# Satisfy the plant's demand

***Build your fertility program on the basis of soil and tissue tests, and give your turfgrass the right amount of nutrients to allow it to perform as you would like***

By WAYNE KUSSOW, Ph. D.

A turfgrass plant does not act like a sponge. The roots of grass plants do not take up soil nutrients in solution the same way that a sponge absorbs water. A generation ago, many agronomists thought this was so, but they were mistaken. We've learned that the plant's processes are much more complicated and precise than that. This is significant as we build our turfgrass nutrition programs.

One of our goals as landscape managers is to provide the turfgrass in our care with enough nutrients to achieve the results that we desire, and no more. These results, among others, may include greener color, a denser stand to crowd out weeds or faster recovery from traffic injury in the case of turf for sports. Their order of importance may be different, of course, depending upon the types of grass that we manage and the uses to which they are put.

For instance, our fertility program would be different for the turfgrass of a busy youth soccer field than for a corporate office park. The soccer field, subject to more traffic and stress, is likely to require more nutrition — indeed, a much different total management program — than the office park where the goal is primarily to provide curb appeal, as in a home lawn. Likewise, a program for a warm-season turf would be different than a program for a cool-season turf.

Whether we're developing a fertility program for athletic turf or a home lawn, or for warm- or cool-season turf, we don't want to use any more nutrients than we need for the results we desire. That would be a waste of material and labor. That's why, we must understand the basics of how a turfgrass plant selects the nutrients that it needs. And, remember, it doesn't withdraw them from the soil solution as in the model of a sponge.

In fact, research has shown that a turfgrass plant tightly controls what it takes up.

The plant will "shut off" the roots or "turn them on" when it needs nutrients. The shoot of the plant communicates with the roots through the use of hormones, nutrient ion gradients and other plant processes. The shoot, in effect, tells the roots, "I need more potassium," or "I don't need more potassium." The root responds accordingly.

**Who's in charge?**

What controls this process? Plant demand controls it.

And what causes plant demand? Shoot growth is primarily responsible for plant demand.

So how can we affect shoot growth? Primarily, we stimulate shoot growth with nitrogen (N).

It has long been shown that as we increase the N rate we increase, in linear fashion, turf shoot growth. We can measure this by comparing clipping weights. Turf growth will peak and level off at a rate of about 12 to 15 lbs. of N/1,000 sq. ft. annually. But, turfgrass is a unique "crop." Unlike most agricultural crops, we're not seeking maximum biomass. We're managing it for aesthetics such as color and density and, in the case of athletic fields, for durability and playability. Therefore, the amount of N we apply to turfgrass is substantially less than what we would apply to encourage peak growth.

**Know your nutrients**

Nitrogen is one of the three major nutrients responsible for plant growth and health. The others are phosphorus (P) and potassium (K). There is a tight relationship between the amount of nitrogen, phosphorus and potassium that a turfgrass plant will use.

The challenge for managers is to find the right combination of nutrients to satisfy the demands of the plants under their care. This is not as simple as picking up a bag of product and applying it, even though there is essentially a constant ratio of nitrogen, phosphorus and potassium ($N\text{-}P_2O_5\text{-}K_2O$) in turf clippings, a ratio of 4-1-3.5

Does that mean you should always use a fertilizer with nutrients in those proportions? Of course not. Soil samples may indicate that the soil of the turf we are managing already contains sufficient phosphorus and potassium to meet the demands of the turfgrass. We can only know this by taking soil samples.

**Playing with the numbers**

If soil tests indicate that P and K levels are low, we should use a fertilizer with enough of each element to correct the deficiency to meet the plants' demands. If they are already sufficient in the soil we want to maintain these levels, and if they are high, there is no reason to add additional amounts since the plant won't use them.

We can, however, increase the turf's "demand" to use greater amounts of P or K, for instance when we're establishing turf or we're seeking rapid recovery of athletic turf, by stimulating shoot growth with additional nitrogen.

Anytime we change the N rate, we're going to alter the demand for P and K. We demonstrated this on turf plots to which we had applied 2, 4, and 8 lbs. N/1,000 sq. ft. respectively. We applied no additional phosphate or potash to the plots. After three years we recorded that the plots that had received 2 lbs. of N showed a 6 ppm reduction in soil phosphorus and a 25 ppm reduction in potassium, the plots receiving 4 lbs. N showed reductions of 10 ppm P and 37 ppm K, and the plots receiving 8 lbs. N recorded a 19 ppm drop in P and a 57 ppm drop in K.

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**NITROGEN CREATES DEMAND FOR PHOSPHORUS AND POTASSIUM**

*Clipping nutrients*

| Annual N lb./M | %N | %P | %K |
|---|---|---|---|
| 2 | 3.8 | 0.42 | 2.4 |
| 4 | 4.3 | 0.44 | 2.5 |
| 8 | 5.2 | 0.48 | 2.9 |

**THE FUTILITY OF APPLYING P AND K WHEN THERE IS NO DEMAND**

*Clipping nutrients*

| N-P-K Applied lb/M | %N | %P | %K |
|---|---|---|---|
| 4-0-0 | 4.3 | 0.44 | 2.5 |
| 4-1-0 | 4.3 | 0.44 | 2.6 |
| 4-0-3 | 4.3 | 0.44 | 2.6 |
| 4-1-3 | 4.3 | 0.44 | 2.6 |

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