

# Forecasting with Tom-Cast and Spectrum® Weather Equipment

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## Disease Forecasting

Disease forecasters can play an important role in IPM systems for vegetable crops by alerting growers when weather conditions are favorable for disease development. Purple spot disease is a problem on asparagus fern that can decrease overall plant vigor and significantly reduce yields. Fungicide sprays are often needed but vary from year to year based on the environment. A tomato disease forecasting system has been adapted to successfully predict purple spot outbreaks in asparagus. Recent research has illustrated the applicability of this disease forecasting system for use in carrots. By timing fungicide applications for optimum efficacy, growers typically make fewer total applications. This bulletin was written to provide step-by-step instruction to assist growers, consultants, extension personnel, and others who are interested in implementing a disease forecasting system as a tool in an IPM program.

In 1978, a computerized forecasting system called FAST was developed for *Alternaria solani*, a fungus that infects tomato, to identify periods when environmental conditions are favorable for early blight development (3). It is based on the following daily environmental parameters: maximum and minimum air temperature, hours of leaf wetness, maximum and minimum temperature during the wetness periods, hours of relative humidity greater than 90%, and rainfall. The FAST system requires fewer fungicide applications compared with weekly spray schedules to obtain the same level of disease control. However, the model is complex and the equipment required is awkward and prone to problems. The FAST

system has also been tested in Spain for scheduling fungicide applications to control necrotic spotting on pear caused by *Stemphylium vesicarium*.

In 1985, a modified FAST program called Tom-Cast was developed to aid in the management of anthracnose, Septoria leaf spot and early blight on tomatoes (5). Tom-Cast does not include the rain model of FAST, but includes the duration of leaf wetness and average air temperature during the wetness periods to calculate a daily disease severity value (DSV) of 0 to 4, corresponding to conditions unfavorable to highly favorable for spore formation of *A. solani*. When DSVs accumulate to a predetermined threshold, fungicides are applied and the DSV is reset to 0. In tomato, the number of fungicide sprays may be reduced by as much as 50% without compromising fruit quality or yield by using Tom-Cast. Tom-Cast is being used in Michigan asparagus for control of purple spot (4), and research has been conducted with this system to manage foliar blight on carrots (1,2).

Tom-Cast requires that leaf wetness and temperature during the leaf wetness periods be monitored. We have used the Spectrum® leaf wetness and temperature sensor to monitor these data in our research.

## Setup of Equipment

Before placing the Spectrum® leaf wetness/temperature sensor in the field, you need to be sure the sensor has a fresh battery. Battery life is about 6 months under field use conditions. Batteries can be obtained from any electronics or camera shop. The battery compartment is



**Leaf wetness/temperature sensor  
in an asparagus field.**

accessed by removing the screws from the bottom plate of the sensor. When inserting the new battery, be sure to center the battery in the rubber removal band. Then slide both the band and battery under the retaining clip. If the battery is inserted correctly, the light on the front of the sensor should blink quickly several times. Replace the bottom plate and tighten the screws so that the rubber gasket makes a water tight seal.

You can mount the sensor on a variety of wooden or steel posts. Galvanized conduit is inexpensive and can easily be made into a mounting pole. Each mounting pole should be painted with a highly visible color. This is to aid in finding each station in the field, and is also helpful in avoiding costly equipment damage by farm machinery. The actual sensor should be mounted on a 45 degree angle in relation to the ground. This will allow excess water to run off the wetness grid and mimic leaf reaction to water. Place the sensor so that the metal grid is facing towards the north, to avoid drying of the surface by the sun. The height of the sensor placement should be approximately  $\frac{3}{4}$  of the canopy height. Avoid false wetness readings by preventing any contact between crop foliage and the sensor. Avoid spray drift when possible. When choosing a location to

place the sensor in the field, try to select an area that is representative of field conditions. A conservative approach is to select an area where the foliage will stay wet the longest. These areas are usually in parts of the field that are shaded by trees and have little air flow.

### **Launching the Sensors**

The sensors can be launched anywhere you have computer access. The easiest method is to launch the sensor in the office and then take it to the field location. The sensor is launched by connecting it to a computer that has the Specware software installed. Most older sensors can be used with both older and newer versions of Specware while the newer ‘Watchdog®’ type sensors will only work with the newer version. Depending on which version of the software that is available on the computer, you need to choose the “**Logger**” option on the top menu and then select “**Launch Watchdog**” (newer sensors) or “**Manage Spectrum and Onset Loggers**” (older sensors). When launching, make sure that you set the weather data to collect at least every hour. At this time, you should give each sensor a unique name to avoid confusion, and it is helpful to write that name on the sensor before placing it in the field. Use less than eight letters when naming the sensor, as this will allow you to use the same name when creating download folders for the weather data you will be collecting over the summer. After the sensor has been successfully launched, the small light on the front of the sensor should blink once every 5 seconds. This indicates that the sensor is working correctly and is collecting weather data.

### **Collecting Weather Data from the Sensors**

Downloading of the weather data is done either by computer or by a ‘Watchdog®’ shuttle. The Watchdog® shuttle will only work on the newer

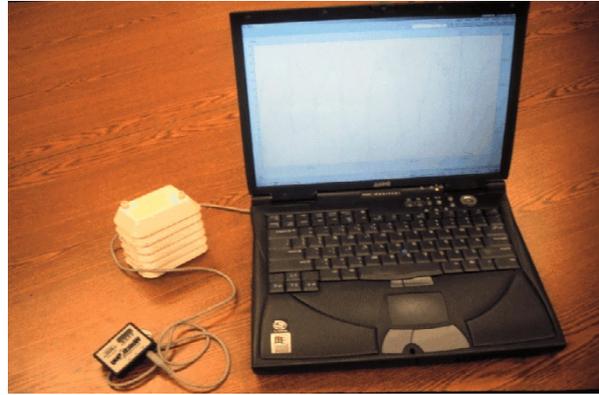
sensors that have the Watchdog<sup>®</sup> emblem on them.

Downloading using a computer is very similar to launching the sensors. You need to have the Specware software on the computer you are using. Using a laptop is most convenient, as you can take it to remote locations. The best method is to bring the sensors to the computer, and download in the shade of the vehicle. The shade makes seeing the LCD screen of the computer easier, and avoids possible damage by sand and water. The sensor is connected to the computer with a serial patch cord. Choose the **“Logger”** option from the top menu and then select **“Get Watchdog Data”** (newer models) or **“Manage Spectrum and Onset Loggers”** (older models). The software program will then connect to the attached sensor and download the data. When downloading a sensor for the first time, the software will prompt you for a location to store the data. You will need to



**Downloading data from a sensor in the field.**

choose a unique name for the file folder to avoid overwriting data from other sensors. It is best to use the same name you have given the sensor at the first launch of the season. You



**Downloading data from a sensor inside.**

need to insure whenever you are downloading the sensor, the data is saved in the same folder location each time. After the data is downloaded, you must relaunch the sensor. Check each sensor to be certain that the light on the front is blinking and then place the sensor back in the field.

If you are using the Watchdog<sup>®</sup> shuttle, there is no need to take a computer to the field, although it might be wise to have one as a backup. Before each downloading session, you will need to launch the shuttle using the Specware software. This is done the same way that you launch a weather sensor. After the shuttle has been launched, the LCD screen on the shuttle should read **“On.”** This means the shuttle has been cleared and is ready to download data from multiple sensors. To download a sensor, connect the shuttle with the sensor using the stereo jack patch cord. After connection, push the arrow button on the shuttle, and the data will be downloaded. After the data is downloaded, the shuttle will automatically relaunch the sensor. The LCD screen on the shuttle should no read **“No. 1.”** This means that data from one station is stored on the shuttle. You can download several stations to the shuttle. Each time a station is downloaded, the number of stations stored on the shuttle will be recorded on the LCD screen. To transfer the data from the shuttle to a

computer, connect them with the serial cord, and select the **“Get Watchdog Data”** option. The shuttle will download the weather data one sensor at a time in reverse order of collection. The number of stations the shuttle can download will depend on the amount of weather data each station has accumulated since the last download. After the shuttle has been downloaded to the computer, it will need to be relaunched before the next collection session.

### **Running the Tom-Cast Model**

After the data has been collected from a site, the DSVs can be determined by running the Tom-Cast model included in the Specware software. Our research with asparagus (4), carrot (1,2) and tomato has indicated that once DSVs have accumulated to 15, a spray is indicated. The DSV is then reset to 0, and they are accumulated again, depending on the weather conditions being monitored.

Running the Tom-Cast model is done by first opening the data file from the sensor location that needs a forecast, by selecting the **“File”** option in the top menu bar, then selecting **“Open File.”** Choose the folder location that holds the data you need, and select the time period that you need. Then make sure the **“TMP”** and **“WET”** boxes are selected at the bottom of the box. Push the **“Open”** button to bring the file up. After the data has been loaded, a graph showing the weather data will be displayed. To obtain the amount of DSVs that have accumulated since the last download, you will need to choose the **“Tools”** option in the top menu bar. Select the **“Disease Models”** option, and then use the **“Select Report”** tab to select the **“Tom-Cast”** model. Going to the **“Where and When”** tab will allow you to choose the date and the sensor folder location where the data is stored. Under the **“Option”** tab, set the **“Temperature Base”** to 0 and the **“Wetness Threshold”** to 0. The **“Upper**

**Limit”** for temperature should be set to 100. Temperatures are in degrees Celsius. To calculate the DSVs for the dates selected, you will then need to choose the **“View Report”** tab. The program will generate a report for the location and dates you have selected. This report can be printed or saved to a file for later use. Next, you can select other locations or dates to run, depending on what information is needed.

### **Literature Cited**

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