DISEASE DEVELOPMENT & ENVIRONMENTAL STRESS

By J. M. Vargas Jr.

Three important environmental stresses which effect disease development are light, temperature and moisture. Every plant has a minimum, optimum, and maximum set of environmental conditions under which it can grow. The closer a plant comes to its environmental extremes the more stress it is placed under until the extremes are finally reached and death results.

The minimum, optimum, and maximum conditions of light, temperature, and moisture differ for each species and even within the same species between cultivars. The effect of temperature on turfgrass species is a good example. Poa annua (annual bluegrass) is very susceptible to high temperature while the Festuca rubra (creeping red fescues), Poa pratensis (Kentucky bluegrasses) and Agrostis tenuis (creeping bentgrasses) are more tolerant. However, they have their southern limit and are not as heat tolerant as the Cynodon dactylons (bermudagrasses) and Stenataphrum secundatum (St. Augustinegrasses). The bermudagrasses and St. Augustine on the other hand are extremely susceptible to cold temperature stress. It is when a grass plant is under one of these stresses that it becomes susceptible to some pathogens.

To further illustrate the point, let's take the example of man and the common cold. If the individual is in good physical condition when he gets a cold chances are pretty good that he will get over it in a week or so. On the other hand, if he is rundown, and not eating properly when he gets the cold virus and continues on this way the cold can lead to pneumonia or other complications and even death.

Perhaps an even better example is measles, which is considered a minor childhood disease in the U. S. A., while in underdeveloped countries in South America there is a 50% mortality rate among children contracting measles. Why? Because the children in the U. S. fortunately receive the proper nutrition and quantity of food they need, while those children in underdeveloped countries do not. Consequently, when the measles virus attacks a child under stress it can be fatal. Plants under stress, likewise, are more susceptible to some plant disease and suffer more severe consequences than when they are not under stress.

Let's look at what effect light stress has on disease development. For example, let's take the cultivar merion which is resistant to powdery mildew. Yes, that is what I said "resistant to powdery mildew". Merion is in fact resistant to powdery mildew when it is grown under proper light conditions of full sunlight. It only becomes susceptible to powdery mildew when it is grown in the shade where it is under light stress which does not allow the plant to grow properly, and consequently its resistance to powdery mildew breaks down and the plant becomes infected and dies.

The classic example for temperature is Rhizoctonia brown patch. Did you ever wonder how those spots got so big overnight? Did you think the fungus grew two feet over night? Well it didn't; under ideal conditions

Rhizoctonia might grow an inch in twenty-four hours. So how did the spots get so big over night? Technically, they didn't. That is, the fungus started growing and infecting when the temperatures were around 70°F. At this temperature the grass plant is growing at near optimum temperature and is able to keep the infection caused by Rhizoctonia to a small lesion. The fungus continues to grow out in a circle in the soil and thatch infecting new plants as it grows but never causing much damage. Then when the temperature goes up to 85°F plus, and remains high at night, the grass plant is placed under high temperature stress tipping the scales in favor of the fungus and consequently the disease develops rapidly throughout the already infected plants, resulting in destruction of large amounts of plant tissue and, in some cases, death of the plant. As long as the plants remain under stress the disease will continue to spread.

Two turfgrass diseases in which moisture stress plays a key role in their development are Fusarium blight and stripe smut. Fusarium blight is a disease which involves nematodes destroying most of the plant's root system and possibly altering the physiology of the plant so that it becomes susceptible to the fungus Fusarium. However, the chief antagonist in the disease is the nematode. The nematode severely reduces the plants root system to no more than an inch in length, so that once the top inch of soil becomes dry the infected plants wilt and die. While Fusarium blight is reported to be a warm weather disease, symptoms will occur at any temperature as long as the weather remains dry and the turf is not watered. With Fusarium blighted turfs, you cannot follow the recommended practice of a heavy watering once a week to a depth of 6-8 inches because Fusarium blight infected plants only have roots of an inch or so in length and all the water below an inch is unavailable. Therefore, turf areas with Fusarium blight must be watered more frequently to prevent the top inch of soil from drying out. If this is done, moisture stress will not occur and neither will the Fusarium blight symptoms.

Stripe smut is another example of a disease in which moisture stress plays an important role. This is a systemic disease which moves throughout the vascular system of a plant. In the cool weather of the spring and fall, (50-70°F), the disease can be easily seen throughout the grass plant with the black spore masses protruding through the leaf cuticle which they have ruptured. However, if adequate rain or watering accompanies the cool weather of spring and fall, as it usually does, very little loss of turf is observed. With the coming of warm weather the black spore masses begin to disappear and, one assumes, the disease along with them, however, this is the time when most of the infected turf is lost if adequate moisture is not applied. These smut infected plants which are already weakened, lose excessive amounts of water through the broken cuticle, and if sufficient moisture is not applied, the moisture stress on these infected grass plants will cause them to wilt and die.

In conclusion, I would like to say that environmental stresses do play an important role in the development of some of our important turfgrass diseases, and understanding these environmental stresses can help prevent the loss of turf.