

*Auto-steering guidance systems have the capability to steer a tractor across the field. At the end of the field, the driver can steer the machine to the next pass where the auto-steering system takes over again.*

## Application of auto-steering technology for tree planting

By Reza Ehsani

Setting up new orchards or planting new trees on existing beds is one of those orchard operations that has not yet been fully mechanized. Auto-steering technology can be used in conjunction with a tree planting unit to mechanize this operation and reduce tree planting costs.

Auto-steering technology is one of those revolutionary changes in agricultural machinery that comes along and completely changes the way we farm. This technology is currently used very effectively for planting, spraying and harvesting of row crops. It can lower costs and increase profits by improving efficiency and productivity of farm operations.

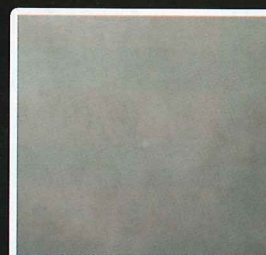
Auto-steering guidance systems have the capability to steer a tractor across the field. At the end of the field, the driver can steer the machine to the next pass where the auto-steering system takes over again. Some of the auto-steering systems also have the capability to drive on a pre-determined path that is programmed into the memory of an auto-steering computer unit.

The main components of an auto-steering system include a GPS receiver, the guidance computer units, a tilt sensor, and hydraulic valves or electrical actuators that work in parallel with the steering system. Auto-steering guidance systems can use one of two different GPS receivers for location position: Real Time Kinematic GPS (RTK-GPS) and Differential Global Positioning System (DGPS). The auto-steering guidance systems with a DGPS receiver have pass-to-pass accuracies between 4 to



An auto-steer tractor used for planting containerized trees in an open field nursery.

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20 inches, depending on the source of the differential signal. When using a DGPS receiver with auto-steering, the driver may experience the vehicle drifting from pass to pass over an extended period of time. The cost for a DGPS auto-steering system is about \$6,000 to \$10,000. Using an RTK-GPS receiver, the auto-steering has the pass-to-pass accuracy of about 2 to 3 inches. The cost for an RTK-equipped auto-steering system is about \$25,000-\$35,000.

### BENEFITS

Auto-steering systems can be beneficial in two ways: increasing productivity and efficiency of field operations,

and facilitating the adoption of new and innovative field practices. Auto-steering can reduce driver fatigue and stress, which means a driver can work longer hours and cover more acres. It is possible to drive at night or under conditions of poor visibility just as accurately as during the day. In addition, it is possible to employ less-experienced drivers, and possibly increase operating speed.

RTK auto-steering is ideal for planting trees. Currently, many growers and contractors are still using a tape measure and sticks to mark the location of trees when establishing a new orchard. Tree planting consists of three differ-

ent operations including: marking the location of a tree, digging holes in the ground, and planting the tree.

According to Ron Muraro, University of Florida economist, the average cost of tree planting in the ridge area is about \$2.58 per tree. Using a tractor with an auto-steering system and a tree planting unit, it is possible to reduce this to a one-pass operation at half the former cost. Moreover, it is possible to formalize a map, with precise GPS coordinates of the rows and spacing of trees in advance, and then use the map to guide the tractor and planting crew in the field. The control computer will use the map to guide the tractor on the exact planned passes. Using this system, it is also possible to plant over existing beds. This could be particularly useful for replanting the groves in which the trees were removed during the canker eradication program.

Currently there are several companies that offer auto-steering systems, but to my knowledge, only one of them has the capability to follow a pre-determined path and has a built-in feature for tree planting. This built-in feature can provide a signal pulse around the pass that determines the location of the tree. The tree planting unit then can use this pulse to plant the tree on the exact location.

Planting the trees in perfectly straight rows could also be very useful for mechanical harvesting and can increase the efficiency of catch frame systems. Additionally, auto-steering technologies can also be used for spraying and fertilizer applications, again potentially increasing operator productivity. One thing to consider is that in the RTK-based auto-steering system, the GPS unit should have clear view of the sky to receive the satellite signals; therefore, in orchards with tall trees, GPS may not be able to work properly.

We are planning to organize a hands-on-workshop to demonstrate the application of auto-steering systems for tree planting in which the participants will have an opportunity to gain experience with this technology first-hand. The workshop will be at the Citrus Research and Education Center in Lake Alfred. If you are interested in participating, please contact the author.

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