Cold influences overseeded perennial ryegrass control

Cold temperatures have a direct impact on the effectiveness of some sulfonylurea herbicides used for overseeded perennial ryegrass control in the transition zone.

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Many superintendents must overseed bermudagrass (*Cynodon* species) with perennial ryegrass (*Lolium perenne*) in order to improve winter playability and aesthetics. However, overseeding is detrimental to the underlying bermudagrass base because perennial ryegrass actively competes with bermudagrass for space, light, water and nutrients. The process of removing perennial ryegrass is known by many as transition. In the Deep South, climate and cultural practices are often effective tools for transitioning to bermudagrass. In the transition zone and the upper South, however, herbicides are needed to control perennial ryegrass in the spring and release bermudagrass from competition with perennial ryegrass.

In recent years, several sulfonylurea herbicides have been registered that effectively control perennial ryegrass without harming bermudagrass. Many university trials and golf courses have effectively used these products. However, in fluctuating transitional climates, several superintendents and researchers have observed perennial ryegrass control failures when using these products. Recalling the specifics of individual situations, most of the cases had one thing in common: cold weather after application.

Limited research has evaluated the effects of environmental conditions on effectiveness of these products. Our objectives are to evaluate the effects of temperature on perennial ryegrass control with Revolver (foramsulfuron), Monument (trifloxysulfuron) and flazasulfuron, and to provide recommendations for using these products for perennial ryegrass control when cold temperatures may occur after product application.

Research methods

Our research was conducted in Blacksburg, Va., on pure stands of perennial ryegrass. Evaluating perennial ryegrass control in the absence of bermudagrass competition allowed the most accurate assessment of perennial ryegrass control. Typical overseeding removal rates of Revolver (17.5 fluid ounces/acre), Monument (0.33 ounce product/acre) and flazasulfuron (1.5 ounces product/acre) were applied to previously untreated plots on four random plots at each of two sites. Applications were made at weekly intervals on 21 dates from mid-February through mid-July. A weather station was placed at each location, with appropriate sensors to measure air and soil temperature, soil moisture, solar radiation and dew period through the duration of the trial. All plots were visually evaluated for perennial ryegrass control and green cover at two, four and nine weeks after treatment.

Influence of cold temperatures

Of all the environmental factors measured, average soil temperatures collected hourly between treatments and one week after treatment correlated best with perennial ryegrass control. Soil temperature significantly reduced speed of control for all three herbicides; when soil temper-

When herbicides were applied at soil temperatures below 65 F (18 C), photographs taken at nine weeks after application show that control of perennial ryegrass by Revolver (A) was reduced more than control by Monument (B) and by flazasulfuron (C). **Photos by J. Willis**

atures were below 65 F (18 C), control was significantly lower for each herbicide at two weeks after treatment (Figure 1). However, at nine weeks after treatment, Revolver was the only product affected by cold temperatures (Figure 2). Of the tested products, Revolver is most sensitive to cold temperatures, flazasulfuron is the least sensitive and Monument falls between the two.

Revolver is a predominately foliar-absorbed product, whereas Monument and flazasulfuron are absorbed by both foliage and roots, which may explain differential sensitivity to cold temperatures. However, the general physiological processes of plants that lead up to growth — including nutrient absorption, movement of sugars within the plant and photosynthesis — are all reduced in cold temperatures.

The sulfonylurea herbicide family kills susceptible plants through the process of enzyme inhibition, leading to the buildup of toxic precursors of amino acids. The process of amino acid production is slower in cold temperatures, hindering the buildup of toxic precursors. Generally, when plant processes slow down, herbicides are not as effective. All of these factors are likely influencing perennial ryegrass control at cold temperatures, complicating the explanation of why these products are not as effective at cold temperatures. Future research at Virginia Tech will focus on cold temperatures' effects on herbicide movement and activity in perennial ryegrass.

Summary

Revolver is a useful product for perennial ryegrass control when soil temperatures are above 65 F (18 C). It also is very active on annual bluegrass (*Poa annua* L.) and goosegrass (*Eleusine indica* L.). If temperatures decrease after Revolver is applied

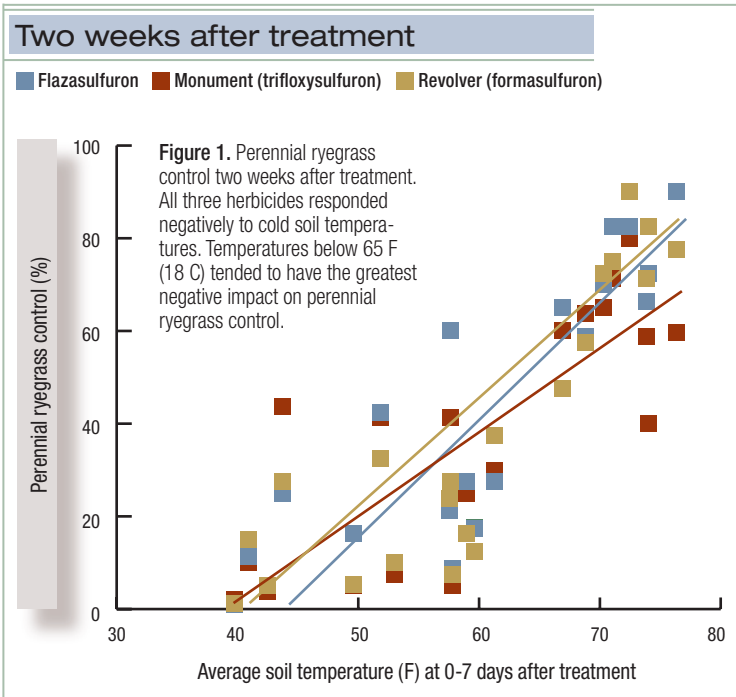

Figure 1. Perennial ryegrass control two weeks after treatment. All three herbicides responded negatively to cold soil temperatures. Temperatures below 65 F (18 C) tended to have the greatest negative impact on perennial ryegrass control.

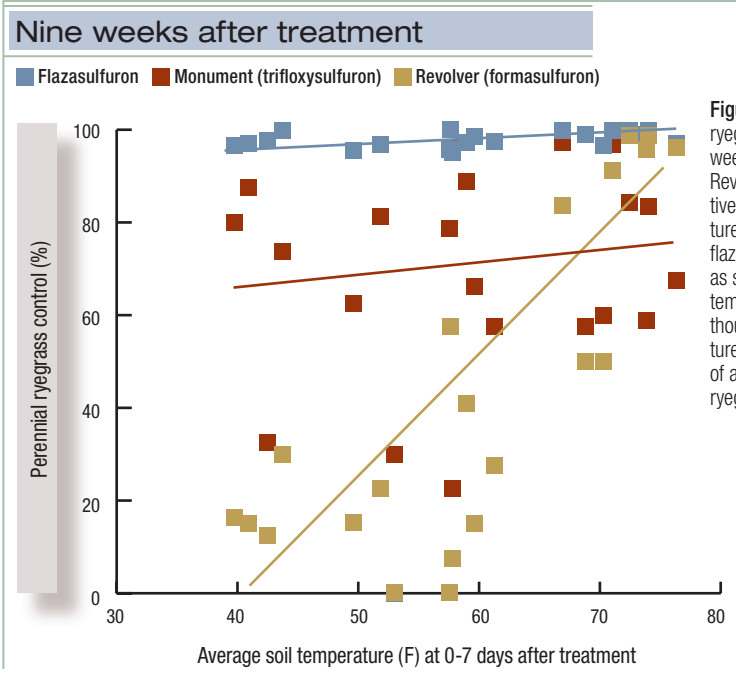

Figure 2. Perennial ryegrass control nine weeks after treatment. Revolver is most sensitive to cold temperatures. Monument and flazasulfuron are not as sensitive to cold temperatures even though cold temperatures reduce the speed of activity on perennial ryegrass control.

Sulfonylurea herbicides have shown different levels of perennial ryegrass control when soil temperatures are cold. **Photo by B. Compton**

for perennial ryegrass control, sequential applications or higher rates of Revolver will probably be necessary to obtain effective control.

Monument and flazasulfuron are less dependent on warmer temperatures and would be the obvious choices if cold temperatures are threatening. Flazasulfuron provides outstanding perennial ryegrass control with bermudagrass tolerance equivalent to Monument and Revolver. However, superintendents should be aware of its high speed of activity. Removing perennial ryegrass while bermudagrass is not aggressively growing can be detrimental to transition aesthetics.

Overall, superintendents using these products in cold temperatures should expect slower activity and reduced long-term control with Revolver.

The research says

- Failures of perennial ryegrass control with sulfonylurea herbicides seem to be related to cold temperatures one week after application.
- Soil temperatures below 65 F (18 C) significantly reduce the speed of perennial ryegrass control with Revolver, Monument and flazasulfuron, but at nine weeks after treatment, cold temperatures reduce the effectiveness of only Revolver.
- If temperatures decrease after Revolver is used to control perennial ryegrass, sequential applications or higher rates may be necessary to achieve desirable levels of control.
- Monument and flazasulfuron would be the obvious choices for perennial ryegrass control when cold temperatures are threatening.

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