



Don't Forget Those Other Growth Regulators

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When things are going well, sometimes old lessons learned long ago are forgotten. Some old lessons were learned in the classroom, and then forgotten about in the field because they didn't apply right away. Others were learned from tribulation in the field and would never be forgotten... until that practice just became too convenient to swear off any longer. Several lessons learned during summers like '88 and '96 were forgotten during the mild summers of recent years, and were painfully brought back in 2010 for many superintendents. A few superintendents were reminded of one old lesson in particular in 2010, and it can serve as a learning experience for everyone. Some fungicides do more than just kill fungi.

One of the prominent aspects of turfgrass management observed by the University of Wisconsin turf team in the past year or two is that plant growth regulators now drive the pesticide application schedule. Research at Wisconsin and other places have determined that reduced fungicide applications can be made and significant fungicide savings obtained through altering fungicide timing (Koch et al., 2009). The most common response to this finding from superintendents in Wisconsin and elsewhere has been, "Well I'm going out every two weeks with my PGR, it's more convenient to spray my fungicide on that schedule." In addition, many are loathe to break from their PGR schedule even when the turf has been severely injured from a biotic or abiotic stress.

This strict adherence to PGR timing is beneficial in many ways to the plant. Less upright growth, increased turf quality, and possible



Figure 1: Some of the desirable growth regulation characteristics of DMI fungicides, most notably the darker green color, can be observed in this photo from Kansas State University. Photo courtesy of Dr. Megan Kennelly.

increased resilience to summer stress are all potential benefits of using a PGR program (Christians, 1998). Add in the effects of growth regulating fungicides and stressful summer conditions, though, and the results can be discouraging. Some fungicides, most notably the demethylation inhibitor (DMI) class, act to control fungi by interrupting the formation of sterols in select fungi. This interruption disrupts the fungal cell membranes and leads to death. In addition, DMI fungicides react with the plant itself to inhibit gibberellic acid (GA) synthesis early in the GA pathway. GA acts to promote plant growth and as far as DMI fungicides are concerned, this inhibition is a non-target effect. Some compounds, most notably paclobutrazol, which are very similar in structure and reactivity to DMI fungicides act primarily as PGR's. When applied together or in close concert, PGR's such as paclobutrazol and DMI fungicides like propiconazole can increase the level of

plant growth regulation beyond a healthy level. Other PGR's like trinexapac-ethyl inhibit GA at a different point on the GA pathway, but can still provide an additive growth regulator effect when combined with DMI fungicides.

In most instances the fungicide growth regulator effect is negligible, and in mild temperatures can even produce the desirable characteristics we normally associate with PGR's. But when high rates of DMI fungicides are used throughout a stressful summer in concert with PGR's, problems can start to develop. Undesirable effects of over regulation with DMI fungicides include coarser leaf blades, yellowing or browning of turf, and reduced recovery ability (Vincelli 2007). This often results in extensive algae or moss invasion, which can be very difficult to remove.

A primary problem with DMI fungicide overregulation is the difficulty in diagnosing it. The symptoms usually manifest themselves as thinning turf, with possible yel-

lowing or browning included. The effect is usually most pronounced on annual bluegrass and certain clones of bentgrass that have segregated from the general population. This can be caused by any number of factors, including traffic and shade. No signs of physical injury are visible either with or without a microscope, which is why a list of recent pesticide applications is so important to accurately diagnosing DMI-induced injury.

There is no question that both DMI fungicides and plant growth regulators are integral pieces in providing high quality turfgrass in the Midwest. That doesn't mean we shouldn't watch out for possible problems they may cause. To be safe, only apply half rates or lower of DMI fungicides when daily high temperatures are over 85°F for 7 or more days. If applying along with a

plant growth regulator in the heat of summer, it is best to change the fungicide application to a different class of fungicide that does not mimic the growth regulator effects. No other fungicide class in turfgrass aside from the DMIs is known to have significant growth regulator activity. If over regulation is suspected based on significant turf thinning, yellowing, or algal infestation then immediately remove all growth regulation from the program and raise the mowing height to promote rapid recovery. Once recovery has progressed to a satisfactory level, renewal of a PGR program can be implemented but should be done so with caution.

All in all, injury attributable to over-regulation caused by DMI fungicide applications is pretty rare in the Midwest. Every now and then a summer will arrive with plenty of

heat, moisture, and humidity that increases disease and insect activity to the point where growing golf course turfgrass a truly unpleasant profession. When one of these summers comes around next, remember some of the old lessons learned back in 2010 for how to proceed.

Sources Used:

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