Fatty Acid Variation Among U.S. Runner-Type Peanut Cultivars

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Fatty acid composition was determined among seven U.S. runner-type peanut (*Arachis hypogaea* L.) cultivars: Florunner, Sunrunner, GK-7, Southern Runner, Sunbelt Runner, Okrun, and Langley. Significant year and cultivar differences were found within these fatty acid profiles. Southern Runner had the best oleic to linoleic ratio and iodine values; whereas Florunner, Sunrunner, and Langley were the highest in unsaturated and lowest in saturated and long-chain fatty acids. For the future, breeding programs need to continue developing peanut cultivars with improved oil quality.

KEY WORDS: *Arachis hypogaea* L., breeding programs, iodine values, oil quality, O/L ratios.

Peanut (*Arachis hypogaea* L.) seed is an important oil crop throughout the world, even in the United States where peanut butter is the main product of consumption (1). Traditionally in the U.S., runner market types have been predominantly utilized for the peanut butter trade, and oil composition likewise plays an important role in the manufacturing of this end-use product.

Since its release in 1969 (2), Florunner has become the most popular runner-type peanut cultivar in the U.S. In 1988, Florunner accounted for over 50% of the total production area (3). Most recently, other cultivars have been released from several peanut breeding programs for this same runner market.

Sunbelt Runner was cooperatively released by the U.S. Department of Agriculture (USDA) and the Georgia Agricultural Experiment Stations in 1982 (4). In 1982, the Florida Agricultural Experiment Station released Sunrunner (5), and released yet another runner-type cultivar Southern Runner in 1984 (6). GK-7 was developed and privately released by AgraTech Seeds, Inc. Langley from Texas (7) and Okrun from Oklahoma in cooperation with USDA (8) were both released in 1986, respectively.

Supposedly, each cultivar should be comparable to or better than Florunner in its oil stability and quality characteristics, however the relative comparison of all of these was not known. Thus, the objective of this study was to determine the fatty acid variation among these current U.S. runner-type peanut cultivars when evaluated together.

MATERIALS AND METHODS

The fatty acid composition of these seven U.S. runner-type peanut cultivars (Florunner, Sunrunner, GK-7, Southern Runner, Sunbelt Runner, Okrun, and Langley) was determined from the 1986, 1987, and 1988 crop years at the Coastal Plain Experiment Station, Tifton, Georgia. Standard cultural practices were used throughout each growing season to ensure good production quality, and cultivars were individually harvested according to visual maturity estimations.

After drying the peanuts to approximately 5% moisture content and shelling them, a 25 g sample of sound mature seed (SMK) was taken from each of three replications. Samples were ground using a Mouli food grater, and then a 100-mg subsample was used for fatty acid methyl ester preparation. These subsamples were treated with 2 mL of 3 methanol:1 benzene reaction solution containing 3% H_2SO_4, and transesterified in a 90°C water bath for 2 hr. After cooling the mixture, 1 mL petroleum ether (Skelly F) was added, and it was shaken. Two mL of distilled water was added to effect phase separation. The petroleum ether-benzene layer was removed and filtered through anhydrous sodium

TABLE 1

Three-Year Average Percentage of Fatty Acid Methyl Esters from Seven U.S. Runner-Type Peanut Cultivars, 1986–88

Peanut cultivars	Fatty acid profile (%)*							
	C16:0	C18:0	C18:1	C18:2	C20:0	C20:1	C22:0	C24:0
Florunner	10.3b	1.5cd	51.7c	29.8bc	1.1bc	1.3a	2.7bc	1.7bc
Sunrunner	10.3b	1.4d	51.1c	30.4ab	1.0c	1.3a	2.7bc	1.5c
GK-7	10.9a	1.5cd	49.6d	30.5a	1.1bc	1.4a	3.1a	1.7abc
Southern Runner	10.3b	1.9a	56.3a	24.1e	1.2b	1.3a	2.9abc	1.9a
Sunbelt Runner	10.8a	1.9a	49.2d	30.6a	1.4a	1.3a	3.0ab	1.8ab
Okrun	10.7a	1.6c	51.2c	29.6c	1.1bc	1.3a	3.0ab	1.6bc
Langley	10.2b	1.7b	55.3b	26.1d	1.1bc	1.3a	2.6c	1.5c
Mean	10.5	1.6	52.0	28.7	1.2	1.3	2.8	1.7

*Percentages within each column followed by the same letter do not differ significantly at P = 0.05.

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TABLE 2

Three-Year Average Oleic to Linoleic Fatty Acid Ratios and Iodine Values from Seven U.S. Runner-Type Peanut Cultivars, 1986–88

Peanut cultivar	Oleic/linoleic ratio	Iodine value*
Florunner	1.7c	96.3ab
Sunrunner	1.7cd	97.0a
GK-7	1.6d	95.9bc
Southern Runner	2.3a	90.5e
Sunbelt Runner	1.6d	95.6c
Okrun	1.7c	95.6bc
Langley	2.1b	93.1d
Mean	1.8	94.9

*Percentages within each column followed by the same letter do not differ significantly at P = 0.05.

TABLE 3

Three-Year Average Fatty Acid Composite Percentages from Seven U.S. Runner-Type Peanut Cultivars, 1986–88

Peanut cultivar	Fatty acid composites (%)*		
	Saturated	Unsaturated	Long-chain
Florunner	12.9c	82.7a	5.2c
Sunrunner	12.8c	82.9a	5.2c
GK-7	13.6b	81.5cd	6.0ab
Southern Runner	13.4b	81.7bc	6.1ab
Sunbelt Runner	14.1a	81.0d	6.2a
Okrun	13.3b	82.1b	5.6bc
Langley	12.9c	82.7a	5.2c
Mean	13.3	82.1	5.7

*Percentages within each column followed by the same letter do not differ significantly at P = 0.05.

sulfate. The solvent was evaporated under a stream of nitrogen.

Methyl esters were analyzed on a Micro Tek 220 gas chromatograph equipped with dual-flame ionization detectors and a Hewlett-Packard 3390A Electronic Integrator. A 1.85 m × 4 mm I.D. glass column packed with 10% Siler 7 Cp on 80/100 mesh chromosorb W (AW) (DMCS) was used. Separation was performed isothermally at 215°C with injection and detector port temperatures at 275 and 300°C, respectively, and a helium flow rate of 100 mL/min. A standard fatty acid methyl ester mixture was run in order to use retention times in identifying sample peaks. Fatty acid levels were determined by digital integration and reported as a relative proportion of the total composition.

Data from each year were analyzed by analysis of variance, and then combined across years. T-test (least significant differences) was used for statistical mean separations.

RESULTS AND DISCUSSION

Significant differences were found within the fatty acid profile among seven U.S. runner-type peanut cultivars, except for C20:1 (Table 1). Percentage means were all within the ranges recently reported by Norden *et al.* (9), except for C18:0 which appears to be slightly lower for some unknown reason.

As expected, oleic acid (C18:1) constituted the major portion of the total fatty acid profile (Table 1). The O/L ratio: oleic to linoleic acid (C18:2) and iodine values are both indicators of oil stability and shelf-life (1). As such, higher O/L ratios and lower iodine values would suggest better stability and longer shelf-life. Accordingly, Southern Runner followed by Langley had the best O/L ratio and iodine value, respectively (Table 2).

Percent unsaturated (C18:1, C18:2, and C20:1), saturated (C16:0, C18:0, and C20:0), and long-chain fatty acid (C20:0, C22:0, and C24:0) composites are also given (Table 3). Florunner, Sunrunner, and Langley were significantly highest in unsaturated and lowest in saturated and long-chain fatty acids.

In addition to the genotypic differences, years were also found to have a significant effect on the following fatty acids: palmitic, stearic, linoleic, and behenic. Significant year effects were likewise found for the O/L ratios and iodine values as well as the saturated, unsaturated, and long-chain composites. This is in agreement with what has previously been reported regarding yearly effect on peanut oil quality (1,9).

These results suggest that genotypic differences do exist in fatty acid composition among present U.S.

runner-type peanut cultivars. In the future, cultivar development within peanut breeding programs may be more strongly influenced by such oil quality characteristics.

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REFERENCES

1. Ahmed, E.M., and C.T. Young, in *Peanut Science and Technology,* edited by H.E. Pattee, and C.T. Young, American Peanut Research Education Society, Inc., Yoakum, TX, 1982, pp. 655–688.
2. Norden, A.J., R.W. Lipscomb and W.A. Carver, *Crop Sci. 9*:850 (1969).
3. Holbrook, C.C., and C.S. Kvien, *Peanut Research 27*:4 (1989).
4. Mixon, A.C., *Crop Sci. 22*:1086 (1982).
5. Norden, A.J., D.W. Gorbet and D.A. Knauft, *Ibid. 25*:1126 (1985).
6. Gorbet, D.W., A.J. Norden, F.M. Shokes and D.A. Knauft, *Ibid. 27*:817 (1987).
7. Simpson, C.E., O.D. Smith and D.H. Smith, *Ibid. 27*:816 (1987).
8. Banks, D.J., J.S. Kirby and J.R. Sholar, *Ibid. 29*:1574 (1989).
9. Norden, A.J., D.W. Gorbet, D.A. Knauft and C.T. Young, *Peanut Sci. 14*:7 (1987).

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