Fall Applications of Potassium: Are They Much Ado About Nothing?

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Just recently most of the turfgrass team at UW attended the Tri-Society Meetings (Agronomy, Crop Science and Soil Science Societies of America) in Long Beach, California. I know this is a harsh life we lead. Trust me this was by far the best location of these meetings since I have been a member. The meetings are fantastic because of the breadth and the quality of the information presented. A significant amount of turfgrass pathology presentations are given but I also enjoy hearing about new technologies, biology and management in other areas of turf research. Outside of the turf presentations I usually attend two or three talks in other disciplines such as soil microbiology or even soil physics. Basically these meetings are a wonderful continuing education opportunity for researchers in turfgrass science.

One topic that caught my attention centered on the effect of potassium applications on snow mold severity of annual bluegrass plants. Applications of potassium are thought to increase tolerance to environmental stress, but potassium applications by themselves do not improve tolerance to snow mold pathogens (2). Research conducted by Dr. Jim Beard indicated that the ratio of nitrogen to potassium was more important than potassium alone for improving resistance to snow mold pathogens (1). Thus the idea of applying fertilizers in late summer to early fall with nitrogen to potassium ratios of 2:1 was established. Dr. Beard found that ratios of 1:4 or 1:8 did not improve resistance to snow mold pathogens. The work presented in one of the sessions was from David Moody, a graduate student in Dr. Frank Rossi's program. During a routine snow mold trial they noticed differences in snow mold severity with applications of potassium. They actually noted that when potassium was applied, snow mold severity was worse! This was an interesting observation considering previous precedence for applications of potassium was shown to limit snow mold and winter damage.

I guess Frank and David found this observation to be very curious, so they designed a very elaborate growth chamber experiment to examine this observation even further. The experiment was conducted in multiple phases where they cycled the temperature and light levels down gradually. They also buried the plants in a thin layer of snow to simulate winter conditions. After the cycling through all the different environmental conditions they inoculated the turf with Microdochium nivale (Microdochium patch pathogen). They determined that with increasing levels of tissue potassium, disease severity levels also increased. These findings go against the previous notion that potassium fertilization may actually improve resistance to snow mold pathogens. The main point from the study was they observed an increase in snow mold severity at each level of potassium application. Looking through the methods they presented they had nitrogen to potassium ratios of 2:1, 1:1, 1:4 and ~1:8 and at each level they observed an increase in snow mold severity, although the increase may have been small.

David and Dr. Rossi then investigated what activity in the cells would prompt the observed increase in snow mold severity. From the same growth chamber experiment they analyzed the tissue for structural carbohydrates, malate, citrate and other plant metabolites. In summary they concluded that potassium applications limit the development of carbon skeletons. Having a limited pool of carbon skeletons could potentially limit the plants natural ability to defend itself. I thought this research was extremely fascinating and I look forward to seeing how it progresses in the future. By no means should potassium fertilization in the fall cease, since there is more work that needs attention with this subject.

On a completely unrelated note, I want to make a few comments about the PCNB situation. To my knowledge the PCNB stop sale order has not been resolved, therefore it would be wise when making the budget for next year to plan for a PCNB-less snow mold program. Of course if you need any assistance please do not hesitate in contacting Paul or myself.

Another issue that needs to be addressed is the long residual control of PCNB. When PCNB was first released one of the desirable characteristics was the long residual control of fungal pathogens. The reason for the length of control was the chemical is fairly persistent in the environment. Extended persistence in the environment is not a desirable trait of "modern" fungicides. For those that needed an alternative to PCNB, keep in mind that a fungicide application during the spring maybe needed to control new infection centers of Microdochium patch (pink snow mold).

Paul's PhD research indicates that the fungicide chlorothalonil and iprodione only provides about 30 to 40 days of protection in winter conditions (Figure 1 and 2). Interestingly we observed that snow cover did not have a profound effect on fungicide efficacy over time. Although we did see fungicide efficacy breakdown around 30 to 40 days, we did not observe snow mold development in treated plots in the field. This information does not open the door to fungicide applications during winter melts. All this is saying is that fungicides applied before snowfall protect against snow mold damage. The reason we do not observe tremendous amounts of snow mold damage with programs lacking PCNB, is likely due to the fact that environmental conditions in January and February are not conducive to snow mold development. Furthermore, if snow mold infection is prevented it is very difficult for snow mold fungi to mount a counter attack later in the winter.

References:

1. Burpee, Lee. 1988. Preventative control of cold-weather diseases. Golf Course Management. August, pgs. 62-68.
2. Nus, Jeff. 1996. Cold-season pathogens. Golf Course Management. August, pgs. 49-52.

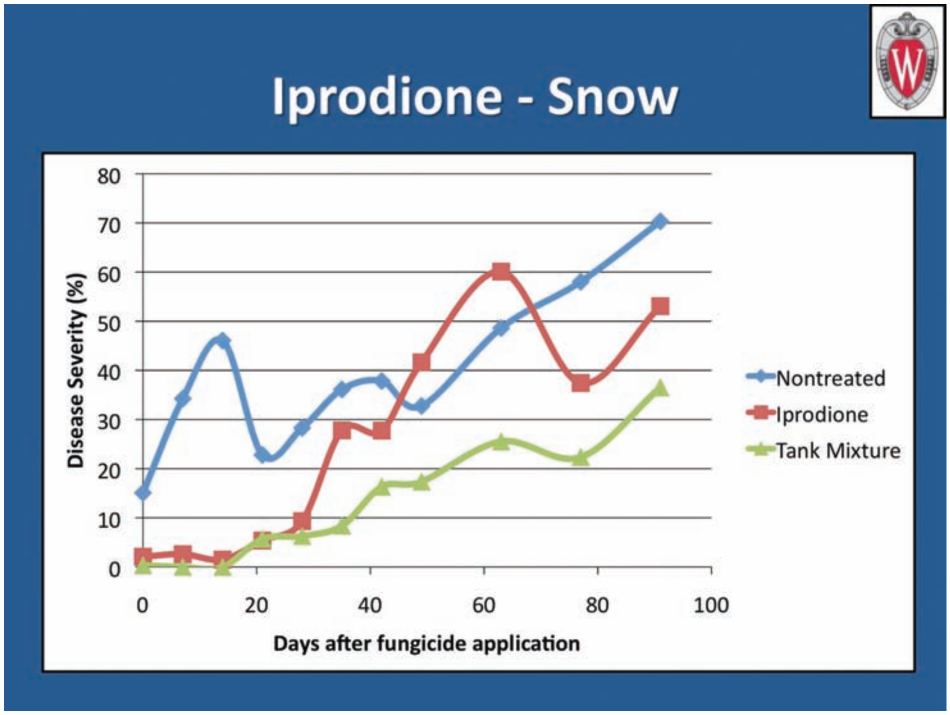

Figure 1. Microdochium patch disease progress as affected by iprodione applications. Fungicides were applied in the field at the OJ Noer Turfgrass Education Center and cores were removed from the research site weekly or biweekly from December 9th to March 4th. Each core was infested with *Microdochium nivale* and disease severity was rated visually. The blue line represents a non-treated control, the red line represents a single application of iprodione and the green line represents a single application of a tank mixture of iprodione and cholorthalonil.

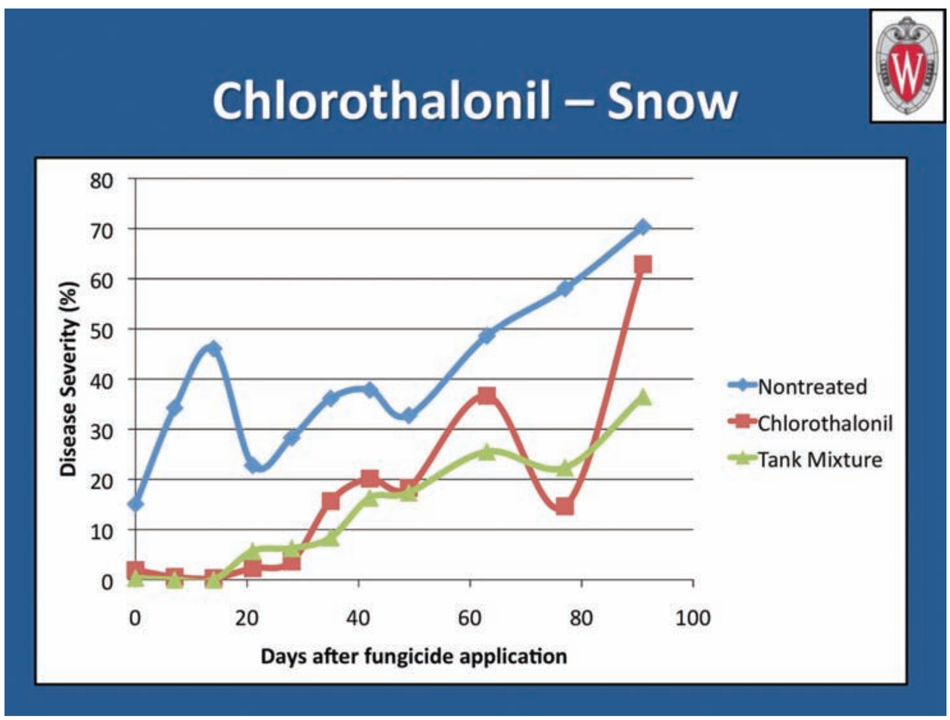

Figure 2. Microdochium patch disease progress as affected by cholorthalonil applications. The methodology was similar to those presented in figure 1's caption. The blue line represents a non-treated control, the red line represents a single application of chlorothalonil and the green line represents a single application of a tank mixture of iprodione and cholorthalonil.