Advanced production systems:





A pathway to disease management and new perspectives on citrus grove value

By Pete Spyke and Bill Castle

magine a 1,000-acre citrus operation developed into 250 acres of residential areas and other social or business uses, with the balance of the land remaining in some form of green use including citriculture (Fig. 1). The 250 acres would contain an average of five or more units per acre, including both detached single-family homes and multi-family dwellings. Those areas would be further divided into smaller walkable residential nodes that are interspersed among the green areas, but connected to each other.

This arrangement would provide for a high percentage of "internal" automobile travel and enhance alternative transportation methods (bikes, golf carts, buses, etc.). The increase in the number of units from lower "ranchette" densities would fund Transfer/Purchase of Development Rights programs that would compensate landowners at values similar to selling the land outright.

One may think such developments are part of a vision for the future, but rather they are being conceived, planned and established today in Florida. However, don't imagine that this look at the present and the future will be business as usual for citrus growers. It isn't. The vision represents an opportunity for citrus growers to engage in a new paradigm for agriculture that will add value above and beyond the crops themselves.

Growers will produce more fruit on less land in more environmentally friendly ways. Agriculture will be fully integrated into area-wide land management and operations plans and increase in value as one component in the larger urban and environmental system. Design of the landscape of new settlements will be a key consideration. Properly situated in relation to urban and natural areas, agriculture will serve many important functions in addition to production of food and energy. In this scenario, conventional citrus production systems will eventually be replaced with advanced production systems which provide the means of continuing agricultural operations as a component in the new paradigm, and more immediately represent to citrus growers, a disease management option for canker and Huanglongbing (greening).

What is an advanced production system (APS)? Conceptually, it consists of two elements: grove design and cultural practices. From the business standpoint, the goals with this approach are to achieve enhanced financial performance. By increasing early yield and income, and sustaining such yields for 10 or more years, above-average fruit returns are realized. Groves will reach break-even much earlier, so if the life expectancy is reduced because of disease impacts, the financial wherewithal exists to completely remove and replant groves at younger-than-normal ages.

Is this concept really any different than what is already practiced commercially? Fundamentally the concept is the same, but it does differ in certain respects. Less vigorous trees are more closely spaced, water and nutrients are applied more regularly and judiciously, and pruning to "train" the trees may be required.

GROVE DESIGN

Grove design is the first step in an APS. Decreasing the spacing among trees is intriguing because it introduces certain production and harvesting efficiencies associated with managing smaller trees. While this approach is very successful with deciduous fruit trees such as apple, it has not been sufficiently demonstrated for citrus because of several questions. Among these is the issue of establishment costs and whether they can ever be recovered. A component of this concern is the cost of nursery trees which are currently more than twice their cost a couple of years ago. Closely spaced citrus trees are well known to produce high yields rapidly, but are often thought to fade in performance. Conventionally spaced trees, however, are the opposite. They start slower and traditionally have maintained production near their peak longer. One objective of the APS concept is to combine the best of these outcomes through new grove designs.

Research in Florida has clearly shown that combining attributes can be achieved when scion-rootstock vigor is properly matched with spacing and site conditions. Experience with advanced production systems in other countries shows that there may be ways to grow vigorous scion-rootstock combinations at closer spacings using specialized pruning techniques. Until these concepts are proven under Florida conditions, however, matching scion-rootstock vigor to spacing and site conditions remains the best bet.

These choices will be a challenging part of the APSgrove design component. It will involve selecting from among three general options that provide different biological and financial results. The first of these options is the conventional grove planted about 12×25 ft or 145 trees/ acre. The performance of the conventional grove is well known, but this option may not be sustainable in the presence of greening. The more modern grove would be planted about 10 x 20 ft or 218 trees/acre, while the "high density" grove would be planted at about 8 x 15 ft or 363 trees/acre. The question then is whether the APS goals can be best reached with the modern or high density (HD) grove, or can be achieved with either option.

The HD grove idea has been tested in Florida, but progress has been impeded by the lack of suitable scion and rootstock plant material, and utilization of only mechanical hedging and topping. Better scion and rootstock choices are now available that should perform well in tight spacings with little or no specialized pruning. Today, for example, modern grove designs are being used commercially with trees on Swingle citrumelo rootstock planted 10 x 20 on typical flatwoods soils like Immokalee fine sand. These groves regularly produce 600 to 800 boxes/acre of oranges and grapefruit and have done so for more than 10 years. The results indicate that even closer spacings may be possible using existing rootstocks and scions, or that similar outcomes could be achieved on different soil situations if APS management practices are applied.

OPEN HYDROPONIC SYSTEM

Once the grove design is selected and trees are planted, the next step is to grow the trees using the concepts of the Open Hydroponic System (OHS). This system is based on the theory that tree performance can be maximized by providing water and nutrients at a rate that closely matches the daily needs of the trees. The delivery of this regime is by drip irrigation to concentrated portions of the root system formed in direct response to the drippers. OHS drip irrigation systems are more expensive to install than microsprinklers, but cost less to operate. Experience with OHS in other countries indicates that a 30-percent savings in both water and fertilizer may be possible.

The system is distinguished from conventional practices in that water is carefully scheduled and applied according to plant needs throughout the day in mature groves. The irrigation schedule and nutrient composition are determined by tree size and activity. The composition would vary depending on the time of year based on shoot or root flushing, fruit setting, and fruit enlargement or maturation. Thus, because water and nutrition are such powerful growth factors, the OHS approach offers an opportunity to manage tree development, cropping and fruit characteristics simultaneously.

In practice, the APS/OHS concept means high performance groves of smallish trees, probably not taller than eight to 10 feet, grown on drip irrigation. Such trees could possibly be treated for their entire life with imidacloprid to control psyllids and help manage greening disease while offering financial advantages.

ADDED VALUES

If the APS/OHS concept is adopted, then what are the added values? Basically, we believe that this approach would lend itself well to groves that would fit better with the urban-agriculture-environment vision. The fruit itself, of course, will become more valuable in the urban-agriculture scenario because the more directly fruit can be marketed to the consumer, the higher the value received by the grower. More fruit will be marketed locally — i.e., community-based agriculture — because residents feel a connection with the agriculture that would be part of their living environment.

On the commercial side, while APS/OHS will certainly be used for production of round oranges for juice, the fresh market possibilities are particularly exciting. To satisfy demanding export markets, growers in other countries have learned to increase packouts by "dialing in" their applications so well that they can produce fruit of a certain size by a certain date, promote earlier color break, increase Brix levels, and control blemishes on fresh fruit.

Fresh fruit will mean windbreaks for canker control. Windbreaks in an urban agriculture scenario could be provided by Conservation Buffers, which provide greater biodiversity than single rows of windbreak trees. These buffers would also provide separation between blocks to aid in canker and greening control, and possibly could add recreational opportunities for urban dwellers. So, to achieve maximum value, the design and layout of the open space will need to be pleasing and multi-functional rather than based only on grove considerations.

Along these same lines of thought, the world is becoming more sensitive to environmental impacts. With OHS, the environmental footprint of a grove would be reduced even though the production would be higher, allowing marketing of fruit with a "green" connotation. The use of treated municipal wastewater for irrigation is a natural fit for OHS as well, since the idea is to add nutrients to all of the irrigation water anyway. Using treated wastewater will also reduce the competition for water between agriculture, urban uses, and the natural environment.

Carbon sequestration may become a minor, but very real, source of income for growers of perennial plants, including citrus. Growers would be paid annually for the amount of carbon captured, which is based on the biomass in the grove. More trees that grow faster will provide a greater annual incremental biomass increase which constitutes the basis for carbon payments.

All of these possibilities, and more, indicate that citrus groves can add values to the environment and urban dwellers over and above that of just the fruit itself. Maximizing these values and marketing them effectively will create income streams far above what we see today, particularly when fruit production can be increased as well. The additional income will offset the higher establishment costs of an APS/OHS grove, and will improve profitability over the life of the grove. APS/OHS will also create new opportunities for small growers and young farmers. Local growers will be more active and recognized in the community, which will strengthen the connections between urban and agricultural segments. Plus, these systems are highly detail-oriented, which will reward diligence and attention by a small grower.

Sale of development rights will provide capital to establish new plantings and will lower the per-acre prices for agricultural land. Favorable financing can be provided to young farmers and small growers if residents recognize the value of maintaining agriculture as part of their living system. Essentially, imagination will be revived as a key component in the advancement of our industry and the numbers and kinds of people participating in these efforts will expand.

So, there are a lot of good reasons to adopt these concepts, and this evolution is actually under way. We believe that the future of Florida citrus is as exciting as it has ever been and that the industry will provide even greater benefits for the people of Florida and to those who enjoy the rewarding lifestyle of a citrus grower.

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