

The USDA/Agricultural Research Service Research Weather Network in Lake County, Ohio — 2002 Update

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Introduction

Weather is among the key factors to be dealt with in managing nursery field operations. In recognition of this and as part of a cooperative field research program, the Application Technology Research Unit of USDA/Agricultural Research Service; nursery growers in Lake County, Ohio; and cooperating staff of The Ohio State University's Ohio Agricultural Research and Development Center began development of a research weather network in 2000.

Initial efforts involved implementation of a portable weather station as part of a multi-year, field research project designed to compare efficacy of conventional axial-fan (airblast) and air-curtain spray application systems in control of scab disease in crabapple.

Permanent meteorological stations have been installed in northeastern Ohio production nurseries to archive weather data during horticultural experiments. Insect and disease management research require detailed knowledge of weather conditions. Data such as soil moisture and temperature, air temperature, relative humidity, precipitation, wind speed, wind direction, barometric pressure and leaf surface moisture that directly impact disease and insect development are being recorded.

Unique to this cooperative project is that this research data is also available to growers as displayed on the USDA, ARS, ATRU website and the NRCS weather network. Impacted by the USDA, ARS, ATRU weather station network are studies on soil insects, sprayer efficacy on apple scab disease, nursery crop phenology, and plant conditioning.

The Weather Stations

Development of the permanent components of the weather network was begun in 2001 with installation of a station at Sunleaf Nursery, Madison, Ohio. Construction of a second station was undertaken in 2002 at Klyn Nursery near Perry, Ohio.

These locations were selected as representative of commercial nursery locations, and of known or expected differences due to terrain and distance from nearby Lake Erie. Space for each station was donated by the host nursery as a contribution to the industry and to cooperative research programs.

The central component of each station is a 10-meter (33-ft.) tilt-down instrument tower set on a concrete base and equipped with a lightning-protection system. The Madison (Sunleaf) tower is shown in Figure 1. There are underground AC power and telephone data transmission lines serving each tower.



Figure 1. The weather station at Sunleaf Nursery, Madison, Ohio. The station near Perry, Ohio, at Klyn Nursery is similar. The shielded temperature and humidity sensor can be seen on the support arm at the left side of the tower, with the solar pyranometer appearing on the support arm opposite, at the right. The rain-snow gauge is in the near background just beyond the tower.

The towers and instrumentation employed are basically adapted UT-30 systems as available from Campbell Scientific, Inc.(Logan,Utah). Instrumentation is deployed in accordance with National Oceanic and Atmospheric Administration (NOAA) standards. Data as currently available are accessible at a web site discussed later.

Weather Instrumentation

Wind Speed and Direction

Wind speed and direction data are provided by a windset combination of a cup anemometer and vane electronic sensors mounted at the standard 33-ft. level of the tower. This deployment is at a higher elevation than typical of some agricultural meteorology applications to assure adequate clearance above hoop-houses or treetops typical of nursery field operations.

On the web site, wind speeds are given in miles per hour and wind direction as azimuthal degrees (zero to 360) clockwise from zero (north).

Air Temperature and Relative Humidity

Air temperature and relative humidity data are provided by a thermister and Vaisala relative humidity sensor combination mounted at about the 2-meter level. The sensors are enclosed in a cylindrical, vented shield for protection from rainfall, foreign matter, and solar heating.

Air temperature and relative humidity are expressed in Fahrenheit degrees and percent, respectively.

Solar Radiation

Solar radiation is monitored with a pyranometer sensor mounted on the south-facing side of the tower opposite the temperature and humidity sensors.

Solar radiation is expressed in watts per square meter.

Atmospheric Pressure

Atmospheric pressure data are provided by an electronic barometric pressure sensor located in the instrumentation enclosure that houses the data logging system. One important application of barometric data will be to enable accurate determinations of local atmospheric moisture and latent-heat conditions for prediction of overnight low temperatures. Barometric data are not currently available on the web site.

Soil Temperature

Initially, soil temperature data will be acquired by means of sensors placed at 2-, 4-, and 8-inch depths in soil adjacent to the tower. Eventually, soil temperature and soil moisture will be monitored at these and additional depths. These data are not currently available on the web site.

Rain and Snow

Rain and snow are monitored with an electronic "tipping-bucket" unit. In winter months, a heating system is provided to enable snowfall measurement on an inches-of- liquid-water basis.

Data Logging System and Data Access

A Campbell Scientific CR23X data logging system is used to digitally acquire and store data from the deployed sensors. The system is housed in a tower-mounted enclosure providing backup battery power in event of AC-line power failure.

Data can be secured for post-processing and archiving by computers at local or remote sites equipped with software and a modem enabling communication with the system. Some data are currently available on a web site that is under development, and accessible at:

www.oardc.ohio-state.edu/usdaweather/

The Madison(Sunleaf) or the Perry(Klyn) station can be selected from among the listed offerings at the site. These are currently the only two sites on the USDA network.

The remaining listings in the web site are in the Ohio State University weather network at various additional locations in the state.

Discussion

Research and nursery-industry uses for data from this weather network envisioned at this time are:

- Archival records of conditions during completed spraying or other grower operations.
- Records of weather conditions during past growing seasons.
- Water management and irrigation scheduling.
- Prediction of overnight low-temperatures with potential for crop damage.
- Forecasting of insect or disease onset, dormancy entry or emergence, based on degree-day calculations and research data.
- Disease-control spray applications based on weather-triggered alerts.
- Research on seasonal or other gradations in weather conditions near Lake Erie.

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