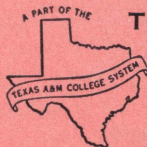


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Consumer Panel Test Of Texas Fortified Red Grapefruit Juice

THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
TEXAS AGRICULTURAL EXPERIMENT STATION

R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS



Summary

Consumer's Ratings of the Three Juices

Consumer panel tests of three canned single-strength grapefruit juices by approximately 300 families in Dallas and Houston, Texas, indicated a definite preference for Texas fortified red juice over Texas white or Florida white grapefruit juices. Sixty-one percent of the 620 family members tasting the juices preferred Texas fortified red, 24 percent Texas white and 15 percent Florida white juice. Similar ratings were given by a taste panel in preliminary laboratory tests by the Texas Agricultural Experiment Station at College Station.

Reasons for Preferences

Consumers in the Dallas and Houston panels emphasized sweetness and natural flavor as their reason for preferring the Texas fortified red grapefruit juice. Low income families tended to select it on the basis of its relative "sweetness." High income families preferred it on the basis of "natural" flavor. The red color also is thought to have influenced some in their choice because of its association with high-quality pink and red grapefruit.

Consumers who preferred Texas white grapefruit juice emphasized "flavor." "Flavor" in the terminology of consumers appears to mean a tendency toward "tartness" or astringency and away from "sweetness."

The 15 percent of the panel that preferred Florida white juice did so on the basis of its "flavor" and tart-sour taste. The majority liked the Florida juice least because it was too bitter and "sour" or "too strong."

Qualities Consumers Desire

Nine out of 10 consumers reported "sweetness" or "flavor" as the characteristic desired in grapefruit juice. It often was qualified with statements such as "natural flavor—like freshly squeezed fruit."

Most of the Dallas and Houston consumer panels disliked the characteristics of "bitterness," "sourness" and a "strong taste."

Consumer's Knowledge of Labeling

Most consumers know that the term "sweetened" or "unsweetened" appears on canned single-strength grapefruit juice labels. Preference for the term "sweetened" is low. The majority prefer juice labels "unsweetened" or "natural flavor." This indicates that although a naturally sweet juice is preferred, one with sugar added is not.

Recommendations

A full-scale market test to validate further the findings of the panel test and to permit a reliable estimate of the market potentials for Texas fortified red grapefruit juice is recommended.

Labels for Texas red grapefruit juice preferably should emphasize "fresh full flavor" or "sweet natural flavor." This would encourage buying by consumers who prefer sweetness and natural flavor. A statement such as "no sugar added" may help dispel the possibility of sales resistance encountered from calorie-conscious consumers who associate sweetness with fattening foods.

Emphasis on the point that the juice is from fresh red grapefruit may strengthen consumer's impression of its "natural sweetness."

The unique character of Texas fortified red warrants consideration of a large-scale promotional-type competition to choose a name for the new product.

Consideration should be given to a colored plastic container or plastic lined cans instead of a regular can. The "tinniness" created by the acid reaction on the can surface masks the natural sweet flavor of the juice to a large extent.

Consideration should be given to the possibility of marketing this juice in special packs for babies and young children.

Consumer Panel Test of Texas Fortified Red Grapefruit Juice

R. E. Branson, Carter Price and H. V. Courtenay*

GRAPEFRUIT HAS ALWAYS BEEN THE MAIN CITRUS CROP produced in Texas. Approximately 2,000 acres were devoted to grapefruit groves in the Lower Rio Grande Valley in 1925. These groves had increased to 80,000 acres, by 1946-47, Figure 1.

Texas was second only to Florida in fresh grapefruit sales several years before 1945, Figure 2. From 1945 until the freezes of 1949 and 1951, Texas rose to a position of leadership and sold more fresh grapefruit than any other state. Freezing weather in the Lower Rio Grande Valley in 1949 and 1951 killed an estimated 75 to 80 percent of the grapefruit trees. Numerous groves were completely destroyed and Texas' leadership was lost.

Many citrus groves have been, and are being, replanted. However, a number of years will be required to regain the peak production levels enjoyed in the mid-forties. Almost all of the replantings have been of the pink and red varieties, Figure 3. Estimates are that red and pink grapefruit trees now comprise more than 80 percent of the present Texas grapefruit trees — bearing and nonbearing ages combined.

Marketing Problems

In a normal year with average market conditions, about 40 percent of the Texas grapefruit crop does not meet fresh fruit grade standards because of size, shape, or miscellaneous external blemishes. Processing of grapefruit for canned single-strength grapefruit juice usually provides producers with a readily available outlet for this portion of the crop. Although prices paid for processing fruit are below those offered for fresh fruit, sales to processors represent an important part of the grower's income.

In the mid-forties, there were more than 40 grapefruit juice canning firms in Texas processing about ten million cases of grapefruit juice per year. The 1949 and 1951 freezes forced many of these processors to suspend operations. Grapefruit juice processing again will become of major economic importance in the Lower Rio Grande Valley as replanted groves come into production.

Development of Texas Fortified Red Grapefruit Juice

During the 1940's when grapefruit production in the Lower Rio Grande Valley was at its peak, white grapefruit comprised about 72 percent of sales in the fresh market and 85 percent of that processed for juice, Table 1.

In the same decade, the production of pink and red varieties lagged behind consumer demand. This resulted in premium prices for these varieties. As a result, the heavy replantings since the 1949 and 1951 freezes have been about 90 percent red and pink varieties. These red and pink plantings now are producing at a rate sufficient to provide fruit for processing.

There has been considerable dissatisfaction with the utilization of red and pink grapefruit varieties

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*Respectively, professor and chairman, Consumer Economics Section; former graduate student and assistant professor, Department of Agricultural Economics and Sociology.

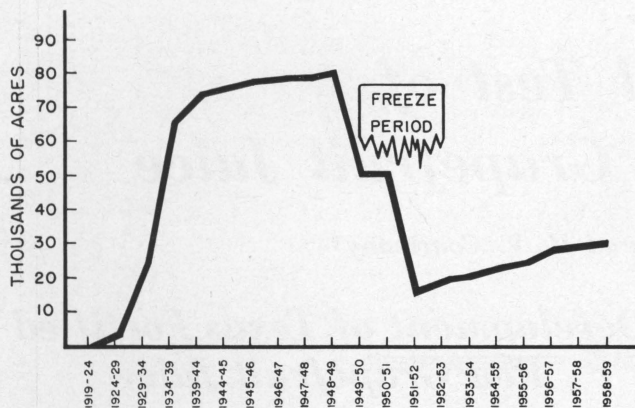


Figure 1. Texas grapefruit-bearing acreage, 1919-59.

for canned juice. Pink and red grapefruit processed for single-strength juice in the same way that white grapefruit is, has several disadvantages. The resulting red or pink juice has a faint pink color which is too weak to have the attractive appearance of the fresh fruit. After a few months of storage, the juice suffers an undesirable browning or discoloration. This "muddy pink" color also contrasts considerably with the white juice to which most consumers are accustomed.

Formerly, canners were able to absorb the small quantities of red and pink grapefruit available for processing by mixing them with the large volume of white juice. Any effects upon the appearance of the white juice were negligible. Now, with a preponderance of reds and pinks, this is no longer the case.

Unless the method of processing of red grapefruit can be modified to eliminate the "muddy pink" appearance, juice processors will be unable to purchase red and pink varieties as readily as white ones.

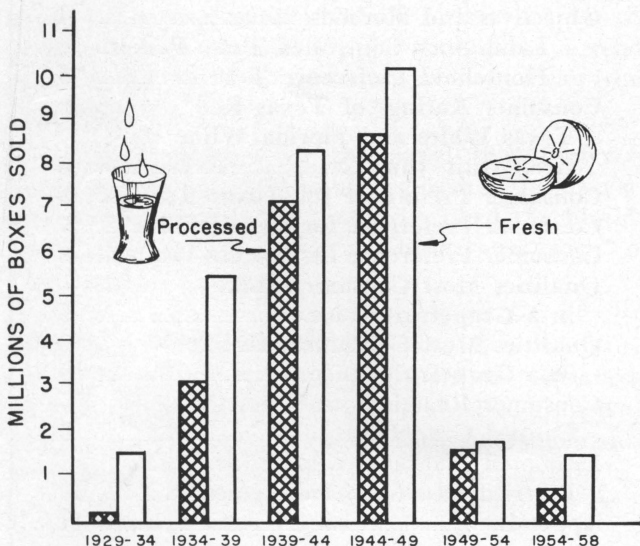


Figure 2. Texas grapefruit sales in fresh and processed forms 1929-58. Average sales in each 5-year period.

Thus, as red and pink grapefruit production in the Lower Rio Grande Valley increases so will the problem of marketing that part of the crop which does not meet fresh market standards.

Because of the above problem, search for a new method of processing Texas red fortified grapefruit juice was started by the USDA Fruit and Vegetable Products Laboratory. A method was found of retaining the red or pink grapefruit pulp to the juice as it was being prepared for canning. The increase in pulp resulted in a deeper colored juice, since the fruit pulp and not the juice carries the color.

To aid in the decision whether to convert to the new method of grapefruit juice processing, the Texas Citrus Industry requested a consumer market test of the new grapefruit juice. A decision could be reached as to whether it was advisable to incur the expense of the additional processing equipment necessary to make the new juice. The Consumer Economics Section of the Department of Agricultural Economics and Sociology recommended that a consumer panel test precede any retail market testing since a panel test would uncover problems in quality and probable consumer acceptance at less expense than a retail store test. Then, if the panel test was favorable, a market test could be undertaken. This report presents the results of the consumer panel test.

Objectives and Methods

Several preference tests to determine the degree of consumer acceptance of this new juice were conducted. The objectives of the research were: (1) to establish preference indications of a laboratory taste panel at College Station, Texas, (2) to determine and evaluate the preferences of a household consumer panel toward the product and (3) to obtain some indication of the market potential for the new juice.

Laboratory Controlled Taste Panels

Two taste panels were used at the laboratory—an expert taste panel and a nonexpert one. The expert panel was comprised of six employees of the Texas Agricultural Experiment Station who have had extensive tasting experience. The nonexpert taste panel was comprised of 34 college employees selected at random and representing various ages of each sex. None of the latter panel had had specific training in food testing.

Representative Florida white and Texas white canned single-strength grapefruit juices were obtained from midseason packs for the taste tests. The Texas white and Florida white juices were colored to match the Texas fortified red. A red neutral flavor artificial food color was used. This eliminated color as a possible basis for discrimination among the juices.

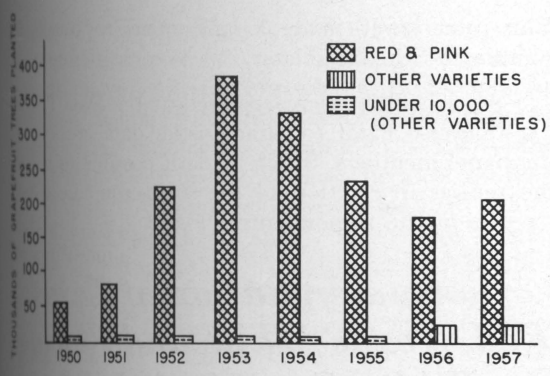


Figure 3. Grapefruit trees by year of planting in the Lower Rio Grande Valley.

The juices were stored at a temperature of 50°F. for 12 hours before each test. This is comparable to ordinary home serving temperature. The three juices were served in nonwaxed cups and identified by a code on the bottom of each cup.

The standard "duo-trio" test was used with both panels. Panelists were requested not to eat anything nor drink any beverage for one-half hour before the test, nor to smoke for 15 minutes before the test. The panelists also rinsed their mouths with water before tasting each set of juices.

The following instructions were given to each panel member at the time of the test: "This is an experiment to discover the ability of consumers to detect differences in canned grapefruit juices. You are going to taste three juices. One of the last two will be different from the first juice. Indicate which of the last two juices is the different one. Remember, there are three juices - one of the last two is different from the first. See if you can tell which one is different."

In presenting the juices, four different sequences were used for each pairing. Reading from left to right, the sequences were as follows:

TEST	TASTING ORDER		
	1	2	3
#1	Control	Control	Test
#2	Control	Test	Control
#3	Test	Control	Test
#4	Test	Test	Control

The two sequences given to each panel member were determined at random.

Results from the panel were tested by Chi-square analysis and showed that the nonexpert taste panel was unable to detect any differences among the juices as presented in the "duo-trio" tests. The expert taste panel, however, was able to discriminate among the juices.

A few days later, the three juices were presented in their natural colors to the nonexpert panel. Eighty-one percent of this panel chose the Texas fortified red grapefruit juice as their preference.

The results of the laboratory panel tests in summary were that a group of consumers selected at random could not identify this lot of Texas fortified red grapefruit juice from among the three juices on the basis of taste alone and that these panelists expressed preferences primarily on the basis of color.

As a result of these pretests, it was deduced that in subsequent tests consumers would probably fall into two categories: (1) a majority of individuals, unable to discriminate among the juices, would necessarily rate them on the basis of color alone, (2) a limited group of individuals with a high capacity to discriminate on a basis of taste would have a preference based all or in part on taste differences. Since the juices used in this test had Brix-acid ratios that were extremely similar, about 7.2 to 7.5, according to USDA and Texas Agricultural Experiment Station laboratory tests, it is not surprising that the preferences of a household consumer panel would be most influenced by the color of the juices.

Household Preference Test

Following the laboratory taste panel tests, two household consumer panel surveys were made - one in Dallas and one in Houston, Texas.

The consumer panel surveys were among 148 families, comprising 358 respondents in Dallas; and 148 families, comprising 262 respondents in Houston. Consumer panels of 300 families each are maintained by the experiment station in Houston, Dallas and Waco for research purposes. The panel households were randomly selected from the city directories of each city in order to assure a representative sample. The household panelists who participated in this study also were selected at random from these panels in Dallas and Houston.

The Dallas test occurred in July and the Houston test in October 1958. These months were selected because the supply of fresh grapefruit is limited during those periods. Therefore, canned single-strength or frozen concentrated grapefruit juices and canned

TABLE 1. TEN-YEAR AVERAGE PRODUCTION OF TEXAS GRAPEFRUIT, BY VARIETIES, 1940-50¹

Variety	Utilization					
	Processing		Fresh market		Total	
	Boxes ²	Percent	Boxes ²	Percent	Boxes ²	Percent
Marsh white	6,091,823	84.4	7,281,863	71.6	13,373,686	76.9
Marsh pink	534,117	7.4	1,667,913	16.4	2,202,030	12.7
Foster pink	245,405	3.4	701,744	6.9	947,149	5.4
Ruby red ²	158,792	2.2	498,340	4.9	657,132	3.8
Duncan	187,663	2.6	20,340	0.2	208,003	1.2
Total	7,217,800	100.0	10,170,200	100.0	17,388,000	100.0

¹Alderman, D. C., "Citrus Variety Trends in the Lower Rio Grande Valley," Texas Agricultural Experiment Station, Bulletin 742, December, 1951, p.4.

²1¼ bushel boxes.

³"Ruby red" is used to designate all red varieties of grapefruit.

TABLE 2. PREFERENCES AMONG THE TEST GRAPEFRUIT JUICES STATED BY DALLAS AND HOUSTON PANEL FAMILIES

First choice	Dallas panel		Houston panel	
	Percent	Standard error	Percent	Standard error
Texas fortified red	61	2.57	62	2.99
Texas white	24	2.25	22	2.55
Florida white	15	1.88	16	2.26
Number of families	358		262	

or frozen grapefruit sections are about the only forms of grapefruit products available. Frozen concentrated grapefruit juice and frozen grapefruit sections usually can be purchased only in large food supermarkets.

Separate professional interviewing teams were used in each of the cities to deliver the juices and instruct the housewife about the test procedures. The juice samples were delivered to the households in insulated picnic boxes cooled with dry ice. Samples were repacked from large-sized cans (46 ounces) into 1 pint, clear plastic containers before delivery to families. Each container of juice had a code number—R for Texas-fortified red, L for Texas white and Y for Florida white. These letters were chosen rather than numbers or other letters in order to avoid those that might be associated with grading systems or any other ranking method which might create a bias in the consumers' minds.

Each household received samples of the three juices in their natural form and color. The delivered samples were immediately placed in the refrigerator. Therefore, all members of each household tasted the juices when they were chilled as they would normally use them from their own refrigerator. Each eligible member of the household was provided with a schedule on which to indicate his preference rating for each juice. Eligible members were those considered old enough to express their own opinion. All were instructed to complete a section of the schedule provided for them and to explain, in their own words, their reasons for preferences. The sequence in which the three juices were to be tasted was outlined on the schedule. Tasting sequences were randomly rotated on these schedules to prevent accumulated order bias.

TABLE 3. COMPARISON OF FIRST CHOICES AMONG GRAPEFRUIT JUICES REPORTED BY THE HOUSEHOLD AND LABORATORY PANELS

First choice	Dallas-Houston household panels ¹		Laboratory panel	
	Percent	Standard error	Percent	Standard error
Texas fortified red	61	1.96	81	7.0
Texas white	24	1.71	13	6.0
Florida white	15	1.43	6	4.2

¹Dallas panel of 358 families and Houston panel of 262 families.

The interviewer made arrangements to obtain the completed schedules later.

All schedules were analyzed at the Data Processing Center. Family characteristics data are kept on the panel members, which made it possible to analyze the replies in relation to the socio-economic characteristics of the respondents.

Consumer Rating of Texas Red, Texas White and Florida White Grapefruit Juice

The results of the consumer panel tests in Dallas and Houston were almost identical, Table 2. Therefore, responses of both panels have been combined for purposes of analysis.

Analysis of the responses showed that nearly two out of three respondents preferred Texas fortified red. One in four preferred Texas white and only 15 percent had a preference for Florida white grapefruit juice. These results were somewhat similar to those from the laboratory taste panel in College Station, Table 3.

Texas fortified red was preferred among all income groups in the household panels. It was also the housewife's preference in every age group and at each educational level. Therefore, it had an extremely wide preference base among the test households.

Consumer Preference for Texas Red

The reasons consumers gave for preferring Texas fortified red juice varied widely in wording. Nevertheless, because many of the comments have similar basic implications nearly all of the reasons have been grouped into three major categories—"sweetness," "flavor" and "tart-sour."

Nine out of ten respondents who preferred Texas fortified red grapefruit juice did so because of its "sweetness" and "flavor," Figure 4. Some typical comments about the new juice were—"it's sweeter," "it has a natural flavor like freshly squeezed fruit" and "it has more rich full flavor." A few said they liked the color. Since red color is often associated with a sweet taste in food products and red grapefruit usually have a less astringent flavor, it may have subconsciously influenced some respondents to mention "sweetness" as a reason for preferring the new juice. Housewives of all races and ages and in homes of all educational levels selected it on the basis of "sweetness."

However, there was some variation in relation to the level of family income. Lower income families, and those where the husband had only a grade school

education, were more likely to prefer Texas red grapefruit juice because of its "sweetness." The problem becomes one of interpreting why a preference for "sweetness" in grapefruit juice is associated with lower income levels. Sociologists consulted at Texas A. and M. felt that lower income groups, because of their manual work, have a greater appetite for high caloric foods, many of which are sweet. Also high income families, according to the sociologists, are in a position to satisfy their "sweet" hunger with expensive pastries, candies and sweet desserts whereas low income groups cannot afford as much of these foods. Therefore, they satisfy their requirements with sweeter tasting staple foods. Further research along these lines would be desirable before making promotional decisions on the basis of these latter assumptions.

From the marketing viewpoint, it is important also to know whether those preferring the new fortified red juice are frequent or infrequent consumers of grapefruit juice. More than half of the respondents stating Texas fortified red as first choice among the three juices used grapefruit juice once a week or more. A further 31 percent used the product at least once a month. Therefore, eight out of 10 consumers preferring Texas fortified red grapefruit juice are reasonably frequent users, Table 4.

Three-fourths of the frequent users preferring Texas fortified red grapefruit juice did so because of its properties of "sweetness" and/or "flavor." Flavor—a difficult quality to define—embodies taste, aroma, consistency or viscosity as well as some psychological factors. This seems to be the reason consumers associate the thought of flavor with comments like "rich," "full" and "natural." These comments suggest that the choice of a grapefruit juice on the basis of flavor implies some movement away from the idea of "sweetness." The consumer's idea of "sweetness" is somewhat different from that of the chemist or food technologist. The former identifies sweetness with lack of astringency or tartness and sour flavor with the presence of astringency, whereas, the food technologist makes a definite distinction between the

TABLE 4. PERCENTAGE OF CONSUMER PANEL RESPONDENTS WHO PREFER TEXAS FORTIFIED RED GRAPEFRUIT JUICE CLASSIFIED BY REASON OF PREFERENCE AND FREQUENCY OF CONSUMPTION OF CANNED SINGLE-STRENGTH GRAPEFRUIT JUICE, DALLAS-HOUSTON

Frequency of use	Reasons			Total
	Sweetness	Flavor	Other	
	Percent			
At least once a week	28.7	18.9	3.4	51.0
At least once a month	20.5	8.2	2.1	30.8
Less frequently than once a month	10.5	3.7	0.8	15.0
Never and no response	2.4	0.8	0.0	3.2
Total	62.1	31.6	6.3	100.0

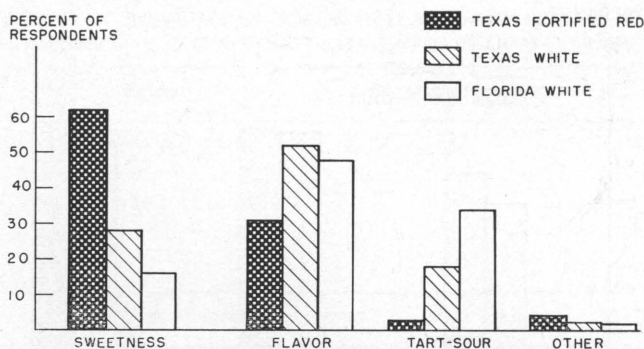


Figure 4. Percentage of distribution of consumer panel respondents classified by reasons for selecting the indicated grapefruit juice as their first choice, Dallas-Houston, 1958.

flavor attributes of sourness, astringency and sweetness.

In view of the preponderance of the preference for Texas fortified red grapefruit juice for its "flavor" and its "sweetness," demand for the product may be encouraged by stressing "sweet natural flavor."

The foregoing part of the report dealt primarily with the preferences and motives of consumers who selected Texas red as their first choice. It may be of interest also to consider the ideas of respondents placing Texas red last in their ratings. Texas fortified red was preferred least by one respondent in five. The reasons most often given were "too sweet," "not too sharp," or "has been sweetened." Nevertheless, there were fewer uncomplimentary remarks about Texas red than about Florida white grapefruit juice.

Consumer Preference for Texas White

Texas canned single-strength white grapefruit juice was the first preference of approximately one-fourth of the combined Dallas-Houston consumer panels. This compares with two-thirds that preferred the Texas fortified red juice.

There was a difference between respondent's reasons for selecting Texas white as first choice in comparison with Texas fortified red. Texas white was generally selected because of its "flavor." Texas fortified red, it will be recalled, was favored primarily for its "sweetness." Results showed that more than half of the respondents preferring Texas white did so because of its "flavor" and about a fourth of them chose it on the basis of "sweetness." Some placed it first because it was "tart" or "sour," Figure 4.

Preferences for Texas white on the basis of "flavor" or "sweetness" appear to be related to the age of the respondent just as they were for Texas fortified red. The preference pattern indicated that a liking for "flavor" and "tartness" increases with age. Conversely, the preferences for "sweetness" decrease with age. Most of the respondents who gave "sweetness" as their reason for selecting Texas white

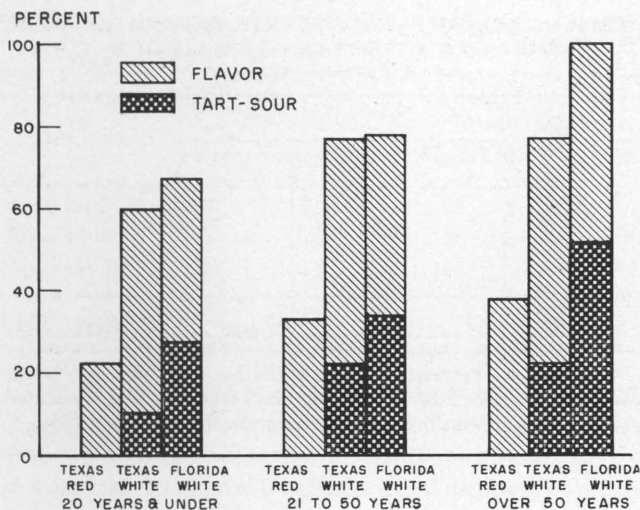


Figure 5. Relative importance of flavor and tart-sour taste in preferences for indicated canned single-strength grapefruit juices, Dallas-Houston panel, 1958.

as their first preference were under twenty. The indication of other research¹ that the taste buds of older people are less sensitive partly explains this correlation.

Educational level, race and income of the respondents were not related to their reasons for preferring Texas canned single-strength white grapefruit juice. The frequency with which respondents normally purchase grapefruit juice did not vary significantly with their reasons for selecting Texas white as their first choice.

The highlights of the findings respecting consumers' preferences for Texas white grapefruit juice can be summed up by saying it was accepted by about one-fourth of the people interviewed and it appeared to be most acceptable to consumers seeking "flavor" in grapefruit juice—particularly those who are twenty-one and over.

In view of this it may be valuable to consider the marketing of Texas white grapefruit juice in two forms—synthetically sweetened and natural flavor—thereby appealing to an even wider range of preferences.

Respondents used the terms "full flavor" and "mild flavor" quite frequently when commenting on Texas white grapefruit juice. Perhaps promotional campaigns, advertising and labeling should be slanted toward these ideas.

Consumer Preference for Florida White

Although only one respondent in six selected Florida white grapefruit juice as their preference

¹USDA Bureau of Agricultural Economics, 3645 (Agri. Washington) USDA 607-51 Market Release, March 21, 1951, Washington, D. C.

when choosing among the three juices it is important to examine their reasons for selecting or rejecting. Such analyses allow us to deduce the characteristics least liked by a large majority of the consumers surveyed.

The small percentage of respondents preferring the Florida canned grapefruit juice said that they chose it mostly because it had "good flavor" and "tart or sour" taste. The most frequent comments accompanying the reasons were: "full bodied," "strong taste," "just-right sweetness," and "I like sour juice." Nearly half of those who selected it as first choice did so on the basis of "flavor" and a further third did so on the basis of "tartness or sourness," Figure 5. Evidently, Florida white is favored by the minority of Houston and Dallas people who prefer a particularly tart, strong-flavored grapefruit juice.

It is worth noting that most of the people interviewed who chose Florida white on the basis of "flavor" or "tart-sour" taste were in the middle and older age groups, Figure 5. This further substantiates the indications mentioned elsewhere in this report that selection on the basis of "flavor," or a tendency to get away from "sweetness," increases with the age of the consumer.

The analysis revealed that more respondents from low income families than high income families gave "tart-sour" as their reason for preferring Florida white. This is the direct opposite of the reasons given by low income people who selected Texas fortified red as their first choice. The seemingly conflicting relationships are difficult to explain. One answer may be that because the number of people choosing Florida white was small, consequently, the number of people in each income bracket was too small to yield reliable information about their preferences. Another possibility is that many low income families have acquired a taste preference for "tart-sour" grapefruit simply because they have used nothing else over a period of time. Their buying of "tart-sour" juice may well have been on the basis of price with little or no consideration for quality characteristics. Other factors such as education of the homemaker and the education of the head of the household did not appear to influence the reasons for choosing Florida white grapefruit juice.

Since more than half of all the panel members placed Florida white last on their preference ranking their reasons for doing so need mentioning.

The most frequent quotes were "too bitter or too strong," or "too sour, tasted old and stale." Some respondents added "it has a canned taste," "rind taste or green-raw taste," or "it tastes artificial." Those placing Florida white last—and a majority of the people surveyed gave it this rank—did so without reservation, judging from the critical comments on the rating schedules.

Qualities Most Consumers Like in a Grapefruit Juice

The reasons given by respondents for preferring the grapefruit juices are helpful when determining the most desirable qualities in a grapefruit juice, Table 5.

"Sweetness" and "flavor" were the criteria mentioned by almost nine out of ten of these respondents. In many instances these reasons were qualified by statements emphasizing "natural flavor" — "like freshly squeezed fruit." Texas fortified red grapefruit juice appears to meet these specifications. It is a sweet flavorful juice and the added pulp enhances its eye appeal by its color (similar to fresh fruit) and by its freshly squeezed appearance.

Qualities Most Consumers Dislike in a Grapefruit Juice

We can assume that the reasons given for not liking the grapefruit juices sampled are caused by qualities which consumers do not want in a grapefruit juice, Table 6. These are mainly bitterness, sourness and a strong taste. Three out of four Houston and Dallas homemakers gave these reasons. Other factors listed by respondents as reasons for placing a particular grapefruit juice last among the three samples were a "canned taste," "rind taste," or "artificial taste." Respondents seldom placed Texas fortified red last because it was bitter or sour. None of the respondents, not even the small number placing it last said it had an artificial taste or a rind, green-rind taste. Actually, most of the panelists who preferred Texas fortified red least among the three samples did so because it was too sweet.

The reasons given for preferring a grapefruit juice indicate that the characteristics consumers want to avoid are a strong bitter or sour taste and any other artificial taste which is not typical of the fresh juice.

Texas fortified red grapefruit juice was considered by an overwhelmingly large majority of respondents to be free from these undesirable characteristics.

Consumer Reactions to Labels on Canned Grapefruit Juice

The consumer preference panel in Houston also was questioned about the labeling of canned grapefruit juice. These questions were not intended as a full-scale study of grapefruit juice labeling. They were merely added as an exploratory device because several households in the Dallas study (which was conducted first) said they were buying sweetened grapefruit juice, but the Dallas retail outlets reported

TABLE 5. REASONS GIVEN BY DALLAS AND HOUSTON CONSUMER PANELS FOR LIKING GRAPEFRUIT JUICE

Reason	Percent of respondents
Sweetness	47
Flavor	39
Tartness or sourness	9
Other	5
	100
Number of families	620

that sweetened grapefruit juices were not ordinarily a regular-stock item. These extra questions submitted to the Houston panel attempted to determine whether consumers were aware that grapefruit juice is usually labeled either "sweetened" or "unsweetened." One hundred and fifty households in Houston completed this special section of the schedule.

Results revealed that: (1) Most consumers know that the word "sweetened" or "unsweetened" appears on the label of grapefruit juice cans, (2) Preferences for the label description "sweetened" were low. Most consumers preferred to buy canned grapefruit juice that was labeled "unsweetened" or "natural flavor," (3) More than one-third of the housewives contacted had purchased canned grapefruit juice within the week preceding the survey, but only 10 percent of all respondents had selected "sweetened" grapefruit juice, and (4) Only a few consumers did not know what was printed on the label or indicated that they had no reaction to it.

It appears that a description of grapefruit juice on the label is expected by Dallas and Houston housewives and that they avoid grapefruit juice products marked "sweetened." Possibly, they consider this means "sugar added" unless otherwise specified. Their preference leans toward the terms "natural flavor" and "unsweetened." This suggests a label along the line of — "naturally sweet flavor — no sugar added." Similar labeling was also indicated by the interpretations of the consumer taste preference results. It also serves to substantiate many of the taste-test interpretations made when results showed that significantly more respondents prefer "natural sweetness" and "natural flavor" when selecting a grapefruit juice. It

TABLE 6. REASONS GIVEN BY DALLAS AND HOUSTON PANELS FOR DISLIKING GRAPEFRUIT JUICE

Reason	Percent of respondents
Bitter, tart or sour	72
No flavor or no taste	8
Too sweet	7
Other	13
	100
Number of families	620

seems that labels for Texas fortified red grapefruit juice should emphasize "naturally sweet flavor" for maximum consumer appeal. An additional phrase such as "no sugar added" might be desirable in that it would tend to discourage calorie-conscious housewives from thinking the juice might be fattening.

Notwithstanding these findings regarding a low preference for "sweetened" grapefruit juice, the Texas white juice sales may benefit from the addition of an artificial sweetener. The sales resistance might be against the label notation "sugar added." Emphasis on "artificially sweetened/no sugar added" may have more appeal to consumers. A recent study in Fort Wayne, Indiana, indicated that artificially sweetened grapefruit juice could be marketed successfully. The test was conducted by the USDA in cooperation with the Florida Citrus growers.² The USDA report says . . . "During the 10-week test, sales of sugar-sweetened grapefruit increased; sales of unsweetened grapefruit decreased. The total sales, however, showed an increase over the pre-promotional period . . . while only 14 percent of Fort Wayne homemakers bought artificially sweetened juice during the study period, such response appears favorable in view of the promotion effort, the length of the study period and the number of regular grapefruit juice users in the market. A high proportion of users made repeat purchases and expressed general satisfaction with the product. A high proportion said that they would continue to buy the product."³

Further research on the Texas consumer's acceptance of grapefruit juices that are "unsweetened," "sugar added" and "artificially sweetened" is worth considering.

Estimated Market Potential for Texas Fortified Red Grapefruit Juice

Estimates of the potential market for red grapefruit juice help growers in developing their production plans. This information also helps processors in making decisions on the installation of special processing equipment to meet expected demands for the new product.

This section of the report is a preliminary estimate of maximum market potential and requires verification by a retail store market test before concrete recommendations can be made or definite inferences drawn.

The estimated potential market for canned single-strength grapefruit juice in Texas has been

²Survey by Robert E. Freye, J. Scott Hunter and Michael G. Van Dress, USDA with Florida Citrus Cooperation, "Artificial Sweetening Sells Grapefruit Juice," *Canner Packer*, October, 1959, p. 40.

³*Ibid.*

calculated at approximately 600,000 to 700,000 cases per year.⁴ Of this total potential,⁵ the consumer preference test indicates that approximately 400,000 cases could be Texas fortified red. However, many variables influence grapefruit juice purchases and therefore this state-wide estimate cannot be used as a basis for making final business decisions.

The foregoing estimated potential market for grapefruit juices in Texas was calculated in the following manner:

(1) a) Purchase estimates by city size of the USDA marketing-service show that in United States cities of 500,000 and over, an average of 39 cases of canned, single-strength grapefruit juice per 1,000 people was purchased during a 6-month period—April through September 1957.

b) During the same 6-month period, consumption in cities of comparable size in the Mountain-Southwest⁶ was 40 cases per 1,000 people.

c) In view of this similarity of consumption patterns in the two areas it seems reasonable to assume that the consumption pattern of 40 cases per 1,000 persons in the Mountain-Southwest, (a region close to Texas) will be also the approximate pattern for cities like Dallas and Houston in a comparable 6-month period.

(2) In the Mountain-Southwest region, 1957-58 season, the average amount of grapefruit juice purchased during a 12-month period was 70 cases of canned, single-strength grapefruit juice per 1,000 people. Consequently, it is assumed that the 12-month period consumption figure in Texas is approximately the same.

Thus, by using the 1958 population estimates of 643,000 for Dallas and 910,000 for Houston, an estimated 108,000 cases of grapefruit juice would be purchased annually in these two cities alone.

(3) The estimated population of Texas in 1958 was 9.13 millions. At a consumption rate of 70 cases per 1,000 population per year, the market potential figure is approximately 668,000 cases. This would, of course, expand as the population increases.

(4) Assuming that the preference pattern of the panel is representative of the two cities surveyed and that this pattern would be approximately the same for the State, the consumer purchases of grapefruit juice should be distributed in approximately the same manner among the three juices, i.e., 61 percent Texas fortified red, 24 percent Texas white and

⁴"Consumer Purchases of Selected Fruits and Juices by Region and Retail Outlets, October to December, 1958," USDA, AMS, (Washington, D. C., March, 1959).

⁵This also assumes that there is no special promotion or advertising to boost sales.

⁶States include: Montana, Idaho, Wyoming, Utah, Nevada, Colorado, Arizona, New Mexico, Texas, Oklahoma.

15 percent Florida white. This would indicate that the estimated market potential for Texas fortified red grapefruit juice in the State would be about 400,000 cases per year.

The assumptions made in calculating this market-potential estimate do not take into consideration variations in sales caused by promotions, advertising, labeling or display of grapefruit juices. Display alone affects the sale of products significantly. Merchandisers have observed, for instance, that cans of juices stacked in a "well" display in a supermarket, rather than on the shelves, is conducive to a higher impulse-buying rate. It is impossible to make allowance for such factors in our calculations. Therefore, they have not been taken into consideration. This being so, the estimated market potential reported here requires some qualification.

It is advisable that a full-scale market test, as suggested by the Texas Canner's Association, be conducted before a final market estimate is made for the new red grapefruit juice. Such a market test will reveal how consumers respond to the juice when they see it on store shelves. The results of this test would permit a more precise market potential estimate, and would facilitate processors in making more accurate and specific plans regarding the processing of Texas red fortified grapefruit juice.

The assumptions made for estimating purposes serve only as working hypotheses and should not be used out of context. It is almost impossible to calculate a satisfactory estimate of the market potential for a new product before retail store market tests are made. These factors, notwithstanding, the authors feel that even this rough an approximation can be useful as an index and a guide in preliminary planning.

Appendix

The survey was made among 296 families in Dallas and Houston who are members of a larger established panel maintained in these two cities for research purposes by the Texas Agricultural Experiment Station. The families surveyed were selected at random from this established panel. A total of 620 respondents was involved.

The Dallas survey was conducted during July 1958 and the Houston survey during October of the

same year. These months were selected because the supply of fresh grapefruit is limited during that period. Therefore, canned single-strength or frozen concentrated grapefruit juices are about the only form of the product available.

The racial distribution of the participating respondents was 73.5 percent other white, 20 percent Negro, and 1.5 percent Latin American.

The income distribution of the families surveyed was 37 percent — less than \$4,000, 36 percent — \$4,000-6,999, 27 percent — \$7,000 and over.

Field interviewers were personnel experienced in interviewing procedures and methods. All attended a briefing and training session before the survey began. Different teams were used for each city. Interviews were spot checked for their authenticity by field supervisors.

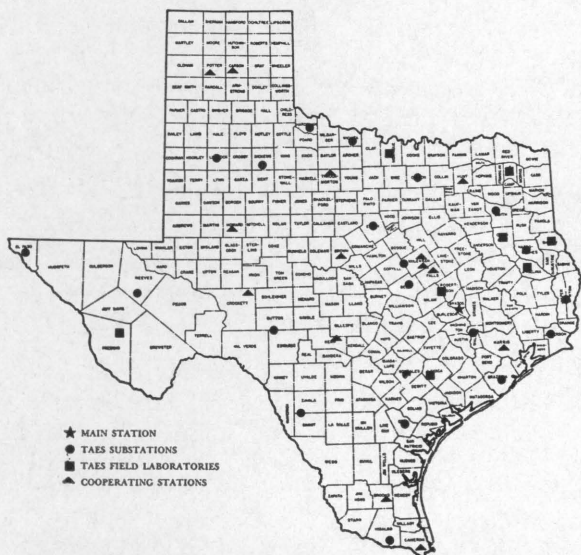
All of the grapefruit juices used in the study were transported to the U. S. Fruit and Vegetable Products Laboratory at Weslaco for storage until they were required. Temperature conditions were representative of those used in commercial storage. Test juices were shipped directly by standard commercial carriers to the test sites.

The three juices were chemically analyzed to determine their respective Brix-acid ratios. The results were Texas fortified red 8.7, Texas white 8.6, Florida white 8.2. Results of previous U. S. Department of Agriculture research with citrus juices indicated that variation in Brix-acid ratios smaller than 2.0 were impossible to discern.

Chi-square analyses and T tests were used throughout the analysis of the survey data. All significances were calculated at the .05 level of confidence.

Those interested in the technical analysis upon which this report is based may obtain it on a loan basis by writing to the Consumer Economics Section, Department of Agricultural Economics and Sociology, The Agricultural and Mechanical College of Texas, College Station, Texas, and requesting the Master's Thesis of Carter Price.

State-wide Research



Location of field research units of the Texas Agricultural Experiment Station and cooperating agencies



The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of the parts of the A&M College of Texas.

ORGANIZATION

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies. Cooperating agencies include the Texas Forest Service, Game and Fish Commission of Texas, Texas Prison System, U. S. Department of Agriculture, University of Texas, Texas Technological College, Texas College of Arts and Industries and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

OPERATION

THE TEXAS STATION is conducting about 400 active research projects, grouped in 25 programs, which include all phases of agriculture in Texas. Among these are:

- | | |
|--------------------------------------|---------------------------------|
| Conservation and improvement of soil | Beef cattle |
| Conservation and use of water | Dairy cattle |
| Grasses and legumes | Sheep and goats |
| Grain crops | Swine |
| Cotton and other fiber crops | Chickens and turkeys |
| Vegetable crops | Animal diseases and parasites |
| Citrus and other subtropical fruits | Fish and game |
| Fruits and nuts | Farm and ranch engineering |
| Oil seed crops | Farm and ranch business |
| Ornamental plants | Marketing agricultural products |
| Brush and weeds | Rural home economics |
| Insects | Rural agricultural economics |
| | Plant diseases |

Two additional programs are maintenance and upkeep, and central services.

Research results are carried to Texas farmers, ranchmen and homemakers by county agents and specialists of the Texas Agricultural Extension Service

AGRICULTURAL RESEARCH seeks the WHATS, the WHYS, the WHENS, the WHEREs and the HOWS of hundreds of problems which confront operators of farms and ranches, and the many industries depending on or serving agriculture. Workers of the Main Station and the field units of the Texas Agricultural Experiment Station seek diligently to find solutions to these problems.

Today's Research Is Tomorrow's Progress