VINEYARD & WINERY MANAGEMENT

TECHWATCH

Vineyard Weather Monitoring

By Marne Coggan

Stand-Alone Systems that Measure, Record, and Display Weather Data - and Often More

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This is the first in a series of articles on harnessing weather data for cost effective, quality conscious vineyard management. In this issue, we'll look at systems which monitor and record weather data. Future articles will discuss technology products and services which will use this data to create vineyard-specific and even block-specific plans for irrigation management, mildew and insect pest control, frost prediction and prevention, and more. You'll learn how using weather data can optimize your cultural practices to reduce your personnel and materials costs, minimize your environmental impact, and improve the quality of your fruit.

What's in a Weather Monitoring System?

A common thermometer is a weather instrument, but it's far from a weather monitoring system. The systems we'll examine in this article all share several key features. First, they measure several different weather variables. Air temperature and relative humidity are always included. Wind speed, wind direction, rainfall and barometric pressure also are common. Since they are optimized for vineyard use, many systems will measure soil temperature, soil moisture, leaf wetness and/or solar radiation.

Finally, and of critical importance, these systems measure time. Time is an essential element for the second key feature of weather monitoring systems —they automatically record the measured data for later use. Weather systems record their data at discrete, generally user-configurable time intervals, pairing each measurement with the time at which it was measured. Since aspects of the weather like temperature or wind can change within any given interval, some systems record the maximum and minimum measured values during each interval, plus the average value observed over the entire interval. Again, to contrast a weather system with a weather instrument, a max-min thermometer will record the highest and lowest temperature it detects, but it won't tell you when those temperatures occurred or how long they lasted.

The Magic of Telemetry

Most of these weather monitoring systems are capable of recording many days', weeks', or even months', worth of data. This provides plenty of flexibility for vineyard managers to choose when they will view or down-load the data. And this brings us to the last key feature of weather monitoring systems. All will export their recorded data to another device for analysis. Granted, several of the monitoring systems will display their weather data right on the field sensing unit or on a nearby display device, but the real usefulness of these systems is that they can move their recorded weather measurements to other devices. There, the data could be automatically acted upon, as it might for initiating frost protection or vineyard cooling systems. Alternatively, the data could be sent to a weather information service or to the computer in the vineyard office where it would be analyzed, perhaps in combination with other data, to produce reports or action plans for scheduling irrigations spraying for powdery mildew prevention.

Telemetry is the term for the movement of data from where it is measured to where it is analyzed. There are several methods of weather telemetry which vary in convenience, distance potential, and expense. The simplest and cheapest telemetric process is having the vineyard manager walk up to the weather sensor and manually initiate a data download into a portable computer, a Palm Pilot or other PDA, or a special-purpose handheld device. More convenient telemetry is automatically initiated by the weather monitor itself, or by the computer or service which is to receive the data. Thus, the next step in telemetry requires a wire between the field monitoring system and a computer in or near the vineyard. Alternatively, a standard phone wire could connect the system to a telephone pole and a built-in phone could send the data. Beyond this are various wireless methods of telemetry using cell phones; licensed UHF, VHF or FM radio bands; or unlicensed spread-spectrum radio frequencies (the same 900MHz and 2.4GHz bands used by the portable phones in your home). The UHF/VHF/FM radio solution offers long-distance connectivity, but at a cost. The cell phone method offers nearly unlimited range, provided your vineyard has reliable cell service to receive the outbound signal. The spread-spectrum solutions are relatively inexpensive, but they transmit only line-of-sight.

Complete Weather Systems from The Wizards of Data Loggers

Many growers are familiar with HOBO® data loggers. These simple, bullet-proof devices have been farmers' staple for spot temperature recording to determine the boundaries of frost prone areas in vineyards with rolling terrain. What may be unfamiliar is the name of the company which produces the venerable HOBO® loggers—Onset Computer Corporation. As Paul Gannett, Onset's Product Marketing and Development Manager notes, "Up to this point, our business has really been focused on the stand-alone data loggers. They're known for being inexpensive and very easy to deploy. Now we're taking that same philosophy and applying it to a system-level product, the new HOBO® Weather Station. It still records weather data into a battery-powered logger, but now it has a larger suite of sensors. Plus, it has our Smart-Sensor technology—the user just plugs in the sensors, and the logger automatically recognizes them. There is no calibration to be done and no special set-up parameters that have to be entered. It's a plug-and-play system, powerful, accurate, and affordably priced."

HOBO® Weather Stations are quite robust. Up to 15 research-grade Smart Sensors can be configured in any combination for weather measurements including temperature, relative humidity, dew point, rainfall, barometric pressure, photosynthetic light, and wind speed. Since the sensors are automatically recognized by the logger, growers can add or unplug sensors whenever they want. The station has the capacity to hold over 500,000 measurements, and it will run for one year on four user-replaceable AA batteries.

With Onset's software, growers can download logged data in the vineyard to Palm handheld devices or Windows-based portable computers. The software also analyzes and displays the weather data, and will export it for use in spreadsheets or other applications. And since the logger's memory will retain data even if the batteries die, the system is nearly fail-safe.

Sensatronics, a New Hampshire company producing a variety of digital weather instruments, offers two product lines to wine growers — Accu-Trax and the Field Monitor. The brand-new Accu-Trax products are not complete weather systems, but rather a set of smaller, palm-sized instruments, each of which produces a specific type of agricultural weather data. According to Keith Wright at Sensatronics, Accu-Trax devices for degree-day computations are available now. Additional Accu-Trax models to compute disease severity values for powdery mildew, phomopsis, and other grape pests are now under development.

Each weatherproof Accu-Trax device is sold complete and ready to mount. No wires or hook-ups are needed, and the batteries which will last a full year are already in place. Viewing Accu-Trax data is a snap. Let's use as an example the Accu-Trax model which computes and displays growing degree-day information. Pressing one button turns on the LCD screen and displays the current temperature, accumulated degree days, battery status, and the number of days that the unit has been on. Pressing another button displays additional data, including the high and low temperatures for the past four days. and the last 24 hourly readings.

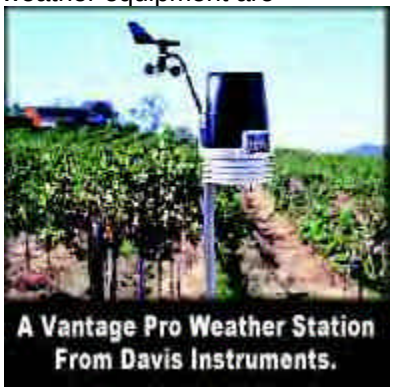
An Accu-Trax degree-day monitoring and recordking device from Sensatronics

Sensatronics' Field Monitor line are complete weather monitoring systems. These total, turnkey solutions include weather data acquisition equipment, telemetry and software. The Field Monitor runs on six C-cell batteries, and includes a display for in-the-field viewing of weather data. Wright notes, "Up to eight weather sensors can be included, but usually only four are used for grapes—leaf wetness, precipitation, temperature and humidity." Sensatronics' CROPS Software package provides easy data retrieval and system management.

Weather Systems from Davis Instruments

Davis Instruments has a long history of producing affordable weather measurement systems. Their time-tested GroWeather

system had been one of the lowest cost complete agricultural weather systems available. But now Davis has released several equally powerful but even lower-cost weather systems for growers—The Vantage Pro series. Director of Marketing Russ Heilig says, “Davis has always tried to give value for money. But with the Vantage Pro systems, I can’t tell you how often we’ve seen people surprised at how inexpensive they are. At grower shows like the Unified Symposium in Sacramento, people who have experience with other weather equipment are a much higher price. It almost gets to the point where they can’t figure out what they’re missing, and I have to go to great lengths to point out that they are not missing anything—it’s all really there.”


A Vantage Pro Weather Station From Davis Instruments.

The Vantage Pro systems include a complete set of weather sensors, including humidity, dew point, air and soil temperature, precipitation, wind speed and direction, barometric pressure, soil moisture and leaf wetness, and solar/UV radiation. A single system can handle up to eight sensors, often in interesting and useful combinations. For example, the system will handle input from two remote, wireless soil moisture stations, each of which has three probes for measurements at different soil depths. Vantage Pro systems also perform degree-day and evapotranspiration computations. They run on three C batteries and are available in both wireless and cabled versions, with the wireless range up to 400 feet, line-of-sight. Davis’ software will use the recorded data to create graphs, calculate totals and averages, analyze trends, and more.

Continues Heilig, “The Advantage Pro systems are really competitive in the professional market. Their wireless nature makes them very easy to set up. You can put a system anywhere in the field, and put the receiver anywhere in your vineyard buildings or house. If you want to move either the system or receiver later, you’re not tied down by wires. So our weather stations are becoming more like the very high-end weather stations in terms of what they deliver, but yet keeping the price at a fraction.”

Automata and Adcon Systems

Automata, Inc. produces both equipment which measures weather and environmental data, and devices which can act on this information. (You’ll learn more about these latter products in future issues which will discuss how weather data can be used for irrigation scheduling and pump control, frost protection and vineyard cooling systems, and Integrated Pest Management.) Automata’s DATA LYNX® weather monitoring and control telemetry equipment provides the link between field measurement stations and a computer, allowing growers to monitor vineyard conditions such as rainfall, soil moisture, dew point and more. The recording and telemetry systems are modular, allowing the connection of from four to forty analog or digital weather sensors, either those produced by Automata or by other manufacturers. The receiving computer can analyze data from just one weather station, or collect the data from hundreds of separate stations.

Adcon is a world-famous manufacturer of weather stations. Its name is synonymous with a well-established wireless agricultural

forecasting network. Adcon itself doesn't sell its equipment.
Instead, Adcon's distributors sell, install and service weather stations in growers' vineyards. Dave Jones of Adcon notes that the distributors aggregate the data from all of their clients' stations, and use this data to provide regional reports to each of their clients. "Our distributors offer network weather data to their clients, usually data beyond that recorded in each grower's vineyard. Terra Space is one of our authorized dealers. Western Farm is another. They add value through their networks and services."

Each Adcon installation is composed of a selection of weather sensors which connect to a remote telemetry unit. Those sensors may directly attach to the telemetry tower, or the sensors themselves may be wireless to gather information from widely different areas within a single vineyard. The Adcon units monitor weather data continually, and every 15 minutes record the data and send it directly to the distributor's aggregating computer. Through their distributor, growers have access to up-to-date weather data 24 hours a day. The combined data from multiple sensors within a single vineyard and multiple stations throughout the growing region can provide detailed information about the weather microclimate in a range of 1/2 to 12 miles around an individual weather station.

What to Do with Weather Data?
Why bother with monitoring weather data in your vineyard? Because the information is really useful. It can give you insight into the health and quality of your vines. It can reduce the environmental impact of your farming practices both within your vineyard and in your neighboring community. And it can help you produce better fruit at lower costs. So stay tuned for future issues where we'll discuss technologies and services which will turn your weather data into better vineyard management practices.