

Citrus Maturity and Packinghouse Procedures

XI Legal Factors

All facets of the Florida citrus industry are subject to legal restraints at the state and federal levels and have been since the beginning of fruit shipments. Laws, and orders, rules and regulations emanating from them, have gradually increased both in number and complexity down through the years, particularly in the last 2 decades. Pertinent dates in the development of maturity requirements, standards for grades, marketing agreements and the like were summarized in Table 2. The more important laws, rules and regulations, agencies and boards of direct interest to those involved in postharvest handling of citrus are noted in Table 24. Sections of the Florida Department of Citrus Official Rules applicable to packinghouses and canneries are listed in Table 25.

A Fresh Fruit Maturity

1. Legal requirements for maturity:

Florida has by far the highest, most comprehensive and most complicated legal maturity standards for citrus fruit anywhere in the world. The requirements have undergone innumerable changes since the first law was passed in 1911. There have been countless wrangles, law suits and even an occasional court injunction (e.g., Judge Petteway's permanent injunction in 1933 enjoining the Florida Dept. of Agriculture from enforcing the arsenic law as it applied to grapefruit). Basically, however, the history of Florida's maturity standards has been throughout one of the continual stiffening, with minor exceptions, of requirements. Changes in the standards have been made with the whole-hearted support of the industry; indeed, most or all of the recommendations for legislative alterations have come from the industry itself. There is furthermore full recognition that the present requirements represent minimum quality standards.

Legal standards for Florida citrus fruit are based on 5 factors: A color break caused solely by nature (excludes sunburn, insect damage, etc.), volume of juice, total soluble solids (or °Brix; expressed as % pure sucrose), acid (titratable acidity, expressed as % anhydrous citric

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acid) and total soluble solids:acid ratio. Factors used in standards for fresh and cannery fruit are listed in Tables 26 and 27, respectively.

2. Laws and Official Rules:

a. Sections of the Citrus Laws (Chapter 601) relating to legal maturity requirements include:

- 1) Maturity: .19 oranges; .16 grapefruit; .21 tangerines.
- 2) Minimum ratio: .20 am. oranges; .17 grapefruit; .22 tangerines
- 3) Determination of solids and acid: .25 am.
- 4) Color break: .26.
- 5) Juice content of grapefruit .18 am.
- 6) Color add: . , .80, .81 ges.
- 7) Arsenic: .9 through .97 gal only on grapefruit)

b. Additional stipulations as to equipment needed, how to conduct a maturity test, standards for citrus hybrids, special permits for export fruit, and "tree run" fruit are given in Dept. of Citrus Officials Rules (Chapter 20-):

- 1) 20-34. Fresh fruit maturity tests.
- 2) 20-13. Maturity requirements for citrus hybrids (Murcott, K-Early, tangelos, 'Temple').
- 3) 20-38. Special permits for export fruit under 10% tolerance rule on solids and ratio (Does not apply to fruit going to Canada or Mexico).
- 4) 20-36 "Tree run" fruit. These fruit are not sized or sorted for grade but must be inspected for maturity as per Rule 20-34.
- 5) 20-44. Stipulations on gift fruit shipments, intrastate shipments and instate retail sales of citrus fruit are given in Rule 20-44. Basically, U.S. No. 2 grade fruit can be sold intrastate, provided containers or bins are marked, with minimum sizes or 56 for seedless grapefruit, 40 for seeded grapefruit and 163 for oranges and 'Temple' at roadside retail fruit stands. Minimum grade for

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interstate gift fruit shipments is U.S. No. 1 Golden (with green color of No. 2). All fruit must meet minimum maturity requirements and those shipped as gift fruit or sold at roadside retail fruit stands must be inspected.

3. Summary of maturity requirements:

a. General: The crop year for citrus in Florida runs from August 1 through July 31. The number of fruit required for a legal maturity test is 10 grapefruit and 20 for all other kinds; the sample size for determination of color break is 50. Maturity tests are run with sized fruit, with usually at least 3 samples (large, medium, small sizes) per grade or lot. Official tests may be made anywhere after fruit are harvested; in practice, they are virtually always run prior to dumping. A composite test (unsized fruit) may be made for ratio (usually done early in the season), with an average of 3 tests failing the minimum by more than 0.5 point resulting on condemnation of the lot (or diversion to a cannery if legal). The color break requirements is largely a dead letter because fruit must meet color standards when they are graded later

b. Oranges:

- 1) Color add is permitted but with higher juice and total soluble solids requirements.
- 2) Color break is 25% for 'Parson Brown' from August 1 through October 31, then 50%; all other varieties 50%.
- 3) Juice content is 4.5 gallons (17.0 liters) per 1-3/5 bu. box (40.8 kg) for natural color and 5.0 gallons (18.9 liters) per box for color add, or a difference of about 11%. (Approximate equivalents are 38% and 42% v/v and 43% and 48% w/w, respectively.)
- 4) There are 3 periods during the year for total soluble solids.
- 5) Minimum acid is 0.4% for natural color and 0.5% for color add.
- 6) There is a dual solids:acid requirement, with a minimum of 9.00:1 for all fruit regardless of total soluble solids and a required ratio according to the actual solids.

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Grape

Color add is not permitted.

- 2) Color break is 25% for all varieties
- 3) Juice content is measured as cc per fruit with 3 periods during the year. (Compare this system with data in Table 28 and Fig. 50)
- 4) There are separate requirements for seeded, white and pink and red seedless varieties as to ratio.
- 5) There are dual ratio requirements as for oranges (see fig 6)
- 6) There is no minimum acid requirement

d. Tangerines

Color add is not permitted.

- 2) Color break is 50% for all varieties
- 3) There are no juice content or minimum acid requirement
- 4) There are 2 periods during the year for total soluble solids and solids:acid ratio.
- 5) There are dual ratio requirements, as for oranges

Example

- 1) Color add is permitted, with a higher (9.0:1) minimum total soluble solids:acid ratio required.
- 2) Color break is 50%.
- 3) There are no juice content or minimum acid requirement
- 4) Minimum total soluble solids is 9.0%.
- 5) The minimum total soluble solids:acid ratio is 8.5:1 with higher minimum ratio requirements according to total soluble solids between 9.0 and 9.5%.

angelos and K-Early':

- 1) Color add is permitted, with the same requirements as natural color fruit.
- 2) Color break is 50% for all varieties
- 3) There is no juice requirement.
- 4) Minimum acid allowed is 0.4%.

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5) There are 6 periods during the year, 4 with minimum total soluble solids requirements and dual solids:acid ratio and 2 with minimum solids:acid ratio requirements only.

g. 'Honey' tangerine (formerly 'Murcott'):

1) Color add is not permitted.

2) Color break is 50%.

3) Fruit are mature if acid is less than 1%; or if the total soluble solids:acid ratio is 12:1 or higher, acid may exceed 1%.

4. Procedure for maturity tests:

a. Facilities and equipment: Adequate testing facilities including running water, sinks and drainboards, lights, sufficient power outlets and desk space for the inspector's use are located at or near the point where fruit is received at the packinghouse. Any packinghouse that shipped more than 200,000 equivalent 4/5 bu. boxes the previous season must also install an Automatic Machinery Corp. Model 2700 fresh citrus juice extractor. The Division of Fruit and Vegetable Inspection is responsible for maintenance and proper settings of the extractor (Dept. of Citrus Rule 20-34). Equipment for maturity tests of fresh fruit and processed fruit are listed in Tables 29 and 30, respectively.

b. The procedure for a maturity test of oranges consists first of a sample of 20 fruit of a size, each fruit being measured with calipers. (The sample for the color break test is 50 fruit collected at random from the entire lot.)

c. Color break: Average color of each of the 50 fruit is checked against the standard (greenish yellow) color plaque. (In practice, this test is seldom run because fruit must meet the standard for color when they are inspected later for Florida or U.S. grade.)

d. Juice content: Cut 20 fruit of a size in half at the equator. Use a hand or motor-driven reamer (400 rpm) with the orange (small) burr to extract the juice, which is strained through a sieve or colander and collected in a pan. Juice is poured into a graduated

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cylinder and volume measured as cc. Record the volume (cc) and then convert to gallons per box with the aid of Table 31.

e. Total soluble solids: Pour the measured juice into a smooth-lipped cylinder, with any overflow being caught in a pan under the cylinder. Ease the hydrometer gently into the cylinder and put the thermometer in the pan. Read the hydrometer after 5 or 10 minutes with the eyes at the level of the top of the column of juice. Record the hydrometer and thermometer readings, then correct the former for temperature with the aid of Table 32. (Note that the juice must be deaerated if a mechanical extractor is used.)

f. Total (titratable) acid: Draw up 25 ml of juice from the hydrometer cylinder with a juice pipette and empty it, blowing out any liquid, into a 125 ml erlenmeyer flask. Prepare 2 samples in this manner. Add 4 to 5 drops of phenolphthalein indicator solution from a dropper bottle. Fill the burette with standard alkali (0.3125 N NaOH) and adjust it to zero, after eliminating bubbles in the outlet tube. Titrate to the pink endpoint with constant swirling of the juice in the flask. Read the burette to the nearest 0.1 ml, record the amount used, then refill the burette and adjust it to zero. Repeat the titration on the second sample, record the amount used and refill the burette. Draw up and run a third sample if the first 2 differ by more than 0.2 ml. Convert the average ml of alkali to % citric acid with the aid of Table 33. (Direct reading burettes calibrated in % citric acid are available; in this case, acid can be read directly from the burette scale without conversion.)

g. Total soluble solids:acid ratio: The solids:acid ratio is obtained either by calculation (divide corrected % total soluble solids by % acid), or looking it up in a ratio book or using the nomograph in Fig. 51.

h. Comparison with legal requirements: The final step is to compare the results with the legal requirements (see Appendix), all of which must be met for the sample to pass.

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(Note: Be sure to rinse pans, strainer, glassware, hydrometer and thermometer thoroughly after use and refill the burette. Citrus juice is an excellent medium for molds and is full of pectin so that immediate cleaning of maturity test equipment is essential.)

B. Fresh Fruit Grade Inspection

1. Legal requirements:

Standards for grades provide uniformity of appearance as to color, size and blemishes, with allowances (tolerances for human and mechanical errors in sorting. Grade factors include requirements as to fruit of a lot having similar varietal characteristics and being mature according to Florida Citrus Laws and Dept. of Citrus Official Rules, plus certain stipulations as to color, firmness, form, texture, discoloration (basis for subclasses of grades; principally rust mite but may include speck-type melanose and scars plus, for grapefruit, mandarins and tangerines, scab along with minor thorn scratches and similar injuries), and blemishes.

a. U.S. Standards: These apply to fruit in interstate commerce. Grades are Fancy, No. 1, No. 2, and No. 3, of which normally only Fancy and No. 1 are shipped out of the state. There are separate standards for Florida oranges and tangelos, Florida grapefruit, Florida tangerines. The standards for lemons are the same as for California and include No. 1, Export No. 1 and No. 2 grades and subclasses based upon color.

b. Florida standards: These apply to fruit in intrastate commerce. Florida standards are given in Dept. of Citrus Rules 20-35 and 20-37. They are identical to the U.S. standards except as noted below:

1) Oranges, 'Temple' and tangelos:

(a) Size, count and pack for approved containers as in Dept. of Citrus Rule 20-39.

(b) Damage: Limit on green spots or oil spots, 5 or less than 1/2 inch (12.7 mm) in diameter (aggregate area), and on scales, blotch less than 3/8 inch (9.5 mm) diameter circle.

(c) Fairly well colored means each fruit shall have yellow or better ground color predominating over green color over entire fruit surface with no distinct green color present.

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(d) Florida No. 1 discoloration 25% of surface in the aggregate

(e) Florida No. 1 Bright discoloration 10% of surface in the aggregate.

(f) Florida No. 1 Golden not more than 30% of fruit by count with over 25% of surface affected by discoloration.

(g) Florida No. 1, regardless of subclass, minimal total soluble solids 9.20% and minimum solids:acid ratio 10 to 1 for oranges (does not apply to 'Temple' or tangelos).

2) 'Murcott': Same as for U.S. Standards for Grades of Florida tangerines, except:

(a) Damage by dryness or mushiness affecting all segments more than 1/4 inch (6.3 mm) at stem end or equivalent elsewhere.

(b) Serious damage by dryness or mushiness, more than 1/2 inch (12.7 mm) at stem end or equivalent elsewhere.

(c) Very serious damage by dryness or mushiness, more than 3/4 inch (19.1 mm) at stem end or equivalent elsewhere.

(d) Florida No. 1 Golden: Not more than the number of fruit allowed in U.S. No. 1 Golden of U.S. Standards for Grades of oranges and tangelos with more than 1/3 of their surface in the aggregate discolored.

3) Tangerines: Same as U.S. Standards.

4) Grapefruit: Same as U.S. Standards, except:

(a) size designated by number in 4/5 bushel (28.2 liters) container as in Dept. of Citrus Rule 20-39.

(b) "Florida Special" grade: Same as U.S. No. 2, except fairly well formed (same characteristic of variety and not more than slightly elongated, pointed, or otherwise deformed) and slightly rough texture (skin slightly thick but not excessively thick, materially ridged or grooved).

5) "Tree run" grade: Sound, wholesome fruit not sorted as to grade or size after harvest and composed of random sizes; tolerance of 5% for unwholesome fruit allowed but only 1% for decay at inspection

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point (Applies to fruit sold by a citrus producer or purchased directly from a citrus producer and transported; that is, it is not handled through a packinghouse either gift or commercial. Also, fruit must meet maturity requirements.)

2. Standards for U.S. No. 1:

a. Special terms and limitations:

1) "Unclassified" means fruits which have not yet been separated into grades.

2) "In the aggregate" means the areas of several small spots are taken together as one large spot.

3) Standards listed under each grade are the maximum permitted for each factor; occurrence of more than one blemish, etc., means that all taken together can not exceed the maximum injury, damage, etc., under the standards for a given grade.

b. Standards for U.S. No. 1 oranges and tangelos, grapefruit and tangerines are given in Table 34.

c. Subclasses of U.S. No. 1 and other grades are given in Table 35.

d. Tolerances: Each set of U.S. Standards for Grades has 2 tables which specify the absolute limit (AL) permitted in a sample, acceptance numbers (maximum permitted) for decay, very serious damage including decay, total defects including decay and very serious damage, off-size, and discoloration for U.S. No. 1, U.S. No. 1 Bright, U.S. No. 2, U.S. No. 2 Bright and U.S. No. 1 Golden, and acceptance numbers (minimum required) for U.S. No. 1 Bronze, U.S. No. 1 Russet and U.S. No. 2 Russet in 50-count samples for oranges and tangelos, 33-count samples for grapefruit and 50-count samples for tangerines at shipping point or enroute or at destination. (Note that tangerines do not have No. 1 Bright, No. 1 Golden or No. 2 Bright subclasses for discoloration.) In addition, there are tolerances of 5% on containers in a lot failing to meet requirements of standard pack and on containers in a lot failing to meet requirements of standard sizing. Tolerances for lemons are based on % of fruit in a lot and % of containers for standard pack and standard sizing.

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3. Inspection for grade:

Inspection of fresh fruit for grade involves 2 separate operations, grading as part of the packingline and official inspection.

a. Packinghouse grading: Each lot of fruit will be inspected prior to being run over the line by the packinghouse foreman and head grader to determine how fruit will be sorted to give the highest packout under the limitations of Marketing Agreement regulations and market requirements.

Most packinghouses pack and ship only a few of the permitted grades and subclasses out of a given lot. The predominant grade statewide is U.S. No. 1 (34.9 million 4/5 bu. boxes out of a total 58.5 million shipped in 1976-77). The Indian River, however, shipped only 2.6 million boxes of U.S. No. 1 as compared to 18.0 million U.S. No. 1 Golden and 2.8 million U.S. No. 2. (Over 17 million boxes of the Indian River shipments of U.S. No. 1 Golden were white and pink and red seedless grapefruit and the remainder were navel oranges.) Details of the grading procedures were given in Chapter IX.

b. Official Inspection (Rule 20-37): Samples of each size in a lot of fruit (same variety and grade on a given day) are obtained from distribution lines to carton or bag filling machines or rollboard tables or from packed containers. There is no set number of samples taken for inspection but inspectors try to grade at least one sample for every 50 boxes per size. Additional ones will depend upon fruit quality (which is based in large part upon how carefully the fruit were graded). Samples will be taken until the inspector is satisfied that each size is in grade or out of grade, in which latter case fruit of the out-of-grade size will be cleaned out of the bins and either sent to the cannery or resorted. Inspection also includes checking on compliance with regulations of Marketing Agreements (federal) and maturity requirements (state).

The preliminary note sheets for inspection of oranges, grapefruit and tangerines are shown in Tables 36a, b, c. (Values in rows beginning with AL are the same as those in the "At shipping point" table for tolerances in the U.S. Standards.) Information on the note sheet is transferred to the certificate of inspection when one is issued for the lot

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Processed Fruit

Nearly 90% of Florida's 250 million box (approximately 10 million m. tons) citrus crop in 1976-77 was processed into a wide variety of products. It is often difficult to realize that frozen orange juice concentrate which now accounts for nearly 150 million boxes was perfected only 35 years ago and chilled juice (orange and grapefruit), presently utilizing 31.5 million boxes, was first marketed in 1955. The historical background of the processing industry outlined in Table 2 shows that progress was slow until the advent of these products. Initially, frozen orange juice concentrate developed at the expense of the fresh fruit segment of the industry. This trend has gradually changed, however, so that today Florida's citrus has 2 primary markets, processed juices, sections and salads and fresh fruit consumed primarily as cut up breakfast and dessert slices and chunks.

All aspects of Florida citrus canneries are under the same general constraints with respect to legal requirements mentioned earlier for fresh fruit (Tables 24, 25). There are different legal maturity requirements after December 1 each year and separate Florida and U.S. standards for grades of many processed products. The manner of conducting official maturity tests is also different, certain additional information being furnished for each lot (e.g., pounds - solids per box) to the cannery on a voluntary basis. A flow sheet of cannery operations is given in Figure 52, where it may be seen there are 6 lines, frozen concentrate (A), chilled juice (B), single strength juice (C), frozen sections, salads, etc. (D), chilled sections, etc. (E), and canned sections, salads, etc. (F), respectively. Virtually all processed products are blends to maintain uniformity and many are mixtures of more than one kind of fruit, including non-citrus in certain instances. Plant quality control is rigorous and inspection of each lot of processed products continuous, the former being done by company personnel and the latter by U.S. Dept. of Agriculture (and Food and Drug Administration) inspectors.

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1. Summary of maturity requirements:

Factors applicable to cannery fruit are given in Table 27. Fruit going to the cannery have the same general requirements as those for fresh shipment from August 1 through November 30. The following apply from December 1 through July 31 unless noted otherwise:

a. Oranges:

1) There are no color break, juice content or minimum acid requirements.

2) Minimum Brix (total soluble solids) is 8.0%.

3) The minimum Brix:acid ratio is 9.0:1 regardless of Brix with a required Brix:acid ratio for fruit with Brix below 11.0%.

b. Grapefruit:

1) There are no requirements for color break, juice content, or minimum acid. Minimum juice requirements from August 1 through November 30 are 35.000, 33.500, and 32.000 lb (15.876, 15.196, 14.479 kg) per box for small, medium and large fruit, respectively (see Rule 20-61, p. 2) equivalent to 41.2%, 39.5%, and 36.7% (w/w).

2) Minimum Brix is 7.0% from December 1 through December 31, then 6.5% from January 1 through July 31.

3) The minimum Brix:acid ratio is 7.00:1 in December, then 6.0:1 from January 1 through July 31.

c. Tangerines:

1) There are no requirements for color break, juice content or minimum acid from November 15 through July 31.

2) The minimum Brix is 9.0% from Aug. 1 through Nov. 14, then 8.75% from Nov. 15 through July 13.

3) The minimum Brix:acid ratio is 7.5:1 for fruit with Brix 10.5% and above with a higher required Brix: acid ratio according to Brix between 9.0 and 10.5% from Aug. 1 through Nov. 14 and 7.25:1 for fruit with Brix 10.5% and above with a high required Brix:acid ratio according to Brix between 8.75 and 10.5% from Nov. 14 through July 31.

d. 'Temple':

1) There are no requirements for color break, juice content or minimum acid.

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- 2) The minimum Brix is 9.0%.
- 3) The minimum Brix:acid ratio is 7.5:1, with a higher required ratio according to Brix below 10.5%.
 - e. Tangelos and 'K-Early':
 - 1) There are no requirements for color break, juice content or minimum acid.
 - 2) Minimum Brix is 9.0% from August 1 through October 31, 8.5% from November 1 through November 15, and 8.0% from November 16 through July 31.
 - 3) There is a flat 8:1 Brix:acid ratio requirement from December 1 through July 31; the ratio from August 1 through November 30 is that required according to % Brix of the juice (i.e., 10.0:1, 10.25:1 and 10.50:1, respectively, for the minimum Brix values listed above).
 - f. 'Honey' tangerines (formerly 'Murcott'): The only requirement is a minimum Brix:acid ratio of 10.0:1.

2. Maturity (quality) tests.

Procedures for maturity tests of processed citrus fruit differ greatly from those for fresh fruit. A mechanical sample selector, which generally consists of a special pocket to hold one or 2 fruit, is attached to the unloading conveyor for each bin. Fruit so collected roll down a special chute to the test room, where they will be held until the sample is run. This method provides a representative sample from each load at the approximate rate of one fruit for each 10 boxes.

The test room is provided with adequate running water, sinks, drainboards, electric lights and power outlets, plus the usual equipment for maturity tests (Tables 39, 30), except for the extractor. The latter which is provided by the processor, is an FMC Model 091B mechanical extractor with automatic feed. Maintenance and settings of the extractor are the responsibility of the Division of Fruit and Vegetable Inspection. (Extractors are checked frequently in every cannery to maintain proper accuracy of individual units and uniformity among those in different canneries.)

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The usual procedure is to use the sample collected by the mechanical sampler, which generally amounts to about half a box of fruit. The sample is first weighed, then the fruit are run through the extractor and the juice is weighed. The usual tests for total soluble solids and acid are made with a Brix hydrometer and titration with standard alkali, the juice being run through a deaerator prior to drawing samples. Brix: acid ratio is found by reference to a ratio book. (Juice in excess of that required for solids and acid tests is given back to the processor.) The final steps are first to verify the fruit are legally mature and second to calculate pounds-solids per box for the lot. Pounds-solids per box is found by the following formula:

$$\frac{\text{Weight of juice}}{\text{Weight of fruit}} \times \text{Weight per box} \times \% \text{ total soluble solids,}$$

where the weight per box is 90 lb (40.8 kg) for oranges, 85 lb (38.5 kg) for grapefruit or 95 lb (43.1 kg) for tangerines.

The processor can then determine the pounds-solids per lot (load) of fruit, since the net weight and thus equivalent number of boxes is obtained when each load enters the plant. Pounds of juice per box will be supplied the processor in case of fruit for single-strength canning. (Nomographs for conversion of Brix and pounds of juice per box into pounds solids per box and price per box of oranges and for conversion of pounds of juice into price per box are given in Figs. 53 and 54, respectively.)

Each processor is required to maintain records on anticipated and actual plant yield for each load of fruit, except those utilized for orange sections and citrus salad. Average actual plant yield for any consecutive 3-week period can not exceed 104% anticipated yield and the total cumulative yields for the early-midseason period and late period can not exceed 102% (Rule 20-63).

3. Standards for grades:

All of the important and many minor processed products have both

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Florida and U.S. standards for grades. Florida standards, which are generally more stringent, are summarized in detail.

a. Florida standards (Florida Citrus Laws 601.9905 through 601.9909 and Dept. of Citrus Official Rule 20-64, 20-65 and 20-69):

1) Canned orange juice: Same as U.S. Standards, except minimum acid for C grade style II (sweetened) same as for C grade style I (unsweetened), minimum Brix:acid ratio for style I (unsweetened) Grade A juice 10:1; raw juice at least 8.5% Brix; canned juice 10.0% Brix, Brix:acid ratio 9:1, minimum 0.55% acid (unsweetened) or 0.60% (sweetened) to 1.55% (unsweetened) or 1.60% (sweetened), maximum 0.050% recoverable oil (0.035% for Grade A).

2) Grapefruit juice: Same as U.S. standards, except minimum 10% Brix exclusive of added sweetener, minimum Brix of raw juice 7.5% minimum Brix canned 9.0%, minimum Brix:acid ratio 7.5:1, minimum acid 0.75%, maximum recoverable oil 0.020%.

3) Canned blend of orange and grapefruit juice: Same as U.S. standards, except mixed raw juice minimum 8.0% Brix; canned minimum 9.5% Brix, minimum Brix:acid ratio 8.0:1, minimum acid 0.65%, maximum acid 1.80%, maximum recoverable oil 0.040%; must contain at least 50% orange juice, of which up to 10% can be from C. reticulata; can be made as single-strength type or reconstituted type with or without single-strength juices added; can be sold as "chilled" if to be refrigerated; must be reasonably free from defects, have reasonably good flavor and color, minimum Brix 10° for single-strength type, 11° for reconstituted type, minimum Brix:acid ratio 9.5:1, maximum ratio 18.0:1, recoverable oil from 0.010 to 0.035% and maximum pulp content 12%.

4) Canned tangerine juice: Same as U.S. standards, except raw juice minimum Brix 9.0%; canned juice minimum Brix 10%, minimum Brix:acid ratio 9:1, minimum acid 0.55%, maximum acid 1.60%, maximum recoverable oil 0.050%.

5) Frozen concentrated orange juice: Same as U.S. standards except Brix:acid ratio 13:1 to 19:5:1, recoverable oil 0.010 to 0.035%

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(reconstituted basis), Brix 44.8 to 47%, no washed pulp solids, not more than 12% sinking pulp; raw juice minimum Brix:acid ratio 10:1 for oranges, 9:1 for tangerines; bulk frozen juice, frozen concentrated juice, concentrated juice and concentrated juice for manufacturing minimum Brix:acid ratio 11:1 (except juices solely of tangerines or sour oranges); minimum No. 3 gel after gel test of concentrate.

6) Concentrated orange juice for manufacturing: Same as U.S. standards, except same requirements as for frozen concentrated orange juice save for Brix range and may contain extracted or washed pulp solids if not to be used for retail or institution containers.

7) Frozen concentrated grapefruit juice: Same as U.S. standards, except recoverable oil 0.008 to 0.02% by volume; maximum centrifuge pulp 10%; Style 1 (unsweetened) Grade A Brix:acid ratio 9:1 to 14:1, Grade B minimum ratio 8:1; Style 2 (sweetened) Brix:acid ratio 10:1 to 13:1.

8) Frozen concentrated blended grapefruit juice and orange juice: Same as U.S. Standards.

9) Other concentrated citrus fruit juices: Same as U.S. standards.

10) Canned grapefruit sections and frozen grapefruit sections: Same as U.S. Standards.

11) Canned grapefruit and oranges for salad: Same as U.S. standards.

12) Chilled orange juice: Same as U.S. standards for Pasteurized Orange Juice and Orange Juice from Concentrate

13) Concentrate soft serve orange juice: Same minimum standards as for concentrated orange juice for manufacturing (for retail use); may contain emulsifiers, stabilizers and artificial color; product must have minimum 11.8% soluble solids exclusive of any added ingredient; minimum container size 32 oz.

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14) Gelled Sunshine citrus salad: Contains gelling agent 1.00-1.50%, dibasic Ca phosphate 0.02-0.06%, sugar 0-10.50%, grapefruit sections (broken, whole or chopped) 20%, grapefruit 10.5° Brix from frozen concentrated unsweetened grapefruit juice (or orange 12.8° Brix from frozen concentrated unsweetened orange juice) balance to 100%, orange oil as needed, grapefruit oil as needed (alternatively can use either grapefruit or orange sections only as 40% of total product).

15) Canned, chilled or other processed citrus products:

(a) Chilled ambrosia: Mixture of orange sections (80% of wt), pineapple, coconut, with or without cherries.

(b) Chilled grapefruit sections: Must be 98% grapefruit.

(c) Chilled orange sections: Must be 98% orange.

(d) Chilled grapefruit and orange sections: Must be 100% citrus with 32-1/2 to 49% orange.

(e) Chilled orange and grapefruit sections: Must be 100% citrus with 32-1/2 to 49% grapefruit.

(f) Chilled fruit salad or chilled citrus salad: Must have at least 32-1/2 % orange and 32-1/2% grapefruit with 85% of fruit ingredients citrus

(g) Chilled mixed fruit: Must contain 20 to 85% citrus. Inspection of products by USDA based on uniformity of color, absence of defects, taste and flavor; freedom from foreign materials.

b) U.S. Standards: (Copies of individual standards can be obtained from the Processed Foods Sections (U.S. Dept. of Agriculture) located in the Division of Fruit and Vegetable Inspection Office, Winter Haven.)

4. Evaluation of frozen concentrated orange juice.

The procedure for evaluation of frozen concentrated orange juice, which is typical of most juice products, involves tests for both state and U.S. requirements.

Citrus Maturity and Packinghouse Procedures

Legal Factors (cont.)

Standards

1) Florida (Citrus Laws 601.9909; Dept. of Citrus Official Rule 20-64, 20-65, 20-67).

(a) Fresh fruit: Juice from Citrus sinensis, C. aurantium, C. reticulata or hybrids; 10:1 ratio for sweet oranges, 9:1 for tangerines 11:1 for bulk juice (except C. aurantium or tangerines).

(b) Processed products (except bulk juice or concentrated juice for manufacture): Ratio, oil content, soluble solids (Brix) given earlier; also no washed pulp solids; not more than 12% sinking pulp and No. 3 gel or less in gel test. (Note that regular concentrates are 3 + 1 or 4 + 1; others, such as 5 + 1 or sweeteners added, require special mits

2) U.S. (Standards for grades of Frozen Concentrated Orange Juice. September 21, 1968. Fourth Issue, as Amended.)

(a) Styles:

(i) Without sweetener

(ii) With sweetener.

(b) Grades

A: Reconstitutes properly, appearance similar to fresh orange juice, very good color, practically free from defects, possesses very good flavor, and has score of 90 or better.

B: Reconstitutes properly, appearance similar to fresh orange juice, good color, reasonably free from defects, possesses good flavor, and has score of 80 or better.

(iii) Substandard: Fails to meet requirements of

U Grade B

b. Evaluation of reconstituted concentrate:

State requirements:

Citrus Maturity and Packinghouse Procedures

Legal Factors (cont.)

(a) Brix and Brix:acid ratio:

Brix: Read either with hydrometer or refractometer to nearest 0.1% and correct for temperature (20°C).

- i) Acid: Pipette 25 ml juice into 125 ml erlenmeyer flask, add 4 to 5 drops phenolphthalein indicator, titrate to pink end point with standard alkali (0.3125 N NaOH); obtain % citric acid corresponding to ml alkali (to nearest 0.1 ml) from Table 3 (p. 10.11) of Bul. 188.

Brix:acid ratio: Divide ° Brix by % citric acid.

(b) Washed pulp solids: Strain juice through 20 mesh screen; put 50 ml into short-conical graduated centrifuge tubes; spin for minutes at 1500 rpm in clinical centrifuge; (ml reading at top sinking

Gel test: Warm a 6 oz. can under tap water (70 80°F 21-26 or 30 minutes, then hold in water bath at 80°F for 24 hours; cut off one end of can glass over the can, invert punch a hole in the can and slide can from the contents; determine the gel number according to definitions in the table on page 4-5 of R 20-6.

Federal requirements:

(a) Color: Formerly samples of in 1-inch (2.5 cm) diameter clear test tubes were compared against standard USDA color tubes under light source of 7200°K; now the Hunterlab Model D45 tristimulus colorimeter shall be used exclusively (Rule 20-65). Color is scored according to the scale on the color chart (Table 37). U.S. Grade A must have a score of 36 to 40, Grade B, 32 to 35; anything less is Substandard.

(b) Defects: Grade A must have score of 8 to 20 and Grade B, 6 to 17; anything less than 16 is Substandard.

- i) Discolored specks, white flakes, etc. Examine sample of juice; Grade A must be practically free and Grade B reasonably free