

**Educating, testing and evaluating an online decision support system for strawberry
frost/freeze protection (FROSTY)**

SRSFC Project #2009 E-02

Outreach/Extension Proposal
Progress Report and Request for No-cost Extension

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Objectives:

The overall objective is to evaluate and test an online decision support system for strawberry frost/freeze protection, called FROSTY. Specifically:

1. Educate a pilot group of strawberry growers in using an automated, online decision support system,
2. Test the system with the pilot group,
3. Evaluate the system's accuracy and practicality,
4. Refine the system

Justification:

Strawberries in North Carolina are a high value crop at an estimated \$25 million annually, and they represent a \$95.6 million dollar crop (farm gate value) for the 14 states who participate in the Eastern Strawberry Consortium for Critical Use Exemption (CUE) for methyl bromide (including SRSFC states NC, VA, SC, GA, TN and AR).

Unfortunately, strawberry crop yields are easily diminished due to unfavorable or abrupt changes in the weather. For example, ice crystals forming in the plant tissue can destroy or significantly lower yield. However, action can be taken to mitigate crop losses.

The uncertainties associated with weather can be mitigated with the use of weather- or climate-based decision support systems. As research makes known the specific relationships of weather, crop maturity, crop risk and disease development, the value of appropriate decision support tools becomes more evident. Weather-based decision making is the key to improving crop yield and mitigating crop losses.

Row covers and/or irrigation can be used to insulate and protect strawberry crops against cold weather and freezing. Timing this has to be just right to achieve optimal effectiveness. Laying down covers too late may not provide enough insulation; irrigating too soon before a cold event may lead to additional heat loss by evaporation. Due to the variable nature of weather and climate and local agricultural practices across our region, a crop advisory for one farm may not be appropriate for another. A more sophisticated, location-dependent advisory is needed.

Since 2000, we have been manually calculating and distributing strawberry crop advisories for strategic regions in North Carolina, South Carolina, Virginia and Georgia. These advisories have proven to be extremely helpful and valuable to the growers. Cooperative Extension Agents throughout strawberry growing counties in NC estimated that 30% -50% of the crop would be lost without *berry mg* advisories. In 2007, these advisories helped growers save from \$7 to 8 million dollars worth of crop from the Easter Freeze in North Carolina.

FROSTY will supplement berry mg

The *berry mg* E-NEWS type weather alerts are issued without interruption in periods of threatening weather events, such as the Easter Freeze of 2007 in which there were 14 updates over a period of one week (including several weekend alerts). Last year, the

Southern Region Small Fruit Consortium (SRSFC) supported Dr. Poling's request for an outreach grant to help pay for his various weather subscription services, including AWIS, SkyBit, and AccuWeather Professional and some student help so that he could provide timely strawberry frost, freeze and heat advisories to SRSFC growers and agents, and a number of these were posted on www.smallfruits.org in the 2008 strawberry season. But, despite Dr. Poling's best efforts to provide state by state advisories to strawberry growers in all of the SRSFC states and regions, it proved to be a very difficult task for one person. To issue detailed advisories for each Southern Region state and its respective regions (e.g. coastal plain, piedmont, foothills and mountains of NC), would require an immense amount of time and resources. However, by partnering with the State Climate Office of NC (SCO), software is currently being developed to automate strawberry advisories for growers all over the Southeast.

Methodology:

The project that SRSFC funded (#2009 E-02) continues an interdisciplinary collaboration between Barclay Poling and the NC State Climate Office (SCO). The website (called FROSTY) being developed by the SCO asks strawberry growers several basic questions about the current status of their crop. The inputs needed to make a location-specific strawberry advisory are:

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| <ol style="list-style-type: none">1) farm location2) type of groundcover between rows3) strawberry varieties being grown4) current crop stage,5) recent irrigation or rainfall amounts6) available row covers and irrigation equipment. |
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Recent weather data archived by the SCO, the SCO's numerical weather models, and Dr. Poling's advisory logic model (see next page) are combined to produce a customized advisory for the grower. If action is needed to protect the crop at the specified location, the specific action and timing will be recommended. Information will be communicated via the website and Dr. Poling's existing channels with extension agents and farmers directly.



FROSTY is being designed to prevent growers from being caught “off-guard” by a sudden cold event. The program takes advantage of localized weather forecast products, and key information on *wind speeds, dew point temperatures, minimum temperatures* and durations below freezing.

Event diagnosis is a very iterative process. Growers often do not know exactly what type of event will occur until several hours before its arrival. Nonetheless, growers can start formulating “an idea” of what may be happen by checking the FROSTY website at 72, 48, and 24-hours in advance of the anticipated event. The various steps in the FROSTY logic model are further explained below.

Step 1. Observe Minimum Temperature Forecast:

- ❖ *If there is potential for minimum air temperatures in the vineyard of less than 34° F, be on ALERT for the potential of a hoar frost.*
- ❖ *If there is a forecast for sub-freezing temperatures, then go to Step 2 (winds).*

Step 2. Evaluate Wind Speed Products:

- ❖ *If the forecast is for winds > 10 mph (and sub-freezing temperatures) you are dealing with a *freeze* and irrigation without row covers is not recommended (with row covers, you may be able to use irrigation)*
- ❖ *If the forecast is for winds in the range of 5-10 mph (and sub-freezing temperatures) you are dealing with a *frost/freeze* and irrigation can be successful (assuming a well-designed irrigation system with adequate pumping capacity)*
- ❖ *If the forecast is for calm winds of less than 5 mph and temperatures near the ground surface are below 32° F, you are dealing with some type of radiational cooling event (go to Step 3 to determine which kind)*

Step 3. Evaluate Atmospheric Humidity with Dew Point (DP) Temperature

- ❖ *A relatively high DP (greater than 28° F) indicates the potential for hoar frost. Go to the next section, *B.3 Event Management for Hoar Frosts*, for control recommendations.*
- ❖ *A relatively low DP temperature indicates drier air, and thus the potential for a killing *black* frost. Go to the next section, *B.4 Event management for Black Frosts*, for control recommendations*

Status of Project:

The website interface has been developed. The logic of generating the risk level for different types of frost has been developed. The integration of the SCO’s numerical weather modeling system is also done. Beta testing with growers is the primary component that is not yet complete. We will invite about 20 growers from the Southeast to begin testing FROSTY in early 2010. Their feedback will help us refine the interface and underlying logic of the system. This will require several months of usage and iterative refinements. We therefore request a no cost extension. This will allow sufficient time for us to further refine the system under real-world conditions.