bermudagrass that was not overseeded had acceptable turf quality. **Photo by Alan Estes**

R.K. McCauley
Bert McCarty, Ph.D.
Haibo Liu, Ph.D.
J.E. Toler, Ph.D.



An aerial view of plots from study 2 (2007) taken in early May. All plots treated with herbicide in mid-April have unacceptable turf quality. Photo by Raymond McCauley

sium/hectare).

Treatments

Cultural treatments were started on April 11 in 2006 and 2007: mowing three times weekly at 0.5 or 1.0 inch (1.2 or 2.5 centimeters) and applying fertilizer at rates of 0.375 or 0.75 pound nitrogen/1,000 square feet/week (1.8 or 3.7 grams nitrogen/square meter/week) with ammonium nitrate (NH4NO3).

Monument 75WG was applied at 0.1 or 0.3 ounce/acre (7 or 21 grams/hectare) in mid-April or mid-May of each year with a nonionic surfactant added at 0.25% by volume. Monument was applied with a carbon dioxide backpack sprayer calibrated at 20 gallons/acre (187 liters/hectare) using a 6.6-foot (2-meter) boom with TeeJet 8003 flat-fan nozzles.

The study was arranged as a split-plot design with four randomized whole plots, five randomized subplots per whole plot and four replications. Whole-plot treatments were mowing height and fertilizer rate. Subplot treatments were Monument applications at a low rate of 0.1 ounce/acre (7 grams/hectare) or a high rate of 0.3 ounce/acre (21 grams/hectare) in mid-April or mid-May.

Ratings

Visual ratings taken throughout the study included weekly turf quality, percent perennial ryegrass density and percent bermudagrass density. Turf quality was rated on a 1 to 9 scale, where 1 is poor, 9 is excellent and less than 7 indicates unacceptable turf. Percent perennial ryegrass and percent bermudagrass densities were rated on a scale of 0% to 100%, where 0% is no perennial ryegrass or bermudagrass and 100% indicates complete perennial ryegrass or bermudagrass coverage.

Clippings were harvested monthly from each treatment with a walk-behind reel mower and then dried and weighed.

At the end of the studies, roots were sampled with a standard golf course cup cutter 4.2 inches in diameter x 6 inches deep (10.6 centimeters in diameter x 15.2 centimeters deep). Clippings were separated, washed, collected, dried at 160 F (71 C) for 72 hours and weighed.

Bermudagrass shoot counts were measured twice during the study, at five and 43 days after the second Monument treatment, using three metal grids, each 3 inches x 3 inches (7.6 centimeters x 7.6 centimeters) with nine squares, each 1 inch x 1 inch (2.5 centimeters x 2.5 centimeters). If a bermudagrass shoot was present at the intersection of one of the 48 total junctures, it was recorded as a positive hit.

Results and discussion

Mowing height

During 2006 and 2007, plots not treated with Monument and mowed at either 0.5 inch (1.2 centimeters) or 1.0 inch (2.5 centimeters) maintained acceptable turf quality throughout both studies. Mowing height had little influence on 2006 perennial ryegrass percentages.

In 2007, however, the 0.5-inch (1.2-centimeter) mowing height hastened ryegrass disappearance and improved the spring transition of both the control and Monument-treated plots. Nevertheless, all control plots still had unacceptable amounts of perennial ryegrass present at the end of the studies, which warrants the use of Monument for complete perennial ryegrass control.

Fertility rate

Throughout 2006 and 2007, plots not treated with Monument at both fertility levels maintained acceptable turf quality. On June 11, 2006, 11% to 29% less perennial ryegrass was present in Monument-treated plots receiving higher fertilizer rates, and by June 24, 2006, plots that were treated with Monument in April and May and had received the high fertility rate had no perennial ryegrass present. On June 24, 2006, control treatments that had received the high fertility rate had less perennial ryegrass present than control treatments receiving the low fertility rate, but both controls had unacceptable quantities (50% to 60%) of perennial ryegrass.

In 2007, the high fertility rate, 0.75 pound nitrogen/1,000 square feet/week (3.7 grams nitrogen/square meter/week), reduced perennial ryegrass density while promoting the bermudagrass base. The high-fertility-rate control treatments

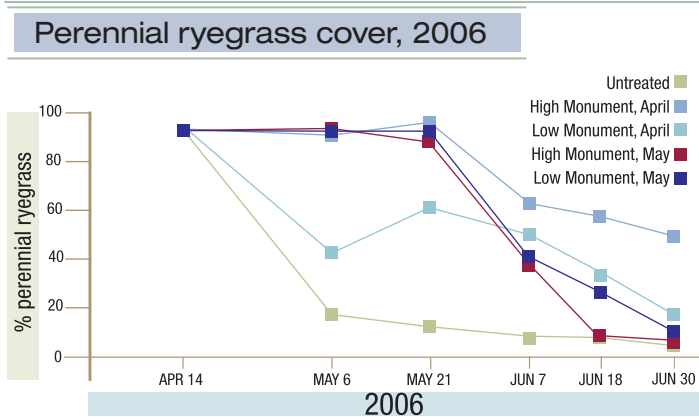


Figure 1. Percent perennial ryegrass cover in plots mowed at 1.0 inch (2.5 centimeters) and treated with Monument 75WG in 2006. The high Monument rate is 0.3 ounce/acre (21 grams/hectare); the low Monument rate is 0.1 ounce/acre (7 grams/hectare).



had 5% less perennial ryegrass and 8% more bermudagrass present on July 1, 2007. However, both control treatments had unacceptable quantities of perennial ryegrass (21% to 25% perennial ryegrass) present on July 1, 2007, regardless of fertility rate.

In both years, the high fertility rate (0.75 pound nitrogen/1,000 square feet/week [3.7 grams nitrogen/square meter/week]) reduced perennial ryegrass density, promoted the bermudagrass base and improved the spring transition of both control plots and plots treated with Monument. However, increased fertility alone did not provide an acceptable transition.

Monument rate

Cultural treatments aided in perennial ryegrass removal, but where Monument was not applied, perennial ryegrass lingered in the plots through the end of both studies. In 2006, plots mowed at 1.0 inch (2.5 centimeters) and treated with the low rate of Monument and either fertility level maintained acceptable turf quality throughout the study. However, at the end of the study on July 1, these plots still had 50% perennial ryegrass cover. The high rate of Monument applied in April and May ensured the best perennial ryegrass control in 2006 (Figure 1).

At the end of the 2007 study, control treatments had 18% to 31% perennial ryegrass present. However, plots treated with either rate of Monument had complete perennial ryegrass control. Plots mowed at 0.5 inch (1.2 centimeters) and treated with the low Monument rate and either fertility level maintained acceptable turf quality throughout 2007.

Monument timing

In 2006 and 2007, plots mowed at 0.5 inch (1.2 centimeters) and treated with Monument in April at either fertility level abruptly lost their perennial ryegrass cover before active bermudagrass growth. As a result, turf quality suffered for two to four weeks until the bermudagrass base filled the perennial ryegrass voids (Table 1). All plots treated with Monument in mid-April 2006 achieved acceptable turf quality by May 29, and all plots treated with Monument in mid-May 2006 exhibited acceptable turf quality by June 24. Plots treated with the low rate of Monument in mid-April at both fertility levels and mowed at 1.0 inch (2.5 centimeters) maintained acceptable turf quality in 2006, but the plots consisted of 50% perennial ryegrass at the study's end on July 1.

In 2007, the most effective spring transition was achieved with mid-May Monument applica-

Turf quality, 2007

Monument rate/date	April 19	April 30	May 16	May 28	June 6	June 11	June 21	July 3
Untreated	9.0a	8.8a	8.9a	8.9a	8.9a	8.9a	8.7b	8.6b
High/April	8.6b	5.8c	6.2c	8.3a	9.0a	9.0a	9.0a	9.0a
Low/April	8.7b	6.2b	6.7b	8.8a	9.0a	9.0a	9.0a	9.0a
High/May	9.0a	9.0a	8.7a	6.9c	6.5c	7.0c	8.8a	9.0a
Low/May	9.0a	8.9a	8.8a	7.6b	7.1b	7.6b	9.0a	9.0a
LSD	0.13	0.21	0.26	0.67	0.31	0.39	0.24	0.19

Table 1. Quality of turfgrass mowed at 0.5 inch and treated with Monument 75WG in 2007. Turf quality below 7 was considered unacceptable. The high rate of Monument was 0.3 ounce of product/acre, and the low rate of Monument was 0.1 ounce product/acre. LSD, least significant difference at 0.05.

tions, at 0.5-inch (1.2-centimeter) mowing height and both fertility levels. All Monument treatments achieved complete bermudagrass coverage and perennial ryegrass control by July 1, 2007, regardless of application date (Figures 2,3). Despite the initial loss of turf quality following application, all April Monument treatments at both heights and fertility rates achieved complete bermudagrass coverage by June 6, 2007. Mid-May Monument treatments applied to turf mowed at 0.5 inch (1.2 centimeters) achieved complete bermudagrass coverage by June 6, and all May treatments achieved complete coverage by June 21, 2007.

Conclusions

Untreated plots maintained acceptable turf quality during both studies. In 2007, untreated plots mowed at 0.5 inch (1.2 centimeters) and fertilized at 0.75 pound nitrogen/1,000 square feet/week (3.7 grams nitrogen/square meter/week) reduced perennial ryegrass density while promoting the bermudagrass base. Nevertheless, in both years, cultural practices failed to provide an acceptable transition (1,2). In contrast, on July 1 in both years, Monument-treated plots had higher bermudagrass density and greater bermudagrass shoot counts than the control plots.

Prolonged perennial ryegrass cover often compromises the bermudagrass base and eventually causes it to deteriorate. It has been suggested that bermudagrass requires approximately 90 to 100 days of ideal growing conditions free from overseeded turf to fully recover and maintain a strong base (3,5,8). Therefore, herbicides that assist with transition are often needed to ensure the bermudagrass base has sufficient time to fully recover (1,2,3,7). Although no treatment was consistent over both years, plots treated with the low rate of Monument in May (0.1 ounce/acre [7 grams/hectare]) at 0.5-inch (1.2-centimeter) mowing height and fertility treatments of 0.75 pound nitrogen/1,000 square feet/week (3.7 grams nitrogen/square meter/week) maintained acceptable



The research says

→ In many areas where superintendents overseed bermudagrass with perennial ryegrass, a combination of chemical applications and cultural practices is necessary to remove the perennial ryegrass and to allow the bermudagrass to green up.

→ High (0.3 ounce) and low (0.1 ounce) rates of Monument (trifloxysulfuron) were tested in combination with 0.5- and 1.0-inch mowing heights and weekly applications of 0.375 or 0.75 pound of nitrogen to determine the most effective combination of chemicals and practices for promoting spring transition.

→ Under normal spring and summer conditions and cultural practices of 0.5-inch mowing height and 0.75 pound nitrogen/week, applying Monument in mid-May at 0.1 ounce/acre provides acceptable turf quality and spring transition.



Perennial ryegrass and bermudagrass cover, 2007

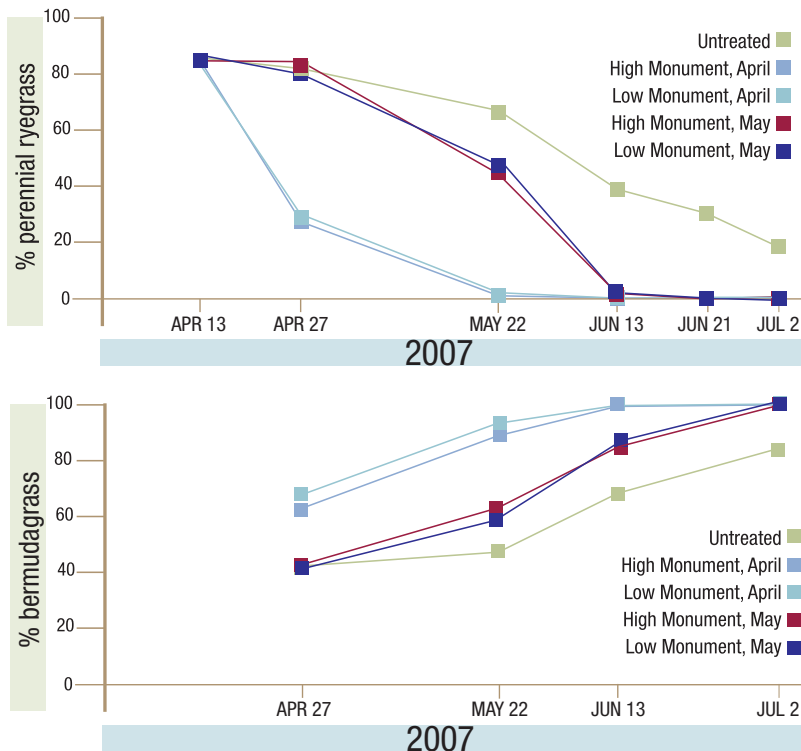


Figure 2 (top). Percent perennial ryegrass cover in plots mowed at 0.5 inch (1.2 centimeters) and treated with Monument 75WG in 2007.

At the end of the study, all April and May Monument treatments had 0% perennial ryegrass. The high Monument rate is 0.3 ounce/acre (21 grams/hectare); the low Monument rate is 0.1 ounce/acre (7 grams/hectare).

Figure 3 (bottom). Percent bermudagrass cover in plots treated with Monument 75WG and mowed at 0.5 inch (1.2 centimeters) in 2007. The high Monument rate is 0.3 ounce/acre (21 grams/hectare); the low Monument rate is 0.1 ounce/acre (7 grams/hectare). All April and May Monument treatments had 100% bermudagrass coverage by July 2.

turf quality throughout 2007.

Despite maintaining acceptable turf quality throughout 2006, plots treated in April with the low rate of Monument and mowed at 1.0 inch (2.5 centimeters) still possessed a substantial quantity of perennial ryegrass (50%). High Monument applications in April provided unacceptable turf quality both years as the perennial ryegrass transitioned abruptly before the bermudagrass began active growth. Subsequently, the bermudagrass base did not rapidly fill in the perennial ryegrass voids.

Percent bermudagrass cover was significantly higher before the May Monument applications, allowing plots treated with Monument in May to experience minimal loss of turf quality (1,2,3,8). A poor 2006 spring transition may be attributed to the unseasonably cool, wet spring, which favored the overseeded perennial ryegrass (2,3). Meanwhile, the hot and dry spring and summer in 2007 were more conducive to an effective spring transition, which may explain why a distinct successful treatment emerged (3).

In Clemson, S.C., cultural practices must be coupled with herbicides that aid spring transition to achieve a complete, timely spring transition. Under normal spring and summer conditions and

cultural practices of mowing at 0.5 inch (1.2 centimeters) and applying 0.75 pound nitrogen/1,000 square feet/week (3.7 grams nitrogen/square meter/week), a mid-May Monument application of 0.1 ounce/acre (7 grams/hectare) provides acceptable turf quality and spring transition.

Funding

Funding for this study was graciously provided by the South Carolina Turf Foundation and Clemson University.

Acknowledgments

The authors extend their sincerest gratitude to Mike Echols, Todd Bramble and Mike Burgess of Smith Turf and Irrigation, and to Alan Estes, Wesley Totten, Jason Higingbottom, the entire Clemson University Athletic Grounds staff and the Clemson University varsity women's soccer team for their cooperation, patience and support throughout this project.

Literature cited

1. Askew, S.D., D. McCall, W.L. Barker and J.B. Beam. 2005. Chemical transitions on overseeded golf fairways and athletic fields. *Virginia Turfgrass Journal* January/February:22-23.
2. Gelernter, W., and L. Stowell. 2005. Improved overseeding programs: 2. Managing the spring transition. *Golf Course Management* 73(3):114-118.
3. Horgan, B., and F. Yelverton. 1998. Removing overseeded ryegrass from bermudagrass. *Grounds Maintenance* 33(1): G18, G22-G25.
4. Mazur, A.R., and D.F. Wagner. 1987. Influence of aeration, topdressing, and vertical mowing on overseeded bermudagrass putting green turf. *HortScience* 22(6):1276-1278.
5. McCarty, L.B. 2005. Best golf course management practices. 2nd ed. Prentice Hall, Upper Saddle River, N.J.
6. Ostmeier, T. 2004. Golf's extreme makeover. *Golf Course Management* 72(7):50-60.
7. Willis, J.B., S.D. Askew and B.W. Compton. 2007. Cold influences overseeded perennial ryegrass control. *Golf Course Management* 75(5):118-120.
8. Yelverton, F. 2005. Spring transition: Going, going, gone. *USGA Green Section Record* 43(2):22-23.

GCM

R.K. McCauley (rmccauley@clemson.edu) is a research assistant, Bert McCarty is a professor and Haibo Liu is an associate professor in the department of horticulture, Clemson University; Joe Toler is a professor in the department of applied economics and statistics, Clemson University, Clemson, S.C.