

# Advanced production systems

By Bob Rouse

This article summarizes information presented during the second day of Citrus Expo in August. The focus was on Advanced Production Systems (APS) that might allow growers to remain in business and keep their trees productive in the long term as they live with HLB (citrus greening disease). All speakers' PowerPoint presentations can be viewed on the Southwest Florida Research and Education Center Web site at [www.imok.ufl.edu](http://www.imok.ufl.edu).

Moderator Kelly Morgan kicked off the day by introducing Jim McFerson of the Washington Tree Fruit Research Commission, who discussed how transitioning to new production systems occurred in apples, pears and cherries. In 2001, the growers found themselves in the trend of increased production and hauling costs and lower profitability. They realized the key was the partnerships between research and grower. After a trip to Florida to see mechanical harvesting and become familiar with other technologies, they set their course defining a future technology roadmap. To be competitive in a global marketplace, their course had four clear parts: 1) use plant breeding, genetics and genomics; 2) change production systems to use automation and precision agriculture; 3) crop health and quality; and 4) improve consumer products and food safety.

To accomplish their goals, the transition technologies (techniques) were to use close-spaced trees of moderate size, improve crop health through better use of water, light and nutrition, use mechanical pruning and harvesting and manage crop load. Through integration of all these technologies, they have been able to remain profitable. McFerson left us with this comment: "Even if you are on the right track, you'll get run over if you just sit there."

## SOUTH AFRICA AND APS

Graham Barry from South Africa presented an overview of the South African citrus industry and gave his perspective on technical innovations their growers are using in citrus production that are considered APS. South Africa has 140,000 acres of citrus, ranks 12th in world production, and is second in fresh exports. The country's production is 65 percent fresh exports, 25 percent processed, and 10 percent domestic fresh. More than 90 percent of its income is from fresh exports.

In South Africa, the perspective is to use technological innovations in four areas: 1) pre-plant considerations, 2) cultural practices, 3) post harvest, and 4) marketing.

The critical aspects of the country's APS are: 1) superior plant material, 2) soil preparation, 3) optimum spacing for varieties/rootstocks and soils, 4) optimize crop load management, 5) fertigation according to plant need, and 6) pruning to manage vegetative growth and flowering.

## GROVE DESIGN

Bill Castle discussed the principles of grove design, stating the objectives were to maximize returns by balancing biological and management aspects of the grove and harvesting operations. This involves light interception, canopy cover, bearing volume over the life of the grove, and production efficiency. These factors are accomplished by using the correct combinations of rootstock, scion, tree spacing and production practices.

Jim Syvertsen explained the importance of water and nu-

trient uptake in relationship to the shoot-root ratio. These are critical factors in obtaining the most efficient tree growth and fruit production, especially in the early years.

## TREE AVAILABILITY

Important to growers is the availability of nursery trees for replacing lost trees in existing groves and planting new groves. Nursery owner Nate Jameson presented statistics on the current shortage in Florida of seed, budwood and nursery trees that face the Florida citrus industry.

Since HLB disease was found in Florida in 2005, the nursery industry has had to move all propagation of trees into greenhouse protective structures. As nurseries have made this conversion, the availability of new trees has dropped from around six million to about one million trees annually in just the last three years. Twenty years ago, we had 300 nurseries, and are now down to less than 50, with only 28 nurseries propagating trees for commercial sale. Estimated production capacity of saleable trees is currently about 3 million. Current tree demand exceeds production capacity, and future demand will depend on growers' management plans for HLB, planting densities and fruit prices.

## OHS

As an introduction to the Open Hydroponic System (OHS), Kelly Morgan presented an explanation of how roots grow in the soil and how root zone size impacts root density with tree size. He made four points: 1) how root densities are influenced by soil, climate, rootstock, tree spacing, irrigation and fertilization; 2) reduced water stress improves tree growth and early yields; 3) restriction of the root system, which is a requirement for OHS as demonstrated in other areas, may be difficult to achieve in Florida with our rainy season; and 4) irrigation system automation is required.

## ECONOMICS

Ron Muraro discussed the economics associated with tree planting densities as they relate to management strategies for canker and greening and advanced productions systems like OHS. After presenting costs associated with additional pest management to manage psyllids and costs for resetting after-tree losses to HLB, he suggested three strategies for the future. These strategies were: 1) bulk-up disease defenses with clean nursery trees, spray and windbreaks; 2) bulk-up per-acre revenues by using high density plantings and mechanical harvesting; and 3) bulk-up research efforts through genetics and advanced productions systems.

## OHS IN SOUTH AFRICA

Rian Briedenhann from South Africa gave an excellent talk defining the principles of OHS and the components of the system as used in South Africa. Rian stated that OHS is the name Rafael Martinez Valero from Spain gave his approach to citrus management. His approach calls for the use of a restricted root system and supplying the water and nutrients to meet the tree needs based on the physiological growth stages while allowing only minimal stress.

The system concentrates roots in the wetted area using fertigation, which improves the uptake efficiency of water and minerals. The system allows optimal moisture and aeration conditions and provides rapid root proliferation with an active

dense mass of root hairs. The system uses drip irrigation with overlapping wet zones. The system is designed with two drip lines per row, although only one may be used at the start when trees are small. The system is pulsed (run for short periods of maybe 30 minutes, several times per day) to meet tree needs and reduce stress by refilling when available soil moisture drops 10 to 25 percent from field capacity.

Trees are planted on elevated ridges to aid in aeration. Nutrient distribution during the season changes to favor growth and flowering in the spring, and fruit development after fruit set. Foliar applications are used to ensure optimum nutrition.

### **FLORIDA GROWERS SPEAK**

Three growers — Pete Spyke, Peter McClure and Mark Colbert — presented comments on their experiences with prac-

tices that are components of an Advance Production System.

Spyke has established an OHS system with several varieties and rootstocks at different spacing. The trees have grown well the first year.

McClure has experience with drip irrigation and believes the newly designed emitters currently available can be used successfully in Florida under the right conditions.

Colbert has several years experience with grove design and close spacing. He stated that his company regularly plants trees at close spacings based on soil types. If trees crowd in the row, they remove trees.

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