

The nitrogen-sun connection

June 1, 2016



Figure 1. Greenup of perennial ryegrass following N fertilizer and sunlight.

There is an interesting connection between the plant nutrient nitrogen (N), sunlight, and plant health. We all know plants need N and sunlight to be healthy. Nitrogen promotes dark green leaves packed with chlorophyll to absorb the sun's energy and ultimately turn CO₂ into sugar. Nitrogen also stimulates growth to promote recovery from traffic and stress. The quality of light also impacts turf health. For example, plants sense the blue light in sunlight, which promotes strong and sturdy growth. The impact of N and sunlight on turf health is obvious, but there is another sun-nitrogen connection that isn't always considered that affects turf health.

Turfgrass roots primarily take up nitrate (NO₃⁻) because it is more commonly available in the soil compared to ammonium (NH₄⁺). Even ammonium-based fertilizers are quickly transformed from NH₄⁺ to NO₃⁻ by soil microbes. That soluble soil NO₃⁻ is moved to the turf roots via mass flow, the process of water being drawn towards the roots as the leaves transpire

– like a sucking on a straw. The NO₃⁻ is then taken up by proteins on the turf roots and moved up to the leaves. This is where the sun-nitrogen connection is important. Light energy from the sun is used to reduce or change the NO₃⁻ back to NH₄⁺ before it can finally be used to make protein.

How is this applicable to everyday turf management? It is important because sun light i) drives transpiration and mass flow of N to the roots, and ii) sun light is required to reduce or transform the NO₃⁻ into a form (NH₄⁺) the plant can use for growth. Shade, low clouds, and constant rain reduce solar intensity, which can slow turf green up following N fertilization. We noticed this at our plots the past two weeks with all the clouds and rain (Fig 1).

Nitrate fertilizer can also help when there is too much light. This can occur on dry and sunny days or during stress (i.e. drought or temperature extremes). During these conditions the plant is absorbing light faster than it can use the energy. Excess energy then escapes and damages the plant through oxidative stress. It is similar to the sun bleaching paint or marker ink. Many products on the market ranging from fungicides to oxidative stress. We have found products like Turf Screen, for example, can help minimize oxidative stress on our putting greens. This led to improved quality and higher levels of chlorophyll in the leaves (Fig. 2). Fertilizers containing nitrate can also help with this stress because some of the excess sun energy can be used to reduce NO₃⁻ to NH₄⁺. The N will also help the plants repair damage caused by light stress.

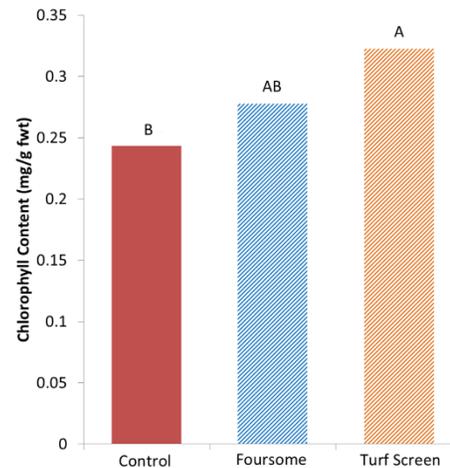


Figure 1. Turf Screen reduced oxidative stress in turf. This increased leaf chlorophyll content. Nitrogen fertilization also can reduce this stress.

When trying to minimize stress, don't forget the importance of N fertilization and the sun-N-stress interaction.

Bill Kreuser, Extension Turfgrass Specialist, wkreuser2@unl.edu