Why plant a model citrus grove?

By Bob Rouse, Bill Castle, Kelly Morgan, Fritz Roka and Adair Wheaton

The answer to the title question, "Why plant a model grove?" is simple: Today, it generally costs more to harvest citrus fruit than to produce it. Therefore, a healthy, viable citrus industry may very well depend on developing sensible and profitable combinations of current and futuristic production and harvesting technologies. Scientific study and commercial evaluations of mass and robotic harvesting techniques and equipment are well under way in Florida. What is missing is the production side of the equation, i.e., model groves to look at basic compatibilities of existing harvesting and production systems or create new ones.

What, then, is a model grove and what distinguishes it from regular groves?

First, the purpose of a model grove is to test novel citrus production systems followed by the testing of appropriate harvesting systems. A model grove may be defined as combinations of varieties, rootstocks, spacings, grove designs and production practices that provide maximum economic yield in today's environment of devastating diseases and insect vectors.

Second, because the long-term profitability of citrus growers in Florida is tied directly to yield, the overall objective is to increase yield and lower harvesting cost on a unit basis. The realities of the Florida citrus industry are such that growers are questioning the sustainability of their current operations because of competition, urbanization, labor availability, cost and the introduction of two serious bacterial diseases (canker and citrus greening).

Third, the cost of harvesting is much higher in Florida and is the primary factor limiting Florida's ability to compete with Brazil. The Florida grove of the future must not only be productive, but also must reduce the cost of harvesting.

It is likely that mass and robotic harvesting will figure significantly into the future of the Florida citrus industry. However, the characteristics of the future grove may differ greatly based on the type of harvesting system that is employed. Or, it is possible that high yielding production systems may actually drive the design of new harvesting concepts and machinery.

Therefore, we established in July 2006 a model grove demonstration site at the UF/IFAS Southwest Florida Research and Education Center in Immokalee. It represented a range of conditions from conventional to more dense spacing and smaller tree size for evaluating harvesting systems as well as both short-term and long-term production potential.

By planting a model grove demonstration site with unconventional grove designs and production technologies, we expect to learn how to increase yield and grower profit with particular emphasis on inducing exceptional cropping one year in advance of the commercial norm and sustaining that level of cropping. Our approach involves:

- a high density grove system involving a size-controlling, scion-rootstock combination at close spacing;
- manipulation of the tree via an intensive water and nutrient management procedure known as the Open Hydroponic System (OHS); and
- evaluating available and new harvesting systems.

The grove production "systems" consist of Hamlin and Valencia trees planted on appropriate rootstocks at either a conventional spacing (150 trees/acre with either Cleopatra mandarin or Volkamer lemon rootstocks), intermediate spacing (200 trees/acre with Swingle citrumelo), or close spacing (545 trees/acre with Flying Dragon) and grown on an intensive irrigation and fertility program.

The trees were planted in two rows on conventional 44' or 48' beds. The closely spaced trees are spaced 8' x 12' with four rows on a 48-foot bed. All trees are irrigated with micro-sprayers and have been pruned to establish them as "high-headed" trees suitable for future mechanical harvesting.

This grove will also serve as a demonstration site and will aid growers in making decisions about grove designs for mechanical harvesting. The initial funding of the project was provided by the Department of Citrus, Harvesting Research Advisory Council. Since then, encouragement and

funding from the Southwest Florida Research and Education Foundation (IFAS Immokalee grower Budwood Foundation) made it possible to clear, bed, install irrigation and plant at the Southwest Center. The irrigation design was prepared by the Collier County NRCS District Conservationist.

Two key elements in the model grove concept are the high density planting and the OHS. Closely spaced trees are not new to the Florida citrus industry. High density orchards are proven and have been commercialized for temperate crops, but not citrus. Research results suggest they have considerable potential for citrus, but they have not been generally accepted as a commercial practice for several reasons. To begin with, the proper plant material is essential and only Flying Dragon was suitable. However, through the efforts of Jude Grosser of the Citrus Research and Education Center plant improvement program, new options are available for evaluation. A management system to overcome yields insufficient to offset the establishment costs of a high density grove is also needed, and that is where the OHS enters the picture.

To achieve maximum early and long-term yield among closely spaced trees and for other reasons, the Open Hydroponic System was developed in Spain and commercialized in South Africa and Australia. It is also practiced in California. In its simplest form, the OHS is an intensive fertigation management technique that is designed to localize portions of the tree root system under irrigation drippers and then provide essentially a non-limiting environment to those roots. Nutrients are supplied during the year according to the needs of the tree and fruit crop and the grower's objectives for crop and fruit size.

The OHS has demonstrated benefits where practiced commercially, but in Florida, the system is untested and its adoption presents certain challenges. The OHS quickly went from concept to commercial practice with little research support. The system, as practiced in other countries, employs drip irrigation for root control and water savings and is used to grow fresh market fruit in climates that receive less annual rainfall than Florida.

Florida growers use microsprayers for irrigation and cold protection. The latter use would be difficult to give up. Soil water-holding capacities in Florida are much lower than the citrus production areas currently adopting the OHS system because of the sandy texture of our soils. Florida growers must also contend with Best Management Practices that limit both the amount and, in some instances, the time of year fertilizer can be applied in the effort to reduce nutrient leaching. However, despite these challenges, the OHS may prove to be a vital part of the future. All that may be needed is just a fine-tuning of a system largely practiced to some extent already in Florida.

If a new production system and matching harvesting system are successful, grower returns will be increased and the added benefit of a management option in light of devastating diseases such as canker and Huanglongbing (citrus greening) will be provided.

Growers normally achieve their expected return on investment within 15 to 20 years of planting. If those goals could be achieved in less time, e.g., eight to 12 years through increased early yields, the grower benefits.

A grove consisting of current scion or rootstock varieties and production systems could simply be replaced rather than reset. The option would exist to replant with canker and/or greening tolerant varieties as they become available.

Additional information can be found at the mechanical harvesting Web site; http://citrusmh.ifas.ufl.edu