25th Annual Southern Peanut Growers Conference
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Westin Savannah Harbor Golf Resort & Spa
Savannah, Georgia

New Uses for Domestic Peanuts & Opportunities for Market Expansion

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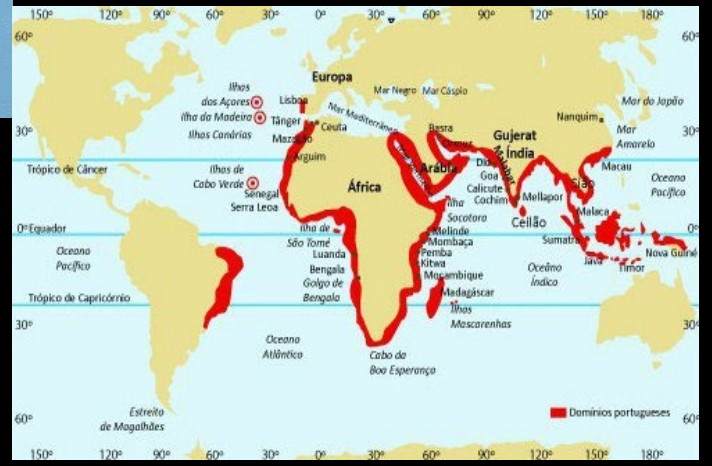
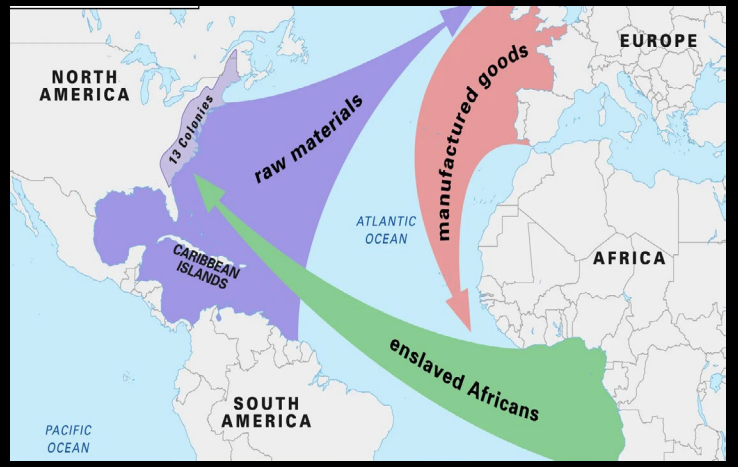
Peanut History-Food to Livestock Feed

- The peanut is a natural hybrid of two wild species originating in South America (now Bolivia) 10,000 years ago.
- 16th and 17th Century- the Spanish transported peanuts via trade routes to Spanish & Portuguese territories (Americas, China, India, and west Africa).
- Peanuts (groundnuts) were introduced to North America through Africa via the transatlantic slave trade and later termed the “goober” in the U.S. South.

Spanish and Portuguese Empires

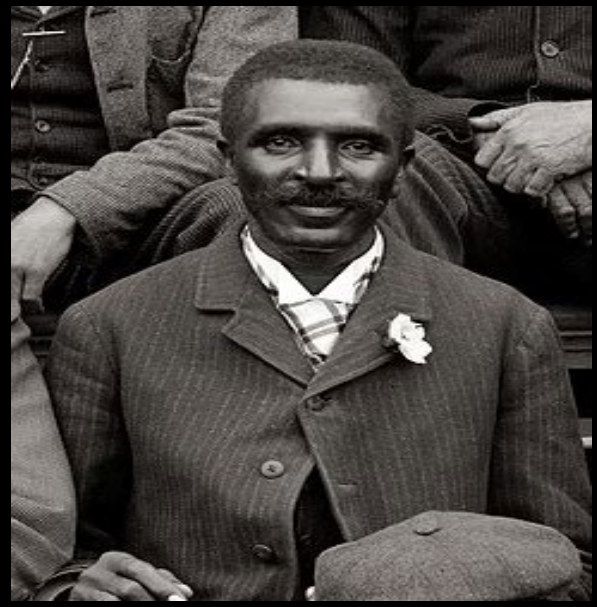


Transatlantic Slave Trade Route



Peanut History-Food to Feed

- Early 1800s, peanuts were cultivated by communities of enslaved persons and utilized for food and feed for livestock in the southern United States.
- Carver encouraged formerly enslaved & new sharecroppers to cultivate peanuts to rectify the widespread nutrient depletion and erosion in southern soils caused by the monoculture of cotton. As nitrogen-fixing legumes, peanuts could return nutrients to the soil as part of a crop rotation that would boost the yield of future cotton plantings.



Dr. George Washington Carver

Peanut History-Food for the American People

- During the U.S. Civil War, the popularity of peanuts grew as a readily available food source and peanut oil replaced embargoed northern whale oil as machinery lubricant.

- After the Civil War, the use of peanut spread (peanut butter) expanded throughout the U.S. and the production of peanuts was popularized by Dr. George Washington Carver, as a pioneering agricultural scientist (c.1864–1943)

Dr. George Washington Carver
Tuskegee University, Alabama,
300 Identified Uses for Domestic Peanuts

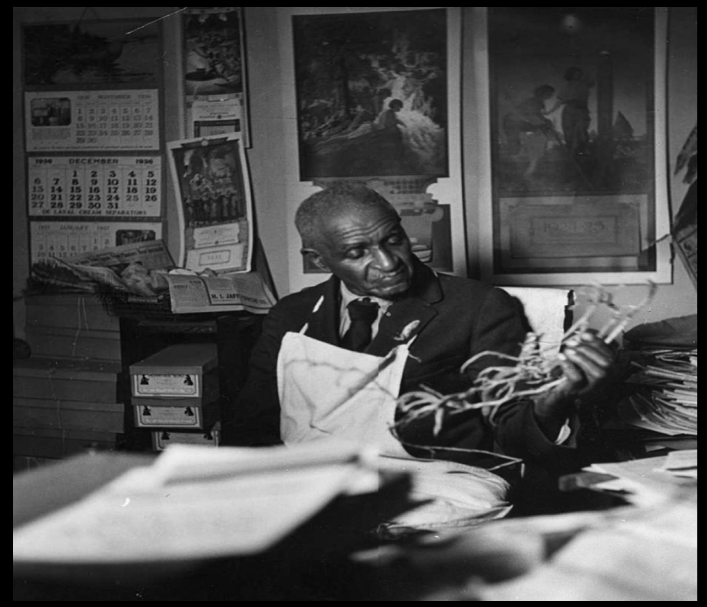
- Carver promoted peanut production on a local and a national scale.

- Foods-soups, cookies, candies, peanut oil, peanut milk, coffee, mayonnaise and other recipes

- Animal Feed from peanuts
  - Peanut hearts feed for egg-laying hens
  - Peanut Meal
  - Peanut Hull Meal
  - Peanut Hull Bran
  - Peanut Hull Stock Food
  - Hay from the dried peanut plant.
  - Hogs fed a diet of peanuts and corn produced high quality hams and bacon

George Washington Carver
300 Identified Uses for Domestic Peanuts

- Cosmetics- Lotion, Face Cream, Shaving cream, Scalp pomade, Peanut oil shampoo, Soap
- Colorants-Dyes for leather & cloth, wood stains, paints
- Paper- Whole peanut plant, peanut skin fibers.
- General Uses-Fuel Brickettes, Paper from vines/hulls/skins, Axel Grease, Diesel fuel, Rubber, Charcoal from shells, Soil conditioner

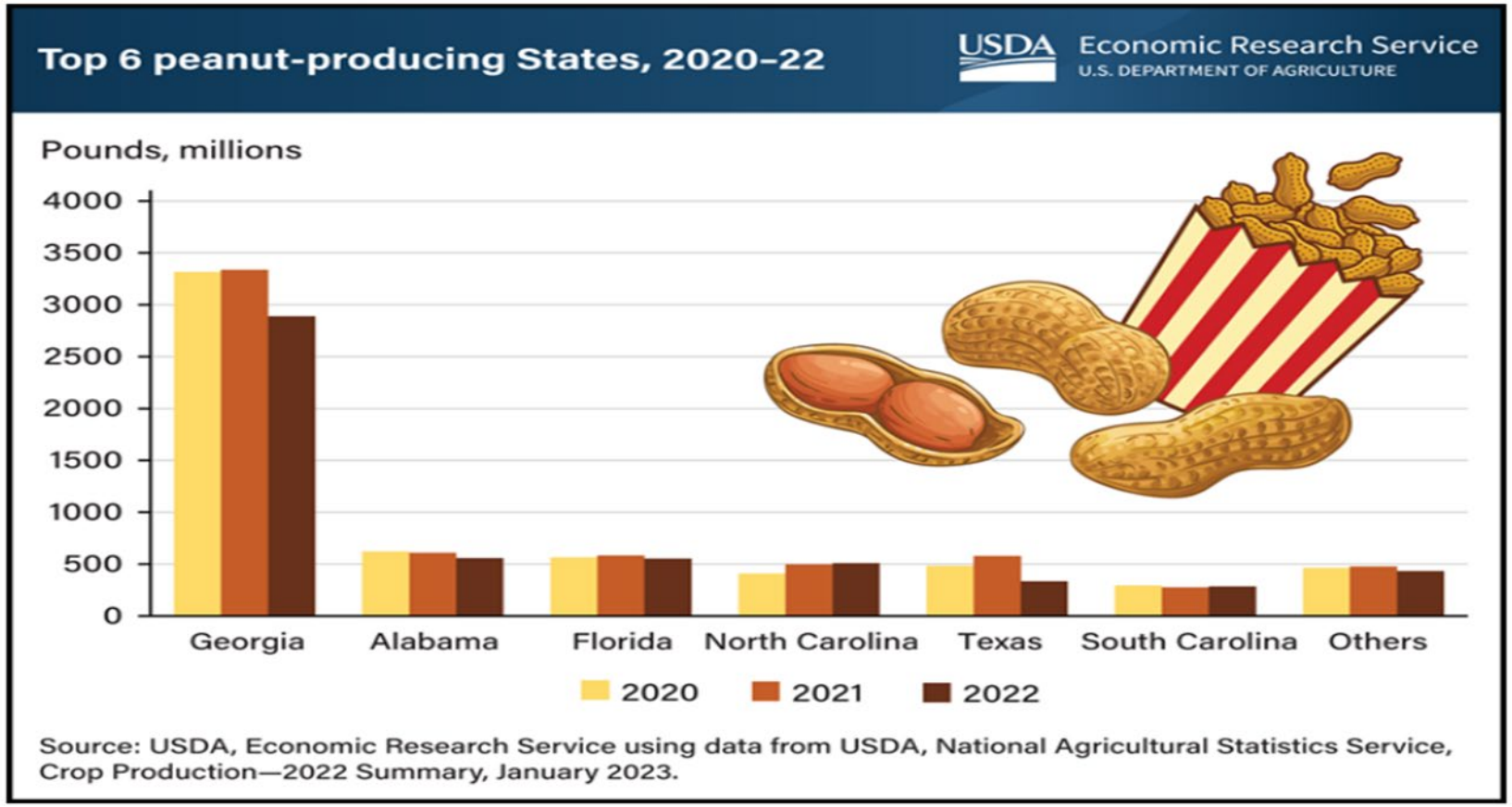


His inventiveness led to Peanuts becoming one of the six most produced crops in the U.S. by the 1940s.

Dr. Carver raised the peanut from a lowly legume to a cash crop that helped save the South's farming economy.

U.S. Peanut Production

USDA's National Agricultural Statistics Service, 2023



- The U.S. peanut crop in 2022 was estimated at 5.57 billion pounds from 1.45 million acres.

- In 2023, around 5.89 billion pounds of peanuts were produced in the United States.

Most U.S. peanut production comes from six States:
Georgia, Alabama, Florida, North Carolina, Texas and South Carolina.

Current Domestic Utilization of Peanuts

- **About 60% of the peanuts are used for peanut butter.**

- **About 15% of the crop is crushed for oil, which produces peanut meal and flour as byproducts.** Peanut Profile | Agricultural Marketing Resource Center (agmrc.org)
  - **PEANUT MEAL**-animal feed .
  - **PEANUT FLOUR-**alternative to regular flour.

- **25% is used as in shell snacks, candy and confections**

https://nationalpeanutboard.org/news/celebrate-record-breaking-peanut-butter-consumption-during-pb-lovers-month-and-beyond/

Food Science and Market Quality & Handling Research Unit

National Program 306-Product Quality and New Uses

Mission

Enhance the marketability of agricultural products, increase the availability of healthful foods, develop value-added food and nonfood products and enable commercially-preferred technologies for post-harvest processing.

Program Vision

Research is focused on developing knowledge and enabling commercially-viable technologies to

1. measure and maintain/enhance post-harvest product quality,

2. harvest and process agricultural materials, and

3. create new value-added products.

Hence, my research program aims to identify NEW USES for PEANUTS as VALUE-ADDED FEED or FOOD PRODUCTS to ENHANCE THE AVAILABILITY OF HEALTHFUL FOODS and to CREATE NEW VALUE-ADDED PRODUCTS.

Project Justification
Intersection of Peanuts & Poultry

The U.S. Southeast predominates in the production of Peanuts and Poultry. The need for poultry feed components far exceeds the ability to produce these ingredients regionally.

Thus, the use of peanuts as a poultry feed ingredient may serve to enhance the nutritional quality of poultry products produced within this region while supporting greater sustainable community focused agriculture.

Seven Layer High-Oleic Peanut Feeding Trials
Three Broiler High-Oleic Peanut Feeding Trials
Two Fish High-Oleic Peanut Feeding Trials

Layer High-Oleic Peanut Feeding Trials

Replacement of Soybean Meal w/ Peanuts

Toomer *et al.* 2019 Poultry Science 98:1732-1748

Trmt	Ave Wkly Eggs Produced	Wk 10 Body Weight (g)	Wk 10 Ave FCR (g egg /g feed)
SBM + Corn	6.4 ± 0.24	1505 ± 37	0.533 ± 0.02[a] (1.87)
20% HO PN + Corn	6.3 ± 0.24	1435 ± 37	0.466 ± 0.02[b] (2.15)
P - value	0.81	0.19	0.01

48 hens per treatment

Toomer *et al.* 2021 Agriculture 11:771

Trmt	Wk 8 Body Weight (g)	Total # Eggs Produced	Total Ave Egg Weights (g)	FCR (kg feed/dozen)
SBM + Corn	2257 ± 54	1598 eggs	68 ± 1.7	2.4 ± 0.09
20% HO PN + Corn	2128 ± 54	1617 eggs	66 ± 1.7	2.2 ± 0.09
3% Oleic Acid + SBM + Corn	2185 ± 54	1665 eggs	65 ± 1.7	2.1 ± 0.09
P - value	0.06	0.09	0.18	0.07

100 hens per treatment

Layer High-Oleic Peanut Feeding Trials

Supplementation of Diets with Peanuts

Toomer *et al.* 2021 Agriculture 11:1176

Trmt	Wk 6 Body Weight (kg)	Total Dozen Eggs Produced	Ave Egg Weights (g)	FCR (kg feed/dozen)
SBM + Corn	1.61 ± 0.03	120 ± 1.40^{b}	57.1 ± 1.7	1.26 ± 0.01^{b}
8% HO PN + Corn	1.64 ± 0.03	126 ± 1.40^{a}	57.1 ± 1.7	1.34 ± 0.01^{a}
4% Whole In-Shell Peanuts	1.66 ± 0.03	122± 1.40^{ab}	57.3 ± 1.7	1.33 ± 0.01^{a}
P - value	0.46	0.01	0.21	<0.0001

100 hens per treatment

Toomer *et al.* 2023 Int. J. Poult. Sci., 22 (1): 73-83

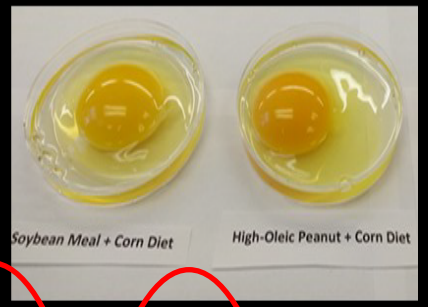
Trmt	Wk 6 Body Weight (kg)	Hen day Production	Ave Egg Weights (g)	FCR (g egg/g feed)
SBM + Corn	1.61 ± 0.04	92.9 ± 1.13^{b}	58.1 ± 0.41	0.56 ± 0.01
8% HO PN + Corn	1.64 ± 0.04	95.9 ± 1.13^{a}	58.5 ± 0.41	0.53 ± 0.01
4% Sweet Potato + Corn	1.65 ± 0.04	92.0 ± 1.13^{b}	58.2 ± 0.41	0.54 ± 0.01
P - value	0.85	0.01	0.35	0.05

100 hens per treatment

Layer High-Oleic Peanut Feeding Trials

Replacement of Soybean Meal w/ Peanuts

Toomer *et al.* 2019 Poultry Science 98:1732-1748



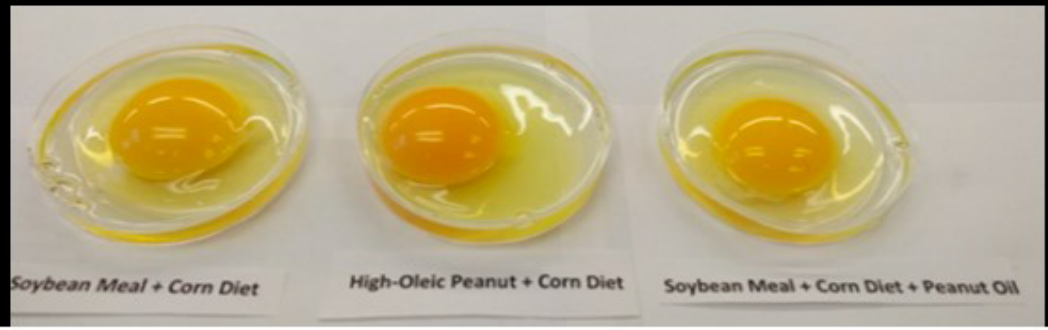
Trmt	Wk 10 Egg Wt (g)	Wk 10 Haugh Unit	Wk 10 Albumen Height (mm)	Wk 10 Yolk Color Score	Wk 10 Beta-Carotene (ppm)
SBM + Corn	59.5 ± 0.7[a]	88.1 ± 0.8	7.82 ± 0.2	2.87 ± 0.15[b]	8.3 ± 0.26[b]
20% HO PN + Corn	57.1 ± 0.7[b]	87.9 ± 0.8	7.64 ± 0.2	5.96 ± 0.15[a]	12.4 ± 0.36[a]
P - value	0.02	0.86	0.41	<0.0001	<0.0001

Toomer *et al.* 2021 Agriculture 11:771

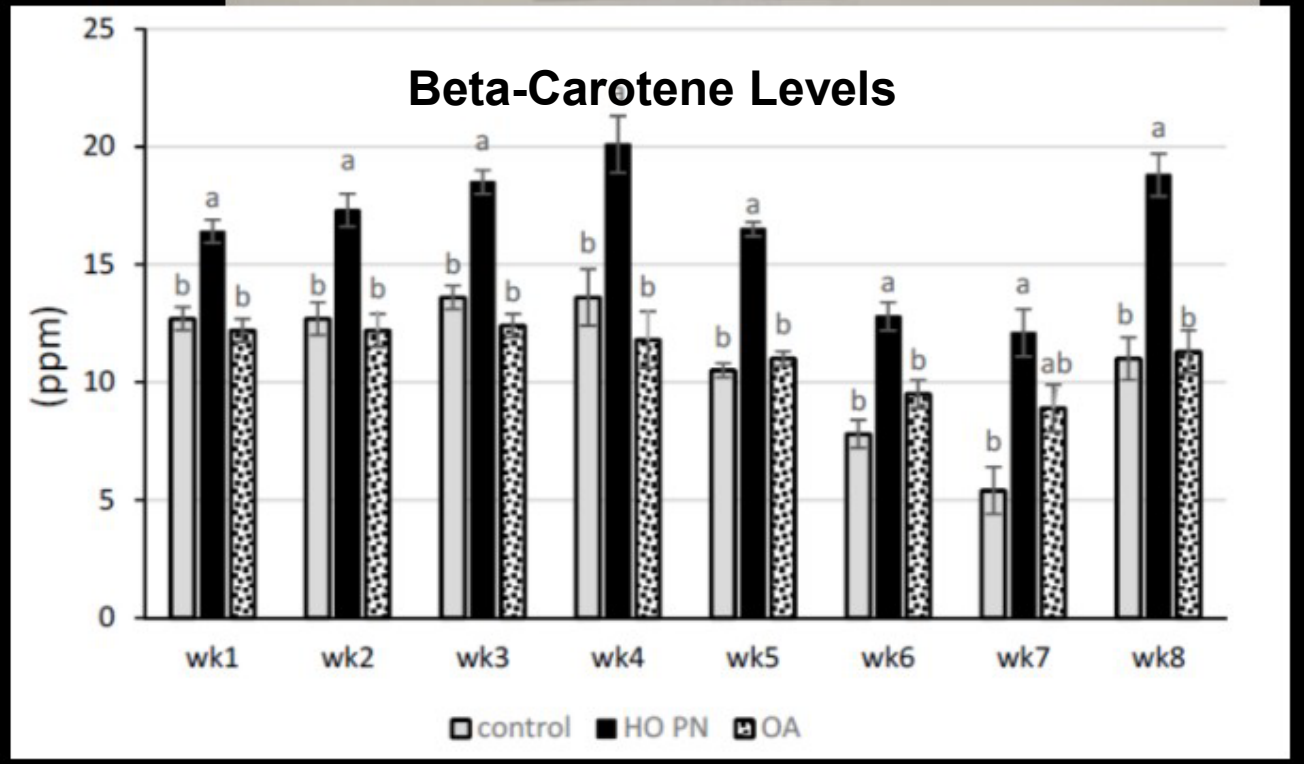
Trmt	Wk 8 Shell Force (N)	Wk 8 Vitelline Membrane Strength (N)	Wk 8 Haugh Unit
SBM + Corn	4833 ± 102	0.23 ± 0.004	92.7 ± 0.71
20% HO PN + Corn	5080 ± 102	0.24 ± 0.004	93.6 ± 0.71
3% Oleic Acid + SBM + Corn	4946 ± 102	0.24 ± 0.004	92.9 ± 0.71
P - value	0.23	0.36	0.60

Layer High-Oleic Peanut Feeding Trials
Replacement of Soybean Meal w/ Peanuts

Toomer *et al.* 2021 Agriculture 11:771



Trmt	Wk 8 Ave Yolk Color Score
SBM + Corn	4.9 ± 0.10^{c}
20% HO PN + Corn	6.7 ± 0.10^{a}
3% Oleic Acid + SBM + Corn	5.4 ± 0.10^{b}
P - value	<0.0001



Layer High-Oleic Peanut Feeding Trials

Supplementation of Diets with Peanuts

Toomer *et al.* 2021 Agriculture 11:1176

Trmt	Wk 6 Shell Force (N)	Wk 6 Albumen Height (mm)	Wk 6 Haugh Unit	Wk 6 Yolk Color	Wk 6 Beta-Carotene (ppm)
SBM + Corn	5252 ± 251	8.34 ± 0.24	91.5 ± 1.2	2.92 ± 0.2	b 2.41 ± 0.6
8% HO PN + Corn	5164± 251	8.26 ± 0.24	90.9 ± 1.2	2.50 ± 0.2	b 2.49 ± 0.6
4% Whole In-Shell Peanuts	5675 ± 251	8.50 ± 0.24	91.5 ± 1.2	2.54 ± 0.2	a 3.82 ± 0.6
P - value	0.18	0.79	0.94	0.05	0.04

Toomer *et al.* 2023 Int. J. Poult. Sci., 22 (1): 73-83

Trmt	Wk 6 Shell Force (N)	Wk 6 Albumen Height (mm)	Wk 6 Haugh Unit	Wk 6 Yolk Color	Wk 6 Beta-Carotene (ppm)
SBM + Corn	5252 ± 273	8.34 ± 0.23	91.5 ± 1.2	6.9 ± 0.2[a]	2.4 ± 0.4
8% HO PN + Corn	5164 ± 273	8.26 ± 0.23	90.9 ± 1.2	6.5 ± 0.2[b]	2.5 ± 0.4
4% Sweet Potato + Corn	5487 ± 273	8.16 ± 0.23	90.0 ± 1.2	7.0 ± 0.2[a]	2.7 ± 0.4
P - value	0.65	0.74	0.50	0.003	0.65

Layer High-Oleic Peanut Feeding Trials

Toomer *et al.* 2019 Poultry Science 98:1732-1748

Replacement of Soybean Meal

Trmt	Wk 10 Total Cholesterol (mg/100g)	Saturated Fats: Wk 10 Palmitic Acid (g/100g)	Saturated Fats: Wk 10 Stearic Acid (g/100g)	Wk 10 Oleic Acid (g/100g)
SBM + Corn	360.4 ± 6.3[b]	26.9± 0.2[a]	8.1 ± 0.1[a]	41.6 ± 0.46[b]
20% HO PN + Corn	391.5 ± 6.4[a]	21.0 ± 0.2[b]	6.0 ±0.1[b]	56.0 ± 0.47[a]
P - value	<0.0001	<0.0001	<0.0001	<0.0001

Toomer *et al.* 2021 Agriculture 11:1176

Supplementation of Diets with Peanuts

Trmt	Wk 6 Total Cholesterol (mg/100g)	Saturated Fats: Wk 6 Palmitic Acid (g/100g)	Saturated Fats: Wk 6 Stearic Acid (g/100g)	Wk 6 Oleic Acid (g/100g)
SBM + Corn	264 ± 39	21.4 ± 0.5	8.63 ± 0.3[a]	30.3 ± 5.8
8% HO PN + Corn	244 ± 39	21.2 ± 0.5	7.03 ± 0.3[b]	37.6 ± 5.8
4% Whole In-Shell Peanuts	326 ± 39	21.3 ± 0.5	8.13 ± 0.3[a]	35.4 ± 5.8
P - value	0.19	0.64	<0.0001	0.56

Layer High-Oleic Peanut Feeding Trials

Toomer *et al.* 2023 Int. J. Poult. Sci., 22 (1): 73-83

Supplementation of Diets with Peanuts

Saturated Fats

Trmt	Wk 6 Total Cholesterol (mg/100g)	Wk 6 Palmitic Acid (g/100g)	Wk 6 Stearic Acid (g/100g)	Wk 6 Oleic Acid (g/100g)
SBM + Corn	264 ± 33	21.4 ± 0.5	8.63 ± 0.3^{ab}	30.3 ± 5.0
8% HO PN + Corn	244 ± 33	21.2 ± 0.5	7.03 ± 0.3^{b}	37.6 ± 5.0
4% Sweet Potato + Corn	212 ± 33	21.0 ± 0.5	9.0 ± 0.3^{a}	28.2 ± 5.0
P - value	0.21	0.15	<0.0001	0.27

Broiler High-Oleic Peanut Feeding Trials

Supplementation of Diets with Peanuts

Toomer *et al.* 2020 Poultry Science 99(4):2236
Toomer *et al.* 2019 Poultry Science 98:5188–5197

Broiler High-Oleic Peanut Feeding Trials

Trmt	Wk 6 Body Weight (kg)	Wk 6 Ave FCR (g egg /g feed)
SBM + Corn	2.55 ± 0.04^{ab}	1.56 ± 0.03^{b}
10% HO PN + Corn	2.43 ± 0.04^{b}	1.62 ± 0.03^{a}
3% Oleic Acid Oil + SBM + Corn	2.59 ± 0.04^{a}	1.56 ± 0.03^{b}
P - value	0.03	<0.01

Broiler High-Oleic Peanut Feeding Trials

Supplementation of Diets with Peanuts

Toomer *et al.* 2020 Poultry Science 99(4):2236
Toomer *et al.* 2019 Poultry Science 98:5188–5197

Broiler High-Oleic Peanut Feeding Trials

Trmt	Hot carcass weight (g)	Breast major	Breast minor	Wing	Frame
SBM + Corn	2018 ± 17[a]	552 ± 10.5[a]	128 ± 2.2[a]	185 ± 1.9[ab]	439 ± 5.3[a]
10% HO PN + Corn	1925 ± 17[b]	510 ± 10.5[b]	120 ± 2.2[b]	181 ± 1.9[b]	416 ± 5.3[b]
3% Oleic Acid Oil + SBM + Corn	2019± 17[a]	561 ± 10.5[a]	126 ± 2.2[ab]	190 ± 1.9[a]	433 ± 5.3[ab]
P - value	<0.01	<0.01	0.03	<0.01	<0.01

NO DIFFERENCES: % BREAST YIELD, LEG QUARTER, % LEG YIELD, SKIN, FAT PAD, % FRAME YIELD

Broiler High-Oleic Peanut Feeding Trials

Supplementation of Diets with Peanuts

Toomer *et al.* 2020 Poultry Science 99(4):2236
Toomer *et al.* 2019 Poultry Science 98:5188–5197

Broiler High-Oleic Peanut Feeding Trials

Trmt	Wk 6 Linoleic Acid (g/100g)	Saturated Fats Wk 6 Palmitic Acid (g/100g)	Wk 6 Stearic Acid (g/100g)	Wk 6 Oleic Acid (g/100g)
SBM + Corn	17.0 ± 1.4[a]	24.8 ± 0.7[a]	7.7 ± 0.2[a]	35.9 ± 2.5[b]
10% HO PN + Corn	10.6 ± 1.4[b]	19.4 ± 0.7[b]	6.1 ± 0.2[b]	55.1 ± 2.5[a]
3% Oleic Acid + SBM + Corn	13.6 ± 1.4[ab]	16.2 ± 0.7[c]	5.5 ± 0.2[b]	55.3 ± 2.5[a]
P - value	0.0005	<0.0001	0.0002	<0.0001

Overall-Eggs Produced from Hens fed an Unblanched High-Oleic Peanut Diet

Replacement of Soybean Meal

- ↑ Yolk Color
- ↑ Beta-Carotene (Pro-Vitamin A)
- ↑ Oleic Acid
- ↓ Saturated Fats
  Palmitic & Stearic Acid
- ↓ Egg Weights
  USDA Grade A-large eggs

Supplementation of Diets with Peanuts

- ↑ Egg production
- ↑ Beta-Carotene (Pro-Vitamin A)
  4% whole in shell peanuts only
- ↑ Oleic Acid
- ↓ Saturated Fats
  Stearic Acid only

Hyde County, NC-Economic Opportunity

3.5 Million Layers in Hyde County, NC layer operations

875,000 pounds (437.5 tons) of layer feed per day

159,688 tons of layer feed per year produced in Hyde County, NC.

At 5% inclusion of High Oleic Peanuts in the diets of layers

7,984 tons peanuts per year

Peanut Price ≈$625/ton ($425/ton in shell farmer price + $200/ton to shell)

≈$4,990,000 Sales Annually

Dr. Kenneth Anderson, Extension Specialist and Professor Commercial Layer and Small Flock Management, Prestage Department of Poultry Science, NC State University.

State of NC-Economic Opportunity

NC total 9 Million Layers

2.25 million pounds of layer feed per day

405, 0000 tons of layer feed per year produced in NC.

At 5% inclusion of High Oleic Peanuts in the diet of layers

20,250 tons of peanuts per year

Peanut Price ≈$625/ton ($425/ton in shell farmer price + $200/ton to shell)

≈$12, 656,250 Sales Annually

NC Egg Association, 2024. Meet NC Egg Farmers - NC Egg Association

Domestic Economic Opportunity

In 2022, 305 Million Layers in the U.S. (NASS, 2023)

76.25 million pounds of layer feed per day
(38,125 tons/day)

14 million tons of layer feed per year produced in U.S.

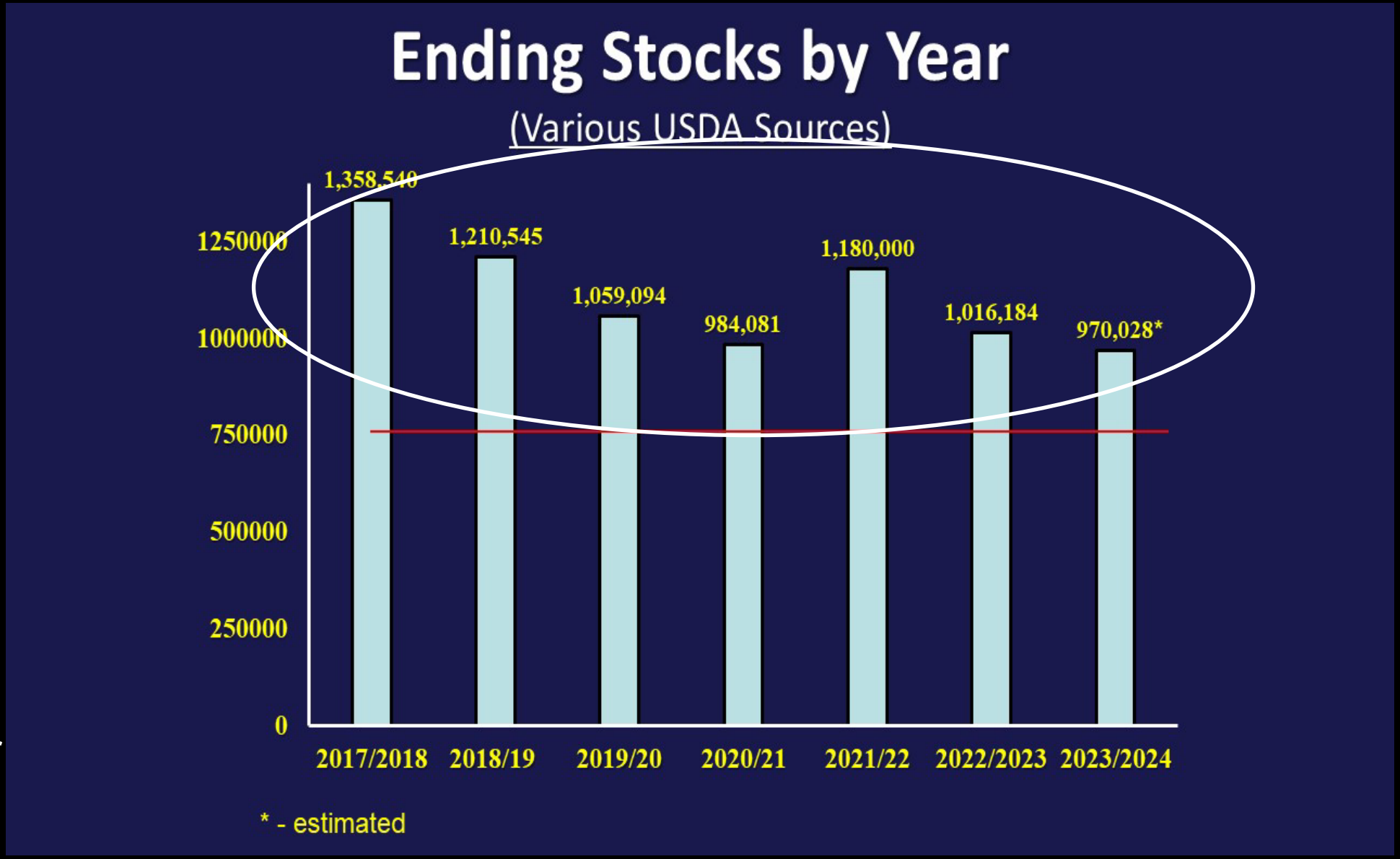
At 5% inclusion of High Oleic Peanuts in the diet

700,000 tons of peanuts would be consumed in the diets of layer in the U.S. annually

Peanut Price ≈$625/ton ($425/ton in shell farmer price + $200/ton to shell)
≈$437,500,000 Sales Annually

Annual Oversupply of Peanuts

- **Utilization of Annual Oversupply of Peanuts.**
  - In the 2021 growing season, the U.S. peanut crop exceeded consumption resulting in a **1.18 million tons** of carryover to 2022.



Potential Benefits- Peanut Industry

- Economic Opportunities
- Utilization of Annual Over Supply of Peanuts
- Market expansion of domestic peanuts

Potential Benefits- Poultry Industry

- Improved animal health.
- Improved Nutritional Quality of Egg and Poultry Meat Products using regionally sourced natural feed ingredients.
  - Enrichment with monounsaturated fatty acids
  - Reduced saturated fats
  - Potential Enrichment of Eggs with Beta-Carotene
  - Increased shelf-life of finished poultry feed with incorporation of high-oleic peanuts
  - Enhanced egg yolk color and carcass skin color

Potential Benefits- Consumer

- Improved Nutritional Quality of Eggs and Poultry Meat
  - Enrichment with monounsaturated fatty acids
  - Reduced saturated fats
  - Potential Enrichment of Eggs with Beta-Carotene

Future Directions

- Econometric Analysis- Layers- Dr. Michael Best
  - Director, EFM, & Assistant Teaching Professor
- Dose Response NO and HO PN Poultry Feeding Trials
- Data analysis of High-Oleic Peanut Fish Feeding Trials

Dr. Michael Best,

Director, Executive Farm Management, & Assistant Teaching Professor, Agriculture Economics, NCSU

Funding Provided By:

- Food Science & Market Quality & Handling Research Unit
- NC Peanut Growers Association (2017-2019)
- ARS Innovation Funds 4th, 6th, 10th, 12th, 18th
- 2024 Georgia Peanut Commission
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