The KISS Principle and Turf Fertilization
January 20, 2016

The principle KISS, Keep It Simple [Superintendents], states that most systems work best if they are kept simple rather than made complicated; therefore simplicity should be a key goal in design and unnecessary complexity should be avoided (Wikipedia, 2016). While originally coined by an early aircraft engineer, the phrase is particularly true with regards to turfgrass fertilization. For example, our newest NebGuide, *Simplifying Soil Test Interpretations for Professionals*, describes how to quickly and easily condense and interpret complex soil test reports. Similar levels of simplicity can also be achieved when designing a nitrogen (N) fertilization program for highly maintained turf (golf putting greens, athletic fields, etc.).

The nitrogen cycle in a turfgrass system is not simple. Nitrogen is constantly changing forms as mineral or plant available N forms (NO_3^- and NH_4^+) are being taken up by plants and soil microbe, turned into soil organic matter, and then mineralized back to plant available forms when soil conditions are right. Nitrogen is also being lost from the system through processes such as clipping removal, leaching, and denitrification. Nitrogen is added back when clippings are returned or when legumes like white clover fix N from the air (Fig. 1). In practical terms, this means that amount of plant available N in the soil is constantly changing.

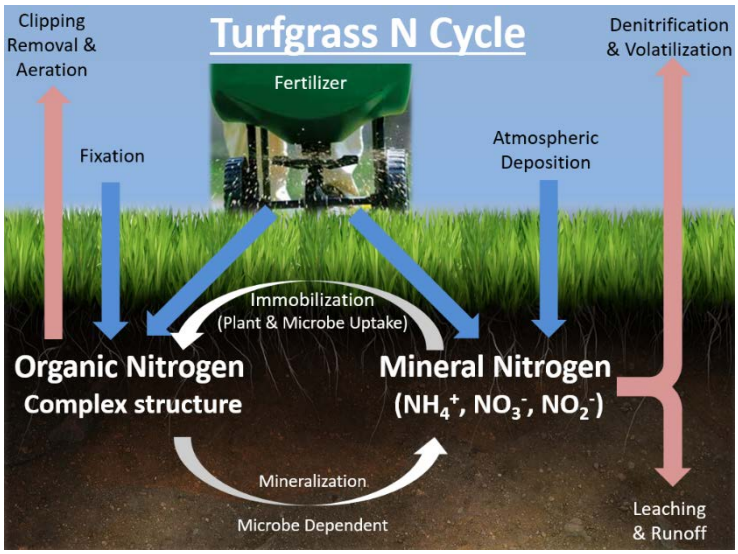

Figure 1. The turfgrass nitrogen cycle is complex and dependent on many factors that impact mineral/plant available nitrogen. The goal of proper fertilization is to maintain uniform levels of mineral/plant available nitrogen for the turf plants to use.

The real goal of a successful N fertilization program is to replace N that has become unavailable to the turfgrass plants (via N immobilization to form organic matter or direct N loss). It's difficult to estimate those amounts and they change from year to year depending on the weather conditions, management, and age of the turfgrass stand. There is also the question of timing. During the middle of a warm and wet summer, breakdown of organic matter can mineralize a significant amount of plant available N and reduce the need for fertilizer. During other times of the year, losses from leaching or microbial immobilization can be high and more N fertilizer is required to sustain acceptable turf color and quality. This means that scheduling N fertilization based on calendar schedules or programs from prior years is vastly inefficient.

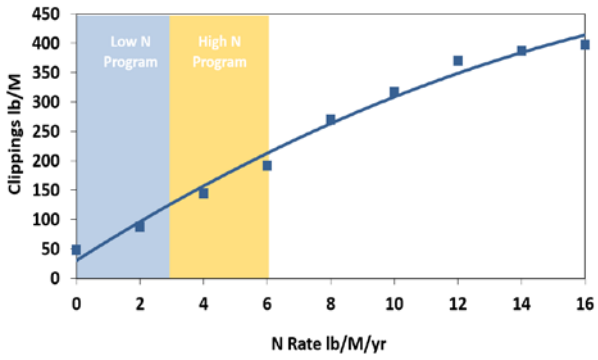

Figure 2. Turfgrass is chronically nitrogen deficient. Clipping yield of a Kentucky bluegrass lawn increased at nitrogen up to 16 lbs N/1000 ft^2. Adding N will most always increase growth and color. From Kussow, 1998.

While the soil N cycle is complex and dynamic, turfgrass response to plant available N is not. Increase the level of mineral/plant available N in the soil and turfgrass color and growth rate will also increase; as long as other nutrients such as phosphorus or iron are not limiting (Fig. 2). This means that the highly sophisticated tool called *our eyes* can be used to estimate the amount of mineral/plant available N in the soil. When the turf looks bad the amount of plant available N is most likely low and fertilizer should be applied. If the stand looks good then hold off on fertilizer until it looks worse or use a lower application rate. It is "spoon-feeding" in the truest sense of the phrase.

An ideal fertilizer source for spoon-feeding is 100% soluble sources of fertilizer. Urea and ammonium sulfate are the most popular because they are cheap and very effective. These sources are preferred because their effects are short-lived (around four weeks) and the turf quickly responds to even small application rates. Soluble fertilizers are also more efficient because they aren't picked up by a greensmower. Short-lived and fast-acting fertilizer sources provide turfgrass managers the highest level of control to complement N that is released by soil microbes during mineralization.

Several Nebraska golf course superintendents have embraced light and frequent applications of soluble fertilizer for their greens fertilization program. Josh Mahar from Wild Horse Golf Club in Gothenburg, NE primarily uses soluble products such as ammonium sulfate and urea to maintain uniform turf color and performance during the season. While he still uses some granular products, Mahar admits that he is using more soluble sources each year because of the control soluble fertilizers provide. Casey Crittenden and Matt Noble from Lincoln Parks and Rec have also made the switch to soluble N sources at Holmes and Pioneers GC. In addition to more control, they appreciate the low cost of these soluble products which allows them to commit additional resources toward other areas of their golf courses.

As you work on crafting your fertilization program for 2016, keep the KISS principle in mind for highly maintained turf areas. Soil nitrogen dynamics are already very complex, use a very *simple* fertilizer source to fill the gaps when mineral/plant available N levels are low.

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