Quality Characteristics of Red Testa Peanuts Associated With Tomato Spotted Wilt Virus Infected Plants[1]

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ABSTRACT

Florunner peanuts with red, cracked testae commonly associated with tomato spotted wilt virus (TSWV) infected plants were examined for size, oil quality and flavor variation. Samples of visually normal and red testa peanuts (RTP) were collected randomly by electronic color sorting and hand-picking from three locations in Texas. Size distributions in the samples indicated higher percentages of RTP in smaller commercial sizes. Mean seed weight was lower for RTP except in the single largest screen size (9.5 mm). The oleic/linoleic acid ratio in oil from various commercial sizes was slightly but consistently higher in RTP and oven test stability of oil was correspondingly longer. Descriptive flavor analysis of roasted normal peanuts and RTP indicated no relevant flavor differences.

Key Words: Peanut, tomato spotted wilt virus, quality, red-testa, seed size distribution, seed coat color, flavor.

The relationship of peanut testa discoloration resulting from any source to actual quality reduction has not been well studied. Sanders *et al.* (11) reported on the occurrence, causes, and relationship of purple testa peanuts to compositional and flavor quality characteristics. They found some differences between normal and exclusively purple testa peanut lots but indicated that percentages of purple found naturally occurring in lots in commerce were inconsequential to quality potential.

The devastating yield loss effects of peanut diseases overshadow the often minor effects that specific diseases may have on composition, flavor and shelf-life quality characteristics of harvested peanuts. The effects of some leaf spot spray treatments and thus levels of disease severity on several quality aspects of peanuts have been reported (1, 10, 14, 15, 16). The significant peanut yield reduction by tomato spotted wilt virus (TSWV), description of field symptoms, and methods of infection have been well documented (2, 3, 4). Peanuts from infected plants frequently have bright red, often cracked testae and although this obvious effect exists, no report of quality variation was found in a search of the literature. Presently, the red testa color associated with TSWV is not accounted as damaged in the peanut grading system as are purple testae; however, the uncharacteristic color does present a potential concern to manufacturers of unblanched, whole nut products. This

[1]Mention of a trade mark or proprietary product does not constitute a guarantee or warranty of the product by the USDA and does not imply its approval to the exclusion of other products that may also be available.

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study was conducted to determine compositional and flavor quality characteristics of red testa peanuts (RTP) from TSWV-infected plants.

Materials and Methods

Red testa peanuts, commonly associated with TSWV infected plants, and normal peanuts, i.e. non-red testa, used for evaluation were obtained from peanut shelling plants in south Texas. Peanut plants from which peanuts were originally obtained previously had been identified as highly infected by TSWV. RTP and normal samples from the same shelling runs were obtained randomly by personnel on a picking line and/or from material picked out by electronic eye sorting while corresponding normal samples were obtained from the same shelling lots. Individual samples were *ca.* 1700 g. A total of three similar weight sample pairs was collected from two shelling plants located approximately 30 mi apart. Approximately 800 g of peanuts were riffle divided from lots to obtain seed weight data. Peanuts in each sample were sized according to thickness over a series of slotted-hole screens having length of 25.4 mm and widths of 10.3, 9.5, 8.7, 8.33, 7.9, 7.1, 6.4, and 5.6 mm. The percentage of seed by weight that rode each of the screens was calculated to provide the seed size distribution. Commercial grade sizes were considered as follows: jumbo (≥8.3 mm), medium (7.1 to 8.3 mm), No. 1 (6.4 to <7.1 mm), and other (5.6 to <6.4 mm). Screen sized peanuts were held at 4 C storage until analyses were complete.

Oil for quality analyses was expressed from each grade size with a Carver Laboratory press maintained at *ca.* 9.06×10^3 kg for 20 min. Fatty acid methyl esters were prepared and analyzed as previously described (8). Oil stability was determined by the gravimetric method of Young and Holley (17). Medium grade size peanuts were roasted as previously described (12) using a modified Farberware roaster model 355. Initial and final roaster temperatures were approximately 36.6 ± 1.5 and 176.0 ± 5.0 C, respectively. Peanuts were blanched with a laboratory blancher and color was then determined with a HunterLab colorimeter. Paste was made from roasted peanuts in a Cuisinart Food processor using a precise grind-cool protocol to maintain temperature below 32 C (12). Peanut paste color was determined and samples were immediately frozen until sensory analysis. Pastes were presented to a 12-member panel trained in the Spectrum Flavor Descriptive Analysis technique (7) to fully characterize the qualitative and quantitative aspects of peanut flavor. Each panelist evaluated the samples independently under red lights. Samples were presented randomly in white transparent cups with three-digit random numbers. Samples were assigned intensity ratings (0-15) for descriptive terms described by Johnson *et al.* (6) and Sanders *et al.* (12). Data are the means of three panel presentations. Data were analyzed using a Statistical Analysis System (13) program package and significant differences among means were determined by the Waller Duncan Test.

Results and Discussion

Size distribution of RTP indicated lower percentages on 7.9 mm and wider screens and higher percentages on 7.1 mm and narrower screens (Table 1). These data are consistent with information on peanuts that have been grown under increased disease stress conditions (10) and under conditions of higher soil temperature (9). Sanders *et al.* (10) reported that Florunner peanuts exhibited a consistent increase in median seed size, indicating a greater proportion of larger seed sizes, in response to decreased leaf spot pressure and that increases in soil temperature without associated water stress resulted in seed size distributions containing higher percentages of small seed (9). The various screen size data translated into commercial grade size indicate that for all the seed in all samples there was approximately 14% more jumbo in normal seed and an equivalent amount more of medium, No. 1 and smaller seed in RTP lots.

Mean seed weights were not significantly different between normal and RTP of each screen size. Weights were consistently numerically higher for normal peanuts except for the 9.5 mm screen (Table 1). Count per ounce calculations based on mean seed weights thus indicate increasing differences in count per ounce as seed size decreased. A similar finding was reported for purple testae peanuts (11). Culbreath *et al.* (2) recently reported that seed yield per plant, number of seed per plant, and mean seed weight were lower for peanut plants infected with TSWV. They did not indicate that seed had been sized thus the lower mean seed weights they reported were probably related to size distribution differences between RTP and normal as indicated in Table 1.

Table 1. Size distribution and mean seed weight of red testae TSWV infected and visually normal Florunner peanuts.

	Distribution[a]		Mean seed weight		Count/oz	
Size	Normal	RTP	Normal	RTP	Normal	RTP
mm	-------wt %------		--------g/seed-------		--------no.--------	
9.5	3.25	3.26	0.823	0.867	34.6	32.7
8.7	23.03	16.06	0.760	0.721	37.3	39.3
8.3	29.82	22.82	0.689	0.641	41.1	44.2
7.9	17.72	16.51	0.661	0.587	42.8	48.2
7.1	21.41	28.08	0.573	0.471	49.4	60.1
6.4	4.16	10.89	0.412	0.344	68.7	82.4
5.6	0.61	2.89	0.309	0.253	90.0	112.3

[a]Data are means of samples of *ca.* 1700 g each collected from three different shelled lots. Differences in g/seed for normal and RTF seed were not significant ($P \leq 0.05$). Count/oz data based on mean seed weights.

Oil quality analyses indicated small but significant differences in oleic/linoleic acid (O/L) ratio and oven stability of oil pressed from normal and RTP samples. Degree of unsaturation in the total fatty acid component is usually related to oil stability and O/L ratio is often considered as a key indicator of shelf life potential. O/L ratios for normal and RTP samples were very similar and although the differences were consistent in jumbo and medium sizes, the small differences are probably of little consequence. Increased soil temperatures during peanut growth generally result in oil with a higher O/L ratio (5,8). Sanders *et al.* (10) found slightly lower linoleic acid and higher oleic acid percentages in Florunner peanuts that had not been sprayed for control of leaf spot in comparison to controls which were sprayed on a 14-d cycle. Unsprayed controls were highly defoliated by leaf spot and consequently soil where pods were growing was exposed to more sunlight than sprayed plants in which little defoliation occurred. The slightly higher O/L ratios of RTP (Table 2) may be related to the same phenomenon of increased soil temperatures due to exposure of soil to sunlight as leaves were lost from the plants later in the growing season. Oven stability of oil followed the same trends as the O/L ratio with the differences being significant in jumbo and medium commercial sizes (Table 2).

Parameters associated with roasting RTP and normal peanuts presented in Table 3 indicate that a slightly longer roast time was required to produce a Hunter L value of about 50.0 in roasted, blanched normal peanuts. Moisture contents were similar and sizes were the same, thus sugars and amino acids, compounds affecting development of

Table 2. Percentage of oleic and linoleic acid, oleic/linoleic (O/L) ratioand oven stability of oil from visually normal and red testae peanuts (RTP).[a]

Commercial size	Type	Oleic acid	Linoleic acid	O/L ratio	Oven stability
		%	%		
Jumbo	Normal	47.1	33.5	1.41 a	21.8 a
	RTP	48.9	32.1	1.53 b	23.3 b
Medium	Normal	46.0	34.7	1.33 a	21.2 a
	RTP	48.2	32.8	1.47 b	22.3 b
No. 1	Normal	43.8	35.9	1.22 a	20.3 a
	RTP	46.3	34.0	1.36 a	21.3 a

[a]Data are the mean of three separate analyses from each size from each of three samples. Means for a size followed by the same letter are not significantly different ($P \leq 0.05$).

Table 3. Hunter L color and roast times for visually normal red testa peanuts (RTF) and medium grade size Florunner peanuts.[a]

	Color values			Roast
	Raw	Roasted/blanched	Paste	time
	Hunter L value			min
Normal	40.2	50.0	48.6	27.3
RTP	31.7	49.9	49.7	25.2

[a]Data are the mean of three samples prepared for descriptive sensory analysis.

roast color, may have been different. Paste colors were slightly different from whole roasted/blanched colors but were within differences reported in previous studies with similar type peanut samples (12).

Descriptive sensory analysis did not identify meaningful differences between RTP and normal samples (Table 4). Significant ($P \leq 0.05$) differences were found only for the tastes bitter and sweet with the normal samples slightly higher in sweet and lower in bitter. Data for purple testae peanuts, reported on the basis of overall hedonic rating, indicated lower flavor ratings for purple than for normal peanuts, although naturally occurring quantities of purple testae peanuts within a population of normal peanuts did not produce differences (11).

Data in this study indicate that RTP commonly associated with TSWV-infected plants are of similar market quality as those without red testae from the same shelled lots. Presently, the RTP discoloration is not graded as damaged in the official peanut grading system and data presented in this study indicate that no change is needed unless visual difference in nonblanched peanuts is determined to be of some consequence to specific manufacturing processes.

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Table 4. Mean flavor descriptor intensity of roasted, visually normal and red testae (RTP) medium grade size peanuts[a].

Flavor descriptor	Normal	RTP
	Intensity	
Roasted peanutty	5.71	5.58
Raw beany	2.39	2.25
Dark roasted	2.50	2.87
Sweet aromatic	3.16	3.09
Woody/hulls/skin	2.17	2.59
Cardboardy	0.78	0.44
Painty	0.21	0.06
Sweet	2.31	2.14
Sour	1.04	1.00
Bitter	1.69	2.08
Salty	0.81	0.77
Astringent	2.31	2.44
Fruity/fermented	0.61	0.67

[a]Intensity of only sweet and bitter tastes was significantly different ($P \leq 0.05$).

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