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A CONSUMER TEST OF CITRUS DRINKS
MADE FROM COMMINUTED WHOLE CITRUS FRUIT

John P. Nichols, Robert L. Degner, Chan C. Connolly
Bruce J. Lime, and Robert Cruse

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Texas Agricultural Market Research and Development Center
Texas Agricultural Experiment Station, College Station
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Weslaco, Texas

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TABLE OF CONTENTS

	Page
INTRODUCTION	1
Objectives	2
RESEARCH DESIGN AND PROCEDURE.	2
The Sample	2
Product Distribution	3
The Measuring Instrument	4
RESULTS.	5
General Usage Patterns of Fruit Juices, Drinks, and Aides	5
Product Evaluations.	6
Rating For All Products: Distributions and Means	8
Appearance	9
Sweetness.	9
Sourness	13
Consistency.	16
Color.	18
Flavor	18
Overall Quality.	21
Demographic Factors	21
Orange Ho.	23
Nectarade.	23
Control Product.	24
Respondent Comments	25
Orange Ho.	26
Nectarade.	26
Control Product.	26
SUMMARY AND CONCLUSIONS.	27
REFERENCES	29
APPENDIX A: Tables.	30
APPENDIX B	41
Introductory Questionnaire	42
Citrus Drink Rating Form	47
General Interviewer Instructions	50

APPENDIX C 53
 Technical Product Descriptions and Analyses 54

LIST OF TABLES

Table	Page
1 Occasions when fruit juices, drinks, and ades are usually served, both cities	7
2 Citrus drink evaluations by percent of respondents, both cities	10
3 Mean ratings for citrus drinks, both cities	12

LIST OF FIGURES

Figure		Page
1	Distribution of product appearance ratings for all 3 products by percent of respondents	11
2	Distribution of product sweetness ratings for all 3 products by percent of respondents	14
3	Distribution of product sourness ratings for all 3 products by percent of respondents	15
4	Distribution of product consistency ratings for all 3 products by percent of respondents	17
5	Distribution of product color ratings for all 3 products by percent of respondents	19
6	Distribution of product flavor ratings for all 3 products by percent of respondents	20
7	Distribution of product overall quality ratings for all 3 products by percent of respondents	22

LIST OF APPENDIX TABLES

Appendix Table	Page
1 Percentage of respondents reporting usage of fruit juices during past month and past year, in Dallas and Columbus	31
2 Percentage of respondents reporting usage of fruit drinks during past month and past year, in Dallas and Columbus	32
3 Form of orange juice used most frequently, Dallas, Columbus, and both cities	33
4 Form of grapefruit juice used most frequently, Dallas, Columbus, and both cities	34
5 Mean ratings for citrus drinks, Dallas	35
6 Mean ratings for citrus drinks, Columbus	36
7 Citrus drink evaluations by percent of respondents, Dallas . .	37
8 Citrus drink evaluations by percent of respondents, Columbus . .	38
9 F tests, Orange Ho versus control, both cities	39
10 F tests, Nectarade versus control, both cities	40
11 Sugar, acid, and pulp content of Orange Ho, Nectarade and the control product	54
12 Color and light transmittance analyses of Orange Ho, Nectarade, and the control product	55

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INTRODUCTION

New product development is a constant challenge to agriculture and agriculturally related industries due to continually changing consumer tastes and preferences.

One of the functions of the United States Department of Agriculture (USDA) Regional Utilization Laboratories is to develop new uses for agricultural products and new forms of products from agricultural commodities which will benefit the agricultural industry and consumers as well.

An essential part of this developmental process is the evaluation of consumer response to newly created products. Without adequate evaluation at various stages of the developmental process, much technical and scientific effort can be lost if the product does not conform to consumers' needs and desires.

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Objectives

This project is designed to provide the consumer evaluation phase of the product development program. Two citrus drink products have been recently developed by personnel of the United States Department of Agriculture, Agricultural Research Service, Food Crops Utilization Research Laboratory at Weslaco, Texas. These citrus drink products differ from conventional fruit drinks in that they are made from comminuted whole citrus fruit; one is an orange drink, the other a grapefruit drink. They are tentatively named Orange Ho and Nectarade, respectively. Both are canned (46 oz. cans) single strength drinks composed of 10% whole fruit puree, 12.5% sugar (sucrose), 0.75% citric acid, and 76.75% water. Technical descriptions of each of the products used in the test can be found in the Appendix.

This study is designed to determine the consumer acceptance of the new products in terms of taste, appearance, and general appeal in relation to a control product, an orange drink that is readily available in the market and has widespread consumer acceptance.

RESEARCH DESIGN AND PROCEDURE

The Sample

A consumer panel of 300 families in each of two cities was established in order to evaluate the two test products and the control product. Dallas, Texas, and Columbus, Ohio were selected as test cities because of their similarities with respect to population and racial composition, effective

family buying power, income distribution, and their diversified economic bases [3].

The sample of 300 families in each city was obtained by a random probability cluster sampling procedure. Thirty clusters were selected at random in each city; within each cluster 10 households were obtained by starting at a systematically selected street address and taking adjacent households. Two call backs were required before an alternate household could be obtained; houses directly across the street were used as alternates where needed.

In the introductory interview of each household, non-users of fruit juices, drinks, or ades were eliminated and another household used in the sample. Non-users were extremely rare; virtually all households used some fruit juices, drinks or ades. A copy of the introductory questionnaire is included in the Appendix.

Using age and income as primary criteria, the sample of households in Columbus matches published city data quite closely, although the sample included a slightly disproportionate number of higher income families. The same was found for the Dallas sample, although the Dallas sample appeared to correspond to the published data more closely than did the Columbus sample. A slightly disproportionate number of higher income families in the sample resulted from poor response in ghetto areas.

Product Distribution

The test products were distributed over a two-week period in late November so that delivery did not occur during the Thanksgiving holiday.

In week 1, alternate households in each cluster received Orange Ho and the control product, and the others received Nectarade and the control. The control selected was a citrus drink which is readily available in the market and has widespread consumer acceptance. After a ten-day period a second distribution was made reversing the test products so that each family evaluated both Orange Ho and Nectarade. Separate rating forms were delivered for each product at each distribution. Since the control product was given to each family each week, approximately twice as many evaluations were obtained for it as for the two test products.

Within each household, all persons 12 years of age or older were asked to evaluate the citrus drinks. Evaluation forms were picked up by the interviewers approximately a week after the products were left with the household.

The Measuring Instrument

A modified Peryam scale was used to evaluate appearance (cloudiness), sweetness, sourness, and consistency [2]. Consistency was described to respondents as "texture" or "feel," i.e., "thick" or "watery." These product characteristics were rated on a nine point scale with 5 being "just right" and 1 and 9 representing the extremes. Three other product characteristics, color, flavor, and overall quality were also evaluated by respondents on a nine point scale where 1 was excellent and 9 was poor. In addition to asking respondents to evaluate the product on these characteristics they were also asked whether the product was chilled and at

which occasion the product was tried. They were also asked for additional comments. Respondents were asked to evaluate each product on a separate rating form; the rating forms were color coded to match the color codes of the test products in order to reduce respondent errors. In other respects, rating forms for all three drinks were identical. A copy of the rating form is included in the Appendix.

RESULTS

Through the introductory questionnaire, it was ascertained that the general demographic characteristics of the sample households matched published data for the two test cities reasonably well which is an indication that the sample is representative.

General Usage Patterns of Fruit Juices, Drinks, and Aides

Practically all households contacted used some kind of fruit juice, drink, or aide. Of those included in the sample, a very high percentage, over 86%, had used orange juice in the previous month. Nearly 32% had used grapefruit juice. An additional 10% had used orange juice in the past year and 19% had used grapefruit juice during the past year. Other frequently used juices included grape, apple and prune (Appendix Table 1).

Fruit drinks, particularly orange drink, were also used extensively by respondents. Approximately 39% reported using orange drink in the past month with an additional 14% using it during the past year. Approximately 7% indicated that they had used grapefruit drink within the past month, and an additional 4% had used it within the past year. Other frequently used

drinks were pineapple-grapefruit, lemonade, grape, apple, and cranberry (Appendix Table 2). Over 70% of the households reported using powdered ades or punches during the past year.

Fruit juices were found to be used most frequently for breakfast. Over 88% of the respondents reported serving fruit juice for breakfast. The other occasions when fruit juice was served most frequently were afternoon snacks, evening snacks, and morning snacks with 29.7, 27.9, and 26.2% respectively. Only 22.4% of the respondents reported using fruit drinks for breakfast. However a sizable number, 32%, used them for lunch. Most reported using fruit drinks for snacks; the same was found to be the case with powdered fruit ades and punches (Table 1).

Approximately 67% of the respondents using orange juice reported using frozen concentrated most frequently, while 15% used canned single strength, 14% used chilled, and 3% used fresh squeezed. Of those respondents who used grapefruit juice, nearly 80% reported using canned single strength most frequently. Usage of frozen concentrate and chilled were quite similar, each with 7.5%, while the remaining 5% reported using fresh squeezed most frequently (Appendix Tables 3,4).

Product Evaluations

At the outset, respondent evaluations of the products for the various characteristics were examined using chi-square analyses to determine whether or not there were significant differences between cities. This was done in order to see if data from the two cities could be combined

Table 1. Occasions when fruit juices, drinks, and
ades are usually served, both cities.*

When Served	Fruit Juices	Fruit Drinks	Ades and Punches
	-----Percent-----		
Breakfast	88.1	22.4	4.2
Mid-morning Snack	26.2	26.2	16.7
Lunch	14.4	32.2	30.7
Afternoon Snack	29.7	44.2	36.4
Evening Meal	11.0	19.9	22.4
Evening Snack	27.9	26.9	29.9
Party	5.2	11.2	11.2

*Percentages total more than 100 because multiple answers were permitted.

Source: Completed questionnaires, Dallas and Columbus, November, 1971.

for overall analyses. A few significant differences were found; however, a closer examination revealed that in most cases ratings from the two cities were similar and that the significant differences reflected degree or intensity rather than direction of the ratings. In general, the differences arise because Columbus respondents were more critical in their ratings. This is to be expected because the Columbus sample contains a slightly disproportionate number of high income respondents. In view of the nature of the city differences, city data were combined for most of the following analyses.

Ratings For All Products: Distributions and Means

Seven basic product characteristics were evaluated by respondents. These were appearance (cloudiness), sweetness, sourness, consistency (texture or feel), color, flavor, and overall quality. Successive integers, one through nine, were assigned to the nine points on the rating scales for the various product characteristics. The resulting numerical values were used to calculate mean ratings for each product and each characteristic. There were approximately 1200 observations for each of the new test products and approximately 2400 observations for the control product when observations from both cities were combined. Means for the ratings from each city may be found in the Appendix (Appendix Tables 5, 6).

In order to facilitate examination of the distributions of the ratings and to obtain valid statistical tests on the distributions, the nine point

scale was condensed into a three point scale. For appearance, sweetness, sourness and consistency the mid-range ratings on the nine point scale, that is 4-6, were combined into a "neutral" category and ratings 1-3 and 7-9 were combined to represent the extreme ratings. For the remaining characteristics color, flavor and overall quality, the condensed categories were termed "good," "fair," and "poor." A comparison of the ratings for the three products for each of the various characteristics follows.

Appearance. The term "appearance" was defined for respondents as cloudiness, and the extreme points on the scale designated as "too clear" and "too cloudy." On the basis of the distributions of the ratings, both test products were judged to be slightly too cloudy, while the control product was judged to be somewhat too clear (Table 2, Figure 1). The distributions of the ratings for Dallas and Columbus are found in Appendix Tables 7 and 8. The means reflect similar results. Means for Orange Ho, Nectarade, and the control are 5.23, 5.38, and 4.74 respectively. In terms of nearness to the "just right" rating of 5, Orange Ho is nearest, followed by the control, and then Nectarade (Table 3). In comparing the means of each test product with the mean of the control, an F test indicates statistically significant differences; however, these results must be interpreted rather cautiously since the control mean and the test product means lie on opposite sides of the "just right" point on the scale (Appendix Table 9 and 10).

Sweetness. Respondents appeared to be evenly divided in their evaluation of the sweetness of Orange Ho. Approximately the same numbers

Table 2. Citrus drink evaluations by percent of respondents, both cities.^a

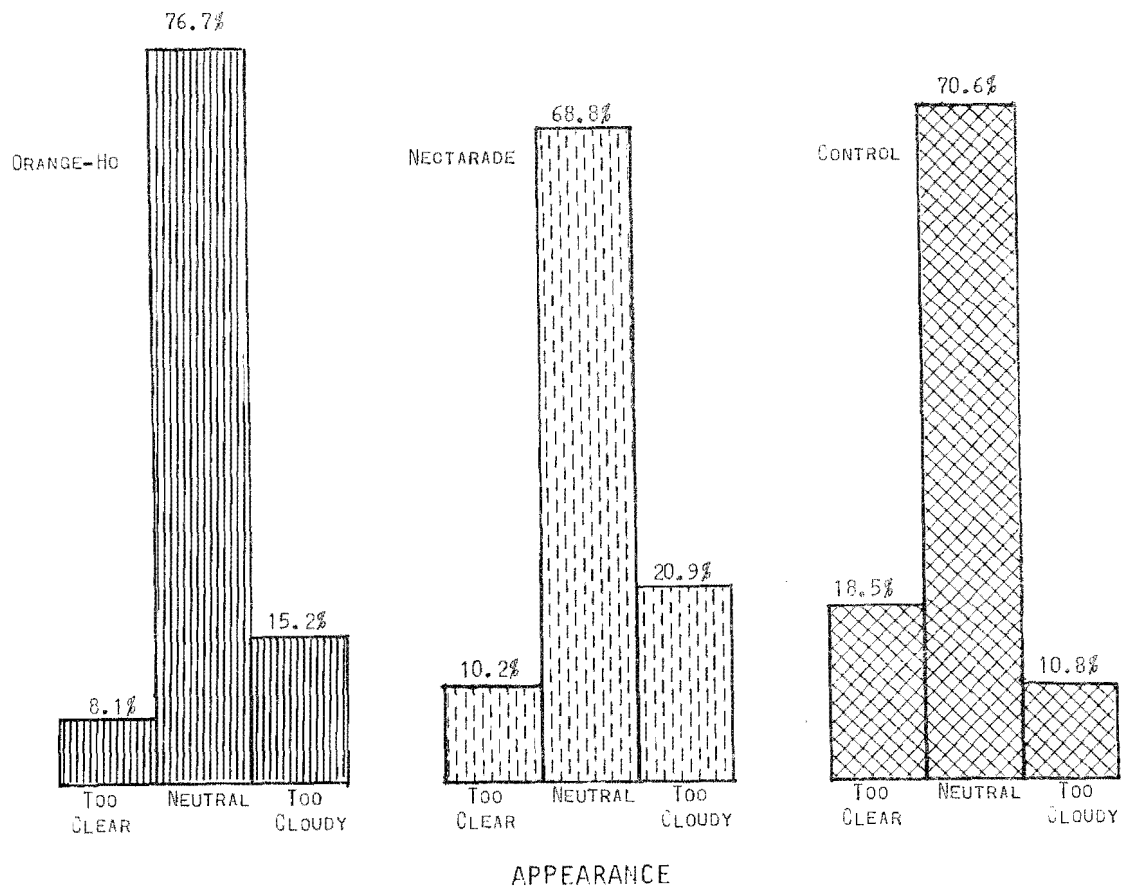
Product Characteristic	Orange Ho	Nectarade	Control
-----Percent-----			
<u>Appearance*</u>			
Too clear	8.1	10.2	18.5
Neutral	76.7	68.8	70.6
Too cloudy	15.2	20.9	10.8
<u>Sweetness*</u>			
Too sweet	15.6	15.6	20.4
Neutral	68.0	63.0	64.7
Not sweet enough	16.3	21.5	14.9
<u>Sourness*</u>			
Too sour	13.9	22.6	11.6
Neutral	72.3	65.3	68.5
Not sour enough	13.8	12.1	19.9
<u>Consistency*</u>			
Too thick	5.0	6.1	2.7
Neutral	77.1	73.8	60.7
Too thin	17.8	20.1	36.6
<u>Color*</u>			
Good	46.2	39.6	39.3
Fair	41.5	42.9	41.2
Poor	12.3	17.5	19.6
<u>Flavor*</u>			
Good	43.9	38.8	33.5
Fair	36.0	33.3	36.4
Poor	20.1	27.9	30.1
<u>Overall quality*</u>			
Good	46.9	39.9	34.5
Fair	32.2	31.4	35.1
Poor	20.9	28.8	30.4

^aPercentages may not sum to 100 percent due to rounding error.

*Indicates a statistically significant Chi-square value at the 5 percent level among products.

Source: Completed questionnaire, Dallas and Columbus, December 1971.

Figure 1: Distribution of product appearance ratings for all 3 products by percent of respondents.



Source: Table 2.

Table 3. Mean ratings for citrus drinks, both cities

Product Characteristic	Mean Ratings and Rank ^a		
	Orange Ho n ≈ 1200	Nectarade n ≈ 1200	Control n ≈ 2400
	(5 = Just right ^b)		
Appearance (cloudiness)	5.23 (1)	5.38 (3)	4.74 (2)
Sweetness	5.01 (1)	5.20 (3)	4.82 (2)
Sourness	4.99 (1)	4.60 (3)	5.25 (2)
Consistency	5.44 (1)	5.50 (2)	6.13 (3)

	(1 = Excellent ^c)		
Color	3.87 (1)	4.27 (2)	4.32 (3)
Flavor	4.19 (1)	4.64 (2)	4.86 (3)
Quality	4.09 (1)	4.64 (2)	4.82 (3)

^aThe products were ranked for each characteristic on the basis of the nearness of their means to the "just right" or "excellent" value, depending on the product characteristic.

^bThese characteristics were evaluated on a nine point scale where 5 was just right. For appearance, a rating of 1 indicated "too cloudy"; for sweetness 1 indicated "too sweet"; for sourness 1 indicated "too sour"; for consistency 1 indicated "too thick". A rating of 9 indicated the other extreme.

^cThese characteristics were rated on a nine point scale where 1 = excellent or like very much and 9 = poor or dislike very much.

Source: Completed questionnaires, Dallas and Columbus, December 1971.

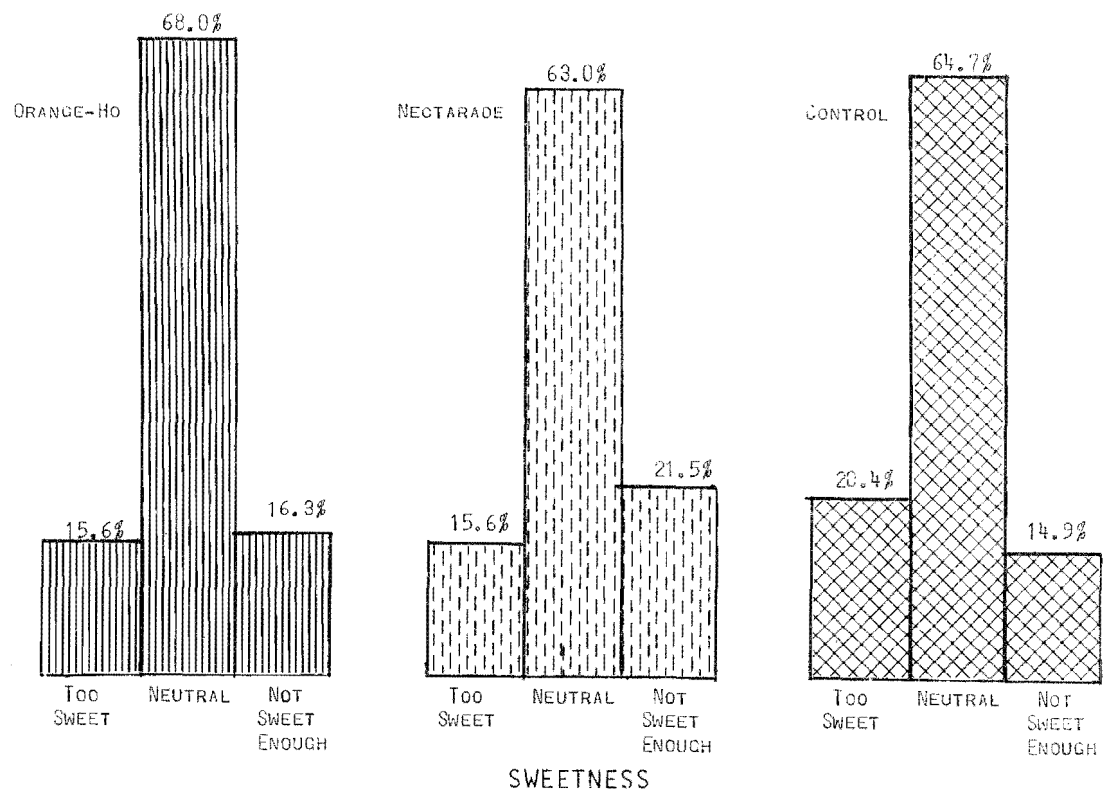
of respondents indicated that it was too sweet as said it was not sweet enough, with a sizable majority indicating neutrality. Nectarade was rated as being not sweet enough, while the control was rated as being too sweet (Table 2, Figure 2).

The means for sweetness for each of the products also show these results. The mean sweetness ratings for Orange Ho, Nectarade, and the control product are 5.01, 5.20, and 4.82 respectively. Ranking these means in terms of nearness to the "just right" value of 5 again finds Orange Ho nearest followed by the control and then Nectarade (Table 3). The means of the test products as compared to the control mean indicates a statistically significant difference (Appendix Tables 9 and 10). Again, caution must be exercised in interpreting these results, particularly in the case of a comparison between Nectarade and the control product. Any inference that one is preferred over the other is somewhat tenuous since Nectarade appears to be not quite sweet enough and the control appears to be somewhat too sweet.

Sourness. This term was defined to respondents as sharpness or tartness. In rating Orange Ho with respect to this characteristic, well over 70% were neutral, and the remaining respondents were evenly divided between "too sour" and "not sour enough" (Table 2, Figure 3). Nectarade was rated as "too sour" and the control was generally considered to be not sour enough.

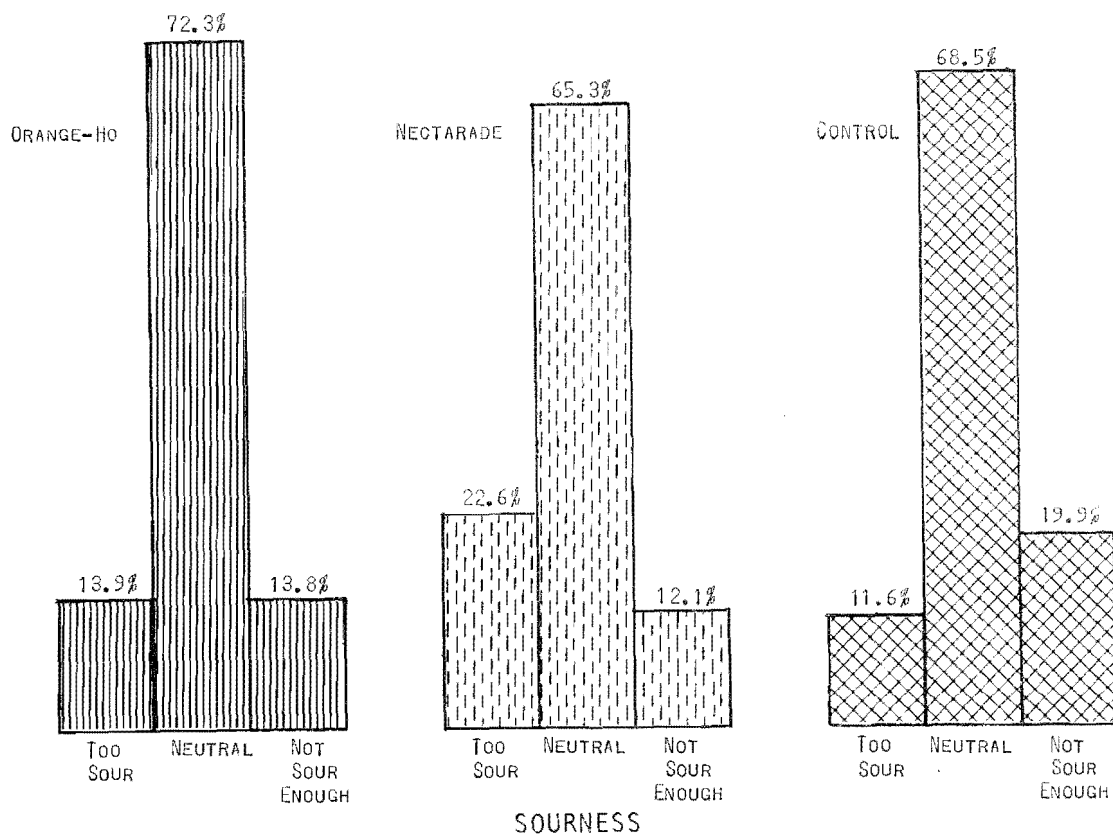
Obviously, the means reflect the same results. The means for Orange Ho, Nectarade, and the control product are 4.99, 4.60, and 5.25 respectively.

Figure 2: Distribution of product sweetness ratings for all 3 products by percent of respondents.



Source: Table 2.

Figure 3: Distribution of product sourness ratings for all 3 products by percent of respondents.



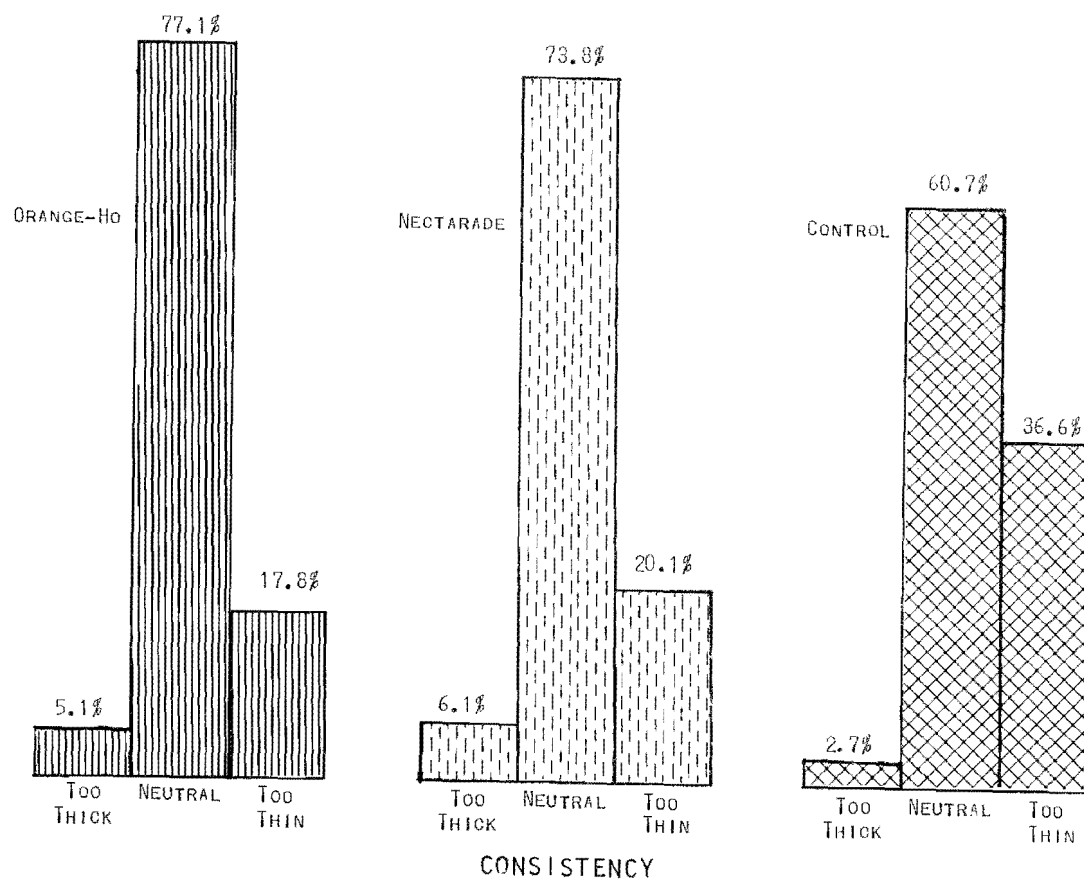
Source: Table 2.

Ranking the products on the basis of the nearness of their means to the "just right" value of 5 again finds Orange Ho nearest followed by the control product and then Nectarade (Table 3). Also, the means for the test products are significantly different from the mean of the control product (Appendix Tables 9 and 10). It may be observed that while sweetness and sourness are not necessarily exact opposites, the respondents tended to think of them in this way and the relative ratings for sourness concur with and support those for sweetness.

Consistency. This characteristic was defined to respondents as texture of feel. They were asked to describe it as "too thick," "just right," or "too thin." Approximately 70% of the respondents were neutral on this characteristic for both test products; a very small percentage, about 5%, rated them as being too thick where as about 20% rated them as being too thin. Respondents were apparently less satisfied with the consistency of the control product, however. Over 36% rated it as being too thin (Table 2, Figure 4).

Orange Ho, Nectarade, and the control product have mean ratings of 5.44, 5.50, and 6.13 respectively. The differences between the means of the test products and the control product are statistically significant (Appendix Tables 9 and 10). On the basis of these findings it is reasonably safe to conclude that the consistency of the test products is preferred to that of the control product. The ratings of the test products may also be improved by making them "thicker"; however, to do so might cause some respondents to shift into the "too thick" category.

Figure 4: Distribution of product consistency ratings for all 3 products by percent of respondents.

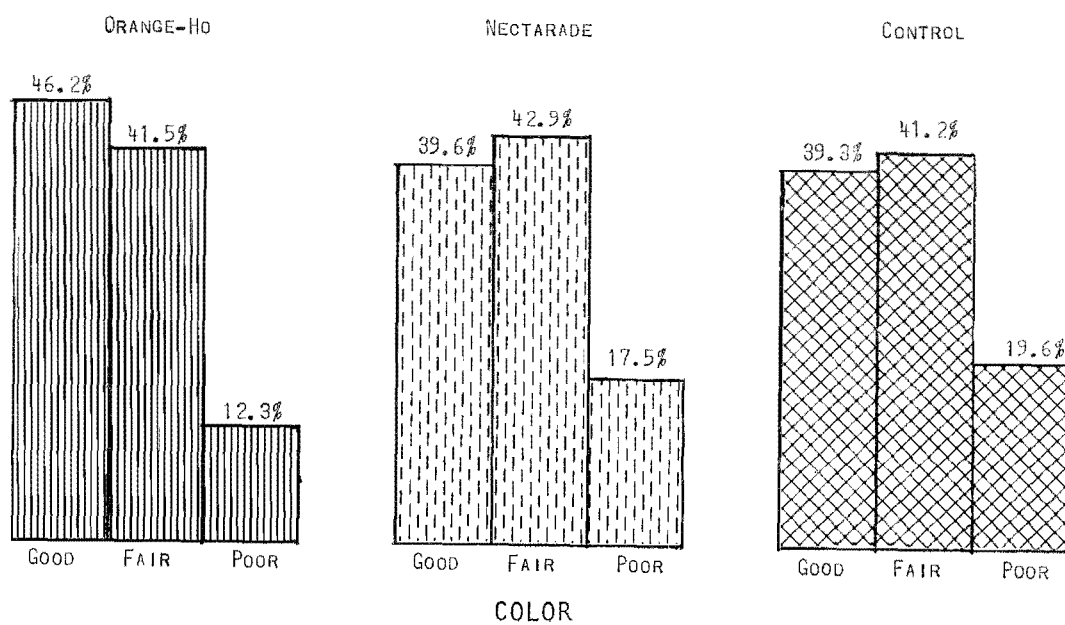


Source: Table 2.

Color. Approximately 46% of the respondents rated the color of Orange Ho as good as compared with 39% for Nectarade and the control product. There were minor differences among the products for the "fair" rating. Approximately 12% rated the color of Orange Ho "poor" as compared with 18% for Nectarade and 20% for the control product (Table 2, Figure 5). The mean ratings for Orange Ho, Nectarade and the control were 3.87, 4.27, and 4.32 respectively, and ranking the means on the basis of nearness to "one" which denoted "excellent" resulted in the same order (Table 3). The difference between Orange Ho and the control product is statistically significant; however, the difference between Nectarade and the control is not (Appendix Table 9 and 10).

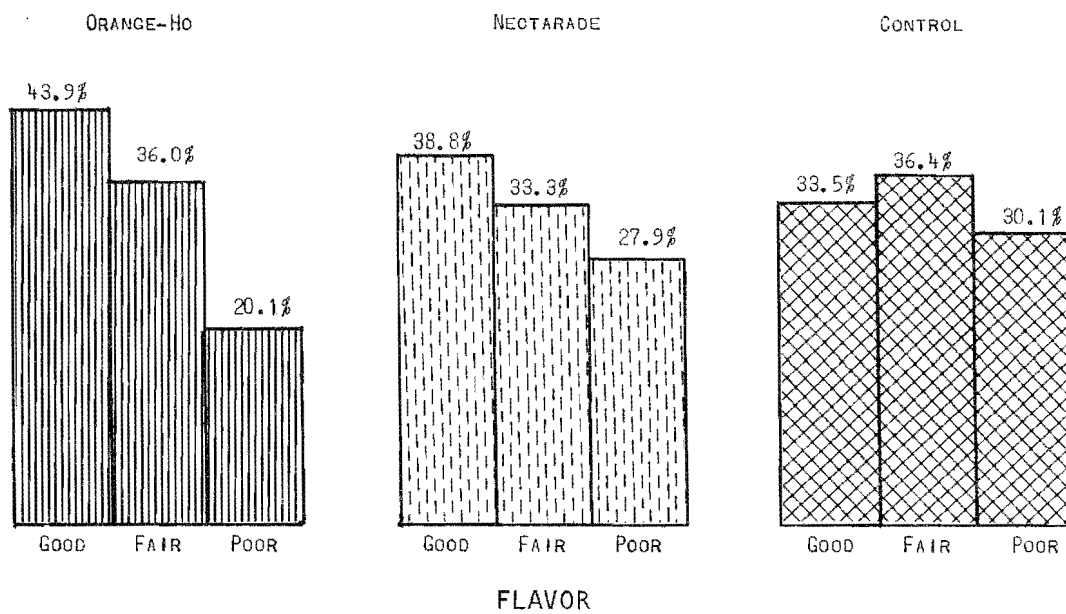
Flavor. Approximately 40% of the respondents rated the two test products as "good" with respect to flavor, as compared with 35% for the control. While 20% rated Orange Ho as "poor," approximately 30% rated Nectarade and the control as poor (Table 2, Figure 6). The means for the flavor ratings of Orange Ho, Nectarade, and the control are 4.19, 4.64, and 4.86 respectively, and when compared to the "excellent" rating of one, the products are ranked in this same order (Table 3). The means of the test products are significantly different from the mean of the control product (Appendix Table 9 and 10). These results indicate that in general the flavor of Orange Ho was preferred to that of Nectarade and the control product, and the flavor of Nectarade was also preferred to that of the control.

Figure 5: Distribution of product color ratings for all 3 products by percent of respondents.



Source: Table 2.

Figure 6: Distribution of product flavor ratings for all 3 products by percent of respondents.



Source: Table 2.

Overall Quality. The ratings for overall quality were consistent with the ratings for the other characteristics. Approximately 47% of the respondents rated Orange Ho "good" as compared with 40% for Nectarade and 35% for the control. At the other end of the scale, 21% rated Orange Ho as being "poor" as compared with 29% for Nectarade and 30% for the control product (Table 2, Figure 7). The mean ratings were 4.09, 4.64, and 4.82 for Orange Ho, Nectarade, and the control product respectively which when compared to the criterion value of one results in the same respective ranking (Table 3). The means for the overall quality rating both test products were significantly different from the control product (Appendix Tables 9 and 10).

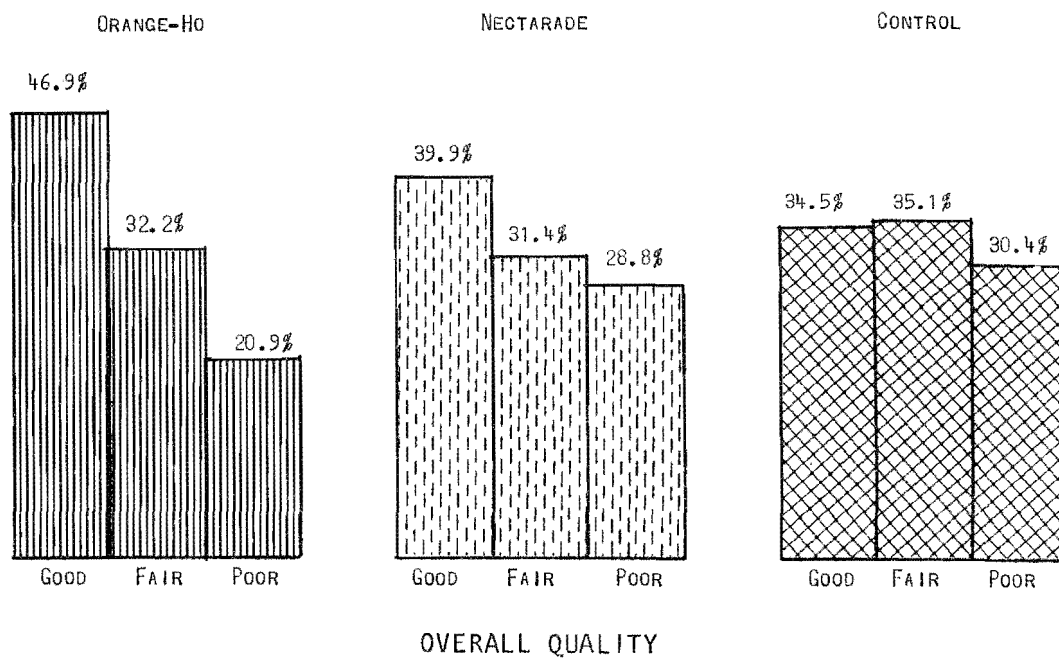
Demographic Factors

A number of chi-square analyses were made in order to ascertain what, if any, relationships existed between income and age and the ratings for the seven product characteristics for each of the three products tested.

Respondents were classified into three broad household income categories. The low income group included respondents whose incomes were less than \$5000 per year. The medium income group included those with incomes of \$5000 to \$15,000, and the high income group those with incomes of \$15,000 or more.

There were 4 age groups, as follows: 12-19 years, 20-34, 35-54, and 55 years of age or older. A brief discussion of the significant findings for each product follows, based upon data from both cities.

Figure 7: Distribution of product overall quality ratings for all 3 products by percent of respondents.



Source: Table 2.

Orange Ho. Respondent ratings for appearance, color, and quality appeared to be related to income level. Higher income respondents had a greater tendency to rate the product as being too cloudy than did lower income respondents. On color ratings, there was no clear cut relationship to income level; however, the low income group was less consistent in their evaluations. A larger proportion of lower income respondents rated color as good, and a larger proportion rated it as poor as compared with higher income groups. On quality ratings, a higher proportion of lower income respondents rated Orange Ho as being good; however, there were no apparent differences among income levels with respect to the proportions of respondents giving the product a poor rating.

The rating of several of Orange Ho's characteristics were apparently affected by the age of respondents. Younger respondents had a greater tendency to rate the product "too cloudy," "too sour," and were also more critical of overall quality. Although sweetness and color evaluations were not statistically significant among age groups, younger respondents generally had a greater tendency to rate the product "not sweet enough." They were also more critical of color than were older respondents.

Nectarade. The highest income group had a greater tendency to rate the product as being too cloudy and too sweet, while the reverse was true for the lower income groups. Higher income respondents were also more critical of color, flavor, and quality than were lower income respondents.

The ratings of several of Nectarade's characteristics were also apparently affected by the age of the respondents, with the effects similar to those evidenced by the Orange Ho ratings. Younger age groups exhibited a greater tendency to rate the product as being "too cloudy," "not sweet enough," and "too sour." While there were no other statistically significant differences in ratings for the other product characteristics, there was evidence that younger respondents were relatively more critical of color, flavor, and overall quality than were older respondents.

Control Product. With respect to income levels of respondents, the ratings for the control product showed the same general results as the ratings for the two test products. Higher income respondents were generally more critical of the product. For the control product, higher income respondents had a greater tendency to rate it as being "too clear," "not sour enough," and "too thin." They were also more critical of color, flavor, and overall quality.

Age was also apparently related to the ratings of the control product. There were noticeable and statistically significant differences in the ratings by respondents under 20 years of age and those over 20 for the ratings of most product characteristics. Older respondents had a tendency to rate it as being "too sweet" and "not sour enough," whereas most respondents in the under 20 age category were neutral or evenly divided between the extremes. As for consistency, all respondents tended to rate the control drink as being too thin, but especially those over 20. Respondents over 20 were noticeably more critical of flavor and quality

than those under 20. This product obviously has greater appeal to the youngest age group than to the older age groups.

Respondent Comments

It is recognized that optional, solicited respondent comments rarely reflect the evaluations of the total sample of respondents for individual products due to the biased nature of the subsample that elects the option to make additional comments. However, such comments can provide a basis for comparisons among products provided the same subsample of respondents make comments on all products. While this condition was not completely fulfilled, it is felt that a reasonably firm basis exists for examining the relative numbers of favorable and unfavorable comments among the three products.

Approximately 46% of the comments made about Orange Ho were favorable as compared to 26% for both Nectarade and the control product. This supports the results of other analyses in that it indicates a general preference for Orange Ho as compared to either Nectarade or the control product. Also, as in other analyses, it appears that overall comparative evaluations of Nectarade and the control product are similar.

Several observations can be made based on the comments of respondents. A metallic taste was one objection. This was expressed regarding all three products and may be a reflection of the period of time that the products were held in storage indicating potential shelf-life problems. A brief discussion of the comments made by respondents for each product follows.

Orange Ho. One of the most frequently mentioned comments was Orange Ho had no distinct fruit flavor. Many respondents were uncertain of the kind of citrus drink they were testing, indicating that it tasted like a combination of orange, grapefruit and even pineapple juices. Several respondents also indicated a dissatisfaction due to bitterness; however, this comment was not made frequently enough to be judged very serious. Also, several comments were made about the fruit having a tendency to "settle out" fairly rapidly, but again, this comment did not appear frequently enough to be viewed as a major problem for Orange Ho.

Nectarade. Many of the comments made about Orange Ho were also made about Nectarade. A few commented on the lack of a distinct fruit flavor. Again, there was some confusion as to what kind of citrus drink it was and some also indicated they thought it contained pineapple juice.

The most frequently mentioned comments pertaining to Nectarade had to do with bitterness and after-taste. This seemed to be one of the major shortcomings of Nectarade. As with Orange Ho, the tendency of the fruit to "settle out" was mentioned, but did not appear to be extremely serious.

Control Product. The greatest majority of the critical comments made about the control product can be summarized in several words: "artificial," "imitation," and "synthetic." Most of the critical comments were simply reiterations of the evaluations made on the formal rating scales for the various product characteristics.

SUMMARY AND CONCLUSIONS

Two new citrus drinks along with a commercially produced citrus flavored fruit drink as a control product were distributed to 600 families in Dallas, Texas and Columbus, Ohio, in order to determine consumer acceptability of the new drinks.

The new citrus drinks differ from conventional fruit drinks in that they are made from comminuted whole citrus fruit. The drink made from oranges is referred to here as Orange Ho, and the one made from grapefruit is referred to as Nectarade. All members of the 600 households 12 years of age or older were asked to rate each of the three products on appearance, sweetness, sourness, consistency, color, flavor, and overall quality, using a nine point modified Peryam scale.

In general, Orange Ho received better ratings than Nectarade or the control product. The ratings for Nectarade and the control product were such that no clear-cut preference can be inferred. Respondents over 20 years of age tended to rate the test products more favorably than those under 20.

Orange Ho was judged to be slightly too cloudy in appearance and the consistency somewhat too thin. This may be due to the fruit puree having a tendency to settle to the bottom if allowed to sit for a few minutes. Other product characteristics of Orange Ho appeared to be acceptable.

Nectarade was also rated as being too cloudy and too thin, probably for the same reason as Orange Ho. In addition, respondents indicated

that it was not sweet enough, that it was too sour, and they were less pleased with the color, flavor, and overall quality than they were with Orange Ho.

In comparing Nectarade to the control product, there were differences (in direction) of the ratings on appearance (cloudiness), sweetness, and sourness, and a definite preference for the consistency of Nectarade. However, the differences in ratings on color, flavor, and overall quality were not appreciable.

In conclusion, consumer response to the new drinks is favorable, particularly for Orange Ho. As with any new product success depends not only on its inherent good qualities but also on its development in relation to market opportunities. With further modifications and market testing these products can serve important consumer needs as well as provide an alternative processing system for citrus products.

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APPENDIX A

Appendix Table 1. Percentage of respondents reporting usage of fruit juices during past month and past year, in Dallas and Columbus.

Juice	Dallas		Columbus		Both Cities	
	During Past Year	During Past Month	During Past Year	During Past Month	During Past Year	During Past Month
	- - - - - Percent - - - - -					
Orange	95.0	88.4	97.3	83.8	96.1	86.1
Grapefruit	55.3	36.8	46.5	26.3	51.0	31.6
Orange Grapefruit	12.2	4.6	21.2	10.1	16.6	7.3
Grape	55.3	29.5	57.2	31.3	56.3	30.4
Apple	41.7	20.5	32.0	18.2	36.9	19.4
Prune	29.8	12.6	21.9	9.4	25.9	11.0
Other	28.5	15.9	47.5	28.3	37.9	22.0

Source: Completed questionnaires, Dallas and Columbus, November, 1971.

Appendix Table 2. Percentage of respondents reporting usage of fruit drinks during past month and past year, in Dallas and Columbus.

Juice	Dallas		Columbus		Both Cities	
	During Past Year	During Past Month	During Past Year	During Past Month	During Past Year	During Past Month
	- - - - - Percent - - - - -					
Orange	48.1	34.8	58.6	43.1	53.3	38.9
Grapefruit	14.2	8.6	8.4	5.4	11.3	7.0
Orange Grapefruit	9.6	3.6	10.1	6.1	9.8	4.8
Pineapple Grapefruit	16.2	8.6	20.2	10.4	18.2	9.5
Lemonade	34.1	17.9	53.2	25.3	43.6	21.6
Grape	45.7	29.8	45.8	30.0	45.8	29.9
Apple	18.9	10.3	14.5	8.4	16.6	9.3
Cranberry	15.3	7.0	19.9	11.1	17.5	9.0
Other	17.6	10.3	24.9	14.8	21.2	12.5

Source: Completed questionnaires, Dallas and Columbus, November, 1971.

Appendix Table 3. Form of orange juice used most frequently,
Dallas, Columbus, and both cities

Form Used Most Frequently	Dallas	Columbus	Both Cities
	----- Percent -----		
Frozen Concentrate	70.3	64.5	67.4
Canned Single Strength	17.0	13.2	15.1
Chilled	9.2	19.4	14.2
Fresh Squeezed	3.5	2.9	3.2
Totals ^a	100.0	100.0	99.9

^aTotals may not equal 100 percent due to rounding error.

Source: Completed questionnaires, Dallas and Columbus, November, 1971.

Appendix Table 4. Form of grapefruit juice used most frequently,
Dallas, Columbus, and both cities

Form Used Most Frequently	Dallas	Columbus	Both Cities
	----- Percent -----		
Canned Single Strength	84.5	73.5	79.9
Frozen Concentrate	5.8	9.6	7.5
Chilled	1.7	14.7	7.5
Fresh Squeezed	7.6	2.2	5.2
Totals ^a	100.0	100.0	100.0

^aTotals may not equal to 100 percent due to rounding error

Source: Completed Questionnaires, Dallas and Columbus, November, 1971.

Appendix Table 5. Mean ratings for citrus drinks, Dallas.

Product Characteristic	Orange Ho n ~ 600	Nectarade n ~ 600	Control n ~1200
	-----Mean Rating-----		
Appearance (cloudiness) ^a	5.09	5.18	4.68
Sweetness ^a	5.02	5.09	4.82
Sourness ^a	4.93	4.69	5.23
Consistency ^a	5.51	5.45	6.01
Color ^b	3.94	3.93	4.10
Flavor ^b	4.20	4.37	4.55
Quality ^b	4.07	4.38	4.48

^aThese characteristics were evaluated on a nine point scale where 5 was just right. For appearance, a rating of 1 indicated "too cloudy"; for sweetness 1 indicated "too sweet"; for sourness 1 indicated "too sour"; for consistency 1 indicated "too thick". A rating of 9 indicated the other extreme.

^bThese characteristics were rated on a nine point scale where 1 = excellent or like very much and 9 = poor or dislike very much.

Source: Completed questionnaires, Dallas and Columbus, December 1971.

Appendix Table 6. Mean ratings for citrus drinks, Columbus.

Product Characteristics	Orange Ho n ≈ 600	Nectarade n ≈ 600	Control n ≈ 600
	-----Mean Rating-----		
Appearance (cloudiness) ^a	5.36	5.57	4.80
Sweetness ^a	5.00	5.30	4.86
Sourness ^a	5.04	4.52	5.27
Consistency ^a	5.37	5.53	6.25

Color ^b	3.80	4.59	4.52
Flavor ^b	4.18	4.91	5.16
Quality ^b	4.11	4.89	5.15

^aThese characteristics were evaluated on a nine point scale where 5 was just right. For appearance, a rating of 1 indicated "too cloudy"; for sweetness 1 indicated "too sweet"; for sourness 1 indicated "too sour"; for consistency 1 indicated "too thick". A rating of 9 indicated the other extreme.

^bThese characteristics were rated on a nine point scale where 1 = excellent or like very much and 9 = poor or dislike very much.

Source: Completed questionnaires, Dallas and Columbus, December 1971.

Appendix Table 7. Citrus drink evaluations by percent of respondents, Dallas.^a

Product Characteristic	Orange Ho	Nectarade	Control
	----- Percent -----		
<u>Appearance*</u>			
Too clear	10.8	10.6	18.2
Neutral	76.4	73.6	72.9
Too cloudy	12.8	15.7	8.9
<u>Sweetness*</u>			
Too sweet	15.5	15.9	19.9
Neutral	67.0	64.1	67.2
Not sweet enough	17.5	20.0	12.9
<u>Sourness*</u>			
Too sour	14.9	20.3	10.1
Neutral	72.7	67.8	72.9
Not sour enough	12.4	11.9	17.0
<u>Consistency*</u>			
Too thick	5.1	6.8	2.8
Neutral	75.7	74.2	64.5
Too thin	19.2	19.0	32.7
<u>Color</u>			
Good	46.2	46.2	43.7
Fair	39.3	38.7	38.1
Poor	14.6	15.1	18.2
<u>Flavor*</u>			
Good	43.5	43.9	38.0
Fair	34.6	30.3	35.4
Poor	22.0	25.7	26.7
<u>Overall quality*</u>			
Good	47.7	44.6	39.4
Fair	29.6	28.6	34.5
Poor	22.7	26.8	26.1

^a Percentages may not sum to 100 due to rounding error.

* Indicates a statistically significant Chi-square value at the 5 percent level among products.

Source: Completed questionnaires, Dallas and Columbus, December 1971.

Appendix Table 8. Citrus drink evaluations by percent of respondents, Columbus.^a

Product Characteristic	Orange Ho	Nectarade	Control
	-----Percent-----		
<u>Appearance*</u>			
Too clear	5.5	9.8	18.8
Neutral	77.0	64.3	68.5
Too cloudy	17.5	25.9	12.7
<u>Sweetness*</u>			
Too sweet	15.7	15.3	20.8
Neutral	69.0	61.9	62.5
Not sweet enough	15.3	22.9	16.8
<u>Sourness*</u>			
Too sour	12.9	24.8	13.1
Neutral	72.1	62.9	64.3
Not sour enough	15.0	12.3	22.6
<u>Consistency*</u>			
Too thick	5.0	5.5	2.6
Neutral	78.5	73.3	57.1
Too thin	16.5	21.2	40.3
<u>Color*</u>			
Good	46.2	33.4	35.1
Fair	43.5	46.9	44.1
Poor	10.2	19.7	20.9
<u>Flavor*</u>			
Good	44.2	33.9	29.3
Fair	37.4	36.2	37.4
Poor	18.3	30.0	33.3
<u>Overall quality*</u>			
Good	46.2	35.3	29.8
Fair	34.6	34.0	35.7
Poor	19.2	30.7	34.5

^aPercentages may not sum to 100 percent due to rounding error.

*Indicates a statistically significant Chi-square value at the 5 percent level among products.

Source: Completed questionnaires, Dallas and Columbus, December 1971.

Appendix Table 9. F tests, Orange Ho versus control, both cities.

Product Characteristic	F Value	Means	
		Orange Ho	Control
Appearance	82.3825*	5.23	4.74
Sweetness	9.3239*	5.01	4.82
Sourness	20.6454*	4.99	5.25
Consistency	166.9339*	5.44	6.13
Color	35.4033*	3.87	4.32
Flavor	58.3311*	4.19	4.86
Quality	69.3255*	4.09	4.82

*Indicates statistical significance at the 5 percent level.

Source: Computed from questionnaires, December 1971.

Appendix Table 10. F tests, Nectarade versus control, both cities.

Product Characteristic	F Value	Means	
		Nectarade	Control
Appearance	128.6428*	5.38	4.74
Sweetness	36.5634*	5.20	4.82
Sourness	188.4455*	4.60	5.25
Consistency	134.1412*	5.50	6.13
Color	0.3904	4.27	4.32
Flavor	5.9431*	4.64	4.86
Quality	4.0388*	4.64	4.82

*Indicates statistical significance at the 5 percent level.

Source: Computed from questionnaires, December 1971.

APPENDIX B

Texas Agricultural Market Research
 and Development Center
 Texas A&M University
 College Station, Texas 77843

OMB No. 40-S71097

Approval Expires June 30, 1972

Household No. _____

Address _____

Interviewer _____

Introductory Questionnaire

Good Morning! I'm _____ representing the Market Research and Development Center of Texas A&M University. We are conducting a survey on fruit and vegetable products in conjunction with the U.S. Department of Agriculture and would like to ask you some questions and have you try some products.

In talking about "fruit juice," we use the term to mean the actual juice of fruit not diluted below its normal level of concentration.

1. a. (HAND CARD #1 TO RESPONDENT) Which of these fruit juices, if any, have you used in your household in the last month? (check below)
- b. Are there any other fruit juices not on this list which you have used in your household in the last month? (list below)
- c. In the past year, which additional fruit juices, if any, have you used in your household? (check or list below)

Juice	Past Month	Past Year
Orange	_____	_____
Grapefruit	_____	_____
Orange-Grapefruit	_____	_____
Grape	_____	_____
Apple	_____	_____
Prune	_____	_____
Other (specify)	_____	_____
_____	_____	_____
_____	_____	_____

2. IF USE ORANGE JUICE:Which form of orange juice do you use most often?

Fresh squeezed at home _____

Frozen concentrate _____

Canned single strength _____

Chilled _____

3. IF USE GRAPEFRUIT JUICE:Which form of grapefruit juice do you use most often?

Fresh squeezed at home _____

Frozen concentrate _____

Canned single strength _____

Chilled _____

In talking about "fruit drinks," we use the term to mean a diluted form of fruit juice; there may be as little as 10% of actual fruit juice in a fruit drink.

4. a. (HAND CARD #2 TO RESPONDENT) Which of these fruit drinks, if any, have you used in your household in the past month? (check below)
- b. Are there any other fruit drinks not on this list which you have used in your household in the past month? (list below)
- c. In the past year, which additional fruits, if any have you used in your household? (check or list below)

Fruit Drink	Past Month	Past Year
Orange	_____	_____
Grapefruit	_____	_____
Orange-Grapefruit	_____	_____

Fruit Drink	Past Month	Past Year
Pineapple-Grapefruit	_____	_____
Lemonade	_____	_____
Grape	_____	_____
Apple	_____	_____
Cranberry	_____	_____
Other (specify)	_____	_____

In talking about "fruit ades and punches," we use the term to mean kool-ade types of products; fruit flavorings used to give them a fruit taste.

5. Have you or have you not used any powdered fruit ades or punches:
(check)

a. In the past month? Have Have Not

b. In the past year? Have Have Not

IF RESPONDENT'S HOUSEHOLD HAS NOT USED FRUIT JUICES, DRINKS, OR ADES IN THE PAST YEAR, GO TO QUESTION 9 TO OBTAIN HOUSEHOLD CHARACTERISTICS AND THEN TERMINATE.

6. a. (HAND CARD #3 TO RESPONDENT) At which of these occasions, if any, do you usually serve fruit juices? (check below)
- b. At which occasions, if any, do you usually serve fruit drinks?
- c. At which occasions, if any, do you usually serve fruit ades or punches?

Occasion	Fruit Juice	Fruit Drinks	Ades or Punches
Breakfast	_____	_____	_____
Midmorning Snack	_____	_____	_____
Lunch	_____	_____	_____

Occasion	Fruit Juice	Fruit Drinks	Ades or Punches
Afternoon Snack	_____	_____	_____
Evening Meal	_____	_____	_____
Evening Snack	_____	_____	_____
Parties	_____	_____	_____

7. Have you or have you not used fresh tomatoes: (check)
- a. In the past month? Have Have Not
- b. In the past year? Have Have Not

(IF NOT FOR BOTH 7 (A) AND (B), GO TO QUESTION 9)

8. In what way do you most often use fresh tomatoes?
- Salad _____
- Sliced _____
- Stewed _____
- Other (specify) _____

HOUSEHOLD CHARACTERISTICS

9. How many family members live in this household? _____
10. Please specify each family household member age 12 and over, indicating relationship to the head of the household (wife, son, etc.) and age group.
(HAND CARD #4 TO RESPONDENT)

Household Members and Relationship	Age Group	Male	Female
<u>(head of household)</u>	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

11. (HAND CARD #5 TO RESPONDENT) Which of these categories best describes your total annual family income from all sources for last year?

- | | |
|-------------------------|-------------------------|
| A. less than \$2500 | F. \$12,500 to \$14,999 |
| B. \$2500 to \$4999 | G. \$15,000 to \$17,499 |
| C. \$5000 to \$7999 | H. \$17,500 to \$19,999 |
| D. \$8000 to \$9999 | I. \$20,000 to \$24,999 |
| E. \$10,000 to \$12,499 | J. \$25,000 or more |

(TERMINATE INTERVIEW IF HOUSEHOLD HAS NOT USED JUICES, DRINKS, OR ADES IN THE PAST YEAR)

12. (ASK ABOUT LEAVING CITRUS AND TOMATO TEST PRODUCTS OVER THE NEXT 2-3 WEEKS WITH THEM.)

Circle one: Will cooperate Will not cooperate

13. If the household will cooperate, verify home address and obtain telephone number.

Name _____

Address _____

Phone _____

Texas Agricultural Market Research
and Development Center
Texas A&M University
College Station, Texas 77843

OMB No. 40-571097

Approval Expires June 30, 1972

Household No. _____

Address _____

Interviewer _____

Citrus Drinks

Rating Form

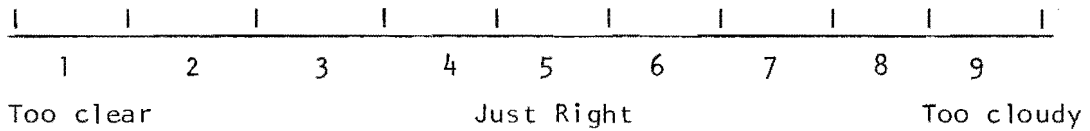
Each member of the household age 12 or older should complete this form immediately after his or her first serving of the product. There are two rating forms attached to this page, one for each of the two drink products you have received this time. Please be careful to match the color of the rating form with the color on the top of the can.

Please circle the appropriate answers.

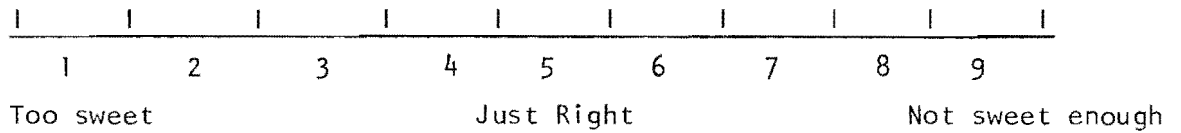
1. Your age group: (1) 12-19 (2) 20-34
(3) 35-54 (4) 55 and over
2. Sex: (1) Male (2) Female
3. Do you or do you not usually buy the groceries for this household?
Do Do Not

4. Please rate this product for each of the characteristics shown below. (Check the scale with an "X" in the appropriate place. Please read each scale carefully. Note that the "best" rating for each is at the center of the scale.)

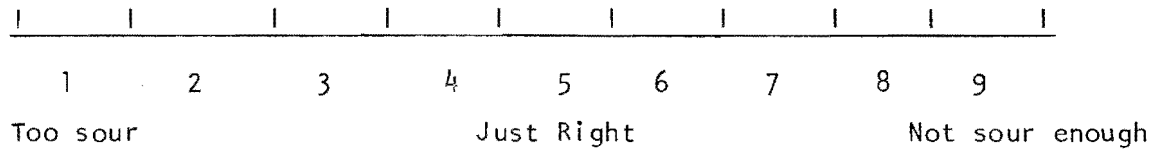
A. Appearance (cloudiness)



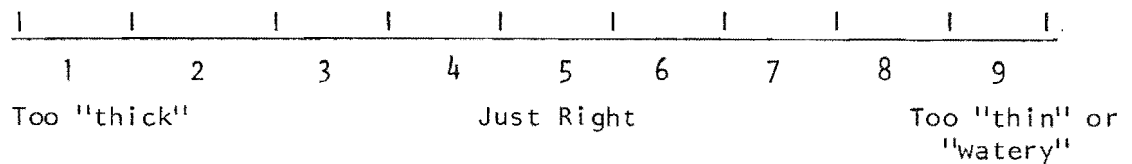
B. Sweetness



C. Sourness

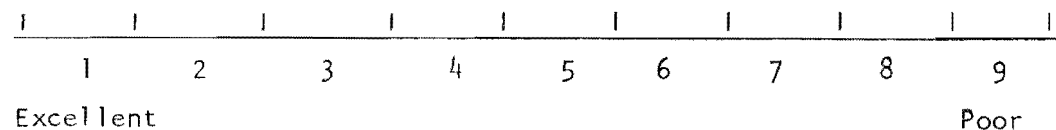


D. Consistency



5. Please rate this product for each of the characteristics shown below. (Check the scale with an "X" in the appropriate place.) Please read each scale carefully. Note that these scales differ from those used above; these scales run from "Excellent" at one end to "Poor" at the other end.

A. Color



B. Flavor

1	2	3	4	5	6	7	8	9	
Excellent					Poor				

C. Overall Quality (How did you like this drink?)

1	2	3	4	5	6	7	8	9	
Like very much					Dislike very much				

6. Was this juice chilled when you drank it or not? (Check)

Was Was Not

7. At which occasion did you try this product? (Check)

Breakfast <input type="checkbox"/>	Mid-day meal <input type="checkbox"/>	Evening meal <input type="checkbox"/>
Mid-morning snack <input type="checkbox"/>	Afternoon snack <input type="checkbox"/>	Evening snack <input type="checkbox"/>
	Party <input type="checkbox"/>	

If you have additional comments, please write them on the reverse side of this page.

General Interviewer Instructions

1. You will be provided with a list indicating where to start with interviewing and product placement. You are to begin at the point designated and contact each household on the right hand side of the street. A two call back procedure is to be used before accepting an alternate household. Alternates to be used are the houses directly across the street. A total of ten (10) households are needed in each cluster.
2. You are to complete the introductory questionnaire during the first visit. Upon receiving cooperation, you will leave one of the two test drink products (a white can or a blue can) and the control product (a red can). Within each cluster of 10 households, half of the households should receive a white and a red can, while the other half receives a blue and a red can. Every household gets a red can, but the two test products should be alternated. Leave a rating form for each member of the household, age 12 or older. Remember, the products and the rating forms are color-coded. Check to make sure the right forms are provided. The respondents should be instructed to rate all products given to them independently. They are not to compare products.
3. At the second visit you will pick up the rating forms from the first visit and leave a sample of the second test product and another sample of the control drink product. Appropriate rating forms should again be provided. Check to make sure. Also be sure you do not leave the same test product as left the first time.

Also at the second visit leave the tomato product and one rating form for the housewife to fill out.

4. At the third visit pick up rating forms for the citrus drinks and tomato product left at the second visit. It is important to obtain the maximum amount of response by actually returning to the household to pick up the forms. Check to make sure you have received all the forms which were left.

Introductory Questionnaire

- a. This is to be completed at the first visit.

b. Question 1:

- Cards will be provided to you which will have a list of responses appropriate for particular questions. At this time use card #1.
- Note the question asks for both the past month and past year.
- It will probably be necessary to differentiate between fruit juice and fruit drink for the respondent.
- Fruit juice refers to the actual juice of the fruit which is not diluted with water below its level of concentration normally found in nature. (This includes frozen concentrated juices).
- Fruit drink is a "diluted" form of the fruit juice. Usually there may be only 10 percent of actual juice. (Hi-C is an example).
- If juice substitutes are mentioned (Start, Awake, Orange-plus, Tang) they should be listed under fruit juices in Question 1.

c. Questions 2 and 3:

- Ask each if appropriate.

d. Question 4:

- Similar to question one but refers to fruit drinks.
- Again, be sure respondent knows the difference.

e. Question 5:

- Refers to "kool-ade" type products.
- Terminate and go to Question 9 if household does not use any fruit juice, drinks, or ades.

f. Question 6:

- Be sure to ask about all three categories.
- The question is based upon their usual usage pattern.

g. Question 7 and 8:

--Basic information on their use of fresh tomatoes is required.

h. Question 9-11:

--Basic household characteristics

--It is very important to get a list of all members of the household age 12 and over.

--If a refusal is given for question 11, do not press for an answer.

i. Question 12 and 13:

--Indication of willingness to cooperate

--Be sure to verify address and phone number.

APPENDIX C

Technical Product Descriptions and Analyses

The formula used in the preparation of Orange Ho and Nectarade contained 10% of the respective whole fruit puree, 12.5% sugar (sucrose), 0.75% citric acid, and 76.75% water [1]

Analyses of the chemical and physical properties of Orange Ho, Nectarade, and the control product are found in the tables below.

Appendix Table 11. Sugar, acid, and pulp content of Orange Ho, Nectarade, and the control product.

Sample	Brix °	Acid %	Pulp %
Orange Ho	15.3	0.60	10
Nectarade	15.3	0.65	8
Control	13.3	0.35	2

Source: USDA, Southern Marketing and Nutrition Research Division, Weslaco, Texas.

Appendix Table 12. Color and light transmittance analyses of Orange Ho, Nectarade, and the control product.

Sample	Cloud ^a	Color ^b	Macbeth Lamp	Hunter Colorimeter		Gardner Difference Meter-LY-1		
	% T	Maerz & Paul		CR	CY	Rd	a	b
Orange Ho	40.2	P. 12, 1K	< 0J6	21.3	58.2	+21.5	-6.8	+19.8
Nectarade	60.3	P. 12, 9J	--- ^c	58.1	58.7	+ 7.5	-2.2	+11.4
Control Product	70.4	P. 11, 4K	> 0J1	>100	85.6	+ 3.7	+3.0	+12.0
LY-1 Standard						+60.0	-2.3	+22.4

^aCloud values are reported as %Transmittance where 100% = a clear solution and 0%T = a completely clear solution.

^bPage number and color plate most closely matching drink from Dictionary of Color by A. Maerz and M. Paul, 1st edition, 1930.

^cColor of Nectarade did not approach the USDA Consumer Marketing Service color standards for orange juice.

Source: USDA, Southern Marketing and Nutrition research Division, Weslaco, Texas.