



CASE STUDY

BASF Turf and Landscape Quantifies Business Case for Drone-Based Sensing at Pinehurst Country Club

GREEN LEVEL INDEX INCREASES 24% ON TREATED SPRIGS PLANTED ON GREENS AT PINEHURST COURSE NO. 7



"PrecisionHawk has enabled BASF to tell the whole story behind the benefits of pre-treating sprigs with Lexicon®. Securing quantifiable data on turf health has enabled us to prove a new use case and pursue new markets."

—Gary Myers, CGCS, BASF Pinehurst Project Lead

KEY ACHIEVEMENTS SUMMARY

Quantifiably measure **sprig growth and green quality** between treated and non-treated areas.

Green Level Index for Lexicon[®]-treated sprigs versus non-treated sprigs (50 days post-planting):

Up an average of

24%

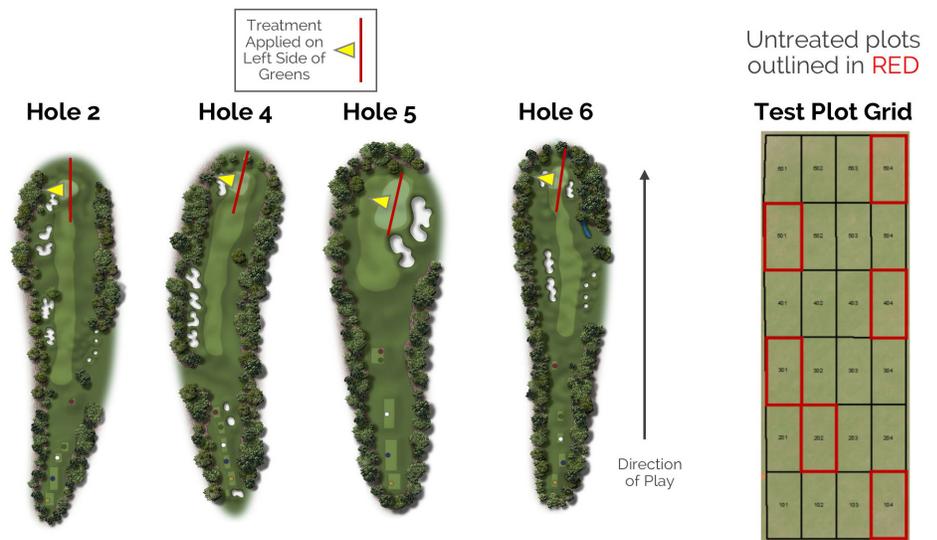
Median rise of

24%

Replacing the visual inspection of greens with an **objective process that is repeatable**, produces data and uses industry-standard vegetation indices.



AREAS OF INTEREST FOR DATA COLLECTION



SITUATION: QUANTIFYING THE EFFECTIVENESS OF AGROCHEMICALS

BASF Turf and Landscape delivers innovative solutions for turfgrass managers and superintendents who seek **healthy, improved turf quality**. To do this, BASF offers a broad portfolio of pest management products to control weeds, disease and insects while providing Plant Health benefits, ensuring greener, healthier turfgrass.

Like all organizations that produce agrochemicals, BASF develops its products using systemic testing and observation. In the best case, observations can be quantified. However, **plant health can be difficult to measure**, with traditional methods relying upon subjective visual analysis. In addition, testing often takes place in controlled environments such as in labs or on unused plots of land—not in **real-world settings** like golf courses.



RGB IMAGERY

Visual (RGB) Cameras absorb light in the Red, Green, and Blue wavelengths, similar to the human visual spectrum.



BGNIR IMAGERY

Multispectral (BGNIR) Cameras collect light in the Blue, Green, and Near-Infrared (NIR) Wavelengths. NIR band is particularly useful for detecting plant stress before it is visible in the RGB wavelengths.



GREEN LEAF INDEX

Vegetation indices measure photosynthetic capability of live vegetation, or how well the plants turn sunlight into food. The Green Leaf Index (GLI) is specifically designed to adjust for greenness or yellowness of a crop. GLI was selected for use as it best allows to distinguish health differences between treated and non-treated areas.

In 2017, BASF Turf and Landscape set out to secure data that would confirm the **benefits of pre-treating sprigs with Lexicon®**, its foundational fungicide for golf greens and tees. Gary Myers, CGCS, BASF Pinehurst Project Lead, had performed tests before and visually inspected treated and non-treated areas. Although he saw **positive changes in the treated areas**, his observations lacked quantitative data.

The Pinehurst Resort & Country Club in Pinehurst, North Carolina, has a longstanding relationship with BASF Turf and Landscape. It uses Lexicon® Intrinsic® as the foundation of its fungicide program at all nine of its golf courses.

A new green establishment at the No. 7 course presented BASF Turf and Landscape with the ideal testing environment. The course, built in 1986, unfolds over dramatic, hilly terrain that's dotted with wetlands in lower-lying areas and houses 63 total acres of turf.

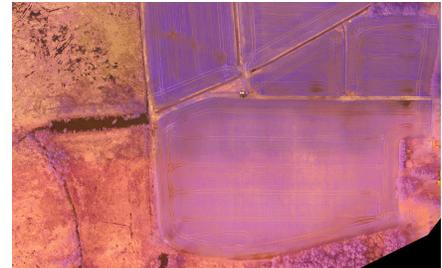


SOLUTION: COLLECTING PLANT HEALTH DATA USING DRONES AND MULTISPECTRAL SENSING

“Our main objective was to gather precise data, which would show the differences in the treated versus non-treated areas of the greens. We needed meaningful statistics to quantify product performance and compare one area to another,” shared Gary Myers, CGCS, BASF Pinehurst Project Lead.

BASF needed a partner with **deep expertise in aerial data collection, advanced remote sensing and data analysis**. Drones seemed like an ideal platform for securing the high fidelity data necessary for analyzing turf health. BASF’s Agricultural team recommended PrecisionHawk due its track record of success in working with the company.

PrecisionHawk—a leading provider of commercial drone technology—helps business leaders use aerial intelligence to transform their operations. From design and development, to flights, analysis and training—the company **provides end-to-end support** for integrating aerial data and analytics into the enterprise.



MULTISPECTRAL SENSORS

A standard visual sensor collects red, green and blue wavelengths of light. Multispectral sensors are able to collect these visible wavelengths as well as wavelengths that fall outside the visible spectrum. These include near-infrared radiation (NIR), short-wave infrared radiation (SWIR) and others.

[Learn more about
Multispectral Sensors](#)

The PrecisionHawk and BASF teams met to determine the data output required and finetune project details. PrecisionHawk recommended using a multispectral sensor, which **collects visible wavelengths as well as infrared radiation and ultraviolet light.**

These advanced sensors are instrumental in plant health and can pinpoint nutrient deficiencies, identify pest damage, optimize fertilization and even detect plant stress well before it is visible to the naked eye.

With multispectral data, **detailed insight can be derived using algorithms from Vegetation Indices.** These indices measure the photosynthetic capability of live vegetation or how well the plants turn sunlight into food.

HOLE 2 RESULTS

Treatment applied on left side of green



The project launched when sprigs at Champion Turf Farms in Bay City, Texas were treated twice with Lexicon®: **the first treatment took place 28 days before harvest and the second 23 days later.**

Once harvested, the sprigs were transported to Pinehurst, North Carolina and planted on the greens at holes 2, 4, 5 and 6.

The treated sprigs were planted on the left hand side of the greens (per the direction of play) and the untreated sprigs were planted on the right hand side of the greens.

The PrecisionHawk Flight Services team created **custom borders with GIS coordinates** (latitude and longitude) for the treated and non-treated areas. Additionally, a test grid comprised of both treated and non-treated plots of land was created to aid in testing and data analysis.

Aerial data collection flights took place on three occasions:

15 DAYS POST-SPRIGGING,

29 DAYS POST-SPRIGGING

50 DAYS POST-SPRIGGING.

Each flight took approximately 30 minutes.



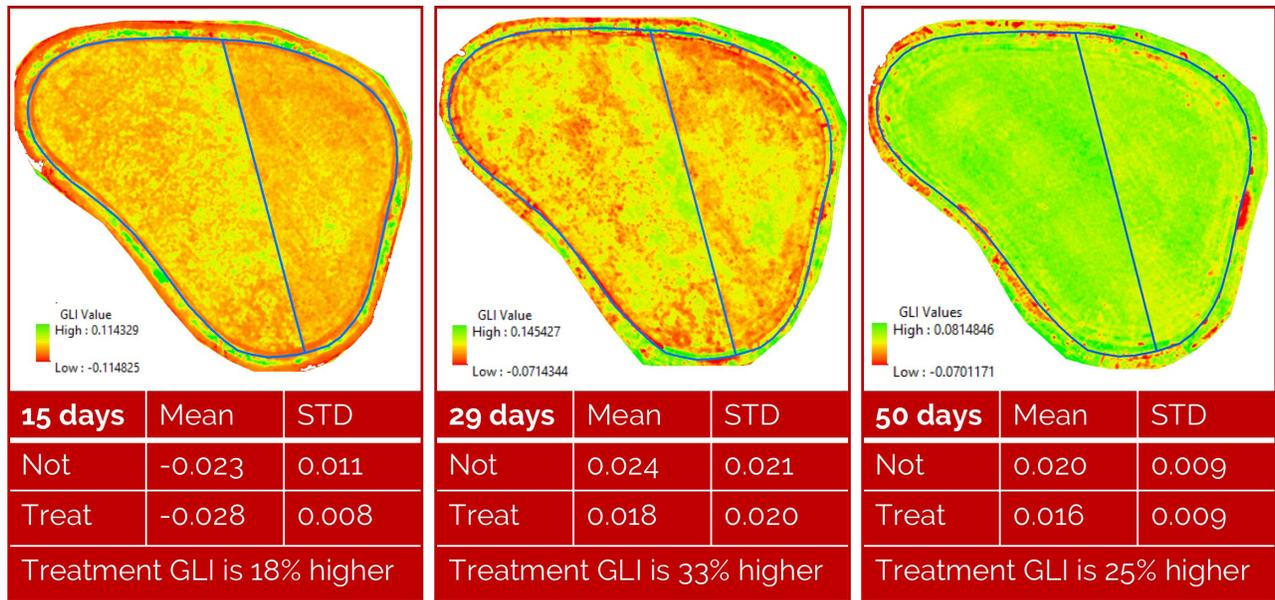
THE HARDWARE

The DJI Matrice 100, which is a multi-rotor drone, carried an RGB (red, green, blue) camera to capture images along with a multispectral sensor, which also had a camera to capture blue, green and near-infrared radiation imagery.

Once the final flight was complete, PrecisionHawk's Data Services team began processing the data. **The Green Leaf Index (GLI)** would be used during data analysis as it was specifically designed to adjust for the greenness or yellowness of a crop.

HOLE 2 RESULTS: GREEN LEAF INDEX

Treatment applied on left side of green



THE RESULTS: QUANTIFIABLE MEASURES THAT VALIDATED LEXICON'S® EFFECTIVENESS

"PrecisionHawk's data collection and analysis confirmed and validated what I had been seeing during my inspections - that Lexicon® treated sprigs adapted and recovered quickly from the stress of being transported across the country and then planted," said Gary Myers, CGCS, BASF Pinehurst Project Lead. **"We use the data as the foundation of our presentations** to prospective customers and golf course superintendents."

By quantifiably measuring sprig growth and green quality, BASF Turf and Landscape was able to demonstrate that treating sprigs with Lexicon® enabled them to grow in quicker and establish a stronger root system in less time.

Green Level Index for Lexicon® sprigs versus non-treated sprigs (50 days post-planting):

Up an average of

24%

Median rise of

24%



“The ability to quantify product performance is instrumental across a variety of industry applications. Drone-based advanced sensing improves the efficiency, accuracy and safety of field data collection and enables better analysis. This technology is increasingly becoming more cost efficient and thus accessible to organizations of all sizes”

—Kevin Lang, PrecisionHawk Vice President of Enterprise Services



PHOTO CREDIT: PINEHURST RESORT AND COUNTRY CLUB

Does your business need data to aid in better decision making and planning?

[Discuss your requirements with a PrecisionHawk team member today](#) →

In 2017, BASF Turf and Landscape set out to secure data that would confirm the benefits of pre-treating sprigs with Lexicon®. BASF partnered with PrecisionHawk due its strong track record with the company.

Select greens at the Pinehurst Country Club's No. 7 course became the testing environment and data was collected via a **drone with an advanced sensor** on three separate occasions.

Once the data was processed and analyzed, BASF Turf and Landscape was able to use quantifiable data to prove that treating sprigs with Lexicon® enabled them to grow in quicker and establish a stronger root system in less time.

