Comparative Quality of Florunner and Spanish Peanut Cultivars in Texas[1]

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ABSTRACT

Starr (St), Spancross (Sp), Goldin I (GI) and Florunner (Fl) peanuts were grown at Pearsall (latitude 28° 53' N) and Stephenville (latitude 32° 12' N), Texas, with the planting dates adjusted within locations to provide similar environments during pod maturation. Two harvests were made per location with the first harvest approximately 128 days after planting for St and Sp, and 150 days for Fl and GI, and the second harvest 143 and 165 days after the respective plantings. Yields averaged: Fl 4,869, GI 4,638, St 4,500, and Sp 4,042 kg/ha. Quality factors including oleic/linoleic acid ratios, oil and protein contents and free fatty acid and peroxide numbers were affected slightly by growing period and location.

Peanut butters representing cultivars, locations, and harvests were prepared and evaluated by semitrained flavor panels prior to and at 40-day intervals during accelerated storage tests at 38°C. Statistically significant differences ($p = 0.0001$) were found between locations, cultivars and storage periods. Preferences for freshly prepared (0-day storage) peanut butters were St > Fl = GI > Sp. After 6 weeks or more storage the flavor and acceptance ratings of Fl and St were equivalent and much higher than for Sp and GI. Peanut butters from Stephenville-grown cultivars scored higher than Pearsall. Late harvest peanut butters were preferred, $p = 0.05$. Results indicate Florunner is adapted for production in southern portions of the Southwest peanut area, and the qualities of Florunner peanuts and peanut butter compare favor ably with traditional Spanish peanut cultivars.

Keywords: **Arachis hypogaea,** peanut butter stability, peanut quality, organoleptic comparisons, runner and Spanish genotypes.

The Florunner peanut cultivar was released by the Florida Agricultural Experiment Station in 1969 (Norden *et al.*, 1969). Reports of excellent yields and producer acceptance of Florunner in the southeastern U.S. followed its release. Within two years it had largely replaced the older runner-type cultivar, Early Runner, and by 1974 it accounted for more than 80% of the peanut acreage in the southeastern growing area (National Research Council Committee on Genetic Vulnerability of Major Crops, 1972; Anonymous, 1975).

The high yields of Florunner in comparison to Spanish cultivars (Anonymous, 1971) stimulated interest in the potential of Florunner for the southwest peanut growing region. Yield comparisons were initiated in Texas and Oklahoma, but before substantive data could be acquired, small seed lots of Florunner began to infiltrate into the southwestern growing area, which had formerly been devoted entirely to Spanish cultivars. By 1975 Florunner accounted for approximately 27% of the peanut production in Texas (USDA, 1975). The introduction of the cultivar into Texas has stimulated many questions regarding the adaptation and quality of southwestern-grown Florunner peanuts and their peanut products.

This paper compares the market and peanut butter qualities of Florunner and three commercially grown peanut cultivars, Starr, Spancross and Goldin I, harvested at two dates at each of two Texas growing locations. Planting dates were selected within locations to allow pod maturation and harvesting of the varieties at similar times. Peanut quality was evaluated on the basis of yield and farmer's stock grading results. Peanut butter quality was assessed on the basis of flavor and shelf-life.

Materials and Methods

The three cultivars chosen for comparison with Florunner are of diverse genetic backgrounds and represent the major Spanish cultivars grown in the Southwest. Starr and Spancross are of typical Spanish botanical-type. Goldin I, marketed as a Spanish cultivar, has large seeds and is intermediate in appearance between the more typical Spanish and Virginia botanical-types. Florunner is a composite of selections from a Spanish and Virginia cross (Norden **et al.,** 1969) and is marketed as a runner peanut. Florunner and Goldin I require 10 to 20 days longer to mature than the smaller-seeded Spanish varieties.

The four cultivars were grown at Pearsall (latitude 28° 53' N) and Stephenville (latitude 32° 12' N), Texas, with supplemental irrigation in 1972. Each cultivar was replicated 4 times in 4-row plots with the rows spaced one meter apart. Planting dates were adjusted by cultivars within locations to permit pod maturation under similar environments. Samples of all cultivars were dug at each of two dates (I, early; II, late) at each location. Planting dates and length of growing periods are shown in Table 1.

Tables 1. Planting and Harvest Dates and Length of Growing Periods.

Location	Cultivars[1]	Planting Date	Harvest I Date	Days	Harvest II Date	Days
Pearsall	GI,Fl,	3-29	8-29	153	9-8	163
	St, Sp	4-19		132		142
Stephenville	GI, Fl,	6-1	10-24	146	11-13	166
	St, Sp	6-22		125		145

[1] GI = Goldin I, Fl = Florunner, St = Starr, Sp = Spancross.

Peanuts harvested from center rows were mechanically dried and retained in storage at ambient conditions until shelled. Samples were shelled with a laboratory sheller and were graded for sound mature (SMK), damaged (DK), and other kernels (OK) following the standard inspection

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procedures of the Consumer and Marketing Service (USDA, 1972), with the exception that no examination was made for concealed damage. Visibly damaged, immature, and off-color nuts were removed by hand, and the remaining sound mature kernels were stored in sealed glass containers at 4°C.

Replicates were pooled by cultivar for chemical analysis and preparation of peanut butter. Oil samples were obtained by cold-pressing the nuts in polyethylene bags as described previously (Brown **et al.**, 1974) or by decanting the resulting oil layer after centrifugation of peanut butters. Oven keeping times (60°C), and oleic/linoleic (O/L) ratios were determined as described by Brown **et al.** (1975). Peroxide and free atty acid numbers, oil and protein contents, and the extent of aflatoxin contamination were determined by standard methods (AOAC, 1970).

Criteria for comparing qualities of the four cultivars for use in roasted peanut product manufacturing were the flavor and shelf-life of peanut butters. Peanuts were roasted in a forced-draft oven modified to contain a stainless steel rotisserie. The oven was preheated to 170°C, charged with 2 to 3 kg of SMK nuts and heated until the nuts reached 155°C. After roasting, the peanuts were cooled in air and blanched mechanically.

Peanut butter was prepared as follows. The nuts were ground to a smooth consistency in a peanut butter mill, and 5% dextrose, 1.5% hydrogenated cottonseed oil and 1.25% salt by weight were added. The ingredients were homogeneously mixed for 15 minutes in a hot water (85°C) jacketed vessel. The peanut butter was then transferred hot to 4 oz. jars which were filled to 3 mm of capacity and sealed with unlined plastic lids. Samples were stored at 4°C until testing was begun. Samples were subjected to accelerated storage at 38°C in total darkness in a temperature-controlled curing room.

Samples to be evaluated organoleptically were held for 72 hours at 4°C prior to testing and then evaluated on a 1-9 hedonic scale for flavor (F), aroma (Ar), and acceptance (Ac) by two semitrained panels of 6 members each. Scoring was as follows: 9, like extremely; 7, like slightly; 5, neither like nor dislike; 3, dislike slightly; and 1, dislike extremely. Each panel member was taught to recognize potential peanut butter flavors and tastes, e.g., sweet, salty and rancid, and a consensus rating of a standard peanut butter was agreed upon prior to participation in the evaluation sessions. The commercial standard, rated F = 6, Ar = 6, Ac = 6, was used as an external reference standard at each tasting session. The experimental design was a 4 x 4 quadruple lattice with each panel member evaluating the samples twice in a period of eight days (Cochran and Cox, 1957, plan 10.2).

Flavor and shelf-life of peanut butters were evaluated immediately after preparation and at approximately 40-day intervals during accelerated storage tests. Panel members rated peanut butters for flavor, aroma, overall acceptance and for sweetness, saltiness and rancidity. Shelf-life of peanut butters was considered to be the length of time in accelerated storage required for the rating of a sample to drop to 3 (dislike slightly). The possible concurrent development of rancidity with flavor deterioration also was investigated.

The data from the panels were evaluated statistically by analysis of variance using the computer program designed by Barr and Goodnight (1972). Peanut butter flavor scores were adjusted to compensate for differences in the extent of roast between samples using the technique of general linear regression analysis (Searle, 1971). The degree of roast was estimated visually according to color. Means for shelling data were compared using Duncan's (1955) New Multiple Range Test. Correlation coefficients and chi square analysis were computed by standard methods.

Results and Discussion

YIELDS AND GRADES

Yields and grades for both locations are shown in Table 2. Florunner and Goldin I were the highest yielding cultivars at both locations for both harvests. Combined over location and harvest, the yields of Florunner were significantly higher than Starr and Spancross but not significantly higher than Goldin I. These yield relationships are typical of results from other tests in these areas (Smith *et al.*, 1976), although the differences in yield between Florunner and the small-seed Spanish types are often larger.

Table 2. Yield and Grade Data for Harvest I and II.

Cultivar	Harvest I				Harvest II			
	Pods (Kg/Ha)	SMK %	DK %	OK %	Pods (Kg/Ha)	SMK %	DK %	O
			Pearsall					
Florunner	4973 a[1]	56 b	12.3[2] b	5.6 b	5249 a	60 b	9.7[2] a	4.
Goldin I	4483 ab	56 b	17.0 b	4.1 a	5009 a	52 c	21.8 b	3.
Starr	4257 b	69 a	3.9 a	4.6 a	4777 ab	69 a	4.6 a	4.
Spancross	3578 c	71 a	3.1 a	4.6 a	4247 b	70 a	4.6 a	3.
			Stephenville					
Florunner	4891 a	77 a	1.1 a	3.1 b	4363 a	79 a	1.2 a	1.
Goldin I	4560 ab	76 a	2.4 b	1.4 a	4500 a	75 a	2.9 b	1.
Starr	4489 ab	77 a	0.3 a	2.2 ab	4479 a	78 a	0.5 a	1.
Spancross	4103 b	78 a	0.3 a	2.7 ab	4242 a	76 a	1.3 a	1.

1 Values bordered by the same letter are not different at the 0.05 probability level by Duncan's New Multiple Range Text.

2 High DK values at Pearsall due to heavy infestation of burrowing bugs.

The high DK (damaged kernel) values at Pearsall were due to a heavy infestation of the burrowing bug, *Pangaeus bilineatus*. Greater losses occurred among the large-seed varieties with Goldin I being damaged most. The sound mature kernel (SMK) fractions were correspondingly affected. Since pod maturation was nearly simultaneous among cultivars, the apparent selectivity by the insects is unexplained.

At Stephenville, pod yields were essentially the same at the early and late harvests. SMK averaged 77%, and the DK and OK fractions were relatively low. Higher DK values were recorded for Goldin I than for the other test entries at both locations. The highest yields in the tests were obtained at Pearsall under the late harvest conditions. SMK averaged 63% for both harvests at Pearsall, and DK and OK percentages were relatively high.

RAW QUALITY FACTORS

Protein and oil contents were very similar at both locations and at both harvests. The oil content averaged 50.0 ± 0.5%, and the protein content averaged 31.9 ± 0.75% (6.25 x % nitrogen). Protein and oil values from the first harvests suggest that the peanuts may have been slightly less mature. Analysis of random samples of the sound mature kernels from both locations revealed no aflatoxin contamination.

PEANUT BUTTER FLAVOR STABILITY

After the first 6 weeks of storage at 38°C, the average flavor and acceptance ratings were higher than immediately after preparation of the peanut butters (Figure 1). Longer storage periods resulted in gradual decreases in flavor and acceptance ratings. Initially, the aromas were very strong,

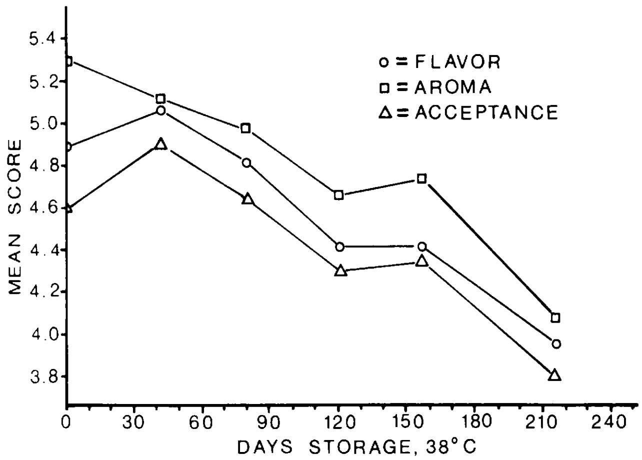

Fig. 1. Effect of 38°C storage on flavor, aroma and acceptance ratings of peanut butters.

but they weakened under accelerated storage, resulting in a continuous decline in the average aroma scores. Sweetness ratings increased as the flavor and aroma deteriorated, probably due to the loss of competing flavor components through oxidation.

Off-flavors and incipient rancidity began to be recorded by some panel members after four weeks' storage. The frequency of rancid off-flavor ratings increased with length of storage period, reaching 17 of 20 taste tests for two samples after seven months of accelerated storage. The frequency of rancid off-flavors was similar among locations, harvests and cultivars. The total number of times that Goldin I received an off-flavor rating was 14 to 25% higher than any of the other varieties, but the differences were not significant at the 5% probability level.

Peroxide numbers (data not shown) of the oils obtained from peanut butters after six months of accelerated storage were less than 4 meg./kg. Willich *et al.* (1954) and Woodroof *et al.* (1949) also observed that peroxide numbers increased very little on ambient storage tests of peanut butters for up to two years. Willich *et al.* (1954) noted that rancidification depends on the availability of oxygen and can only proceed until the supply of oxygen in the container is exhausted. Thus, it is not surprising that loss of shelf-life was not closely related to rancidification and peroxide numbers.

Statistical Analysis of Peanut Butter Storage Tests

Results of the analysis of variance for flavor, aroma and acceptance are recorded in Table 3. Other main effects and potential first and second order interactions were tested, but none were significant at the 0.05 level of probability.

Although standardized roasting conditions were

Table 3. Summary of Analysis of Variance for Flavor, Aroma and Acceptance of Peanut Butters.

Source of Variance	Degrees Freedom	F-Value Flavor	Aroma	Acceptance
Tests	5	27.50****	42.87****	22.64****
Replicates	18	10.69****	10.21****	10.45****
Judges	14	31.51****	38.66****	32.40****
Cultivars	3	9.78****	3.43*	8.88****
Locations	1	16.76****	2.50	9.49**
Harvests	1	4.94*	4.38*	4.58*
Roasts	2	7.85***	9.80***	11.12****
Test X Cultivar	15	1.01	0.34	0.64
Test X Location	5	0.58	1.73	0.43
Test X Harvest	5	2.55*	2.36*	2.73*
Cultivar X Location	3	5.01**	2.08	3.40*
Cultivar X Harvest	3	2.64*	2.81*	4.59**
Total	2059			

* 5% level of significance.

** 1% level of significance.

*** 0.1% level of significance.

**** 0.01% level of significance.

adopted, some batches of peanuts utilized in preparing the peanut butters did not received identical roasts. Preliminary statistical analysis of the data revealed that differences in roast were significant at probability levels of at least 0.01 for aroma, flavor and acceptance, and that the panel members were biased toward the most highly roasted batches. Therefore, correction factors for differences in roast were calculated by linear regression analysis, and the scores were adjusted accordingly. Adjustment to average roast conditions decreased the ratings approximately 0.20 units. All numerical and statistical values reported herein are based on the adjusted data.

The statistical inferences drawn from the analysis of variance (F-values) shown in Table 3 are based on 2059 degrees of freedom. Utilization of such large samples makes this statistical technique an extremely powerful tool for detecting small differences. Differences which can be detected at the commonly accepted levels of significance (5 and 1%) may lack practical significance. Therefore, two additional significance levels (0.1 and 0.01%) have been indicated in the table to aid in interpreting the data.

Effects of Storage Periods, Replicates and Judges

Statistically significant differences, $p < 0.0001$, were recorded between replicates, judges, and storage periods (tests). The changes in flavor, aroma and acceptance during the seven-months' storage at 38°C are readily apparent in Figure 1. As noted previously, panel members showed a preference for peanut butters held in storage at 38°C for six weeks, with the average flavor, aroma and acceptance scores being 5.08, 5.15 and 4.90, respectively. After 218-days storage, the average scores had dropped to approximately 4.0. Differences between replicates were partially due to differences between jars and to utilization of the same replication scheme to evaluate the peanut butters after each storage period. The highly significant differences between judges reflect differences in individual preferences between peanut butter flavors and roasts, as well as differences in the ability of semitrained panel members to discriminate changes in flavor.

EFFECT OF HARVEST DATE

Small but significant differences, $p < 0.05$, were recorded in the flavor, aroma and acceptance scores of peanut butters from the two harvests. Higher scores were received by peanut butters prepared from peanuts which were harvested at the latter harvest date and which had an additional 10 to 20-day growing period. The preference for the late harvest peanut butters was recorded initially and after all periods in storage except 218 days. Mean flavor, aroma and acceptance scores for all varieties over the entire storage test averaged 0.13 units higher for harvest II.

The flavor, aroma and acceptance scores for all varieties except Spancross were higher at the second harvest. These differences were significant at a probability level of 0.01 for acceptance and 0.05 for flavor and aroma. The changes in acceptance scores obtained by harvesting the four varieties at the second date are illustrated in Figure 2. Differences in acceptance and aroma scores were smaller. Starr and Florunner peanut butters were rated highest with a very slight preference for Starr at both harvests. No reason for the drop of 0.2 units in the mean scores given Spancross peanut butters at harvest II was apparent.

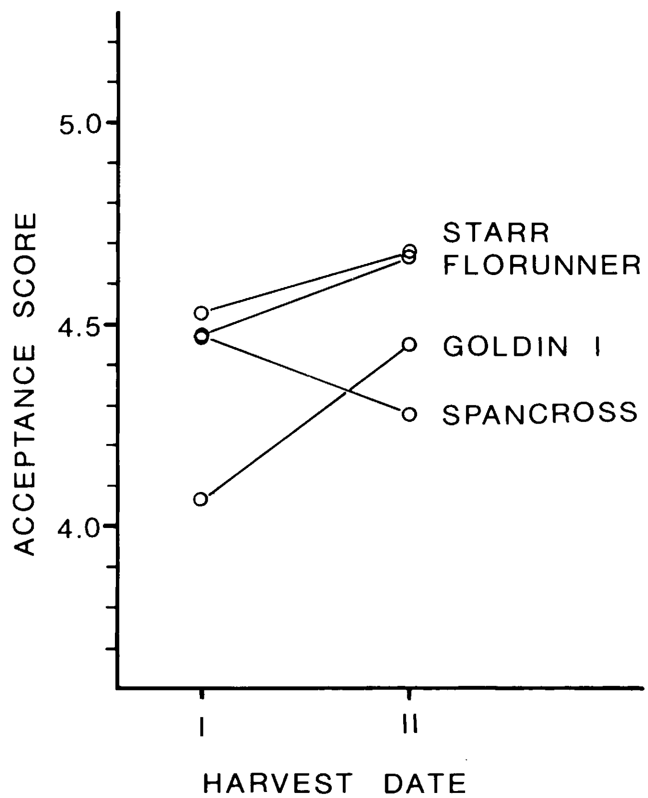

Fig. 2. Mean acceptance scores of peanut butters from early and late harvested peanuts. Starr and Spancross harvested approximately 130 and 145 days after planting. Florunner and Goldin 1 harvested approximately 150 and 165 days after planting.

In earlier work Young (1970) and Pang (1968) also found that peanut butters from later harvest dates were preferred to those from earlier harvested peanuts. These authors suggested that the effect was due to a greater degree of maturation within the later harvested crops. Presumably the chemical composition of mature peanuts is more favorable for the development of good roasted flavor, e.g., amino acid composition (Young *et al.* 1974a) and sugars (Mason *et al.* 1969).

EFFECTS OF LOCATIONS AND VARIETIES

Data illustrating the relationships between cultivars, locations, test X location and cultivar X location for flavor and acceptance are compiled in Table 4. Similar data were collected for the relationships with aroma scores. However, the differences between aroma scores were generally smaller and statistically less significant (Table 3).

Both location and cultivar affected the flavor and acceptance ratings of the peanut butters. The overall mean flavor score of peanut butters from Stephenville was 4.70 or 0.20 units higher than at Pearsall. The preferences for Stephenville peanut butters were recorded initially and after every storage period except 78 days. Butters prepared from Stephenville grown peanuts were preferred over those from Pearsall for all cultivars except Starr.

Peanut butter flavor and acceptance were significantly affected by cultivar $p < 0.0001$, whereas aroma scores were affected much less by cultivar $p < 0.05$. The apparently low sensitivity of aroma scores in differentiating between cultivars in the storage tests is probably due to the rapid loss of aroma noted by the panelists and subsequent lack of strongly aromatic compounds after the first few weeks in storage. The overall flavor and acceptance rankings were similar at Stephenville and Pearsall, although the scores were approximately 0.20 units higher at Stephenville. Mean flavor and aroma rankings of Florunner and Starr over the entire test were nearly identical, being flavor 4.70 and 4.79 and aroma 4.56 and 4.52, respectively. Spancross and Goldin I peanut butters scored approximately 0.30 units lower on the average. It is interesting to note that Starr peanut butters were clearly preferred when the freshly prepared peanut butters were tested, but after the initial six weeks of aging at 38°C there was little difference between Starr and Florunner.

COMPARISON OF RAW PEANUT QUALITY FACTOR. AND PEANUT BUTTER FLAVOR SCORES

Several parameters suggested in the literature for establishing raw peanut quality were determined for the four varieties grown at Sephenville and Pearsall. The results of these determinations

Table 4. Flavor and Acceptance Scores of Peanut Butters after Storage at 38°C.

Cultivar	Flavor[1] 0	43	78	120	155	218	Cultivar Mean	Acceptance[1] 0	43	78	120	155	218	Cultivar Mean
							Stephenville							
Florunner	5.10	5.43	4.75	4.70	4.91	4.53	4.90	4.97	5.33	5.01	4.54	4.61	4.25	4.82
Starr	4.92	5.06	5.07	4.51	4.66	4.31	4.76	4.78	4.95	4.72	4.43	4.66	4.08	4.58
Spancross	4.87	5.10	4.71	4.60	4.41	4.04	4.62	4.47	4.93	5.00	4.32	4.41	3.75	4.50
Goldin I	5.04	5.02	4.48	4.41	4.15	3.86	4.55	4.50	4.80	4.65	4.20	4.15	3.86	4.28
Test Mean	4.98	5.15	4.75	4.55	4.55	4.18	4.70	4.64	5.01	4.86	4.37	4.55	3.94	4.55
							Pearsall							
Florunner	4.63	4.94	4.97	4.39	4.14	3.86	4.49	4.51	4.68	4.47	4.31	4.11	3.75	4.31
Starr	5.37	5.36	4.86	4.64	4.61	4.07	4.82	4.81	5.31	4.81	4.47	4.59	3.96	4.66
Spancross	4.42	5.13	5.04	3.82	4.34	3,81	4.43	4.20	4.95	4.43	3.87	4.23	3.80	4.24
Goldin I	4.67	4.59	4.80	4.27	4.09	3.24	4.28	4.71	4.61	4.42	4.27	4.06	3.33	4.23
Test Mean	4.78	5.00	4.91	4.28	4.29	3.74	4.50	4.56	4.78	4.43	4.23	4.15	3.70	4.34

(Rating after Storage, Days)

[1] Flavor and acceptance scores shown have been statistically adjusted for differences in roast.

Table 5. Relationships Between Quality Factors of Raw Peanuts and Mean Peanut Butter Flavor Scores.

Cultivar	Mean Flavor Score	Oven Keeping Time (Days)	O/L Ratio	Free Fatty Acids %	Peroxide Number
		Pearsall			
Florunner	4.49	9.5	1.64	0.18	0.66
Goldin I	4.28	7.5	1.43	0.18	0.51
Starr	4.82	9.2	1.26	0.10	0.58
Spancross	4,43	9.2	1.34	0.10	0.51
		Stephenville			
Florunner	4.90	13.9	1.42	0.04	2.28
Goldin I	4.55	14.4	1.12	0.05	2.01
Starr	4.76	10.0	1.14	0.04	1.70
Spancross	4.62	10.0	1.16	0.03	1.98
Correlation with Flavor Score and Standard Error of Estimate					
Correlation Coefficient		0.49	-0.30	-0.66	0.55
Standard Error of Estimate		1.96	0.16	0.04	0.61

and the mean flavor scores of the peanut butters prepared from the respective peanuts are compared in Table 5. Oven keeping times for Florunner peanut oils averaged 2 days longer than the Spanish varieties, Starr and Spancross. The oleic/linoleic acid (O/L) ratio was at least 0.2 units higher than in any of the other varieties. Prior to preparing the peanut butters, the free fatty acid contents and peroxide numbers for the raw Florunner peanuts were slightly higher than for the Spanish varieties.

An increased linoleic acid content in peanuts is thought to adversely affect peanut product stability (Young *et al.* 1974b; Worthington *et al.* 1972) and northern grown peanuts usually have higher linoleic acid contents than when the same cultivars are grown in a more southerly location (Brown *et al.* 1975). Thus, it is interesting to note that the peanut butters receiving the highest ratings were grown at the more northerly location. Cultivars with a high oleic/linoleic acid ratio are also reported to yield peanut butters with longer keeping qualities and better flavor (Young *et al.* 1974b). Florunner, which has a high O/L ratio, received high ratings throughout the test, while Goldin I, which also had a relatively high O/L ratio at Pearsall, did not score nearly so well. Maturity, insect damage, environmental conditions and curing and drying conditions are also important production factors which affect roasted flavor.

Included in Table 5 also are the correlation coefficients and standard errors of estimate for each of the raw peanut parameters and the mean flavor scores over both locations. The standard errors of estimate were generally high, and the validity of these four raw quality factors for predicting shelf-life seems questionable. However, results of the tests indicate little difference between the quality of raw Florunner, Starr, and Spancross peanuts grown under common environmental conditions in the Southwest.

Conclusions

Organoleptic ratings of peanut butters are higher after a few weeks storage than immediately after preparation. Rancidification of stabilized peanut butters was not a serious problem in accelerated storage tests equivalent to approximately 2 years of ambient storage. Generally, peanut butters wth high initial flavor, aroma and acceptance ratings maintained their quality longer. The effect of growing location on shelf-life appears to be more closely related to initial organoleptic properties than to other factors.

The quality of mature raw Florunner peanuts compares favorably to the quality of the mature, typically small-seeded Spanish varieties grown in the Southwest. Peanut butter made from Texas grown Florunner peanuts has good flavor properties and keeping qualities. Results of field trials indicate that Florunner, and perhaps Goldin I, offer the potential for increased yields in Texas.

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References

1. Anonymous. 1971. 1971 Field Crops Variety Trials. Ga. Agr. Exp. Sta. Res. Rep. 115. pp. 54-58.
2. Anonymous. 1975. Southeastern Assoc. Elects Davis. Peanut J. and Nut World 53: (10) 8, 18.
3. AOAC. 1970. Official Methods of Analysis of the Association of Official Analytical Chemists. 11th ed. W. Horowitz, ed. Washington, D. C. pp. 445-46.
4. Barr, J. A. and J. H. Goodnight. 1972. A User's Guide to the Statistical Analysis System. Students' Supply Stores. North Carolina State Univ. Raleigh, N. C.
5. Brown, D. F., C. M. Cater and K. F. Mattil. 1974. Effects of Extraction, Cold-pressing and Period of Storage on Oven Stability of Peanut Oils. J. Am. Oil. Chem. Soc. 51: 502-06.
6. Brown, D. F., C. M. Cater, K. F. Mattil and J. G. Darroch. 1975. Effect of Variety, Growing Location and Their Interaction on the Fatty Acid Composition of Peanuts. J. Food Sci. 40: 1055-60.
7. Duncan, D. B. 1955. New Multiple Range and Multiple F Tests. Biometrics 11: 1-42.
8. Mason, M. E., J. A. Newell, B. R. Johnson, P. E. Kohler and G. R. Waller. 1969. Nonvolatile Components of Peanuts. J. Agr. Food Chem. 17: 728-32.
9. National Research Council Committee on Genetic Vulnerability of Major Crops. 1972. Genetic Vulnerability of Major Crops. Nat. Acad. Sci. Washington, D. C. pp. 217-224.
10. Norden, A. J., R. W. Lipscomb and W. A. Carver. 1969. Registration of Florunner Peanuts. Crop. Sci. 9: 850.
11. Pang, L. S. 1968. The Influence of Maturity and Time of Harvesting Spanish Peanuts on Peanut Butter Quality. M. S. Thesis. Okla. State Univ. Stillwater, Okla.
12. Searle, S. R. 1971. "Linear Models." John Wiley and Sons, Inc. New York, N. Y.
13. Smith, O. D., C. E. Simpson, T. E. Boswell, D. H. Smith, Jr., and E. R. Howard, 1975. Comparisons of Florunner with Spanish Peanut Varies in Texas. Texas Agr. Exp. Sta. Progress Report, PR-3378.
14. USDA. 1972. Farmers' Stock Peanut Inspection Instructions. U. S. Dept. Agric., Consumer Marketing Service, Fruit and Vegetable Div. Washington, D. C.
15. USDA. 1975. Peanut Tonnage Report. 1975-1976, Daily and Accumulated Totals by States. Dec. 1975. U. S. Dept. Agric. Marketing Service. Federal State Inspection Service, Albany, Ga.
16. Willich, R. K., N. J. Morris and A. F. Freeman. 1954. Peanut Butter. V. The Effect of Processing and Storage on the Stabilities of Their Oils. Food Tech. 8: 101-04.
17. Woodroof, J. G., H. H. Thompson and S. R. Cecil. 1949. Special Food Industries Report on . . . Peanut Butter. Food Industries 21: 186-91.
18. Worthington, R. E., R. O. Hammons and J. R. Allison. 1972. Varietal Differences and Seasonal Effects on Fatty Acid Composition and Stability of Oil from 82 Genotypes. J. Agr. Food Chem. 20: 727-30.
19. Young, C. T. 1970. Biochemical Studies of Peanut (**Arachis hypogaea** L.) Quality. Ph.D. Dissertation. Okla. State Univ., Stillwater, Okla.
20. Young, C. T., G. R. Waller, R. S. Matlock, R. D. Morrison and R. O. Hammons. 1974a. Some Environmental Factors Affecting Free Amino Acid Composition in Six Varieties of Peanuts. J. Am. Oil Chem. Soc. 51: 265-68.
21. Young, C. T., R. E. Worthington, R. O. Hammons, R. S. Matlock, G. R. Waller and R. D. Morrison. 1974b. Fatty Acid Composition of Spanish Peanut Oils as Influenced by Planting Location, Soil Moisture Conditions, Variety and Season. J. Am. Oil Chem. Soc. 51: 312-15.