

# Putting the pixels together in turfgrass management

**Editor's note:** This article was written by an employee of TurfScout



Photo courtesy of TurfScout®

**Wilbur** Wright pioneered the art of aerial photography shortly after the first airplane flight. What began as a fascination with capturing events, landscapes and architecture paved the way for the science of satellite imaging and remote sensing. Simply put, remote sensing is the act of measuring characteristics of an object without coming into contact with that object. In turfgrass, characteristics measured with remote sensing can be a tremendous asset for: stress detection, monitoring recovery, precision turf management, and irrigation efficiency, to name just a few.

The old adage, "A picture is worth a thousand words," falls short here; remote sensing on turfgrass "Speaks volumes."

How can a camera or sensor measure turf quality and more importantly, how can it "see" what turfgrass managers can't? The amount of light reflected from a surface tells us something about that surface. As different environmental conditions affect a turfgrass (water stress, nutrient deficiency or disease, for example), rapid and predictable changes occur at the cellular level that impact how the plant tissue reflects light. In turf, (and most plants), red and blue light are absorbed for photosynthesis. Healthy turf will absorb more red and blue light than unhealthy turf. In near-infrared wavelengths, healthy turf is highly reflective

and would appear very "bright" to the human eye, if we could see in that region of the light spectrum. In other words, a *decrease* in near-infrared reflectance signals stress while an *increase* signals recovery or improvement in turf quality. This technology has recently garnered the attention of the turfgrass community, but the science behind the sensor dates back to 1950s and has been extensively researched in the agricultural community since the early 1970s.

Over the last decade, the research community has investigated the role of remote sensing in turfgrass. A driving force behind the research has been the ever present demand for a more efficient, conservation-conscious and resource-savvy approach to managing turfgrass. Research shows visible and near-infrared reflectance is sensitive to water stress, nutrient deficiency, disease pressure, and mowing height, for example. As mobile sensors that are easily mounted on mowers or carts are coming to market, the transition from cutting edge technological developments to practical turfgrass solutions has become a reality.

TurfScout is already delivering remote sensing to the turfgrass industry. The company processes raw light reflectance and GPS data to create maps and charts of turf quality designed to help turf managers improve quality, prevent problems and save money. The set-up is nearly

## How refueling propane-powered equipment works

**MORE THAN TWO DOZEN MODELS** of propane-fueled commercial lawn mowers are available from brands well known to sports turf managers. Propane-fueled mowers reduce greenhouse gas emissions by almost 50% and carbon monoxide emissions by more than 80% compared with gasoline mowers.

Refueling is easy thanks to a proven model adopted from another market: the forklift industry. This mature business model applies the exact same methodology to the propane-fueled commercial mower market. Propane providers replace empty cylinders with full counterparts through a just-in-time inventory schedule that meets a sports turf manager's needs, ensuring that a propane mower fleet will never have too much or not enough fuel on hand.

Cylinder exchange programs usually include installation of a storage cage in a centrally located spot that is easily accessible to personnel. When a mower cylinder is empty, appropriately trained personnel can access the cage and refuel their mower in a matter of minutes by removing the empty cylinder and installing a full replacement from the cage, using all relevant safety measures and personal protective equipment.

**In addition to on-site refueling, there are currently thousands of propane refueling stations across the country with locations in every state.**

For fleets that require a large propane volume, a propane provider can install a no-spill dispenser on-site that turf managers can use to refuel empty mower cylinders, as well as tanks for vehicles fueled by propane autogas. Depending on storage necessity, longevity, and available space, this on-site refueling infrastructure includes underground or above ground storage tanks for longer-term use. After installing the dispenser, propane providers facilitate training on how to safely refill both propane cylinders and propane autogas vehicles.

In addition to on-site refueling, there are currently thousands of propane refueling stations across the country with locations in every state. To learn more about propane-fueled commercial lawn mowers, vehicles fueled by propane autogas, and available refueling options, visit [www.poweredbypropane.org](http://www.poweredbypropane.org). -*Brian Feehan, VP, Propane Education & Research Council* ■



**>> PROPANE CYLINDERS** are typically installed horizontally on a mower, and are either located in the mower's rear, or on the sides, as shown here.



turnkey, and making maps is as easy as downloading photos from your digital camera. Our team has automated the science of making “Smart Maps and Charts.” Smart Maps and Charts of turf quality are available almost immediately from our website. Without being an expert in mapping or remote sensing technology, the turfgrass manager or consultant can now use objective measurements of turf quality, and the “big picture” view of Smart Maps, to refine inputs, such as water, nutrients and pesticides, evaluate turfgrass response and recovery, streamline resources and labor, and take action before a problem has taken the turf.

Ongoing turf breeding research at the University of Georgia’s Tifton campus has been geared toward the identification of more stress tolerant grasses for the future. “Preliminary results of a 48-day drought study during 2010 indicate that spectral reflectance data collected by TurfScout correlate very well with traditional visual ratings of turfgrass quality, as well as with newer methods of estimated % green cover using digital image analysis,” says Brian Schwartz, PhD. Schwartz says the only difference between these techniques to date has been that spectral reflectance data is predicting the visual assessments by about 3 days. For Schwartz’s turfgrass breeding program, this means that he can effectively identify drought tolerant genotypes in the field using quantitative data taken by workers without years of training and experience with visual ratings. For the turfgrass manager, it could allow the detection of stressed areas well in advance of visual symptoms, thereby giving them a chance to apply treatments before anyone else ever knew there was a problem.

You also can track and manage disease control and nutrient management with Smart Maps. How effective is your program? Did a particular product prevent otherwise inevitable stress? Or did the product speed recovery time? Dave Spak, PhD, with Bayer Environmental Science is currently using reflectance data as a component of their Plant Health Initiative. Spak says, “Measuring plant health through radiometry has become a routine evaluation in many of our product programs, particularly our fungicide program. Although we still rely on human element and visual evaluations, this technology takes the subjectivity out of quality evaluations. Also, the technology has the ability to detect plant stresses that may not be visible to the naked eye.

Lastly, use of GPS and TurfScout allows us to rapidly process and manage the huge volumes of data which was a major hurdle in the adoption process. As we are still learning how to use this tool, we expect the innovation in the area of remote sensing in plant research will continue to evolve.”

In another example, Harsco Minerals, manufacturer of specialty micronutrient fertilizer Excellerator, decided to look at this technology in conjunction with TurfScout as a way to capture reflectance as an indirect indicator of turf quality following Excellerator applications to three golf course greens. “We were happy to find that the reflectance data revealed clear areas of turf response to Excellerator-

treated areas compared to areas on the same green not receiving treatment. We were able to see the hidden beneficial effects on turfgrass such as significant improvement in root growth. We also saw enhanced turf health from Excellerator applications that may go unnoticed by the naked eye,” says Marty Campfield, global product manager. “Having been involved with GPS and GIS for many years, it seems clear that the marriage of these technologies has created an innovative approach to capturing on-the-go reflectance data.”

Because sensors can be mounted on a mower or cart, mapping may be integrated into routine operations and Smart Maps available in minutes. The application of this

kind of approach spans both research and golf course management. Bruce Martin, Ph.D. at Clemson University is currently using Smart Maps and Charts to support his research program and evaluate turfgrass management strategies. “TurfScout has created a very convenient way to couple objective reflectance data, such as NDVI and RVI measurements [both are near-infrared and red reflectance indices], with precision GPS to create maps, manage data and provide a near real-time evaluation of experiments in progress. I think the data and their programs for data management enhance and help to validate our more subjective ratings. Both are needed, along with ‘ground-truth’ measurements and examinations of stressed turf to provide a good evaluation of turf management strategies,” says Martin. ■

*Dana Sullivan, Ph.D. has more than 10 years experience in precision agriculture and remotely sensed data analysis.*

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### New Toro turf sprayer

The new Pro Control XP console delivers instantaneous rate response to ensure the correct rate is applied from start to stop, pass after pass. The exclusive six-diaphragm pump produces up to twice the volume to achieve the full spectrum of spray rates and simultaneous aggressive agitation for a homogeneous mixing of tank contents. The Cleanload Eductor lets operators safely load the tank without first mixing a slurry. And we created an automated Fresh Water Rinse System for an on-the-fly triple rinse. Available accessories include a lightweight Drift Reduction Boom Shroud, easily attached to the standard boom, and the new Ultra Sonic Boom Leveling System, which automatically adjusts the booms to the correct spraying height in undulating turf conditions.

[www.toro.com](http://www.toro.com)



### Turfco improves T3000 spreader and sprayer applicator

Turfco introduces a series of upgrades to its T3000 applicators. The T3000 maintains the overall compact design that can fit through a 36-inch gate while still offering 6- and 9-foot wide spreading widths. Operators will enjoy the optional electric start. A 16-amp charging system provides turf professionals with greater versatility in mounting accessories. Cruise control helps maintain speed while freeing operators' hands to control spreading and spraying. A new variable speed diaphragm pump features Viton® valves for extended life and minimized maintenance. The T3000's unique, adjustable, high-pressure, high-velocity systems creates larger droplets with less drift and fewer callbacks. An improved spinner design is longer lasting and easier to maintain.

[www.turfcodirect.com](http://www.turfcodirect.com)



### Sprayers from John Deere

The HD200 and HD300 models offer a choice of centrifugal or diaphragm pumps, manual or automatic rate controls, and boom options that come standard with an electro-hydraulic lift. No tools are needed for tank removal, and storage stands allow the operator to get more out of the vehicle, even while not spraying. The optional CleanLoad chemical agitator makes it easy to load chemicals by ensuring that every last drop is used, and a jet agitator makes sure the tank solution is mixed thoroughly. Controls are mounted at the operator's fingertips and can be removed without tools for storage. Durable 11-gauge booms feature bi-directional breakaway to protect the boom. And, a common wiring harness makes control system changes a breeze.

[www.johndeere.com](http://www.johndeere.com)



### LT Rich Products' Z-Max sprayer

Z-Max sprayers cover up to 200,000 square feet of liquid application per fill and hold more than 320 lbs of granular product. Powered by a 16-hp Vanguard electric start using Hydro-Gear Pump and Parker Wheel Motors, this unit can cover even the largest of properties. With a 4.0 gpm pump this unit can create constant by-pass agitation and able to spray wettable powder products. Give yourself more security with the Locking Caster System for more side hill stability, 2, 6, 8 or 10-foot spray width options, 50-foot Cox hose reel to reach those hard to get areas and the ability to interchange the nozzle tips.

[www.z-spray.com](http://www.z-spray.com)



### Field Commander is versatile

The Field Commander by Kromer is available in five different configurations to meet the needs of today's athletic field maintenance managers. The Field commander can be equipped with a large capacity 65 gallon tank with an integral fresh water rinse tank. The Kromer easy fill system pumps liquids from a storage container directly into the tank so no more lifting. You can configure your Field Commander with four sizes of spray booms reaching up to a maximum of 163 inches. In addition there are multipurpose spray guns located on the tank that will give you 25 feet of spraying range.

[www.kromerco.com](http://www.kromerco.com)



### TurfEx releases new electric-powered sprayer attachment for ZT mowers

The new US250 sprayer from TurfEx features a universal mount that allows it to attach to the front of most available zero-turn mowers. This unique mounting system stays within the mower's footprint, unlike competitive tow-behind units. Furthermore, the US250 is completely electric powered, meaning there are no engines or hydraulics to maintain. Driven by a 12-volt electric motor, the sprayer draws its power from the mower's battery. The pump is rated at 2 gallons per minute at 60 psi, and the corrosion-resistant polyethylene tank holds up to 25 gallons. To apply liquid, the US250 features an adjustable spray wand, which is attached to 25 feet of hose. This makes the unit ideal for many turf care applications, including weed spraying, tree and flower watering, and pest control.

[www.trynexusfactory.com](http://www.trynexusfactory.com)



### New sprayer from EarthWay

EarthWay's new S25 Spray-PRO Mark III push sprayer is designed for spraying ice control products, pesticides, herbicides, and fertilizers. The Mark III has an all-new adjustable spray system that makes sidewalks and parking lots easy to manage, as well as the ability to apply precise amounts of liquid. Use it on any area that your boom sprayer will not go. No gas, no batteries, no problem.

[www.earthway.com](http://www.earthway.com)

## Gravelly Turf Stadium 80

Gravelly offers the Stadium 80 sprayer, part of the Gravelly Turf line, to its ever growing line of turf machinery. The compact design of the Stadium 80 has an 80-gallon, low profile tank designed for maximum visibility. A lockable spill tank lid with anti-siphon fill and low center of gravity helps prevent chemical spills. Available with an engine-driven Silver Series™ roller or 12-volt electric diaphragm pump, the Stadium 80 also features a spray gun, 25-foot hose and a low-maintenance, 10-foot, three-way folding boom with electric on and off controls.

[www.ariens.com](http://www.ariens.com)

## Jacobsen's new riding greens mower

Jacobsen has introduced its GP400 ride-on triplex greens mower. Replacing the G-Plex III, the GP400 retains many of the features of its predecessor including a swing-out center reel for easy maintenance and adjustment and the cutting units with 7, 9 or 11-blade reels. There's a choice of engines; a Briggs and Stratton V twin, air cooled gas engine, or a Kubota 3 cylinder diesel engine. A new tank design incorporates the fuel and hydraulic reservoirs in a single molded unit providing better weight distribution and improved stability. As the fuel tank empties it has less effect on the machine's centre of gravity and a sump in the bottom alleviates fuel starvation on slopes.

[www.jacobsen.com](http://www.jacobsen.com)

## Husqvarna sprayers

The BP5 backpack sprayer's standard features include: high grade Viton/Nytril O-rings, seals and gaskets, pistol grip with built-in filter, brass wands, and extra long hoses. All sprayers come with a CD-ROM that covers all aspects of field maintenance to reduce downtime. Heavy-duty blow-molded tanks with UV inhibitors are ergonomically designed for comfort - with adjustable, heavily padded shoulder straps that follow the contours of the body and eliminate stress points. With no exposed parts, the internal piston pump is protected for the rigors of everyday use but, is easily repaired. Spraying pressures from 15 to 168 psi, tank holds 5.3 gallons and has a brass wand.

[www.husqvarna.com](http://www.husqvarna.com)



## Better infield skin moisture control

Imagine being able to water once and drag several times over the course of a hot day, still turning up moisture and retaining a perfect playing surface. Just incorporate Ready Play Field Magic into the soil and see how the infield will absorb and retain moisture, either after watering or a rain. Field Magic will let you keep that perfectly moist playing surface through-out the entire day, saving you material, labor, and water! A normal application will involve the incorporation of anywhere from 1200lbs-2000lbs of product 2-2 1/2 inches



deep into your skinned infield. Annual reconditioning with smaller amounts of product will be needed to maintain optimal results.

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