MLSN newsletter #18

Hello,

In this 18th MLSN newsletter, I've written a short essay about how I use MLSN. I hope you'll read this and perhaps find from it that MLSN is even easier than you had thought, if that is possible. But first, a few new things.

MLSN research survey

Richard Last is doing a Masters thesis at Myerscough College about how MLSN and other fertilisation strategies are actually working—what the results are. One of the first steps is a survey, which there is still time to complete if you haven't already. Please complete this survey to help Richard have the broadest possible assessment of this topic.

ATC podcasts and videos

I've been making more videos, and I started two podcasts, as a way to share turfgrass information in more ways. I put links to all the shows, for viewing and subscribing, and explained what to expect, in this post at micahwoods.com.

Two new posts & one article

Bit of overlap here, because one of the new MLSN-related blog post includes the article. It has the full text of an article I wrote for the Sports Turf Association New Zealand newsletter: One thing I'd like everyone to understand about MLSN.

I also wrote about potassium (K) in sands, and how the mineral forms of K in the sand can serve as a K reserve in the soil.

How I use MLSN

It occurred to me to write this as I was responding to a question about keeping soils at or above the MLSN for sulfur (S). As it turns out, I don't worry much about the MLSN for S. And there is also the issue of calcium (Ca) and magnesium (Mg) MLSN values, which can be (and have been) criticized as being irrelevant.

I thought it would be interesting to explain a few things about how I actually make use of MLSN, and to explain why MLSN includes numbers for Ca and Mg and S. I started writing about that in section D of this post, and I realized this topic is worth exploring in more detail.

Why are Ca, Mg, and S even in MLSN?

That's easy. We developed MLSN as an alternative to the conventional guidelines. The conventional guidelines, which you can read about here, include medium sufficiency ranges for P, K, Ca, Mg, and S. We included those elements in MLSN because we had developed an alternative to the conventional guidelines and we expected that turfgrass managers would want to see how their test results could be evaluated for each of those elements.

As time has gone on—MLSN was introduced 10 years ago—it may now seem incongruous to have values for Ca, Mg, and S as part of MLSN, yet to be informed that I'm generally disregarding them when I make fertilizer recommendations. It's not incongruous to me, for three reasons.

Reason 1 is that Ca, Mg, and S are classified as secondary nutrients. Not macronutrients, not micronutrients, but somewhere in-between. Pretty important, then. Out of curiosity, I think it's interesting to know how a soil sits with its levels of secondary nutrients, compared to other soils. Having an MLSN for the secondary nutrients makes this easy, and with the sustainability index app anyone can find *exactly* how their test results compare to the MLSN dataset.

Reason 2 is that although we haven't updated MLSN for a while, we have done updates, and regular updates to MLSN have always been part of the project plan. I've explained that updates to MLSN in the future are going to move the numbers closer to what is seen in the Global Soil Survey (GSS) results (see Table 2 of the GSS article for reference). Remember, MLSN is not a soil test calibration, and does not make any prediction about probability of response to fertilizer. It is a comparison to nutrient levels in soils that are producing good turf. With the GSS numbers, you can see that K shifts down from 37 to 31 ppm; Ca goes all the way down to 256, and Mg drops to 36. The next update to MLSN won't be exactly those numbers, but it will definitely go in that direction because of the addition of more recent data and the dropping of old data. Most turf soils producing good turf have Ca (by Mehlich 3) more than 256 ppm, Mg more than 36 ppm, and S more than 7 ppm. It's not incongruous to me to have those values as part of MLSN, because if my turf is in the lowest 10%, I'd like to be aware of that.

Reason 3 is a big one, and gets its own section heading.

Why P and K are often required as fertilizer (and Ca, Mg, and S usually are not)

You'll recall that I explain the method for making a fertilizer recommendation using MLSN as $a + b - c = Q$, where a is expected plant use of the element being calculated, b is the MLSN for that element, c is the soil test result for the element, and Q is the fertilizer recommendation for the time period over which a was estimated.

This is site-specific to a remarkable degree, because *a* takes into account grass type, climate, and the way the grass will be managed, and *c* takes into account soil conditions.

That equation, the *abc* one, is what I use for P and for K. But I don't really bother with it for Ca, Mg, and S.

Let's look at that value for *a*, the expected plant use. I estimated this for three scenarios. One is creeping bentgrass in New York City getting 15 g N/m^2/year (3 lbs N/1,000 ft^2); another is Corvallis, Oregon, with bentgrass getting the same N rate; and the third is Tifeagle in Bangkok getting 36 g N/m^2/year (7.2 lbs N/1,000 ft^2).

I looked at recent ATC irrigation water tests from 28 water sources in six countries to find the median values for P, K, Ca, Mg, and S in the water. I calculated the irrigation water requirement for Bangkok and Corvallis using my irrigation requirement calculator, and for New York using the estimated median annual water budget for the Northeast region from Gelernter et al.'s 2015 report on the GCSAA water survey.

You can work through this for your own site, and I do recommend checking irrigation water every few years in normal cases—more frequently when there are salinity issues—to find out what is in the water. I'm using median values from my own data, and note that these values are on the low end of normal ranges given in Table 6 of Duncan, Carrow, and Huck's 2000 GSR article for nutrient guidelines in irrigation water.

To keep this as simple as possible, I'm not going to include P. In my irrigation water data, median P is actually below the detection limit of 0.2 ppm (mg/L), I have made some assumptions about the P in those samples and come up with a median value of 0.12 ppm. For all these examples, P use by the grass is going to be similar to use of Ca and S, and the supply through irrigation is negligible (on average), so if P is needed, the *abc* equation works fine.

Median values I'm using for nutrients in the average irrigation water, calculated off the median of recent ATC data, are:

- K, 5.5 ppm
- Ca, 21 ppm
- Mg, 6 ppm
- S, 14 ppm

Bentgrass in New York

Expected maximum use is 5.9 g of K, 1.8 of Ca, 0.71 of Mg, and 1.7 of S. Annual irrigation is expected to be 0.73 acre-feet (223 mm).

For that average irrigation water, then, applied in that amount, it supplies:

- 1.2 g K (20% of annual use)
- 4.7 g Ca (260%)
- 1.3 g Mg (188%)
- 3.1 g S (184%)

As you can see, the average irrigation water with an average irrigation requirement supplies a lot more Ca, Mg, and S than the maximum estimate of plant use for the year. And this is in a location with a relatively low irrigation requirement.

Bentgrass in Corvallis

Now we come to a location with a higher irrigation requirement; I'm using 565 mm for Corvallis. Now that same average irrigation water supplies 54% of maximum annual K use, 673% of Ca, 499% of Mg, and 479% of S.

You may be noticing why I generally don't worry about Ca, Mg, or S fertilizer.

Tifeagle in Bangkok

Now we move to a tropical location with a year-round growing season and a long dry season. At this location, the grass uses a lot more nutrients, but the irrigation requirement is a lot higher too. The irrigation requirement goes all the way to 1,001 mm.

After estimating the maximum nutrient use for Tifeagle with the specified N supply, and looking at how much of that is supplied by the average irrigation water, it comes to 45% of the K being supplied in irrigation water, 686% of the Ca, 409% of the Mg, and 368% of the S.

A trend

You'll have noticed a trend. In all these locations, a substantial portion of the annual K use (20% to 54%) is in the irrigation water, almost none of the P is in irrigation water, and for all of these locations, the average irrigation water is supplying way more than 100% of the maximum plant use of Ca, Mg, and S.

And that, my dear readers, is why P and K are often required as fertilizer, but Ca, Mg, and S are not.

In summary, and sampling recommendations

If it appears unneccesary that Ca, Mg, and S are part of MLSN, please consider how the numbers can be useful for comparison to other soils, and that one usually doesn't need to calculate a fertilizer recommendation for those elements anyway. Do go ahead and keep track of what the nutrient content is in your irrigation water, and how much you are applying, and you'll be able to figure this out for your location too. The *abc* equation is not necessary for Ca, Mg, and S in most cases because the quantity *a* is so small in relation to what is in the soil, and to what is in the irrigation water.

I'm going to write in the future about sampling recommendations. Timing, the most important things to be aware of, my current recommended sampling methods, and the minimum quantity of samples that are required to make a reasonably accurate fertilizer recommendation. You don't need to sample a lot to be able to get these types of data for your facility.

Please let me know any questions about this, or disagreements, and I'll discuss them in future blogs, newsletters, or podcasts. As always, thanks for your interest in these topics and thank you for reading.

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