Maturity Effects on Sensory and Storage Quality of Roasted Virginia-Type Peanuts

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ABSTRACT

Virginia-type peanuts from two yrs were studied to determine differences in sensory and storage characteristics of five mesocarp-color based maturity classes. Peanuts were roasted, stored at 37°C, and sampled over 12 wk to evaluate flavor and oil. Higher intensities of roasted peanutty and sweet and lower painty flavors were found in the most mature classes. Painty increased more quickly in immature classes. Oxidative stability and fatty acid profiles indicated this change. Immature peanuts had lower flavor impact and deteriorated faster. Distributions at progressive harvest dates indicated more immature peanuts in the Extra Large Kernel grade at early harvest. Variability in sensory characteristics of maturity classes and changes in their distribution in size-based commercial grades indicate a high potential for maturity related flavor variation between lots.

Key Words: Arachis hypogaea, descriptive sensory, oil quality, maturity

INTRODUCTION

ATTAINING AND MAINTAINING CONSISTENT roasted flavor is important in peanut manufacturing operations. Variations in flavor may occur due to conditions in agronomic, environmental, and handling practices. Maturity has been consistently shown to affect peanut composition, quality, and flavor. Sanders et al. (1989a) evaluated flavor of medium grade size runner peanuts from hull scrape maturity classes and demonstrated that peanuts from mature pods had greater potential for full flavor than those from immature pods. Sanders et al. (1989b) reported that peanuts from immature classes developed more fruity-fermented off-flavor and less roasted peanut flavor than mature peanuts of the same size when all were cured in-shell at 16.8°C above ambient temperature.

The most apparent difference in peanut maturity has been found in large vs small peanuts. Sanders (1989) and Williams et al. (1987) demonstrated that within sized lots there were maturity distributions (percent of each maturity class) which could vary widely among lots. Williams and Drexler (1981), Sanders (1989), and Sanders and Bett (1995) studied many types of samples and demonstrated that maturity distributions were related to environmental and cultural practices including harvest date. As the maturity profile changes toward higher percentages of mature pods with increased time after planting, the percentage of mature seed in each commercial, seed-sized grade increases (Sanders, 1989; Sanders and Bett, 1995). Pattee et al. (1982) reported that the smallest screen size seed within various commercial sizes were of inferior quality and negatively affected the sensory quality.

Our objective was to determine the differences in sensory and storage characteristics of roasted virginia-type peanuts of different maturities. Because virginia-type peanuts are often consumed as cocktail or roasted-in-the-shell (ballpark type) peanuts, these data have relevance to the sensory quality and storability of individually consumed roasted peanuts. Additionally, changes in maturity distribution (percent of each maturity class) in commercial seed-sized grades were determined on progressive harvest dates to evaluate any potential effects on overall quality perception of lots which may be used in peanut butter or chopped nut products. Another objective was to further demonstrate the strong relationship between harvest date, maturity, and maturity distributions and peanut quality.

MATERIALS & METHODS

IN 1992 AND 1993 NC-9 (VIRGINIA-TYPE) peanuts (approximately 98 kg) were hand-harvested daily for 4-5 days from the North Carolina Dept. of Agriculture Peanut Belt Research Station in Lewiston. Peanut pods removed from the plants were subjected to gentle abrasion with a slurry of small glass beads in water to remove the exocarp and expose the mesocarp color which was evaluated for maturity class determination (Williams and Monroe, 1986). Pods were visually sorted into increasing maturity classes based on mesocarp color designated as yellow, orange A, orange B, brown, and black. Color class designations corresponded to classes previously described (Williams and Drexler, 1981; Williams et al., 1987). Pods in each class were counted to determine the maturity profile change over time.

Maintaining maturity class integrity, pods were placed in mesh bags and cured with ambient air until mean seed moisture was 7-8%. Peanuts in each maturity class were hand-shelled, and seeds were sized according to diameter over slotted hole screens as previously described (Sanders, 1989) to obtain the Extra Large kernel (ELK) commercial grade category (>7.9 mm width) for virginia-type peanuts (USDA, 1993). Based on the quantity of each maturity class harvested on a given date and the quantity of ELK seed in that class, the maturity distribution (percent of each maturity class) in the overall ELK size for that day was calculated. Weights for all pods and seeds were recorded. Pod and seed weights were analyzed using a Chi square test ($X^2$). Harvest date differences were found to be significant at $P = 0.01$.

Harvest date samples of ELK for each individual maturity class were combined to provide duplicate samples in each year. Roasting of samples was accomplished in a Farberware Roaster, Model 355 modified with a Watlow digital temperature controller to increase temperature stability (Fletcher, 1987). Initial temperature in the roaster was 27±2°C and the final temperature was 205±3°C for all roasts. To obtain similar roasting color (HunterLab 50±1), ELK peanuts of different maturity classes were roasted for increasing times from 26 to 31.5 min, with the longer times required for more mature peanuts (Sanders et al., 1989a). Duration of roast for different maturity classes was determined after preliminary test roasts of several maturity classes.

After roasting, peanuts were removed from the roaster and cooled for 20 min at 2°C. Peanuts were hand blanched and color was determined with a HunterLab colorimeter (Model D25-PC2). Roasted peanuts were sealed in airtight containers and placed in an incubator at 37±1°C for storage. Containers were opened and peanuts aerated at two day intervals. Samples were taken at 0, 4, and 12 wk for sensory analysis. Peanut paste was prepared with a Cuisinart food processor using a precise grind-cool protocol to maintain temperature <32°C (Sanders et al., 1989a). Peanut paste color was determined, and pastes were frozen at -20°C until sensory analysis.

Sensory analysis

Pastes were presented to a six-member panel trained in peanut flavor descriptive analysis. The panel was trained in the Flavor Descriptive Spectrum Analysis Technique (Meilgaard et al., 1987) to fully characterize the qualitative and quantitative aspects of peanut flavor. Samples were presented ran-
Table 1—Roast time and color of roasted peanuts and peanut pastes of Extra Large Kernel grade peanuts from hull scrape maturity classes

<table>
<thead>
<tr>
<th>Maturity classes</th>
<th>1992</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roast time Peanuts Paste</td>
<td>Roast time Peanuts Paste</td>
</tr>
<tr>
<td>Yellow</td>
<td>29.0 50.2 50.5</td>
<td>30.0 50.9 50.9</td>
</tr>
<tr>
<td>Orange A</td>
<td>28.0 50.3 50.3</td>
<td>30.5 49.7 49.6</td>
</tr>
<tr>
<td>Orange B</td>
<td>30.0 49.7 49.9</td>
<td>30.0 49.7 50.4</td>
</tr>
<tr>
<td>Brown</td>
<td>29.5 50.1 51.1</td>
<td>30.5 50.6 50.4</td>
</tr>
<tr>
<td>Black</td>
<td>29.0 50.5 50.4</td>
<td>31.5 49.1 49.6</td>
</tr>
</tbody>
</table>

*Pod mesocarp color

Prepared in Cuisinart food processor.

L value is a measure of light to dark determined with a Hunter colorimeter.

RESULTS & DISCUSSION

Roast color and sensory characteristics

Roast times for peanut and peanut paste colors of maturity classes were compared (Table 1). Buckholz et al. (1980) and Crippen et al. (1992) reported data demonstrating the effects of variable roast color on sensory and/or quality of roasted peanuts. Roast color was consistent among maturity classes and should preclude any differences related to degree of roast.

Roasted peanutty is the sensory descriptor most associated with the unique flavor of freshly roasted peanuts. Before storage, roasted peanutty intensity (Fig. 1) of the mature classes (orange B, brown and black) was higher (P ≤ 0.05) than that of immature classes (yellow and orange A). Initial roasted peanutty intensity for yellow and orange A was 3.3 and 3.7, respectively, whereas, intensities >4.6 were consistently found for mature classes.

Storage time affected the roasted peanutty flavor of all maturity classes (P ≤ 0.05) with general decreases occurring across storage time (Fig. 1). Changes in roasted peanutty intensity for all maturity classes after 4 wk, except for the black maturity class which declined only slightly. Roasted peanutty intensity of all classes declined after 12 wk of storage. However, even with the change in roasted peanutty intensity for the black maturity class, the final intensity was only slightly lower than the initial intensity of the yellow class. The general trend was that the mature seed consistently had a higher roasted peanutty intensity which remained high for a longer period of time than the immature seed.

Sweet taste intensity mean differences among maturity classes were significant (P ≤ 0.05) and more evident after 4 and 12 wk of storage than after the initial analysis (Fig. 1). Immature peanuts had sharper and more consistent decreases in this taste than did mature peanuts. Trends in these data parallel the changes found in roasted peanutty intensity and may be related to panelist perception of the sweet aromatic portion of the roasted peanutty descriptor. Sanders et al. (1989a, b) used descriptors roasted peanutty, sweet aromatic and sweet and found that mature runner-type peanuts had a lower intensity of sweet than did immature peanuts.

Woody/hulls/skins (Fig. 1) is an aromatic associated with the base flavor character notes in roasted peanuts. Intensity of woody/hulls/skins declined in yellow and orange A seed during storage (P ≤ 0.05). Changes in mature seed were not significant across storage, with exception of the orange B maturity class where woody/hulls/skins intensity decreased. These changes in base note character closely followed changes described in roasted peanutty and sweet taste and apparently were part of the overall loss of flavor (flavor fade) in roasted peanuts during storage.

The painty sensory descriptor is commonly associated with the general term “rancid” and strongly correlates with lipid degradation products such as aliphatic aldehydes, ketones, and alcohols (Litman and Numrych, 1978; Bett and Boylston, 1992). Immature seed had initial higher intensities of painty (Fig. 1) and its intensity in all maturity classes increased within 4 wk with the exception of the black maturity class (P ≤ 0.05). The painty intensity for the black maturity class increased by 12 wk of storage, while the intensity in the other maturity classes continued to increase but at a slower rate, with the exception of orange A. Sanders (1980a, b) and Sanders et al. (1982) conducted studies on oil composition changes with peanut maturation that indicated greater potential for lipid degradation in immature peanuts. Thus, sized lots containing higher percentages of immature peanuts are more likely to exhibit lipid degradation off-flavors such as painty. Some of the previous descriptors were potentially masked by the large increase in the painty descriptor. This hypothesis had been presented by Bett and Boylston (1992) in studies with different seed sizes and was supported by volatile analyses.

Lipid quality as a function of maturity

Changes in lipid quality with maturity have been identified (Sanders, 1980a,b). The
relative stability of various lipid fractions and compositions in peanuts is strongly related to fatty acid composition, especially oleic and linoleic acid content. Fore et al. (1953), Sanders et al., (1994), and Grimm et al., (1995) demonstrated relationships between oleic/linoleic acid ratio and oil stability. The oleic/linoleic ratio (Table 2) increased with increasing maturity as previously reported in runner-type peanuts (Sanders, 1980b). The relationship of O/L ratio to changes in intensity of the painty descriptor during storage, especially after 12 wk, was especially strong. Oxidative stability of oil from all maturity classes decreased with storage time (P ≤ 0.05) although changes were not uniform across all classes. Greater oxidative stability was observed for the more mature classes ( brown and black) than for the immature classes (yellow and orange A). The flavor descriptor painty (Fig. 1), associated with lipid degradation, closely paralleled changes observed in the oxidative stability index (Table 3). The yellow maturity class oxidative stability index changed from 10.23 to 1.86 over 4 wk and the intensity of the descriptor painty changed from 1.57 to 9.13. In contrast, the oxidative stability index values for the black maturity class decreased from 14.59 to 6.18 in 4 wk and the intensity of painty changed little over 4 wk of storage.

**Maturity-size-quality relationships**

The sensory quality of a seed sized commercial grade is based on the sensory characteristics and quantity of each maturity class present. The relative weights of each class make a quantitative contribution to the precursors for flavor generation. These in turn have been homogenized in pastes to give a uniform impression for the seed size. The sensory quality of peanuts eaten one or two days after harvest date while immature pods (yellow and orange A) decreased by 8%, while seed from mature pods increased by 8% in 1992.

Seed size distributions of the peanut maturity for the initial and final harvest dates for 1992 and 1993 were compared (Fig. 3) (χ²=6389.72, χ²=5094.47, χ²=5149.73, and χ²=9752.21, respectively). These size distributions indicate that within each maturity class a wide range of seed sizes were present. As pod maturity progressed, seed maturity progressed and the size distribution within a commercial lot was affected. All maturity classes contained seed ≥ Screen No. 20 (7.9 mm) which would be commercially sized into the Extra Large Kernel (ELK) grade. Because compositions and potential differences differ, the relative percentages of peanuts of each maturity class (maturity distribution) in a given commercial size would influence characteristics such as flavor/off-flavor potential, storability, and roast color variation.

Maturity distributions of peanuts in the Extra Large Kernel (ELK) grade for both years (Fig. 4) demonstrated the consistent relationship between size and maturity. ELK, being the largest seed size category in Virginia-type peanuts, contained high percentages of seed from mature pods (orange B, brown and black). Over the harvest dates, ELK seed from immature pods (yellow and orange A) decreased by 8%, while seed from mature pods increased by 8% in 1992 (χ²=662.16). A similar trend was evident in 1993 with a decrease of 11% in seed from
increased intensity of the flavor descriptor. roasted to the same color indicated a trend
towards roasted peanutty, woody/hulls/skins, and
sweet taste and decreased intensity of the
painty flavor descriptor as peanuts mature.

Data indicate that maturity distributions
(percentage of each maturity class) in sized
plots vary considerably. Those lots containing
higher percentages of mature peanuts
have higher potential for high roast peanut
intensity and higher potential for long shelf-
life. Sensory quality of individual peanut lots
is thus based on positive and negative aspects
of individual maturity class components and
their relative flavor contributions.

CONCLUSIONS

DESCRIPTIVE FLAVOR ANALYSIS OF DIFFERENT VIRGINIA-TYPE PEANUT MATURITY CLASSES

REFERENCES


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