Weather Stations Unlock Nature's Secrets

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Good golf course superintendents depend greatly on two skills, anticipating problems in advance and responding before they get out of control. Until recently, these skills were based heavily on experience and a collection of personal observations. Today's superintendent has access to information gathering tools that unlock the secrets of nature and provide advance warning to turf and ornamental health problems.

Some stressful conditions are controllable, while others are not. Weather is one of the most difficult factors, beyond human control. Yet, weather can be the greatest influence on turf quality. Consistent, accurate weather predictions cannot even be relied on to plan management practices. With historical and current detailed weather data, insect and disease activity can be predicted. Degree-day accumulations for insect activity and computerized disease models can be used to predict favorable conditions for pests.

A complete weather station with disease model software can do just that. In the spring of 1994, North Shore Country Club purchased what I consider to be a complete weather station made by Metos. It includes 10 sensors, two thermometers (one for air temperature five inches above the turf and one for soil temperature two inches below the turf in our 4th green), a rain gauge to measure rainfall and irrigation water, two leaf wetness sensors, a solarimeter to record solar radiation and day length, and a soil moisture probe located two inches deep in the 4th green. Relative humidity is measured six inches above the turf. Wind speed and direction are sensed and recorded.

Based on information from all its sensors, the weather station offers raw weather data, degree-day calculations, evapotranspiration (ET) value, and three disease models (Pythium Blight, Brown Patch, and Dollar Spot). Spray data can be entered into the program to track the impact of spray decisions on disease activity. The micrologger automatically scans all sensors every 12 minutes, and stores this data for up to a week. Information is downloaded from the micrologger to the personal computer in the office of the grounds department any time. The data is stored on the hard drive and used in the software. One more attribute on the weather station is the solar-powered charging system.

Singularly or collectively, data from these sensors provides information, which improves and, at times justifies, many of our management practices. The station utilizes air temperature, relative humidity, wind speed and solar radiation to calculate evapotranspiration. According to the Penmann formula, ET gives an estimate of water lost by evaporation into the atmosphere and by transpiration from the turf plant. It references ET as inches or millimeters of water loss per 24 hour period.

Soil temperature information has helped us time our first fungicide application better to control summer patch (*Magnaporthe poae*) and Take-all patch (*Gaeumannomyces graminis*). Soil temperature data also indicates the proper timing of pre-emergent herbicide treatments for crabgrass control.

Microbial activity is governed largely by soil temperature and moisture. Nutrient release by some fertilizer carriers is also governed by soil moisture and temperature. With a better understanding of these factors, we can better understand and predict fertilizer activity.

Insect development can be predicted by tracking accumulated heat, expressed as degree days. Our weather station calculates degree days by averaging 120 air temperature measurements for the day. Once the average is obtained, the degree total for the day is this average minus the base temperature. We use a degree base of 50 degrees F. For a day

Dinelli stands next to weather data sensors which recorded exceptionally hot weather that damaged North Shore Country Club's *Poa annua* on greens.

with an average temperature of 59 degrees, the degree days for that day would be 9. This calculation is repeated each day and the result is added to the running total of accumulated degree-day values. Researchers have developed degree-day thresholds for many insects. An article by Rick Brandenburg (*TurfGrass TRENDS* 11: 95) discussed intuitive forecasting of turfgrass insect pests, including degree-day modeling and monitoring equipment and services. Knowing the degree-day value and referencing it to a particular insect's development, the turf manager can focus scouting on a particular insect and target insecticide applications better.

Plants also respond to accumulated heat. Some plants' inclination to flower or set fruit can be predicted with degree-day information. Some weeds share degree-day characteristics with other plants. For example, pre-emergent crabgrass controls should be applied when the Bridal Wreath Spirea (*Spiraea x vanhouttei*) blooms. In this case, the Bridal Wreath Spirea is an indicator plant for the conditions of crabgrass germination. For further information on timing pest management with ornamental plant development, the book "Coincide" by Donald A. Orton is a good reference.

A helpful feature of our weather station is disease model software. The Metos station has three prediction models for turf diseases, -- Pythium Blight (*Pythium aphanidermatum*), Brown Patch (*Rhyzoctonia solani*), and Dollar Spot (*Lanzia & Moellerodiscus spp.*). The predictive models are based on information collected from sensors of air temperature, soil temperature, rain or irrigation, relative humidity and length of leaf wetness. They do not account for inoculum pressure, species or cultivar resistance to disease, fertility or future weather (environmental) conditions that could influence disease development. Ultimately, it is the turf manager who makes the decision on disease pressure versus needed controls.

The weather stations has proved to be an important tool in our integrated pest management program It has helped us fine tune our irrigation needs. It also helped our timing to scout for disease and insect activity. People who may question our management activities can relate to a computer printout. This "scientific" support of what we do is becoming increasingly important.

Considerable work is still needed. More disease models must be constructed. Degree-day models need to be calculated for other pests as well as for beneficial insects. There is a lot of room for "home grown" research based on collected data coupled with field observations. The uses and applications are limited only by your imagination — that's what makes a weather station so exciting!

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References

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