



Nitrogen-based fertilizers require careful application to avoid runoff. Image credit: Flickr user Luis Villa del Campo (CC BY 2.0)

Next time the grass looks greener on your neighbor's side of the fence, ask if he is adjusting his lawn fertilizer applications based on spectrophotometer color measurements. Odds are, he'll just tell you to get off his lawn. But if he, too, is a commercial turfgrass grower, his answer might be different.

Several studies¹ have shown a direct correlation between the chlorophyll concentration (and thus, color) of turfgrass and the nitrogen fertilizers that you use to feed it. But commercial growers also face continual pressure to conserve water and minimize artificial fertilization. So while it might be impractical for a single homeowner to fine-tune his lawn maintenance via optical measurements, turfgrass growers can use these methods to limit environmental impact, reduce growing costs—and produce healthy, aesthetically pleasing turfgrass.

Chlorophyll and Nitrogen Fertilizer

Nitrogen-based fertilizers are widely used across to produce brightly colored, healthy grasses. The problem, of course, is that if you use too much fertilizer, it can contaminate both surface and groundwater², which means that you must carefully control the amount and application during growing operations. Excess nitrogen can affect aquifers thousands of miles from the fertilization source³, creating serious enough environmental concerns that the EPA is currently addressing nutrient runoff at a national level⁴.

That means commercial growers are stuck trying to find a balance between enough fertilizer to satisfy customers, and so much fertilizer that you inadvertently contaminate water sources. Many operations strike this balance by applying fertilizer according to set schedules and general perceptions of turf quality. But if quality appears poor or fertilization schedules are out of sync with

growing conditions, you risk over-fertilizing, increasing both operating costs and environmental risks. And because cycles of over- and under-fertilization can quickly spiral out of control, a more targeted approach is something of a Holy Grail within the industry.

Spectrophotometry and Turfgrass Growth

Turfgrass leaf blades will absorb and reflect different wavelengths of light as a function of their health, so attempts have been made to measure this color with spectrophotometers. However, earlier generations of spectrophotometers relied on natural sunlight as an illumination source. Variations in sunlight from hour to hour and with changing atmospheric conditions (whether clouds or rain) impaired the reliability of measurements and made it virtually impossible to establish a database of control readings.



Modern spectrophotometers are able to take shifting natural light sources into account. Image credit: Flickr user sagesolar ([CC BY 2.0](#))

But next generation spectrophotometers and other color measurement devices have been developed to account for these light variations. HunterLab produces [a series of portable spectrophotometers](#) that are ideal for commercial turfgrass field use. These handheld models include the same dual-beam technology and other advanced features that are found in benchtop devices, yet they are compact and lightweight enough for ease of use in the field. Like their larger benchtop counterparts, HunterLab's portable machines can also provide reflected color measurement, assessment of small samples and discrete growing areas, and filtering for gloss or other distortions.

Nor are these applications purely hypothetical. The versatility of portable spectrophotometers for turfgrass production has already been demonstrated in a pilot study in which researchers combined spectrophotometric measurements and GPS technology to map plant health over a large growing

area⁵. The map revealed contrasting areas of greater and poorer health that were not apparent via visual inspection alone.

Such mapping techniques will allow you to focus nitrogen fertilization on regions that actually need the fertilizer, reducing growing costs and minimizing the environmental impact of runoff.

Practical Applications



Groundskeepers can also benefit from spectrophotometric technology. Image credit: Flickr user Sonny Abesamis ([CC BY 2.0](#))

Professional turfgrass farms stand to gain the greatest benefits from spectrophotometers, but golf course groundskeepers and other sports maintenance professionals can also benefit.

Groundskeepers have long relied on lawn paints to touch up brown spots and to give their fields a green, lush appearance, but they now have the ability to measure local areas—and to spot fertilize, rather than painting over regions that are doing poorly.

Handheld and other portable spectrophotometers have the potential to revolutionize the turfgrass industry by improving uniform grass health, reducing waste, and minimizing environmental impact. HunterLab produces several portable spectrophotometer models that are readily adaptable to turfgrass color measurement. Please [get in touch with us](#) to learn more about how our spectrophotometers can improve your growing operations.

1. “Optical Sensing of Turfgrass Chlorophyll Content and Tissue Nitrogen,” 2004, <http://hortsci.ashspublications.org/content/39/5/1130.full.pdf>
2. “Turfgrass Reflectance Measurements, Chlorophyll, and Soil Nitrate Desorbed from Anion Exchange Membranes,” January

2005, <http://digitalcommons.uconn.edu/cgi/viewcontent.cgi?article=1016&context=plsc>
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3. Where Nutrient Pollution Occurs, 2017, <https://www.epa.gov/nutrientpollution/where-nutrient-pollution-occurs>
4. “What EPA is Doing to Reduce Nutrient Pollution,” 2017, <https://www.epa.gov/nutrient-policy-data/what-epa-doing-reduce-nutrient-pollution>
5. “Construction of a Mobile Spectrophotometer for Mapping Plant Health: Combining Crop Circle™ and GPS Technology,” 2011, https://works.bepress.com/keith_bartley/4/