Reduced Height Orchards - Developing and Maintaining Tree Structure and Size

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Reduced Height Orchard Philosophy

Lowering tree height is one of the methods that growers can use to reduce labor costs. In our trials with 'Summer Bright' nectarine at the Kearney Ag Center beginning in the mid-1990s, we demonstrated that labor costs could be reduced by 15-40% depending on the orchard operation in question when trees were grown to a height of 8-9' rather than the common 12-13'. Somewhat surprisingly, there was no difference in yield between the different height trees. However, we had also gone to great lengths to ensure that light interception characteristics of the two systems were as similar as possible.

The initial rationale for exploring the reduced height concept was based on the premise that 1) the largest-sized, highest-quality fruit develops in the light rich environment at the top of the tree, and 2) the fruit in the lower portion of the tree is usually of poorer size, quality, and profit potential. Given that the most valuable fruit was also the most expensive to harvest, we decided to simply lower the top of the tree by 3-4' so that it could be accessed by workers more easily. A different way of putting this might be "Why keeping adding structure to the top of the tree and making fruit more expensive to produce if that same fruit can be produced less expensively elsewhere?"

Based on these trials, and subsequent grower experiences, the following comments are given for those who might wish to consider a reduced height orchard (RHO).

Developing Tree Structure

To reduce orchard height effectively without harming yield two critical things must occur 1) light interception must be maximized, and 2) excessive vigor must be controlled. These are essential whether "retrofitting" and older orchard or developing a young orchard from initial planting. Regardless, the following concepts should be considered:

- Variety and Site – in general, avoid those varieties and locations that are of excessive vigor. Also, it is best to assume that the RHO concept is **most** suitable for early and mid-season varieties since is may be difficult to put sufficient crop loads on some very low (8-9') RHO orchards.
- Canopy Volume– this concept is essential in developing an orchard with sufficient structure to intercept adequate light and have enough of a framework to support the necessary fruit counts to achieve economic yields. It is usually necessary to go to a denser planting to achieve this. Four and six

leader Vs, spaced 8-12' apart, and with 15-18' rows are currently considered the best design. These systems maximize the number of scaffolds in the mid and lower part of the canopy, and even when grown at reduced height can allow for high light interception.

- Branch Angle – Concomitant with canopy volume is the importance of branch angle and limb positioning. A suppressed branch angle of 50-60 degrees will help fill row volume most effectively, will help induce fruitfulness, and will help reduce excessive vigor. Methods of achieving these "flatter than natural" angles include branch bending, limb tying using twine or bamboo, or summer pruning techniques.
- Pruning
    - Summer Pruning – as mentioned above, summer pruning can be used to help select and flatten limbs and scaffolds. However, it usually works best when performed in conjunction with the one of the other techniques mentioned.
    - Pruning Style and Cuts – when developing young RHOs a light dormant pruning is best. Overall growth will be more manageable and marketable yields will be achieved earlier by avoiding heading cuts and severe pruning that stimulate excessive vigor.
- Fertility Management – fertility needs should be met but not exceeded when developing a RHO. Light, frequent fertilizer applications are usually best. The idea is to fill the allotted tree space as quickly as possible but without introducing excessive vigor. This usually means scaling back on fertilizer during or after the third growing season.
- Rootstocks – dwarfing rootstocks are now being introduced that will help perform the steps necessary in achieving a true "pedestrian" orchard, i.e. one in which ladders are not at all necessary. However, the comments presented here assume the use of those rootstocks currently available and proven, including Nemaguard, Lovell, and the plum rootstocks such as Citation, and the Myrobalan and Mariana types.

Maintaining Tree Size

Once the proper structure has been developed, it then becomes a challenge to maintain that structure. In our initial trials, we were able to effectively manage the vigor in the RHO portion of the 'Summer Bright' block. In so doing, we accepted the premise that we could not treat 9' tall trees as if they were 13' tall. This is a major shift from conventional wisdom and **MUST** be embraced if the RHO is to be successful. The following comments help to summarize that mindset:

- Fertility Management – once the final tree height was established in the third leaf we backed off on fertilizer applications. Typically, we would provide 50-75 pounds of N per acre or less to the trees. The general rule of thumb was keep extension growth at the top to approximately 4 feet.
- Irrigation – we were careful not to apply too much water either. Excessive irrigation can induce unwanted vigor. Depending on the variety, postharvest waster stress can also help limit vigor. Care should, of course, be taken to

apply a full irrigation in late August or early September to reduce the number of doubles the following season.

- Ground Cover – we have had great success using perennial groundcover mixes containing dwarf fescues and ryes. If excessive vigor is a problem, they will go a long way in helping to reduce the problem.
- Summer Pruning – once a RHO is under control, excessive summer pruning is not necessary. Summer pruning should not be viewed as the primary method of vigor management, look instead at those concepts discussed above. One pre-harvest and possibly one post-harvest summer pruning should suffice in most situations. One of the real benefits of a RHO is that virtually all summer pruning can be performed from the ground using the longer handled shears that are now available. This results in both lower cost and greater effectiveness.
- Mechanical Topping – this may be one of the best methods to manage vigor and to "retrofit" existing orchards to the RHO concept. We are currently performing a study to help determine when the "best" time to do this may be. However, we have had success in very vigorous orchards in using a "double-topping" concept. This involves topping once at a height 1-2' greater than the desired end height, and then coming back 30-60 days later and topping at the final height. This will help dilute excessive vigor by channeling it into the subsequent new growth, which is then sheared off during the second topping. The combined costs of these topping are usually less than trying to perform the same task through summer pruning alone.

Concluding Remarks

Developing a RHO is just one more method that can be considered in the pursuit to grow quality stone fruit profitably. We have passed the point at which the focus was on maximum production and entered into the arena in which maximizing quality and lowering per unit input costs is essential for profitability. At some point, the law of diminishing returns sets in and it no longer makes economic sense to focus on maximum yield per acre. Instead, that focus should be on maximum profit per acre, which very well may mean growing 600 boxes/acre of high quality, good-sized fruit rather than 850 boxes of average size and quality. It is under these conditions that a RHO makes the most sense.