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PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Improvement of Sensory Quality and Composition of Virginia-Type Peanuts**

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DEPARTMENTS: **[1]Biological and Agricultural Engineering, [2]Crop Science, [3]USDA-ARS Market Quality and Handling Research Unit**

REPORT:

The objective of the project is to evaluate composition and sensory quality of breeding lines developed by the NCSU peanut breeding project using conventional procedures and near-infrared reflectance (NIR).

NIR spectroscopy was applied to 814 ground raw SMK peanut samples from 274 different breeding lines and checks entered in trials conducted at the NCDA Peanut Belt (PBRS), Upper Coastal Plains (UCPRS), and Border Belt Tobacco (BBTRS) Research Stations. The trials included the 2008 NCSU Advanced Yield Test (AYT, 100 entries) grown at all three locations. These entries included the lines considered either entered as "official" entries in the 2009 Uniform Peanut Performance Test (UPPT) and others included as "local options" in the North Carolina reps of the 2009 UPPT. Also included were samples from a three trials conducted only at PBRS and UCPRS [the Disease Preliminary Test (DPT, 49 entries), the Jumbo Pod Advanced test (JAT, 25 entries), and the Early Maturity Advanced Test (EAT, 56 entries)] and two trials conducted only at a single site [the Leafspot Advanced Test, Sprayed and Unsprayed (LAS and LAU, 72 entries) and the Tallury Advanced Test of wild-species-derived lines (TAT, entries)]. Using the NIR instrument, light absorption/reflectance was measured at wavelengths from 400 to 2500 nm in 2-nm increments. Prediction equations developed from data collected in previous years to relate absorption at specific wavelengths to sensory attribute intensities of paste ground from roasted peanuts and scored by a professional sensory panel were used to predict intensities of the roasted peanut, sweet, and bitter sensory attributes or "flavor notes." Sixteen lines (51 total samples) representing the upper range of predicted flavor were identified for actual sensory evaluation by the panel. These lines were ones that are of interest in the cultivar development program and would have been tasted in any case. Additional checks and lines representing extremes of the ranges for predicted roasted peanut, sweet, and bitter were identified and included in the sensory panel sessions. Six samples were initially roasted to a color outside the range preferred for maximum development of roasted peanut attribute intensity (either lighter or darker), so a duplicate sample was roasted to a more nearly optimum color. All 72 samples were evaluated by the sensory panel. Observed sensory intensity scores were compared with predicted scores for the three flavor notes.

Correlations between observed and predicted values for roasted peanut, sweet, bitter, fruity / fermented/ and astringent sensory attributes were very poor. There were some correlations between different observed and predicted values, but these were not the same as found in previous years. In spite of the difficulties we have had in developing sufficiently robust prediction equations, we would like to continue to try. The NIR instrument can be used to scan hundreds or thousands of samples in the interval between harvest and the following planting season compared with the few dozens that can be scored by the sensory panel. If we can find predictions that even marginally correlated with observed sensory quality, the breeder can get reasonably good indication of the flavor profile of large numbers of preliminary and advanced breeding lines in order to eliminate from his program lines with inferior flavor.

The results from the samples that were actually subjected to sensory analysis were more satisfying. Sensory data collected on samples from the 2008 crop year were pooled with data collected in previous years, and the subset of the multiple-year data including those lines as well as released cultivars and breeding lines that are candidates for release was analyzed. This resulted in the analysis of 286 data points representing 36 entries and 34 trials conducted over a span of 12 years. Intensity of the fruity / fermented attribute and linear and quadratic effects of roast color were applied as covariates to data on roasted peanut, sweet, and bitter attributes as indicated by statistical tests[1]. Means were adjusted to the average values of the applied covariates and to the average environmental effect. Statistical comparisons among the adjusted means were made using t-tests. Of the checks that had been tested over several years, Georgia Green, the dominant runner-type cultivar grown in the Southeastern peanut production region, had the best flavor profile. Florunner, the long-time flavor standard of the peanut processing industry, was significantly inferior to Georgia Green for the sweet attribute but not for roasted peanut or bitter. There were several disease-resistant high-oleic NCSU breeding lines that were not statistically different from Georgia Green. These lines were developed as part of our program of breeding for resistance to early leafspot, Cylindrocladium black rot, Sclerotinia blight, and tomato spotted wilt virus, and they have superior disease resistance in addition to high yield and superior flavor profiles. In addition to having the yield, grade, and disease resistance growers demand, they meet our goal of improving the flavor of virginia-type lines meet or surpass that of Florunner.

The USDA-ARS Market Quality and Handling Research Unit (MQHRU) housed in NCSU's Department of Food, Bioprocessing, and Nutrition Sciences has a separate program to evaluate market quality in advanced breeding lines submitted for testing in the cooperative Uniform Peanut Performance Test (UPPT), but funds for those tests are limited. The UPPT is used as a final step in breeders' variety testing programs. Each participating breeder is limited to three entries per year. Most years, there are 10 to 16 entries in the UPPT. Entries tend to be lines with a high probability of release within one to two years. There were three NCSU lines formally entered in the 2008 UPPT, and composition and sensory data was acquired on samples of those lines grown at ten sites across the southern USA. In the North Carolina UPPT, there were 13 additional lines or "local options" included in the test. Although the USDA-ARS MQHRU has committed to compositional and sensory analysis of up to only ten local options per cooperator, they performed the sensory analysis on all 13 NCSU local options (Table 2). In the data collected in North Carolina and Virginia on selected lines, there was statistically significant variation among entries for the positive sensory attributes "roasted peanut," "sweet aromatic" and "sweet," and for the negative attributes "bitter" and "fruity/fermented" (usually indicative of immaturity of the kernels or of too-high drying temperature). There was no detectable variation for the negative sensory attributes "dark roast" (indicative of over-roasting), "raw/beany" (indicative of under-roasting), "astringent," or "stale/cardboard" (indicative of staleness or rancidity). Among the lines tested in this program, high-oleic line N99103ol and disease-resistant lines N03089T and N03090T, sisters of the Bailey cultivar, exhibited superior profiles that were comparable to flavor standard runner-type Florunner and the currently dominant runner-type cultivar Georgia Green.

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[1] Our research has consistently shown that roast color has a significant effect on sensory perception of flavor and that the presence of detectable levels of the fruity attribute (also called "fruity/fermented") has a marked effect on the perception of roast peanut flavor. The optimum roast color to maximize roast peanut intensity is 58.3 on the CIELAB L* scale, measured on freshly ground paste cooled to room temperature, and that for each unit of increase in the intensity of the fruity attribute in a sample, the roast peanut intensity decreases by about half a unit. The fruity note is the result of too-warm temperatures in the windrow following digging or during drying following combining. High temperature causes the seeds to respire at higher rates, and when the seed cannot absorb sufficient oxygen to satisfy the increased demand, they undergo anaerobic respiration, producing alcohol and other volatile compounds that give rise to the fruity flavor. Immature peanuts are more metabolically active than are fully mature peanuts and are therefore more prone to develop detectable levels of the fruity attribute.

Table 1. Flavor profiles of advanced experimental lines compared with common virginia- and runner-type cultivars. Data from peanuts grown in trials in North Carolina only.

	Extent of testing						Sensory attribute											
Line	No. of reps	No. of tests	Years No.	Years First	Years Last	Roast color	Over-roast	Under-roast	Roasted peanut	Sweet	Bitter	Fruity / fermented	Stale / cardboard	Wood-hulls-skins	Astringent	Bitter aftertaste	Nutty aftertaste
						CIELAB L score*	*flavor intensity units (1=imperceptible to 14=most intense)*											
N05021F	5	3	2	2005	2008	58.48±0.64^{a-d}	1.11±0.24^{ns}	2.27±0.23^{ab}	4.32±0.17^{a-d}	3.14±0.19^{def}	2.42±0.13^{a-d}	1.61±0.16^{abc}	1.65±0.12^{ns}	2.86±0.16^{ab}	2.95±0.13^{ns}	2.30±0.14^{ns}	3.31±0.15^{a-e}
N05044FCSm	2	1	1	2008	2008	58.41±0.91^{a-d}	1.10±0.34^{ns}	2.75±0.33^{abc}	4.31±0.25^{a-d}	3.49±0.27^{b-e}	2.78±0.19^{b-e}	1.79±0.23^{abc}	1.97±0.18^{ns}	3.03±0.23^{ab}	3.18±0.18^{ns}	2.54±0.21^{ns}	3.14±0.22^{b-e}
N06011EJ	7	2	1	2008	2008	56.71±0.53^{d}	1.42±0.20^{ns}	2.70±0.19^{bc}	4.13±0.15^{cd}	3.62±0.16^{bcd}	2.56±0.11^{b-e}	1.76±0.14^{abc}	1.71±0.10^{ns}	3.22±0.13^{b}	3.20±0.10^{ns}	2.67±0.12^{ns}	3.26±0.13^{b-e}
N06012EJ	3	2	1	2008	2008	59.98±0.76^{a}	1.14±0.28^{ns}	3.26±0.28^{c}	3.97±0.21^{cd}	2.80±0.23^{f}	2.70±0.16^{b-e}	1.67±0.19^{abc}	1.67±0.15^{ns}	3.13±0.19^{ab}	3.14±0.15^{ns}	2.60±0.17^{ns}	3.13±0.18^{cde}
N07018JCSm	5	3	1	2008	2008	57.92±0.61^{bcd}	1.28±0.22^{ns}	2.35±0.22^{abc}	4.06±0.17^{cd}	3.38±0.18^{cde}	2.23±0.13^{a}	1.62±0.15^{abc}	1.84±0.12^{ns}	2.97±0.15^{ab}	3.07±0.12^{ns}	2.51±0.14^{ns}	2.99±0.15^{e}
N07033olSm	3	3	1	2008	2008	57.84±0.76^{bcd}	1.35±0.28^{ns}	2.22±0.28^{ab}	4.52±0.21^{abc}	3.58±0.22^{bcd}	2.52±0.16^{a-e}	1.38±0.19^{a}	1.52±0.15^{ns}	2.83±0.19^{ab}	2.82±0.15^{ns}	2.37±0.17^{ns}	3.72±0.18^{a}
N07036olSmT	2	2	1	2008	2008	58.60±0.92^{a-d}	1.29±0.34^{ns}	2.24±0.34^{ab}	3.96±0.25^{cd}	2.92±0.27^{ef}	2.82±0.19^{cde}	1.36±0.23^{a}	1.96±0.18^{ns}	3.23±0.23^{ab}	2.95±0.18^{ns}	2.57±0.21^{ns}	3.16±0.22^{b-e}
N07037olSm	3	3	1	2008	2008	57.55±0.76^{bcd}	1.56±0.28^{ns}	2.06±0.28^{ab}	4.18±0.20^{a-d}	3.20±0.22^{def}	2.58±0.16^{a-e}	1.50±0.19^{abc}	1.73±0.15^{ns}	3.04±0.19^{ab}	3.03±0.15^{ns}	2.67±0.17^{ns}	3.34±0.18^{a-e}
N08023EF	3	2	1	2008	2008	59.18±0.76^{abc}	1.01±0.28^{ns}	2.96±0.28^{bc}	4.17±0.21^{bcd}	3.17±0.23^{def}	2.66±0.16^{b-e}	1.92±0.19^{abc}	1.92±0.15^{ns}	3.30±0.19^{b}	2.85±0.15^{ns}	2.60±0.17^{ns}	3.09±0.18^{de}
N08027EF	2	2	1	2008	2008	57.69±0.91^{bcd}	1.28±0.34^{ns}	2.54±0.33^{abc}	4.04±0.25^{cd}	4.05±0.27^{ab}	2.82±0.19^{de}	1.99±0.23^{abc}	1.61±0.18^{ns}	3.12±0.23^{ab}	3.00±0.18^{ns}	2.53±0.21^{ns}	2.85±0.22^{e}
N08028EF	4	2	1	2008	2008	56.49±0.67^{d}	1.25±0.25^{ns}	2.24±0.24^{ab}	4.42±0.19^{a-d}	4.47±0.20^{a}	2.38±0.14^{abc}	2.02±0.17^{c}	1.61±0.13^{ns}	2.73±0.17^{a}	2.90±0.13^{ns}	2.63±0.15^{ns}	3.37±0.16^{a-e}
N08033E	3	2	1	2008	2008	57.48±0.76^{bcd}	1.26±0.28^{ns}	2.46±0.28^{abc}	4.21±0.21^{a-d}	3.91±0.23^{bc}	2.47±0.16^{a-d}	2.05±0.19^{c}	1.84±0.15^{ns}	3.18±0.19^{ab}	3.19±0.15^{ns}	2.60±0.17^{ns}	3.30±0.18^{a-e}
N08059olFCT	2	1	1	2008	2008	58.48±0.91^{a-d}	1.29±0.34^{ns}	2.13±0.33^{ab}	4.35±0.25^{a-d}	4.07±0.27^{ab}	2.42±0.19^{a-d}	1.73±0.23^{abc}	1.60±0.18^{ns}	2.96±0.23^{ab}	3.18±0.18^{ns}	2.41±0.21^{ns}	3.14±0.22^{b-e}
N08060olFCT	2	1	1	2008	2008	58.95±0.91^{abc}	1.29±0.34^{ns}	2.50±0.33^{abc}	4.53±0.25^{abc}	3.36±0.27^{b-f}	2.40±0.19^{a-d}	1.42±0.23^{ab}	1.41±0.18^{ns}	3.03±0.23^{ab}	3.00±0.18^{ns}	2.60±0.21^{ns}	3.39±0.22^{a-e}
N08061olFCT	2	1	1	2008	2008	58.86±0.91^{abc}	1.47±0.34^{ns}	1.88±0.33^{a}	4.79±0.25^{a}	3.78±0.27^{bcd}	2.52±0.19^{a-e}	1.73±0.23^{abc}	1.53±0.18^{ns}	3.03±0.23^{ab}	2.93±0.18^{ns}	2.34±0.21^{ns}	3.58±0.22^{a-d}
N08063olFCT	2	1	1	2008	2008	59.24±0.91^{abc}	1.22±0.34^{ns}	2.25±0.33^{ab}	4.43±0.25^{a-d}	3.70±0.27^{bcd}	2.75±0.19^{b-e}	1.48±0.23^{abc}	1.53±0.18^{ns}	3.21±0.23^{ab}	3.00±0.18^{ns}	2.60±0.21^{ns}	3.33±0.22^{a-e}
N08064olCT	2	1	1	2008	2008	59.68±0.91^{ab}	1.29±0.34^{ns}	2.25±0.33^{ab}	4.74±0.25^{ab}	3.73±0.27^{bcd}	2.67±0.19^{b-e}	1.67±0.23^{abc}	1.60±0.18^{ns}	2.90±0.23^{ab}	3.31±0.18^{ns}	2.48±0.21^{ns}	3.64±0.22^{abc}
N08069olJCT	5	3	1	2008	2008	57.32±0.60^{cd}	1.48±0.22^{ns}	2.34±0.22^{abc}	4.45±0.16^{abc}	3.52±0.18^{b-e}	2.40±0.13^{abc}	1.80±0.15^{abc}	1.70±0.12^{ns}	2.98±0.15^{ab}	3.04±0.12^{ns}	2.52±0.14^{ns}	3.51±0.15^{a-d}
N08073olCT	2	1	1	2008	2008	59.37±0.91^{abc}	1.16±0.34^{ns}	2.50±0.33^{abc}	4.30±0.25^{a-d}	3.57±0.27^{b-e}	2.76±0.19^{b-e}	1.67±0.23^{abc}	1.72±0.18^{ns}	2.65±0.23^{a}	3.12±0.18^{ns}	2.54±0.21^{ns}	3.39±0.22^{a-e}
N08075olCT	1	1	1	2008	2008	59.43±1.26^{abc}	1.60±0.47^{ns}	2.32±0.46^{abc}	4.18±0.34^{a-d}	3.10±0.37^{c-f}	2.77±0.26^{a-e}	1.54±0.32^{abc}	1.53±0.24^{ns}	3.53±0.32^{b}	3.31±0.25^{ns}	2.60±0.29^{ns}	3.08±0.30^{a-e}
N08080olC	5	3	1	2008	2008	56.64±0.61^{d}	1.75±0.22^{ns}	1.97±0.22^{ab}	4.60±0.17^{ab}	3.81±0.18^{bcd}	2.37±0.13^{ab}	1.55±0.15^{abc}	1.44±0.12^{ns}	2.80±0.15^{a}	3.17±0.12^{ns}	2.56±0.14^{ns}	3.67±0.15^{a}
N08083olCT	1	1	1	2008	2008	58.43±1.26^{a-d}	1.47±0.47^{ns}	1.94±0.46^{ab}	4.44±0.34^{a-d}	3.10±0.37^{c-f}	2.79±0.26^{a-e}	1.42±0.32^{abc}	1.66±0.24^{ns}	3.03±0.32^{ab}	3.06±0.25^{ns}	2.60±0.29^{ns}	3.46±0.30^{a-e}
N08084olC	5	3	1	2008	2008	57.73±0.60^{bcd}	1.50±0.22^{ns}	2.34±0.22^{abc}	4.38±0.16^{a-d}	3.61±0.18^{bcd}	2.67±0.13^{b-e}	1.62±0.15^{abc}	1.60±0.12^{ns}	3.03±0.15^{ab}	3.09±0.12^{ns}	2.52±0.14^{ns}	3.41±0.15^{a-e}
N08086olJCT	1	1	1	2008	2008	58.72±1.26^{a-d}	1.22±0.47^{ns}	2.07±0.46^{ab}	4.29±0.34^{a-d}	3.84±0.37^{a-d}	2.69±0.26^{a-e}	1.79±0.32^{abc}	1.53±0.24^{ns}	2.90±0.32^{ab}	3.56±0.25^{ns}	2.60±0.29^{ns}	3.46±0.30^{a-e}
N09051olCSm	3	2	1	2008	2008	57.36±0.76^{cd}	1.72±0.28^{ns}	2.28±0.28^{ab}	4.49±0.21^{abc}	3.05±0.22^{def}	2.70±0.16^{b-e}	1.55±0.19^{abc}	1.60±0.15^{ns}	3.12±0.19^{ab}	3.23±0.15^{ns}	2.72±0.17^{ns}	3.65±0.18^{ab}
NC 7	42	27	11	1995	2008	58.04±0.21^{bcd}	1.51±0.08^{ns}	2.42±0.07^{abc}	3.99±0.06^{d}	3.12±0.06^{def}	2.84±0.04^{e}	1.65±0.05^{abc}	1.73±0.04^{ns}	3.13±0.05^{b}	3.11±0.04^{ns}	2.80±0.05^{ns}	3.13±0.05^{e}
Gregory	26	18	7	1995	2008	58.75±0.27^{abc}	1.29±0.10^{ns}	2.58±0.10^{bc}	4.22±0.08^{cd}	3.25±0.08^{def}	2.67±0.06^{cde}	1.53±0.07^{abc}	1.82±0.05^{ns}	3.08±0.07^{ab}	3.04±0.05^{ns}	2.60±0.06^{ns}	3.23±0.07^{cde}
Bailey	**21**	**14**	**5**	**2003**	**2008**	**57.81±0.31^{cd}**	**1.51±0.12^{ns}**	**2.28±0.11^{ab}**	**4.37±0.09^{a-d}**	**3.37±0.09^{de}**	**2.62±0.06^{b-e}**	**1.81±0.08^{abc}**	**1.78±0.06^{ns}**	**3.08±0.08^{ab}**	**3.10±0.06^{ns}**	**2.63±0.07^{ns}**	**3.31±0.08^{b-e}**
Sugg	**16**	**12**	**5**	**2003**	**2008**	**57.29±0.35^{cd}**	**1.48±0.13^{ns}**	**2.09±0.13^{ab}**	**4.41±0.10^{a-d}**	**3.60±0.10^{bcd}**	**2.48±0.07^{a-d}**	**1.57±0.09^{abc}**	**1.77±0.07^{ns}**	**2.85±0.09^{ab}**	**3.01±0.07^{ns}**	**2.64±0.08^{ns}**	**3.48±0.08^{a-d}**
Florunner	30	12	7	1995	2005	57.41±0.28^{cd}	1.79±0.10^{ns}	2.23±0.10^{ab}	4.38±0.08^{a-d}	3.41±0.09^{de}	2.45±0.06^{a-d}	1.86±0.07^{bc}	1.88±0.05^{ns}	3.20±0.07^{b}	3.03±0.05^{ns}	2.55±0.06^{ns}	3.36±0.07^{a-e}
Georgia Green	23	10	4	1998	2008	57.50±0.31^{cd}	1.27±0.11^{ns}	2.28±0.11^{ab}	4.36±0.09^{a-d}	4.01±0.10^{b}	2.27±0.06^{a}	1.98±0.08^{c}	1.75±0.06^{ns}	2.76±0.08^{a}	2.97±0.06^{ns}	2.42±0.07^{ns}	3.27±0.07^{b-e}
Mean						58.17	1.37	2.35	4.32	3.51	2.59	1.68	1.68	3.03	3.08	2.56	3.33
CV (%)						2.1	29.2	21.4	8.0	9.7	11.2	21.8	14.6	10.5	8.3	11.59	8.8

Table 2. Sensory means from samples of the Uniform Peanut Performance test (UPPT) grown in Virginia, North Carolina, and South Carolina. Data on selected lines; means adjusted to a common environmental effect.

	Extent of testing					Sensory attribute										
Line	No. of reps	Years tests	No.	First	Last	Roast color	Dark roast	Raw / beany	Roasted peanut	Sweet aromatic	Sweet	Bitter	Fruity / fermented	Stale / cardboard	Wood / hulls / skins	Astringent
						Hunter L score	*flavor intensity units(0=imperceptible to 15=most intense)*									
Virginia lines						**49.53±0.30^{ns}**	**2.92±0.03^{ns}**	**2.04±0.03^{ns}**	**4.52±0.04$^{\beta}$**	**2.82±0.03$^{\beta}$**	**2.21±0.03$^{\beta}$**	**2.73±0.03$^{\alpha}$**	**0.03±0.03$^{\beta}$**	**0.30±0.05^{ns}**	**3.01±0.02$^{\alpha}$**	**1.03±0.01^{ns}**
CRSP911	3	3	1	2008	2008	49.43±0.99^{ns}	2.95±0.11^{ns}	2.05±0.11^{ns}	4.46±0.14^{b-g}	2.77±0.10^{def}	2.23±0.11^{d-g}	3.01±0.11^{a}	0.19±0.10^{bcd}	0.30±0.15^{ns}	3.06±0.08^{ab}	1.12±0.04^{ns}
N03089T	6	6	4	2005	2008	49.34±0.71^{ns}	2.81±0.08^{ns}	2.10±0.08^{ns}	4.83±0.10^{a}	2.96±0.07^{a-e}	2.44±0.08^{a-d}	2.50±0.08^{c-f}	-0.01±0.07^{d}	0.29±0.11^{ns}	2.89±0.06^{bc}	1.00±0.03^{ns}
N03090T	5	5	4	2005	2008	49.00±0.78^{ns}	3.00±0.09^{ns}	1.92±0.09^{ns}	4.74±0.11^{a-d}	3.11±0.08^{ab}	2.56±0.09^{abc}	2.65±0.08^{b-e}	0.04±0.08^{d}	0.17±0.12^{ns}	2.98±0.06^{abc}	1.06±0.03^{ns}
N04072CT	3	3	1	2008	2008	48.64±0.99^{ns}	2.95±0.11^{ns}	2.05±0.11^{ns}	4.50±0.14^{b-g}	2.82±0.10^{c-f}	2.12±0.11^{efg}	2.81±0.11^{ab}	-0.02±0.10^{d}	0.33±0.15^{ns}	3.13±0.08^{a}	1.04±0.04^{ns}
N05008	3	3	1	2008	2008	49.72±0.99^{ns}	2.92±0.11^{ns}	2.08±0.11^{ns}	4.43±0.14^{d-g}	2.72±0.10^{f}	2.07±0.11^{fg}	2.76±0.11^{abc}	-0.02±0.10^{d}	0.26±0.15^{ns}	2.99±0.08^{abc}	1.05±0.04^{ns}
VT024051	3	3	1	2008	2008	50.56±0.99^{ns}	2.95±0.11^{ns}	2.01±0.11^{ns}	4.34±0.14^{fg}	2.61±0.10^{f}	2.04±0.11^{fg}	2.76±0.11^{abc}	0.05±0.10^{d}	0.63±0.15^{ns}	3.06±0.08^{ab}	1.02±0.04^{ns}
NC 7	22	18	8	2001	2008	49.04±0.39^{ns}	2.92±0.04^{ns}	2.05±0.04^{ns}	4.49±0.05^{efg}	2.80±0.04^{ef}	2.11±0.04^{fg}	2.73±0.04^{bc}	0.00±0.04^{d}	0.19±0.06^{ns}	3.03±0.03^{ab}	1.04±0.02^{ns}
NC-V 11	5	5	5	2003	2008	50.66±0.78^{ns}	2.88±0.09^{ns}	2.15±0.09^{ns}	4.28±0.11^{g}	2.63±0.08^{f}	2.03±0.09^{g}	2.79±0.08^{ab}	0.06±0.08^{d}	0.11±0.12^{ns}	3.02±0.06^{abc}	1.02±0.03^{ns}
Bailey	8	8	4	2005	2008	49.46±0.62^{ns}	2.84±0.07^{ns}	2.01±0.07^{ns}	4.59±0.08^{a-g}	2.87±0.06^{cde}	2.33±0.07^{def}	2.61±0.07^{b-f}	0.02±0.06^{d}	0.38±0.10^{ns}	2.98±0.05^{abc}	1.00±0.03^{ns}
Sugg	6	6	4	2005	2008	49.06±0.71^{ns}	3.01±0.08^{ns}	2.00±0.08^{ns}	4.58±0.10^{b-g}	2.88±0.07^{cde}	2.29±0.08^{d-g}	2.71±0.08^{bcd}	-0.01±0.07^{d}	0.41±0.11^{ns}	3.06±0.06^{ab}	1.00±0.03^{ns}
CHAMPS	11	8	6	2002	2008	49.93±0.56^{ns}	2.83±0.06^{ns}	2.07±0.06^{ns}	4.46±0.08^{efg}	2.79±0.06^{def}	2.10±0.06^{fg}	2.66±0.06^{bcd}	0.01±0.06^{d}	0.20±0.09^{ns}	2.93±0.04^{bc}	1.02±0.02^{ns}
Runner lines						**49.03±0.35^{ns}**	**2.91±0.04^{ns}**	**2.02±0.04^{ns}**	**4.67±0.05$^{\alpha}$**	**3.01±0.04$^{\alpha}$**	**2.44±0.04$^{\alpha}$**	**2.54±0.04$^{\beta}$**	**0.14±0.03$^{\alpha}$**	**0.25±0.05^{ns}**	**2.95±0.03$^{\beta}$**	**1.03±0.01^{ns}**
C724-19-25	10	7	3	2006	2008	49.00±0.64^{ns}	2.92±0.07^{ns}	1.97±0.07^{ns}	4.65±0.09^{a-e}	3.05±0.06^{abc}	2.45±0.07^{a-d}	2.50±0.07^{def}	0.02±0.06^{d}	0.22±0.10^{ns}	2.99±0.05^{abc}	1.03±0.03^{ns}
CRSP708	3	3	1	2008	2008	46.79±0.99^{ns}	2.89±0.11^{ns}	2.01±0.11^{ns}	4.65±0.14^{a-f}	3.01±0.10^{a-d}	2.48±0.11^{a-d}	2.62±0.11^{b-f}	-0.02±0.10^{d}	0.30±0.15^{ns}	2.96±0.08^{abc}	1.02±0.04^{ns}
GA052524	3	3	1	2008	2008	47.31±0.99^{ns}	2.92±0.11^{ns}	2.05±0.11^{ns}	4.56±0.14^{a-g}	2.92±0.10^{b-e}	2.30±0.11^{c-g}	2.71±0.11^{bcd}	0.43±0.10^{ab}	0.30±0.15^{ns}	2.99±0.08^{abc}	1.12±0.04^{ns}
GA052527	3	3	1	2008	2008	50.13±0.99^{ns}	2.95±0.11^{ns}	1.98±0.11^{ns}	4.60±0.14^{a-g}	2.99±0.10^{a-e}	2.47±0.11^{a-d}	2.59±0.11^{b-f}	0.43±0.10^{abc}	0.26±0.15^{ns}	2.99±0.08^{abc}	1.06±0.04^{ns}
GA052529	3	3	1	2008	2008	47.68±0.99^{ns}	2.99±0.11^{ns}	2.05±0.11^{ns}	4.44±0.14^{c-g}	2.96±0.10^{a-e}	2.33±0.11^{b-f}	2.66±0.11^{b-e}	0.51±0.10^{a}	0.40±0.15^{ns}	2.89±0.08^{bc}	1.02±0.04^{ns}
TxL061816	3	3	1	2008	2008	51.32±0.99^{ns}	2.85±0.11^{ns}	2.05±0.11^{ns}	4.62±0.14^{a-g}	2.85±0.10^{c-f}	2.32±0.11^{b-f}	2.49±0.11^{c-f}	0.04±0.10^{d}	0.33±0.15^{ns}	2.93±0.08^{bc}	1.01±0.04^{ns}
TxL061821	3	3	1	2008	2008	49.33±0.99^{ns}	2.95±0.11^{ns}	1.95±0.11^{ns}	4.79±0.14^{abc}	3.05±0.10^{abc}	2.39±0.11^{a-e}	2.50±0.11^{c-f}	-0.02±0.10^{d}	0.23±0.15^{ns}	2.96±0.08^{abc}	1.03±0.04^{ns}
UF07303	6	6	2	2007	2008	49.44±0.71^{ns}	2.93±0.08^{ns}	2.08±0.08^{ns}	4.74±0.10^{a-d}	3.02±0.07^{abc}	2.39±0.08^{b-e}	2.42±0.08^{ef}	0.11±0.07^{d}	0.19±0.11^{ns}	2.92±0.05^{bc}	1.02±0.03^{ns}
UF07305	6	6	2	2007	2008	50.13±0.71^{ns}	2.86±0.08^{ns}	2.03±0.08^{ns}	4.71±0.10^{a-d}	3.03±0.07^{abc}	2.57±0.08^{ab}	2.40±0.08^{f}	0.06±0.07^{d}	0.15±0.11^{ns}	2.94±0.05^{bc}	1.00±0.03^{ns}
UF80301	3	3	1	2008	2008	48.65±0.99^{ns}	2.95±0.11^{ns}	1.98±0.11^{ns}	4.80±0.14^{ab}	3.18±0.10^{a}	2.66±0.11^{a}	2.46±0.11^{def}	0.08±0.10^{d}	0.20±0.15^{ns}	2.83±0.08^{c}	1.00±0.04^{ns}
Florunner	23	19	8	2001	2008	48.88±0.38^{ns}	2.97±0.04^{ns}	1.98±0.04^{ns}	4.72±0.05^{a-d}	3.03±0.04^{abc}	2.41±0.04^{bcd}	2.56±0.04^{c-f}	0.01±0.04^{d}	0.22±0.06^{ns}	3.03±0.03^{ab}	1.04±0.02^{ns}
Georgia Green	10	10	6	2002	2008	49.75±0.58^{ns}	2.75±0.07^{ns}	2.12±0.06^{ns}	4.73±0.08^{a-d}	3.03±0.06^{abc}	2.55±0.07^{abc}	2.50±0.06^{def}	0.05±0.06^{d}	0.21±0.09^{ns}	2.96±0.04^{abc}	1.05±0.02^{ns}
Mean						49.54	3.00	2.05	4.67	2.98	2.41	2.52	0.06	0.20	3.06	1.04
CV (%)						3.2	6.0	8.6	4.7	5.4	7.5	6.8	261.2	121.0	4.0	6.5

α,β Market-type means within a column followed by the same Greek letter are not significantly different by t-test (P<0.05).
a,b,c Line means within a column followed by the same Roman letter are not significantly different by t-test (P<0.05).
ns Denotes means for which the F-test of aggregate variation was not significant (P<0.05).

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Extension __ **Research** _X_
ON Campus
REPORT PERIOD **01/01/2009 – 12/31/2009**

IMPACT STATEMENT

Virginia-type extra large kernels have been replaced with runner-type jumbo kernels in some products including Planters dry roasted peanuts. The reason given by processors for this switch to runners is that the flavor of runner-type peanuts is superior to that of virginia-type. European processors have also indicated that their customers prefer the size of virginia-type peanuts but recognize the flavor disparity. These processors would use more virginia-type peanuts if their flavor measured up to that of runners. By developing virginia-type cultivars with flavor equal or superior to that of runner-type cultivars, we will eliminate this rationale for the use of runners over virginias. Our latest releases, the Bailey and Sugg cultivars, have superior flavor profiles. We hope that improved flavor of virginia-type peanuts will result in improvement of their marketability.