

After developing and deploying an RFID system to track trays of seedlings at its own greenhouse, Knox Nursery plans to market the solution to other plant growers as well.

By Claire Swedberg

May 29, 2009—Since late fall 2008 [Knox Nursery](#), located in Winter Garden, Fla., has been using an RFID system that is working so well, its creators at the nursery—together with enterprise software and services company [BizSpeed](#)—have begun marketing it to other commercial plant growers and wholesalers. The Grower's Own RFID-based system is commercially available now, while an upgraded version with additional features is slated to become available in the third quarter of 2009.

Knox Nursery grows seedlings that it sells to wholesalers and retailers that, in turn, raise the plants until they are large enough for the consumer market. During busy seasons, the company typically sells as many as 30,000 trays of seedlings per week. The nursery employs RFID to identify the disposable plastic trays it sows with seeds—mostly floral annuals, as well as some herbs—then uses the technology to track the inventory and movement of those trays throughout its 13-acre greenhouse, and to expedite the shipping of seedlings to its customers.



Handheld interrogator for reading tray tags

Without RFID, Knox says, the process of growing the seedlings and preparing them for shipment is daunting. Knox and similar nurseries often plant approximately 20 percent more of a product than they require, in order to account for any loss during the growing process, thus making it that much more difficult to track their product. Because it has a short shelf life, much of the product excess is often discarded. In addition, identifying which types of seedlings are on any particular tray can be hard to do

simply by looking at them. Some nurseries use bar-coded labels to track their trays. Knox Nursery has done so as well, says Eric Claiborne, the company's manager of information systems and the lead developer of Grower's Own, but the bar-code system proved to be problematic.

"It was one headache after another," Claiborne says. Soil or water often covered the bar-coded labels, which were not all located in the same spot on each tray, and in some cases, plants could grow over the bar-code labels as well. All of this, he notes, reduced the rate of successful bar-code scans, making it challenging for workers to identify the trays. In 2006, Claiborne began conducting research into RFID, though he could not find anyone with the specific knowledge of the technology to help him.



*Eric Claiborne, Knox's
manager of information
systems*

When Claiborne contacted Chris Henry, BizSpeed's CEO and cofounder, in 2006, they had phone conversation that lasted several hours, leading to a one-week pilot that involved the application of RFID tags to trays that were then tracked through the shipping process. After that pilot's conclusion, Claiborne began installing the Grower's Own system one phase at a time, positioning a total of eight [Motorola XR400](#) and [XR440](#) fixed RFID interrogators at various points within the greenhouse. By October 2008, the company had reached full deployment, with every tray tagged and read multiple times before it is shipped.

The trays are first put to use when an order comes in for specific plant seedlings. At that time, employees enter data regarding each tray's order number and the variety to be sown in that tray, then a [Zebra Technologies](#) printer and tag application system prints and applies an adhesive label containing an [Avery Dennison AD-223 EPC Gen 2](#) RFID inlay to the edge of the tray.

Each label has information written on the front, including the order number and a bar-coded serial number. To encode the label's RFID inlay, Henry explains, Knox utilizes a system specially designed by Knox and BizSpeed that automatically scans the bar-coded serial number and writes it to the RFID inlay, then verifies that the inlay was encoded correctly and sends a confirmation to the Grower's Own software system (using an MS SQL server for storage) via an Ethernet connection.

The tray then passes down a production conveyor belt, where the seeds are planted in it. At this point, the tray's RFID inlay is scanned once more by a fixed Motorola reader, thereby indicating that a specific type of seed has been sown in that particular tray, which is recorded as being "in production."

During the growing process, each tray may be read multiple times. Staff members sometimes move the trays from one section of the greenhouse to the next, pushing them on rolling beds, which hold 42 trays at a time. These rolling beds pass through an RFID portal that captures all of the trays' ID numbers, then transmits the data to the back-end system, indicating which trays have been moved within the greenhouse.



Box Shipping Station for FedEx shipments

Knox's staff also conducts numerous inventories using a Motorola handheld RFID reader with a Wi-Fi connection, thereby enabling the company to track which trays are being stored in which sections. Inventory counts previously required two full days of work from two workers, Claiborne says. "It's very difficult to get a human or bar-code scan of each one of the trays in a greenhouse of that size," he

states, adding that because the trays are placed side by side in deep rows, it is often impossible for an employee to read or scan a label attached to the side of a tray. But now, using RFID handhelds, it takes one person two to three hours—and the counts, he adds, are more accurate.

When the seedlings have grown to a specified size, Knox ships them to its customers. For large orders, typically transported by truck, the operator utilizes a touch screen to select the order to be shipped. The screen then displays all products on the particular order, and as the seedlings are moved through a portal, its interrogator captures and confirms each tray's ID number. If an employee attempts to pack an incorrect tray, such as one intended for a different order, an audible alarm sounds, indicating the shipper needs to remove that tray. Once the order is completely packed, the worker then touches the screen, prompting the Grower's Own system to print a shipping list and send an advance shipping notice to the customer.

Smaller orders are usually shipped via [Federal Express](#). In this case, the operator uses a touch screen cabled to the RFID interrogator to select the order and the box sizes. The touch screen displays the items needed to fill the order, and the reader captures each tray's ID number as it is packed in a box, and also updates the data on the screen. Again, an alarm sounds if the interrogator detects an incorrect tray. Once the order is filled, the operator presses the 'box filled' prompt. The software then accesses the Fed Ex Web site to generate a shipping label, which is printed, along with a packing list, and applied to the box.

The Grower's Own software system collects inventory data, thereby enabling the Knox nursery staff to know what inventory it has in the greenhouse—and how much of each item—as well as when trays were shipped. Employees can also use it to determine in which section of the greenhouse the tray is stored, but not where the tray is located within that particular section. For that reason, the nursery intends to expand the system with a method for tracking each tray's location within the greenhouse. BizSpeed is designing an RFID reader cart that could pass through the greenhouse and read all of the tags with a boom that passes above the rows. In that way, the nursery could take inventory in less time, and with greater detail regarding the location. BizSpeed and Knox hope to have the reader cart, now in the prototype stage, included in the Grower's Own package available to other customers, as well as for Knox Nursery, in approximately three months.

According to Claiborne, Knox has already recouped the costs of the hardware and software. The improved shipping accuracy has been the company's greatest benefit, he says. The system's ability to track inventory saves the firm man-hours previously spent searching for trays or conducting manual inventories, and also reduces the number of excess plants that are sown and then discarded due to a lack of visibility into greenhouse inventory. "I believe it's been paid for—it took about a year," he says, noting that the largest gains have come most recently, following full deployment, as the staff got used to the system.