Evaluations of New Peach Tree Training Systems

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Introduction and Objectives

We compared and demonstrated upright and conventional growth habit peach varieties within four training systems, ranging from high to low planting density in growing years 2007 to 2012 and analyzed yield results, tree morphology, labor, and economic value for tree systems. This is an ongoing long-term project, and this report summarizes results for 2012, as well as some cumulative results since the beginning of the study.

Plan of Work

A peach orchard was established at the Penn State Fruit Research and Extension Center (FREC) in Arendtsville, PA to compare the performance of Sweet'N'Up, a peach cultivar with an upright tree growth habit, and Loring, a standard growth habit cultivar chosen because it has a similar time of ripening as Sweet-N-Up. Each variety (growth habit) is being grown in three high-density systems and one standard density peach system. The systems include perpendicular V at 5 ft in-row spacing (PV5), quad V at 7 ft in-row spacing (QV7), hex V at 10 ft in-row spacing (HV10), and open center at 14 ft in-row spacing (OC14). All four systems are planted at 18 ft between rows. The varieties and systems are compared on the basis of cumulative yield, fruit size, color and quality, tree size, establishment costs, production costs, and return on investment. These data are being used to make recommendations to growers as to which systems offer the best production of marketable yield. Additionally, the systems are evaluated for suitability for mechanization, and evaluated for use with mechanical labor-saving aides, such as the Darwin mechanical blossom thinner and labor assist platforms. Production practices such as pruning, hand thinning, and harvest are also evaluated in the different growing systems to determine which growth habits, canopy parameters, and spacing provide optimal productivity and labor efficiency.

In 2012 we conducted an analysis of red fruit coloration of fruit samples from the third harvest date of each cultivar. Samples of twenty-four fruits per plot were collected from the lower canopy in all seven plots of each training system and the extent of red blush coverage of the fruit surface was measured by digital image analysis.

Results and Discussion

Cumulative tree growth was assessed by measuring trunk cross-sectional area annually for all years of the study (Figure 1). In each year, trunk growth increased proportionately with increasing tree spacing. The open center trees had the greatest trunk growth, followed in descending order by the HV10, QV7, and PV5 systems. The closer the tree spacing, the less the trees grew. This was true even in the first year of planting, when tree-training practices were essentially the same for all systems. We surmise there was competition between trees at close spacing, even when the trees were newly transplanted and took up the smallest portion of the space allotted them.

In 2009, Sweet-N-Up produced more yield than Loring, but Loring produced the most annual yields from 2010 to 2012, and consequently has produced higher cumulative yield (Figure 2). All of the V systems, planted at higher tree density, produced more fruit per acre than the OC14 trees. QV7 trees produced the greatest cumulative yield for with both varieties, while HV10 yields were greater than PV5 yields.

Annual yield for the HV10 and QV7 systems was very similar and greater than that of the other systems in 2012. In 2012, Loring QV7 yield (641 bushels per acre), and HV10 yield (628 bushels per acre) were greater than that of the traditional OC14 (295 bushels per acre) by a huge margin. Similarly, cumulative yields for HV10 and QV7 (1641 and 1730 bushels per acre, respectively) far out-distanced the OC14 (939 bushels per acre cumulative yield). While the PV5 also produced more cumulative bushels per acre (1515) than OC14, it produced less total yield and less large fruit than the medium density QV7 and HV10 trees. Thus we conclude that the additional investment in tree number at planting required to establish the PV5 system isn't justified. The QV7 and HV10 systems establish more bearing surface per acre, which explains the greater productivity of these medium density systems over lower- and higher- density systems (data not presented). Similar margins between systems were recorded for Sweet-N-Up, although yields were slightly lower than Loring.

Growers often observe that V systems produce more small peaches than those grown on open center trees. While all three V systems in our study produced more small sized fruit than the OC14 trees, the QV7 and HV10 also produced more 2.75 inch and 3.0 inch fruit than the OC14. All four systems received appropriate pruning to reduce excess crop potential, mechanical blossom thinning, and timely green fruit hand thinning. These cultural practices, followed by trickle irrigation during final fruit swell, resulted in highly desirable fruit size distribution, regardless of training system. Our results to date suggest that this is the result of higher productivity, and should not be considered a failing of closely planted V systems to produce a quantity of large fruit, if good management practices are used.

Figure 3 shows representative images after preparation for digital color analysis. The black sections of each fruit image show where the skin is red, while white sections lack marketable red pigmentation. Loring fruits from the lower half of the canopy of all 3 V systems were redder than those from the open center trees (Figure 4). There were no differences in the extent of red coloration between systems for Sweet-N-Up, which characteristically colors better than Loring.

The upright growth habit of Sweet-N-Up offered few advantages over the standard growth habit in this study. Sweet-N-Up was more precocious in year three, and produced somewhat redder fruits than Loring.

With the development of mechanical blossom thinning and mechanized labor platforms, the loss of labor efficiency associated with the need to use ladders in tall tree systems can be greatly reduced. Open center training to produce a pedestrian orchard has reigned as the predominant system in the eastern U.S. for over 150 years. The results of this study show unequivocally that a change in our peach orchard training systems is long overdue. QV7 is a productive and easy to train tree wall system that facilitates mechanization for labor efficiency.

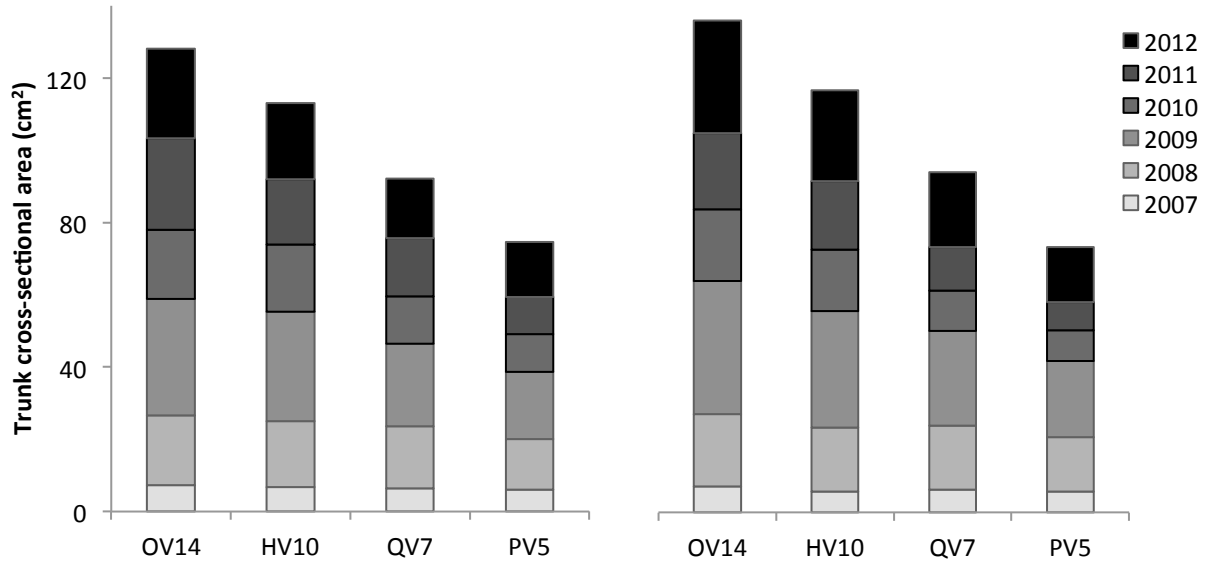

Figure 1. Tree size as indicated by cumulative trunk growth per system in all years of the trial (Sweet-N-Up left, Loring right).

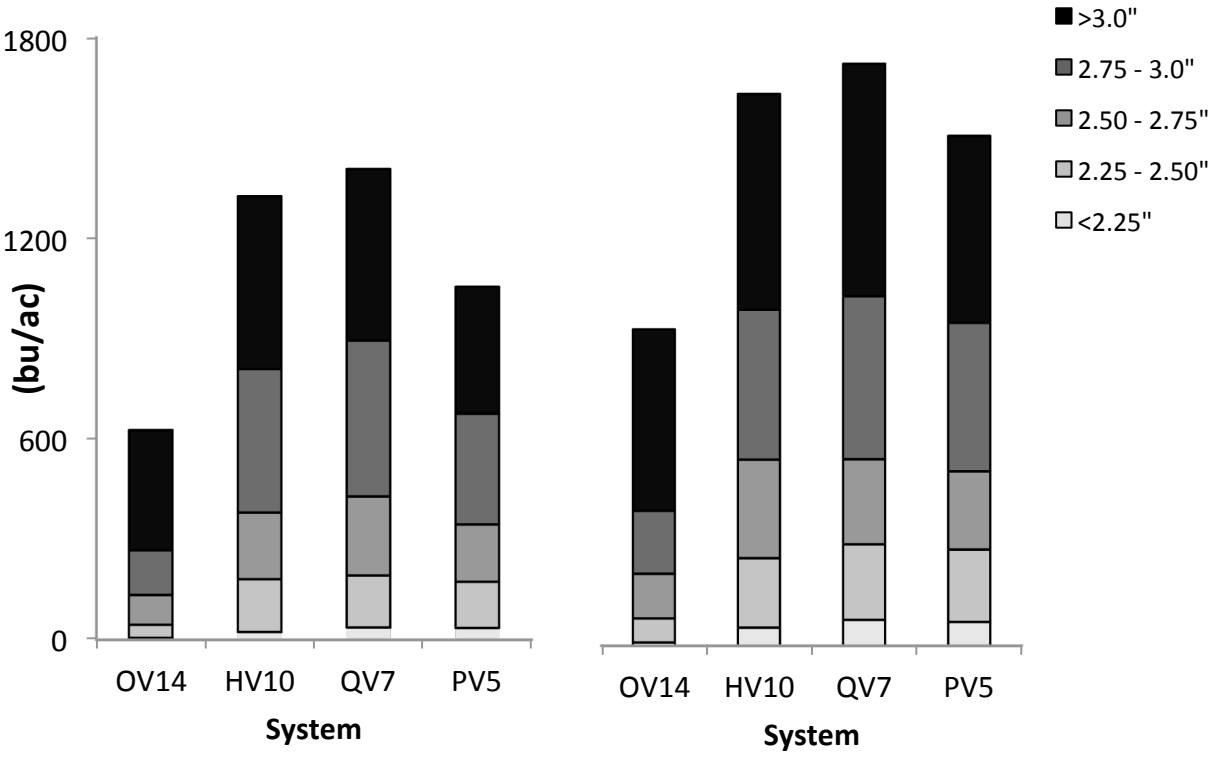

Figure 2. Effect of training systems and in-row tree spacing on cumulative yield (bushels per acre) and fruit size (inches) of Sweet-N-Up (left) and Loring (right) peaches, 2009 - 2012.

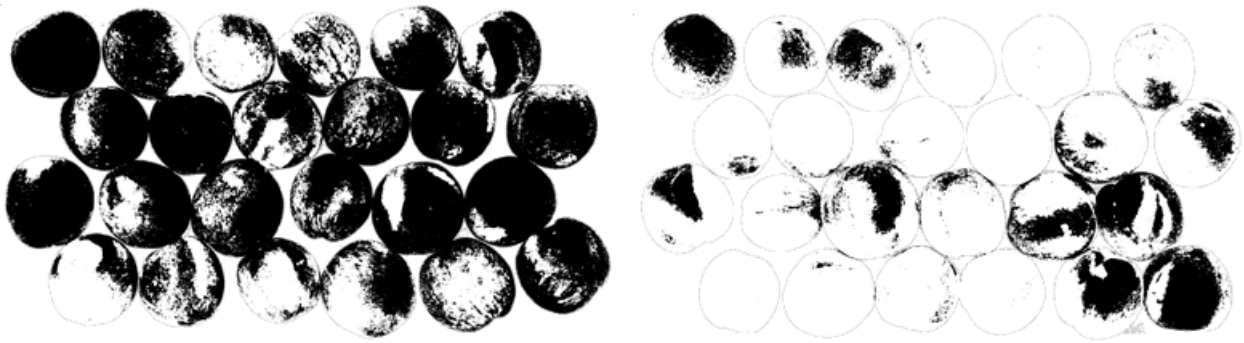

Figure 3. Digital images classified into blush (black) and non-blush (white) regions of Loring peach fruit sampled from the lower canopy of two training systems, 2012 (HV10 system, left; OV14, right).

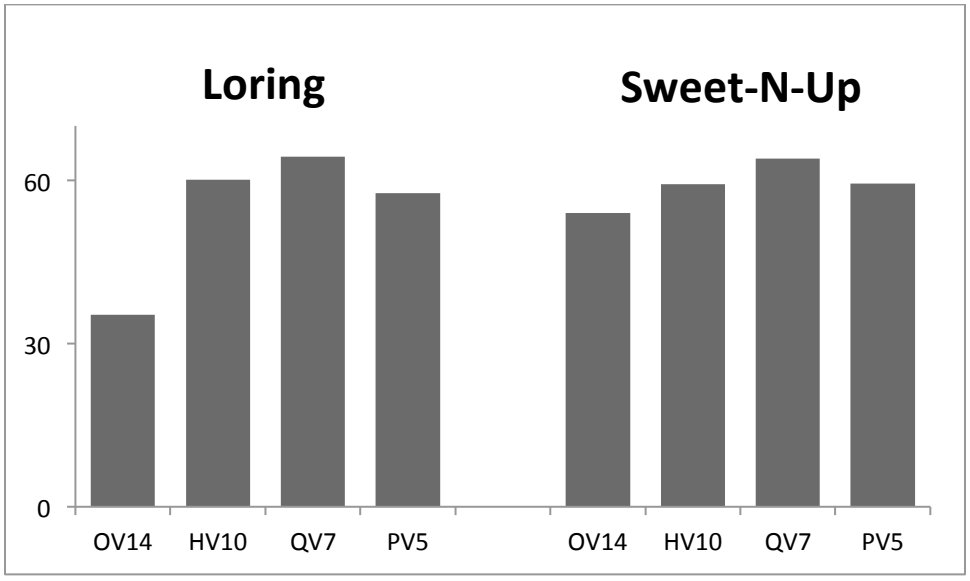

Figure 4. Extent of red blush coverage on the surface of Loring and Sweet-N-Up peach fruit sampled from the lower canopy of four training systems, 2012.

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