

"Enviro-weather decision-making tools for the grape and wine industry"  
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**Goals and Objectives:** Michigan State University's Enviro-weather program provides Michigan's agriculture with online access to weather-based pest, crop and production management information for decision-making. Enviro-weather's goal is to help agricultural producers in Michigan understand the effects of weather on their crops and make relevant pest and production management decisions to mitigate negative effects. The primary objective of the current project was to support the operation of the existing weather stations that serve the grape industry. In particular, this proposal sought funding to help support the ongoing maintenance, repair, and operation of four Enviro-weather stations in wine grape growing regions (Northport, Old Mission, Scottsdale and Berrien Spring, MI).

**Literature Review:** MSU's Enviro-weather program was formed in 2007 with the mandate to establish a dependable, sustainable, weather-based information system to support agricultural pest, production and natural resource management decision-making. Enviro-weather started with a network of 48 weather stations and a suite of predictive models and weather summaries that provided decision-making information primarily to tree-fruit growers. Since that time, Enviro-weather has expanded to 80 plus weather stations and has more than doubled in number and diversity of on-line tools; Enviro-weather now includes many more applications specifically for small fruit, vegetables, field crops, Christmas trees, and landscape and nursery. New applications are continually being developed and added.

Grape and wine producers that visit the Enviro-weather website ([www.enviroweather.msu.edu](http://www.enviroweather.msu.edu)) can access real-time, locally based, relevant weather-related information. They can easily:

- Quickly view current weather conditions across the state (air and soil temperatures, wind speed and direction, relative humidity, dew point, leaf wetness and precipitation amounts).
- Access accumulated degree-days (for predicting crop and pest development).
- Compare weather conditions and degree-day accumulations across regions and between years.
- View hourly overnight temperatures across the region and forecast predictions of low temperatures to anticipate frosts/freezes.
- Access disease (e.g., grape black rot) and insect pest (e.g., grape berry moth) model predictions to determine the need for and correct timing of pesticide applications.
- Visit linked IPM resources for information on pests, diseases and production.

Each Enviro-weather station is equipped with research-quality sensors that continually collect weather data (air and soil temperature, rainfall amounts, relative humidity, solar intensity, soil moisture, wind speed and direction and leaf wetness). During the growing season stations automatically send their data every 30 to 60 minutes (via cellular IP technology) to a central server on the MSU campus. Data are checked for accuracy, then organized, stored and archived in a database, where they are used to produce the tools, predictive models, and weather summaries that help growers make informed decisions.

The on-line tools are developed by subject matter experts (for example, campus specialists Annemiek Schilder and Rufus Isaacs) and are checked for validity under Michigan growing conditions before they are made accessible on the Enviro-weather website. Available tools are

determined by industry needs and are modified, when necessary, to improve accuracy and ease of use.

A number of on-line, informational applications are available to grape growers on Enviro-weather (concord grape berry weight, grape berry moth, grape black rot). Non-specific weather summaries include: current weather conditions, precipitation summaries (regional, historical), daily temperature, rainfall and degree-day summaries, overnight temperatures (regional), daily soil conditions (temperature and moisture), and a number of degree-day summaries.

**Results and Accomplishments:** Funding for this project was used for 2014 maintenance and operation of Enviro-weather stations located in Scottdale, MI; Northport, MI; Old Mission Peninsula, MI; and Berrien Springs, MI.

The Scottdale, MI Enviro-weather station was visited for routine maintenance in April 2014 and equipment was checked, cleaned, and recalibrated. The wind speed sensor was replaced at that time.

The Northport, MI Enviro-weather station was visited in August 2014 for routine maintenance site and equipment was checked, cleaned, and recalibrated. On November 30, 2014 the analog “land line” for data transmission was replaced with a cellular modem, and on Dec 6, 2014 a cable was replaced to improve communication.

The Old Mission Enviro-weather station was visited to perform routine maintenance in July 2014 and a damaged precipitation bucket was replaced. The battery was replaced in Jan 2014.

Routine maintenance of the Berrien Springs, MI Enviro-weather station equipment and site was performed in 2014. Besides maintenance additional visits were made. In January 2014 the battery was replaced. On May 1 the soil temperature sensors were reinstalled and on May 16, 2014 the communications modem was replaced.

Enviro-weather used the funds provided by the Michigan Grape and Wine Industry Council for travel to and from the station sites, technician salaries, and equipment to perform the tasks described above. The funds were also used to pay for communications charges for these stations (the cost of transmitting data from station to campus via cell modem), which is approximately \$15 per month per station and to help defray the expense of archiving the weather data generated in the database.

**Impacts:** Since Enviro-weather’s formation, its use has steadily increased. Enviro-weather access using stations supported by the Michigan Grape and Wine Industry Council has increased dramatically from 2007 to 2014 (Figure 1). There was a spike in use in 2012, due to the unusual early and warm growing season. Most of the increase in access in 2012 occurred in March and April. The usage trends for each station, record weather years notwithstanding, is increasing.

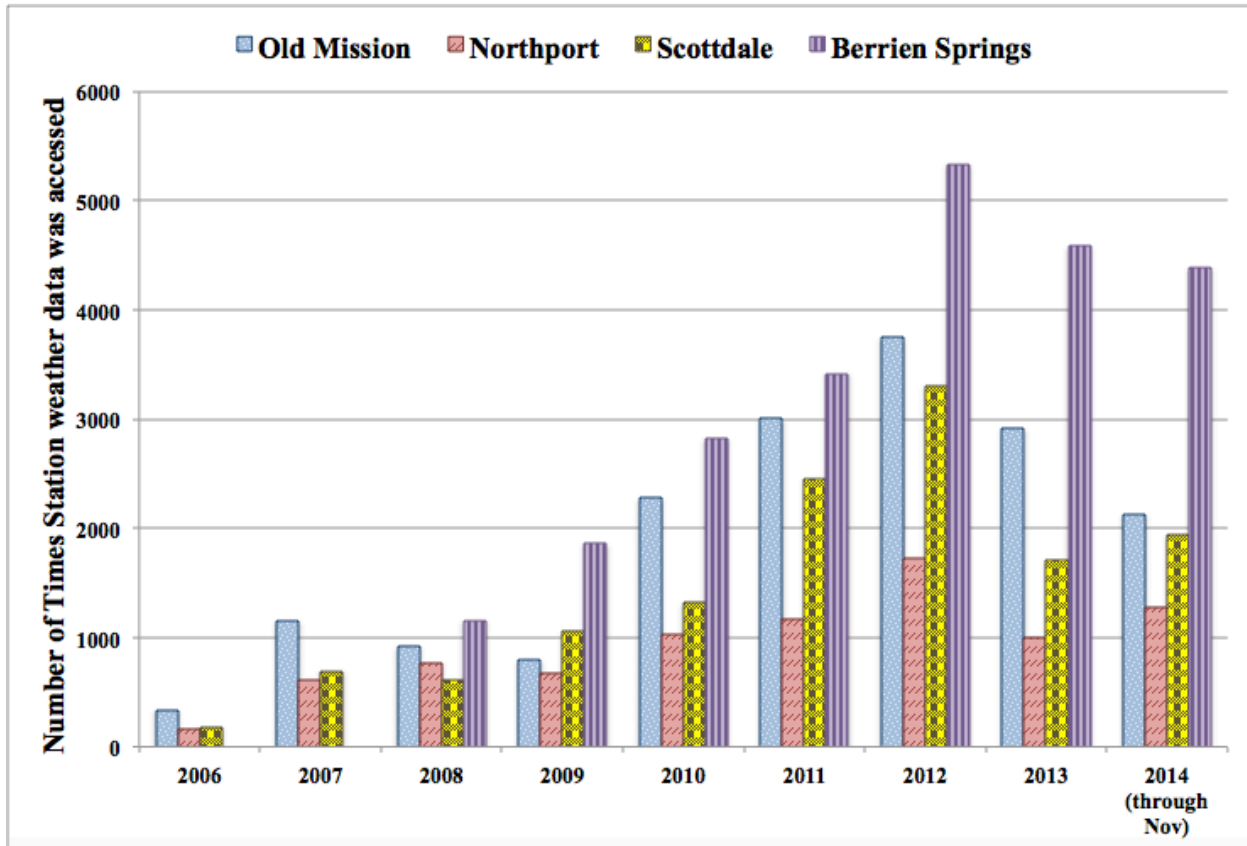


Figure 1. The number of times each Enviro-weather station was used to access Enviro-weather Tools by year.

Enviro-weather has specific weather-based tools relevant to the grape and wine industry. There are three grape tools, grape berry moth, grape black rot, and Concord grape berry weight. Overall, the use of these grape-specific Enviro-weather tools has grown over the years (Figure 2). Users accessed the grape black rot model approximately 300 to 800 times per year, usage reflecting weather conditions. The grape berry moth model was added in 2009 and its use has increased from approximately 800 times per year (in 2009) to between 1500 and 2000 times per year (from 2012 - 2014).

Use of Enviro-weather’s general weather tools (not specific to any particular crop) of particular interest to grape growers has also increased. For example, use of the ‘temperature, rainfall and degree-day summary’ tool has increased every year. This tool is Enviro-weather’s most “popular” tool and is applicable to a large diversity of agricultural and natural resources applications. In 2014 this tool was accessed over 43,000 times.

Enviro-weather’s ‘overnight temperatures’ tool (used to help predict freezing temperatures) has been accessed at least 10,000 times per year since 2010. The usefulness of this tool is very dependent on current weather conditions. For example, in 2012 because of the very early start of the growing season and subsequent frost potential, this tool was accessed approximately 45,000 times; it was used over 30,000 times in April 2012 alone.

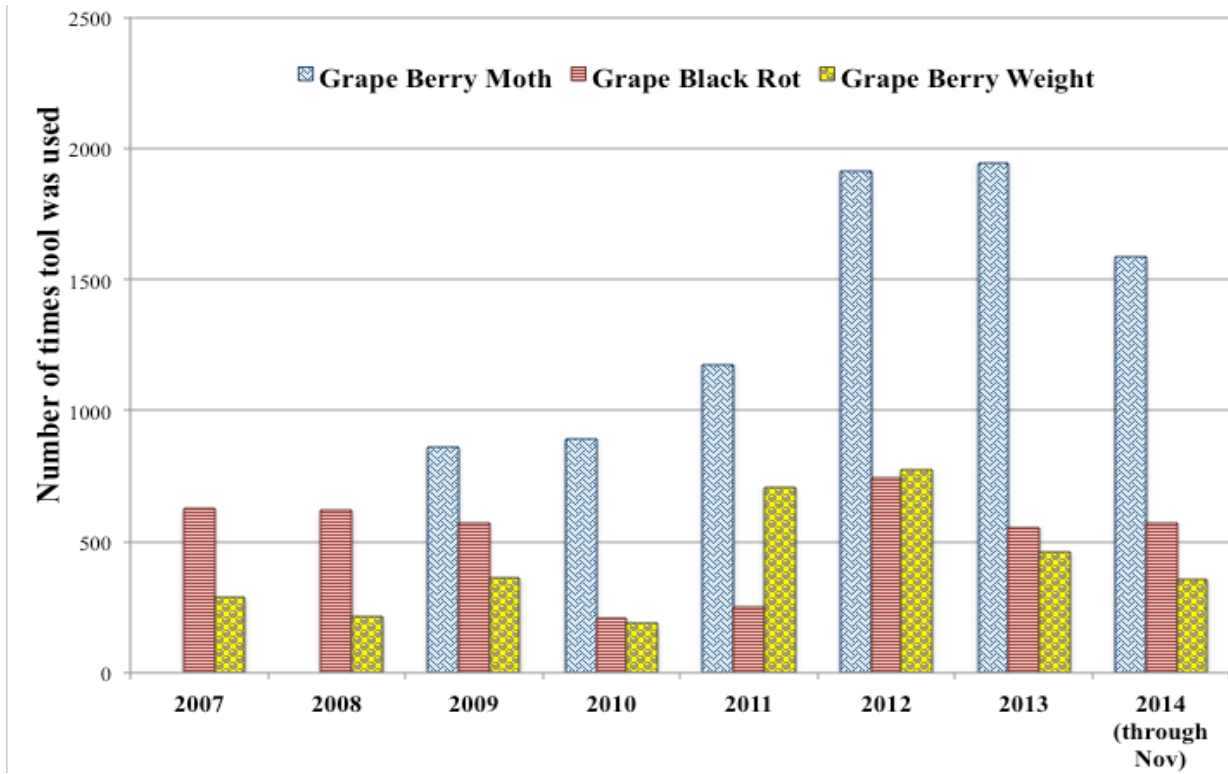


Figure 2. Number of times grape-specific Enviro-weather applications were used each year.

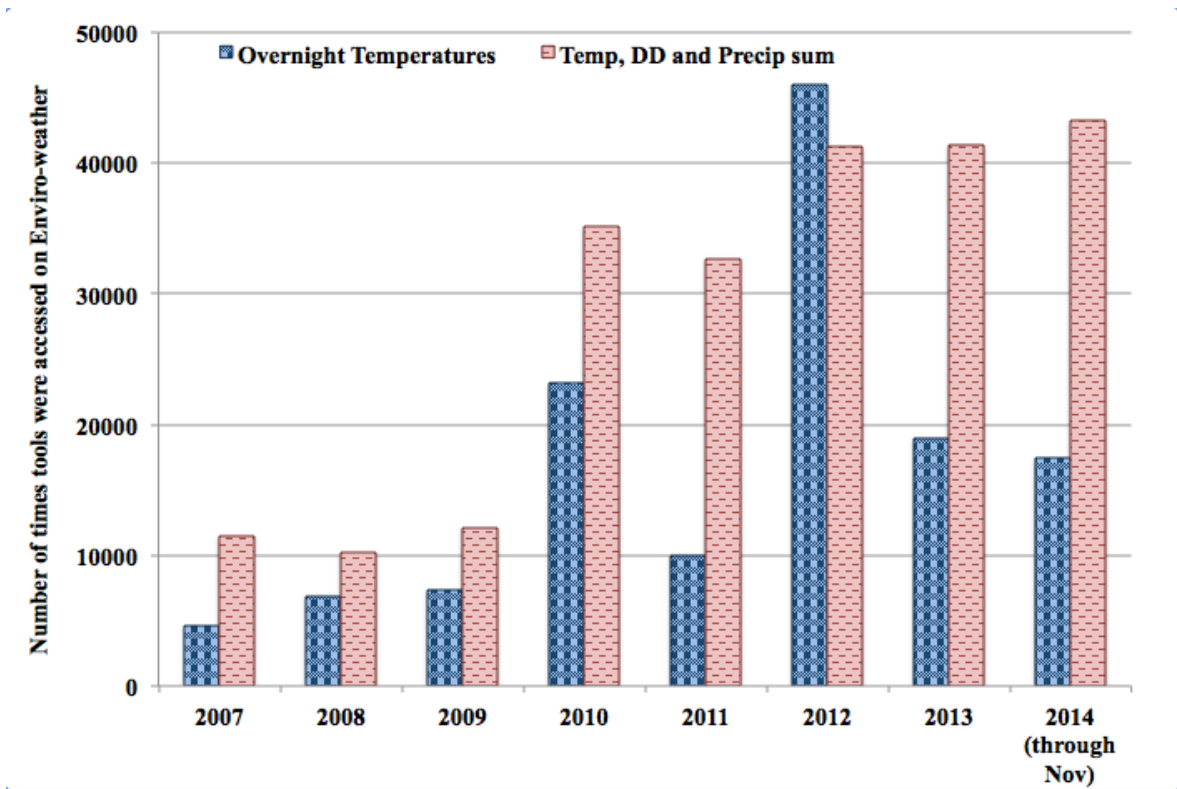


Figure 3. Number of times Enviro-weather general weather applications were accessed each year.

We know from the results of the 2011 survey of tree fruit growers conducted by Enviro-weather and NASS, that use of Enviro-weather tools help growers save time and money, reduce pesticide applications, and improve quality and yield. It is reasonable to conclude that increasing use of Enviro-weather by grape growers has the same positive impact on grape and wine production. Feedback from growers and industry support this.

**Funding Partners:** MSU's Enviro-weather project is made possible through contributions from a number of sources, including MSU Extension, MSU AgBioEnergy, Project GREEN, private industry, private donations by growers and others, and Michigan commodity groups such as the Michigan Wine and Grape Industry Council.