By Thomas Serensits and Dr. Andrew McNitt

Can plant growth regulators *improve your field?*

WE HAVE ALL SEEN FOOTBALL GAMES when a player goes to make a cut only to slip and fall, kicking out a chunk of sod, leaving him to shake his head and go back to the huddle. These divots happen because the playing surface lacks stability.

As athletic field managers, we know that it is often what lies beneath the surface that ultimately determines the playability of our fields. We tailor our maintenance practices to promote rooting so we can go into the season with a "tight" field. We do things like core aerify and verticut to stimulate root growth and select plant species that have aggressive stolons and/or rhizomes. Most of us would agree that anything that makes our field "tighter" is a good thing.

So what about plant growth regulators (PGRs)? The old

rule of thumb was that PGRs have no place in athletic field management because the turf will not be able to recover from damage. And in some cases that is correct. For instance, on high-use fields that are continuously used throughout the year, spraying a PGR may not be the best idea. But, on a field that is only used in the fall, like a football stadium field with moderate wear, applying a PGR can help improve surface stability.

In order to understand why PGRs can improve playing surface conditions, we need to look at how they work. We will focus on products containing the active ingredient trinexapac-ethyl (TE), such as Primo Maxx. TE inhibits the biosynthesis of the plant hormone responsible for cell elongation, gibberellic acid. As a result, the plant's newly produced cells are smaller, thereby reducing vertical growth.

While it is easy to see the effects of TE on shoot growth, it is what is happening at and below the surface that really matters to us as athletic field managers. Turfgrass plants absorb TE through their leaf blades and crown. Less than 5% of the applied TE is actually moved to the root and rhizome system of the plant. So, while shoot growth is reduced, root and rhizome growth is not. In fact, TE application can stimulate root and rhizome growth. In addition, TE can also increase tiller density. An increase in tiller density means more plants to provide more surface stability.

With the idea that TE could increase both root/rhizome growth and tiller density, we investigated how TE applications affected divot resistance compared to cultivation methods and an untreated control. Research plots were constructed at Penn State's Joseph Valentine Turfgrass Research Center on both a USGA sand-based rootzone and a silt loam soil. Nine cultivars of Kentucky bluegrass were planted on each soil type. Each cultivar received TE treatments and a cultivation treatment in addition to a control area. We also applied various levels of simulated wear to each cultivar from late July through October to replicate the stresses

of a football season. Divot resistance was measured once per year in November using a weighted pendulum with the head of a pitching wedge attached to one end.

We evaluated two TE treatment regiments. One regiment included TE (0.5 fl oz/1000ft2) applied monthly from May-July (3 applications). We chose this treatment schedule so that our last treatment coincided with when football practices typically begin. In essence, our goal was to pre-condition the turf before the onset of the stresses of our simulated football season, then, allow the turf to resume normal growth for the duration of the season.

The other treatment regime included TE applications from May-October (6 applications). The cultivation treatment was performed in early May and consisted of core aerification coupled with a deep vertical mowing. The vertical mower blades were set to penetrate one-half inch below the soil surface. The reason for setting the blades this deep was to sever existing roots and rhizomes with the hopes of stimulating additional growth.

While our main objective was to measure divot resistance, we also evaluated a number of other factors related to playing surface stability. For instance, we measured tiller density and root/rhizome weight. We also evaluated wear tolerance throughout our simulated football season.

Results from our research show that TE applied from May-July increased divot resistance by up to 20% on the sand-based rootzone and up to 15% on the silt loam soil. Applying TE from May-October resulted in little change from the control. Also, results from the combination of core aerification and vertical mowing showed slight divot resistance improvements.

Why was the application of TE from May-July our most effective treatment? For the answer to this question we need to look at the effects of TE on our other measured factors. TE applied May-July was the only treatment to affect root/rhizome weight, increasing it by about 10%. TE May-July also increased tiller density by about 10%. No other treatment affected either root/rhizome weight or tiller density with the exception of the application of TE from May-October, which increased tiller density.

We included various wear levels to determine if our treatments showed consistent performance under different field conditions. If we observed divot resistance improvements with a particular treatment under no wear, we wanted to evaluate if those same improvements were observed under high wear. If the effectiveness of a treatment disappeared under high wear, the treatment would have less value late in the season or in the high wear areas of a field. Our data indicates that our most effective treatment, TE applied from May-July, consistently improved divot resistance at each wear level compared to the control.

What about wear tolerance?

What about the effect on wear tolerance? There is a school of thought that TE increases wear tolerance because it increases tiller density. The reasoning goes if there are more plants, it will take

longer to see the effects of wear. However, we also need to consider the fact that because shoot growth is slowed, recuperation may also be slowed. In our studies, we found minimal effects from each of our TE treatments on wear tolerance. We did see a slight trend that under heavy wear conditions, wear tolerance was slightly reduced when the turf was treated with TE through October.

Another thing to consider when applying TE is the post-suppression growth surge or "rebound effect." Once the turf breaks from growth regulation, a flush of growth occurs. If applied at the labeled rate, this flush typically occurs 28 days after application. Growth rates can be as much as 160% of the normal growth rate in the days following the break. We can use this flush of growth to our advantage. If we follow the research-based suggestions and apply TE from May-July, we can time the final application of TE to wear off immediately after the first game. This provides an increased growth rate for accelerated early-season recovery.

In our study, we also evaluated the divot resistance of various Kentucky bluegrass cultivars. On the USGA sand rootzone, 'Limousine,' 'Rugby II,' and 'P105' were the most divot resistant cultivars. 'Midnight' was least divot resistant, with 33% less divot resistance than Limousine. The differences in divot resistance among cultivars on the silt loam soil plots were minimal. 'Julia' had the highest divot resistance on silt loam soil while all other cultivars had the same resistance to divoting.

Our treatment of TE applied from May-July produced some interesting effects on the tested cultivars. For example, the least divot resistant cultivars benefited most from TE application. In fact, TE-treated Midnight, the least divot resistant cultivar, had greater divot resistance than untreated P105. So, while your field may not contain the best cultivars, by applying TE from May-July, you can make your turf perform like the most divot resistant cultivars.

We have found that plant growth regulators can indeed fit into an athletic field maintenance program. Golf course superintendents often talk about pre-conditioning their turf with TE before summer stress. Our research shows that TE can pre-condition athletic fields before the stresses of a football season. So, give plant growth regulators a second thought. They can be another tool for improving field playability. ■

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