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Effect of Variety, Location and Year on Tannin Content of Peanut Seed Coats

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ABSTRACT

Tannin concentrations in the seed coats of six peanut varieties grown in seven geographical locations for 2 years were determined. Tannin content within variety varied significantly between locations. Levels among varieties at a location were also variable. Tannin concentrations for a specific variety at a specific location in 1975 and 1976 were compared and 60% of the comparisons differed significantly. These data indicate that any resistance to *Aspergillus parasiticus* colonization associated with peanut seed coat tannin concentration would probably vary somewhat with production location and year.

Key words: *Arachis hypogaea* L., seed coat, tannin.

Recent reports (2, 3, 7) indicate a close relationship between peanut (*Arachis hypogaea* L.) seed coat tannin content and resistance to colonization by *Aspergillus flavus*. In peanuts grown in Nigeria, Carter (2, 3) observed that certain varieties with colored testa were usually more resistant to invasion by *A. flavus* than those with white testa. Sanders and Mixon (7) reported a correlation coefficient of 0.77 (significant at 5% level) for the relationship between percent seed colonization in the laboratory and mg tannin per gram seed coat in 9 varieties. In that study (7), some varieties grown in different locations contained significantly different levels of tannin in the seed coat. The *in vitro* inhibitory effects of peanut seed coat tannins on *A. flavus* spore germination have been reported (2). Sanders and Mixon (7) found that growth of established cultures of *A. parasiticus* was inhibited from 63-88 percent as seed coat tannin concentration in potato dextrose agar increased from 2.5-7.5 percent (w/v).

Bartz *et al.* (1) reported percent colonization was not always similar for different lots of peanut seed of the same line unless the dates of digging, methods of curing, and location of the plantings were the same. In fact, some shifts in susceptibility were marked. Explanations offered for the observed variability were: 1) heavy natural infestations with fungi of the *A. flavus* group, 2) damaged seed, and 3) presence of fungi antagonistic to *A. flavus*. Wilson *et al.* (8) found very different aflatoxin levels after storage of uninoculated, shelled seed of the same line grown in two consecutive years. Before storage, the lines had 2 and 3 percent background internal infection with *A. flavus* group fungi. Although the amount of aflatoxin present is not always highly correlated with the amount of visible *A. flavus*, the yearly variability in resistance is evident. This study was conducted to examine the effects of variety, location, and year on the tannin content in peanut seed coats.

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Materials and Methods

Peanuts used in this study were grown, harvested, and cured by conventional methods in 1975 and 1976 as part of the National Peanut Performance Trials. Representative plot samples were supplied from Headland, Alabama; Gainesville and Marianna, Florida; College Station and Stephenville, Texas; Raleigh, N. C.; and Suffolk, Virginia. Two varieties in each of three market types were examined: Spanish—Starr, Tamnut 74; Runner—Florunner, Tifrun; Virginia—Florigiant, Early Bunch. Peanuts were mechanically shelled, and seed riding a 0.635 x 1.905 cm shaker screen were sealed in plastic bags and stored at 4°C. Percent colonization determinations on machine-harvested and -shelled seed were often greater than on hand-picked and -shelled seed (5, 8) even after careful visual screening for damage. Percent colonization on the machine-shelled samples used in this study would be questionable at best. Therefore, colonization percentages were not determined.

Tannin was determined on visually sound mature kernels as previously described by use of the Folin-Denis assay with a tannic acid standard curve (7). Seed coat weights were determined by weighing the seed coats from approximately 5 g of intact seed dried 3 hr at 130°C. Data reported are the mean of three replications.

Results and Discussion

Tannin content and an estimation of relative seed coat weight for three peanut market types are presented in Table 1. In 1975, mean tannin content of seed coats was similar for Virginia- and Runner-type peanuts grown at 7 locations, but was significantly higher for Spanish-type peanuts; in 1976, the pattern was similar. In all market types, tannin levels were significantly higher in 1975 than in 1976. Sanders (6) reported that tannin content of peanut seed coats varied with maturity, but that the tannin level for conventionally harvested and cured seed was similar to the mean of the three most mature stages. The influence of maturity in this study should be minimal because samples were selectively screened at shelling and some degree of selection is inherent to conventional harvesting and curing techniques. Percent seed coat did not differ between 1975 and 1976 in any market type (Table 1). Apparently, the ratio of seed coat to seed was relatively constant within types. However, percent seed coat was significantly higher for Spanish than for either Runner or Virginia. The fact that tannin content changed between years and percent seed coat did not, indicates that some factor(s) other than quantity of seed coat per seed influenced different tannin level on a yearly basis. Quantity of seed coat per seed depends on seed area and seed coat thickness and density. Expressed as percent (dry wt seed coat/dry wt seed x 100) in Table 1, seed density also was a factor. Gilman and Smith (4) reported similar seed densities for ten peanut genotypes, including Starr and Florunner. If Virginia and Runner are similar in seed density and size, they also must be similar in seed coat thickness and density. If seed density is similar for the three types, data presented herein indicated that the Spanish-type seed coats are thicker, denser, or both than either Virginia- or Runner-types.

Table 1. Tannin content and percent seed coat of Spanish, Virginia and Runner Peanuts.

Type	mg tannin/g seed coat[1] 1975	1976	percent seed coat[2] 1975	1976
Spanish	411.52 A	355.34 A	2.62 A	2.55 A
Virginia	389.88 B	337.28 B	2.35 B	2.38 B
Runner	379.31 B	326.93 B	2.30 B	2.35 B

Each value is the mean of 3 replications of 2 varieties at 7 locations

Percent seed coat = dry wt seed coat/dry wt seed X 100

[1]Means for 1975 and 1976 are significantly different in each market type

[2]Means for 1975 and 1976 are not significantly different in each market type

Means in a column followed by the same letter are not significantly different (5% level Duncan's New Multiple Range Test).

From the 6 varieties grown in 1975 and 1976, there were significant differences in tannin content within variety (Tables 2 and 3, comparisons made by columns). No trends were detected for areas consistently producing high or low tannin content. However, in 1975 tannin contents of peanuts produced at Gainesville, Florida were consistently among the highest. In 1976, Headland, Alabama consistently produced the highest tannin contents. There was, however, no consistent location effect either year since peanuts in at least one other location were not significantly different in tannin content. For most varieties, differences among locations were slightly less in 1975 than in 1976. For Tamnut and Starr, tannin values were lowest at Stephenville, Texas both years. In 1975 the other varieties were not consistently low in tannin at any location, but in 1976 those grown at Raleigh, N. C. and Suffolk, Virginia were among those with the lowest tannin levels.

As indicated for market types in Table 1, tannin levels were generally higher in 1975 than in 1976. When means for a given variety at a given location in 1975 and 1976 were compared, about 60% of the comparisons differed significantly (Tables 2 and 3). With-

Table 2. Tann in content of peanuts grown in various locations in 1975.

Location	Tamnut	Starr	Florunner	Tifrun	Florigiant	Early Bunch
			mg tannin/g seed coat			
Headland	*380.9 BC bc	*424.4 B a	*361.6 B c	*385.1 AB bc	*370.5 A c	*403.7 AB ab
Gainesville	450.7 A a	443.1 A a	394.6 A b	379.3 AB b	388.2 A b	*394.4 AB b
Marianna	415.2 AB a	*381.9 C abc	362.9 B bc	409.8 AB a	*396.1 A ab	*351.3 AB c
College Station	*422.9 AB a	419.2 B a	*316.3 C c	*360.8 B b	*360.1 AB b	417.9 B a
Stephenville	370.7 C ab	366.6 C b	364.7 B b	392.2 AB ab	*331.1 B c	*404.3 AB a
Raleigh	422.7 AB b	411.4 B b	362.9 B c	424.7 A b	371.3 A c	469.5 A a
Suffolk	380.9 BC bc	454.8 A a	377.4 A bc	*411.6 A abc	377.4 A c	429.9 A ab

*Means for 1975 and 1976 were not significantly different (5% level, Duncan's New Multiple Range Test).

Means in a column followed by the same capital letter are not significantly different (5% level).

Means in a row followed by the same lowercase letter are not significantly different (5% level).

Table 3. Tann in content of peanuts grown in various locations in 1976.

Location	Tamnut	Starr	Florunner	Tifrun	Florigiant	Early Bunch
			mg tannin/g seed coat			
Headland	*401.3 A b	*462.4 A a	*341.9 A c	*388.1 A bc	*361.8 A bc	*372.0 A bc
Gainesville	344.6 BC a	333.7 C ab	318.1 AB ab	301.8 B b	324.9 AB ab	*330.6 BC ab
Marianna	360.2 B ab	*382.9 B a	339.6 A b	339.0 B b	*343.2 A b	*361.0 AB ab
College Station	*395.9 A a	357.7 BC ab	*300.3 B c	*345.6 AB abc	*333.0 AB bc	361.7 AB ab
Stephenville	300.6 D b	294.1 D b	313.7 AB b	348.3 AB a	*346.1 A a	*350.6 ABC a
Raleigh	341.3 BC a	342.4 C a	296.7 B bc	326.8 B a	289.0 BC c	317.6 C ab
Suffolk	328.7 C ab	335.0 C ab	293.6 B bc	*323.6 B abc	280.7 C c	349.7 ABC a

*Means for 1975 and 1976 were not significantly different (5% level, Duncan's New Multiple Range Test).

Means in a column followed by the same capital letter are not significantly different (5% level).

Means in a row followed by the same lowercase letter are not significantly different (5% level).

in varieties, peanuts from Headland, Alabama and College Station, Texas were the most consistent in tannin content.

Tannin levels among varieties grown at a location exhibited significant variability (Tables 2 and 3, comparisons made by rows). In 1975 and 1976 Tamnut, Starr, and Early Bunch were generally among the highest at all locations. The data in Tables 2 and 3 indicate that tannin content varied as much or more with production area and year as with variety. Based on these observations and the previous correlation of tannin and percent colonization by *Aspergillus parasiticus* (7), resistance to colonization that is associated with tannin content would vary significantly with production location and year. In complex biological systems, several factors often interact to effect some result. Tannin concentration appears to be only one of several factors (soluble amino compounds, cuticular wax, testae structure, etc.) that are significantly correlated with the degree of resistance of peanuts to *A. flavus* colonization.

Mention of firm names or trade products does not imply that they are endorsed or recommended by the Department of Agriculture over other firms or similar products not mentioned.

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Literature Cited

1. Bartz, J. A., A. J. Norden, J. C. La Prade, and T. J. DeMuynk. 1978. Seed tolerance in peanuts (*Arachis hypogaea* L.) to members of the *Aspergillus flavus* group of fungi. Peanut Sci. 5:53-56.

2. Carter, J. B. H. 1970. Studies on the growth of *Aspergillus flavus* on groundnut kernels. Ph. D. Thesis, University of Reading (London, England). 170 p. Univ. Microfilms, Ann Arbor, Mich.

3. Carter, J. B. H. 1973. The influence of testa, damage and seed dressing on emergence of groundnut (*Arachis hypogaea*). Ann. Appl. Biol. 74:315-323.

4. Gilman, D. F. and O. D. Smith. 1977. Internal pericarp color as a subjective maturity index for peanut breeding. Peanut Sci. 4:67-70.

5. Mixon, A. C. and K. M Rogers. 1975. Factors affecting *Aspergillus flavus* Lk. ex Fr. colonization of resistant and susceptible genotypes of *Arachis hypogaea* L. Peanut Sci. 2:18-22.

6. Sanders, T. H. 1977. Changes in tannin-like compounds of peanut fruit parts during maturation. Peanut Sci. 4:51-53.

7. Sanders, T. H. and A. C. Mixon. 1979. Effect of peanut tannins on percent seed colonization and *in vitro* growth by *Aspergillus parasiticus*. Mycopathologia. 66:169-173.

8. Wilson, D. M., A. C. Mixon, and J. M. Troeger. 1977. Aflatoxin contamination of peanuts resistant to seed invasion by *Aspergillus flavus*. Phytopathology 67:922-924.

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