Q&A

Tiger Stripe Field

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Questions?
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Q *A few weeks ago we saw these odd striping patterns on our bermudagrass fields after the first cold snap. The stripes kind of looked like a tiger or zebra stripe with brown and green turf. We were wondering if this was due to differences in soil moisture. I know it is related to the cold temperatures, but what else?*

These patterns have been talked about for years among turfgrass managers with bermudagrass fields. When noticed it is often called "chill damage" because the temperatures were not low enough to cause the entire canopy to go dormant. After a few years of seeing the patterns, I started snapping shots of them to use in presentations. The patterns frequently come up in conversation in the fall when I'm talking to turf managers.

The photo included with this article was taken by Dr Art Bruneau, Professor Emeritus at North Carolina State University. This picture is particularly interesting because it illustrates the potential impact of cutting height on these patterns.

Turns out that the different response of the same grass mowed at different heights is important in understanding what is causing the patterns. The phenomenon is related to fluid movement, but not in the same way most hypothesize. About 2 years ago I tried to convince an eager graduate student from Duke University's Environmental Science program that is was not soil moisture causing the patterns. She was not convinced, so she took on this phenomenon as a research project. This student, Sally Thompson, and a NC State physics professor published their findings on this subject in the January 2010 edition of the *American Naturalist* journal.

Initially, they thought that the mottled response was a Turing-type effect based on soil moisture differences (primarily droughty areas). It seems that these types of patterns are often seen in dessert vegetation when looking down from high above. But soil moisture tests run immediately after these patterns were noticed, indicated no relationship between a grass's condition (brown or green color) and soil moisture. The brown turf was not a result of dry soil.

So, what is going on? The scientists used what is called a "porous convection model" along with measured data to describe the pattern's cause. Several criteria are required for the patterns to appear. First, the plant has to be sensitive to near freezing temperatures. Bermudagrass fits that criterion. Secondly, ground temperatures must still be warm in comparison to rapid onset of decreasing air temperatures. This is often the case in early fall when we get our first chilly temperatures.

The warm ground provides a temperature buffer from the chill damage. This is why lower mowed turf often goes dormant later than higher mowed turf (see photo). With taller mowed turfgrass (e.g. typical height range of athletic fields), the height allows reasonable temperature differences to develop within the canopy.

The temperature difference allows thermal convective motion within the grass canopy (heat moving around the grass blades). The temperature differences, along with plant density and stem/leaf width, direct the patterns of thermal movement. Patterns develop with the influence of rising warm air and falling cold air within the grass canopy. The chilling injury with the falling cold air causes turf dormancy (brown leaf tissue), whereas the warm air from the ground may be enough to maintain green color. The scientists used five mathematical equations to explain the phenomenon (if you are really interested).

So, now you know how these patterns are caused—thermal currents. You may also take some comfort in knowing that their cause has very little to do with how you manage your fields. Yes, if the field was cut lower it may not happen. Some years the first significant cold spell is so cold we see total browning of leaf tissue. When the first cold spell is late, the soil temperature may be cool enough that the temperature gradient is not sufficient to result in adequate thermal convective motion within the canopy, so the entire turf turns canopy goes dormant at the same time. ■

>> **TALLER MOWED TURFGRASS** showing effects of chilling temperatures and convection movement.