

causing difficulties with establishing overseeded grasses in the fall.

Patriot bermudagrass has been widely successful in the northern states due to its density, wear tolerance, and cold tolerance. One of the largest problems facing those who adopt Patriot for their game fields is difficulty in establishing perennial ryegrass in the fall. The canopy architecture of Patriot has not been scientifically compared to previously existing cultivars but close observation reveals several differences. Patriot's density seems to come predominately from stolon mass and not leaf mass (see Fig. 1). Patriot had more than twice the biomass of Midiron due to a higher percentage of stolons. Starch content per unit stolon weight was actually higher for Midiron because Patriot's stolons were smaller (data not shown). Patriot tends to have a densely packed canopy of small stolons with a layer of leaves on the surface (Fig. 2). In contrast, most other bermudagrasses have leaves throughout the canopy and much lower stolon mass.

The increased stolon mass and canopy architecture of Patriot likely give the grass its superior wear tolerance but is also responsible for increased scalping problems when mowing is delayed and for decreased perennial ryegrass establishment in fall. Research is currently underway to characterize methods that will aid in the establishment of overseeded grasses into Patriot and other dense bermudagrasses. Although the data are not in, the following are techniques that we plan to test at Virginia Tech to help solve the establishment problem:

**Verticut and open the canopy.** Field managers in the Deep South are accustomed to cutting or slicing the field in several directions to aid in perennial ryegrass establishment. In the North, winterkill is more of a concern and the practice is less common. At Virginia Tech, we have verticut Patriot up to four directions before overseeding and have not had problems. More research is needed to thoroughly test the procedure.

**Use a plant growth regulator or suppression chemical.** Products like Primo Maxx (trinexapac ethyl) can be applied to bermudagrass until emergence of the overseeded grass. Other growth regulators like Cutless (flurprimidol), Trimet (paclobutrazol), and Embark (mefluidide) may be injurious to perennial ryegrass seedling emergence. Turflon Ester (triclopyr) can also be used for more

aggressive bermudagrass suppression but may be too aggressive against bermudagrass and injurious to seedling establishment. Consult the label to determine restrictions on seeding after treating with any suppression chemical.

**Use a spiker to force seed through the canopy.** Any piece of equipment that can safely move the perennial ryegrass seed down to the soil is beneficial to overseeded establishment. We have even used blowers for this purpose. Several Patriot fields have had problems where overseeded perennial ryegrass germinates in the middle of the Patriot canopy. Although perennial ryegrass roots can find the soil even if the seed are lodged between bermudagrass stolons, any wear on the field quickly severs these roots, killing the perennial ryegrass. Topdressing the field with sand or other materials could also help in survival of these "midcanopy" seedlings.

**Use paint to keep things green.** In addition to winterkill, a second problem with aggressive disruption of the bermudagrass canopy is decreased turf aesthetics. Even folks who don't like using paint might consider the use during this transitional period. After the perennial ryegrass is established, the need for paint will diminish. By the way, paint is an excellent alternative to overseeding on dense bermudagrass fields and should be considered depending on how aggressive the field is

used and the expected turf quality during the dormant season.

**Use covers to keep things green.** Dr. Mike Goatley at Virginia Tech has conducted several experiments demonstrating the ability to keep bermudagrass green during winter using turf covers. Depending on your playing season, turf covers could be an excellent method to keep fields looking good during the winter. By keeping turf paint on hand as a "backup," you may be able to go at it alone with just bermudagrass.

### Killing the overseeded grass

About the time your overseeded perennial ryegrass reaches a perfect stand and the field is striping nicely, it is time to kill it to release bermudagrass that is breaking dormancy. Bermudagrass needs 85 to 100 days of competition-free growth to sustain maximum density and health. It is important that the overseeded grass be eliminated as soon as possible in the spring. In the Deep South, simple cultural practices such as lower mowing, increased fertility, and decreased watering will do nicely to aid bermudagrass in overcoming and killing the existing cool-season grass. These practices help in the North, but herbicides must be used due to lack of harsh climate and shorter bermudagrass growing season. There are several new herbicides in the sulfonylurea class of chemistry that



[Figure 1] Dry biomass of aboveground foliage from Patriot and Midiron bermudagrass as affected by the number of competition-free days the bermudagrass was allowed to grow in Blacksburg, VA.



are available to chemically transition overseeded game fields (see Fig. 3).

Plots were treated weekly at Virginia Tech with Revolver (foramsulfuron), Monument (trifloxysulfuron), and Flazasulfuron 25DF, an experimental herbicide from ISK biosciences, to determine effects of environment on herbicide efficacy for perennial ryegrass control. Of these, Revolver has the market share due to excellent bermudagrass safety, reduced restrictions on seeded bermudagrass, and excellent perennial ryegrass control. Monument is an excellent choice and provides superior perennial ryegrass and annual bluegrass control. Manor can be hit and miss for perennial ryegrass control and is less effective for annual bluegrass but still performs excellently for a large sector of the market, especially in the South.

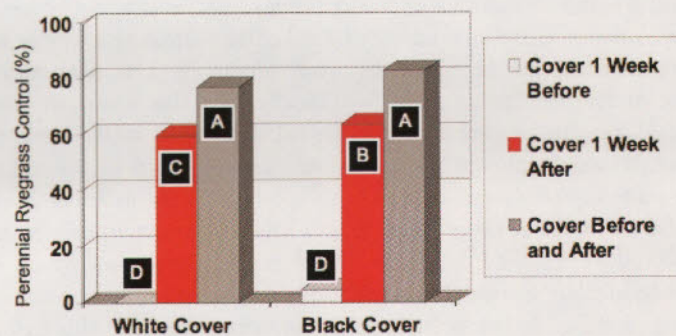
Tranxit GTA (rimsulfuron) is also an excellent herbicide for perennial ryegrass control at rates of 2 oz/A or better. Kerb (pronamide) is an older herbicide that gives a smooth transition in the South but often fails to completely control perennial ryegrass and annual bluegrass in the North.

Several complaints of poor perennial ryegrass control have been received from patrons who used sulfonylurea herbicides in winter. Since it seemed these control failures were related to temperatures, we conducted studies last year to evaluate temperature influence on three sulfonylurea herbicides (Revolver, Monument, and Flazasulfuron 25DF. These herbicides were applied at labeled rates each week for 17 weeks. Environmental conditions including soil and air temperature, solar radiation, photosynthetically active radiation, leaf wetness period, and soil moisture were recorded at hourly intervals with weather stations at each site (Fig. 4).

## Temperature effects on efficacy

Soil temperature was the most influential environmental influence on perennial ryegrass control with the three herbicides tested. Cold temperatures negatively impacted Revolver more than Monument or Flazasulfuron 25DF. Perennial ryegrass control 9 weeks after treatment

## Effects of Turf Covers on Perennial Ryegrass Control with Foramsulfuron – 6 WAT



Note: Revolver application without covers did not control perennial ryegrass

[Figure 3] Plots were treated weekly to determine effects of environment on herbicide efficacy for perennial ryegrass control.

by Monument was not correlated to temperature and tended to be inconsistent at both high and low temperatures. Revolver tended to control perennial ryegrass consistently when average soil temperature for 5 days before and after treatment were 65 F or higher. Despite some inconsistencies, Monument controlled at least 70% of perennial ryegrass 65% of the time when temperatures were below 65 F and 67% of the time when temperatures were above 65 F.

In contrast, Revolver controlled perennial ryegrass equivalently only 10% of the time at temperatures below 65 F and 88% of the time when temperatures were above 65 F. In short, Monument is more effective than Revolver when average temperature is below 65 F.

## Ryegrass establishment problems?

If you are having problems establishing perennial ryegrass into a dense bermudagrass canopy, try the following:

- Increase seeding rate
- Verticut the bermudagrass or otherwise open up the canopy to receive seed
- Use a spiker or other device to force seed through the bermudagrass canopy to the soil
- Topdress seed to improve wear tolerance
- Use a plant growth regulator, like Primo, to slow bermudagrass growth during overseeding establishment
- Use turf paint instead of overseeding
- Use covers to keep bermudagrass green instead of overseeding

## Ryegrass killing problems?

If you are having problems killing perennial ryegrass, try the following:

- Only apply Revolver at 17-fl oz/A when soil temperatures are greater than 65 F
- Increase the Revolver rate from 17-fl oz/A to 27-fl oz/A when below 65 F
- Use Monument at 0.33 to 0.56 oz/A instead of Revolver when below 65 F
- Apply a turf blanket after Revolver application and leave the blanket in place for 1 week.

Continued on page 14



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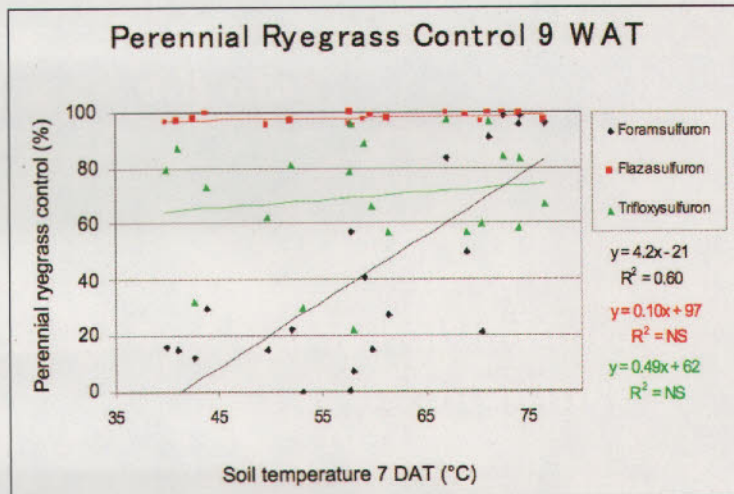


Flazasulfuron 25DF is not currently registered for use on game fields but may be soon. This herbicide controlled all of the perennial ryegrass 100% of the time, regardless of temperature.

Several things may cause poor herbicide performance. Let's examine a few other reasons sulfonylurea herbicides like Monument and Revolver may perform poorly:

- Did not use an adjuvant
- Rainfall soon after treatment
- Turf was mown soon after treatment
- Target weed is stressed due to heat, drought, disease, etc
- Mixing and calibration errors
- Poor water quality (hard water, or pH 2 units above or below 7)
- Large weeds and/or bermudagrass is not competitive

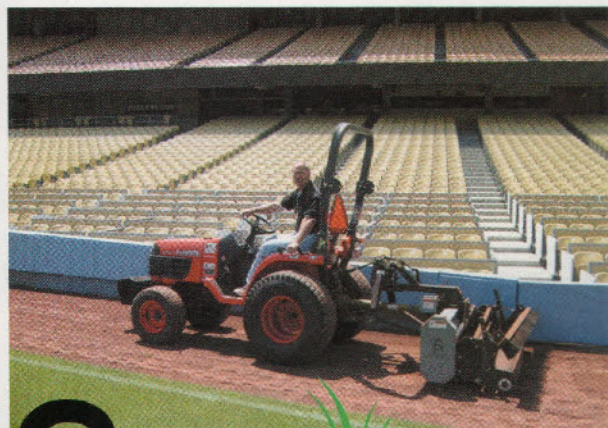
John B. Willis, Research Associate and Graduate Student, Virginia Tech, established and maintained most of the research trials discussed in this article. His efforts have made and continue to make substantial impact in the turfgrass community. Dr. Mike Goatley, Associate Professor of Turfgrass Science, Virginia Tech, provided valuable insight for the writing of this article. David McKissack, Kevin Hensler, Brent Compton, Matt Goddard, Matt Page, Andrew Monk, and Julie Keating provided technical assistance for research trials. The contributions of these individuals are much appreciated. ■



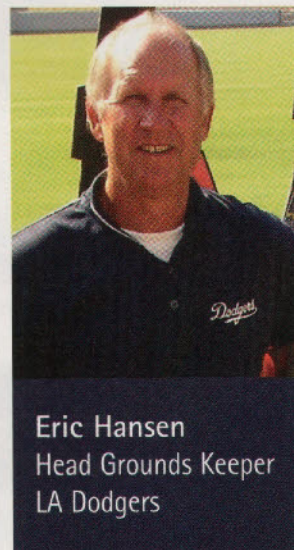
[Figure 4] Perennial ryegrass control with three sulfonylurea herbicides as influenced by soil temperature in Blacksburg.

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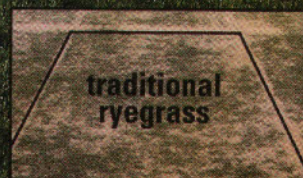


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# Breeding Better BLUE GRASSES

By Dr. David R. Huff, Dr. Ambika Chandra, and Jeff "Vern" Borger

The United States is a land of immigrants and so is our most popular sports turfgrass, Kentucky bluegrass (*Poa pratensis* L.). Kentucky bluegrass is native to Eurasia and was brought to North America by the first European settlers as feed

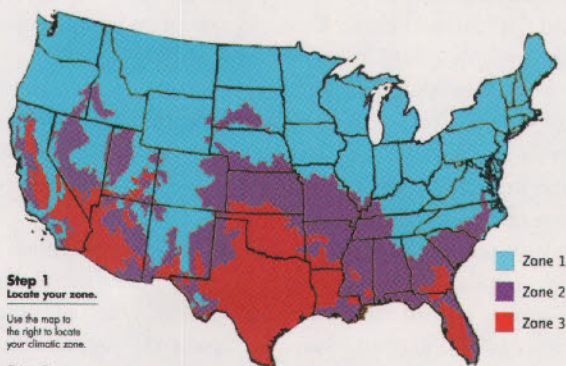
and bedding for their livestock. In this warmer climate, Kentucky bluegrass became naturalized and like the nation's immigrants, Kentucky bluegrass developed and prospered in its use as lawns and sports field surfaces.

American-born sports like baseball and football began using Kentucky bluegrass for its

beauty and durability under intensive use. Unlike any of our other immigrant cool-season turfgrasses (e.g., perennial ryegrass, tall fescue or bentgrass), Kentucky bluegrass is sod-forming and provides superior stability and traction due to its production of underground rhizome stems. These rhizomes intertwine and hold the



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<b>ZONE 3</b>	<b>SOS 400</b> 15 lbs./1,000 sq. ft.	<b>SOS 211</b> 15 lbs./1,000 sq. ft.	<b>SOS103</b> 20 lbs./1,000 sq. ft.

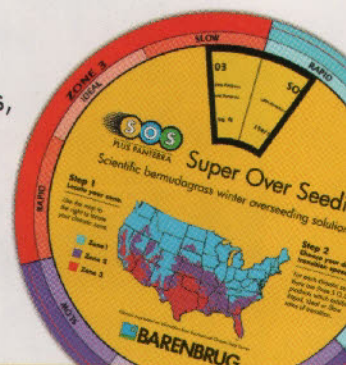
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sod together against shearing forces. They also contain growing points called nodes where new plants can begin to develop. Normally new plants form at the tips of rhizomes as they reach the soil surface. However, a deep vertical mowing can cut rhizomes and stimulate the production of new daughter plants all along each rhizome. Turf manager Robert Hudzik uses this feature at Penn State's Beaver Stadium each spring to increase shoot density without additional overseeding.

The aesthetic beauty of Kentucky bluegrass is beyond compare due to its combination of rich green color, medium fine texture, and high shoot density. Its disadvantages include susceptibility to disease and insect pests and a tendency to become thatchy. Just as the rhizomatous growth habit of Kentucky bluegrass creates a strong sod and stable playing surface, these same rhizomes also contribute to the addition of organic matter, underneath the green leaves, called thatch. If the thatch layer becomes too thick ( $>1/2$  inch) then playability may be hindered as the sports field becomes too soft.

In addition, the field will lose some of its ability to grow and recover from damage due to a shallower than normal root system. However, if there is

too little thatch ( $<1/4$  inch), then the field will lose its ability to absorb the impact of participants, increasing the risk of injury and/or reducing traction and the predictability of ball bounce. Properly managing the height of cut and thatch thickness of Kentucky bluegrass creates some of the highest quality sports field in any venue.

In Europe and Australia, perennial ryegrass is favored over Kentucky bluegrass (known in these countries as smooth-meadow grass) for sports fields. Here in America, Kentucky bluegrass has historically been the first choice for sport fields and today is often mixed with either perennial ryegrass or tall fescue.

During the 1980s and 90s, the component percentage of Kentucky bluegrass seed in high maintenance mixtures began to decrease as significant genetic improvements were bred into the turf-type perennial ryegrasses. In other words, genetic advances in traits like higher shoot densities, darker green color, and shorter stature began to give perennial ryegrass a quality that rivaled that of Kentucky bluegrass, and subsequently perennial ryegrass use increased in the sports turf market.

During the same time, similar genetic gains were also being realized in tall fescue. Genetic improvements in Kentucky bluegrass have lagged behind those of either perennial ryegrass or tall fescue for the simple fact that Kentucky bluegrass does not normally reproduce seed through a sexual process. The breeding system of Kentucky bluegrass is known as apomixis, which results in the asexual (without sex) production of seed. This means that every seed produced is genetically identical to the plant that produced it, or in other words, a genetic carbon copy of the seed-bearing parent. As such, attempting to bring together traits from different parents or improving a trait through artificial selection is nearly impossible. Thus, new types of Kentucky bluegrass only occur when the apomixis system malfunctions and produces



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The aesthetic beauty of Kentucky bluegrass is beyond compare due to its combination of rich deep green color, medium fine texture, and high shoot density.

an off-type, or an aberrant, progeny.

Most aberrant plants are quite unacceptable for turf, however, and so tens of thousands of seedling bluegrasses need to be grown in order that just a few aberrant plants can be detected that might exhibit potential improvements. Once a superior plant has been identified, then the rest of the breeding process is comparatively easy because apomixis is a great way to preserve the genetic makeup of the superior plant and to produce genetically uniform seed. But finding an aberrant plant that exceeds the performance of any of today's top cultivars is no easy challenge. Nonetheless, the need for improved cultivars of Kentucky bluegrass remains strong because as Dr. C. Reed Funk, Rutgers University, would say, "We have a lot of good cultivars of Kentucky bluegrass, but we don't have any great ones."

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