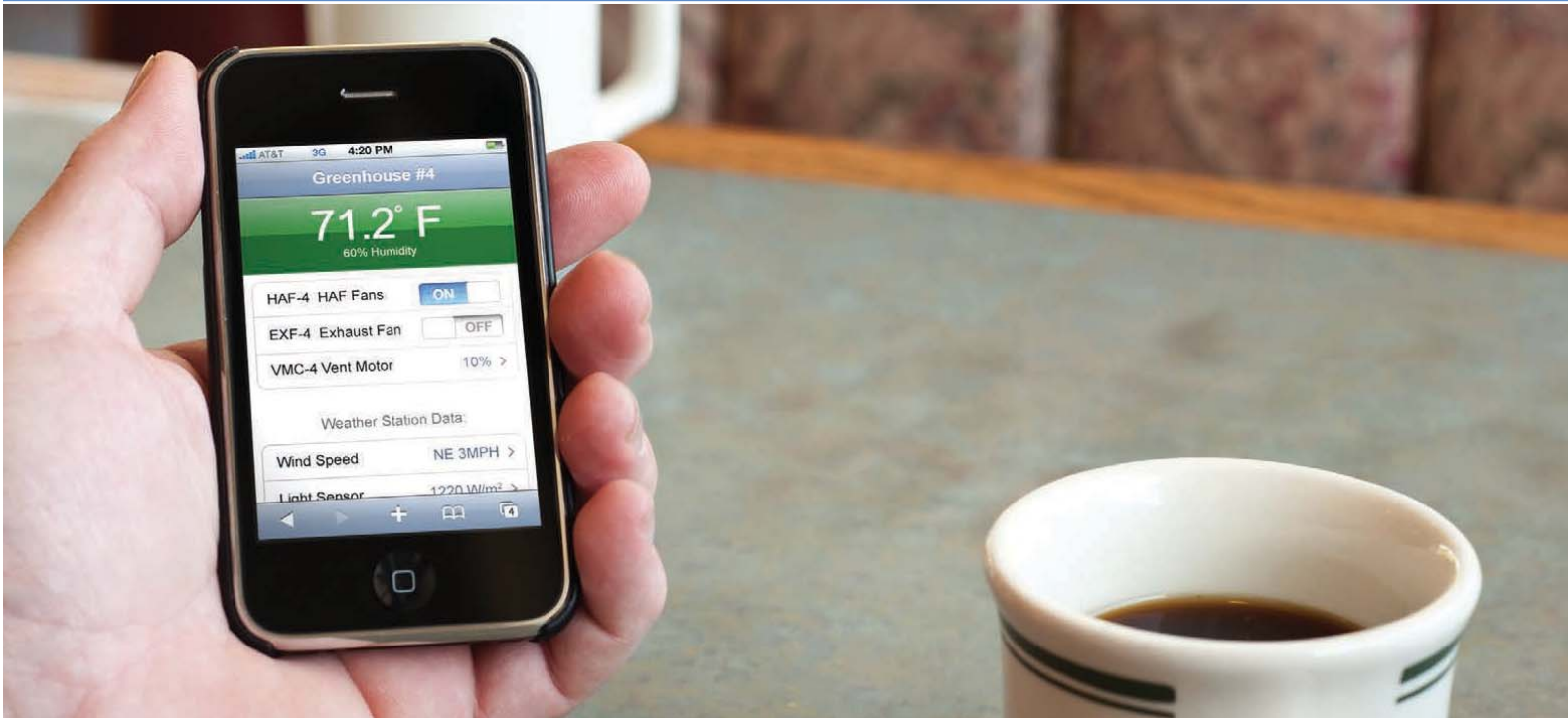From Forest Nursery Notes, Winter 2012

130. Evolving environmental controls. Pham, Y. Greenhouse Management 31(7):74, 76, 77. 2011.

EVOLVING ENVIRONMENTAL CONTROLS

Today's technology helps growers maintain a competitive edge

We are all aware of how quickly technology is progressing but you may not realize that a number of the latest advances have found their way into very cost effective greenhouse environmental control products. Some of the features that were previously available only with advanced computer control systems are now available on small low cost controllers.

Starting simple

Manual thermostats and basic step controls have been the mainstay of environmental control for small- and medium-size growers for many years. Thermostats are simple, but can be inaccurate, resulting in wasted energy. Energy can also be wasted because of the lack of staging in the equipment. It would not be uncommon to have separate thermostats for heating and cooling equipment and having both operating at the same time.

Thermostats are an inexpensive investment. Two thermostats cost around $150-$200. They are simple and easy to operate. What appears to be a low cost approach to control is, in reality, quite expensive. Over the life of the controllers operation, one must consider the wasted energy, time and labor costs and the impact on plant quality.

Control improvements

The basic first generation step controller eliminated some of the thermostat problems related to heating and cooling simultaneously, temperature inaccuracy, staging and the lack of flexibility to meet the simplest greenhouse

needs. Humidity sensing and control was not an option with the first generation step controllers. Another deficiency was the inability to store data and provide valuable historical information. These controllers cost from four to eight times more than simple heat and cool stage thermostats.

Second generation programmable controllers added the humidity sensing capability along with many other features that gave growers the tools they needed to be more energy efficient and to increase plant quality. However, these programmable controllers came at a price about 10 times greater than the two thermostat set up.

The programmable controllers were characterized by small one to four line alpha-numeric displays and small 10-16 digit keypads. Program updates in the field, if possible, usually required the physical replacement of one or more memory chips or the transfer of the program via specialized tools. In most cases these controllers could be networked to a host computer that, typically, was used to provide data storage, graphics, printer output and remote access.

Third generation controllers

Today there are a number of third generation controllers on the market. They have added even more features with a dramatic reduction in cost. This is not unlike what has occurred with advancements to mobile phones. It is now possible to have an advanced environmental controller at a price competitive with a multiple thermostat set up, especially when a thermostat is used to control each stage in a growing zone.

One feature of third generation programmable controllers is a large graphical display, some with touch screen capabilities. With memory chips having increased capacity, large amounts of data can be stored and displayed graphically without the need for downloading the data to a host computer. Because of the significant increases in processing power at a much lower price point, far more programming features are achievable, many of which were only available in PC-based or much more powerful systems in the past.

Third generation controllers, much like many modern smart phones, are capable of multitasking running several different applications at the same time. The basic program runs continuously in the background even though the user may be doing other things with the controller. For example, a grower may be making program changes or reviewing historical data or setting up a graph. At the same time, the controller itself could be managing various internet transactions in the background. The benefit is there is no disruption with the environmental control and monitoring functions while all these activities are happening concurrently.

Third generation controllers are internet enabled allowing them to be accessed from any internet portal. Whether it's an iPhone or another web-enabled

smart phone, users have the ability to monitor greenhouse data through the controller and, if needed, make changes from the phone at their convenience.

Data collection

Another key feature to the programmable controllers is their data capturing capabilities. Gone are the days of just parameter measurements and controls. These are also loggers. With so much memory available, growers can now capture environmental sensor data, equipment run-time data and other meaningful event data. Calculations such as the energy consumption rate for a greenhouse can be made in real-time.

With all the data collected on the controllers, there are various ways to retrieve it for grower analysis. Modern controllers are able to network to a computer to collect the data. If an internet connection is available, remote data retrieval through the internet is now an option. Another choice is a USB flash drive. Similar to the conventional application of USB memory drive to transport data from one computer to another. The same device can be used to transfer data between the greenhouse controller and the typical computer. Settings can be transferred from one controller to another as well.

Optimizing yield, efficiency

The improvements made to modern environmental controllers enable growers to make more effective, informed decisions that

Environmental control improvements lead to better crop management.

lead to better crop management. With a reasonable investment a grower can upgrade greenhouse controllers from thermostats or older generation controllers. This change can quickly reap the benefits of crop relevant data to optimize yield and operational efficiency. Aside from the immediate energy and labor savings, relevant business decisions can now be made with measureable quality performance metrics down to plant level. GM

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ENVIRONMENTAL CONTROLS