Best fertilizer management: a blueprint for success

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WHETHER YOU ARE MANAGING MUNICIPAL FIELDS or big league stadiums, the correct nutrient management programs will provide a blueprint for vigorous turf and prepare you—if you have not dealt with it already—if or when fertilizer use laws limit your resources. Nutrient management is one important cultural practice that forms the foundation for successful turf management; however the interpretation of soil test/water quality data, and selecting the appropriate source, timing, and rate of fertilizer is often overlooked. Many chapters in textbooks have been written on the topic of fertilizer source, selection and use so consider this short piece as a resource to help optimize your fertilizer programs and allow you to think "broad brush" about how you approach your role as a sports field manager.

UNDERSTAND PLANT COMMUNITY

First and foremost, a comprehensive understanding of the site will guide your fertilization approach. Clearly identify the turf(s) use, or function and its associated expectations. Consider safety improvements carefully. What grass(es) exist and what are their strengths, weaknesses, biology, and cultural requirements? What plants are unwanted? Soil physical and chemical properties and the time of year determine the source and frequency of fertilizer applications. For example, soil *texture* influences drainage, extent of compaction, firmness, all important factors for playability, but it also affects nutrient holding capacity and subsequently the potential effectiveness of fertilizer programs.

EXISTING OR PENDING FERTILIZER LEGISLATION

Get started now to determine how current or pending fertilizer use laws will affect your ability to manage turf in your state. New Jersey, New York, Wisconsin, Minnesota, Florida, Connecticut and Pennsylvania have or are cur-

▲ **Figure 1: IN STATES** where phosphorus (P) applications are banned, one exception is the ability to use P fertilizers on sites to establish turfgrass.

rently in the process of regulating fertilizer inputs such as nitrogen (N) and phosphorus (P) source and timing of application (see Figure 1). In Connecticut, schools and municipalities are moving toward an organic program mandate. Natural organic fertilizer sources have effectively escaped regulation in many states because the P cannot be removed from manure or compost. Source ingredients and the manufacturing process of natural organic fertilizers differ, so you should familiarize yourself with the benefits and potential disadvantages of these formulations before making a purchasing decision. Interestingly, many existing and future laws are not based on science, but perception. Poorly written laws produce unintended consequences such as reduced turf vigor and subsequently more leaching, weeds, soil erosion, and runoff. If possible, get involved! Find out what laws may be in the pipeline in our local community and fight for what you believe in; you can take it as far as you see necessary or have the available time to pursue.

SOIL TESTING

I recommend soil testing regularly (at least once a year) to determine if any major chemical problems exist. The pH should fall within a fairly wide range of 5.5 – 7.3. Most calibration and correlation data exists for *exchangeable* nutrient cations, so interpret this data to select fertilizer inputs. Sand sites often contain less calcium (Ca), magnesium (Mg), and potash (K) and hold fewer nutrients in general. If applicable, test the irrigation water. Many chemical problems such as high sodium (Na) and chlorine (Cl) or bicarbonate (HCO_3-) arise due to poor irrigation water quality, or construction/amendment with high lime or calcareous sands. Importantly, soil tests should be used as a rough guideline and your observation equally important. Become a keen observer by carefully assessing turf vigor and how its response to a fertilizer application and/or recovers from mechanical stress, lack of water, and/or divoting?

CONCEPTS OF BEST FERTILIZER MANAGEMENT

Beyond understanding the broad plant/soil community and collecting soil test data, best fertilizer management (BFM) includes selecting the correct fertilizer and applying it at the correct time. The concepts focus on fertilizer use and fate with the goal to maximize plant use of nutrient and minimize loss to the environment. Like everything else in our lives, efficiency is better. This starts with developing a master plan, staying fluid, and making good choices. BFM *requires* an integrated approach and using all available options.

Fortunately, turf mangers now have technologically advanced fertilizer options, from slow release granule formulations that can be applied at higher rates, to highly efficient liquid, or foliar, options generally applied frequently and in low doses. The latter, referred to as "spoon feeding," allows turf managers the ability to "meter" nutrient inputs. More athletic field mangers now use this approach particularly where resources exist to supplement a granular fertilizer program. Foliar fertilizers can increase the speed of establishment, maximize vigor, enhance recuperative capacity, improve wear tolerance, or maximize aesthetics (see Figure 2). These effects are more pronounced on sand soils, during environmental stress, or when root growth is compromised. The correct use of efficient foliar fertilizers and slow release granule carriers will improve nutrient use by turfgrass plants, maintain a high level of vigor needed to fill voids; and thus limit weed germination and growth, and minimize nutrient losses. Enhancing nutrient uptake efficiency provides an agronomic, environmental, and economic benefit.

▲ **Figure 2: THE USE OF** efficient foliar fertilizers will maximize color and provide added control of nutrient inputs.

A final, yet critically important concept of BFM includes calibration. With so much out of our control, why not fine tune every other aspect of a fertilizer application? Calibration ensures that you apply the correct amount of nutrient, not too little so that turf vigor

suffers or too much so that you waste money or potentially cause pollution. Most fertilizer programs start with N because plants require it in the highest amounts, and it should be the focus of a successful Best Fertilizer Management Program.

SELECTING A FERTILIZER

Ratio and Grade: A fertilizer ratio determines the relative amounts of N, P, K, or primary macronutrients in fertilizer, for example 3-1-2, 7-1-3, or 1-0-1. Choose a ratio based on N and K requirements, and/or soil type. The grade refers to the fertilizer analysis and you can attain the desired ratios with different grades. For example, both 21-3-9 and 28-4-12 have the same 7-1-3 ratio. Many fertilizers also contain secondary macronutrients including Ca, Mg, and S and minor nutrients. Generally, I recommend a balanced and complete fertilizer such as the examples above for general maintenance. Synthetic organic sources generally have a higher nutrient analysis and more soluble nutrient compared to natural organic sources, which are used effectively on sandy soils, as a dormant feed, or where laws prohibit P applications to turf.

PHYSICAL CHARACTERISTICS

You have the choice of dry or liquid (foliar) fertilizer and this may be determined solely on the equipment available. Foliar fertilizer use represents a supplement to an existing granular program and liquids can also be an effective soil targeted application because the nutrients tend be highly soluble. Many also contain a wetting agent which increases uniformity of application. Among other things, particle size affects ease and distribution of application and rate of nutrient availability for slow release N sources.

Nitrogen Release Characteristics/Burn Potential. Most general maintenance granular fertilizers contain some slow release N (SRN), many ≥ 50% SRN. A variety of SRN formulations are available including those where N is released by temperature, water, or microbial activity. As a consequence, soil physical properties influence the release of N (See Soil Type below). The most common soluble N sources, in the order of high to low burn potential, include *urea, potassium nitrate, ammonium sulfate, di-or monoammonium phosphate*. Focus on the plant community (dominant grass and stage of growth) to determine annual N requirements. Correctly formulated foliar fertilizers contain soluble nutrients with low burn potential.

Soil Type/Reaction Effects. Native soils often contain high levels of residual N, allowing a turf manager the option to cut back on N inputs during certain times of the year, saving money. How can you tell? Conduct a tissue test and target ≥ 5% leaf N. In addition, fewer N inputs will limit excess biomass production, decreasing organic matter and thatch production. Conversely high sand soils drain well, but promote nutrient leaching, such as K and nitrate-N (NO_3-). In this situation, a turf manager might select more foliar fertilizer, use slow release sources of N and K, and not apply too much soluble N in a granule form, particularly during periods of slow growth or prior to heavy rainfall.

Soil pH affects microbial activity and nutrient solubility, for example high pH or alkaline soils limit minor nutrient availability. In addition, high pH soil or water increases urea volatilization, particularly at high pH (≥ 7.3). Soil test P data usually fall in the 'above optimum' category, however P complexes with calcium (Ca) (high pH), Al or Fe (low pH), or clay minerals rendering it unavailable to the plant. With routine fertilizer additions that contain a small amount of P, plants are likely receiving adequate P nutrition. To know conclusively, conduct a tissue test.

▲ **Figure 3: COOL SEASON** root growth can be compromised by high soil temperatures rendering soluble granular sources ineffective with a high burn potential.

Seasonal Adjustments/Timing. For cool season grasses, the optimum timing for higher rates of soluble N is in the spring and fall, ideally fall. Conversely for warm season grasses, the optimum timing for higher rates of soluble N is in the summer months; however this also represents the rainy season in the some southern states like Florida so caution must be used when deciding on how much soluble N to apply at any one time during the summer. Supplement with liquid/foliar fertilizers when plant roots are compromised by temperature stress or on high sand soils due to lower nutrient holding capacity and high leaching potential (see Figure 3).

ADDITIONAL BFM STRATEGIES SPECIFIC FOR SPORTS TURF MANAGERS

Water Management: Do you have access to irrigation or rely on natural rainfall? If you irrigate, how is the water quality? Many fertilizers require post application irrigation to ensure safety, release nutrient, and increase uniformity of coverage. Do not over water. Many granule or liquid products need only 6-8 minutes of irritation to effectively water them in. If you are fortunate enough have to ability to control water inputs, you have the advantage to control soil moisture and speed establishment by supporting microbial activity and nutrient release (see Figure 4).

Wear tolerance/Increase Rooting: Do not over apply N; shoot growth at the expense of root growth, particularly in the spring of the year for cool season turf will negatively affect turf vigor and summer stress tolerance. Cultural practices such as aeration and sand topdressing, and the use soil targeted Ca and N will help wear tolerance and rooting. When you have the opportunity to cultivate, do it aggressively! Calcium supplied to growing root tips will increase overall root depth. For cool season turf, supply

▲ **Figure 4: A SOPHISTICATED IRRIGATION SET UP** provides the ability to control water inputs to the root zone, cool plants, and water in fertilizer.

low dose of soluble N (≤ 0.25 lbs/M) in the mid fall to increase carbohydrate storage in the roots and increase winter hardiness. For warm season turf like bermudagrass raise the height of cut going into winter. Maintain a balanced fertilization program in the fall and limit N fertilization. Be careful in the spring and do not try to push bermudagrass with heavy doses of soluble N; this can have a dramatic negative affect if you encounter extreme cold in late March or April.

IMPLEMENT THE PLAN

Develop a rough yet integrated fertilizer use plan based on your evaluation of the site, resources, and expectations and use it as a template for your agronomic plan. Consider fertilization a critical cultural practice along with water management, cultivation, seeding, and mowing which forms the foundation for turf vigor.

Get involved with state legislatures and understand existing or pending laws regarding fertilizer use. If necessary, begin to experiment or even implement programs to meet the requirements of these law(s). Given that you might as a consequence have to use more natural organic fertilizers, understand the benefits and limitations of these materials.

Education is the key to procuring the resources needed to provide safe, functional, and aesthetically pleasing turf for sports use. For fertilization, choosing the correct source, time and rate of N applications, (based on species) will have the biggest impact on rooting, turf vigor and recuperative capacity. Maximize efficiency and minimize environmental losses by supplementing soil targeted slow release fertilizer applications with low dose and soluble foliar nutrition. Use quickly available sources with low burn potential to speed recovery and during establishment. Evaluate new organic fertilizer technologies and always look for research to back up any claims. And lastly, become a keen observer and trust what you see! ■

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