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HS950

UF UNIVERSITY of FLORIDA
IFAS Extension

Weather Data for Citrus Irrigation Management[1]

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Weather is one of the most important factors that affects citrus growth and production. Citrus can be grown in a variety of arid and humid climates and can withstand temperatures ranging from 28 to 105°F. However, it performs best in the range between 60° and 86°F.

In addition to certain temperature requirements, citrus also requires a certain amount of water for optimum growth. In Florida, it generally takes 48 to 50 inches of water per year to grow a crop with the majority of this water supplied by rainfall. Irrigation is a supplement, but it has a major impact on yield if rainfall is deficient in the spring. In arid regions, most of the water needs are met by irrigation, and rainfall is a secondary provider of water.

FAWN Weather Data

When scheduling irrigation, it is important to have good rainfall and temperature data. In Florida, one of the best sources of up-to-date weather information is the FAWN weather network on the internet. FAWN stands for Florida Automated Weather Network and is available at **http://fawn.ifas.ufl.edu**. It provides weather information from a number of locations throughout the state at 15-minute intervals. Many of the weather collection points are at the various research and education centers (RECs) or Extension offices around the state. The sites are listed in Table 1 and shown in Fig. 1. New FAWN sites are added periodically. FAWN provides data on air and soil temperatures, rainfall, dewpoint, relative humidity, windspeed, wind direction, and radiation. Air temperatures are measured at 2, 6, and 30 foot heights, and soil temperature is measured at a 4-inch depth. It also indicates maximum and minimum values of several parameters. The mission of FAWN is to provide accurate and timely rural weather data to a variety of users.

Table 1. Weather collection sites - FAWN.

Alachua	Fort Lauderdale	Monticello
Apopka	Fort Pierce	Ocklawaha
Avalon	Hastings	Okahumpka
Balm	Homestead	Ona
Belle Glade	Immokalee	Palmdale
Bradenton	Jay	Pierson
Bronson	Kenansville	Putnam Hall
Brooksville	Lake Alfred	Quincy
Carrabelle	Live Oak	Sebring
Citra	Macclenny	Tavares
Dover	Marianna	Umatilla

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FAWN is being enhanced with additional weather stations and more Web-related services. Decision modules, such as disease prediction, crop phenology, and impacts on crops based on climate forecasts, are being added to the Web site. Its present home page gives several ways to search the weather database. The available weather data parameters are listed in Table 2. When searching the data, a grower can find daily, weekly, or monthly summaries. Of particular use is the daily summary which gives daily maximum and minimum temperature, rainfall, total radiation, calculated evapotranspiration (ET), and hours below certain temperatures. For scheduling irrigation, this daily summary gives much of the information needed to make good scheduling decisions.

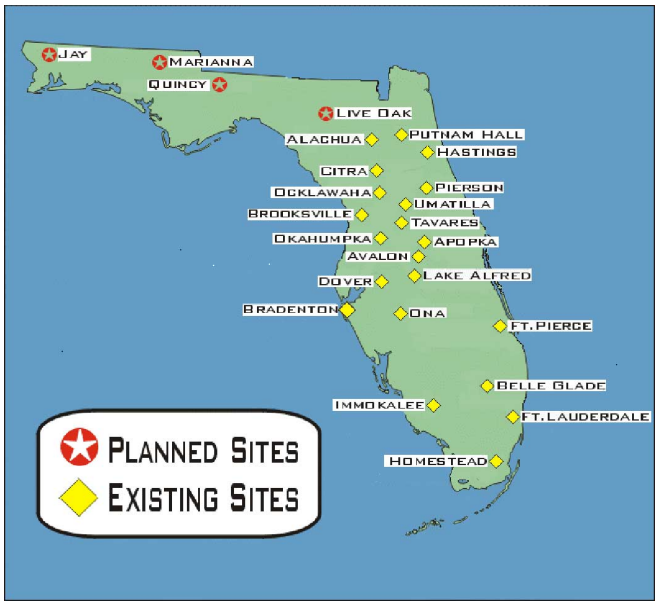

Figure 1. Map of FAWN site locations in Florida.

Table 2. Weather data collected at FAWN sites.

Location	e.g. Lake Alfred
Date/Time	
Station	
Air Temperature	°F, °C @ 2, 6, and 30 ft
Soil Temperature	°F, 4 inch
Relative Humidity	%
Dewpoint	°F
Rainfall	inch, cm
Wind Direction	°
Wind Speed	miles/hour (max and min), m/sec
Total Radiation	Watts/m^2

Evapotranspiration

Evapotranspiration or ET, is the combination of two processes: evaporation and transpiration. Evaporation is the vaporization of water from a free water surface, such as a lake or any moist surface such as soil. Transpiration is the movement of water vapor from the plant to the atmosphere. Various factors influence ET. These include radiation, temperature, vapor pressure deficit (the difference between saturation vapor pressure and actual vapor pressure, or the dryness of the air), and windspeed. Most of these factors are included in the FAWN dataset. FAWN also lists a calculated ET which can be used in irrigation management. Daily average ET varies from 0.07 to 0.19 inches/day from winter to summer. On some clear, high radiation, hot days, ET can be as high as 0.25 inch/day. During periods of prolonged high ET, irrigation schedules can be adjusted to replace the extra water lost by the plants.

Frost/Freeze Information

Besides giving rainfall, temperature, and ET information that can help with irrigation management, FAWN weather data can be particularly valuable on freeze nights. Growers can follow changes in temperature throughout the state during the night. If cold air is blowing in from the north, one can watch the progression of the freezing weather as it moves down the state.

FAWN is not a weather forecasting system, but it provides timely information that growers can use to help make their own forecast. On predicted frost nights, the information from FAWN can be particularly useful, since humidity plays a major role in how cold it will get. FAWN provides both temperature and humidity (dewpoint and wet bulb) data. For definitions of terms used in frost protection, see EDIS publication HS931 "Microsprinkler Irrigation for Cold Protection of Florida Citrus."

Brunt Minimum Temperature Estimator

Under "Management Tools", there are several useful tools. One is the Brunt Minimum Temperature Estimator. By knowing the dew point and air temperatures at sunset on a cold night, a grower can estimate the minimum temperature. If the sunset air

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temperature is 40°F and the dew point is 20°F, by using the chart shown in Figure 2, a line can be drawn from the 20°F dew point to the diagonal sunset temperature at 40°F. A horizontal line is then extended from the point on the 40°F diagonal line to the left margin of the chart. The point where the horizontal line meets the left margin is the estimated minimum temperature for the next morning. In this case, the minimum temperature would be 22°F.

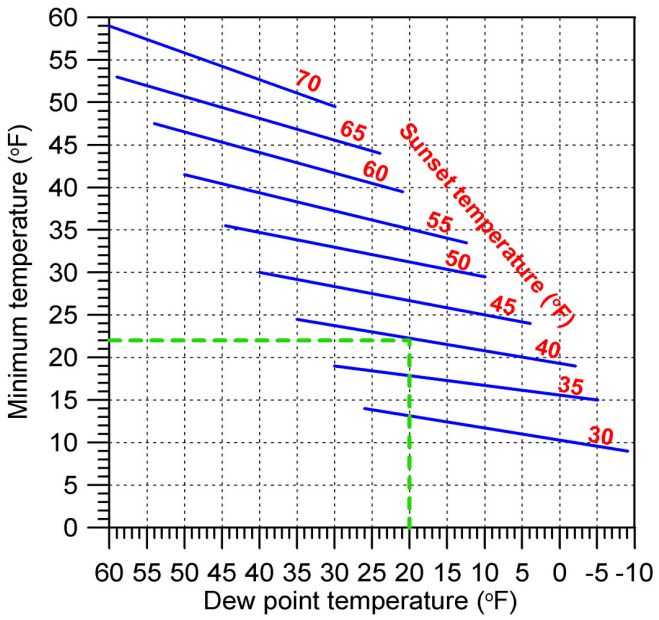

Figure 2. Minimum temperature prediction chart using air temperature and dew point temperature observed at sunset.

The method is simple and requires only two temperature measurements at sunset. Growers should measure the sunset temperature directly in their groves, because air temperatures can vary widely depending on elevation, topography, and height above the ground. The dew point can be determined by using a psychrometer. Since dew point temperatures do not vary greatly over a distance of a few miles, the grower can also use the calculated sunset dew point from the nearest FAWN site. While this FAWN dew point will not be the exact dew point temperature of the grove, it can be useful as an approximation.

Growers can either use the chart in Figure 2, or now they can use the FAWN site to estimate the minimum temperature. To estimate this temperature, do the following:

1. Log onto the FAWN web site – **http://fawn.ifas.ufl.edu/**
2. Obtain dew point temperature at the site closest to your grove at the time nearest sunset.
3. Return to FAWN main page, go to Management Tools, and find the Brunt Minimum Temperature Calculator.
4. Enter the dry bulb from your grove and dew point temperature obtained above. Click on Calculate Min. Temp.
5. The estimated minimum temperature over sand and muck soils will appear on the calculator.

There can be a difference of a few degrees between the temperature calculated from the chart in Figure 2 and the FAWN computer calculation, but either method will give an approximation of the minimum temperature.

This Brunt method for estimating the minimum temperature was designed to be used for a stable air mass of uniform moisture. If dry air moves in or winds increase noticeably, significant errors could be introduced.

Wet Bulb Temperature

Another advantage of FAWN is that it plots a calculated wet bulb temperature. The wet bulb temperature can be used as an indicator of when to turn the water off. There is always a risk when using water or microsprinkler systems for frost protection. Low humidities or wind can increase evaporative cooling which can chill wetted trees below the air temperature. The wet bulb temperature is the lowest temperature to which air can be cooled by the addition of water. When the wet bulb temperature is 32°F or higher, the irrigation system can be stopped without danger of damage to the citrus tree. Considering the distance from the FAWN site and the estimation of the temperature, growers may want to wait until the wet bulb temperature reaches 34°F to be safe. In any case, it is not necessary to keep irrigating until all the ice has melted from the tree. When the wet bulb goes above freezing, growers can start to shut the irrigation systems down. By using the wet bulb temperature as a guide, growers can save

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substantial amounts of water and irrigation costs by stopping the irrigation when the wet bulb temperature goes above freezing. Under Management Tools, the Wet Bulb Irrigation Cutoff estimates a safe air temperature at which irrigation can be stopped without causing damage to citrus.

Other FAWN Tools

Another management tool uses temperature, rainfall, and leaf wetness to advise when to apply fungicide for Alternaria (Brown Spot) control. New management tools will be added over time.

Other Weather Information Sites

In addition to the FAWN site, there are a number of other sites on the internet that provide weather information. Several of these weather information sites come from television stations, industries, or government agencies. A listing of some of these sites is given in Table 3. Internet site addresses change from time to time, so a grower will need to update these site addresses. These internet sites provide a wide range of information including weather forecasts, animated radar, and local conditions. Using this information, growers can better predict how to manage water for irrigation and freeze protection in their groves.

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Table 3. Selected Internet sites for weather information.

Channel 10 Tampa: http://www.wtsp.com/weather/index.asp
Channel 13 Tampa: http://www.wtvt.com/
Channel 9 Orlando: http://www.wftv.com/weather/
Channel 2 Ft. Myers: http://www.nbc-2.com/weather/
The Ultimate Citrus Page: http://www.ultimatecitrus.com/
NBC Intellicast: http://www.intellicast.com/
Accuweather: http://wwwa.accuweather.com/adcbin/public/index.asp
Florida Weather Center: http://www.weathercenter.com/
NOAA Weather Site: http://www.goes.noaa.gov/
The Weather Channel: http://www.weather.com/
National Climatic Data Center: http://www.ncdc.noaa.gov/
University of Illinois at Urbana-Champaign, Dept. of Atmospheric Sciences: http://www.atmos.uiuc.edu/
NOAA National Weather Service Homepage: http://www.nws.noaa.gov/
Internet Weather Resources: http://tdc-www.harvard.edu/weather.html
National Weather Service Tampa Bay, FL: http://www.srh.noaa.gov/tbw/
The Weather Network: http://www.theweathernetwork.com/
Weather Underground: http://www.wunderground.com/
National Severe Storms Laboratory: http://www.nssl.noaa.gov/
Atlantic Tropical Weather Center: http://www.atwc.org/
University of Michigan Weather -- Weather Net: http://yang.sprl.umich.edu/wxnet/