APPLICATIONS OF COLORED SORGHUM IN FOOD PRODUCTS

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Traditional uses of Specialty Sorghums

• In East and Southern Africa, brown (tannin) sorghums have been used for stomach ailments.

• Traditional foods made from sorghum are
  – Porridges
  – Cous Cous
  – Flat Breads
  – Cooked Whole Grain
Varieties of Sorghum

- A Wide Range of Colors and bioactive compounds are present in sorghum.
  - White
  - Red
  - Black
  - Brown (tannin)
  - Yellow
Pericarp Color

— Controlled by the R and Y genes

White

\[ R_{yy} \]

\[ rr_{yy} \]

Yellow

\[ rr_{Y}\_ \]

Red

\[ \_R_{Y}\_ \]

Black
Non-Tannin vs. Tannin Sorghums

Testa

Tannin Sorghum

Non-Tannin Sorghum

(Adapted from Earp et al. 2004)
Tannin Content

FGIS/GIPSA Class

- Sorghum
  - No Tannins
    - Genetics: $b_1b_1B_2$  
  - Tannin Sorghum
    - Low Tannins
      - Genetics: $B_1b_2b_2$  
    - High Tannins
      - Genetics: $B_1B_2$  

- Tannin Sorghum
  - Low Tannins
    - Genetics: $b_1b_1B_2$  
  - High Tannins
    - Genetics: $B_1B_2$
Tannin Sorghums

- Most sorghums do not contain tannins
- All sorghums contain phenol compounds
- Only brown or tannin sorghums contain condensed tannins
- Exhibit a reduced feed efficiency
- Tannins bind proteins and complexes with minerals
Antioxidant Activity Among Cereal Grains

![Bar graph showing antioxidant activity among various cereal grains, adapted from Guajardo-Flores et al. 2006.](image)

Adapted from Guajardo-Flores et al. 2006
Benefits of Specialty Sorghums

• Tannin sorghums are high in antioxidants which exhibit anti-cancer activity

• Sorghum is the only dietary source of 3-deoxyanthocyanins found in nature
  – Black sorghums are an excellent source

• Natural attractive dark colors that are pH stable and ideal for use in foods

• In vitro anti-breast & colon cancer activity

• Anti-inflammatory Activity

Uses for Sorghum in Food

• White sorghum can be used in a wide variety of products.
  – Cakes
  – Breads
  – Muffins
  – Sweetbreads
  – Flatbreads
  – Tortillas
  – Noodles
  – Snack Foods
Sorghum for Bakery Products

• There are 3 primary types of milled sorghum that can be for baked goods.
  – Whole Grain Flour
  – Bran
    • Finely Milled
    • Coarse
  – Decorticated Flour

• Milling particle size and shape is a critical factor to baking characteristics.
Bran Particle Size Effects on Muffins

- Color significantly darkened with bran addition (P<0.05), larger milled particles created a significantly lighter crumb color (P<0.05).
- 20% addition of larger milled bran resulted in a significant reduction of specific volume (P<0.05).
White Sorghum in Bread

- White sorghum flour should be used in combination with starches like tapioca or potato starch.
- If you are wanting to create a gluten free bread using sorghum a hydrocolloid such as guar gum or xanthan gum will be needed to replace the functional properties of glutenin and gliadin in dough.
White Sorghum in Wheat Free Bread

Whole grain white sorghum can be used up to 80% of the flour blend of gluten free sandwich breads, however at higher levels of substitution specific volume will be lower and crumb air cells will be smaller.
White Sorghum in Wheat Free Bread

20% White Sorghum Flour

30% White Sorghum Flour

40% White Sorghum Flour
Black Sorghum Bran in Wheat Free Bread

5% Black Bran

10% Black Bran

15% Black Bran
Black Sorghum Flour in Wheat Free Bread

20% Black Sorghum Flour
30% Black Sorghum Flour
40% Black Sorghum Flour
Brown Sorghum Flour in Wheat Free Bread

20% Brown Sorghum Flour
30% Brown Sorghum Flour
40% Brown Sorghum Flour
Sumac Sorghum Bran in Wheat Free Bread

5% Sumac Bran  10% Sumac Bran  15% Sumac Bran
Antioxidant Activity of Specialty Sorghum Breads

Antioxidant Activity (umol TE/g)

Samples with the same letter do not statistically differ (ANOVA, Tukey's HSD P<0.05)
Specific Volume of Wheat Free Breads Using Specialty Sorghum

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Aspects of Developing Foods Using Specialty Sorghums

• Percentage of usage of flour or bran will affect finished product quality.
  – As bran or flour addition increases, color will darken.

• Variety and particle size of sorghum will affect aspects of the finished product.
  – This is due to pericarp thickness and shape of flour or bran particles after milling
  – Specific Volume will be influenced by particle size & shape
Specialty Sorghums in Wheat Bread

0-30% Wheat bran

0-30% White sorghum bran

0-30% Brown sorghum bran

0-30% Black sorghum bran
Specialty Sorghums in Wheat Bread

• When tested in wheat bread formulations, black sorghum bran produced the lowest specific volume loaves.

• If using sorghum bran in wheat bread, it is recommended to add gluten or other dough strengthening agents when you use more than 10% bran in your formulation.
Specialty Sorghums in Wheat Bread

Vita Bread®

A unique heart-healthy blend of fiber, omega-3 oils and antioxidants.

With Milled Flaxseed & Brown Sorghum Bran.

BREAD MIX
For bread machine or conventional oven

Yeast packet included
NET WT 19.84 OZ (562.45 g)
Sorghum Extrusion

- Sorghum can be used for breakfast and snack type extruded products.

Sugar coated 80% white sorghum extrudate
Sugar coated 80% high tannin sorghum extrudate
Sugar coated 80% black sorghum extrudate
Japanese Sorghum Snacks
Sorghum Bran in Cookies

• Colored sorghum bran can be used as an inclusion in cookies to improve dietary fiber levels.

• Brown sorghum bran was added at a 5% flour basis to these cookies to create a healthy fun snack.
Specialty Sorghum in Tortilla Chips
In Conclusion

- Sorghum is an excellent grain for use in foods due to the wide variety of pH stable colors, high dietary fiber content, low glycemic index, high antioxidant content, as well as being naturally gluten free.

- Increased availability of specialty sorghums gives companies a wide array of colors and an excellent source of dietary fiber that can be easily used in new products.