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RESEARCH REPORTS & UPDATES

Food Distribution: Structure and Practice

Moderator: H. L. Goodwin,
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UPDATES

Competitiveness of Firms in the Texas Food Processing Sector:

A Profile

by

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Abstract

This research update deals with the competitiveness of firms in the Texas food processing sector, the basis of the evaluation being value-added activity. Data from the U.S. Department of Agriculture shows that Texas is one of the leading producers of agricultural products as well as one of the leading producers of value-added products. Furthermore, value-added activities are becoming popular as a means of rural and regional economic development. Therefore, a means of evaluating the impacts of various value-added activities must be identified.

The purpose of this research is to identify the opportunities that exist for the Texas food processing industry. The investigation is facilitat-

ed by a study of value-added activities, input-output analysis, and mathematical programming. These studies culminate in the development of a framework with which to identify industries with value-added potential, and the framework is tested using a model deemed appropriate for this purpose.

Connor's gross margin definition of value-added is closely related to input-output theory. The gross margin approach compares the value of inputs with the value of outputs. Input-output surveys provide the template for data collection for this type of value-added analysis.

The population of Texas food processors has received an input-output survey. Questions relate to the value, source, and type of inputs; the

reasons for buying or not buying inputs from within Texas; and the value, destination, and type of outputs.

This information is used to calculate data such as the revenue, cost, profit, and labor to capital ratios for products, as well as the value of each input used in each product. A heuristic framework is constructed with which to evaluate the value-added potential of the various industries. Industries with the highest marginal potential will be identified. The framework is tested based on the results of changes in such factors as employment, supplies of inputs or outputs, and similar components of the food processing sector to help identify the competitiveness of firms in the Texas food processing sector.

Consumer Perceptions of Irradiated Food

Attributes: The Continuing Account

by

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Introduction

Recent proposals to approve food irradiation have generated public debate about the wisdom, safety, and overall acceptability of the process as an appropriate alternative to current food preservation methods. Irradiation technology will not solve all the problems of postharvest deterioration of highly perishable fresh produce. However, it can be viewed as another form of processing and storage--a possible supplement to refrigeration and

other postharvest technology procedures aimed at reducing postharvest losses.

Objectives

Since no irradiated food products, except spices for processed foods, are currently marketed, the data needed to measure actual consumer response in the marketplace are lacking. This study attempted to determine consumers' perspectives toward irradiation-induced attributes and willingness to pay for potential benefits. Straw-

berries were selected for use in achieving project objectives because of their short shelf life. The specific research objectives were to:

- 1) obtain value-added comparisons among quality attributes of irradiated and nonirradiated strawberries, and
- 2) examine from a value-added approach the effects premium and discount pricing have upon consumer willingness to pay for irradiated strawberries and their "new" characteristics.

Methodology

Data collection was initiated in May 1989, when approximately 2,500 samples (each sample consisted of separately bagged and labeled irradiated and nonirradiated strawberries plus a self-addressed stamped questionnaire) were distributed at ten randomly selected high consumer traffic areas in the Kansas City, Missouri region. With the exception of the irradiation treatment, both groups of strawberries were transported and stored in a traditional manner until samples were distributed. Included in one-quarter of the samples were one-page flyers explaining the concept of food irradiation. These sheets included a brief description on the irradiation process, purposes and possible benefits, and information regarding safety issues. All recipients of samples were asked to evaluate the strawberry characteristics several days later.

Survey Results

The return rate for distributed samples was 16.1 percent. Only thirty percent of all respondents indicated that they had heard of food irradiation. Respondents were asked to evaluate various irradiated and nonirradiated strawberry attributes. In terms of appearance, freshness, firmness, and color, over 80 percent of the respondents felt the irradiated strawberries were equal or superior to the nonirradiated strawberries. Approximately one-fourth of the respondents rated the storage life of both groups of strawberries to be equal, while 40 percent rated the storage life of the irradiated strawberries as superior. More than 20 percent found the nonirradiated strawberries to have a

better taste, but 27.4 percent preferred the taste of the irradiated product; however, 41.9 percent could not discern any difference in taste and 10.1 percent did not attempt to make a taste comparison.

Respondents were, in percentage terms, generally willing to pay higher prices when one-page fact sheets containing positive information about food irradiation were included in the samples. Only 14 percent of those returning surveys felt that irradiated strawberries should not be featured in their favorite supermarkets, while 51.3 percent indicated they would welcome such displays. However, 34.7 percent of the respondents had ambivalent feelings toward stocking display cases with irradiated strawberries. While 80.1 percent of the respondents stated they were pleased with the irradiated strawberries, only half of them definitely wanted them featured in their favorite supermarket. Apparently, there are large numbers of food consumers in the study area who have yet to take a position on the subject of food irradiation and who can be influenced, either pro or con, by information presented to them.

Conclusions and Implications

As in the case of other new food preservation techniques, educational programs promoting the benefits gained from irradiating produce will be needed. The irradiation process is not expected to be a solution to all food preservation problems and continues to be controversial, but could find niches in food product marketing. If marketing programs are developed, better freshness and taste over the extended life of the product could be emphasized. Whether large quantities of irradiated produce will ever be commercially accepted will depend on the shoppers' willingness to accept the irradiation process. The consumers' image of food irradiation will be of prime importance to its future in domestic food supplies. Although this study did not look explicitly at perceived and objective food irradiation safety risks, it does indicate that a substantial portion of Kansas City area consumers might be interested in the food irradiation process and willing to pay for the extended shelf life attribute.

Consumer Response to State-Oriented Fresh Produce Displays in Supermarkets

by

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Introduction and Objectives

The Tennessee Department of Agriculture (TDA) has developed a logo that growers, wholesalers, processors, and retailers are invited to use to help promote the sale of any product that is grown and/or processed in Tennessee. The logo contains the words "Pick Tennessee Products," with Tennessee written in cursive across a banjo. A rather modest budget, plus a broad spectrum of clientele, have restricted the TDA Marketing Division's efforts to conduct research regarding the effectiveness of their promotional activity.

This research project is based on a cooperative agreement between the TDA and The University of Tennessee Agricultural Experiment Station (UTAES). It is funded by the Agricultural Marketing Service, USDA. The general goal is to analyze the effectiveness of the TDA's logo campaign in retail supermarkets. Three specific objectives of the project are listed below.

- (1) Identify the states with fresh produce promotional campaigns.
- (2) Analyze the impact on fresh produce sales at within-state retail supermarkets from spe-

cial displays that emphasize the availability of Tennessee-grown produce.

- (3) Conduct an in-store survey of fresh produce customers to obtain information about attitudes and perceptions toward the special displays of Tennessee-grown fresh produce.

Objective One

All State Departments of Agriculture (DA) within the continental United States were contacted by mail to solicit answers to three questions. First, "does your DA have a state developed logo available for use by fresh produce growers?" Second, "if your DA does have a logo program," and third, "what is the budget allocated to fresh produce?" States that did not respond by mail were contacted by telephone. Thus far, responses have been obtained from 45 states. Of these, 31 have logo programs or plan to launch logo programs in the near future. Nine states had conducted or supported some research regarding logos. Most of the states reported that they do not have their budgets separated into individual commodity groups. Among the few that did have specific budgets for produce marketing, the reported amount ranged from zero to \$365,000.

Objective Two

In Chattanooga, Tennessee, four supermarkets from one regional chain participated with the TDA and UTAES in the in-store sales experiment. Two stores served as test stores and two served as control stores. One in each set was selected to represent upper income consumers and the other to represent lower income food shoppers. Within the control stores the managers were instructed to display locally grown produce in the same manner as in previous years. This meant the products were not grouped together and the stores did not use any special signage that included the P-T-P logo. In the test stores, special displays were designed so that all Tennessee-produced products were displayed next to each other on part of a center table. The Tennessee origin and prices of the products were placed on shelf-talkers that included the P-T-P logo. Above the display tables several large banners with the P-T-P logo were hung from the ceiling. The produce managers recorded the sales volumes and prices on a weekly basis.

During the 11 week experiment period (June 25 to September 8), as many as 14 different Tennessee products were sold in the test stores. Several growers were contacted and arrangements made with the retailer regarding products, volumes, quality, and delivery schedules. While considerable planning effort was expended, there were occasions throughout the experiment period that the local product was not present in adequate supply and/or the product was not of top quality. Even with this effort, shortages did occur. Quality of the product was not a serious problem, but was noticeably lacking on a few occasions. Work is in progress to analyze the sales data collected.

Objective Three

Employees of the UTAES interviewed 229 produce customers in the two test stores. Some preliminary analysis of the responses are noted below.

Do you care where fresh produce is grown?
57% yes.

Would you like information regarding origin?
86% yes.

Did the P-T-P display prompt you to purchase more produce than planned?
19% yes

Why did you purchase more produce than originally planned?
79% reported quality better than expected.

Do you read newspaper ads regularly?
70% yes.

Prior to today, did you have any knowledge of the P-T-P campaign?
65% no.

Would you switch supermarkets to purchase Tennessee products?
41% yes.

Do you shop at more than one store to purchase advertised specials?
50% yes.

More involved analysis of the survey responses will be undertaken in the next few months.

Measuring Consumer Willingness to Pay for Organic Produce:

An Adaptive Conjoint Analysis

by

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Introduction

In order to understand a consumer's decision making process, the determination of how buyers trade off conflicting criteria in their purchase decision making is critical. A good can be interpreted as a bundle of attributes with levels within each attribute. Thus consumers make decisions based on a set of attributes such as appearance, taste, feel and method of production.

Objectives

The overall objective of this study is to estimate consumer utilities in purchase decision making of organic versus conventional produce, with a special interest in price effects. Specific objectives are:

- 1) Identify attributes most important to consumers' decision to purchase types of produce.
- 2) Determine utility values of the various considered attributes through adaptive conjoint analysis.
- 3) Establish price impact on consumer purchase decisions for variations in attribute combinations and the levels within.
- 4) Perform market simulations of potential organic vs. conventional product attribute situations.

Procedures

This study will interview 200 random consumers in produce departments throughout the state. The interviews will be computer administered, integrating the Adaptive Conjoint Analysis software package with the ci2 interview package, from Sawtooth Software.

The attributes and level of attributes need to be defined in terms of utility, from which attribute importance can be derived. An adaptive conjoint analysis program must be designed to enable interviewing, utility calculations and end result analysis. Conjoint analysis methodology permits a development of utility values for various product attributes. The methodology utilizes a decision tree approach. Attributes utility values are not determined in isolation, but are measured in interaction with the other attributes.

The Adaptive Conjoint Analysis System customizes each interview session for each respondent, questioning the respondent only on the respondent's determinant attributes that are determined in an initial screening section. The screening section allows determination of relative desirability of each attribute level and importance of each attribute to the particular respondent. The researcher can then interview the respondent only on attribute levels which would be acceptable to the respondent, and only on attributes regarded as relatively important.

Thus, an interview can be conducted under a reasonable time framework, while still achieving the full breadth of respondent's utilities. For example, if someone would refuse to ever buy a produce unit for \$5/lb regardless of other attributes, then it is pointless to continue questioning the respondent about product concepts that include this price attribute level.

The ACA develops a series of calibrating concepts by using attributes determined to be most important and the levels most salient to the particular respondent. The product concepts range from very undesirable to very desirable. The respondent then gives their percentage likelihood of buying that concept. This information is then used to determine the attribute importance estimated earlier.

Respondent utilities are estimated using a least squares updating algorithm. Initial estimates of utilities are based on the individual's rank orders of level preferences and attribute importance ratings. Estimates are updated after each response and early utility estimates decrease in importance as the interview progresses. The final utility estimates are true least squares with equal weight for each of the respondent's answers.

A Conjoint Analysis of Consumer Preferences Toward Farm-Raised Seafood Products

by

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Problem

U.S. consumption of seafood products is rapidly expanding. Per capita consumption has increased over 51 percent between 1964 and 1989. However, production from domestic stocks of many finfish and shellfish species are nearing or have achieved maximum sustainable yields (Adams). Therefore, some of the nation's largest agricultural companies are looking to expand into the aquaculture industry. Aquaculture is projected to account for 25 percent of all U.S. seafood production by the turn of the century. The success of these aquatic ventures depends largely on the marketability of the product. The key to marketing seafood successfully lies in the understanding that the closer the seafood producer, processor, wholesaler, and retailer can come to supplying consumers with what they want, the more they will buy or the more they will be prepared to pay (Shaw). The aquaculture industry is an infant industry. Therefore, it is vital that producers, processors, distributors, and retailers have as much current information as possible concerning consumers' wants and desires for sea-

food. This will be accomplished in three steps. First, a survey will be conducted to investigate consumer familiarity with and attitudes toward farm-raised seafood products. Second, the relative importance of various seafood product attributes will be determined. Utility values will be estimated for specific levels of each controllable seafood product attribute. These utility values will be employed to compare consumer preferences for several feasible farm-raised seafood product configurations. Finally, the attribute utility values will be used to design the optimal (in terms of consumer utility) farm-raised seafood products to ensure maximum consumer acceptance and market penetration.

Procedures

The conjoint measurement experiment will be incorporated within a nation wide market survey administered to 3,600 consumer selected at random. In the conjoint analysis, consumer preference for seafood is assumed to be a function of the attributes of species, inspection system, flavor, production environment (wild catch or farm-

raised), product form, product condition (fresh, frozen, etc.), availability, product size, packaging, grade level, and price. A conjoint preference model will be developed with preference rating as the dependent variable and fish attributes as explanatory variables. The preference model will be estimated using logit and weighted least squares analysis. The estimates will be used to calculate attribute level utility values, probabilities, and attribute relative importance weights for each market segment. In a simulation framework the utility values will be used to determine the ideal seafood products for different market segments.

Implications

To the Food Distribution Industry

Consumer perceptions and preferences toward seafood rely heavily on the product attributes. Results from this study will provide information which will allow the infant aquaculture industry to provide seafood products tailor-made to meet the needs and desires of consumers.

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Evaluation of Harvest Criteria for Empire Apples: How Does It Affect Consumer Preference?

by

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Problem Addressed

The Empire apple is a cross between a Red Delicious and a McIntosh, resulting in an attractive, very marketable fruit. The Empire apple is growing in importance, primarily in Michigan and the Northeast. Apple growers typically harvest the Empire variety based on the USDA specifications for color rather than on consumer tastes regarding texture and flavor.

The Empire was placed under the grading requirements of the Red Delicious by the USDA, and needs 66 percent of its surface to be of "good red color" in order to meet the highest grade, which is U.S. Extra Fancy. The McIntosh, on the other hand, only requires that 50 percent of its surface reach "good red color" to make the top grade. Many industry leaders and growers feel

that the color standard for the Empire apple was arbitrarily assigned.

Empire apple growers, like the growers of other red apples, have an economic incentive to harvest according to the color specifications of the grading system. As the apples mature enough to reach the color requirements, they lose firmness and are often picked beyond their prime in terms of taste and texture. Past research on the Empire has shown that the apples get softer as the harvest date increases, especially after storage (Blanpied, 1989). At the same time, industry literature has indicated that apple texture is of primary importance to consumers. There has been a growing acceptance of non-red apple varieties that are perceived to be crisper by the consumer.

Research Objectives

The research conducted will determine what differences exist between Empire apples harvested prior to making the top USDA grade, and when the apples have met the top USDA grade. Consumer preferences of apple flavor, texture, sweetness and overall acceptability will be evaluated. The receptiveness of the consumer to a crisp, greenish-red apple will be determined.

Methodology

Empire apples were randomly harvested at two separate intervals from a New York orchard. An early sample and a sample taken around the normal harvest period were collected.

Starch-iodine, sugar, and pressure tests were used to test each randomly selected sample for the stage of maturation. The apples were examined and graded on the basis of color by a USDA inspector. The apples were then placed into controlled atmosphere storage. Consumer preference taste tests will be conducted in January, 1991 at the Hudson Valley Mall.

Results/Implications

An analysis of the means was conducted on the results of the starch, sugar and texture tests using the Student's T Test. Significant differences existed between the samples. The apples harvested early were firmer and less sweet. Color grading indicated that the apples harvested later had more red color and were assigned a higher USDA grade. The preliminary results from the consumer taste tests are expected by February, 1991. If the results show that consumers prefer the lower graded apples harvested based on eating quality attributes, it will demonstrate a disparity between the USDA grading system for Empire apples and consumer tastes.

Consumer Opinions Concerning Fresh Produce For Eastern Shore Counties, Maryland and Virginia

by

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Introduction

This study is part of a project involving obtaining data from Maryland, Virginia and Delaware. Once the data is combined we will be able to summarize the results for the Delmarva region.

Objectives

The overall objective is to determine consumers' understanding and attitudes toward fresh produce. Specific objectives are as follows:

1. Determine level of consumer interest in current food regulated issues such as food safety.
2. Determine the level of consumer interest in organic and conventional produce.

Procedures

A mail questionnaire was sent to 2900 randomly selected consumers, using the Donnelly

Directory as the data source. A total of 303 consumers responded, for a 10.5 percent return rate. The survey area included the following: Caroline, Cecil, Dorchester, Kent, Queen Anne, Somerset, Talbot, Wicomico, and Worcester counties in Maryland; and Accomac and Northampton counties in Virginia.

Preliminary Results

The consumers responding were in the following age groups: 18 to 34, 15.5 percent; 35 to 49, 38 percent; 50 and over, 46.5 percent. Additionally, 43 percent of the respondents were females and 57 percent were males. The predominant family size was two. Concerning education, 73 percent completed high school and 19 percent had four or more years of college. The respondents were living in the following types of locations: city, 23.7 percent; suburbs, 17.1 percent; town, 32.4 percent; rural farm, 7.4 percent; and rural nonfarm, 19.4 percent.

The respondents' occupations were as follows: professional, 21 percent; blue collar, 17 percent; office/clerical, 13.5 percent; retail sales, 11.4 percent; homemaker, 9.7 percent; retired, 24 percent; and other occupations accounted for the remaining 3.5 percent.

Total household incomes of the respondents were as follows: less than \$20,000, 12.6 percent; \$20,000 to \$29,999, 15.5 percent; \$30,000 to \$39,999, 15.2 percent; \$40,000 to \$49,999, 16.6 percent; \$50,000 to \$59,999, 14.4 percent; \$60,000 to \$69,999, 9.0 percent; and \$70,000 and above, 19.6 percent.

Respondents expressed serious concerns with **residues** from herbicides and pesticides, radiation and preservatives. Approximately 34 percent of the consumers indicated that organically grown produce was much better. However, only about 15 percent of the consumers buy organic produce on a regular basis. They indicated five major factors used when buying organic produce: nutrition, safety, healthfulness, flavor and price.

A detailed analysis will be made of the data within the next year.

Evaluation of Consumer Buying Patterns of Fresh Produce and Meat Products in Delaware

by

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Problem

The introduction of scanning checkout systems into U.S. supermarkets in the mid 1970s opened tremendous opportunities for economic research. However, scanner data has been used mainly for inventory control with very limited use in demand analysis. Only since 1979 have scanner data, through refinements by manufacturers of electronic scanning checkout systems, combined

with the improved understanding of these sophisticated systems by retail users, been generated with enough reliability and consistency for application in economic research.

From the demand studies that have been conducted using scanner data, retailers have only been given a brief glimpse of the management potential contained in their data base. Therefore, the overall objective of this study will be to use

Delaware supermarket scanner data to identify consumer buying patterns. Specifically this project will:

1) Determine consumer buying patterns of disaggregate fruits and vegetables produced in Delaware and assess the impacts of prices and other factors on the movement of these products,

2) Determine consumer buying patterns of disaggregate meat, poultry, and seafood products produced in Delaware and assess the impacts of prices and other factors on the movement of these products, and

3) Determine potential uses of scanner-derived information for managerial decision-making in food production and retailing in Delaware.

Procedure

Scanning data will be collected from several retail grocery stores in Delaware. The scanning data will be based on the universal product codes (UPC) as well as internal store codes, and provide weekly sales volume and prices for the selected products. Several non-price factors will be monitored to determine their effect on demand. These non-price factors will include promotional activities as well as socio-demographic effects such as unemployment rates, population changes, seasonal, and payday effects.

The analysis will focus on the relative importance of price and the non-price factors of demand. Perhaps of more interest to Delaware retailers would be the elasticities associated with the various products including the degree of substitutability between Delaware poultry products and other meats produced within the state compared to those produced from outside the state. This study will also evaluate how sales of fresh produce and other products produced in Delaware and carrying the "First Rate From The First State" logo compare with products not carrying the logo label. The linkage between scanner data and retail management will also be explored.

Implications To the Food Distribution Industry

Scanner data indeed may result in the most detailed and definitive source of retail food industry statistics available to market and research analysts. However, the realization of benefits from the use of scanner data is still in the embryonic stage of development. With proper management and care, scanner data may well prove to be one of the most important data sources for demand and market analysis at the retail level.

Retail Demand for Catfish and Crawfish in a Local Market

by

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Problem Addressed

Traditional fishery landings indigenous to the United States are at or near maximum sustainable yields. Consequently, this traditional source of finfish and shellfish is supplemented by aquacultural production. In particular, catfish and crawfish production levels have grown dramatically in the last decade.

Production levels are currently no longer limited by physical or technical constraints, as in the early days of aquaculture, but rather by market constraints. Limited knowledge is available about the supply side of the market from previous investigations, but information about the demand side is lacking. This lack of knowledge, especially in the seafood industry, is a formidable barrier to market expansion and stability. In this light, the purpose of this research is to evaluate marketable product forms of catfish and crawfish (both convenience and fresh products) in retail food stores through the use of scanner data.

Methodology Used

This research rests on the collection, organization, and use of scanner data from a retail food firm in Houston. Data on a weekly basis are available from the period January 1986 to Novem-

ber 1988 (150 weeks). The analysis centers on the specification and estimation of econometric models which relate point-of-sale purchases per 1000 customers, the dependent variable in question, as a function of a number of exogenous factors: (1) price variables; (2) seasonality; and (3) advertising.

Major Findings

Fresh catfish products, which give rise to about \$10,100 in sales per week, comprise roughly 89 percent of all catfish sales. The principal fresh catfish products are catfish fillets and whole catfish. Convenience catfish products (e.g. Hormel Catfish Bobber Snacks; Mrs. Paul's Catfish Strips) give rise to roughly \$1,300 in sales per week, about 11 percent of all catfish sales. Convenience crawfish products (e.g. Cajun Cook Crawfish Etouffe with Rice) constitute about \$550 weekly in sales, approximately 90 percent of all crawfish sales. Fresh crawfish products constitute the remaining ten percent. Tremendous variability exists in purchases on a weekly basis. Generally, for both crawfish and catfish products, the explanatory power of the econometric models is on the order of 60 to 80 percent. The own-price elasticities for fresh catfish range from -1.3 to -6.5, and for convenience catfish the range is -5.5 to -12.8. The own-price elasticity for fresh crawfish is -3.2,

and the own-price elasticity for convenience crawfish is -1.5. For fresh catfish products and crawfish products, cross-price elasticities are generally not statistically different from zero. The reverse is true for convenience catfish and crawfish products. Own-advertisement elasticities are significantly different from zero only for fresh catfish fillets and the aggregate of all fresh catfish products. The respective own-advertisement elasticities for these products are 0.035 and 0.063, much smaller in magnitude than the corresponding own-price elasticities. No cross-advertisement effects are significantly different from zero. Seasonality is a key factor in purchases of all catfish products, fresh as well as convenience. On the other hand, seasonality is only a key factor in purchases of fresh cooked crawfish.

Consumer Evaluations of New Juice from Seedless Table Grapes

by

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Consumer tests were conducted in grocery stores in 1989 and 1990 to evaluate grape juices developed from Arkansas' seedless table grape cultivars. This was a joint project with: (1) the Department of Food Science as well as Agricultural Economics and Rural Sociology, University of Arkansas, (2) Ozark Table Grape Growers Association, Inc. (OTGGAI) of Searcy, AR and (3) the Agricultural Marketing Service (AMS), U.S. Department of Agriculture, Washington, D.C. Grant fund support for this research project was provided through the Federal-State Market Improvement Program, AMS. The juices which consumers tested were the new "Ozark Natural" brand and a grape/apple blend, both of which have a bright red color and are relatively transparent in contrast to the opaque appearance of almost all other brands of grape juice. Grapes for the juices were produced in the vineyards of members of the OTGGAI with more than 97 percent of the raw product coming from *Venus*, Arkansas' most widely produced seedless table grape cultivar.

Grocery store customers were asked to taste and make a rating of the flavor and color of the new OTGGAI juices against two nationally established brands of grape juices: (1) a purple (*Concord*) and (2) a red (blend) brand. The 1989

tests were conducted using a "product blind" tasting technique where the customers were given only three digit codes to identify each of the three juices. In the 1990 tests, sugar/acid balance was included along with the sensory evaluation tests of flavor and color for four juices. The "double blind" technique was used for 1990 in that both interviewers administering the tests and the customer tasting the juices knew them only by three digit code identification. The same national brand juices were purchased from supermarket shelves for the test in both years. The evaluation periods for each location were set on Thursday, Friday, and Saturday so as to get exposure to as large a sample of supermarket shoppers as possible within a short period.

Interviewers for the 1989 test were recruited from (1) the OTGGAI membership and (2) the Arkansas Agricultural Experiment Station personnel associated with the project. In 1990, the double blind technique required that interviewers be especially hired and trained from separate groups of personnel who were not familiar with the juice development project. In both the 1989 and 1990 evaluation tests, respondents were asked to taste and rank the flavor and color of the juices using a nine point hedonic or "pleasantness" rating

scale. The numerical values assigned for the flavor and color ratings were: like extremely (9), like very much (8), like moderately (7), like slightly (6), neither like nor dislike (5), dislike slightly (4), dislike moderately (3), dislike very much (2), and dislike extremely (1). The sugar/acid balance rating in the 1990 test was on a seven point scale with assigned values ranging from too sweet (7), to just right (4), to not sweet enough (1). To minimize order bias, the sequence of tasting and viewing was re-randomized by balanced procedures after each respondent sampled the juices.

Display of the relative frequency distributions of the preference ratings illustrates the dominance of the *Concord* national brand for both flavor and color in both 1989 and 1990 (Figures 1, 2, 3, and 4). However, in the color ratings for 1990, Ozark Natural 100% (OTGGAI brand) showed a relative improvement over the 1989 version (Figures 2 and 4). Also, in 1990 both the grape/apple blend and the Ozark Natural 100% received higher ratings for color than the red national brand for the like extremely and like very much categories. The sugar/acid balance ratings in 1990 showed there was a peak in preferences for all the grape juices near the "just right" level (Figure 5). Many respondents made comments confirming earlier laboratory and controlled taste tests that the new juice flavors were "crisp and tangy," and possessed marketable qualities.

Statistical analyses were made of the sample means which were calculated using the frequencies of the numerical values assigned to the preference rating categories (Table 1). These tests of mean values for flavor revealed that all the juices were significantly different from one another in both the 1989 and 1990 tests. For example, the LSD of 0.178 for 1990 would indicate that all four juice flavor sample means were significantly different and possessed a range of 1.42. Furthermore, the three juices in 1989 were also significantly different from one another with an LSD of 0.133 and displayed within a 1.21 range. The order of ratings of flavor preferences were parallel each year as follows: (1) Concord 100 percent grape juice (first choice), (2) red 100 percent grape juice (second choice), followed by (3) the OTGGAI

blend juice (1990 only) and (4) the Ozark Natural 100 percent grape juice.

Changes between years in the rating of preferences for color could be explained by both relative comparisons and improvements in processing development. For example, within a 1.71 range of color rating sample means in 1989, the LSD of 0.131 showed that the three juices were significantly different and in the same order as their flavor ratings. However, the 1990 color sample means had a 2.15 range and an LSD of 0.176, indicating there was no significant difference between the red national brand and the Ozark Natural 100 percent grape juice in the third choice category. The consistent first choice of the *Concord* national brand, in both years, was related to the expressed consumer expectations of a dark purple color or "what grape juice is supposed to look like." However, the 1990 version of the Ozark Natural 100 percent was relatively improved by the product changes between seasons.

Even though there was a clustering near the "just right" category for the sugar/acid balance in the 1990 test, the LSD of 0.145 revealed significant differences between the Ozark Natural 100 percent and the grape/apple blend and the national brands. The sugar/acid balance test could be one of the strongest points indicating a market for OTGGAI grape juices. One encouraging point would be that 4.0 or just right could represent a "perfect" rating and the Ozark Natural 100 percent has a sugar/acid balance which, according to the sample LSD, is not significantly different from this ideal.

Because some respondents failed to give complete ratings for either color, flavor or sweetness, the number of participants varied between tests within each year. Variations observed between test locations in 1989 were minimized so as to be non-significant for all test sites in 1990. In that the sample mean values for color and flavor for the new juices were greater than five (neither like nor dislike), it was judged that favorable ratings outweighed negative responses. Also, market potentials for these new juices should be indicated by the ratings relative to the national brands for flavor, color, and sugar/acid balance.

The statistical tests indicated that flavor preferences between juice varieties tended to be significantly influenced by order of presentation in both years. However, there was no order-variety interaction, and co-variance analysis revealed that the randomization of presentation had balanced any potential order bias. Because this procedure verified the consistency of the data, the flavor, color, and sugar/acid balance preference ratings would be judged as valid estimates.

Marketing potentials should exist for the new Ozark Natural 100 percent and the OTGGAI grape/apple blend juices as long as a supply of raw product (mature grapes) can be supplied to processors at a competitive price. Additional analyses will be made to determine the significance of the family status, age, and other variables recorded in these surveys.

Table 1. Average values of Preference Ratings for Flavor, Color, and Sugar/Acid Balance of Grape Juices in Grocery Store Tests, 1989 and 1990.

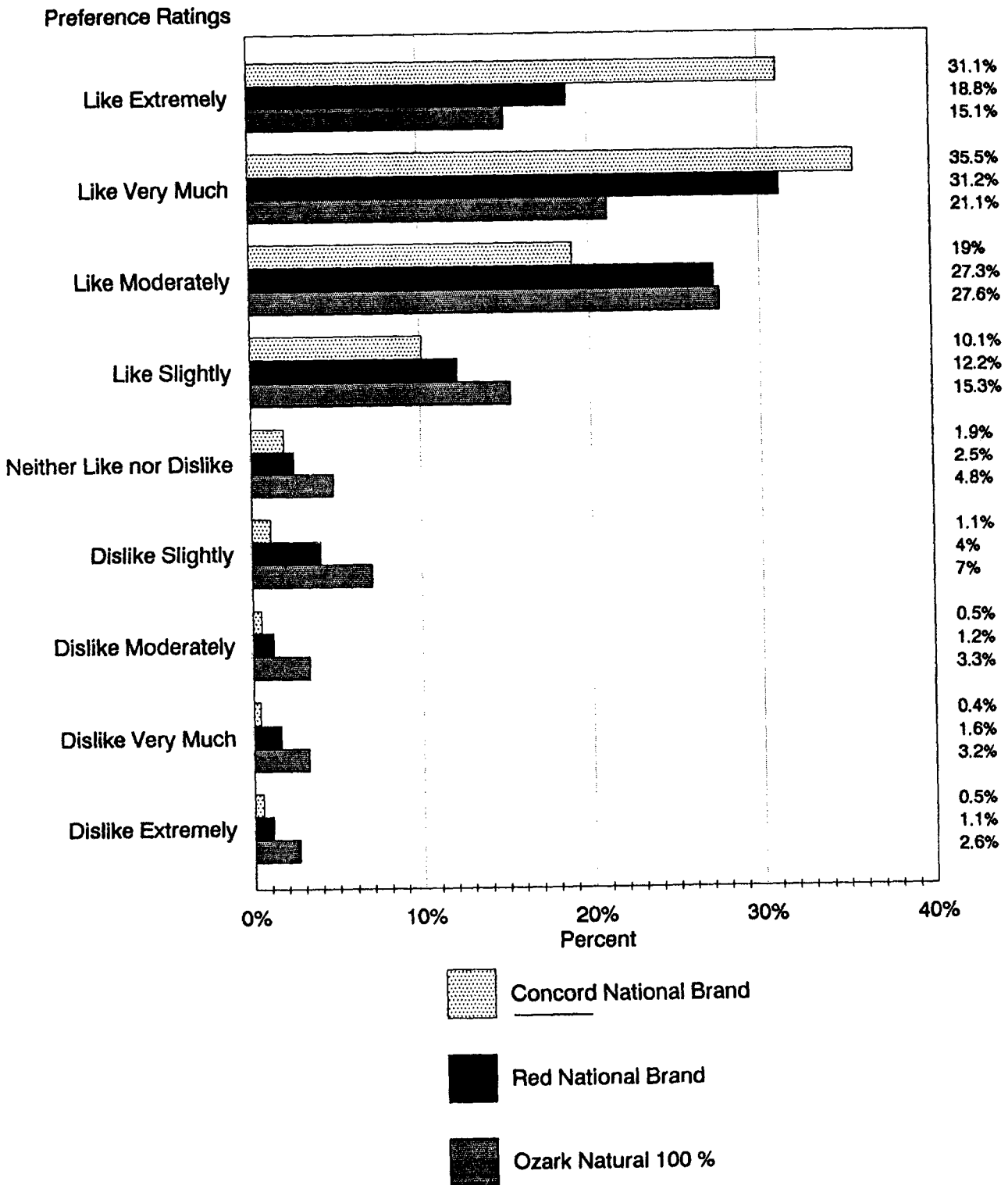
Grape Juices		Years	
		1989 ¹	1990 ²
		----sample means----	
A. Flavor	Concord 100% (National Brand)	7.84	7.31
Preference Ratings	Red 100% (National Brand)	7.27	6.80
	OTGGAI* Blend (60% Grape/40% Apple)	----	6.15
(1 to 9 Scale)	Ozark Natural 100% (OTGGAI* Brand)	6.63	5.89
	[Number of Respondents]	(1230)*	(820)**
		<u>*LSD - 0.133**LSD - 0.178</u>	
B. Color	Concord 100% (National Brand)	8.05	7.95
Preferences	Red 100% (National Brand)	6.86	5.80
Ratings	OTGGAI* Blend (60% Grape/40% Apple)	----	6.36
(1 to 9 Scale)	Ozark Natural 100% (OTGGAI* Brand)	6.34	5.81
	[Number of Respondents]	(1227)*	(819)**
		<u>*LSD - 0.135 **LSD - 0.176</u>	
C. Sugar/Acid	Concord 100% (National Brand)	----	3.85
Balance	Red 100% (National Brand)	----	3.75
Ratings	OTGGAI* Blend (60% Grape/40% Apple)	----	4.25
(1 to 7 Scale)	Ozark Natural 100% (OTGGAI* Brand)	----	4.08
	[Number of Respondents]		(81.8)
		<u>LSD - 0.145</u>	

¹ Tests conducted in one super-market in Searcy and Clinton, AR, Sept. 7-9; and Little Rock and Hot Springs, AR, Sept. 21-23, 1989.

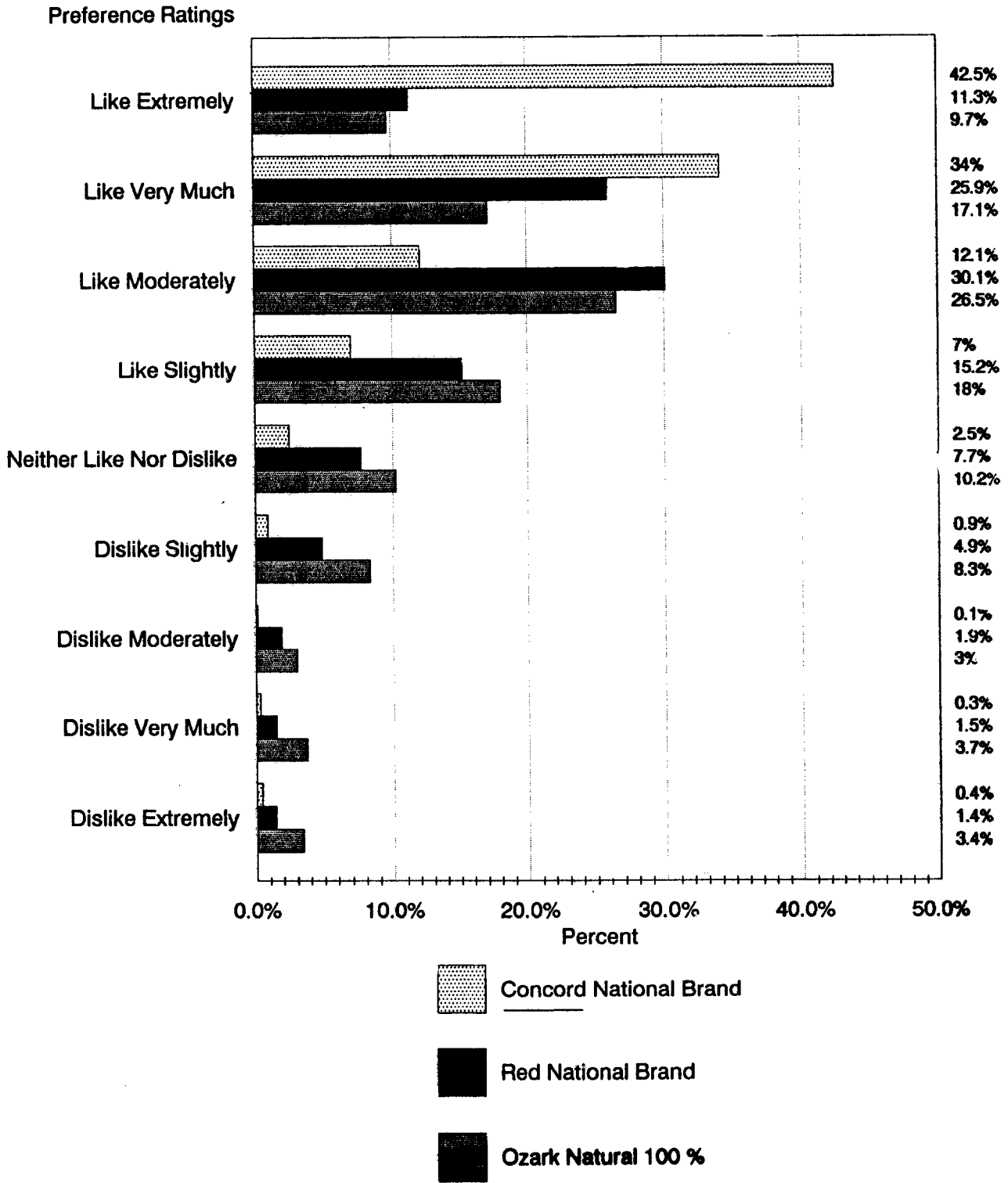
² Tests conducted in three super-markets in Fayetteville, AR, Nov. 10-3, Nov. 8-10, and Nov. 15-17, 1990.

* OTGGAI = Ozark Table Grape Growers Association, Inc.

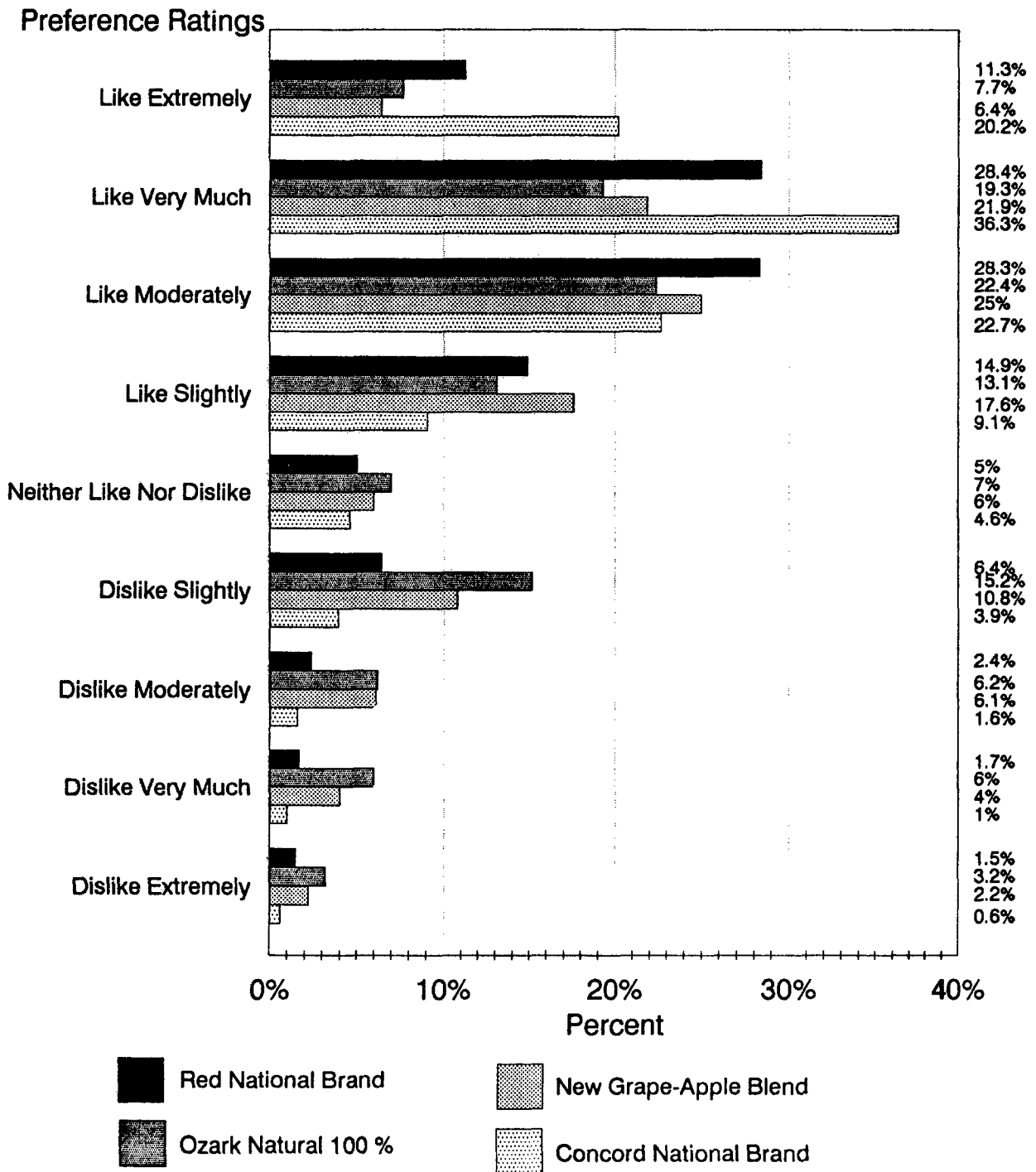
**Figure 1. Percentages of Respondent Ratings of Flavors of Three Grape Juices
1989 Arkansas Grocery Store Customer Panel**



**Figure 2. Percentages of Respondent Ratings of Colors of Three Grape Juices
1989 Arkansas Grocery Store Customer Panel**



**Figure 3. Percentages of Respondent Ratings of Flavors of Four Grape Juices
1990 Arkansas Grocery Store Customer Panel**



**Figure 4. Percentages of Respondent Ratings of Colors of Four Grape Juices
1990 Arkansas Grocery Store Customer Panel**

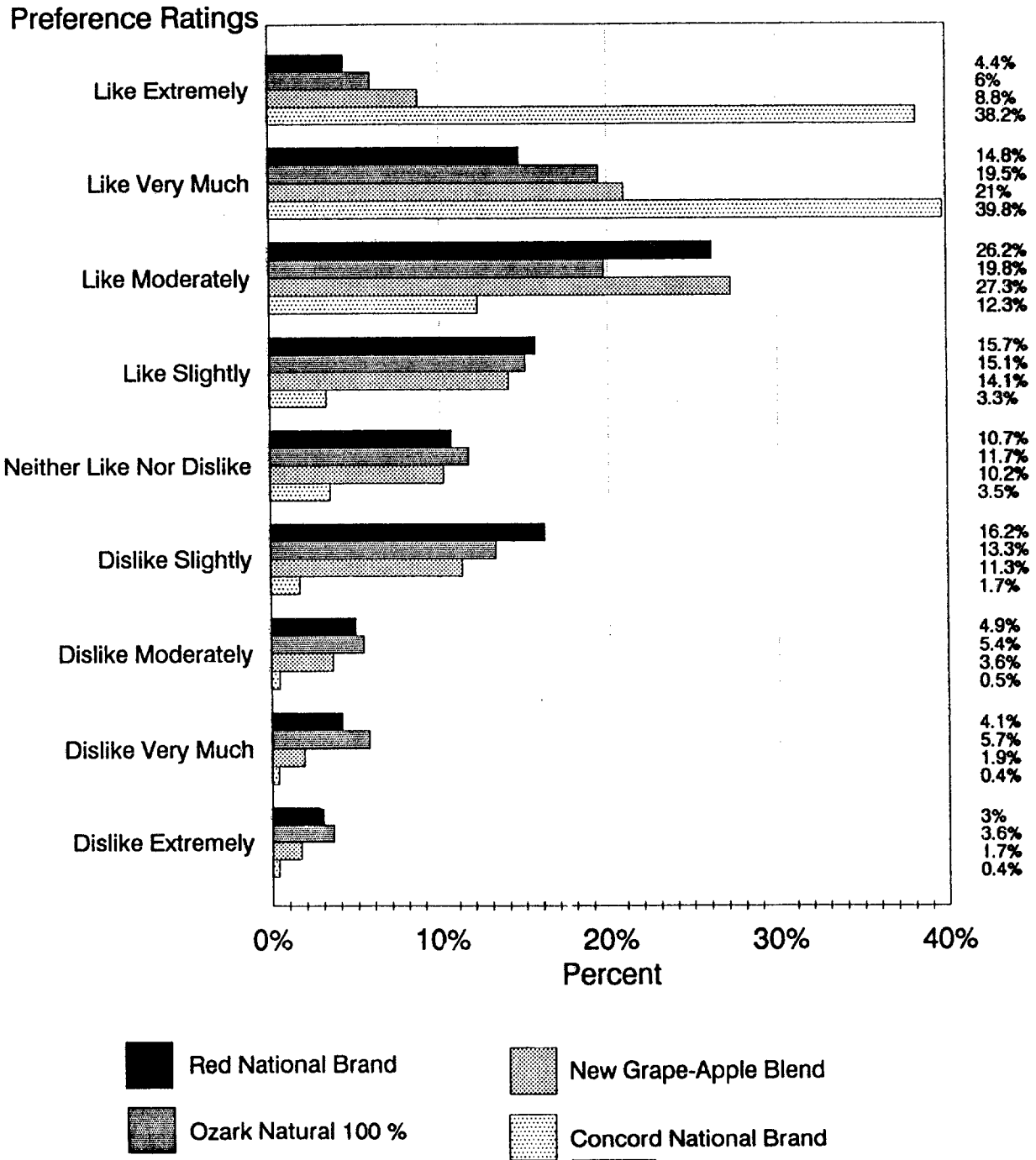


Figure 5. Percentage of Repondent Ratings of Sugar/Acid Balance of Four Grape Juices 1990 Arkansas Grocery Store Customer Panel

Sugar/Acid Balanced Ratings

