

SENSORY EVALUATION OF COMMERCIAL, CANNED FLORIDA GRAPEFRUIT JUICE

S. M. BARROS AND J. E. DAVIS
 Scientific Research Department
 Florida Department of Citrus
 Citrus Research and Education Center
 700 Experiment Station Road
 Lake Alfred, FL 33850

Additional index words. acidic, bitter, processed, sweet.

Abstract. Since the 1973-74 season, 1194 samples of commercial, canned Florida grapefruit juice have been evaluated for flavor and aroma by an experienced taste panel. Comments indicate that juices judged to have poor flavor were mostly "acidic" and "bitter" and those with acceptable flavor were found to have "good," "excellent," and "full flavor." Adverse aroma comments were of "heated" aroma whereas positive comments included "good," "excellent," and "fresh juice" aroma.

Total consumer purchases of grapefruit juice for the period Dec. 1983 through Nov. 1984 were 53.67 million single-strength (SS) gallons. Ready-to-serve grapefruit juice in cans represented 26.9 million SS gallons or 50.1% of total purchases. When compared to the previous season's total of 35.97 million SS gallons purchased, a 25% drop in the purchase of canned grapefruit juice is realized. The market share of canned grapefruit juices also dropped from 2.2% in Dec. 1983 to 1.5% in Nov. 1984, a 0.7 point change (6).

Federal Standards of Identity for canned grapefruit juice (4) recognize 2 forms of the product, (a) that prepared from unconcentrated, undiluted liquid extract from mature grapefruit, and (b) grapefruit juice from concentrate. The first form may contain concentrated grapefruit juice ingredient for adjustment, without label declaration, provided that the quantity of such concentrated grapefruit juice ingredient added does not contribute more than 15 percent of the grapefruit juice soluble solids in the finished food (4).

The effects of °Brix, acid, and bitterness on flavor of canned grapefruit juice have also been reported by several investigators (1, 2, 3, 5). Barros and coworkers (3) showed that flavor scores of canned grapefruit juice as determined by an experienced taste panel have declined steadily over the 10-year period 1973-74 through 1982-83. The data presented in the present paper represent 11 seasons of data gathering on the flavor and aroma of canned grapefruit juice produced in Florida.

Materials and Methods

Since 1973 when the Florida Department of Citrus (FDOC) initiated a grapefruit products improvement program, the collecting of canned grapefruit juice, on the 1st and 15th of each month, beginning in November of each season and terminating at the end of the following June or beginning of July, has been a part of the total program. Samples are obtained from Florida processing plants by U. S. Dept. Agr. Processed Foods Division supervising inspectors and delivered to the Citrus Research and Education

Center in Lake Alfred by USDA and FDOC personnel. Samples are evaluated for various parameters (2), including flavor and aroma within a week of production in order to minimize any degradation of quality due to storage.

Each sample was evaluated by an experienced 10-12 member panel using an evaluation form similar to that shown in Fig. 1. Aside from rating the flavor of each juice using the 9-point hedonic scale shown, panelists were encouraged to make comments on the flavor and aroma of the juice being evaluated. Samples were generally presented 3 at a time and the position of each sample was changed in order to minimize the effects of a particular sample on other samples being tasted. Panelists were instructed to judge each sample on its own merit and not compare samples. On occasion, 4 samples were evaluated during a particular session. A total of 1194 samples were tasted by the panel yielding 13774 tastings. Samples known to have been sugar added were not included. Of the 1194 samples analyzed, only 168 or 14.1% of the total samples were known to be from concentrate. The largest quantity (90 samples) of reconstituted product was acquired after the 1981-82 season.

Results and Discussion

Table 1 lists the most common adverse flavor and aroma comments of the commercial, canned grapefruit juices. The number of comments of a particular type as well as percent of adverse comments and percent of total

Name _____		Date _____	
Code _____	Code _____	Code _____	Code _____
Like Extremely	Like Extremely	Like Extremely	Like Extremely
Like Very Much	Like Very Much	Like Very Much	Like Very Much
Like Moderately	Like Moderately	Like Moderately	Like Moderately
Like Slightly	Like Slightly	Like Slightly	Like Slightly
Neither Like nor Dislike	Neither Like nor Dislike	Neither Like nor Dislike	Neither Like nor Dislike
Dislike Slightly	Dislike Slightly	Dislike Slightly	Dislike Slightly
Dislike Moderately	Dislike Moderately	Dislike Moderately	Dislike Moderately
Dislike Very Much	Dislike Very Much	Dislike Very Much	Dislike Very Much
Dislike Extremely	Dislike Extremely	Dislike Extremely	Dislike Extremely
Comments _____	Comments _____	Comments _____	Comments _____

PLEASE EVALUATE EACH SAMPLE FOR DEGREE OF BITTERNESS BY CIRCLING THE APPROPRIATE ANSWER

NEGLIGIBLE	SLIGHT	MODERATE	EXTREME
NEGLIGIBLE	SLIGHT	MODERATE	EXTREME
NEGLIGIBLE	SLIGHT	MODERATE	EXTREME
NEGLIGIBLE	SLIGHT	MODERATE	EXTREME
NEGLIGIBLE	SLIGHT	MODERATE	EXTREME

Fig. 1. Sensory evaluation form.

Table 1. Most common adverse flavor and aroma comments^a of commercial, canned grapefruit juice packed during the 1973-74 through 1983-84 seasons. Number of adverse comments = 7183. Total comments = 9217.

Comment	Number of comments	% of adverse comments	% of total comments
Sour, tart, acidic	1834	25.5	19.9
Too bitter	1592	22.2	17.3
Weak flavor	635	8.8	6.9
Nondescript off-flavor	590	8.2	6.4
Heated, processed flavor	477	6.6	5.2
Heated aroma	474	6.6	5.1
Flat, stale, bland flavor	205	2.9	2.2
Metallic (tinny) flavor	191	2.7	2.1
Stored, canned, flavor	150	2.1	1.6

^aNinety-three different negative flavor and aroma comments recorded.

Table 2. Most common positive flavor and aroma comments^a of canned, single-strength grapefruit juice packed during the 1973-74 through 1983-84 seasons. Number of positive comments = 2034. Total comments = 9217.

Comment	Number of comments	% of positive comments	% of total comments
Good, excellent flavor	643	31.6	7.0
Good, excellent aroma	514	25.3	5.6
Sweet	270	13.3	2.9
Full flavor	152	7.5	1.7
Good ratio	104	5.1	1.1
Fresh juice aroma	76	3.7	0.8
Fresh flavor	64	3.1	0.7
Balanced flavor	44	2.2	0.5

^aTwenty-five positive flavor and aroma comments recorded.

comments is also shown. The number of adverse comments totaled 7183 and the number of total comments numbered 9217. In all there were 74 different adverse flavor and 19 adverse aroma comments made. As can be easily seen, "sour," "tart," "acidic," and "too bitter" were by far the most common adverse comments made of canned grapefruit juice. Those 2 areas amounted to 47.7% of all adverse comments. Grapefruit studies (1,5) have shown that harsh processing as well as the processing of immature fruit will yield juice which evokes these types of comments. "Nondescript off flavor" is the third most common flavor descriptor and is used by the panelist when he/she senses that the flavor isn't right but is not able to definitely describe the deficiency. A juice described as having "weak flavor" was interpreted as lacking full body, as though the juice had been watered down. The most common adverse aroma comment made was of a "heated juice" aroma. This is probably due to over pasteurization of the juice in a pasteurizer or in an evaporator or even both in the case of reconstituted juice. "Heated flavor," "processed," "flat," "stale," "bland flavor," "metallic (tinny) flavor," "stored," and "canned flavor" complete the list of most common adverse comments.

Table 2 lists the most common positive flavor and aroma comments associated with canned grapefruit juice. The total number of positive comments made were 2034. The most common positive comments made were "good," "excellent flavor" and "good," "excellent" aroma. Together these comments equaled 56.9% of total positive comments. These particular comments were made of juices which

closely resembled juice from freshly squeezed grapefruit with a minimum of processed (heated), storage flavor or aroma, and are indicative of good grapefruit juice processing and storage practices. The third most common positive attribute of canned juice was "sweet" tasting, meaning either juice from mature fruit or low acid fruit. This category could also be combined with the "good ratio" category. "Full flavor" in the juice was also found to be a quality needed in canned grapefruit juice. Generally, these were juices from mature fruit, high °Brix and some bitterness, enough to give the juice a distinctive grapefruit juice taste. "Good ratio", "fresh aroma," "fresh flavor," and "balanced flavor" complete the list of most common positive attributes. In all, 25 different positive comments were recorded.

One of the problems of working with an experienced taste panel as opposed to a trained taste panel is in evaluating the comments made of the juices being tasted. A trained panel is instructed to define a certain characteristic in a certain manner common to all panel members. The comments are used in the event that a question arises concerning a particular sample's flavor score. It is possible that several of the categories shown in Tables 1 and 2 could be combined as describing the same characteristic, but that type of data manipulation could lead to a wrong conclusion, therefore, only comments whose meanings were the same e.g. "tart;" "sour;" and "acidic," were combined.

In summary, 1194 samples of Florida commercial, canned grapefruit juice were tested for flavor and aroma by an experienced taste panel. All the comments made concerning flavor and aroma were recorded and tabulated over 11 seasons, beginning with the 1973-74 season. The comments were grouped into adverse and positive categories for flavor and aroma. "Sour," "tart," "acidic," and "too bitter" accounted for 47.7% of the adverse flavor comments and "heated aroma" was found to be the most common adverse aroma comment.

On the positive side, "good," "excellent" flavor and "good," "excellent" aroma were found to be the most prevalent positive flavor and aroma comments, respectively. In all, 93 different negative comments (flavor and aroma) and 25 different positive comments (flavor and aroma) were recorded during the study.

One problem found in using an experienced taste panel as opposed to a trained taste panel was in interpretation of some of the comments.

Literature Cited

1. Attaway, J. A. 1977. Factors influencing the flavor of grapefruit juice. *Proc. Intl. Soc. Citriculture* 3:816-820.
2. Barros, S. M., J. E. Davis, M. H. Dougherty, and J. T. Griffiths. 1983. Inter-relationships of °Brix, °Brix/acid ratio, naringin and limonin and their effect on flavor of commercial, canned single-strength grapefruit juice. *Proc. Fla. State Hort. Soc.* 96:316-318.
3. Barros, S. M., M. H. Dougherty, E. L. Moore, and R. D. Carter. 1984. Commercial, canned grapefruit juices produced in Florida, 1973-74 through 1982-83 seasons. *Proc. Fla. State Hort. Soc.* 97:92-94.
4. Food and Drug Administration Standard of Identity for Grapefruit Juice (21 CFR 146.132).
5. Rouseff, R. L., S. M. Barros, M. H. Dougherty, and S. F. Martin. 1980. A survey of quality factors found in Florida canned, single-strength grapefruit juice from the 1977-78, 1978-79 and 1979-80 seasons. *Proc. Fla. State Hort. Soc.* 93:286-289.
6. State of Florida Department of Citrus. 1984. *Citrus Digest*, (Nov.), p. 8.