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Focus on Fusarium Patch

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Fusarium patch is becoming more of a problem in many parts of Canada, especially during wet springs. One of the main reasons for this shift is the discontinued registration for all mercury based fungicides as of December 31, 1995 due to health and environmental concerns. Mercurial fungicides were applied to suppress pink snow mold (caused by *Microdochium nivale*). They were very effective, and in addition, their persistence gave good control of spring Fusarium patch (also caused by *Microdochium nivale*). This was beneficial, as spring Fusarium patch damage can be quite severe if it is not controlled, see Figure 1.



Figure 1. Fusarium patch in *Poa annua* (S. Fushtey).

With the loss of mercurial fungicides, turf managers may need to consider alternate ways of managing Fusarium patch. Perhaps there are some tips that can be obtained from the west coast, which has the dubious honour of being the "Fusarium Patch Capital". B.C. turf managers have had to develop experience in Fusarium patch management because the "Wet Coast" climate suits the fungus well and because mercury fungicides have not been used in B.C. for over 25 years.

The approach taken by many B.C. turf managers has been multi-faceted and has worked well. There are 3 main components, which are:

1. use preventive practices to avoid the conditions that lead to disease,
2. monitor for early signs of disease, and
3. use more than one practice to suppress the fungus when it becomes active.

This article relates the successful experiences of various turf managers in B.C., and includes information from research reports. Perhaps there are tips that could be useful in your operation.

The first component: Preventive practices

Know your foe! The more you understand what contributes to the success of the disease, the better prepared you are to find its weaknesses and prevent it from starting. The fungus that causes Fusarium patch is *Microdochium nivale*, although you may also know it by its old names *Gerlachia nivalis* or *Fusarium nivale*. It is active during the temperature range of 1 to 15°C and requires more than 10 hours of leaf wetness for infection¹. Therefore, periods of cool and wet weather will promote disease development. Although there is nothing that can be done about the weather, there are practices that can be used to alter the turf microclimate (the immediate area surrounding the turf plant) so that leaf wetness periods are minimized as much as possible. This includes the following list of practices:

Mechanical practices

- Dedewing (dew removal) greens is one of the most effective ways to minimize Fusarium patch and to reduce the number of fungicide applications for its control. The most common methods of dew removal are mowing, or dragging a hose across the turf. Timing irrigation to the predawn-early morning period also knocks dew off.
- Promote good air circulation and encourage morning sun exposure through judicious pruning of surrounding trees.
- Assess drainage and improve as required so greens drain properly. Watch for layers that may develop from regular tine aeration and break them up with occasional deeper aeration activity.
- Manage thatch levels. In addition to creating a stressful rootzone environment, thatch holds moisture which increases humidity levels in the turf microclimate, especially where there is poor air movement.
- When irrigation is required, time it during the predawn-early morning period.
- Frequent sand top-dressing seems to help keep the crowns dry as well as discourage the buildup of thatch. This helps to reduce the atmospheric water vapour content in the turf microclimate.

Fertilization and pH

- Avoid heavy applications of quick release nitrogen, especially in the fall, but do not starve the greens when there may still be root growth. Lower levels such as 1/10 lb. N/month/1000 ft² are used in coastal B.C. during mild winter periods when some growth may occur. This is especially important where high rainfall levels leach out nitrogen during the winter. Overall yearly applications of N have been decreasing in B.C. to average levels of 5-7 lbs. N/1000 ft² from 9 lbs or higher. The lower level seems to be beneficial in producing a harder plant. Turf plants grown under higher levels of nitrogen have thinner cell walls which are more easily penetrated by the fungus. Note that it takes careful management to reduce overall nitrogen levels. There is no extra buffer to prevent nitrogen deficiency so turf nutrition needs to be monitored very closely.
- Apply fertilizer balanced in a 3:1:2 ratio for the overall yearly application. Add up your applications for the year and find out what your ratio is.
- Maintain adequate soil potassium levels, especially in the fall. Check them and consider adding potassium in the fall.
- Maintain the pH for *Poa annua* between 6.0 to 6.5, and between 5.8 to 6.5 for bentgrass.
- Acidifying materials tend to discourage Fusarium Patch. Sulfur at 4 lbs/1000 ft²/year has given good results with bentgrass trials in Puyallup, WA². Ammonium sulphate can be a good source of sulfur although it should not be the sole source of nitrogen. If *Poa annua* is the main species on greens, it is better to keep sulfur applications below 1.5 lbs/1000 ft²/year.

The Second Component: Monitoring for Fusarium Patch

Symptoms - catch them early

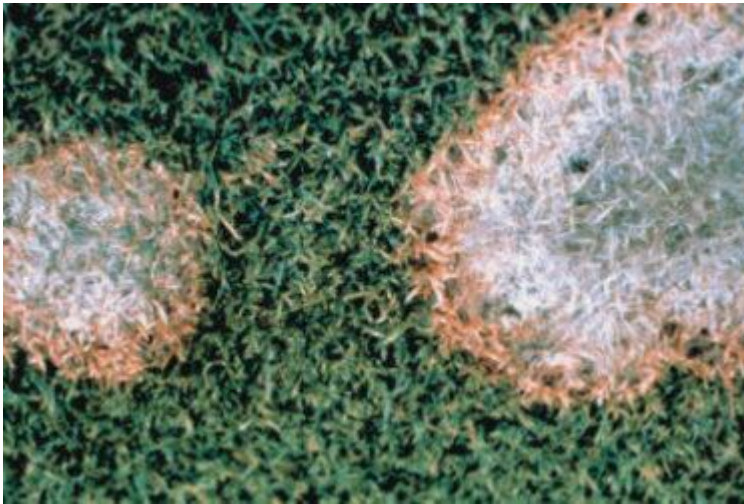


Figure 2. Textbook example of Fusarium Patch (S. Fushtey).

If you are going to look for symptoms you cannot wait for the classic "text-book picture". See Figure 2. By the time the symptoms are that obvious, the disease has probably caused more damage than you're willing to accept. Therefore, catching disease development at its early stage is the way to maintain the upper hand. The earliest symptoms are small patches (1.5-2 cm in diameter) of collapsed, water-soaked, olive coloured leaves. See Figure 3. Ensure your grounds crew are aware of the symptoms, and make use of each set of eyes on the course. It is important to catch infections early as the fungus can produce spores on infected leaves even when the patches are still only 1.5 to 2 cm wide. See Figure 4.



Figure 3. Early symptoms of Fusarium Patch on bentgrass.

Symptoms that develop in the fall do not disappear very quickly because turf growth is slow at that time of year. Therefore, it may appear that fungicide applications applied in the fall are not giving good control, when in fact they are protecting turf from new infections. Good control of Fusarium patch in the fall is important to keep inoculum levels low before snow fall. High inoculum levels at this time will increase the severity of pink snow mold.



Figure 4. Spores are extruding en masse through stomata in bentgrass leaves shortly after symptom development.

Where weather changes from cool and wet, to hot and dry in the spring, Fusarium can be misdiagnosed as Brown Patch or dollar spot. Consult with a provincial plant diagnostic lab if you are not sure.

How to monitor:

- Train the grounds crew to identify early signs of disease. Show them pictures.
- Monitor "problem" greens for the first signs of disease. These will likely be in areas that stay wet longer. *Poa annua* is more susceptible to Fusarium patch than bentgrass. See Figure 5.
- Consider recent and upcoming weather trends and the likelihood that they will encourage disease.



Figure 5. Poa annua on right side is more susceptible than 'Pennncross' creeping bentgrass (S. Fushtey).

How do you know when Fusarium is active?

The best way is to carefully examine the grass around the circumference of the patch. If the disease is active, the leaf tissue will be water-soaked and olive coloured. This is a result of the enzymes produced by the fungus to break down plant cell contents for food. If the disease is not active, the leaf tissue will appear straw-coloured. In severe infections, the fungus may penetrate as far as the crown, but will usually not kill the plant. If the plant does die, it is more likely from subsequent winter injury or another cause.

The Third Component - Suppressing Fusarium Patch

Maintain a vibrant soil microbe population

Encouragement of a vibrant soil microbe population may provide natural suppression of the fungus that causes Fusarium patch. Microbes need organic matter, air and water to live. In an effort to enhance these natural populations, some turf managers have sprayed sugar solutions onto their turf. The sugar acts as a food source for certain microbes which obtain their energy from decomposing organic matter as opposed to plant pathogens which obtain food by breaking down living plant tissue. Further research is needed before specific recommendations can be made, but perhaps one day, you will hear someone say, "excuse me, I have to go sugar the green".

Research into the biological control of Fusarium patch has shown that certain bacteria belonging to the genus *Pseudomonas* may be effective. These bacteria also have the interesting but unrelated characteristic in that they fluoresce when exposed to ultraviolet light if they are grown with specific nutrient sources. Trials at Washington State University have identified 2 isolates that reduced Fusarium patch on bentgrass, and one of these isolates also reduced disease development on *Poa annua*³. Unfortunately, this information is only food for thought as biological controls are not yet registered for use on turfgrass in Canada..... So what are the options when Fusarium patch becomes active?

When Fusarium patch is active

If you have monitored a problem green and noticed the disease is active, you have to make a decision at some point whether a fungicide is required. If so, you will need to consider if you are going to treat just the problem greens or all greens.

Consider that the fungus survives in soil, thatch and plant debris. Therefore it will be present in most places where turf is grown. So, given the right conditions, it will become active and produce mycelium and thousands of sticky spores which can be transported to healthy turf by foot traffic and machinery traffic. Now, the healthy turf will likely also have some *Microdochium nivale* spores and mycelium in the thatch, soil etc., but the level may be much lower, especially if there is a strong population of organisms suppressing it. However, if machinery or traffic drop a high concentration of spores on the leaves at the onset of cool, wet weather, you could expect disease development on this previously healthy turf.

If there are numerous patches, and imminent weather conditions are favorable for disease development then a comprehensive protectant program may be required. However, spot spraying may be adequate if patch development is slow, and/or imminent weather conditions are not favorable for disease development. This would also be a good time to quickly review recent practices and determine if there were opportunities to have prevented the initial infection.

If you decide to proceed with a fungicide application, there are a handful of products registered to control Fusarium patch in Canada. These are:

Fungicide	Active Ingredient	Class
Benomyl, Tersan 1991	benomyl	benzimidazole
Daconil 2787	chlorothalonil	substituted aromatic

Rovral Green F, Scott's Fungicide X	iprodione	dicarboximide
Banner 130 EC	propiconazole	demethylation inhibitor (DMI)
Scott's DSB	thiophanate-methyl	benzimidazole
Quintozone 75WP and various fertilizer/quintozone trade names	quintozone	chlorinated hydrocarbon

In the selection of a product there are various considerations such as price, availability, and past experience. Do not forget to also consider the class of fungicide to avoid increasing the chance of selecting for tolerant strains of the fungus. Fortunately, there are no situations in Canada where *Microdochium nivale* strains have a tolerance to any fungicides. However, judicious selection and use of fungicides is important to maintain this favourable status.

Consider that iprodione-tolerant *Microdochium nivale* developed under conditions where iprodione was applied 6 times one year and 4 times the following year during a trial⁴. Control was not obtained after the third application in the second year. In further field trials, the tolerant isolates were not controlled with an application of iprodione at the highest label rate.

Is fungicide tolerance temporary?

You may wonder how long the tolerant strains would survive and whether they would continue to present a problem. In many cases, tolerant strains are less fit than the natural wild-type population and die out over time. In the above case, although the tolerant isolates grew only 85% as fast as the wild-type sensitive strains, they were still capable of surviving from one disease season to the next. Iprodione tolerance has occurred in New Zealand too⁵.

In addition to iprodione, there is the potential for tolerance to occur to benomyl/Tersan 1991, thiophanate-methyl and Banner. If you check the above table, note that benomyl and thiophanate-methyl are within the same class "benzimidazole". They should not be rotated or tank-mixed with each other as they have the same type of activity. If any of these products are frequently used, evaluate your program. Consider a program that alternates the classes of fungicides and/or uses tank mixes of two fungicides having different modes of action. Daconil 2787 is often included as a tank mix because it has multi-site activity against the fungus which significantly lowers the chance of selecting for tolerant strains of fungus.

Remember to use as many preventive practices as possible to keep the leaves dry, monitor to catch the disease at an early stage, encourage a vibrant soil microbe population and carefully select and apply fungicides.

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