

Project Concluding: Summary Report
Mandarin Trial for the California Desert

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Mandarin production has been a stable source of income for growers in the Coachella Valley for over three decades. Growers continue to have success with Fairchild Mandarin as well as with Minneola Tangelo. However, in order to stay competitive with domestic and global fresh citrus markets, there is a need for seedless mandarin varieties suitable for the California desert climate.

The major objectives of our project were to provide the industry with information on the tree growth, fruit quality characteristics and timing of legal maturity for selected mandarin varieties in the California desert. Although the initial goal was to find a variety that matures early in the season, information on mid- and late season maturing varieties could be useful as the market needs change. This report summarizes results for the 2004-2005 season and provides an overall summary for this project.



This trial was planted in a completely randomized block design with 25 trees per variety, planted in the fall of 1997. In May 2001, replacement trees were planted so that each cultivar had a minimum of 25 trees to evaluate. Trees are evaluated annually for tree vigor in July. A rating of 0 to 5 was used where 5 = healthy and vigorous and 0 = dead. In 2004-2005, the varieties that have shown vigorous growth are USDA 88-2, Gold Nugget, TDE 1, Shasta Gold™ mandarin hybrid (TDE 2), Yosemite Gold™ mandarin hybrid (TDE 4), and W. Murcott Afourer. This was the first year that USDA 88-2 had vigorous growth consistent with the others that have shown vigorous growth.

In 2004-2005 and for the 3 prior seasons (2002-2005), fruit load was estimated in July of each year of the trial. Data is summarized in Table 1. Ratings were made relevant to tree size; therefore, a small tree (3' x 3' canopy size) with 20 pieces of fruit was given a 5 rating, whereas a large tree (6' x 6' canopy size) with 20 pieces of fruit would be given a rating of 3. These ratings are subjective and thus are relative to the year of observation.

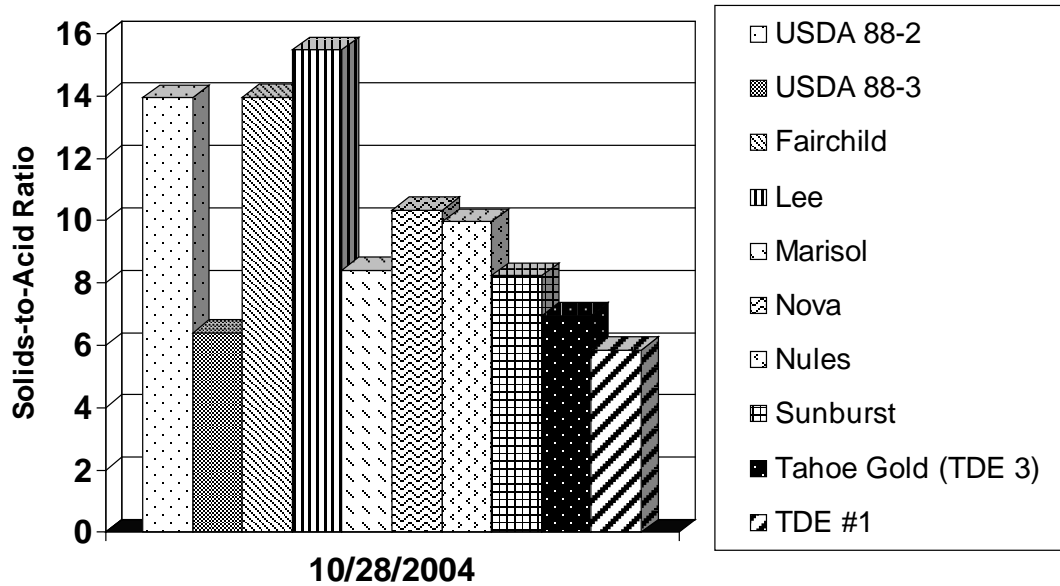
Thus far, the most productive variety is W. Murcott Afourer. Fruit load in 2004 was variable due to excessive early heat. In 2005 season, fruit load is consistent with past performance with W. Murrcott Afourer having the highest fruit load. Gold Nugget, Shasta Gold™ mandarin hybrid (TDE 2), and Tahoe Gold™ (TDE 3) mandarin hybrid appear to bear alternately.

Fruit was sampled annually for fruit evaluations. In 2004-05, the early group was harvested on October 28, 2004, whereas the late group was sampled on February 25, 2005. For the October 28, 2004 sample date for fruit evaluations, the early group consisted of Fairchild, Sunburst, Marisol, Clemenule, Caffin, USDA 88-2, USDA 88-3, TDE 1 mandarin hybrid, Tahoe Gold™ (TDE 3) mandarin hybrid, Lee and Nova. The late group consisted of Gold Nugget, Shasta Gold™ (TDE 2) mandarin hybrid, Yosemite Gold™ (TDE 4) mandarin hybrid, W. Murcott Afourer (Afourer).

Granulation was a significant issue. For the early group of varieties, the Clementine selections (Clemenules, Caffin and Marisol) had very high levels of granulation again this year. All Caffin samples were completely granulated so we were unable to take fruit quality data on fruit of this variety (Table 2). Each of the five samples of Marisol and Clemenules fruit were 100% granulated, but in some cases the amount of granulation per fruit only covered part of the cut surface, so we were able to take fruit quality data but on a smaller sample of fruit. Based on the granulation data and consistently lower vigor ratings, we eliminated these three Clementine selections from the trial (Table 2).

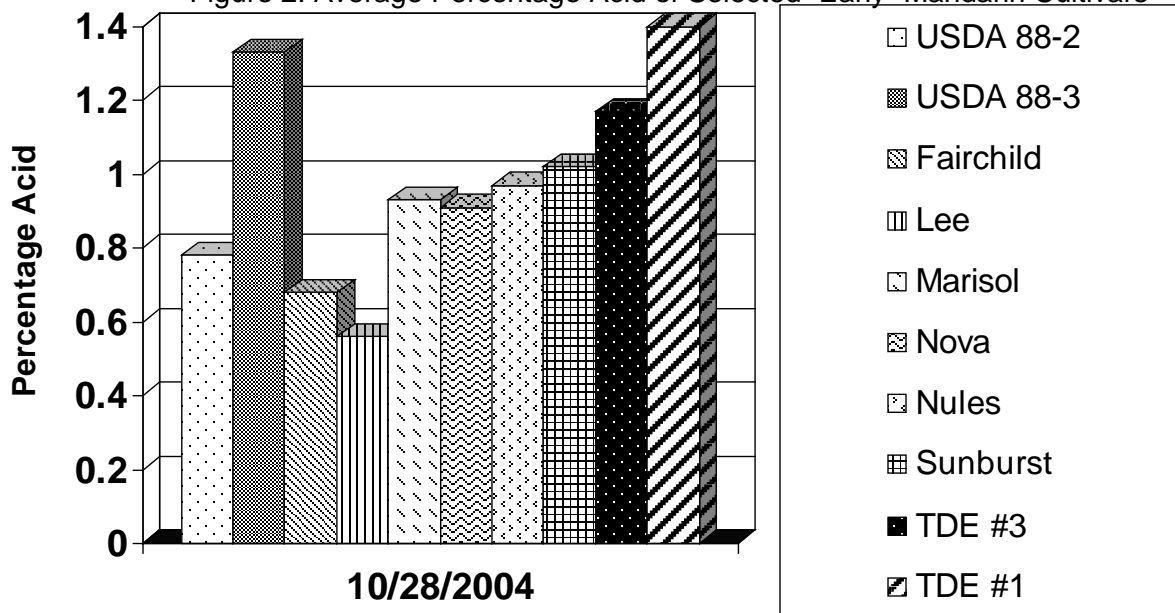
Nova, USDA 88-3 and Sunburst had higher levels of granulation than the remaining varieties in the early group, and this was the second year for high granulation rates for these varieties. Fruit of the late group of varieties had no granulation during this past season (Table 3). W. Murcott Afourer and Yosemite Gold™ mandarin hybrid fruit had a minimal amount of granulation during the previous season (Table 3).

Figure 1. Average Solids-to-Acid Ratio of Selected "Early" Mandarin Cultivars



Results based on average of five replicate ten-fruit samples per cultivar and per sample date except for Marisol and Clemenule which had high levels of granulation.

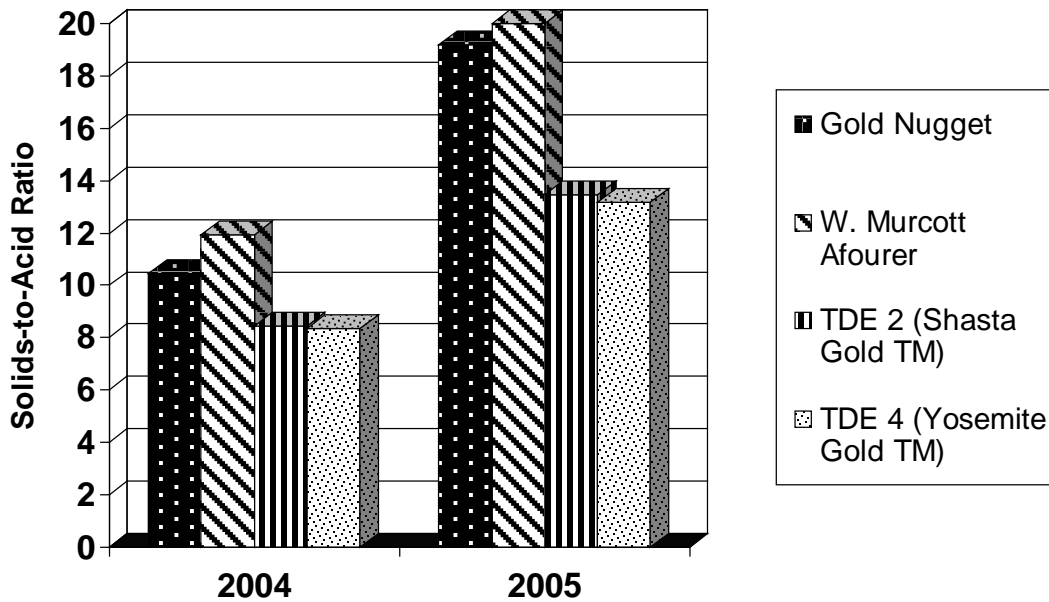
Figure 2. Average Percentage Acid of Selected "Early" Mandarin Cultivars



Results based on average of five replicate ten-fruit samples per cultivar and per sample date except for Marisol and Clemenule which had high levels of granulation.

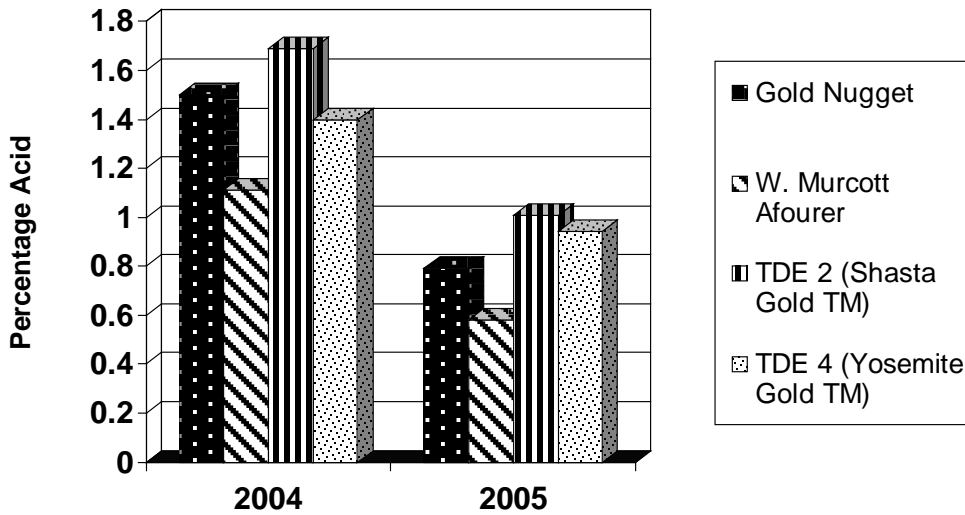
Figures 1 and 2 summarize the solids-to-acid ratios, percent acid and total soluble solids for the early group of mandarins that were sampled October 28, 2004. All varieties of the early group (Figure 1) except USDA 88-3 and TDE 1 had reached legal maturity by October 28, 2004. Tahoe Gold™ had reached legal maturity 6.95:1. Lee is consistently over-mature at this October sample date, and last season Fairchild was also over-mature with average percentage acid levels below 0.7%.

Figure 3. Average Solids-to-Acid Ratio of Selected “Late” Mandarin Cultivars



Results based on average of five replicate ten-fruit samples per cultivar and per sample date.

Figure 4. Average Percentage Acid of Selected “Late” Mandarin Cultivars



Results based on average of five replicate ten-fruit samples per cultivar and per sample date.

Figures 3 and 4 summarize the solids-to-acid ratios, percent acid and total soluble solids for fruit of the late group sampled on February 25, 2005. All cultivars had reached legal maturity with W. Murcott Afourer being over-mature with an average percentage acid level way below 0.7% which would make the fruit insipid in flavor.

Table 1. Average vigor and fruit load rating for mandarin trees. Evaluated 7-25-00, 7-20-01 and 7-19-02, 7-16-03, 7-12-04, 6-23-05.										
Cultivar	2000 Vigor Rating*	2001 Vigor Rating*	2002 Vigor Rating*	2003 Vigor Rating*	2004 Vigor Rating*	2005 Vigor Rating*	2002 Fruit Load Rating**	2003 Fruit Load Rating**	2004 Fruit Load Rating**	2005 Fruit Load Rating**
USDA 88-2	3.14	2.79	2.01	2.88	3.25	3.85	0.22	0.94	0.44	0.94
USDA 88-3	2.5	2	1.44	1.78	2.03	2.50	1.17	0.94	0.61	1.22
Clementina- Caffin	2.91	1.39	1	1.18	2.2	2.75	0.22	0.25	0.73	0.79
Fairchild	3.29	3.27	2.53	3.3	2.94	3.52	1.35	1.28	1.56	2.04
Gold Nugget	4.03	3.66	3.83	3.43	3.93	3.93	0.86	1.97	0.79	1.59
Lee	3.28	2.9	3.08	2.56	3.31	3.29	2.79	3.17	3.79	3.50
Marisol	2.79	3	2.3	2.16	2.38	2.55	1.57	2.05	1.95	2.10
Nova	3.28	2.95	2.77	3.09	3.43	3.55	2.43	3	2.97	3.98
Clemenules	3.19	2.98	2.52	2.56	2.79	3.31	1.99	2.54	1.81	3.46
Sunburst	3.8	3.18	2.7	2.82	3.2	3.61	1.32	2.21	3.71	4.14
TDE 1	3.91	3.53	3.48	2.81	3.76	4.05	0.31	0.72	0.24	1.00
Shasta Gold™ TDE 2	4.05	3.6	3.65	2.94	3.9	4.30	0.63	1.19	0.63	1.00
Tahoe Gold™ TDE 3	3.23	3.23	2.63	2.73	3.25	3.77	0.65	2.42	0.38	1.75
Yosemite Gold™ TDE 4	3.74	3.25	3	3.06	3.71	4.15	1.25	1.8	0.38	0.83
W. Murcott	3.89	4.03	3.35	3.03	3.55	3.88	4.22	4.73	1.79	4.43
*Vigor was based on a scale of 1 (low vigor, no new growth to 5 very vigorous, large tree). Vigor was rated by the same individuals for 2000 and 2001.										
**Fruit load ratings: 0=no fruit, 1=low, 3=med, 5=high volume of fruit relevant to tree's size.										

Table 2. Average Percentage Granulated Fruit and Range of Granulation for selected "Early" Cultivars.				
Cultivar	Percentage Granulation		Range	
	2003	2004	2003	2004
USDA 88-2	2	0	0-10	0
USDA 88-3	63	20	20-100	0-60
Caffin		86		60-100
Fairchild	5	6.7	0-30	0-20
Lee	13	6.67	0-30	0-30
Marisol	60	100	20-90	100
Nova	72	25.7	60-100	0-100
Clemenule	15	100	0-60	100
Sunburst	40	55	20-80	30-70
Tahoe Gold™ (TDE 3)	0	4	0	0-10
TDE#1	14	0	0-60	0

Results based on average of five replicate ten-fruit samples per cultivar and per sample date.

Table 3. Average Percentage Granulated Fruit and Range of Granulation for Selected "Late" Cultivars		
	Percentage Granulation 2/19/2004	Percentage Granulation 2/25/2005
Gold Nugget	0	0
W. Murcott Afourer	3.3	0
Shasta Gold™ (TDE 2)	0	0
Yosemite Gold™ (TDE 4)	1.7	0

Results based on average of five replicate ten-fruit samples per cultivar and per sample date.

SUMMARY

It is unfortunate that the funding for this trial was cut off just prior to packinghouse tests, thus we cannot make any conclusions as to how fruit will perform in a packinghouse nor how they will respond to ethylene tests. Yet, we can make a number of conclusions based on 6 years of vigor rating data, 4 years of fruit load data, and 4 years of evaluations of fruit quality characteristics including level of fruit granulation from small samples of fruit available 2002-2005.

For the past six seasons, varieties that have shown vigorous growth are Gold Nugget, TDE 1, Shasta Gold™ mandarin hybrid (TDE 2), Yosemite Gold™ mandarin hybrid (TDE 4), and W. Murcott Afourer. In regards to fruit load, Gold Nugget, Tahoe Gold™ (TDE 3) mandarin hybrid and Shasta Gold™ (TDE 4) mandarin hybrid appear to alternate bear as is common with many mandarin varieties, but these have shown vigorous growth and other promising characteristics. Future work is needed to determine methods to offset alternate bearing. Thus far, the most productive variety is W. Murcott Afourer.

We do not recommend planting Clementine selections in the Coachella Valley due to very high levels of granulation. Tahoe Gold™ (TDE 3) mandarin hybrid has shown promise as a seedless early variety and Shasta Gold™ (TDE 4) mandarin hybrid as a seedless late variety. Yet of all the varieties evaluated since the onset of this trial, W. Murcott Afourer was the most promising of the varieties for the Coachella Valley.

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