

where,

- $A_x$  = activity coefficient of the specific ion,  
 $n$  = charge or valence of the ionic species,  
 $m$  = ionic strength.

The ionic strength,  $m$ , of a solution can be estimated by the following:

$$m = 2.5E-5 * (TDS) \quad \text{Eq. [8]}$$

A limitation to this method of computing the saturation pH is that Eq. [8] is only valid for calculating the activity coefficients for water up to a TDS of 4000 mg/l.

For the temperature range of 0-60°C, equations for the two constants,  $K_2$  and  $K_{sp}$ , and were derived from linear regression based on values given by (Tchbanoglous and Schroeder, 1987).

The equilibrium constant,  $K_2$ , can be estimated by the following equation:

$$K_2 = [2.5E-11 + (8.3E-13*T)] \quad \text{Eq. [9]}$$

where,

$$T = \text{temperature } (^\circ\text{C}).$$

The solubility constant,  $K_{sp}$ , can be estimated by the following equation:

$$K_{sp} = \exp[-18.51 + (T*-0.02711)] \quad \text{Eq. [10]}$$

where,

$$T = \text{temperature } (^\circ\text{C}).$$

A spreadsheet solution is available on diskette by contacting the corresponding author.

#### Literature Cited

Burt, C., K. O'Connor and T. Ruehr. 1994. *Fertigation*. Calif. Polytech. State Univ. San Luis Obispo, CA.

- Cowan, J. C. and D. J. Weintritt. 1976. *Water Formed Scale Deposits*. Gulf Publishing Co. Houston, Texas.
- Dade County. 1995. Metro-Dade Planning Department Report.
- Hills, D.J., F. M. Nawar and P. M. Waller. 1989. Effects of chemical clogging on drip tube irrigation uniformity. *Transactions of the Am. Soc. Agr. Eng.* 32(4):1202-1206.
- Hoek, C. van den, D. G. Mann and H. M. Jahns. 1995. *Algae: An Introduction to Phycology*. Cambridge Univ. Press.
- Hoffmeister, J. E. 1974. *Land from the Sea: The Geologic Story of South Florida*. Univ. of Miami Press. 1974.
- Langelier, W. F. 1936. *Chemical equilibrium in water*. J. Am. Water Works Association. Vol. 38.
- Needham, J. G. and P. R. Needham. 1965. *A Guide to the Study of Fresh-Water Biology*. Fifth Ed., Holden-Day Inc., San Francisco.
- Parchomchuk, P. 1976. Temperature effects on emitter discharge rates. *Transactions of the Am. Soc. Agr. Eng.* 19(4):690-692.
- Pitts, D., K. Peterson, G. Gilbert and R. Fastanue. 1996. Field assessment of irrigation system performance. *Appl. Eng. in Agr.* 12(3):307-313
- Pitts, D., A. Smajstrela and D. Haman. 1990. Causes and prevention of emitter plugging in micro irrigation systems. *Inst. Food Agr. Sci. Bul.* 258. Univ. of Fla.
- Prescott, G. W. 1978. *How to know the freshwater algae*. Third Ed. The Pictured Key Nature Series, Wm. C. Brown Company Publishers, Dubuque, Iowa.
- Round, F. E., R. M. Crawford and D. G. Mann. 1990. *The Diatoms: Biology & Morphology of the Genera*. Cambridge University Press.
- So. Fla. Water Management. Dist. 1995. *District Water Management Plan, Lower East Coast*. Vol. 1. West Palm Beach, FL.
- Schwankl, L. J. and T. L. Prichard. 1990. Clogging on buried drip irrigation systems. *Calif. Agr.* 44(1):16-17
- Tchobanoglous, G. and E. D. Schroeder. 1987. *Water Quality Management*. Addison and Wesley.
- Todd, D. K. 1980. *Groundwater Hydrology*. John Wiley and Sons. N.Y.
- U.S. Dept. Agr. 1996. Dade County F.O., Natural Resources Conservation Service. Dade County, FL.
- Weir, T. E., C. R. Stocking, M. G. Barbour and T. L. Rost. 1982. *Botany: An Introduction to Plant Biology*. John Wiley & Sons, NY.

*Proc. Fla. State Hort. Soc.* 109:242-245. 1996.

## ANALYZING THE SOCIOECONOMIC CHARACTERISTICS AND CONSUMER PERCEPTIONS OF TABLE GRAPES: "FRY" VS "THOMPSON SEEDLESS"

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**Abstract.** The study, though preliminary and confined to Tallahassee, provides useful market information on consumer perception and willingness to purchase muscadine grapes that could be used to gauge the market potential of muscadine grapes as fresh fruit. There is adequate information to suggest that muscadine grapes as fresh fruit is marketable in supermarkets although more shoppers tend to have a favorable perception of Thompson Seedless. The greatest purchase potential for muscadine grapes is in the African American community, particularly among female African Americans who showed the greatest willingness to purchase the grape. African Americans, in general, also have more favorable perceptions of muscadine grapes than caucasian shoppers. The most favorable price of muscadine grapes appears to be around \$1

per pound, under or over-pricing will have an adverse effect on market demand and a grower's net revenue. The study also provides evidence that strongly suggests that the taste of muscadine grapes is an acquired one. Those who are not familiar with it will most likely not like the taste and are unlikely to purchase them. The market for muscadine grape appears to be in a community where consumers are accustomed to the taste of muscadine and are familiar with the fruit, for both African American and caucasian consumers.

The declining market demand for muscadine wines has made the production of muscadine wine grapes uneconomical and commercially unattractive for growers. Recent trends suggest that, while the acreage and production of muscadine wine grape has stagnated or declined, the fresh fruit acreage and production has increased over the last several years. The lack of market demand for muscadine wine grape has encouraged new growers to get into the fresh fruit market. However,

most of the muscadine grapes produced as fresh fruit are sold through pick-your-own outlets. Although it is an important market outlet, the pick-your-own outlet has major requirements for it to be successful. The recent emphasis on fresh fruit production of muscadine grapes has created an urgent need to explore the market potential of alternative outlets for the grapes. Among the available market alternatives, supermarkets provide the most promising outlet for muscadine grapes as fresh fruit. Studies have shown that store managers were willing to purchase and sell muscadine grapes if growers have adequate quantities and are willing to deliver the grapes at regular intervals (Leong, 1989). While this is encouraging news, there were store managers who were not convinced of the fruit's marketability and downgrade its market potential (Degner & Mathis., 1980). Although, we have a mixed signal, there is a consensus among grape growers that shoppers will buy muscadine grapes if it is displayed in the store. In order to acquire a better understanding of consumers' perception and likelihood of purchasing muscadine grapes as fresh fruit in supermarkets, a study was initiated in 1995 to gather market information that could be used to support promotional and advertising activities for muscadine grapes. This paper presents some of the results of this ongoing project.

The objectives of the ongoing study are (1) to determine the consumers' perception of "Fry" as fresh fruit, (2) to determine any significant relationship between the socioeconomic characteristics of consumers and their willingness to purchase "Fry", and (3) to determine the market potential for "Fry" as fresh fruit relative to a nonmuscadine grapes such as "Thompson Seedless" based on consumer perception, preference, and willingness to buy the grapes.

### Materials and Methods

Three Winn Dixie supermarkets in Tallahassee participated in the study. The selected stores were located in the northern, southern and central part of the city where a good cross-section of shoppers could be sampled. A survey questionnaire developed by the University of Arkansas was adapted for this study. Shoppers were randomly selected in the stores and asked if they would be willing to participate in the study. Willing participants were given a muscadine grape, "Fry" or a nonmuscadine grape, "Thompson Seedless" to taste and then asked to answer the survey questionnaire.

Due to the nature of the questions asked, the responses were often categorized as ordinal or nominal data. Under the circumstances, it was necessary to use the chi-square test, a non parametric statistical test, to analyze the data. Statistically, the chi-square is less restrictive than the traditional t and F tests, makes no assumption of the normality of the sampling distribution of the data and can be used to analyze small and discreet data sets (Siegel, 1956). In this study, the chi-square was used to determine if there was any significant relationship between the variables of interest in the contingency table. This was done by comparing the expected frequencies and the observed frequencies for the respective comparisons. If the postulated null hypothesis is true, then there is no significant difference between the expected frequencies and the observed frequencies as shown by the chi-square statistic.

$$\chi^2 = \sum_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where  $O_{ij}$  = observed value, and  
 $E_{ij}$  = expected value.

Conversely, if the null hypothesis is rejected, then the variables are said to exhibit some form of statistical relationship between them.

*Sample size.* The number of shoppers to be randomly selected for the study was based on the city of Tallahassee's population of 137,057 (Florida Statistical Abstract, 1996) with a 90% confidence level and 5% margin of allowable error as shown below (McCall, 1982, p. 194).

$$n = \pi(1 - \pi) / ([\epsilon^2 / Z^2] + \pi(1 - \pi) / N)$$

where  $n$  = the estimated number of shoppers to be interviewed,

$\pi$  = the preliminary estimate of the proportion in the population that favors muscadine (a previous study indicated it to be 0.5),

$Z$  = is the two-tailed value of the standardized normal deviate associated with the desired level of confidence.

$\epsilon$  = is the acceptable error, or half of the maximum acceptable confidence interval, and

$N$  = number of individuals (population) in Tallahassee.

The total number of shoppers who participated in the study in 1995 was 543. Three hundred and fifty-three shoppers tasted Fry. The number of shoppers who tasted Thompson Seedless was 190 or 30% short of the desired number of 270. Because of the lack of sample size for Thompson Seedless, this data will be used only for making relative comparison with no statistical inference. Statistical analysis was applied only to the Fry data.

Table 1. Selected characteristics of shoppers who tasted "Fry" and "Thompson Seedless" in the survey

	Fry		TS	
	Number	%	Number	%
<b>Race:</b>				
African American	176	49.86	115	60.53
Caucasian	143	40.51	58	30.53
Hispanic & Others	20	4.79	6	3.16
Unidentified	14	3.50	11	5.78
Total:	353	100.00	190	100.00
<b>Sex:</b>				
Male	122	35.91	73	38.42
Female	231	65.66	117	61.58
Total:	353	100.00	190	100.00
<b>Age group:</b>				
< 25 yrs	115	32.58	77	40.53
25 - 34	76	21.53	38	20.00
35 - 44	77	21.81	27	14.21
45 - 54	45	12.75	21	11.05
> 54	40	11.33	27	14.21
Total:	353	100.00	190	100.00
<b>Household size:</b>				
1 Person	51	14.45	28	14.74
2 Persons	111	31.44	67	35.26
3 Persons	72	20.40	42	22.11
4 Persons	59	16.71	29	15.26
> 4 Persons	60	17.00	24	12.63
Total:	353	100.00	190	100.00

Table 2. Shoppers with favorable perceptions of "Fry" and "Thompson Seedless", by race and gender.

	Color		Taste		Texture	
	Fry	TS	Fry	TS	Fry	TS
----- Percent -----						
African American						
Female	79	74	80	79	77	76
Male	71	80	71	84	71	80
$\chi^2$	0.43		0.54		0.24	
Caucasian						
Female	57	77	76	84	68	77
Male	50	80	68	80	73	85
$\chi^2$	0.46		0.45		0.18	

TS = Thompson Seedless.

### Results and Discussion

Details of respondents surveyed and their socioeconomic characteristics are shown in Table 1. The discussions in the preceding sections will focus on African American and caucasian shoppers as they formed the largest group of consumers in the study. Hispanic and other shoppers have been excluded because of their relatively low number in the survey.

*Shoppers perception.* Consumers perception for Fry and Thompson Seedless were based on their perceptions of color, taste and texture of the grape they tasted. As expected, a larger proportion of shoppers have a favorable perception of Thompson Seedless than Fry (Table 2). The survey found that 57% of caucasian males and 50% of caucasian female shoppers liked the color of Fry compared to 79% and 71% respectively, for African American shoppers. Surprisingly, close to 80% of African American females in the survey liked the color, taste and texture of Fry. This percentage was higher than their counterpart who liked Thompson Seedless. Considering the popularity of Thompson Seedless this result was unexpected. There appeared to be no significant relationship ( $P>0.05$ ) between males and females in their perceptions for color, taste and texture of Fry.

Classifying shoppers into those who have tried the muscadine grape before and those who tried it the first time produced an important finding that substantiates the long held opinion that the muscadine taste is an acquired one (Table 3). For both African American and caucasian shoppers, the percentage of shoppers who have a favorable perception of muscadine grape is substantially higher among those who have tried the fruit before as compared to those who tried it the first time, particularly, for female African Americans.

Table 4. Percent of shoppers who were willing to purchase "Fry" and "Thompson Seedless", by race and gender.

	Fry	TS
----- Percent -----		
African American		
Female	73	74
Male	63	76
$\chi^2$	0.74	
Caucasian		
Female	53	73
Male	54	75
$\chi^2$	0.01	

Table 5. Percent of shoppers who were willing to purchase "Fry" between those who have tried it before and first timers, by race and gender.

	Tried before	First time	$\chi^2$
----- Percent -----			
African American			
Female	85	43	13.78*
Male	75	50	5.00*
Caucasian			
Female	72	43	7.31*
Male	83	45	11.28*
Will purchase:	81	46	9.65*

\*Significant at  $P<0.05$ .

There appeared to be a significant relationship between perception and whether a consumer has tasted muscadine grape before.

*Willingness to purchase.* Shoppers were asked whether they would be willing to purchase the grapes after tasting it. The percentage of shoppers willing to buy Thompson Seedless was higher than those willing to buy Fry (Table 4). Although the percentage difference in willingness to buy Fry and Thompson Seedless for caucasians was substantial, it was relatively small for African Americans. In particular, 73% of female African Americans surveyed were willing to buy Fry compared to 74% who were willing to buy Thompson Seedless. The chi-square analysis showed no significant relationship between gender and willingness to purchase Fry although the study found that those who have tried muscadine grapes before are more likely to purchase them again. In general, there appeared to be a significant relationship between willingness to buy muscadine grapes and whether a consumer has tried muscadine grapes before ( $P<0.05$ ) (Table 5).

Table 3. Shoppers with favorable perceptions of "Fry" between those who have tried it before and first timers, by race and gender.

	Color		Taste		Texture	
	Tried before	First time	Tried before	First time	Tried before	First time
----- Percent -----						
African American						
Female	88	57	6.61*	88	60	5.28*
Male	78	63	1.60	81	58	3.81**
Caucasian						
Female	69	52	2.39	86	71	1.43
Male	75	43	8.68*	83	64	2.46

\* Significant at  $P<0.05$ . \*\* Significant at  $P<0.10$ .

Table 6. Percent of shoppers who were willing to purchase "Fry" and "Thompson Seedless" at selected prices.

Price/lb	Fry	TS
	----- Percent -----	
\$0.79	67	87
\$1.09	66	68
\$1.39	54	66

When the price of grapes was mentioned to the shoppers, 67% of those who tried Fry were willing to buy it at \$0.79 per pound, compared to 87% for Thompson Seedless. At \$1.39 per pound, only 54% of the shoppers indicated they were willing to buy Fry compared to 66% for Thompson Seedless (Table 6). The study found that a \$0.30 increase in price from \$0.79 to \$1.09 per pound resulted in a 19% decline in the number of shoppers who were willing to buy Thompson Seedless compared to a 1% decline for Fry. Conversely, when the price was increased by another \$0.30 from \$1.09 to \$1.39 per pound, only a 2% decline in shoppers was observed for Thompson Seedless compared to 12% for Fry.

The percentage of shoppers willing to purchase Fry and Thompson Seedless by age group and sex also provided use-

ful market information in identifying the most promising group of buyers. For African American females in all age groups, more than 60% of those surveyed were willing to purchase Fry. However, for African American males below the age of 25, less than 50% of them were willing to purchase Fry (Table 7). A similar trend was observed for caucasian males less than 25 years of age where only 33% of them were willing to purchase Fry. Caucasian females between the ages of 25-34 years and 45-54 years showed more than 50% purchase potential while African American females above the age of 25 showed an encouraging 70% purchase potential.

#### Literature Cited

- Degner, L. R. and K. Mathis. 1980. Consumer Acceptance of Muscadine Grapes. Proc. Fla. St. Hort. Soc. 93:140-143. Florida Statistical Abstract 1996. The University Press of Florida, Gainesville, 1996.
- Leong, S. 1989. Sources, Pricing Policies and Likelihood of Sale of Muscadine Grapes in Supermarkets in Florida. Proc. Fla. State Hort. Soc. 102:214-217.
- McCall, C. H. 1982. Sampling and Statistics Handbook for Research. Iowa State University Press, Ames, Iowa, 1982.
- Siegel, S. 1956. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw Hill Book Co., 1956.

Table 7. Percent of shoppers who were willing to purchase "Fry" and "Thompson Seedless" by race, age group and gender.

Race	Age	Female		Male	
		Fry	TS	Fry	TS
		----- Percent -----			
African American	< 25 yrs	60	70	47	80
	25 - 34 yrs	86	75	67	63
	35 - 44 yrs	76	75	80	67
	45 - 54 yrs	71	83	64	75
	> 54 yrs	88	100	100	100
Caucasian	< 25 yrs	41	83	33	80
	25 - 34 yrs	68	80	57	33
	35 - 44 yrs	48	64	82	100
	45 - 54 yrs	75	80	60	—
	> 54 yrs	25	50	—	100