Turf Nutrition

Minimum Levels of Sustainable Nutrition

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In this feature I will jump around the globe a little bit, introducing a few different ways of thinking about and how this relates to the application of turf nutrition.

Then I'll tie it all together by explaining how the minimum levels for sustainable nutrition (MLSN), which I spoke about at BTME in January, work for all of these situations.

Technically, MLSN is just a set of numbers used in soil test interpretation. In practice, however, MLSN involves estimating turfgrass nutrient use, and ensuring that fertiliser applications are made to supply all that the grass can use.

With sustainability becoming increasingly important, knowing exactly how much nutrition you need to apply will prevent overfeeding and wastage and the excessive maintenance and mowing that would result from this.

As a starting reference, we can consider the nutrient survey of golf courses in the USA in 2014 (https://dx.doi.org/10.2134/cftm2015.0225).

The median annual fertiliser rates for greens in the USA were, for nitrogen, phosphate, and potash respectively, 185, 55, and 195 kg/ha/yr. Half the golf courses applied more than those amounts; half applied less.

There's some more interesting data from that survey — the respondents who utilise soil testing applied substantially more fertiliser than those who did not soil test. The authors of the study wrote that "those who conduct soil tests with the belief that it will help them to reduce fertiliser inputs may end up unintentionally increasing those inputs instead, probably because the guidelines used to evaluate their results may be higher than necessary".

If we consider that to be the typical nutrient management level of fine turf in the USA today, let's look at the opposite approach for a moment. We can consider what the person who wrote "soil chemists, backed by fertiliser salesmen with no knowledge of botany or golf, set up arbitrary standards and analysed soils as a commercial gimmick" had to say about fertiliser. That, of course, would be Jim Arthur.

There are only eight libraries in the United States with a copy of Arthur's Practical Greenkeeping. The Mann Library at Cornell University in New York is one of those eight, and when I was a graduate student there in the early 2000s, I read that book with great interest. I was at Cornell for my PhD and my research was about turfgrass nutrition in sand rootzones — specifically about different testing methods for nutrients, and about the general availability of nutrients to turf.

What does Arthur say about fertilisers? Quite a bit, actually, as he has an entire chapter on "Fertilisers and Lime," and I'll use this quote from that chapter as a general summary of his approach:

Above left: Turf growth at Ealing in London will require more nutrients than a links surface but fewer than in a warmer climate.

Above right: The grasses at Rama IX Park in Bangkok, Thailand, have the potential to grow rapidly and thus require more fertiliser nutrients if that growth rate is to be sustained.

"To sum up on fertilisers, while there will always be a tiny minority of exceptions. All that mown fine turf requires, where the cuttings are collected, is a little nitrogen in spring, no phosphates, and very little potash. When the grass cuttings are returned and there is consequently no depletion of nutritional reserves, no fertiliser is required at all."

I agreed with that statement — with a pretty big caveat — when I read it the first time, and I still agree with it. The caveat is that the nutrient requirement is proportional to how much the grass grows. For golf course turf in northern Europe, and especially links-style surfaces in that climate, the grass doesn't grow much, and thus the nutrient requirement is low. Arthur's advice in that climate is correct.

Today I'm sitting in Trang province in southern Thailand, 7.4° north of the equator, and it is 33°C today. On average here, the hottest month of the year is April, with an average temperature of 28.6°C. The coolest month in Trang, November, isn't much different— the average in November is 26.1°C.

For the average low temperatures, those reach a minimum in January and February. The average low in both those months is 21.2°C. Oh, it rains a lot here too. The average annual precipitation is 2,188mm.

The point I'm making is that plants in this climate grow really fast, because there is a high temperature and plenty of water. This has implications for nutrient requirements.

London, by comparison, has only two months in the year, July and August, during which the average high temperature — 21.7 and 21.4°C, respectively — exceeds the average low temperature at its lowest in Trang. And the average annual precipitation in London is 754mm.

The average annual temperature and precipitation in Trang are about triple those in London and there is more photosynthetic light for plant growth at this location too. Plants grow more rapidly in these conditions, and thus require more nutrients.

We've got the American approach, which is applying substantial quantities of fertilisers, and applying even more fertilisers if soil tests are done.

Then we've got Jim Arthur stating that the requirement is a little nitrogen, no phosphates, and very little potash. I agree with him, but believe we need to consider how much the grass grows, because I'm a former greenkeeper and I really don't want to mess around with nutrient deficiencies.

Arthur's approach works great when we have slow-growing turf, but where the grass grows more, we need to supply the nutrients the grass requires.

That's where the STERF "precision fertilisation" approach (http://www.sterf.org/sv/library/handbooks/fertilisation) comes in with a fine solution. This means applying all the elements to the turf in the proportion they are found in the plant and in the amounts necessary to produce the desired growth rate.

This approach guarantees there will be no deficiencies, but it also presupposes that the soil can supply nothing. Everything the grass uses is supplied in the fertiliser.

The MLSN approach fits somewhere between all of these. For full details see https://www.paceturf.org/journal/minimum_level_for_sustainable_nutrition.

With MLSN, we start with the assumption that the fertiliser requirement is nothing, as Arthur suggests. But as soon as the grass grows, the MLSN approach starts accounting for how many nutrients the grass is using, like STERF's precision fertilisation. And MLSN also includes soil testing, like the American way. But the MLSN guidelines for interpreting soil tests are based on the type of soils that produce good turf today. The MLSN guidelines were also developed by turfgrass scientists and a former greenkeeper, not by "soil chemists, backed by fertiliser salesmen with no knowledge of botany or golf," as Arthur put it.

Making a fertiliser plan using MLSN involves doing a soil test, comparing the results to the MLSN guidelines, and also considering how much you want the grass to grow. The amount it grows sets an upper limit on its nutrient use.

I won't work through all the math — there are spreadsheets or reference articles for that — but rather will emphasise that looking at the nutrients in the soil, considering the quantity of nutrients the grass will use, and then applying the amount of each element required to stay above the MLSN guideline, will give fertiliser recommendations that work for any kind of surface.

On a links course, using MLSN will almost certainly recommend applying no phosphate and very little potash. For fine turf in northern Europe on which clippings are returned, the fertiliser recommendation will almost certainly be for nothing. In the tropics, the recommendations will be much higher, because the growth rate and consequently the nutrient use is much higher.

The MLSN approach ensures there won't be nutrient deficiencies, and at the same time avoids recommending fertiliser that won't have any effect on turfgrass performance.

Right: The MLSN guidelines are designed to work for any turf, as in these fairways at Hanoi in Vietnam, making recommendations for all the nutrients the grass can use and still accounting for nutrients supplied by the soil.