



Automated data-capture technology allows a new level of flexibility, efficiency and tracking previously unavailable to nursery and greenhouse growers.

Keeping Track

For any commercial producer of live plant material, keeping track of inventory in the nursery or greenhouse is no small task. In today's competitive environment, the margin of error continues to shrink — so finding problems fast and keeping input costs as low as possible never have been more important. The devil always seems to be in the details.

That's why many of the top plant producers have invested in systems that enable them to track individual containers and in-ground plantings from before the cradle to after the grave. Bar code technology to facilitate automated data collection has made this feasible. To minimize the costs of data collection, Plantware Inc., Batavia, IL, and other solutions developers are exploiting technology to automate data capture throughout the entire production process.

How it Works. Each container is assigned at creation a unique number or "license plate." The container can be a tray, potted specimen or, in the case of in-ground caliper trees, the plant itself

(three-fourths of an inch, 1½ inches, 2½ inches and so on). This identity enables the capture of information relating to when, where and how that container was grown, as well as when, where and how the container ultimately was dispensed. By formatting the unique number into a specific bar code symbol, bar code readers can be used to easily record activities and/or changes that take place relating to the container. Information important for people to read, such as the variety name, container (or product form) name, the scheduled sow, stick, line-out and ship week, must also be presented in text form.

Production software applications like Vericell Vision are structured to record the events that occur during the life of a

container by capturing the bar code during important processes. For a typical 5-gallon container from creation to final dispensation, a plant started from a potted liner via transplant from a tray is a common example. However, plants originating as unrooted cuttings or whips, bare-root divisions or even seed are handled in the same fashion. If production is by seed, the potting or sticking line screen prompt can be removed, and the sowing line can then be cued.

Demand for the container (tray, pot or other product form) can be recorded in the application in several ways: via customer order, from a production speculation requirement or from a scheduled transplant. On the container's scheduled sow or stick week (and prior to planting), a label must be created using a print prompt, then manually applied to the container or fastened to the tree or plant.

by ROBERT F. GABELLA



Many top growers have invested in systems that allow them to track individual containers and in-ground plantings throughout the production process.

Until very recently, this process was almost always manual and exceedingly tedious. Batches of labels were placed on containers prior to sowing or sticking, or they were hauled into the field prior to direct planting. With the help of an equipment-fabrication company, Plantware has designed and integrated into its software a device that automatically prints the label and applies it to the container — provided the container is adaptable to conveyor handling.

The print-and-apply apparatus resides in the sowing line after the flat filler and before the seeder. The software system passes each label's print job to the printer, assuring the label includes each container's unique identification number. Once the container is labeled, a conveyor moves it to the seeder. Prior to sowing, a seed lot is placed into the hopper.

Each seed package is also bar coded, so the operator can scan the current seed lot being sown and record the information. The container then moves through the seeder and, as it emerges from the cylinder, the bar code is

scanned. Vericell Vision then passes the data to a centralized repository, updating the database with the exact date and time it was sown, the operator carrying out the activity and the seed lot used. If the seed hopper empties before all containers are sown, the new seed lot is scanned, enabling new containers to be associated with the correct lot.

For vegetatively produced material, Plantware also developed software systems that allow a first-line producer to associate cuttings, graft scions or other asexual propagules with the specific stock block from which they were harvested. This enhances the level of information capture from the secondary producer to the end client, and it allows for a full accountability of a container's origin should there be a performance and/or health issue, or a claim against the material.

Automated data capture has been a cornerstone of many recent inventory-management projects in the green industry. And the flexibility of a range of systems and devices, as well as the needs of each individual production operation, have prompted a multitude of solutions. Such solutions range from absolute real-time inventory communicated via wireless technology to near real-time inventory dependent upon uploading data stored on a device connected to a workstation.

Tracking Container Location. Once the container is potted or the propagule — in a form such as a whip or branched liner — is planted in the field, it is assigned to either a bench or to a production block. Whether this is a manual or automated process, the container or other product form is scanned to identify the unique bench or block to which it is assigned.



The print-and-apply apparatus resides in the sowing line after the flat filler and before the seeder.

For greenhouse production, scanning containers to greenhouse benches is currently a manual process. Plantware developed equipment that automatically links every container bar code to its bench. The automated bench-move function can be configured to operate either with automated bench loading equipment or when containers are placed on benches manually.

Once the container is associated with a bench or block, it's important to track the bench's location within a greenhouse facility or even multiple facilities. Of course, this would not be necessary for nursery production of in-ground material. Plantware created an automated bench-location system that tracks bench movement throughout a facility using radio frequency identification technology. Tracking benches manually can also be accomplished using hand-held computers that can be uploaded to the production management software.

The location system easily helps with various tasks. For example, it can generate reports that identify container whereabouts or explain if plants require any specific instructions. The same technology works equally well with production blocks of container and in-ground material or covered greenhouse plants. Strategically placed antenna systems can also provide coverage of many acres of production at once.



Each seed package is bar coded, enabling the operator to scan the current seed lot into the software. The container moves through the seeder, and the bar code is scanned as it emerges from the cylinder.

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At the end of the season, it is possible to summarize the various reasons for loss at all points throughout the production process, including losses that appear after overwintering.

Transplant Automation. When it comes to transplanting, it's important to identify how many containers have been started. In the case of transplant dependency, it's also necessary to remove any trays from inventory that were once used as transplant donors. Vericell Vision can automatically capture this data from the transplant line to keep inventory levels accurate without operator input.

In addition, the software gives growers the ability to record losses using the bar code by simply selecting a reason for the loss from an on-screen drop-down menu, then scanning the container. A typical example would be "lost to maintenance" in the case of donor trays for manual or automated plug patching. But reasons for loss are infinitely configurable to the needs and business rules of any type of production operation. At the end of the season, a grower can summarize the various reasons for loss at all points throughout the production process, including disease, washout, rodent damage or losses that appear after overwintering.

Picking an Order. Through data generated by a reporting system, such as a Crystal Reports interface, a printout of ordered containers or individual plants — complete with a bar code containing the order number — manually picks an order based on bench or block location of the required trays, pots or specimens.

For in-ground production, a dig re-

quest can be generated. As manual picking is completed, filled carts or trailer loads can be taken to the scanning station (which is itself a "virtual bench" and assigned its own bar code), where the bar codes on picked trays, pots or trees are scanned against a corresponding bar code on the order printout.

Any discrepancies between material manually picked and material on the actual order are noted immediately by an error tone and will not scan. If the order was picked manually without error, the need for user intervention in the picking process is minimal. However, should the required material be unavailable, a "real world" option exists for the operator at the scanning station to make adjustments on the scanning line from a drop-down menu of reason codes and backorder options configurable according to the business rule of each operation. After this is completed, the operator can commit to the order.

The next step is packing and shipping. Manual options require the greatest amount of additional user intervention and are available for shipments via commercial or grower truck, or for options such as customer pick-up. Tray shipments are tracked automatically and handled by carriers such as FedEx. They can be packed with bar codes pointing upward in the box, and the boxes pass by yet another camera-linked scanner to record any discrepancies prior to the box being sealed. Another print-and-apply station then automatically labels the box for shipping based on its actual contents.

Brave New World. The use of automated data-capture technology for greenhouse production allows a different level of flexibility, efficiency and tracking previously unavailable to commercial producers. In addition, it streamlines many former labor-intensive processes via the elimination of hands-on labor. Through the accomplishment of key software development goals, the need for intensive user intervention during automated production runs on a variety of different workstations has been dramatically reduced. Without a doubt, the integration of automated data-capture technology has set the stage for a new era for nursery and greenhouse growers alike.

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