Pedestrian Orchard Systems for Plums

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Economic pressures have forced growers to reevaluate all farming activities. For production practices, labor costs dominate all others. For more than 15 years we have been studying the relationship between tree height, production potential, and labor cost savings. Much of this work has been done with peach/nectarine, and these studies have shown that labor cost savings of 25% to 45% are possible when tree height is maintained at 7 to 9 feet. At the same time, production and fruit size potential of short trees has been similar to trees in the conventional 12-13' tall height range.

In March 2007, we initiated a study to understand if plums behave in a similar fashion. A block of "Owen T" plums growing on the semi-dwarfing rootstock Citation (about 75-80% of the vigor of Nemaguard) were planted at University of California Kearney Field Station. Our overall goal was to compare the yield and fruit size potential of standard height plum trees with a true pedestrian orchard in which no ladders are used or required.

Methods

Two row spacings/tree height configurations were used: 1) standard 18 foot wide rows in which the trees were allowed to grow to standard height (12-14 feet tall); and 2) 15 foot wide rows in which the tree were kept at a pedestrian height (~7 feet tall). Tree conformation within height included three training systems: 1) 6-leader Hex-V trees, 2) 4-leader Quad-V trees, and 3) 2-leader Kearney V trees planted at 12, 8, and 4 feet apart respectively. A summary of the treatments is presented in table 1.

Table 1. Per acre tree and scaffold counts for "Owen T" plums on "Citation" rootstock, growing at differing densities and conformations and planted at the Kearney Ag Center in March 2007.

Row Spacing	**Tree Form**	**Trees/acre**		**Scaffolds/acre**	
		15' row	**18' row**	**15' row**	**18' row**
4'	Kearney-V	726	605	1452	1212
8'	Quad-V	363	303	1452	1212
12'	Hex-V	242	202	1452	1212

One of our primary goals was to try to achieve full production in 2010, the fourth leaf. To do this, we performed virtually no pruning during the first and second growing season (2007 and 2008); instead relying upon very minor in-season shoot tipping to induce branching and spur formation. Some scaffold orientation was performed in August 2008 by limb tying and/or bending. As a consequence, and especially in the most closely planted treatments, we were able to develop large fruiting areas and quickly fill the allotted tree space. Dormant pruning was performed annually prior to the 2009 and subsequent seasons. Full tree size was achieved during the 2009 growing season, and trees were mechanically topped to their ultimate heights in mid-October 2009 and again in October 2010.

Results
Unfortunately, in 2011 fruit set in this block was generally light and no thinning was required. We had planned to perform differential thinning treatments within each tree height/training system combination, but we were unable to do so as a consequence of the low fruit counts.

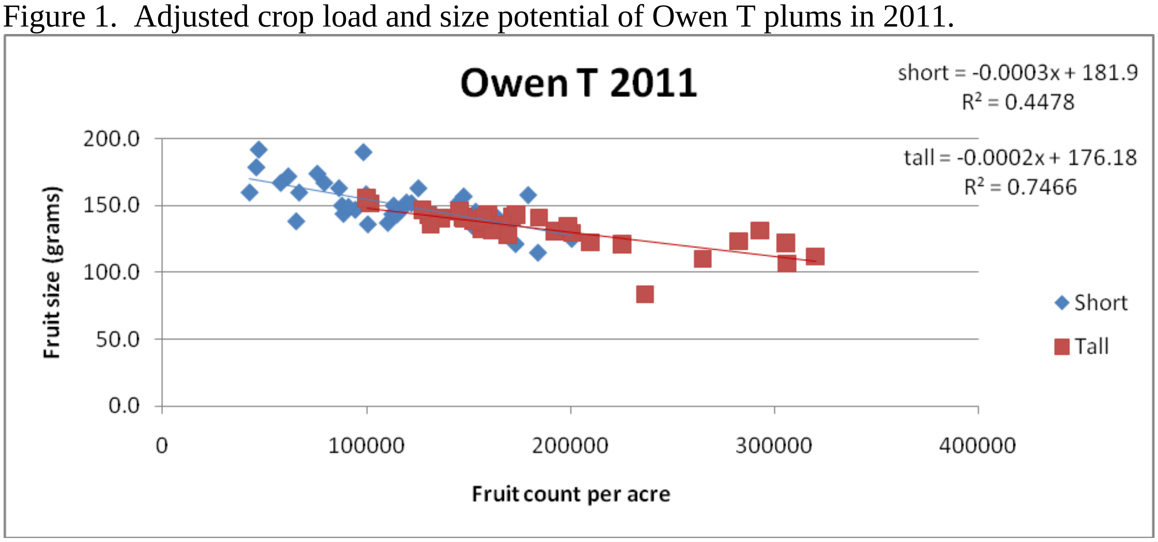
Yields for 2011 are presented below in table 2, and show that tall trees had great yield and crop loads, but that short trees had significantly larger fruit. This is not surprising given that the tall trees had more spurs and shoots, and a larger fruiting area than short trees. Typically, these differences are somewhat adjusted for during the thinning processs, but that was not possible in 2011 since sets were too low to require thinning.

However, further examination of these 2011 data using regression analysis indicated that both short and tall trees tended to have similar size and yield potential when crop loads were standardized, (figure 1).

Table 2. Yield, crop load and fruit size of fifth-leaf Owen T plums trained to various tree conformations/densities and growing at the Kearney Field Station. Trees harvested 13 July 2011. (Boxes per acre calculated at 28.5 lbs/box @ 75% packout.)

	Short Trees (15' Row Width)				**Tall Trees (18' Row Width)**			
Tree spacing	**boxes/ac**	**g/fruit**	**fruit/tree**	**fruit/ac**	**boxes/ac**	**g/fruit**	**fruit/tree**	**fruit/ac**
4'	953	148	155	113,000	1665	113	443	269,000
8'	975	150	320	116,000	1299	138	541	164,000
12'	951	156	450	109,000	1187	140	727	147,000

Figure 1. Adjusted crop load and size potential of Owen T plums in 2011.



During the life of the orchard, yields were primarily related to tree density, with the 2-leader KAC-V trees having the greatest yields, irrespective of tree height, (table 3 and figures 2, 3, and 4). These data also illustrate that tall trees tended to have cumulative yield equal to or slightly greater than short trees. However, and as illustrated in figure 1, this is primarily a function of crop load rather than superior production potential of tall trees.

It was especially encouraging to observe such high yields during the early life of the orchard. Several of the treatments produced in excess of 1000 boxes per acre in 3rd leaf. This response demonstrates the benefit of minimal pruning and illustrates the role of tree and scaffold density in achieving early yields.

Additionally, there has been trouble in maintaining the short trees at their limited heights. Summer pruning has not been necessary and a single topping event in fall has provided sufficient light to maintain healthy fruit quality in all treatments.

Table 3. Total cumulative production data of Owen T plums through fifth leaf. (Boxes per acre calculated at 28.5 lbs/box @ 75% packout, and fruit sizes are weighted averages across all years.)

	Short Trees (15' Row Width)				**Tall Trees (18' Row Width)**			
Tree spacing	**boxes/ac**	**g/fruit**	**fruit/tree**	**fruit/ac**	**boxes/ac**	**g/fruit**	**fruit/tree**	**fruit/ac**
4'	3389	130	618	449,000	4103	107	1093	662,000
8'	2449	132	877	319,000	2878	122	1349	408,000
12'	2309	132	1243	301,000	2391	127	1608	325,000

Figure 2. Seasonal and cumulative yield of Owen T plums trained to various tree conformations/densities and heights and growing at the Kearney Field Station. (Boxes per acre calculated at 28.5 lbs/box @ 75% packout.)

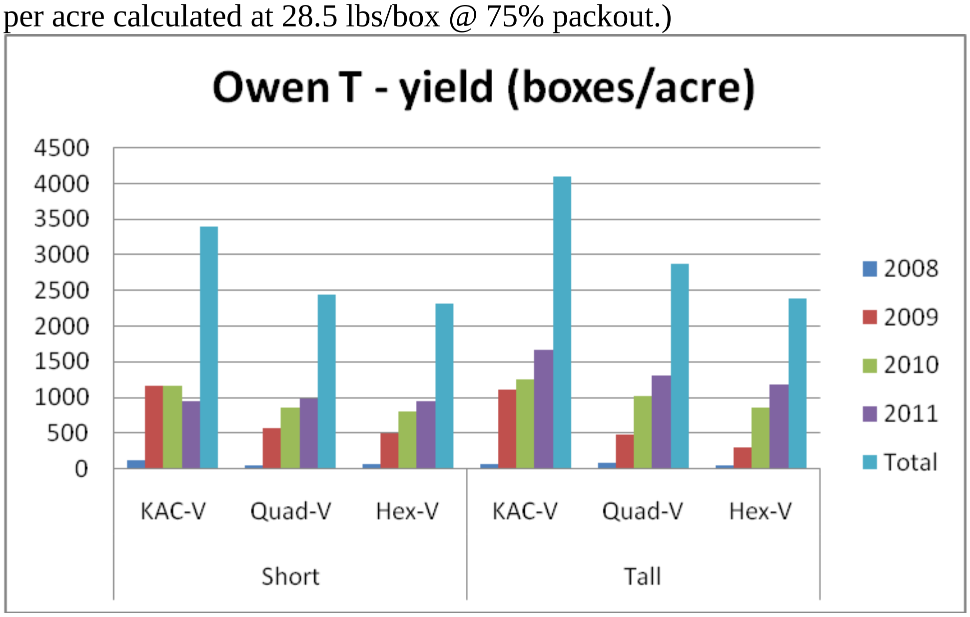


Figure 3. Seasonal and average weighted fruit size of Owen T plums trained to various tree conformations/densities and heights and growing at the Kearney Field Station.

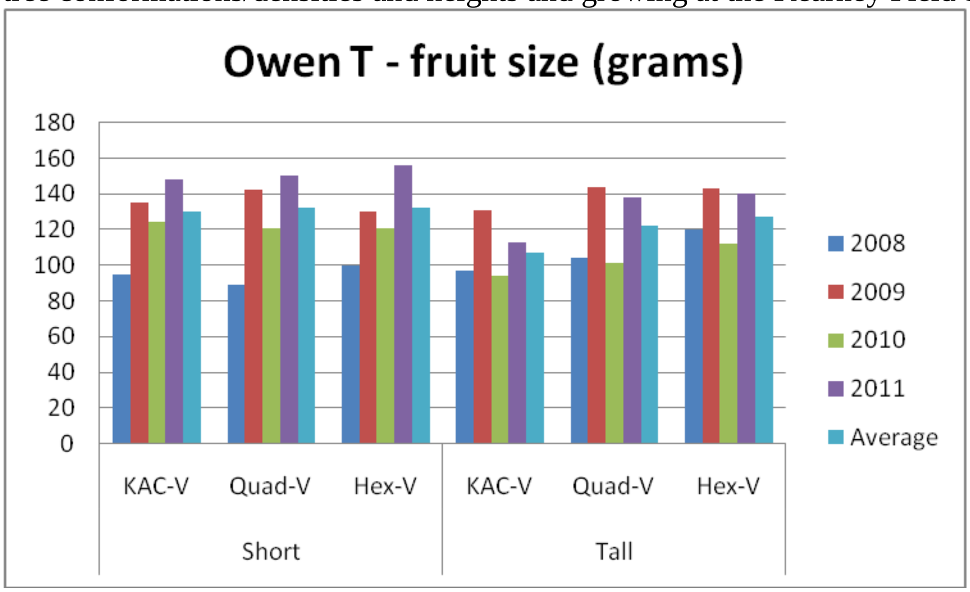
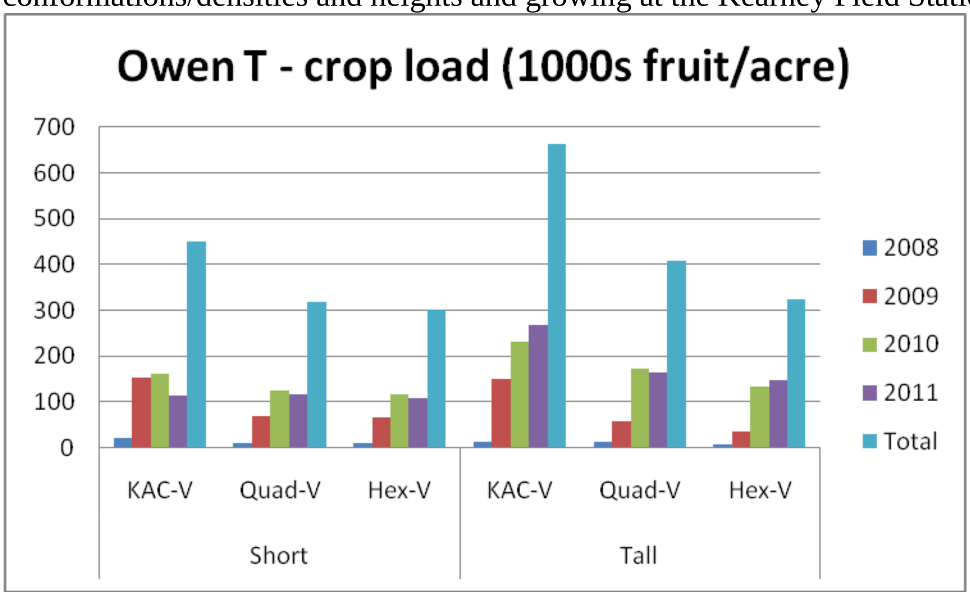


Figure 4. Seasonal and cumulative crop load of Owen T plums trained to various tree conformations/densities and heights and growing at the Kearney Field Station.



Summary

In general, short plum trees tended to have greater fruit size and tall trees greater yield. Regression analysis of both 2010 and 2011 data indicates that this appears to have been primarily related to crop load rather than a function of tree height, and that when crop loads are equalized both short and tall trees have similar production and sizing potential.

This is similar to what we have observed in our studies with peach/nectarine, and is not especially surprising given that fresh-shipping fruits are grown to emphasize fruit size rather than gross yield. The severe pruning and fruit thinning that is performed in these commodities vastly limits their production to mere percentages of what the trees could actually produce if size were of no issue. Consequently, very large trees – and their accompanying production potential of large quantities of smaller fruits – are unnecessary when the restrictions of market demand for large sized fruit are included in the production matrix. In such a situation is makes sense to consider smaller, more easily-managed trees.

Acknowledgements

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