Soil, turf around the world, and humbug

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Soil conditions for the best turf today

This is the handout for my presentations at the 2019 OGCSA fall meeting. I'm the Chief Scientist at the Asian Turfgrass Center, www.asianturfgrass.com, and an Adjunct Assistant Professor in the Department of Plant Sciences at the University of Tennessee. Contact me at micah@asianturfgrass.com or find me on Twitter at @asianturfgrass. The slides for these presentations will be posted after the seminar at https://speakerdeck.com/micahwoods.

The soil nutrient levels that produce good turf are not necessarily the same as those one reads about in textbooks. Furthermore, the typical soil test report will classify a number of elements as *low* or *high*, but those labels can be applied to turf that is performing perfectly well.

Tom Turner and Don Waddington wrote an article,[1] published in 1978, about soil testing and fertilizer recommendations. The article contains this quote that is still relevant now, 41 years later: "Unfortunately, turfgrass recommendations appear to be based on *research done with other crops*, such as forages, results from turfgrass fertility studies *not designed to relate to soil testing*, and the *best judgement of the agronomist making the recommendations.*"[2]

[1] T. R. Turner and D. V. Waddington. Survey of soil testing programs for turfgrasses. *Comm. Soil Sci. Plant Anal.*, 9(1):71–87, 1978. doi: 10.1080/00103627809366789

[2] The emphases are mine.

In 2012, PACE Turf[3] and ATC introduced the minimum levels for sustainable nutrition (MLSN) guidelines. The MLSN guidelines are a method used to make fertilizer recommendations for turfgrass.[4] By considering how much of each nutrient is in the soil, the maximum amount of each nutrient the grass can use, and ensuring an untouched amount of each nutrient remains in the soil, this approach provides site specific fertilizer recommendations for any grass, any where.

[3] www.paceturf.org

[4] See https://www.asianturfgrass.com/2018-02-03-new-mlsn-cheat-sheet/ for more details.

The MLSN guidelines and the resultant fertilizer recommendations tend to be lower than conventional recommendations. Our development of the MLSN guidelines was based on soil test results from good performing turf from a dataset of soil tests conducted at Brookside Labs through ATC and PACE Turf. We wanted to check that the MLSN guidelines were not *too* low, and to do that we conducted the Global Soil Survey (GSS) from 2013 to 2016.

With the GSS, we invited turfgrass managers from around the world to submit soil samples from good-performing turf at their facilities.[5] Collecting samples from a wider geographic range than those represented in the PACE and ATC data would provide validation that the MLSN guidelines were reasonable, or the GSS results could show that the MLSN guidelines weren't quite matching the soils that produce good turf.

[5] M. S. Woods, L. Stowell, and W. Gelernter. 2014 Global Soil Survey (GSS) report. 2014. doi: 10.5281/zenodo.23033

In Table 1, the GSS results are summarized. The median values are the best to look at for the average value from this type of data. The

Soil parameter	n	Min	Median	Mean	Max	GSS
pH	159	4.6	6.5		8.2	
OM %	159	0.17	1.8	2	10	
K ppm	159	10	60	72	296	33
P ppm	159	6	68	76	450	24
Ca ppm	154	125	587	838	4709	260
Mg ppm	159	23	74	90	516	37
S ppm	159	5	14	18	91	8

Table 1: Summary of Global Soil Survey data from September 2013 through September 2016.

'GSS' column in the table shows what the MLSN guideline for that element would be if the MLSN algorithm (the calculation is described in the MLSN preprint[6]) were applied to the GSS data.

The GSS results show that the MLSN guidelines match the type of soils in which good turf is growing today, and in the case of Ca and Mg, the MLSN guidelines are higher than values suggested by the GSS.

The implications of all this are that the MLSN guidelines don't appear to be too low, and that if one applies enough fertilizer to keep the soil above the MLSN guideline, the grass will almost certainly be provided with all the nutrients it can use, and with all the nutrients required to produce good turf.

[6] Micah S Woods, Larry J Stowell, and Wendy D Gelernter. Minimum soil nutrient guidelines for turfgrass developed from Mehlich 3 soil test results. *PeerJ Preprints*, 2016. DOI: 10.7287/peerj.preprints.2144v1. URL `https://doi.org/10.7287/peerj.preprints.2144v1`

Turf around the world

I'VE BEEN LUCKY to see a lot of different grasses, maintained for many uses, all over the world. No matter what grass is grown and how it is maintained, I eventually noticed that there is a common thread connecting high quality turf all over the world.

Textbooks describe turfgrass as a unique crop in that yield is not the objective. Instead of the yield that one wants to maximize for crops, the crop of turfgrass has a goal of maximum quality. By discounting yield in turfgrass, I had been somewhat blind to the importance of growth rate. Whether it is kikuyugrass in Los Angeles or in Sydney, *Poa annua* in Pittsburgh or in Portland, or seashore paspalum in Bangkok, the grass will only achieve its optimum quality when the growth rate (the yield) is set at just the right level.

I wrote about this in *A Short Grammar of Greenkeeping*[7] and the discussion of turfgrass around the world involves my realization that growth rate is more important than I once thought it was. No matter how the grass is maintained, or the tools available, I would look at modifying inputs to get just the right growth rate as the ultimate management objective.

[7] Micah S. Woods. *A Short Grammar of Greenkeeping*. 2016. URL `https://leanpub.com/short_grammar_of_greenkeeping`

Bah, Humbug

From 2006 to about 2014, I wrote articles and taught seminars and gave advice that amounted to "apply topdressing to match the amounts[8] recommended by the USGA and try to remove 20% of green surface area by coring." While I was recommending this amount, turf managers were telling me that it was more than they were doing. I kept waiting, year after year, to see the grass fail because of this lack of topdressing and lack of core aerification. "What you are doing might work for the short term," I'd say, "but over the long term the organic matter management you are doing won't be enough to keep up with organic matter production, and you'll see problems."

Starting in about 2012, I began to notice that my predictions weren't coming true. I kept seeing surfaces that were of surprisingly good quality year after year. And these surfaces were not receiving the amount of sand topdressing nor the amount of surface removal that I had thought was required. I also began to appreciate how much disruption the organic matter management programs conducted on putting greens can cause to golf play. And I changed my mind, to where I now suggest doing as little coring and topdressing as is required.[9]

I think the best way to check this is to consider the surface conditions. Are they too firm, too soft, or just right? Also, consider how much water is held near the surface. Is it too wet, just right, or too dry? Then make an accurate measurement of the total organic matter of the soil.[10] Then, keep track of how much sand is applied, and of how much surface removal is done. Then check the total organic matter again, and see if it has gone up or gone down.

If one wants to get the surfaces firmer, or drier, then one would like to see the total organic matter decrease. If one wants the surfaces to be softer, or to hold more water near the surface, then the total organic matter should increase. And if conditions are perfect, then the total organic matter should stay at the same level.

[8] This is about a half inch (12 to 15 mm) of sand per year.

[9] I've written about this on my blog quite a bit. For a summary, see this post `https://www.asianturfgrass.com/2019-06-25-one-simple-trick-better-greens/`

[10] See the blog post above for recommendations.