Sensory Comparison of Runner Peanut Market Grades from Selected Varieties[1]

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ABSTRACT

Peanut processors have often inquired about the sensory quality difference between market grades. A literature search indicates that information on this subject is not directly available nor uniformly presented. Where statistical tests were applied, larger size grades of peanuts generally were measurably superior in flavor to those of the smallest size grade (Jumbo Runner or virginia extra large kernels and medium versus No.1). However, in none of the cited studies did panelists make paired comparisons of different grades of peanuts to determine whether the difference in flavor was discernable. In this study, a triangle comparison testing was used to determine if trained panelists could discern a flavor difference between adjacent grades of runner peanuts and the sensory attributes that might contribute to discernment. Discernment was attained in four out of 10 combinations: Jumbo Runner versus medium kernels of Florida MDR 98 and all three comparisons of medium versus No. 1. When the flavor data were pooled across combinations, panelists were able to correctly discern the difference between Jumbo Runner and Medium kernels 49% of the time ($P < 0.05$) and between medium and No. 1 kernels 90% of the time ($P < 0.01$). The adjusted mean sensory scores were significantly different among the three grades for fruity and sweet attributes but not for roasted peanut or bitter due to the presence of interaction between kernel size and genotype. The flavor intensity range between medium and No. 1 kernels for fruity and sweet was greater than 0.5 units. This difference is probably the reason why panelists were able to correctly discern between them 90% of the time. The basis for this discernment between Jumbo Runner and medium kernels appeared to be differences in bitterness, but the direction of the difference was not consistent across genotypes.

Key Words: *Arachis hypogaea*, Jumbo Runner, medium, No. 1, sensory attributes.

Peanut processors often have inquired about the sensory quality difference between market grades. A search of the literature indicates that information on this subject is not directly available nor uniformly presented. A summary of the flavor data gleaned from the literature (Table 1) shows that the roasted peanut and fruity attributes improve monotonically as grade size increases. When statistical tests were applied, larger size grades of peanuts generally were measurably superior to those of the smallest grade (Jumbo Runner or virginia extra large kernels and medium versus No.1). In previous work, it has been asserted that a flavor intensity difference of 0.5 units is necessary to be detectable by trained sensory panelists (Pattee *et al.*, 1993). However, in none of the cited studies did panelists directly compare different grades of peanuts to determine whether the difference in flavor was discernable. It was the objective of this study to ascertain whether trained panelists could discern a flavor difference between adjacent grades of runner peanuts and to determine the sensory attributes that contribute to discernment.

Materials and Methods

Genotype Resources. Genotypes C-99R (UF94320) (Gorbet and Shokes, 2000b), UF97318, and Florunner were grown in Marianna, FL and Lewiston, NC as a part of the 1998 Uniform Peanut Performance Test (UPPT) (Branch, 1999). Florida MDR 98 (Gorbet and Shokes, 2000a) was grown at Marianna, FL in 1998 in the same field as the UPPT but as part of another variety test. Plants were grown and harvested under standard recommended procedures for the specific location.

Sample Handling. Seed samples were shelled and screened into No. 1, medium, and Jumbo Runner market grade lots. The samples from both locations were shelled and screened concurrently at Raleigh, NC and then placed in controlled storage at 5 C and 60% RH until roasted.

Sample Roasting and Preparation. The samples were roasted in May 1999 using a Blue M "Power-O-Matic 60" laboratory oven, ground into a paste, and stored in glass jars at -20 C until evaluated. The roasting, grinding, and color measurement protocols were as described by Pattee and Giesbrecht (1990).

Sensory Evaluation. A seven-member trained roasted peanut profile panel at the Food Science Dept., North Carolina State Univ., Raleigh, NC, was used to evaluate all roasted peanut-paste samples. A triangle difference test was conducted within each genotype for each grade size and location. An incomplete block experimental design was used for order of testing. Two triangle difference tests (Chambers and Wolf, 1996) were conducted at each panel session. For all analyses, two sessions were conducted each week on nonconsecutive days. The same panel descriptively

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Table 1. Sensory attribute scores for graded peanut kernels as reported in published literature.

Market-type	Market grade	Screen size	Attribute[a] Roasted peanut	Fruity	Sweet	Bitter
		cm	fiu			
Large-seeded virginia (Pattee *et al.*, 1982)						
	Extra large	>0.873 – 0.913	7.3 a	------	------	------
	Extra large	>0.794 – 0.833	6.2 ba	------	------	------
	Medium	>0.714 – 0.754	5.6 b	------	------	------
	No. 1	>0.595 – 0.635	2.8 c	------	------	------
Large-seeded virginia[b] (Pattee and Young, 1987)						
	Medium	>0.714 – 0.754	4.2 b	------	------	------
	No. 1	>0.675 – 0.714	2.8 b	------	------	------
	No. 1	>0.635 – 0.675	1.4 b	------	------	------
	No. 1	>0.595 – 0.635	1.4 b	------	------	------
Large-seeded virginia (Pattee *et al.*, 1989)						
	Extra large	>0.952	7.1 a	1.5 a	------	------
	Medium	>0.714 – 0.952	7.1 a	1.5 a	------	------
	No. 1	>0.595 – 0.714	4.9 b	7.5 b	------	------
Runner (Pattee *et al.*, 1990)						
	Jumbo Runner	>0.794	8.8 a	1.2 a	------	------
	Medium	>0.714 – 0.794	8.4 a	1.4 a	------	------
	No. 1	>0.635 – 0.714	6.8 b	2.5 b	------	------
Runner (Sanders *et al.*, 1990)						
	Jumbo Runner	>0.833	6.8 a	1.2 a	3.2 ab	3.3 a
	Medium	>0.714 – 0.833	6.6 a	1.2 a	3.0 b	3.3 a
	No. 1	>0.635 – 0.714	6.3 a	2.4 b	3.5 a	2.9 a
Runner (Pattee *et al.*, 2002)						
	Jumbo Runner	>0.833	3.6 a	1.2 c	2.4 b	3.1 a
	Medium	>0.714 – 0.833	3.3 b	1.4 b	2.5 b	3.1 a
	No. 1	>0.635 – 0.714	3.2 b	1.9 a	2.8 a	3.0 a

[a]All flavor intensity units converted to a 1-14 scale range for uniform comparison. Means in the same column followed by the same letter are not significantly different at $P \leq 0.05$.

[b]Statistical comparisons not published.

evaluated all peanut-paste samples using a 14-point intensity scale. Panel orientation and reference control were as described by Pattee and Giesbrecht (1990) and Pattee *et al.* (1993). Sensory evaluation commenced the first week of June 1999 and continued until all samples were evaluated. The averages of individual panelists' scores on sensory attributes were used in all analyses in this study.

Statistical Analysis. Analysis of the data from the triangle test assumes that panel members could not distinguish between pastes made from different market grades. Under this null hypothesis, there is a one-third probability that an individual will identify the odd member in the set of three correctly. If this is repeated n independent times, the total number of correct identifications will follow the binomial probability distribution. The distribution is evaluated to see if the number of correct observations is sufficiently large to be deemed statistically significant and reject the null hypothesis of no ability to discriminate. Data from the triangle difference test were evaluated using the binomial probability distribution in SAS. Contingency tables were constructed to compare the rates of successful discernment in different germplasm, locations, or grades. PROC GLM in SAS (SAS Inst., 1997) was used to perform the statistical analyses of the sensory attribute data.

Results and Discussion

Because the number of triangle difference tests performed within a specific combination of location and genotype was limited to seven, there was little statistical power within specific combinations. Only when the panelists could successfully discern the difference correctly more than four times out of seven could the result be considered significant. Significant differences were attained in four out of 10 combinations (Table 2)—Jumbo Runner versus medium kernels of Florida MDR 98 grown at Marianna, FL and all three comparisons of medium versus No. 1. Pooling data across combinations provided greater power. Panelists were able to discern correctly the difference between Jumbo Runner and medium kernels 49% of the time ($P < 0.05$) and between medium and No. 1 kernels 90% of the time ($P < 0.01$). Based on contingency tables using the Yates correction, the 49% success rate for the comparison of Jumbo Runner versus medium was independent of genotype ($\chi^2 = 1.34$ with 3 df, $P = 0.720$) and of location ($\chi^2 = 1.06$ with 1 df, $P = 0.302$). Discernment between medium and No. 1 kernels was superior to that between Jumbo Runner and medium (90% success rate, $\chi^2 = 9.00$ with 1 df, P =

Table 2. Results of triangle tests comparing adjacent grades of normal seed.

Germplasm	Location	Grade comparison	Detect difference	Total observations	Success rate	P{X ≥ x}[a]
Florida MDR 98	Marianna, FL	Jumbo Runner vs. Medium	5	7	0.714	.0453
Florunner	Marianna, FL	Jumbo Runner vs. Medium	4	7	0.571	.1733
UF 97318	Marianna, FL	Jumbo Runner vs. Medium	3	7	0.428	.4294
C-99R	Marianna, FL	Jumbo Runner vs. Medium	4	7	0.571	.1733
UF 97318	Marianna, FL	Medium vs. No. 1	5	7	0.714	.0453
Florunner	Lewiston, NC	Jumbo Runner vs. Medium	2	7	0.286	.7366
UF 97318	Lewiston, NC	Jumbo Runner vs. Medium	2	7	0.286	.7366
C-99R	Lewiston, NC	Jumbo Runner vs. Medium	4	7	0.571	.1733
Florunner	Lewiston, NC	Medium vs. No. 1	7	7	1.000	.0005
UF 97318	Lewiston, NC	Medium vs. No. 1	7	7	1.000	.0005
Pooled results:						
Jumbo Runner vs. Medium overall			24	49	0.490	.0167
Medium vs. No. 1 overall			19	21	0.905	.0000
Jumbo Runner vs. Medium for Florida MDR 98			5	7	0.714	.0453
Jumbo Runner vs. Medium for Florunner			6	14	0.429	.3102
Jumbo Runner vs. Medium for UF 97318			5	14	0.286	.7388
Jumbo Runner vs. Medium for C-99R			8	14	0.571	.0576
Jumbo Runner vs. Medium at Marianna, FL			16	28	0.571	.0082
Jumbo Runner vs. Medium at Lewiston, NC			8	21	0.381	.3992
Medium vs. No. 1 at Lewiston, NC			14	14	1.000	.0000

[a]Probability that the observed number of successes or more would be obtained if the true success rate were 1/3.

0.003).

The adjusted mean sensory scores for the three grades (Table 3) indicate that there were statistically significant differences among them for fruity and sweet attributes but not for roasted peanut or bitter. However, roasted peanut and bitter scores exhibited significant statistical interaction between genotype and kernel size (Table 4). For roasted peanut, the interaction was produced by the high score for No.1 kernels in UF 97318. For bitter, the interaction was produced by the high score for medium kernels in C-99R. In all other genotypes, bitterness increased with increased kernel size. The monotonic changes in flavor quality (higher for roasted peanut and bitter and lower for fruity and sweet) observed as kernel size increased in previous studies (Table 1) were not observed in this study for roasted peanut or bitter averaged across genotypes. The monotonic changes with increasing kernel size were observed for fruity and sweet (Table 3). Moving from No. 1 to medium kernels, the difference in flavor intensity for fruity and sweet was greater than 0.5 flavor intensity units (fiu), the amount required for a difference in a single attribute to be detectable by a trained sensory panelist. The large difference in fruity and sweet between medium and No. 1 kernels is probably the reason why panelists were able to discern correctly between them 90% of the time. Within Florunner and UF 97318, the two genotypes in which the comparison could be made, bitterness was sufficiently different between medium and No. 1 kernels to provide a basis for discernment in the triangle test. The unusually high roasted peanut score for No. 1 kernels of UF 97318 may have provided additional basis for discernment between medium and No. 1 kernels in that genotype.

Table 3. Adjusted main-effect means and standard errors for and sensory attributes measured on three peanut grades.[a]

Source	Roasted peanut	Fruity	Sweet	Bitter
	----------fiu----------			
Jumbo Runner	3.19±0.10	1.24±0.17 b	2.29±0.13 b	2.94±0.11
Medium	3.06±0.10	1.38±0.17 b	2.53±0.13 b	2.99±0.11
No. 1	3.18±0.17	2.56±0.28 a	3.12±0.21 a	2.94±0.18

[a]Means followed by no letters are not significantly different by F-test at P ≤ 0.05. Means followed by the same letter are not significantly different by protected t-test at P ≤ 0.05.

There were no significant differences between Jumbo Runner and medium kernels averaged across genotypes for any attribute, yet panelists were able to discern between them correctly 49% of the time, significantly more than expected by random chance. Examination of the sensory attribute scores for grades within genotypes (Table 4) shows several significant differences between Jumbo Runner and medium kernels for the bitter attribute. The direction of the difference in bitter was not consistent across genotypes, but the panelists were able to separate Jumbo Runner from medium kernels on the basis of bitterness in three out of four genotypes. The magnitude of the difference was close to 0.5 fiu in each of the three genotypes. In spite of the apparent detectable difference in bitterness, it may be that the panel-

Table 4. Adjusted two-way means and standard errors for sensory attributes measured on three peanut grades in four genotypes.[a]

Genotype	Source	Roasted peanut	Fruity	Sweet	Bitter
		fiu			
Florida MDR 98	Jumbo Runner	3.02±0.11 bcd	1.12±0.54 ab	2.09±0.39 ab	3.51±0.12 a
	Medium	2.88±0.10 cd	1.82±0.54 ab	2.79±0.39 ab	2.94±0.09 bc
	No. 1	---[b]	---	---	---
Florunner	Jumbo Runner	3.29±0.07 b	1.25±0.37 b	2.47±0.26 ab	3.29±0.09 ab
	Medium	3.16±0.07 bc	1.13±0.37 b	2.76±0.26 ab	2.83±0.08 c
	No. 1	3.11±0.12 bcd	2.28±0.54 ab	3.41±0.39 a	2.15±0.11 d
C-99R	Jumbo Runner	3.18±0.07 bc	1.26±0.37 b	2.26±0.26 b	3.03±0.06 bc
	Medium	3.21±0.07 b	1.26±0.37 b	2.18±0.26 b	3.50±0.07 a
	No. 1	---	---	---	---
UF 97318	Jumbo Runner	2.94±0.07 cd	1.19±0.37 b	2.24±0.26 b	2.97±0.07 bc
	Medium	2.85±0.07 d	1.46±0.37 ab	2.50±0.26 ab	2.78±0.06 c
	No. 1	3.73±0.11 a	2.66±0.37 a	3.03±0.26 ab	2.33±0.10 d

[a]Means followed by the same letter are not significantly different by protected t-test at $P \leq 0.05$.

[b]Insufficient number of seeds available for sensory evaluation.

ists' ability to correctly discern between Jumbo Runner and medium kernels is the result of an accumulation of differences in several sensory attributes. A similar result was found in comparisons between normal seeds and seeds with the reddened testa characteristic of infection with tomato spotted wilt virus (Pattee *et al.*, 2002).

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