

‘TDE3’ Mandarin Hybrid - Tahoe Gold™

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‘TDE3’ (patented by the University of California under the ‘TDE3’ name) is a mid-season maturing mandarin hybrid that combines large fruit size, attractive deep orange rind color, rich fruit flavor and the virtual absence of seeds even in mixed plantings. No other mandarin currently available combines this set of characteristics. It may be successful in a marketing window that currently has few low-seeded cultivars. The pedigree of ‘TDE3’ is (Temple tangor x 4n Dancy mandarin) x Encore mandarin. The female parent was tetraploid. The variety is triploid. It will be marketed under the trademarked name Tahoe Gold.

Fruit Characteristics: ‘TDE3’ fruit are oblate (slightly flattened) in shape (Figure 1). The fruit base (stem end) is convex with a small neck while the apex (blossom end) is depressed. The average fruit size is medium-large for a mandarin (classed as Jumbo by California state standards) with a mean width of 66mm (2.6 in.) and a height of 56 mm (2.20 in.), giving a height to width aspect ratio of 0.85, and a mean weight per fruit of 135 grams (4.75 oz., heavy for the fruit size). Rind color is very deep orange for fruit harvested in Riverside in mid- February, with similar values for fruit from the San Joaquin Valley, Ventura and north San Diego County areas. The rind texture is variable, depending on tree age and crop. For older trees with a moderate to heavy crop, rind texture is rather smooth to slightly grained with fairly conspicuous oil glands. The rind of fruit from trees with very light crops is often excessively rough or bumpy. The rind is of medium thickness and moderately easy to peel when fruit are mature, but can be much more adherent early in the season. The fruit is typically very juicy averaging 48% juice content. Flesh is deep orange in color, with a fine texture.

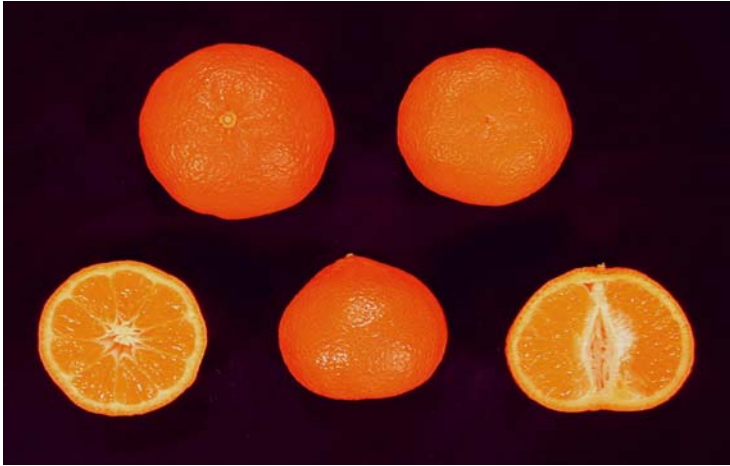


Figure 1: Fruit of ‘TDE3’ from Riverside



Figure 2: ‘TDE3’ tree on Carrizo citrange at Riverside

Tree Characteristics: Tree shape (Figure 2) is approximately spheroid, rather similar to that of orange trees. Leaves are on the large size for a mandarin with leaf shape more orange than mandarin-like. Canopy density is good and many fruit are born inside the canopy, which serves to limit sunburn and help maintain the very distinct rind color. Fruit exposed to excessive sun will lose significant color on the exposed surface. Overall trees are vigorous, more so than most mandarins. In comparison with most old-line citrus cultivars, trees of ‘TDE3’ are fairly thorny, with normal branches having short length (6 mm, 1/4 in) thorns at about 13% of the nodes, with vigorous sprouts having long (27 mm, 1.1 in) thorns at about 63% of nodes. Thorniness will probably decrease as the cultivar ages. To reduce thorniness, budwood should be selected from thornless, upper canopy branches.

Rootstocks and Tree Performance: Several different rootstocks were used in ‘TDE3’ evaluations including Carrizo citrange, C-35 citrange, Rich 16-6 trifoliolate, Cleopatra mandarin, Schaub rough lemon, and trees topworked on Valencia orange on Troyer citrange rootstock. Overall trees performed well on all rootstocks with no indications of rootstock-scion incompatibility although all trial trees are still too young to evaluate longevity and long-term performance. Tree vigor varies greatly by location. At southern desert locations canopy volumes of 7-year-old trees averaged 21.1 m³ (745 ft³) in trials. In contrast, at the cooler Santa Paula and Ojai (Ventura County) locations, 7-year-old trees averaged 6.2 and 3.6 m³ (219 and 127 ft³). 7-year-old trees at Lindcove and Orange Cove (San Joaquin Valley) averaged 9.9 and 7.3 m³ (350 and 258 ft³). Canopy volumes were greater for topworked trees in north San Diego County. Trees have performed best in locations with more moderate climates such as the coastal and inland valleys of southern California and the San Joaquin Valley. The topworked trees tested were quite vigorous being larger overall than trees on all other rootstocks at the same age. Trees on Schaub rough lemon were larger than those on Carrizo citrange or C-35 citrange at Santa Paula and Ojai. At Lindcove and the southern desert sites, trees on Rich 16-6 trifoliolate and Cleopatra were smaller than those on Carrizo and C-35 citranges. Tree spacing in field plantings will depend on vigor of the rootstock. For Carrizo citrange rootstocks, a recommended tree density would be 150 (15’ x 20’) to 200 (11’x20’) trees per acre. Higher densities are possible but will require more frequent pruning or hedging. In comparison with Carrizo, C-35 rootstock reduces size of sweet orange trees, but it

is not yet known if it will reduce final size of 'TDE3' trees to the same extent. Care of young trees should be similar to that used for other mandarins or oranges. Flowering occurs from early April into May at all locations except the desert where it is earlier. The normal flowering overlaps with many mandarin varieties including Clementinas. It is not known whether 'TDE3' trees require cross-pollination for fruit set because all experimental trees were grown in mixed plantings. Therefore, we do not recommend establishing large plantings without provision for cross-pollination. Trees should be grown with pollinizer cultivars such as Minneola, Valencia orange, or unrelated mandarins that produce viable pollen until the requirement for cross-pollination is better understood. Trees that were screened to exclude bees during flowering produced very few fruit for two consecutive years, but it is possible that 'TDE3' is self-fertile but requires pollination for fruit set. Pollen viability is low (about 11%), suggesting that 'TDE3' will have little effect on seediness of Clementines or other cultivars, but direct experimental evidence to confirm this is not yet available. Optimal pruning practices have not yet been developed, but in many locations trees have performed well with relatively little pruning. Although not yet fully supported by experimental data on this cultivar, if fruit set is very heavy, then trees should be pruned to reduce the crop in order to reduce future alternate bearing. The trees have not been noted as particularly susceptible to any diseases and, based on a freeze in 1999, appear only slightly more cold-hardy than oranges of similar age.

Yields: Yield evaluations of 'TDE3' indicate that alternate bearing is common in this cultivar, as in most mandarins, although at some sites tested the off year crops are reasonably good. Crops were rated on a scale ranging from 0 (no crop) to 5 (very heavy crop); a crop rating of 2.5 is considered to be commercially acceptable yield while a crop rating of 5 cannot be sustained over many years by most mandarins. Using this rating scale data indicate that topworked trees showed the highest and most consistent crops, ranging between 2 and 4.5 over the 4 years studied. It is not clear whether the more consistent yields at this location are due to tree propagation method, management, or location. Yields were also relatively consistent at Ojai on Schaub, Carrizo and C-35 rootstock, being 1.5 or greater in all years. At Lindcove, Orange Cove, and Santa Paula, crop ratings indicated alternate bearing on Rich 16-6, Carrizo, C-35 and Cleo rootstocks with values averaging about 3, 0.5, and 1.5-4 from 1999-00 to 2001-2002 across these sites. Mean yields across all rootstocks at Lindcove in 1999-2000 and 2000-2001 were 28.7 and 4.6 kg per tree (63.1 and 10.1 lbs.), while at Orange Cove yields were 63.2 and 0 kg (139 and 0 lbs.) per tree. Six-year-old trees on Rich 16-6 trifoliolate have consistently had the highest yields (37-91kg in 'on' years, 81-200 lbs.) followed by C-35 (23-72 kg, 51-158 lbs.), Carrizo (23-64 kg, 51-141 lbs.) and lastly Cleo (25-39 kg, 55-86 lbs.). Overall, performance of the eight trees in the southern desert indicates that 'TDE3' may not bear well enough for commercial use in desert areas. However, the number of trees is small and additional plantings at more locations should be evaluated to better characterize adaptation to desert environments.

Fruit Maturity: An important determinant of maturity date for citrus fruit is the solids:acid ratio. The estimated dates on which fruit reached an 8:1 solids:acid ratio were November 1 for the southern deserts, December 15 for Valley Center (north San Diego County) and Ojai, January 8 for Orange Cove, January 12 for Lindcove, and January 20 for Santa Paula. In California, state standards specify a solids:acid ratio of at least 6.5 for tangerines and mandarins. The 8:1 ratio is used for oranges. We believe that 'TDE3' should not be marketed until fruit reach a solids:acid ratio of at least 10:1. Taste panel evaluations support this recommendation. This would delay maturity by about 3 weeks compared with the dates above and would result in a much better tasting and easier to peel fruit. 'TDE3' does not hold especially well on the tree for an extended period. They become soft and develop slightly off flavors by mid to late March at the warmer locations. Fruit from trees on Volkamer lemon and Schaub rough lemon generally have slightly lower solids and acid than those from trees on Carrizo citrange, C35 citrange, or Rich 16-6 trifoliolate orange, but this effect is less noticeable than with oranges and does not preclude the use of Volk or Schaub as rootstocks with trees used for fresh fruit marketing.

Fruit Storage: Limited data indicate that fruit of 'TDE3' store very well after harvest. Trials of fruit taken from a mid-January harvest in the San Joaquin Valley, run over a packline at the University of California Lindcove Research and Extension Center and waxed were stored 11 days at 68° F (20.5° C), 12 days at 37° F (3.4° C) followed by 7 days at 55° F (13.3° C), or 12 days at 41° F (5.6° C) followed by 7 days at 55° F (13.3° C). These samples would represent peak maturity fruit of 'TDE3'. Their storage ratings were good for all traits before storage, and were little changed or improved by both cold storage treatments. Storage at a continuous 68° F (20.5° C) reduced the scores for visual appeal and peelability.

'TDE3' is being released along with two sister siblings, 'TDE2' and 'TDE4'. In comparison with its siblings, fruit of 'TDE3' are not as flat as 'TDE2' or 'TDE4' and have a small neck whereas the others rarely exhibit a neck. Rind color of 'TDE3' is slightly deeper orange than 'TDE4' and much deeper than 'TDE2'. Fruit of 'TDE3' mature earlier than 'TDE2' and 'TDE4' at all locations and do not hold their quality on the tree past maturity nearly as well as the others. 'TDE3' has a finer flesh texture and is slightly juicier than 'TDE2', significantly juicier than 'TDE4'. 'TDE3' is more difficult to peel than either of its siblings. All three varieties are heavy for their size. Overall yields of 'TDE3' have been similar to 'TDE4' and 'TDE2' although less data has been available for 'TDE2' comparisons. Alternate bearing habits are similar for all three varieties.

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