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**CITRUS VARIETIES FOR THE LOWER
RIO GRANDE VALLEY**

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Division of Horticulture



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There have been marked changes in the grapefruit variety situation in the Lower Rio Grande Valley during its relatively brief history. The seedy types such as Duncan were soon supplanted by Marsh Seedless. This has been superseded by the bud sports, Thompson (Marsh Pink) and later the red-blushed types such as Ruby.

Growers who planted orange trees during the early days of the industry are more fortunate than those who planted grapefruit. Valencia is still the standard late variety, and even seedy varieties of the Pineapple and Parson Brown type are readily saleable. Growers who started planting Hamlin orange trees at an early date are in an enviable position as this excellent seedless variety is also the most highly productive. Superior types of oranges which are less perishable than some of the standard types are called to the attention of the grower in this bulletin.

Tangelos are an interesting group of fruits that should be used in every home orchard but have little commercial value.

Mandarin type oranges are not recommended for commercial planting because of the highly perishable nature of this type of fruit.

Limes and lemons may be grown by persons who are financially able to equip their orchards with heaters.

There are many types of citrus fruits that may be grown as ornamentals or for special purposes, but none of these are of commercial importance.

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CITRUS VARIETIES FOR THE LOWER RIO GRANDE VALLEY

W. H. Friend and J. F. Wood†

After many trial and error plantings of citrus fruits during the early days of the Valley's citrus industry, varieties are now fairly well standardized. The grower demand for these varieties, previously recommended in publications of the Valley Experiment Station (1), is so well crystallized around a few types that it is now difficult to persuade commercial nurserymen to propagate any other sorts. The purpose of this publication is to call attention to some of the new but noteworthy varieties, and to compare the merits of some of the older and better known varieties with what should now be regarded as standard varieties.

The popular demand for trees is now centered on Ruby and Marsh grapefruit; Hamlin (early) and Valencia (late) oranges; Clementine tangerine; Meyer (cold resistant) and Eureka (everbearing) lemons; and the Mexican lime. These varieties have won their popularity through sheer merit, but it is logical to suppose that better varieties will be introduced or created. Plant explorers and plant breeders are at work adding to the list of citrus materials which can be evaluated only by fair and impartial adaptability tests. Once a variety has been shown to be superior it gradually replaces the older standard sorts.

The importance of variety in fruit growing is emphasized by the relative permanence of the trees. Thus differences between varieties in yielding capacity, popularity of the fruit, hardiness to cold, and so on are maintained from year to year and the distinction between profit and loss may easily depend upon the choice of varieties, which is made before the orchard is set.

Responsibility for trueness to type lies with the nurseryman who selects the budwood. Since bud mutation is comparatively frequent in citrus material, wood for propagation should be secured only from trees known to be normal in every respect. Results of work on Marsh and Thompson grapefruit at the station (4) leads to the conclusion that an improvement in the normal yielding capacity of a variety cannot be obtained by means of bud selection and therefore the grower is not justified in paying a premium for trees on such a basis.

The yield data and the descriptive material presented on the following pages furnish the basis for recommendations to Lower Valley growers.

METHODS

The variety test blocks were started in 1925 and some additions were made to the collection each year since the study was started. Three trees

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of each variety have been used in most instances, but in the case of some of the tangelo varieties, the descriptions and the adaptability rating have been based on single, specimen, trees.

Wherever possible station results and experiences have been checked with those of commercial growers of these same varieties. Statements concerning varieties are, therefore, substantiated by the experience of actual growers and handlers of citrus fruit.

The yield data represent the average annual production of three trees on sour orange understock unless otherwise stated. It is realized that the number of trees used is too small to give an absolutely reliable measure of productive capacity, but the relative bearing ability of the trees of the standard varieties seems to be in agreement with the experience of commercial orchardists who give their citrus trees reasonably good care. The yield figures represent the total production of fruit expressed in pounds, with no consideration given to size or grade. Since most growers sell their fruit on an orchard run basis, total yield now appears to be the most important consideration. Acre yields can be computed by multiplying the yields shown by seventy, as the trees in these tests are spaced so as to have seventy trees per acre.

The oldest trees used in these studies were obtained from commercial sources, but those set after 1927 were grown in station nurseries. Authentic budwood of most standard varieties was obtained from the U. S. Department of Agriculture. Much interesting and some valuable material was collected from local nurserymen and orchardists who have discovered bud sports or trees which must have been inadvertently propagated from bud sports. The large number of bud sports which have been discovered in this region would seem to justify the conclusion that bud mutation is not an uncommon occurrence in citrus in the Lower Rio Grande Valley.

The varieties were described during the height of their respective ripening seasons. Thirty or more individual fruits from trees of authentic parentage, were used as a sample for description. Some of the varieties were described in more than one season. The figures in the tabulated descriptions are based on the means of the individual fruit measurements for all seasons. The narrative descriptions are based on a single season. In the case of some characteristics which were determined by observing typical fruits, the numerical system of designating the adjectives that apply was used.

GRAPEFRUIT

Trees of most commercial varieties of grapefruit are much more productive than orange trees during the first ten years of bearing. This accounts for the greater popularity of grapefruit as compared with oranges during the developmental stage of the Valley's citrus industry, as prices received for grapefruit were then on a par with those received for oranges.

In the case of grapefruit, lack of information about varietal adaptability and desirability has resulted in disaster to many of those growers who

pioneered in the citrus orcharding business. Much of this havoc was due to the planting of seedy varieties of grapefruit. The plight of pioneer grapefruit growers was made even more acute by the introduction of two outstandingly good varieties after the industry was fairly well established. Few growers realized that trees of Pink Marsh grapefruit were available for commercial planting as early as 1924. However, Valley growers were so well pleased at that time with the returns being received for the original Marsh that they were loath to pay the extra cost of trees of this promising new variety. The discovery of the Ruby grapefruit came at a time when Valley growers had learned to appreciate the merits of the pink fleshed, seedless grapefruit, and they were quick to recognize its merits. Plantings of this excellent variety have been quite heavy since its introduction to the public in 1933. It would seem that varieties of grapefruit in the Valley have reached the acme of perfection, but there is still a demand for grapefruit having certain qualities not possessed by any now grown.

For convenience, the varieties of grapefruit which have been grown at the Experiment Station are divided into four groups: (1) those varieties with numerous seeds; (2) varieties having few seeds and normal colored pulp; (3) varieties having few seeds and pink colored pulp; and (4) the non-commercial pummelo.

Seedy Types

Duncan: This variety has been grown in the Valley since the establishment of the commercial citrus industry. Shortage of planting stock of the more desirable seedless varieties and lack of knowledge on the part of those who developed orchards account for the relatively large numbers of old trees of this variety. Trees of Duncan grapefruit deteriorate relatively

Table 1. Variety test of grapefruit, yields in pounds per tree, 1934-1938

Variety	Year set	1934	1935	1936	1937	1938	Avg.
Cecily	1932				300.0	340.0	320.0
Conner's Prolific	1927	231.3	756.3	660.0	1150.0	240.0	607.5
Duncan	1925	153.3	894.7	630.0	1333.3	380.0	678.2
Duncan**	1925	283.0	575.0	751.0	1042.5	562.5	642.8
Duncan	1927	204.7	734.0	453.3	775.0	140.0	461.4
Foster	1925	322.3	690.7	700.0	744.0	466.7	580.7
Inman's Late	1927	170.0	887.0	272.0	1375.0	160.0	572.8
Little River	1929	314.0	121.7	365.7	665.0	472.7	387.8
Marsh	1925	307.7	718.7	916.7	916.7	948.3	761.6
Marsh**	1925	702.0	534.0	962.7	1078.7	1010.7	857.6
Marsh	1927	470.0	440.7	740.0	740.0	916.0	661.3
McCarty	1925	515.0	750.3	887.7	816.7	800.7	754.1
McCarty	1927	361.0	603.0	640.0	750.0	480.0	568.0
Thompson	1925	692.3	654.0	1055.0	840.3	968.3	842.0
Thompson*	1925	499.5	671.5	1080.0	1036.5	1329.0	921.5
Thompson Pink	1929	165.6	276.4	656.0	764.6	562.0	472.9
Triumph	1925	65.0	1006.0	245.0	200.0	475.0	398.2
Triumph	1927	160.0	109.0	495.0	325.0	475.0	312.8

*On Cleopatra Mandarin rootstock.

**On rough lemon rootstock.

early and show symptoms of deficiency disease much sooner than those of the Marsh type. They are alternate bearers (Table 1), and the fruit produced during the off year is over-sized, thick skinned and unsalable except as third grade, useful only as cannery stock.

Duncan grapefruit is the standard of quality for this type of citrus fruit and few varieties equal it in flavor. The presence of the excessively large numbers of seed makes this and other seedy varieties an uneconomical fruit for the producer, canner or consumer (Table 9). Since highly acid, seedy varieties retain their flavor while in storage much better than do the Marsh type fruits, these Duncan type grapefruit can frequently be stored for a few weeks and then sold at a good price, after the Marsh grapefruit season is closed (3).

Technical description: Form oblate-rounded, 10.57 cm. x 9.40 cm.; wt., 502 gms.; stem end, smooth; blossom end, smooth; rind, color yellow, surface slightly rough, thickness 6.6 mm.; segments 11-14, average 12.8, fairly irregular; septa texture, medium; flesh, color yellow; appearance of flesh texture, medium; juice sacs, medium size; core type, closed, medium size; number of seed 49-66, average 57.1; volume of juice, 209.4 cc.; per cent juice by wt., 43.4; typical seed, 15 x 8 mm.; total solids, 11.85; acid, 1.66; solids to acid ratio, 7.1:1. It matures from October 1 to November 15.

Walters: This seedy variety was sold to unsuspecting developers of citrus property during the early days of the Valley's citrus industry with the claim that it was a highly productive, early maturing variety. The trees of the Walters variety are similar to Duncan in most respects, and are highly productive under Valley conditions. Like all seedy varieties, the trees deteriorate at an early age, unless they are well fertilized each season. The fruit is inferior to Duncan and is too bitter because of high naringen content to be considered highly palatable. There appears to be no justification for allowing trees of this variety to occupy valuable orchard space.

Innman Late: Another of the seedy varieties that is quite similar to Duncan in most respects. Like the Duncan variety it has no place in Valley horticulture.

Conners Prolific: Pioneer citrus orchard developers planted some acreage to this variety in the belief that the trees were more prolific and that the fruit became palatable relatively early in the fall. Neither has proved to be true. As with other seedy varieties, there appears to be no justification for the propagation of this variety.

McCarty (Indian River): The origin of this variety seems to be obscure, but Hume (5) states that this is the famous Indian River variety. However, it is generally admitted that Duncan, or any of the good seedy varieties, have exceptionally fine quality when produced on the marl soils of the Indian River district. The good quality must be attributed to their adaptability to this environment rather than to other varietal character-

istics. Trees of this variety at the Valley Station have produced exceptionally fine annual yields (Table 1). A peculiar characteristic of this variety is the production of fruits singly instead of in clusters. McCarty grapefruit produced on the calcareous soils of this region is fully the equal of the famous Indian River grapefruit of commerce, but shippers and canners discount the excellent flavor of any fruit that is excessively seedy.

Technical description: Form oblate, 10.7 x 9.2 cm.; weight, 497.9 gms.; stem end, smooth; blossom end, smooth; rind, color yellow, surface, slightly rough, thickness 7.6 mm.; segments 12-14, average 12.7, regular; septa texture, medium; flesh color, yellow; appearance of flesh texture, medium; juice sacs, medium size; core type, closed, medium size; number of seed 47-61, average 56.2; volume of juice, 207.5 cc.; per cent juice by wt., 43.4; typical seed 15 x 8 mm.; total solids, 11.05; acid, 1.74; solids to acid ratio, 6.35:1. The McCarty is an early, oblate, seedy type, yellow-fleshed fruit, quite similar to the Duncan. Ripening season, October 1 to November 30.

Foster: This pink fleshed bud sport of the Walters grapefruit originated in Florida. Under Valley conditions, the Foster is a distinct improvement over its parent variety in quality. Trees of Foster grapefruit are alternate bearers and deteriorate relatively early (Table 1). The fruit of Foster grapefruit is most attractive in appearance because of the pink blush which develops as the fruit ripens. Many persons consider Foster grapefruit to be the finest flavored fruit produced in the Lower Rio Grande Valley. Because of its erratic bearing habits and also because of the seedy nature of the fruits, Foster grapefruit can no longer be considered a variety worthy of propagation (Table 1).

Technical description: Form oblate, 11.2 x 9.7 cm.; weight, 569.0 gms.; stem end, smooth; blossom end, smooth; rind, color yellow with a deep pink blush, surface rough, thickness 7.2 mm.; segments 11-16, average 12.7, fairly regular; septa texture, medium; flesh color, light pink; appearance of flesh texture, medium; juice sacs, medium size; core type closed, medium size; number of seed, 42-55, average 47.4; volume of juice, 254.1 cc.; per cent juice by wt., 46.4; typical seed, 15 x 9 mm.; total solids, 10.10; acid, 1.40; solids to acid ratio, 7.21:1. Ripening season, November 1 to December 15.

Triumph: This variety is listed under grapefruit, but it is undoubtedly an orange-grapefruit hybrid. It is interesting primarily because of the distinctive quality of the juice, which has a decided pummelo flavor with very low acidity (7). Trees of this variety resemble orange trees in their habit of growth and regularly produce large crops of small (size 150) round grapefruit that have coarse pummelo-like flesh and many seeds (Table 9). The fruit is relished by some persons because of its distinctive flavor and low acidity. The variety has no commercial possibilities.

Seedless Types

Marsh (Marsh Seedless): This was the most extensively planted variety of grapefruit in the Valley until the introduction of the Thompson Pink and Ruby (red blush) varieties. The adaptability of this variety to Valley conditions accounts for the extensive planting and present over-production of fruit of this type (6). The tree is quite vigorous and produces high yields of fruit each season. The fruit matures earlier than that from any other grapefruit producing region of the United States (7, 8). When grown on well drained, sandy loam soil, the trees have a relatively long life expectancy. The fruit, when produced on trees in properly managed orchards, has an exceptionally fine texture and is very attractive in appearance. The flesh is tender and mild in flavor. The low acidity of Marsh grapefruit when produced under average Valley conditions has gained recognition for Texas grapefruit in many markets in the United States as fruit of superior dessert quality (Table 9).

Marsh is still the leading commercial variety because of the large acreage planted to trees of this type. The entire canning industry and the main portion of the citrus fruit enterprise is based on this seedless variety. Because of this large acreage there seems to be no advantage in further expanding the plantings of this variety.

Technical description: Form oblate-rounded, 9.08 cm. x 8.18 cm.; wt., 295.2 gms.; stem end smooth, blossom end smooth; rind, color yellow, surface very slightly rough, thickness 6.5 mm.; segments 11-16, average 13, irregular; septa texture, medium; flesh color, yellow; appearance of flesh texture, fine to medium; juice sacs, small to medium; core type fairly dense, medium size; number of seed 1-8, average 3.5; volume of juice, 126.9 cc.; per cent juice by wt., 44.7; typical seed 14 x 9 mm.; total solids, 11.11; acid, 1.50; solids to acid ratio, 7.4:1. Ripening season, October 15 to December 1.

Little River Seedless (Davis Seedless): This seedless variety is said to have originated as a bud sport of Duncan. The fruit possesses some of the good qualities of the parent Duncan variety but does not possess the high flavor characteristic of Duncan. Trees of Little River Seedless grapefruit are similar to Duncan trees in their general appearance, but bear annually in contrast to the parent variety (Table 1). The fruit is relatively seedless and is slightly more acid than that of Marsh which it closely resembles in many respects. Because of its somewhat higher acidity, this could be used as a superior type for marketing late in the season or for holding in storage (Table 9).

Technical description: Form oblate, 9.96 cm. x 8.70 cm.; wt., 410.8 gms.; stem end smooth, blossom end smooth; rind, color yellow, surface slightly rough, thickness 6.8 mm.; segments 11-16, average 12.9; irregular; septa texture, medium; flesh color, yellow; appearance of flesh texture, medium; juice sacs, medium size; core type dense, medium size; number of seed 1-10, average 5.3; volume of juice, 191.0 cc.; per cent juice by wt., 48.4;

typical seed 15 x 9 mm.; total solids, 10.15; acid, 1.68; solids to acid ratio, 6.0:1. Ripening season, October 15 to December 1.

Cecily Seedless: This seedless variety is said to have originated on the Cecil Rhodes properties in South Africa. Trees of this variety are quite similar to those of the Marsh variety in appearance and productive capacity (Table 1). The fruit is so similar to Marsh in all characteristics that for all practical purposes it might be considered identical.

Garner Seedless: This seedless variety originated near Laredo, Texas, and was named for John M. Garner. The tree appears to be quite vigorous and productive. The fruit might be considered by some to be superior to the milder flavored Marsh as Garner grapefruit has a bit of the rugged characteristics of the highly flavored Duncan variety.

Pink Fleshed Seedless Varieties

Thompson Pink (Pink Marsh): This excellent variety originated as a bud sport on a Marsh grapefruit tree in a Florida citrus grove. The tree of the Thompson variety is fully as well adapted and productive as that of the parent (Table 1). Contrary to common belief, the fruit is not inherently small in size, as this character is governed by the amount of fruit produced and by the care and fertilizer the tree receives. The fruit is relatively seedless and the flesh has an attractive pink color, but is similar in all other respects to the parent variety (Table 9). The increased consumer demand for pink fleshed, seedless grapefruit has given impetus to the commercial production of this variety of grapefruit. Thompson Pink is second only in value to its own bud sport, Ruby, a red blushed variety.

Technical description: Form oblate, 10.3 cm. x 8.79 cm.; wt., 438.2 gms.; stem end smooth, blossom end smooth; rind, color yellow, surface slightly rough, thickness 7.3 mm.; segments 11-15, average 13.3; irregular; septa, texture medium; flesh color, light pink; appearance of flesh texture, fine to medium; core type slightly open, medium size; number of seed 2-9, average 5.1; volume of juice, 189.5 cc.; per cent juice by wt., 45.0; typical seed 14 x 10 mm.; total solids, 10.45; acid, 1.56; solids to acid ratio, 6.7:1. The color tends to fade toward the end of the season, leaving an unsightly, blotched appearance. Ripening season, October 15 to December 1.

Ruby (Redblush): This attractive variety originated in the Lower Rio Grande Valley as a bud sport of the Thompson Pink variety. Many of these red fleshed, blushing sports have been discovered but the Ruby, the first to be described, was discovered by Mr. E. A. Henninger of McAllen, Texas (2). Trees of the Ruby grapefruit appear to be fully the equal of their Marsh Seedless grandparent in their adaptability and productive capacity. The young trees are especially precocious and it is not uncommon for three year old trees to yield returns greater than their cost of maintenance.

Fruit of the Ruby grapefruit is unexcelled. The smooth textured, oblate fruits have a most attractive undertone of red that develops into a distinct blush as the fruit reaches maturity. The flesh is spectrum red in color and of somewhat superior quality to Marsh Seedless grapefruit because it contains slightly more acid (Table 9). The attractive color and flavor coupled with the relative seedlessness of this variety would seem to make it the outstanding citrus development since the establishment of the grapefruit industry in the United States.

Technical description: Form oblate, 9.5 x 7.9 cm.; weight, 351.0 gms.; stem end, smooth; blossom end, smooth; rind, color yellow with a deep red blush, surface slightly rough, thickness 6.1 mm.; segments 11-14, average 12.8, fairly regular; septa texture, medium; flesh color, deep pink to light red; appearance of flesh texture, medium; juice sacs, medium size; core type open, medium size; number of seed 2-6, average 4.3; volume of juice, 171.4 cc.; per cent juice by wt., 50.78; typical seed, 14 x 9 mm.; total solids, 10.95; acid, 1.34; solids to acid ratio, 8.17:1. Ripening season, October 1 to November 30.

Pummelo Varieties

The pummelos (shaddocks) are an interesting group of citrus fruits and are generally considered to be the progenitors of the grapefruit, as we know it today. The Chinese pummelos, as typified by the Thong Dee variety, are characterized by the large, thick-skinned coarse fruits which have equally coarse flesh. The pulp of the pummelo has a distinctive odor and flavor that is not relished by many persons. The red fleshed pummelos are prized by some persons as a salad fruit. The large, thickwalled juice sacs, which are easily separated from the membranes, make a most attractive salad base. All varieties of pummelos are excessively seedy and are characterized by the strong musky flavor and aroma of the pulp.

ORANGES

It is now known that orange trees are even better adapted to conditions in the Lower Rio Grande Valley than are grapefruit trees. The young trees do not come into heavy bearing quite as early as do young trees of grapefruit, but old trees bear regularly and heavily and the fruit is at present more valuable commercially than that of standard varieties of grapefruit. From the commercial standpoint, orange varieties may be divided into four groups (1) early seedless varieties, (2) early seedy varieties, (3) late oranges, and (4) navel oranges.

Early Seedless Varieties

Hamlin (Norris Seedless): This early maturing seedless variety was introduced into the Valley from Florida in 1924. The oldest specimens are tremendous trees with enormous bearing capacity. It is not uncommon for trees of this variety to produce more than a thousand pounds of

oranges annually. Hamlin trees are very precocious and produce heavy crops of fruit each season. No known variety will outyield this one on good Valley soil (Table 2).

The fruit is of fine texture and has a skin that is as smooth as a kid glove. The interior quality is excellent, there are comparatively few seeds, and the pulp has a mild flavor and is almost devoid of acid (Table 7). When the trees are grown on good soil and properly cared for, the fruit is not subject to splitting or drying within its normal ripening season. The high productive capacity of the trees and the ready market for the fruit makes this variety a favorite with Valley growers. The tendency of the trees to produce small size fruit, its rather poor shipping and keeping quality and its tendency to lose flavor after December are rather serious faults of the variety.

Table 2. Variety test of round oranges, yields in pounds per tree, 1934-1938

Variety	Year set	1934	1935	1936	1937	1938	Avg.
Hamlin.....	1925	288.3	381.3	727.3	560.0	885.0	568.4
Hamlin.....	1927	196.3	264.7	586.3	517.0	655.0	443.9
Hamlin.....	1929	152.0	106.5	420.0	361.0	489.5	305.8
H. mossasa.....	1927	145.7	175.3	385.0	368.0	404.7	295.7
Joppa.....	1927	72.5	178.5	498.5	251.5	678.5	335.9
Lou Gim Gong.....	1925	166.7	351.3	526.3	240.4	431.1	343.2
Lou Gim Gong.....	1927	54.0	113.0	316.7	104.0	198.7	157.3
Malta Blood.....	1927	115.0	141.0	43.0	340.0	238.0	175.4
Parson Brown.....	1925	261.3	230.7	577.3	355.7	659.7	416.9
Parson Brown.....	1925	255.0	272.3	630.0	432.0	818.3	481.5
Parson Brown.....	1927	142.0	167.7	300.0	329.7	316.7	251.2
Pineapple.....	1925	148.0	59.0	355.5	267.5	484.0	263.0
Pineapple.....	1925	242.0	190.0	536.7	272.7	712.0	390.7
Pineapple.....	1927	128.7	91.7	352.7	212.0	497.0	256.4
Round O. No. 37783.....	1925	120.0	198.0	359.0	360.0	588.0	325.0
Ruby Blood.....	1925	161.7	189.0	442.7	273.3	731.7	359.7
Ruby Blood.....	1927	135.0	197.0	200.0	510.0	524.0	322.0
Valencia.....	1925	153.3	230.3	539.3	197.3	384.0	300.8
Valencia.....	1925	183.3	322.3	590.0	321.3	468.7	377.1
Valencia.....	1927	50.0	147.0	329.7	340.0	303.1	234.0

Technical description: Form rounded, 6.98 cm. x 6.68 cm.; wt., 174.4 gms.; stem end smooth, blossom end smooth; rind, color light orange, surface fairly smooth, thickness 3.4 mm.; segments 9-13, average 10.8, regular; septa texture, medium; flesh color, pale orange; appearance of flesh texture, medium; juice sacs, medium size; core type dense to closed, size medium; number of seed 2-11, average 5.4; volume of juice, 65.9 cc.; per cent juice by wt., 44.5; typical seed, 13 x 8 mm.; total solids, 11.51; acid, .81; solids to acid ratio, 14.2:1. Ripening season, October 15.

Joppa (Joppa Seedless): This is the only variety which offers serious competition to Hamlin. It originated as a seedling of the famous Chamouti orange which is the leading orange variety on European markets. The trees are characterized by an upright habit of growth somewhat similar to that of the Navel variety. They are not nearly so precocious as those

of the Hamlin variety, nor do they seem to have its exceptionally high productive capacity (Table 2). They are more like trees of the Valencia variety in their fruiting habits.

Fruit of the Joppa orange is similar to that of the Hamlin orange both in size and in external appearance. Because of its heavier rind it has superior shipping and keeping quality compared to Hamlin fruit. Joppa fruits are relatively seedless, the pulp has a fine texture, and a pleasing subacid flavor (Table 7). Because fruit of the Joppa variety holds its fine flavor until late in the season and because of the superior shipping and keeping quality of the fruit, it would seem worthy of propagation on a commercial scale.

Technical description: Form rounded, 7.48 cm. x 7.25 cm.; wt., 215.5 gms.; stem end, smooth; blossom end, smooth; rind, color yellow, surface, rough, thickness, 3.0 mm.; segments, 9-12, average, 10.23, fairly irregular; septa texture, tough; flesh color, yellow-orange; appearance of flesh texture, medium; juice sacs, medium; core type, dense, medium size; number of seed, 5-16, average, 9.36; volume of juice, 113.13 cc.; per cent juice by wt., 54.86; typical seed, 12 x 7 mm.; total solids, 11.31; acid, .92; solids to acid ratio, 12.29:1. Ripening season October 15.

Texas Seedless: This is an early maturing bud sport of the Lou Gim Gong variety that originated in the Valley. This variety is in a somewhat unstable state as a few limbs on some of the trees produce fruit having perfect navel markings. Trees are somewhat more vigorous than those of the parent variety and produce good yields of comparatively large sized fruit. The fruit is similar to that of Lou Gim Gong in appearance, but it colors and ripens somewhat earlier. It seems to be entirely seedless and to have excellent interior quality. Because of the fine qualities of the fruit, and also because it ripens between the Hamlin and Valencia seasons, this variety may prove to be worthy of propagation on a commercial scale.

Rico Oranges: This group of varieties represent outstanding seedlings selected by Mr. A. D. Shamel during an expedition through the island of Porto Rico in 1932. Some of these appear to have exceptional vigor, the habit of growth being similar to that of navel orange trees. Fruit of the best selection of Rico oranges is oval in shape, practically seedless, and quite similar to the Joppa orange in many respects. Information pertaining to these varieties is too limited to justify any recommendation, but it now seems that they may be worthy of consideration.

Early Seedy Types

Pineapple: The Pineapple variety is probably the best known and most widely planted of the early maturing varieties that have an objectionable number of seeds. The trees are highly productive, and bear heavy crops every year (Table 2). The fruit is in no way superior to that of the Hamlin variety, and its objectionable seediness causes it to sell at a lower price. There appears to be no justification for continuing this variety commercially.

Technical description: Form rounded, 7.83 cm. x 7.32 cm.; wt., 241.56 gms.; stem end, smooth; blossom end, smooth; rind, color yellow, surface, rough, thickness, 3.66 mm.; segments, 10-13, average, 11.06, fairly irregular; septa texture, medium; flesh color, yellow-orange; appearance of flesh texture, medium; juice sacs, medium; core type, closed, medium size; number of seed, 8-19, average, 12.96; volume of juice, 120.63 cc.; per cent juice by wt., 51.93; typical seed, 16 x 13 mm., 6 x 7 mm.; total solids, 9.99; acid .63; solids to acid ratio, 14.27:1. Ripening season, October 15 to November 1.

Parson Brown: This is an early maturing variety that is similar to Pineapple in many respects and is sold through commercial channels as Pineapple orange. The trees have high productive capacity and bear every year (Table 2). The fruit matures at the same season as Hamlin, and somewhat earlier than Pineapple. Because of its objectionable seediness, it has lost favor with Valley growers.

Technical description: Form rounded to slightly oblate, 6.75 cm. x 6.41 cm.; wt., 122.3 gms.; stem end, smooth, blossom end smooth; rind, color deep orange, surface smooth, thickness 2.7 mm.; segments 9-13, average 10.9; fairly irregular; septa texture, medium; flesh color, light orange; appearance of flesh texture, medium; juice sacs, medium size; core type closed, medium size; number of seed 10-28, average 18.7; volume of juice, 61.6 cc.; per cent juice by wt., 43.9; typical seed 13 x 9 mm., 19 x 7 mm.; total solids, 12.00; acid, .77; solids to acid ratio, 15.5:1. Ripening season, October 15.

Homossasa: This variety, which is a favorite with some Florida growers, has few qualities to recommend it to Valley orchardists. The trees are vigorous but not so productive as those of the Hamlin variety (Table 2). Fruit of the Homossasa is more like that of the Joppa orange in appearance but is objectionably seedy. There appears to be no good reason for propagating this variety in the Valley.

Technical description: Form rounded, 8.37 cm. x 8.15 cm.; wt., 302.9 gms.; stem end, smooth; blossom end, smooth; rind, color yellow, surface rough, thickness, 4.36 mm.; segments, 9-13, average, 10.56, fairly irregular; septa texture, medium; flesh color, yellow-orange; appearance of flesh texture, medium; juice sacs, medium; core type, closed, medium size; number of seed, 2-27, average, 15.5; volume of juice, 142.3 cc.; per cent of juice by wt., 48.80; typical seed, 14 x 8 mm.; total solids, 9.86; acid, .61; solids to acid ratio, 16.16:1. Ripening season, December 1.

Mediterranean Sweet: This variety was introduced from Florida with the claim that it had superior quality. The trees are quite similar to those of the Pineapple variety both in appearance and performance. The fruit is just another seedy orange with no distinctive characteristics to recommend it.

Blood Oranges

Ruby (Ruby Blood): This variety is the most desirable in this group. The trees are vigorous and regularly produce heavy yields of fruit (Table

2). The fruit is similar to that of the Pineapple variety in external appearance and has fewer seed and a more sprightly flavor. There are no blood markings in the pulp of this orange when grown under Valley conditions, as is the case with the Malta Blood orange. The Ruby Blood is the only one of this group that has any possibilities as a commercial variety, and it must be considered inferior to varieties such as Hamlin and Joppa for commercial planting.

Technical description: Form rounded to slightly oblate, 7.74 cm. x 7.14 cm., wt. 217.44 gms.; stem end very slight basined, blossom end smooth; rind, color light orange, surface rough, fairly tough; thickness, 4.01 cm.; segments 11-12, irregular; septa texture, medium; juice sacs, medium length and narrow; appearance of flesh texture, medium; core type closed, size small, texture coarse; number of seed 13-14, mean wt. .28 gms., color cross-section, white. Volume of juice, 97.80 cc.; per cent juice by wt., 45.75. Total solids, 10.36; acids, 1.75; sugar to acid ratio, 13.85:1. Although it is a blood orange, the red pigmentation is mottled or entirely lacking when grown in the Lower Rio Grande Valley. Ripening season, November 15 to December 1.

Malta Blood: This is the only one of the blood oranges that shows any of the usual, distinctive blood markings in the pulp. The trees are vigorous but do not produce as regularly nor as heavily as do those of the Ruby Blood (Table 2). The oblong fruits are at their best during January. Because of their intense sweetness, they appeal to many consumers.

St. Michael Blood: This thin skinned variety is interesting because it is one of the really worthless varieties that has been sold to unsuspecting orchardists. The trees are not as vigorous as those of the Hamlin and they shed fruit excessively when conditions are even moderately unfavorable. The fruit is small, very thin skinned and has few qualities to recommend it. A large portion of the crop is lost each season from splitting.

Late Varieties

Late varieties of oranges might be classified as those types that, because of their relatively high acidity, must be withheld from the market until after February first.

Valencia: This is undoubtedly the most widely planted variety of orange in the world as most of the new plantings in South America, South Africa and the Eastern Mediterranean region have been set to this variety. It is the most profitable variety of orange grown in California and large acreages of young trees have been planted in both Florida and Texas. The cold hazard is the principal factor limiting the popularity of this variety in the Valley.

The trees are fairly vigorous but are not so precocious nor so productive as those of the Hamlin variety (Table 2). The fruits average somewhat larger in size than those of the Hamlin orange but have a thicker, rougher rind that imparts better shipping and keeping quality. They contain rela-

tively few seeds, and the pulp is firm and has a sprightly acid, true orange flavor. This is the standard late variety and much of the new acreage will be planted to Valencia oranges.

Technical description: Form, rounded 7.7 x 7.3 cm.; weight, 232.9 gms.; stem end, smooth; blossom end, smooth; rind color, light orange, surface rough, thickness 4.5 mm.; segments 10-13, average 11.6, slightly irregular; septa texture, medium; flesh color, orange; appearance of flesh texture, medium; juice sacs, medium size; core type dense, medium size; number of seed 0-12, average 4.6; volume of juice, 114.8 cc.; per cent juice by wt., 51.3; typical seed, 17 x 7 mm.; total solids, 11.35; acid, .92; solids to acid ratio, 12.3:1. Ripening season, January 15 to February 1.

Lou Gim Gong: This late variety originated as a seedling of the Valencia orange and is thought by some to be identical to the parent tree. There is some evidence that fruit of this variety colors and ripens somewhat earlier than that of the Valencia. The trees are as vigorous and productive as comparable Valencia trees (Table 2), and some growers claim they produce larger fruits. A bud sport of the Lou Gim Gong, the Texas Seedless, definitely does produce fruits that mature earlier and are larger in size than those of the Valencia variety. It is the opinion of some growers that the fruits of Lou Gim Gong are less subject to splitting than those of the Valencia variety.

Pervis: This is a strain of Valencia orange that is said to be much more resistant to cold than the parent type. The trees and fruit appear to be identical with Valencia, and there seems to be no good reason to consider this as a distinct variety.

Navel Oranges

This group of large fruited varieties is characterized by the vigorous upright growth habits of the trees and their shy, alternate bearing habits. The fruit of most strains is large, coarse, and of questionable quality.

Washington Navel: This variety which attains such perfection in California is not adapted to Valley conditions. The trees are erratic producers and the fruit lacks uniformity in size and quality. During certain seasons the fruit shows poor shipping quality. The trees develop rapidly and are quite vigorous but bear normal crops only occasionally (Table 3). The fruit is large (Table 7) and rather irregular in shape. The quality of Washington Navel oranges is dependent on the weather during the ripening season. Abundant rainfall causes the fruit to be watery and insipid, while dry windy weather causes the fruit to be ricey in texture and lacking in juice.

Technical description: Form rounded, 8.45 cm. x 8.58 cm.; wt., 316.7 gms.; stem end smooth, navel small, even; rind, color light orange, surface rough, thickness 4.4 mm.; segments 9-14, average 10.6, fairly irregular; septa texture, medium; flesh color, pale orange; appearance of flesh tex-

ture, medium; juice sacs, medium size; core type dense, size medium; number of seed 0-10, average 1.9; volume of juice, 131.6 cc.; per cent juice by wt., 42.2; typical seed 13 x 10 mm.; total solids, 13.10; acid, .58; solids to acid ratio, 22.5:1. Ripening season, October 15 to November 1.

Thompson Navel: This variety is sometimes known as the "wooden" orange because of its tendency toward internal drying. The trees are similar to those of the Washington Navel, and are fully as erratic in their bearing habits. The fruits are much smoother in appearance than those of the Washington Navel but the internal quality is even more variable than that of the parent variety.

Buckeye Navel: This bud sport of the Washington Navel variety appears to be distinctly superior to the original type under Valley conditions both as to the uniformity of the fruit and interior quality.

Sunny Mountain Navel: This strain which appears to be superior under California conditions has proven to be disappointing here in the Valley. The fruits appear to be typical of the Washington Navel variety.

Surprise Navel: This strain of the Washington Navel orange originated in Florida and is said to have some points in its favor. It has never assumed commercial importance in that state and cannot be considered worthy of propagation in this region. The surprise apparently refers to the shock one receives when he cuts a fruit of this variety anticipating something good.

Navelencia: This outcast of the Navel family is also referred to as the wooden orange because of its poor interior quality.

Rio Grande Navel: This name is applied to one of a number of Brazilian Navel selections which were made by A. D. Shamel in the original home of the Washington Navel variety. Several of these strains are distinctly superior to other varieties of Navel oranges in that they regularly produce good crops of fairly uniform fruit that is not subject to internal drying. The best selection (P. I. 37769) has been named Rio Grande. Trees of this strain attain large size and are quite vigorous. When mature, tree

Table 3. Variety test of navel oranges, yields in pounds per tree, 1934-1938

Variety	Year set	1934	1935	1936	1937	1938	Avg.
Buckeye Navel.....	1927	49.5	79.5	134.0	203.0	111.5	115.5
Navel P. I. 37783.....	1925	105	359	470	320	536	358.0
Navel P. I. 37758.....	1925	32.0	341.0	337.0	454.5	426.5	318.2
Navel O. P. I. 37766.....	1925	122	358	435	510	588	402.6
Navel O. P. I. 37769.....	1925	105.3	444.3	424.3	503.0	572.7	409.9
Seedless Navel O. P. I. 37788.....	1925	72.0	385.0	628.0	552.5	770.0	481.5
Spiny Navel.....	1927	125.0	254.7	171.1	333.0	162.0	209.2
Texas Navel P. I. 37783.....	1925	475	518	500	391	618	500.4
Texas Navel P. I. 37758.....	1925	480.0	511.0	574.0	695.0	595.0	571.0
Washington Navel.....	1925	63.0	123.0	325.0	280.0	400.0	238.2
Washington Navel.....	1927	79.7	204.0	232.7	189.0	291.7	199.4

yields range well above 500 pounds of fruit per tree annually. Fruit of the Rio Grande strain is superior in uniformity and conformation to either that of Washington Navel or Texas Navel, but the interior quality of the flesh is not nearly the equal of the latter variety.

Technical description: Form rounded, 7.7 cm. x 7.9 cm.; wt., 239.5 gms.; stem end, smooth; navel medium size, even; rind color, light orange, surface rough, thickness 3.9 mm.; segments 8-12, average 10.8, fairly irregular; septa texture, medium; flesh color, pale orange; appearance of flesh texture, medium; juice sacs, medium size; core type closed, medium size; number of seed 1-7, average 2.9; volume of juice 93.3 cc.; per cent juice by wt., 40.5; typical seed, 13 x 9 mm.; total solids, 7.90; acid .69; solids to acid ratio, 11.14:1. Ripening season, October 15 to November 1.

Texas Navel: This strain was introduced with a group of Brazilian Navel oranges. The exceptional vigor of the trees, their tendency to produce regularly good crops of medium sized fruits (Table 3), and the sprightly flavor of the fruit (Table 8) first attracted attention to trees of this parentage. The trees are extremely vigorous, being much larger than any trees in the station collection. Average yields range considerably higher than those of the standard Washington Navel variety.

The fruit is rather irregular and somewhat coarse in appearance, but the interior quality is definitely superior to that of any other Navel oranges in the station collection. For growers who desire to increase plantings of Navel oranges, this strain has possibilities especially for border planting to afford wind protection to less vigorous varieties.

Technical description: Form rounded, 7.96 cm. x 7.27 cm.; wt., 244.6 gms.; stem end, smooth, navel medium size, very slightly protruding; rind, color light orange, surface rough, thickness 3.6 mm.; segments 9-12, average 10.7, fairly irregular; septa texture, medium; flesh color, pale orange; appearance of flesh texture, medium; juice sacs, medium size; core type closed, medium size; number of seed 1-7, average 2.7; volume of juice, 90.2 cc.; per cent juice by wt., 44.5; typical seed, 8 x 11 x 15 mm.; total solids, 11.25; acid, .88; solids to acid ratio, 12.7:1. Ripening season, October 15 to November 1.

TANGELOS

These hybrid fruits, which were developed by workers of the U. S. Department of Agriculture by crossing grapefruit and tangerine, are useful for home planting but few commercial plantings have been made. Because of their perishable nature they are much more difficult to merchandise than are round oranges and grapefruit. Most of these fruits more closely resemble the Mandarin orange parent than they do their pomelo parent.

Early Varieties

Thornton: This is the best known of the worthy tangelo varieties of the U. S. D. A. The trees are similar to those of the standard grapefruit

varieties but average smaller in size. Mature trees bear crops ranging around 500 pounds per tree annually. The fruit resembles a small, warty grapefruit in appearance both inside and out. The pulp is light straw color and has the melting consistency of its tangerine parent. The fruit is a perfect blending of the best flavor to be found in the tangerine and the grapefruit, with the grapefruit flavor predominating (Table 4). This attractive fruit is comparable to the Temple orange, but is doomed to oblivion because of seemingly insurmountable marketing difficulties.

Mineola: This beautiful fruit represents the best of this type. The trees are similar to those of Thornton in size, type and productive capacity. The fruit is about the size of a large Temple orange, has the high color and general shape of the Dancy tangerine, and deep orange-red flesh of melting consistency. The flavor represents a perfect blending of the juice of the King Mandarin with the McCarty grapefruit (Table 4). It is unfortunate that the public must be deprived of the pleasure of enjoying this superb fruit. Until marketing difficulties can be overcome, plantings of this variety should be limited to door yard orchards.

Altoona: The trees and fruit of this variety are somewhat similar to the Mineola (Table 4), which is to be preferred for home planting.

Clemente: This is a large fruited variety that partakes more of the nature of its grapefruit parent. The tree is quite similar to that of the other tangelos. The fruit is similar in form and general appearance to that of the Thornton tangelo having a warty yellow rind, but it averages considerably larger in size. The flesh is yellowish and has the tenderness of a Mandarin orange. There is some of the distinctive flavor of the tangerine, but the grapefruit flavor predominates (Table 4). This variety has nothing to recommend it above varieties such as Thornton or Mineola.

Lake: This early ripening tangelo might be considered to be an orange of the Temple type. The trees might be said to have two objectionable tendencies. They have an upright habit of growth, resemble seedling trees in appearance, and are extremely thorny. They are not as productive as some of the other varieties of tangelos. The fruit resembles those of the Temple orange in size and shape but lacks the rich color of that variety. The flesh is light orange in color, but has the tenderness typical of the tangerine fruits. The flavor lacks the distinctive character of the Temple orange but would be rated as highly acceptable by most consumers (Table 4). Because of the undesirable characteristics of the trees, this variety is unlikely to become commercially important.

Wekiwa (Pink Fleshed Tangelo): This is the first citrus fruit to ripen during the early fall season. The trees of this variety are quite small in size and resemble miniature grapefruit trees. They regularly produce heavy crops. The fruits resemble tangerines in size and shape, but have the external and interior coloring of the Foster grapefruit. The straw-colored flesh is flecked with pink, but lacks the melting texture character-

istic of other tangelos. The flavor is mildly subacid with a faint suggestion of the pummelo. (Table 4). This is strictly a home orchard variety for juicing.

Late Varieties

Temple: The origin of Temple is unknown. It appears to be a Mandarin hybrid. It is propagated commercially, but has encountered serious marketing difficulties. The tree is a beautiful, gracefully spreading tree of the Mandarin orange type that attains considerable size and produces heavy crops of fruit each year (Table 5). As is typical of many Mandarin oranges, Temple trees have a tendency to shed a considerable portion of their fruit at the least provocation. When the crop is harvested before serious dropping occurs, mature trees will yield well over 600 pounds per tree annually.

Fruit of the Temple orange is attractive in appearance and the flavor of a well ripened fruit is unsurpassed by any variety of citrus. In external appearance the fruit resembles a large sized tangerine having a pebbly skin that is a deep orange color overlaid with tangerine red. The internal structure of the fruit is typical of the Mandarin oranges having a deep orange-red color and very tender flesh. The flavor of the pulp is an unexcelled blending of sweetness, acidity and slight bitterness that is attained in no other fruit. The large number of seeds is a serious fault of this variety (Tables 4 and 7). It is unfortunate that fruit having the fine characteristics of the Temple orange should not be available to the buying public. Losses incurred in shipping and marketing this fruit tend to make it a high priced commodity. Its commercial planting is not being encouraged.

Technical description: Form, oblate-rounded, 7.6 x 6.5 cm.; wt., 212.7 gms.; stem-end, smooth; blossom end, very slightly basined; rind color, deep orange, surface rough, thickness 3 mm.; segments 10-14, average 11.5, fairly regular; septa texture, fine; flesh color, deep orange; appearance of flesh texture, fine; juice sacs, small; core type open, medium size; number of seed 22-30, average 26.2; volume of juice, 108.5 cc.; per cent juice by wt., 53.0; typical seed, 13 x 7 mm.; total solids, 12.80; acid, 1.26; solids to acid ratio, 10.2:1. Peel separates easily from pulp, not a good shipper. Ripening season, January 1 to January 15.

Sampson: This is the best known of the smooth skinned, worthless varieties of Tangelo. The trees resemble small grapefruit trees in appearance and regularly produce heavy crops of fruits that have an attractive appearance. The fruit resembles a large tangerine in size and shape, but has the color and smoothness of an orange. The flesh has a rich orange color and a flavor that combines the worst features of the strongest flavored tangerine and a sour orange (Table 4).

Mandelo: Trees of this variety are quite similar to the Sampson tangelo in size, general appearance and bearing capacity. The fruit resembles an oblong, smooth skinned lemon in appearance and is fully as poor as Sampson in flavor (Table 4).

Table 4. Tangelo variety test

Variety	Season of Ripening	Vigor	Pre-cocity	Productivity	Size	Shape	Smoothness	Color		Flavor	Seedlessness	Rag
								Rind	Flesh			
Altoona.....	medium	8	7	6	6	oblate	9	lemon	orange	8	5	9
Clemente.....	medium	8	7	7	8	oblate	6	lemon	lemon	8	3	9
Lake.....	early	5	4	3	6	oblate	7	orange	orange	8	5	9
Mandelo.....	late	7	7	9	4	oblong	9	lemon	lemon	3	5	9
Mineola.....	medium	8	7	8	6	oblate	7	orange	orange-red	9	4	9
Sampson.....	late	9	8	9	3	oblate	9	orange	orange	1	2	9
Seminole.....	late	8	7	8	6	oblate	6	lemon	lemon	1	2	8
Temple.....	late	7	9	9	6	oblate	9	orange	orange	7	8	9
Thornton.....	early	8	7	9	4	oblate	6	lemon	lemon	9	3	7
Umatillo.....	late	9	9	9	6	oblate	6	orange-red	orange-red	9	3	9
Wekiwa.....	early	6	9	9	3	oblate	8	pale yellow	pink	8	5	6
Yalaha.....	late	6	5	6	5	oblate	9	lemon	lemon	5	6	9

Legend:

Very vigorous-9; medium vigor-5; weak-0.
 Very precocious-9; yield in fourth year-5; slow-0.
 Very productive-9; fairly productive-5; unproductive-0.
 Very large-9; medium sized-5; small-0.
 Very smooth-9; medium smooth-5; very rough-0.
 Excellent flavor-9; satisfactory-5; very poor-0.
 Seedless-9; few seeds-5; very seedy-0.
 No rag-9; fairly fibrous-5; very fibrous-0.

Yalaha: Trees of this variety are somewhat similar to those of the Lake but are more prolific. The fruit is similar to that of the Thornton in external appearance, but it has the rind and flesh color of the Lake tangelo. As grown in the Lower Valley the flavor is an unfortunate combination of bitterness, sourness and muskiness (Table 4).

Seminole: Trees of this variety appear to be vigorous and quite productive. They are similar in shape to those of the grapefruit but are smaller in size. The fruit is somewhat similar in appearance to that of the Clemente but the flavor of the pulp is extremely unpalatable.

Umatillo: This extremely late maturing variety is even more attractive in appearance than Mineola. The trees resemble those of Thornton in general appearance and productive capacity. The fruits are similar to those of the Temple orange in size and shape but resemble a small bright orange colored grapefruit in smoothness and general appearance. The flesh has the color of that of the King Mandarin and is quite tender. The flavor of the Dancy tangerine predominates and the juice is sharply acid (Table 4), even when the fruit is fully ripe. A fruit of this type might appeal to the fountain trade, where highly colored, acid fruits are in demand.

MANDARINS AND TANGERINES

The slip skin, or kid-glove type, of orange has never attained much commercial importance in the United States. The most extensive plantings of tangerines and satsumas have been made in Florida and in the Gulf Coast region of several southern states. Due to their perishable nature, it seems impracticable to merchandise this type of fruit so as to yield the producers a reasonable profit.

Unfortunately, all of the commercial varieties of Mandarin oranges produce fruits which have rinds that predispose them to bruising. Most varieties are objectionably seedy and have a relatively high percentage of rag and low percentage of juice.

Dancy: This is the best known and the most extensively planted of the tangerine varieties. The trees are relatively short lived under normal Valley conditions but regularly produce heavy crops of fruit that matures in mid-December (Table 5). The fruit is relatively small in size and is highly colored inside and out. It contains an objectionable amount of rag, and the flavor is too strong to be highly acceptable to most consumers. There is a limited demand for fruit of this type, but a tangerine enterprise is too highly speculative to be recommended.

Technical description: Form oblate, 5.84 cm. x 4.89 cm.; wt., 90.3 gms.; stem end slightly necked, blossom end slightly basined; rind, color deep orange, surface fairly smooth, thickness 2.0 mm.; segments 8-13, average 10.7; fairly regular; septa texture, coarse; flesh color, deep orange; appearance of flesh texture, coarse; juice sacs, large; core type open, large; number of seed 10-22, average 15.2; volume of juice, 36.1 cc.; per cent

Table 5. Mandarin orange and tangelo variety test, Yield in pounds per tree, 1934-1938

Variety	Year set	1934	1935	1936	1937	1938	Avg.
Clementine Tangerine....	1927	145.7	232.0	451.0	241.0	551.3	324.2
Dancy Tangerine.....	1925	321.0	543.0	396.0	195.0	337.5	358.5
King Mandarin*.....	1925	85.0	0.0	10.0	30.0	10.0	27.0
Temple Orange.....	1925	165.0	498.7	664.7	749.0	826.7	580.8
Temple Orange.....	1927	182.7	259.3	256.7	341.1	433.3	294.6
Thornton Tangelo.....	1927	191.3	240.7	477.3	356.3	571.0	367.3
Willow Leaf Mandarin....	1927	357.7	306.0	496.0	396.0	454.7	402.1

*On Rough Lemon.

juice by wt., 43.3; typical seed 12 x 4 mm.; total solids, 12.55; acid, 1.29; solids to acid ratio, 9.7:1. Ripening season, December 1 to January 1.

Warnurco: This is the large fruited mid-season (November) tangerine. The trees have an upright habit of growth and regularly produce abundant crops of fruit. The fruits resemble those of the Temple orange in general appearance, but are lighter in color. The pulp is milder in flavor than that of the Dancy tangerine, but the percentage of rag (fiber) is especially high. There appears to be no justification for the commercial propagation of this variety.

Clementine (Algerian): This variety of tangerine was developed by Father Clemente and was sent to this country from the Botanical Gardens of the Sultan of Algeria. The trees are quite vigorous and produce heavy crops of fruit over a long period of years (Table 5). The trees resemble those of the wild Mandarin in appearance and are quite attractive.

The fruits are relatively small in size, and lack the deep color that is characteristic of Dancy. The first fruits ripen in October and the crop should be harvested before December, as over-ripe fruit deteriorates rapidly. The flavor is much milder than that of the Dancy tangerine and is highly acceptable to most persons. The pulp is less fibrous than that of Dancy but extreme seediness is an objectionable feature. Unless Valley shippers will agree to open the tangerine shipping season in November, the acreage planted to this variety should not be further increased.

Technical description: Form oblate, 6.00 cm. x 4.97 cm.; wt., 97.8 gms.; stem end fairly smooth, blossom end slightly basined; rind color, deep orange, surface rough, thickness 2.2 mm.; segments 8-13, average 9.6; fairly regular; septa texture, coarse; flesh color, deep orange; appearance of flesh texture, slightly coarse; juice sacs, fairly large; core type open, large; number of seed 5-25, average 13.8; volume of juice, 33.4 cc.; per cent juice by wt., 43.2; typical seed, 8 x 6 mm.; total solids, 13.97; acid, 1.15; solids to acid ratio, 12.1:1. Ripening season, October 15 to November 1.

Spice (Willow Leaf): This variety of Mandarin has little or no commercial value. The trees are attractive in appearance and produce good

crops of fruit (Table 5). The fruit is similar to that of the Clementine in size and general appearance, but is lighter in color. The pulp has a high percentage of rag and a pleasing spicy aroma. There is no market demand for fruit of this type.

Technical description: Form oblate, 6.41 cm. x 5.41 cm.; wt., 117.93 gms.; stem end moderately necked, blossom end slightly basined; rind, color orange, surface rough, fairly tough; thickness, 3.1 cm; segments 11-12, irregular; septa texture, medium; juice sacs, short and wide; appearance of flesh texture, medium; core type, open; size fairly large, texture coarse; number of seed 24-25, average, 24.9; volume of juice, 35.46 cc.; per cent juice by wt., 29.80; total solids, 12.05; acid, 1.06; sugar to acid ratio, 11.37:1. Ripening season, November 15 to December 1. Ripens before Dancy but later than Clementine.

King: This large fruited late maturing mandarin orange is not adapted in the Lower Rio Grande Valley. The trees have an upright habit of growth, are unattractive in appearance and are lacking in productivity (Table 5). The fruit is larger than that of the Temple orange and is much rougher in appearance. The pulp has a rich reddish-orange color, but the percentage of juice, by weight, is relatively low due to the thick rind, abundance of seed and rag. Temple is far superior to the King mandarin under Valley conditions.

Kinnow: This King x Satsuma hybrid appears to offer some promise in the Valley as a late December variety. The young trees appear to be quite productive. The fruits resemble a smooth Temple orange in general appearance, and the interior quality is good. The fruit seems to have less rag and much better flavor than the Dancy tangerine.

Owari Satsuma: This tangerine-like fruit ripens at about the same season as the Clementine tangerine (October 15) but must be grown on citrange stock to be successful under Valley conditions. The trees are quite hardy to cold. They have a weeping willow-like habit of growth and the foliage is not as dense as that of other citrus varieties. The fruits are somewhat similar to the Clementine tangerine in general appearance but are larger. During a favorable season, the fruits contain a relatively high percentage of juice of pleasing, mild flavor. The percentage of rag and the number of seeds are less than that found in fruits of the Clementine variety (Table 8).

Technical description: Form oblate, 6.3 x 4.9 cm.; weight, 104.1 gms.; stem end, smooth; blossom end, smooth; rind, color light orange, surface rough, thickness 3.4 mm.; segments 8-13, average 10.7, fairly regular; septa texture, medium; flesh color, orange; appearance of flesh texture, fine; juice sacs, fairly small; core type open, medium size; number of seed 0-8, average 3.6; volume of juice, 41.9 cc.; per cent juice by wt., 41.9; typical seed, 11.4 x 7.3 mm.; total solids, 11.55; acid, .92; solids to acid ratio, 12.5:1. Ripening season, September 15 to October 15.

LEMONS

Lemons have been quite popular with orchard property developers because of the good financial returns received for summer fruit. Since most commercial varieties of lemons are quite tender to cold, commercial plantings should be limited to acreage that can be protected by heating.

Eureka: This is the standard commercial variety and seems to thrive under Valley conditions. The trees are large and vigorous and produce a high percentage of summer fruit. Because of the dense nature of their growth, they require considerably more pruning than other types of citrus. They are much less thorny than those of the Lisbon variety but are somewhat more tender to cold.

The fruit is distinctly more uniform than that of the Lisbon, but it is not as smooth skinned as that of the Meyer variety. It contains few seeds and the percentage of acid in the juice is relatively high (Table 6). The juice content even of cured Eureka lemons is much less than that of uncured fruits of the Meyer variety. Eureka is probably the best of the cold tender commercial varieties available for planting.

Lisbon: This old variety appears to be somewhat more hardy to cold than Eureka. Extreme thorniness of the trees is a highly objectionable feature. The trees are quite vigorous but are not as productive as those of Eureka (Table 6). The fruits are quite rough, lack uniformity and are not the equal of those of Eureka. There appears to be no justification for the commercial propagation of Lisbon lemons in this region.

Hayden: This is a variety that was discovered near Edinburg, Texas. The trees are similar in appearance to Eureka and are said to produce good crops of fruit. The fruit is distinctly oblong and remarkably smooth for a lemon. There are practically no seeds and the juice is abundant and highly acid (Table 6). This recently discovered type seems to have possibilities.

Meyer: This hardy lemon was introduced from China by the U. S. Department of Agriculture plant explorer, Frank Meyer. It has never been propagated commercially except in the Lower Rio Grande Valley. It is the most resistant to cold of any commercial variety of lemon. The trees are somewhat like those of the Eureka in appearance, but also have some of the spreading characteristics of the Mexican lime. They are considerably smaller than grapefruit trees of comparable age but regularly produce heavy crops of fruit which mature during late summer and the fall seasons (Table 6). Trees grown from cuttings have produced average yields ranging well above 500 pounds per tree annually.

The fruit partakes of the nature of both the lime and the lemon, having the size, shape, and color of a lemon (Table 6) and the bouquet of the lime. Because of the exceptionally high juice content and its aromatic bouquet, this variety is particularly popular with the soda fountain, bar and restaurant trade. However, the Meyer lemon is a thin skinned fruit that dries out

Table 6. Lemon variety test

Variety	Season of Ripening	Tree Characteristics			Fruit Characteristics			Acidity	Aroma			
		Vigor	Hardi-ness	Thorni-ness	Preco-city	Produc-tivity	Size			Form	Smooth-ness	Color of rind
Eureka	summer	9	2	5	5	7	5	oblong	6	yellow	9	1
Haden	summer	9	5	5	5	7	5	elongated	6	yellow	9	3
Lisbon	summer	9	5	9	4	5	5	oblong	2	yellow	9	1
Meyer	late summer	5	9	4	9	9	5	pyriform	9	orange-yellow	6	9
Meyer Thornless	late summer	5	9	1	9	9	5	pyriform	9	orange-yellow	6	9
Perrine	summer	3	2	9	7	8	5	pyriform	7	ivory	6	9
Pondorosa	late fall	4	6	2	7	8	9	oblong	1	yellow	9	3
Rickart	late summer	5	9	4	9	9	5	necked	8	orange-yellow	6	9
Variiegated	summer	3	5	2	9	2	2	oblong	1	yellow and ivory	9	1

Legend:

- Very vigorous-9; medium vigor-5; weak tree-0.
 Hardy as grapefruit-9; slightly tender-5; very tender-0.
 Very thorny-9; medium thorny-5; practically no thorns-0.
 Very precocious-9; yield in fourth year-5; slow-0.
 Very productive-9; medium producer-5; poor producer-0.
 Very large-9; medium-5; very small-0.
 Very smooth-9; medium smooth-5; rough-0.
 Very acid-9; medium acid-5.
 Distinct aroma-9; medium aroma-5; none-0.

rapidly and is not popular with retail fruit vendors who display fruit without refrigeration. Trees grown as rooted cuttings are good producers but those budded on sour orange stock have not proven entirely satisfactory.

Technical description: Form, round, 6.06 x 6.44 cm.; wt. 123.7 gms.; stem end, smooth; blossom end, smooth; rind color, green, surface smooth, thickness 2 mm.; segments, 9-11, average 10.2, fairly regular; septa texture, medium; flesh color, light yellow; appearance of flesh texture, medium; juice sacs, fairly small; core type closed, fairly large; number of seed, 6-16, average 10.3; volume of juice, 55.7 cc.; per cent juice by wt., 46.6; typical seed, 9 x 6 mm.; total solids, 9.30; acid, 4.16. Ripening season, August 1 to November 1.

Rickert: This strain of the Meyer variety, is thought to be congenial with sour orange rootstock. The fruit is not as uniform in shape and conformation as that of the original Meyer strain (Table 6).

Ponderosa: This is a novelty variety and is grown principally for the ornamental value of the large fruits. The trees seldom attain large size but regularly produce good yields of large coarse fruits (Table 6). The fruit has no commercial value unless commercial by-products could be prepared from the fruit or rind.

Variegated: This is another of the ornamental types of lemon which has rather attractive light green foliage mottled with ivory. The small rough fruits also have this mottled appearance (Table 6).

Perrine: This hybrid variety was developed by U. S. Department of Agriculture workers who crossed the Mexican lime with the Genoa lemon. The trees are more typical of the lime in their tenderness to cold, thorniness and general appearance (Table 6). The fruit is about the size and shape of the Persian (Tahiti) lime and has the typical lime color. The flesh is gray in appearance, lacking in aroma, but has a relatively high acid content (Table 10). This variety has few if any qualities to recommend it as a commercial sort except that the fruit keeps well after being harvested.

Technical description: Form, ovate, 5.7 x 7.2 cm.; wt., 110.4 gms.; stem end, necked; blossom end, fairly smooth; rind, color deep yellow, surface fairly rough, thickness 4 mm.; segments 10-12, average 11.1, fairly regular; septa texture, medium; flesh color, light yellow; appearance of flesh texture, medium; juice sacs, medium; core type closed, small sized; number of seed, 16-40, average 24.1; volume of juice, 35.9 cc.; per cent juice by wt., 33.9; typical seed, 12 x 6 mm.; total solids, 11.05; acid, 7.70. Ripening season, August 1 to November 1.

LIMES

Limes are the tenderest members of the citrus family and commercial plantings should be provided with adequate heater protection.

Mexican (Key): This appears to be the most desirable commercial type. The trees attain large size and produce large crops of fruit, most of which

ripens during the summer season. These trees are extremely thorny and the fruit is harvested with great difficulty. The fruits are small in size, have a thin rind and high juice content. The juice is highly acid and has a delightful bouquet that is characteristic of the green fleshed limes. The fruits dry out rapidly after being removed from the trees, and for this reason, are not popular with retail fruit vendors and storekeepers.

Mexican Thornless: This variety originated in Mexico and was first propagated commercially by Valley nurserymen. The trees have a characteristic upright habit of growth quite unlike other varieties of limes. They are not as productive as the true Mexican lime and produce a considerable portion of their crop during the off season. The fruit is quite similar to that of the original Mexican variety, and can be harvested without difficulty. This is an excellent variety for the home garden but is not likely to be popular with commercial orchardists because of its low productive capacity.

Persian (Tahiti): This large fruited variety has few points to recommend it. The fruit is too large to meet the needs of the fountain trade and dries out too rapidly to meet with favor from retail merchants. The trees are tender to cold and appear to be rather susceptible to breakage. The fruits are about the size of a small lemon, have attractive green flesh and the high acid and aroma characteristics of the Mexican lime. The commercial planting of this variety is not advocated.

KUMQUATS

Kumquat fruits have little or no commercial value except as decorations for Christmas packages. The trees are chiefly prized by home owners because of their ornamental value. The trees are the pygmies of the commercial citrus tribe but produce an abundance of small brightly colored fruits which are rather fibrous and lacking in juice. Kumquats are somewhat similar to Satsuma oranges in that they are not congenial with sour orange understock. They may be propagated successfully on Rough lemon or the more vigorous types of citrange.

Nagami: This variety is probably the best known and most widely propagated of the kumquats. The trees are rather upright in their habit of growth and produce abundant crops of showy fruit. The fruits are about the size and shape of a large olive and have the skin color and texture of an orange. The flavor is similar to that of orange peel.

Meiwa: Trees of this variety are more spreading in their habit of growth and are not nearly so productive as those of the Nagami variety. The fruits are more nearly spherical in shape and are less highly colored than those of the Nagami variety, but contain more juice.

Marumi: Trees of this variety are somewhat like a round headed shrub in appearance, and usually produce an abundance of tiny, orange-like fruits. This variety is useful only as an ornamental plant.

LIMEQUATS

These acid fruits were produced by workers of the U. S. Department of Agriculture in an attempt to combine the cold hardiness of the kumquat with the high acid characteristic of the Mexican lime.

Lakeland: This is the best adapted, but lacks the distinctive flavor and aroma of the Mexican lime parent. The trees are definitely more resistant to cold than those of the Mexican lime, and the fruits contain a high percentage of acid. Since the fruits keep better in storage than do those of the Mexican lime, they might find favor with the fountain trade.

Eustis: Trees of this variety are quite similar to Lakeland but have not proven as well adapted to Valley conditions.

Tavares: This odd shaped variety has many of the desirable characteristics of the Mexican lime combined with the cold resistance and good keeping quality of the kumquat. The trees are upright in their habit of growth and are much less prolific than those of the Lakeland. The fruits are elongated, pyriform and have greenish flesh similar in appearance and flavor to those of the Mexican lime. Unfortunately, the fruit of this variety is so freakish in appearance that it would be difficult to sell.

MISCELLANEOUS TYPES

Calamondin (*C. mitis*): This citrus species is planted primarily for its ornamental value. The trees, when grown from seed, are upright in their habit of growth and attain considerable size. They resemble mandarin orange trees in their general appearance, and the fruit is typically a very small, highly acid tangerine. Calamondin fruit contains a high percentage of sharply acid juice that has the mandarin orange flavor. It is used to a limited extent in flavoring tea and other drinks.

Seville (orange): This is the marmalade orange of commerce. The trees are somewhat similar to grapefruit trees in their habit of growth, but are smaller in size and have a very distinctive, ornamental type of foliage. They normally produce abundant crops of fruits. The fruits are relatively small, rough, sour oranges and have a thick warty rind. The pulp contains a considerable amount of fiber but is highly prized for the manufacture of bitter orange marmalade.

Citrons: These novelty fruits are sometimes grown as a curiosity, but have no commercial value. The trees are tender to cold and are unattractive in appearance. Some varieties, such as the Italian, are much more desirable from the ornamental standpoint than are Etrog or the citron of commerce.

Calishu (orange): This is a Calamondin-like fruit that might be described as a sweet fruited type of Calamondin. The trees are similar in appearance to tangerine trees and the fruits are indistinguishable from those of the Calamondin in appearance.

Rangpur (lime): This odd citrus fruit is well adapted to conditions in the Lower Rio Grande Valley but has no commercial value. This variety is very similar to the Rose Lemon of South America. The trees resemble those of the Meyer lemon in appearance. They regularly produce enormous crops of fruit resembling wild mandarins. The fruit is quite similar to the Dancy tangerine in appearance and has tangerine colored flesh and sharply acid juice. These fruits are used to a limited extent by the bar trade and as a substitute for lemons.

RECOMMENDATIONS

Grower interest in varieties is always a favorable sign, as it shows that the prospective planter of trees is aware of the benefits to be derived from using the better adapted varieties for commercial planting.

In the Lower Rio Grande Valley of Texas, citrus growers are principally interested in sweet oranges (*Citrus sinensis*) and grapefruit (*C. grandis*). None of the varieties of pummelo (*C. maxima*) are commercially desirable, and all varieties of lemon (*C. limonia*) and lime (*C. limetta*) are quite tender to cold. There is limited interest in tangerines (*C. nobilis*), but marketing difficulties always act as a check on the popularity of this species. Grower interest is now based on salability and shipping quality of the fruit as well as productive capacity of the trees, and this interest is reflected in the demand for nursery stock. Like many other horticultural enterprises, citrus fruit growing is somewhat speculative in nature, and the grower who uses good judgment in selecting the varieties he puts his money into is most likely to be successful.

Since standardization is a highly desirable factor in citrus fruit production, it is unnecessary for nurserymen or growers to burden their minds with more than a half dozen varieties.

Orange varieties of the early, midseason, and late types are available for commercial planting. The Hamlin orange is the outstanding early variety because of the smoothness and fine appearance of the nearly seedless fruit and because of the exceptionally high productive capacity of the trees. Joppa Seedless is a midseason variety worthy of commercial recognition because the trees are only slightly less productive than those of the Hamlin variety, and the fruit is definitely superior in flavor, keeping quality, and size. A good demand for authentic trees of this variety is likely to develop during the next few years. Valencia is the standard late variety, but early, seedless strains of this fine variety are now available. The cold hazard is the principal factor limiting the popularity of the Valencia variety. Navel oranges are not popular with Valley growers, but there is a limited demand for the large, mild flavored fruits of this variety. Because of the exceptional vigor of the trees and also because of the excellent interior quality of its fruit, Texas Navel is recommended above other strains of the navel orange. There are many other varieties of oranges which thrive in this region, but the Station feels justified in recommending only the above mentioned varieties.

Grapefruit is not as popular with Valley growers as it was back in 1927-1929, when good Marsh fruit sold for forty dollars per ton. The trend is now definitely toward the pink or red fleshed varieties, and there seems to be little justification for increasing the acreage of standard Marsh grapefruit. It seems highly desirable to reduce the acreage planted to seedy varieties and acreage on marginal lands. Ruby (Red Blush) grapefruit is decidedly the most popular fruit of this type, and its popularity is well deserved.

Tangerines can hardly be classed as a commercial type of citrus, as the demand for tangerines is very limited. Due to their highly perishable nature, it is not likely that there will ever be a heavy demand for tangerines, tangelos, Temple oranges, or Satsumas. Clementine is the best early tangerine for Valley planting, but the fruit must be moved before December 15. Some of the new tangelo varieties such as Mineola and Lake and two of the new King orange hybrids are fine fruits for the home garden but have no commercial value.

Limes and lemons are the cold tender species of citrus, and as few growers care to risk extra hazards in the production of fruit, the acreage planted to these crops is not likely to increase rapidly. The good prices received for lemons has encouraged persons who are able to afford heater protection to enter lemon production on a limited scale. Eureka is still the leading commercial variety of the standard type, while the Meyer cold resistant lemon, grown from cuttings, is the most dependable acid fruit for the average Valley grower to produce.

There are many varieties of citrus fruit which could be grown in the Valley, but since most of the fruit is produced for sale, it pays to confine commercial plantings to a few varieties known to be popular with shippers and handlers of citrus fruit.

Table 7. Summary of orange variety descriptions

Characters	Hamlin	Parson Brown	Pine-apple	Ruby	Joppa	Homosassa	Temple	Valencia	Washington Navel	Texas Navel	Rio Grande Navel
No. fruits per sample.....	30	30	30	30	30	30	30	30	30	30	30
No. samples measured.....	2	2	2	1	2	1	1	1	3	3	1
Fruit:											
Diameter, cm.....	7.1	7.1	7.8	7.7	7.2	8.4	7.6	7.7	8.4	7.8	7.7
Depth, cm.....	6.8	6.7	7.2	7.1	7.0	8.2	6.5	7.3	8.6	7.3	7.9
Weight, gms.....	180.8	185.6	229.6	217.4	198.1	302.9	212.7	232.9	313.6	235.4	239.5
Stem end shape.....	5.2	5.1	5.2	5.0	5.4	5.7	4.9	6.0	5.5	5.4	5.1
Blossom end shape.....	5.0	5.0	5.0	5.0	5.2	5.6	6.0	5.4	1.4-4.0	3.1-3.6	2.1-4.4
* Navel size.....	8.0	9.0	5.8	8.0	6.2	5.3	9.0	8.4	7.8	8.2	8.0
Rind:											
Smoothness.....	2.3	2.3	4.4	5.0	4.4	5.7	5.0	5.0	4.6	4.9	3.8
Rind thickness, mm.....	3.3	3.6	4.0	4.0	3.3	4.4	3.0	4.5	4.0	3.7	3.9
Flesh:											
No. segments.....	10.7	11.1	11.0	11.2	10.5	10.6	11.5	11.6	10.6	10.6	10.8
No. irregular segments.....	1.9	2.6	2.4	3.5	1.7	1.7	1.8	2.6	3.1	2.8	3.8
Septa texture.....	6.2	6.8	7.3	6.0	5.1	6.5	2.0	5.4	5.8	5.0	5.7
Flesh color.....	7.0	8.4	7.0	7.0	7.0	7.0	9.0	9.0	7.2	8.2	7.4
Flesh:											
Texture (appearance).....	3.3	4.2	5.0	5.0	3.8	5.0	1.9	4.4	5.0	3.8	5.0
Juice sacs (size).....	4.0	3.1	4.0	4.0	3.4	4.4	2.0	4.1	4.4	3.1	4.5
Core type.....	8.2	9.0	8.3	9.0	6.8	8.5	1.5	4.9	6.1	7.6	9.0
Core size.....	3.4	3.2	3.0	1.0	3.8	5.1	6.3	5.3	5.0	4.4	4.8
No. seeds.....	4.5	18.1	17.7	13.3	8.3	15.5	26.2	4.6	2.5	3.2	2.9
Volume juice cc.....	77.3	78.4	108.7	97.8	102.7	142.3	108.5	114.8	127.1	100.7	93.3
Per cent juice by weight.....	44.5	43.9	49.2	46.8	53.9	48.8	53.0	51.3	42.2	44.5	40.5
Typical Seed:											
Length, mm.....	13	13	16	14	12	14	13	17	13	13	13
Width, mm.....	8	9	6	8	7	8	7	8	9	8	9
Total Soluble Solids.....	11.51	12.00	9.99	10.26	11.31	9.86	12.80	11.35	9.71	10.41	7.90
Percent Citric Acid.....	0.81	0.77	0.63	0.75	0.92	0.61	1.26	0.92	0.48	0.70	0.69
Solids to Acid Ratio.....	14.2:1	15.5:1	14.27:1	13.85:1	12.29:1	16.10:1	10.2:1	12.3:1	20.22:1	14.87:1	11.14:1

Key to citrus variety descriptive table 7

Stem-end shape.....	1-necked	5-smooth	9-basind
Blossom-end shape.....	1-necked	5-smooth	9-basined
Navel.....	(1-small, 5-medium, 9-large)	(1-protruding, 5-even, 9-recessed)	
Rind color.....	1-green	5-yellow	9-orange
Rind smoothness.....	1-smooth	5-rough	9-wrinkled
Septa texture.....	1-fine	5-medium	9-coarse
Flesh color.....	1-colorless	5-yellow	9-orange
Flesh texture (appearance).....	1-fine	5-medium	9-coarse
Juice sacs (size).....	1-small	5-medium	9-large
Core type.....	1-open	5-dense	9-closed
Core size.....	1-small	5-medium	9-large

Table 8. Summary of tangerine variety descriptions

Characters	Dancy	Clementine	Willow Leaf	Satsuma
No. fruits per sample.....	30	30	30	30
No. samples measured.....	2	2	1	1
Fruit:				
Diameter, cm.....	6.2	6.0	6.4	6.3
Depth, cm.....	4.9	5.2	5.4	4.9
Weight, gms.....	102.3	101.3	117.9	104.1
Stem end shape.....	4.5	4.6	3.1	5.3
Blossom end shape.....	6.9	7.0	6.1	5.9
Navel.....				
Rind:				
Color.....	9.0	9.0	9.0	8.1
Smoothness.....	3.0	4.8	5.0	5.4
Thickness, mm.....	2.2	2.3	3.1	3.4
Flesh:				
No. segments.....	10.9	9.7	11.5	10.7
No. irregular segments.....	2.5	2.2	4.0	3.0
Septa texture.....	7.8	6.6	4.0	6.1
Flesh color.....	9.0	9.0	9.0	9.0
Texture (appearance).....	6.6	6.0	5.0	1.0
Juice sacs (size).....	8.6	7.0	8.1	2.3
Core type.....	1.0	1.0	1.0	2.3
Core size.....	8.6	7.1	6.6	6.2
No. seeds.....	15.1	16.6	24.9	3.6
Volume juice, cc.....	42.6	42.1	35.5	41.9
Percent juice by weight.....	43.3	43.2	29.8	41.9
Typical Seed:				
Length, mm.....	12	8	10	11.4
Width, mm.....	4	6	5	7.3
Total Soluble Solids.....	12.55	13.97	12.05	11.55
Percent Citric Acid.....	1.29	1.15	1.06	0.92
Solids to Acid Ratio.....	9.7:1	12.10:1	11.37:1	12.5:1

Key to citrus variety descriptive table 8

Stem-end shape.....	1-necked	5-smooth	9-basined
Blossom-end shape.....	1-necked	5-smooth	9-basined
Rind color.....	1-green	5-yellow	9-orange
Rind smoothness.....	1-smooth	5-rough	9-wrinkled
Septa texture.....	1-fine	5-medium	9-coarse
Flesh color.....	1-colorless	5-yellow	9-orange
Flesh texture (appearance).....	1-fine	5-medium	9-coarse
Juice sacs (size).....	1-small	5-medium	9-large
Core type.....	1-open	5-dense	9-closed
Core size.....	1-small	5-medium	9-large

Table 9. Summary of grapefruit variety descriptions

Characters	Marsh	Little River	Thompson Pink	Ruby (Redblush)	Duncan	McCarthy	Foster
No. fruits per sample.....	30	30	30	30	30	30	30
No. samples measured.....	1	1	1	1	1	1	1
Fruit:							
Diameter, cm.....	9.1	10.0	10.3	9.5	10.6	10.7	11.2
Depth, cm.....	8.2	8.7	8.8	9.9	9.4	9.2	9.7
Weight, gms.....	295.2	410.8	438.2	351.0	502.0	497.9	569.0
Stem end shape.....	5.1	5.6	5.5	5.8	5.4	6.2	5.9
Blossom end shape.....	5.0	5.1	5.0	5.7	5.0	5.3	5.4
Rind:							
Color.....	5.0	5.0	5.0	5.0*	5.0	5.0	5.0*
Smoothness.....	3.2	3.4	3.8	3.5	3.8	3.9	4.2
Thickness, mm.....	6.5	6.8	7.3	6.1	6.6	7.6	7.2
Flesh:							
No. segments.....	13.0	12.9	13.3	12.8	12.8	12.7	12.7
No. irregular segments.....	5.6	4.4	4.4	3.3	3.7	3.7	2.1
Septa texture.....	4.6	4.8	4.8	5.4	4.9	4.8	5.7
Flesh color.....	5.0	5.0	light pink	deep pink-high red	5.0	5.6	light pink
Texture (appearance).....	3.2	3.8	3.7	3.1	3.9	5.5	5.5
Juice sacs (size).....	2.8	3.4	3.5	3.1	3.6	3.2	3.6
Core type.....	3.3	3.3	2.3	2.3	3.0	3.5	3.0
Core size.....	3.5	5.3	5.8	6.7	4.5	5.3	5.0
No. seeds.....	3.5	5.3	5.1	4.3	57.1	56.2	47.4
Volume juice, cc.....	126.9	191.0	189.5	171.4	209.4	207.5	234.4
Percent juice by weight.....	44.70	48.40	45.00	50.78	43.38	43.38	46.35
Typical Seed:							
Length, mm.....	14	15	14	14	15	15	15
Width, mm.....	9	9	10	9	8	8	9
Total Soluble Solids.....	11.11	10.15	10.45	10.95	11.85	11.05	10.10
Percent Citric Acid.....	1.50	1.68	1.56	1.34	1.66	1.74	1.40
Solids to Acid Ratio.....	7.4:1	6.0:1	6.7:1	8.17:1	7.1:1	6.35:1	7.2:1

*Pink Blush.

Key to citrus variety descriptive tables 9 and 10

Stem-end shape.....	1-necked	5-smooth	9-basined
Blossom-end shape.....	1-necked	5-smooth	9-basined
Rind color.....	1-green	5-yellow	9-orange
Rind smoothness.....	1-smooth	5-rough	9-wrinkled
Septa texture.....	1-fine	5-medium	9-coarse
Flesh color.....	1-colorless	5-yellow	9-orange
Flesh texture (appearance).....	1-fine	5-medium	9-coarse
Juice sacs (size).....	1-small	5-medium	9-large
Core type.....	1-open	5-dense	9-closed
Core size.....	1-small	5-medium	9-large

Table 10. Summary of lemon variety descriptions

Characters	Meyer	Perrine
No. fruits per sample.....	30	30
No. samples measured.....	1	1
Fruit:		
Diameter, cm.....	6.06	5.70
Depth, cm.....	6.44	7.24
Weight, gms.....	123.70	110.40
Stem end shape.....	5	1
Blossom end shape.....	4	3
Rind:		
Color.....	1	5
Smoothness.....	1	3
Thickness, mm.....	2	4
Flesh:		
No. segments.....	10.20	11.10
No. irregular segments.....	1.90	2.50
Septa texture.....	5	5
Flesh color.....	4	4
Texture (appearance).....	5	5
Juice sacs (size).....	3	5
Core type.....	9	9
Core size.....	6.50	3
No. seeds.....	10.30	24.10
Volume juice, cc.....	55.70	35.90
Percent juice by weight.....	46.60	33.88
Typical seed:		
Length, mm.....	9	12
Width, mm.....	6	6
Total Soluble Solids.....	9.30	11.05
Percent Citric Acid.....	4.16	7.70
Solids to Acid Ratio.....	2.2:1	1.4:1

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