Project's title: Effects of Winter Nitrogen, Phosphate, and Potassium Rates on Microdochium Patch

Background:

Microdochium patch is particularly problematic on golf course putting greens from September through May in the Northwest. Historically, more money is spent on fungicides to combat this disease in the Northwest than any other turfgrass disease. Considering increasing concerns associated with pesticide use the turfgrass industry as a whole is in need of pesticide alternative control practices and strategies.

Research on primary nutrient (N, P and K) ratios have suggested that maintaining the proper balance of the nutrients is critical to disease mitigation. However, research on N, P, and K ratios relevant to annual bluegrass and Microdochium patch is not available. Contrary to traditional recommendations, recent research has also suggested that winter applications of N can improve annual bluegrass playing conditions and disease resistance, however, if N rates get too high, Microdochium patch will increase.

Benefits and Beneficiaries:

Benefits of this research will provide managers with primary nutrient (N, P and K) winter fertility recommendations for mitigation of Microdochium patch on annual bluegrass in the Northwest. Having a winter fertility program that reduces Microdochium patch severity will reduce the current dependence on fungicide applications for management of this pathogen. Improved turfgrass quality and playing conditions in the winter months will likely be an added benefit of this research. Exploration of these fertility practices will be incorporated into the fungicide alternative integrated pest management (IPM) program for annual bluegrass putting green, developed at Oregon State University.

Beneficiaries of this research include turfgrass managers in the Pacific Northwest, and elsewhere who apply fungicides to control Microdochium patch. Additionally, to the extent that water quality and the environment are healthier as a result of fewer fungicide applications, then all individuals and other organisms living in the communities surrounding the golf courses are better off.

Objective:

The objective of this research is to evaluate the effects of winter applied N, P and K rates on Microdochium patch development within an annual bluegrass putting green in the absence of traditional fungicides.
Methodology:

Field research is being conducted on a putting green which was constructed in 2009 using annual bluegrass plugs from Emerald Valley Golf Course in Creswell, Oregon. These plugs were placed on 12 inches of 100% USGA sand over a silty clay loam soil at the Lewis-Brown Turf Farm, Corvallis, OR. Experimental design is a 2 by 2 by 2 factorial randomized complete block design with four replications; factors include nitrogen rate, phosphorus rate, and potassium rate.

Nitrogen (Urea - 46-0-0) Rate\(^1\)
1. 0.1 lbs N/1,000 ft\(^2\)
2. 0.2 lbs N/1,000 ft\(^2\)

Merchant Grade Phosphoric Acid (0-52-0) Rate\(^2\)
1. Control
2. 0.025 lbs. P/1,000 ft\(^2\)

Potassium Chloride (0-0-60) Rate\(^3\)
1. Control
2. 0.10 lbs. K/1,000 sq. ft\(^2\)

\(^1\)Nitrogen will be applied once per month at a rate of 0.1 or 0.2 lbs. N/1,000 ft\(^2\) from October to April (totaling 0.7 and 1.4 lbs N/1,000 ft\(^2\) applied in the winter months).

\(^2\)Nitrogen, phosphate and potassium rates were developed using N:P:K ratios that reflect tissue sampling data (Kussow et al., 2012), and standard extension recommendations for putting greens (Cook, 2008; Kreuser, 2014);

\(^3\)Phosphoric acid and potassium chloride will be applied using the same timing as the nitrogen treatments (October to April) at the rates defined above.

The total number of treatments within this experiment will be 32 (2 nitrogen rates x 2 triple super phosphate rates x 2 potassium chloride rates x 4 replications). All of these treatments will receive monthly applications of phosphite (Duraphite 12 applied at 3.7 kg H\(_3\)PO\(_3\) ha\(^{-1}\) in year 1 and 7.4 kg H\(_3\)PO\(_3\) ha\(^{-1}\) in year 2) and sulfur (Sulfur DF applied at 12 kg S ha\(^{-1}\)), fungicide alternatives that have shown promising results for control of Microdochium patch. Traditional fungicides will not be applied to this experiment for the duration of the study, except for summer anthracnose.

The putting green will receive biweekly fertilizer applications from May to September (total 4 lbs. N/1,000 ft\(^2\)), when considering the 2 rates of nitrogen applied from October to April (0.1 or 0.2 lbs N/1,000 ft\(^2\) per month) the annual nitrogen fertility rate will be 4.7 and 5.4 lbs. N/1,000 sq. ft. May to September fertilization will be coupled with plant growth regulator applications including a Proxy/Primo MAXX application in the spring followed by applications of Primo MAXX alone throughout the growing season. The entire experimental area will be aerified with hollow tines (1/2 inch inside diameter tines on a 2 inch by 2 inch spacing) twice annually in May and September using a John Deere Aercore 800. Light and frequent sand topdressing applications will be applied to the green throughout the growing season May to October. Irrigation and hand watering will be applied as needed during the summer months to provide healthy annual bluegrass.


**Preliminary Findings:**

In both years, N applied alone resulted in more disease. In year 1, the high rate of N resulted in more disease (Figure 1), but in year 2, the low rate of N had more disease (Figure 2). In year 1, potassium applied at a rate of 0.1 lbs N per 1,000 sq ft reduced percent disease when compared to treatments that did not receive K. In both years, the main effect of P rate and the interactions between N, P and K were not significant.

In October 2019 (year three) the nitrogen, phosphorus and potassium rates were initiated again. Treatments will be applied until April 2020. As previously done, all treatments will receive monthly applications of phosphorous acid (Duraphite 12 applied at 3.7 kg H$_3$PO$_3$ ha$^{-1}$ in year 1 and 7.4 kg H$_3$PO$_3$ ha$^{-1}$ in year 2) and sulfur (Sulfur DF applied at 12 kg S ha$^{-1}$) to minimize disease pressure without traditional fungicides.

![Figure 1: Percent disease observed at the peak of disease in year 1 (2/22/2018);
Nitrogen (N) rates include 0.1 and 0.2 lbs N per 1,000 sq ft applied every four weeks;
Phosphorus rates included 0.0 and 0.025 lbs P per 1,000 sq ft every four weeks;
Potassium (K) rates included 0.0 and 0.1 lbs K per 1,000 sq ft applied every four weeks;
Fertilizer was applied at these rates from October 2017 to April 2018.](image-url)
Figure 2: Percent disease observed at the peak of disease in year 2 (2/12/2019); Nitrogen (N) rates include 0.1 and 0.2 lbs N per 1,000 sq ft applied every four weeks; Phosphorus rates included 0.0 and 0.025 lbs P per 1,000 sq ft every four weeks; Potassium (K) rates included 0.0 and 0.1 lbs K per 1,000 sq ft applied every four weeks; Fertilizer was applied at these rates from October 2018 to April 2019.

Research Team:

Alec Kowalewski: Turfgrass Specialist (Assistant Professor) at Oregon State University. I have over 10 years of research experience and multiple publications on various cool-season and warm-season turfgrass species obtained while employed as a Research Assistant at Michigan State University, Assistant Professor at Abraham Baldwin Agricultural College, Research Scientist at the University of Georgia, and Assistant Professor at Oregon State University.

Brian McDonald: Research Assistant has been with the program for 17 years and has his office on-site year round overseeing the day to day operations, conducting research trials, and supervising the undergraduate student workers.
Communication of Results:

This project theme will critically evaluate winter fertility practices that have the potential to mitigate Microdochium patch on Poa annua putting greens in the absence of tradition fungicides. Upon completion of this project there will be documented scientific research on winter N, P and K rates for annual bluegrass. The results from this project will also be integrated into the “Oregon State University Best Management Practices (BMP) Program for Annual Bluegrass in the Absence of Traditional Fungicides” to be shared with turfgrass managers.

Findings will be presented at the 2020 Northwest Turf Association Meetings, and published in the appropriate association magazines. Findings from the preliminary research will also be discussed at the 2020 “OSU Turf Field Day” held annually in September in Corvallis, OR, and the 2020 “Microdochium Patch Field Day” held annually in February in Corvallis, OR.

Findings obtained from research will be written up for scientific journals publication, and presented at the Crop Science Society of America (CSSA) International Meeting. In addition, the results will be posted on the OSU Turf Website (www.BeaverTurf.com) and published as an Extension Bulletin though the OSU Extension Services (EESC).