Chemical Composition of Kernels in Virginia Market Type Cultivars Based on Pod Mesocarp Color

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Abstract

Pod mesocarp color is used to determine relative maturity of pods and subsequently to estimate kernel development and mass. Expression of the oleic acid content can be influenced by pod maturity in some cultivars. Research was conducted over two years in two separate fields each year to determine if expression of the high oleic trait in the cultivars Emery, Sullivan, and Wynne was maintained across pods expressing yellow, orange 1 and 2, brown, and black mesocarp colors. The main effect of cultivar and the interaction of cultivar by pod mesocarp color were not significant for oleic acid concentration in kernels and percent of maximum pod mass. However, the main effect of pod mesocarp color was significant for these measurements. When pooled over cultivars, percent of maximum pod mass was 36%, 61%, 74%, 83%, and 92% for pods expressing yellow, orange no. 1, orange no. 2, brown, and black pod mesocarp color designations, respectively, based on official USDA standards. Oleic acid content was similar for brown and black pods and expression exceeded that of pods expressing yellow orange no. 1, and orange no. 2 colors. The order for oleic acid expression for other pod mesocarp colors was orange no. 2>orange no. 1>yellow. Regardless of pod mesocarp color, oleic acid expression was adequate for peanut to be considered high oleic based current industry standards.

Introduction

Determining the appropriate harvest date for peanut can be difficult due to the indeterminant growth nature. Harvesting too early can result in reduce quality and yield. For high oleic peanuts, harvesting too early can mean a reduced expression of high oleic acid. For high-oleic peanuts to be accepted, 95 out of 100 kernels must pass the minimum fatty acid chemistry threshold (Sweigart et al., 2011). This threshold consists of a 74% minimum oleic acid concentration found in individual kernels (Knauft et al., 2000). If kernels do not meet this minimum threshold it is possibly they are either too immature to express the appropriate concentration of oleic acid or the kernels may be contaminated with normal oleic kernels (Davis et al., 2017). High oleic peanuts exhibit over 14 times greater oxidative stability when compared to normal oleic peanuts, resulting in a longer shelf-life (Braddock et al., 1995). High oleic peanuts are also known to maintain flavor quality longer than normal oleic peanuts due to a slower decline in peanutty flavor over time (Braddock et al., 1995).

The objective of this research is to examine the relationship between oleic acid expression and pod maturity/mesocarp color.

Experimental Design

- Peanut was planted in 2017 and 2018 in Lewiston-Woodville, NC.
- Peanut was planted in two locations each year.
- Peanut was planted at mid and late-May each year.
- Four cultivars were planted (3 high oleic, 1 normal oleic).
- Planting was in a randomized complete block design with four replications.
- Peanut was harvested at five different harvest dates (100, 110, 120, 130 and 140 days after planting).

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Materials and Methods

Peanut maturity was determined using the hull-scrape method as described by Williams and Drexler (1981). Data collected included yield distribution and weights of peanut kernels based on classification of color, total oil content, fatty acid content, tocopherol content and sugar content. Oil content was determined using nuclear magnetic resonance (NMR). Peanut oil was then extracted using a hydraulic press and analyzed for fatty acid methyl esters using gas chromatography (GC) and tocopherols using high performance liquid chromatography (HPLC). Carbohydrate analysis was performed on peanut fresh weigh using HPLC. Data was subjected to analysis of variance (ANOVA) using SAS 9.4 (SAS Institute Inc., Cary, NC). Data are pooled over years and means were separated using Fisher's protected least significant difference test or a t-test for main effects at $p \leq 0.05$.

Results

Table 1. Average seed weight in grams (g)

Variety	Yellow	Orange 1	Orange 2	Brown	Black
Bailey	0.458a	0.659c	0.829e	0.945fg	0.995gh
Emery	0.508ab	0.776de	0.941fg	1.043hi	1.112jk
Sullivan	0.462a	0.725d	0.818e	0.922f	0.9823g
Wynne	0.541b	0.795e	0.985g	1.068ij	1.139k

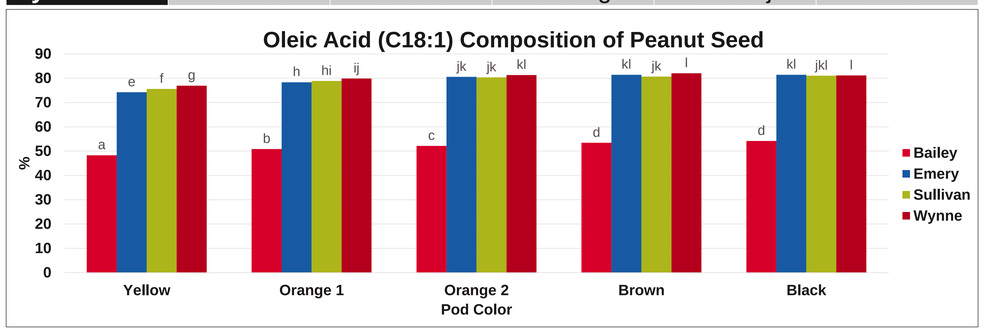

Figure 1. Percent of oleic acid (C18:1) fatty acid composition in peanut seed for each pod mesocarp color.

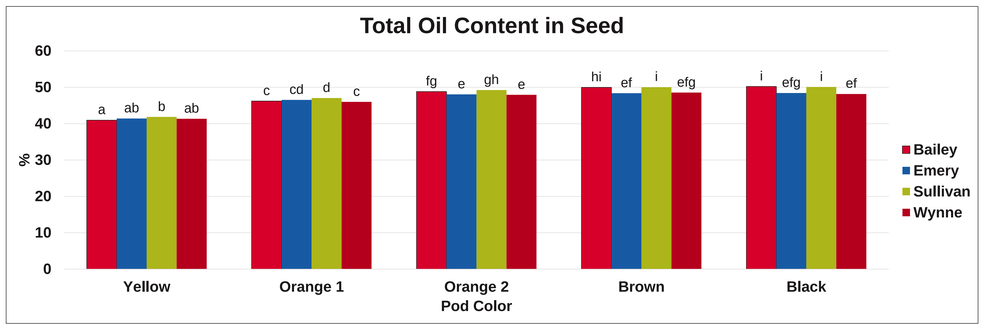

Figure 2. Percent of total oil content in peanut seed for each mesocarp color.

Resources

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Results continued…

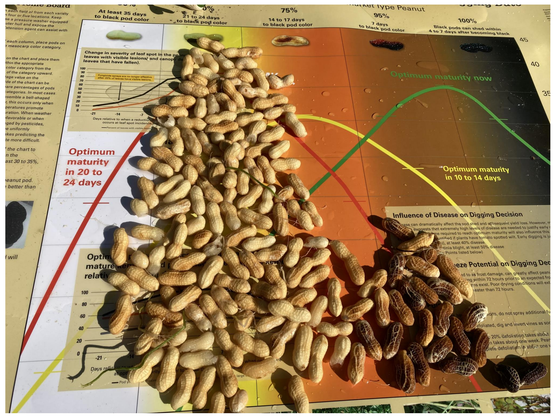

Figure 2. Peanut pods with mesocarp color exposed indicating that optimum pod maturity for digging and vine inversion is approximately three weeks later.

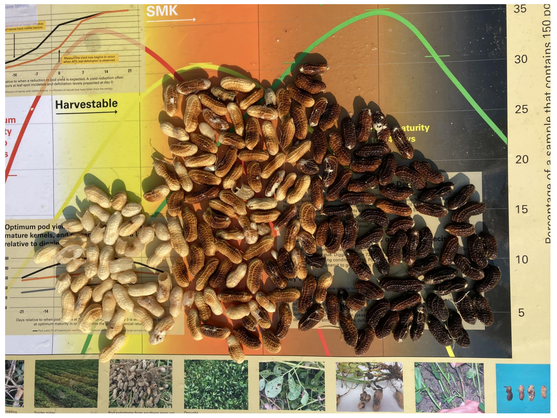

Figure 3. Peanut pods with mesocarp color exposed indicating that optimum pod maturity for digging and vine inversion is approximately one week later.

Summary and Conclusion

In conclusion, high oleic cultivars such as Emery, Sullivan, and Wynne exhibited adequate oleic acid to be considered high oleic according to industry standards for all pod colors shown (Figure 1). Table 1. depicts pods with a yellow mesocarp color to be approximately half the weight of pods with black mesocarp colors. Figures 3 and 4 depict the change in pod maturity over two weeks. This information is important for growers as it displays the importance of waiting until optimum maturity to harvest due to the impact it can have on pod quality and yield.