

White Sorghum, the New Food Grain

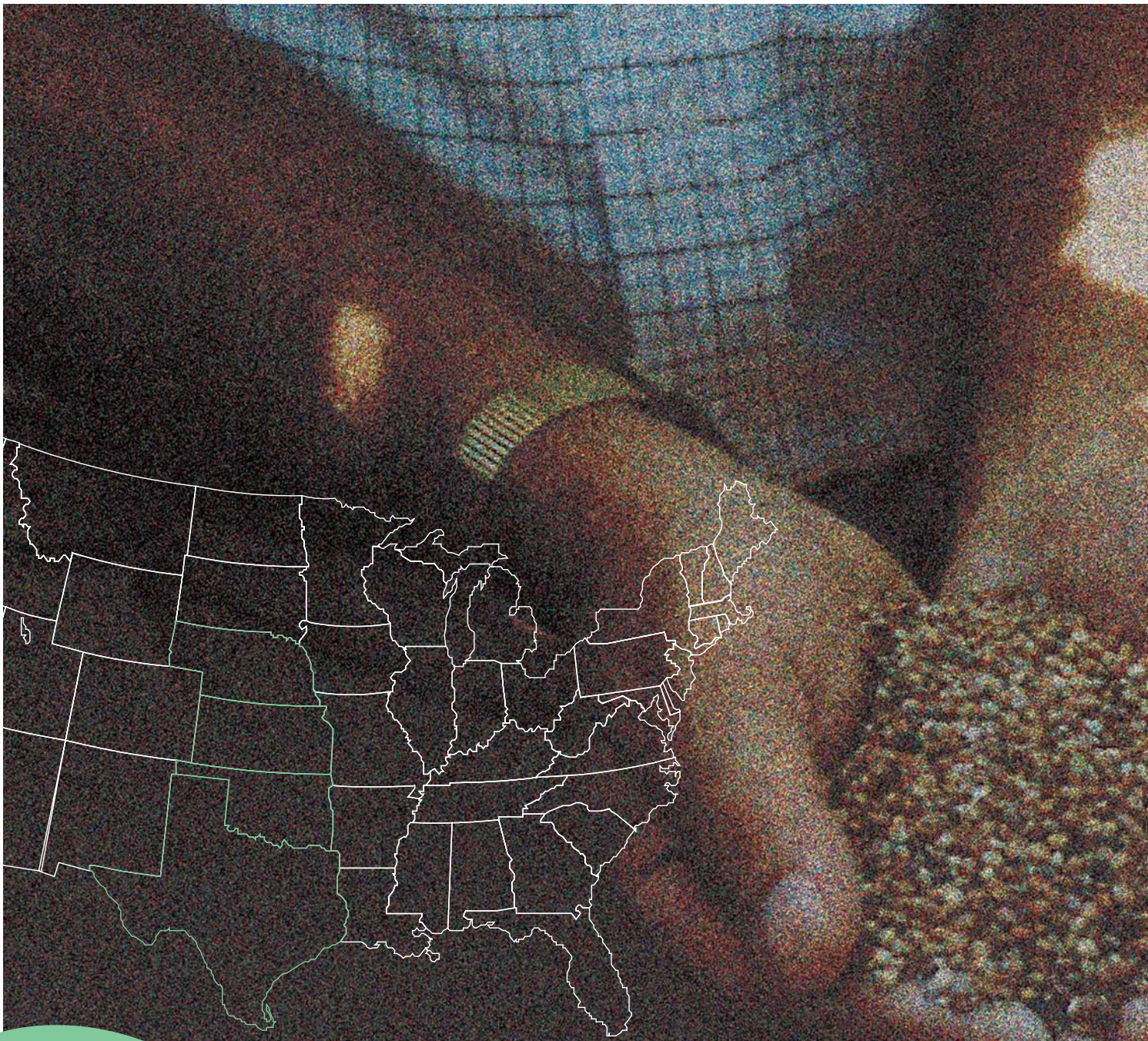
SORGHUM HANDBOOK

All About White Sorghum



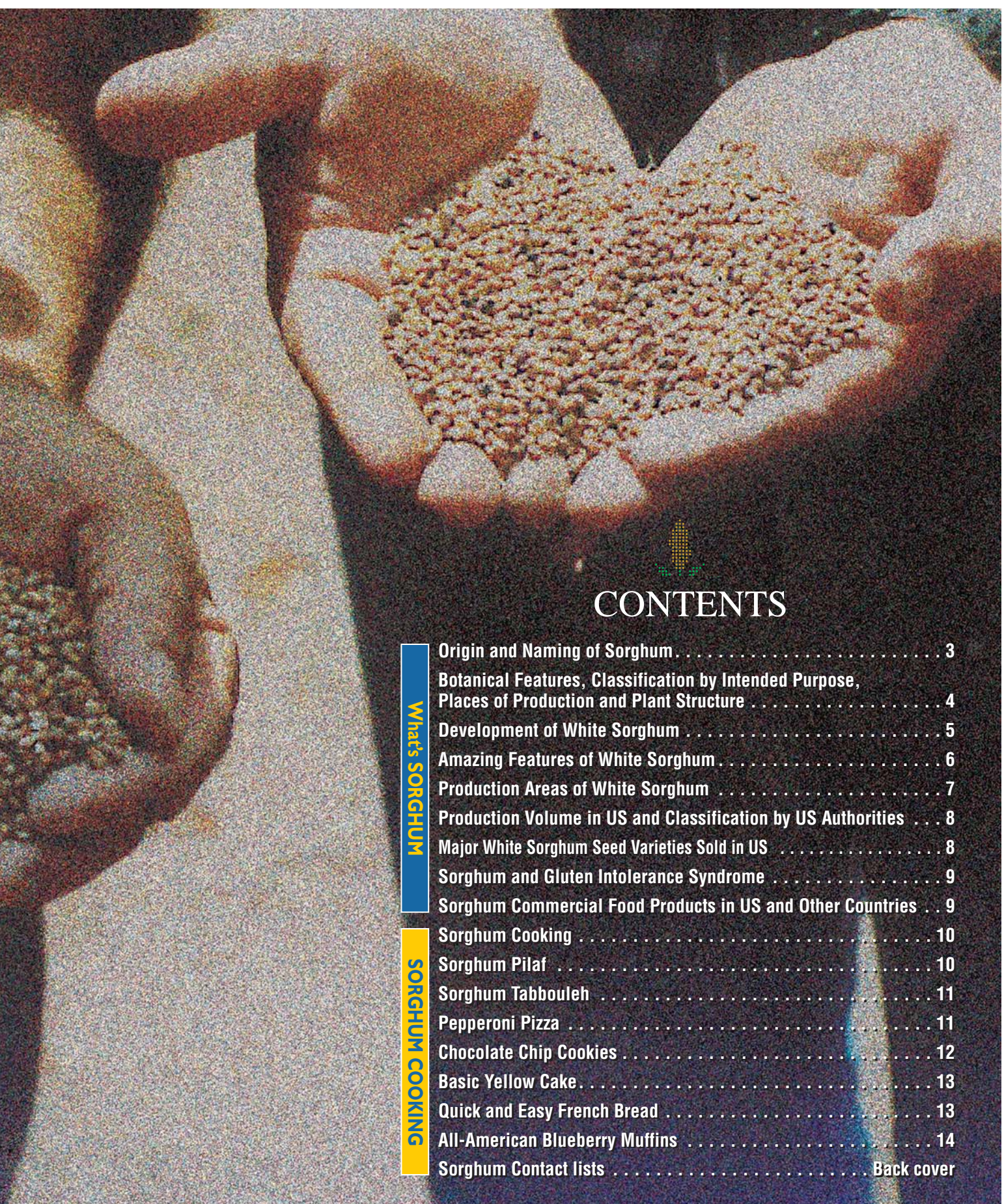
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Grain sorghum is the third most important cereal crop grown in the United States and the fifth most important cereal crop grown in the world.

SORGHUM



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Origin Sorghum (Scientific name: *Sorghum Bicolor* (L.) Moench) is native to the tropical areas in Africa. The oldest cultivation record dates back to B.C. 3000 in Egypt. Sorghum is produced throughout the tropical, semi-tropical and arid regions of the world. Sorghum came to the Americas via trade routes in the 1700's.

Naming Sorghum is called various names in different places in the world. In Western Africa, it is called great millet, kafir corn or guinea corn, which represents a connection with corn or millet. It is called jowar in India, kaolian in China and milo in Spain.



What's

SORGHUM

Botanical Features

Sorghum is a self-pollinating plant and its drought resistance is higher than that of corn.

The height of the plant is about 60cm high to as high as 460cm. The long, wide leaves grow from the stalk. The seed is small and round. A seed head of about 25cm to 36cm is seen on the top of the stalk of a mature sorghum plant.

Classification by Intended Purposes

Sorghum is a member of the grass family and is classified in the following 4 groups by application:

1. Grain Sorghum
2. Sweet Sorghum
3. Broom Sorghum
4. Grass Sorghum

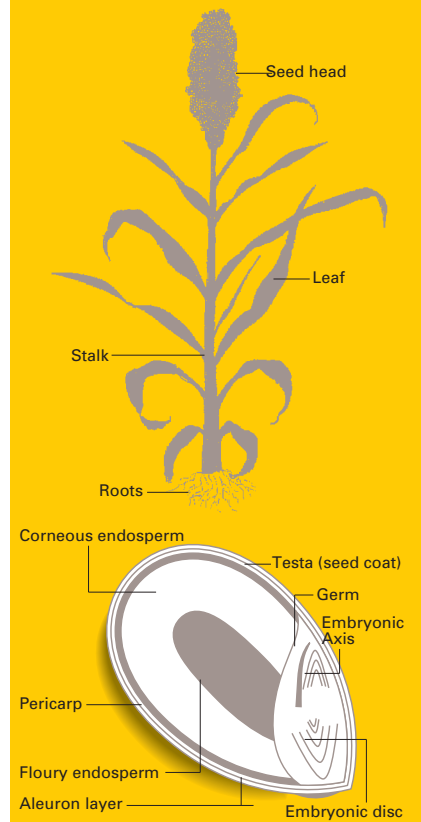
Grain sorghum is mainly used as a principal food in tropical areas and often used as raw materials for alcoholic beverages, sweets and glucose. Broom sorghum is used as a material to make brooms, while sweet sorghum is used as a material for sweetener syrup. Grass sorghum is grown for green feed and forage use.

Places of Production

The United States is the world's largest producer of grain sorghum followed by India, Nigeria, and Mexico. It is a leading cereal grain produced in Africa and is an important food source in India. Leading exporters are the United States, Australia and Argentina

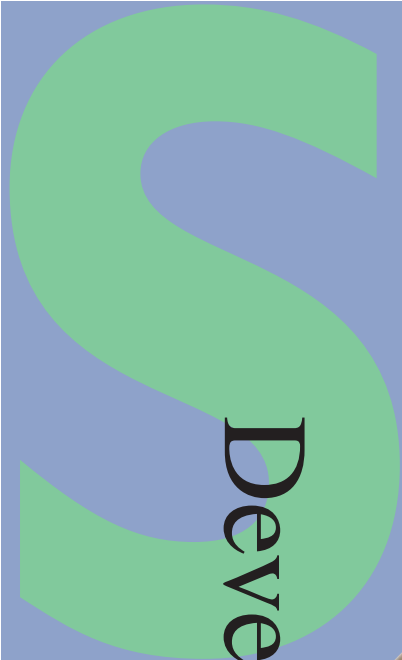


Plant Structure



Sorghum seed consists of 3 major anatomic sections - pericarp (outer layer), endosperm (storage organ) and the germ. The pericarp that is expressed from the ovary wall is made of 3 segments - epicarp, mesocarp and endocarp. The epicarp is the outermost layer and usually covered with a thin waxy film. The thickness of the mesocarp, the middle structure, varies from the very thin cellular remnant of small amount of starch granules to 3 or 4 cellular layers containing a large amount of starch granules. Sorghum is the only food grade crop that is reported to contain starch in this anatomical section. The endosperm is a storage organ that is comprised of aleurone layer, peripheral, corneous and floury areas.

The aleurone contains proteins (protein bodies, enzymes), ash (phytin bodies) and oil (spherosomes). The germ is comprised of 2 major parts, the embryonic axis and embryonic disc. The protein of the germ contains high levels of lysine and tryptophan that are excellent in quality.



SORGHUM

Development of White Sorghum



What's

Sorghum is recognized to be the most important farm crop behind corn, soybeans and wheat in the U.S. It features higher resistance against dry weather and high temperatures than soybeans, wheat, corn and other crops. In the 1950's, hybrid sorghums were developed for higher yields and it became a popular crop as yields increased dramatically. Originally the color of sorghum was purple or red and the seed coat was red. The color and the taste were regarded to be inappropriate as a food crop. To overcome the drawbacks, breeding improvements were pursued and realized, which lead to the development of white sorghum that has a white seed coat, champagne colored body and wheat colored head.



Amazing Features of White Sorghum

Nature-cared crop

- It has strong resistance to harsh environments such as dry weather and high temperature in comparison with other crops. It is usually grown as a low-level chemical treatment crop with limited use of pesticides.
- It has the potential to adapt itself to the given natural environment. It can be called “Nature-cared Crop” as it requires little artificial care such as irrigation and insect removal.

Versatile Food Material

- It can be added to a variety of foods as it is almost taste and scent free and naturally white in color.
- The material advantages of other added ingredients such as taste are not harmed.

No Gluten Content

- Unlike wheat flour, it does not contain gluten. This makes it a suitable alternative food for people with wheat gluten allergies.

No Biotech Sorghum

- It is not modified genetically and can be used for products that are labeled as non-genetically engineered products.

Small Amount of Tannin Content

- This means that polyphenols (phenolic acid and flavonoid) are available.

Componential Analysis of White Sorghum Flour and Grain

* Flour was analyzed by JOWAR FOOD in the US and Japan Food Research Laboratories.

Analyzed item	Results (100g)		Analysis method
	Flour	Grain	
Water	11.6g	8.9g	Atmospheric pressure dry by heating method
Protein *1)	9.1g	9.9g	Kjeldahl method
Fat	3.4g	3.4g	Acid dissolution method
Ash	1.2g	1.3g	Direct ashing method
Carbohydrate *2)	70.6g	66.4g	
Calorie *3)	349 kcal	336 kcal	
Dietary fiber	4.0g	10.0g	Oxygen-gravimetric technique
Tannin (as tannin acid)	0.06g	0.06g	FOLIN-DENIS method

*1) Nitrogen-protein conversion factor: 6.25

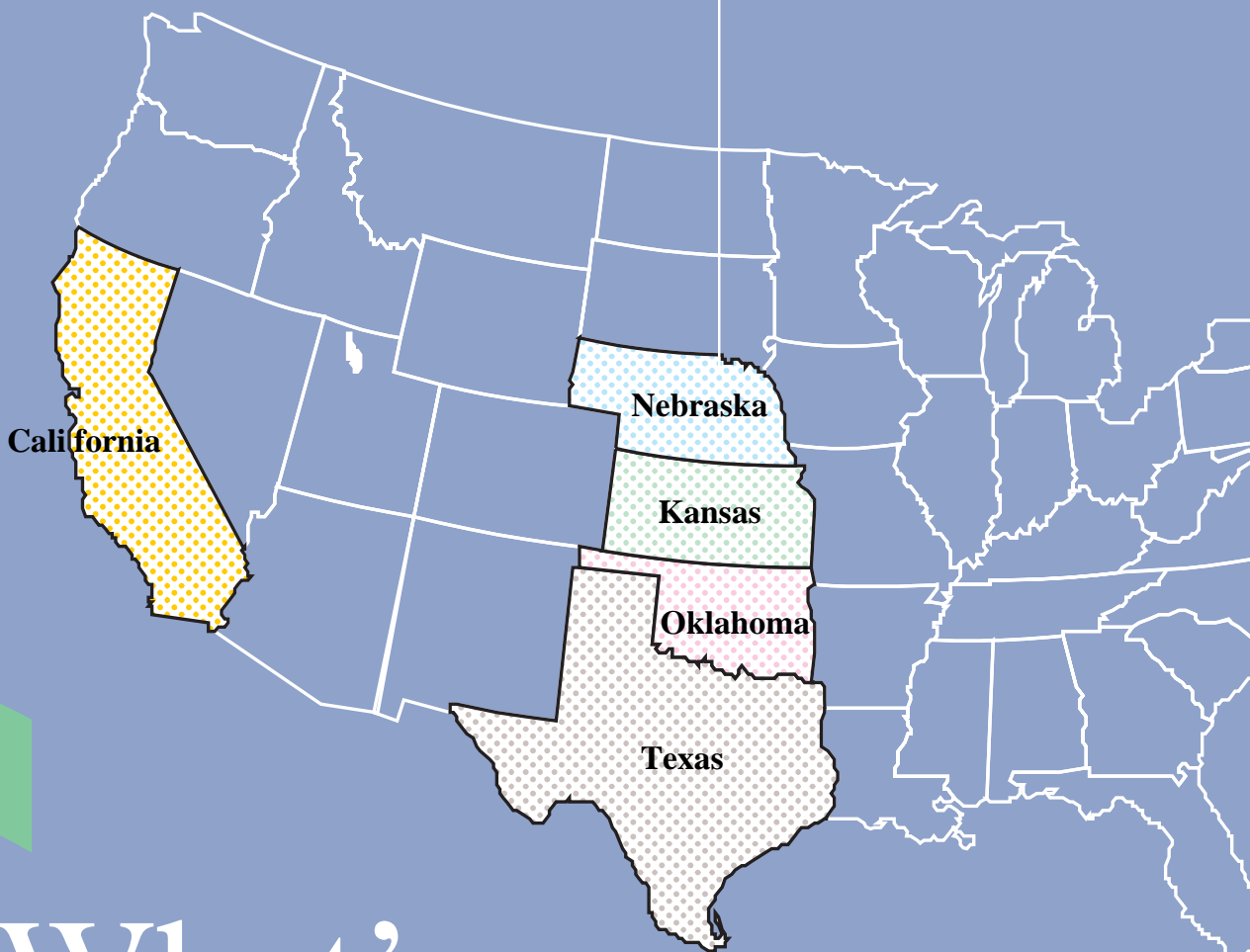
*2) 100 - (water + protein + fat + ash + dietary fiber + tannin) based on the Nutrition Labeling Standard (Ministry of Health and Welfare Public Notification No. 146 in 1996)

*3) Energy conversion factor: protein 4, fat 9 and carbohydrate 4, based on the Nutrition Labeling Standard (Ministry of Health and Welfare Public Notification No. 146 in 1996)

Production Areas of White Sorghum



White sorghum has been developed for farming in the U.S. and increasingly cultivated. The major production areas are in Texas, Oklahoma, Kansas, Nebraska, and California.



What's SORGHUM

U.S. Sorghum Production

Sorghum production estimate 2003/04

Area planted	9.4(mil. acres)	.....	3.8(million hectares)
Area harvested	7.8(mil. acres)	.....	3.2(million hectares)
Yield	52.7(bushels/acre)	.....	3.3(MT/hectare)
Production	411(million bushels)	.....	10.44(million metric tons)
Exports	210(million bushels)	.....	5.33(million metric tons)
Total domestic use	200(million bushels)	.....	5.08(million metric tons)

Major states' sorghum production numbers 2003

	Planted		Production	
	(acres – thousand)		(hectares)(1000 bushels)	(1000MT)
Texas	3200	1295	153900	3909
Oklahoma	300	121	9250	235
Kansas	3550	1437	130500	3315
Nebraska	660	267	31000	787
California	18	7.3	900	23

Classification of Sorghum by U.S. Authorities

In the U.S., sorghum is classified into 4 classes based on tannin content and color by the grain standards stipulated by the USDA Federal Grain Inspection Service (FGIS). While the classes can be visually identified, properties of the types are determined by tannin content.

Sorghum

Low in tannin content due to the absence of a pigmented subcoat and contains less than 98% white sorghum and not more than 3% tannin sorghum. The color of the seed coat in this class may appear, white, yellow, pink, orange, red or bronze.

Tannin Sorghum

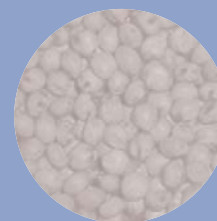
Sorghum which is high in tannin content due to pigmented subcoat and contains not more than 10% non-tannin sorghum. The color of the seed coat is usually brown, but may also be white, yellow, pink, orange, red or bronze.

White Sorghum

Low in tannin content due to the absence of a pigmented subcoat and contains not more than 2% of other classes. The color of the seed coat is white or translucent and includes sorghum containing spots that cover 25% or less of the kernel.

Mix Sorghum

Sorghum which does not meet the requirements for any of the other classes.



Major White Sorghum Seed Varieties Sold in U.S.

The following shows the names of major sorghum seed varieties currently sold in the American market and their web page addresses:

- Fontanelle W 1000 <http://www.fontanelle.com>
- Sorghum Partners 828 <http://www.sorghumpartners.com>
- Producers 79 <http://www.producershybrids.com>

Sorghum Replaces Wheat in Gluten-Free Diets

Rather than give up their favorite wheat-based foods like bread, cookies, cake, and pizza, gluten-free people learn to cook with gluten-free ingredients such as sorghum. Distantly related to corn, sorghum is gaining wide popularity as a wheat substitute in America. About 10-15% of Americans cannot eat wheat (and its cousins barley, rye, and spelt) because it contains gluten, an otherwise harmless protein that is toxic for certain people. This includes those with wheat allergies as well as the 2.2 million people with increasingly common autoimmune condition. Celiacs must avoid gluten because it damages the lining of the small intestine, preventing absorption of nutrients in food. This can lead to diarrhea, anemia, osteoporosis, infertility, lymphoma, and other complications. The only treatment is a gluten-free diet for life. Left untreated, it can be fatal.

Many other people avoid wheat due to food intolerances, where symptoms reduce our quality of life with annoying—though rarely life-threatening—headaches, rashes, nasal congestion, sinusitis, stomach aches, and fatigue. National associations such as the Gluten Intolerance Group, the Celiac Disease Foundation, and the Celiac Sprue Association recommend sorghum for the gluten-free diet. Several manufacturers use sorghum in their gluten-free products and baking mixes. Fortunately, sorghum-based ingredients are readily available at natural food markets, on the Internet, and some traditional supermarkets. This allows gluten-free consumers to incorporate sorghum into their diets using specially-formulated recipes. Manufacturing companies and home cooks value sorghum flour for its light color, neutral taste, and the pleasing texture it brings to baked goods such as cakes, cookies, breads and pizza. Whole sorghum grain—with its hearty, chewy texture—makes it the perfect gluten-free substitute for couscous, bulgur, and pearled barley in soups and side dishes.

Sorghum Is Found In Commercial Food Products in the U.S.

Sorghum is currently available in two forms: whole grain and flour. Its light color, neutral flavor, and pleasing texture have resulted in sorghum being featured in (A) gluten-free cookbooks; (B) ready-made foods such as cookies, cereal, bagels, and bars; (C) baking mixes for bread, brownies, cakes, and pancakes; (D) bread from gluten-free bakeries; (E) gluten-free beer; and (F) restaurants serving whole grain sorghum dishes.



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Gluten-free sorghum gains popularity
By DIANE YATES
EXTENSION NOTES
Last update: 26 June 2009

Q: Sorghum is listed as a gluten-free grain. Is this the same plant used to make syrup?

Sorghum for use as a grain is known as milo or food-grade sorghum. Other varieties of sorghum are grown for use as livestock feed. The syrup sorghum is made from yet another variety of the grain, known as sweet sorghum or "syrup." Sweet sorghum plants have a much higher sugar content, making them ideal for syrup production.

Food grade sorghum (milo) has been a part of the human diet in Africa and India for centuries. In the United States, the increase in sorghum popularity is probably due to its lack of gluten. An estimated 1 to 2 million people in this country are diagnosed with celiac disease, a condition marked by intolerance to gluten protein present in grains such as wheat, rye and barley. Wheat flours have the ability to make gluten, an elastic protein that gives structure to breads. Gluten is formed when liquid combines with several proteins found in wheat flour. The kneading process further develops the gluten into a strong cellular network. This structure traps gases, making the finished bread light. Non-wheat flours have little or no gluten and produce breads that are dense and low rising. Because it lacks the gluten proteins, sorghum is now a primary grain candidate for the food industry's search for the perfect gluten-free bread.

Currently, researchers have used multiple food grade varieties of sorghum to produce acceptable loaves of bread that are about 70 percent sorghum. Also under study are other commercial based goods made with sorghum, such as breakfast foods.

Sweet sorghum for syrup production has been planted in the South for many years. It differs from grain sorghum in several ways: the stalks are taller, the grain or seed heads are smaller, and the sugar content is higher. Since sweet sorghum can adapt to a wide variety of soils and growing conditions, it became a popular source of extra income for small Southern farmers. Juice is extracted from the plant stalks, or canes. Evaporation of the juice by heating eventually results in syrup with a distinctive flavor prized by many.

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C SORGHUM COOKING



“Sorghum is one of my favorite flours and I use it in all of my cookbooks.”
—Carol Fenster, Ph.D.



Carol Fenster, Ph.D.

PROFILE

President and Founder of Savory Palate, Inc., a publishing house and information resource for people with food allergies, celiac disease, autism, and other medical conditions that require a gluten-free diet.

Dr. Fenster is the author of 5 gluten-free cookbooks, she teaches cooking classes for natural food stores, and she is an internationally recognized speaker on the gluten-free lifestyle.

She is featured on several episodes of the Health Network’s “Food for Life” and she develops gluten-free products for leading food manufacturers.

Her articles and reviews of her books have appeared in Woman’s World, Taste for Life, Vegetarian Times, Veggie Life, Better Nutrition, Energy Times, Gluten-Free Living, and Living Without magazines as well as newsletters from the Food Allergy and Anaphylaxis Network (FAAN), Gluten Intolerance Group (GIG), and Celiac Disease Foundation (CDF).

“When I was advised to stay away from wheat years ago—to get relief from chronic sinusitis—I didn’t want to give up my favorite foods like bread, pizza, and desserts. With my passion for good food and a degree in home economics, I learned to make all my favorite foods with gluten-free alternatives. Along the way—as I literally baked my way back to good health—I was delighted to discover sorghum flour. Sorghum flour’s light color and neutral flavor allow me to use it in a wide variety of dishes, ranging from delicate cakes to hearty dishes like breads and pizza. It also has a mysterious, but wonderful synergy with other flours that actually improves the overall flavor of the dish—which is particularly advantageous since we must use a combination of flours in gluten-free baking, rather than just one.

One of the things I especially missed when I gave up wheat was its texture—for example, that wholesome ‘mouth-feel’ in hearty homemade breads. Sorghum flour helps me duplicate that hearty bread with its chewy crusts. I also missed the satisfaction of chewy cooked bulgur in my favorite tabbouleh recipe or pearly barley in my homemade vegetable soup. But I find that cooked sorghum grain is a marvelous replacement, so I can replicate those dishes and everyone enjoys them—even friends and family who aren’t gluten-free. Nutritionally, sorghum contains more protein than typical wheat substitutes such as rice flour and I find that this higher protein makes better breads and rolls. I also like the fact that it is rich in antioxidants, which makes it a safe, delicious, and healthy choice for the gluten-free diet.”

Cooked sorghum grain is especially versatile. It can be used in place of couscous, bulgur, or pearly barley. In this pilaf recipe, it makes a delicious side dish to accompany chicken or fish. Nuts and dried fruits provide color and texture and a pleasingly sweet contrast to the savory seasonings.



Sorghum Pilaf

Sorghum Pilaf

1 cup uncooked sorghum grain
1 tablespoon olive oil
3 cups gluten-free chicken broth
1 teaspoon dried minced onions
1/2 teaspoon dried thyme
1/8 teaspoon ground white pepper
1/4 cup dried cranberries
1/4 cup golden raisins
2 tablespoon fresh chopped thyme leaves
Salt to taste
1/4 cup toasted almond slices
Fresh thyme or parsley sprigs for garnish

1. Rinse sorghum grains with water; drain thoroughly.
2. In a heavy, medium-size saucepan over medium-low heat, combine sorghum grains and olive oil. Stirring constantly, gently toast grains in oil for 2-3 minutes or until they are slightly browned.
3. Add chicken broth, onions, thyme, and white pepper and bring to boil. Reduce heat, cover, and simmer 30-40 minutes or until liquid is absorbed and grains are tender.
4. Remove from heat and drain, if necessary. Stir in cranberries, raisins, fresh thyme, and salt to taste (depending on the saltiness of the chicken broth). Cover and let stand for 5 minutes. Transfer to large, 12-inch plate or platter. Sprinkle with toasted almond slices. Garnish with fresh thyme or parsley sprigs. Serve hot. Makes 3 cups. Serves 6 (1/2 cup servings).

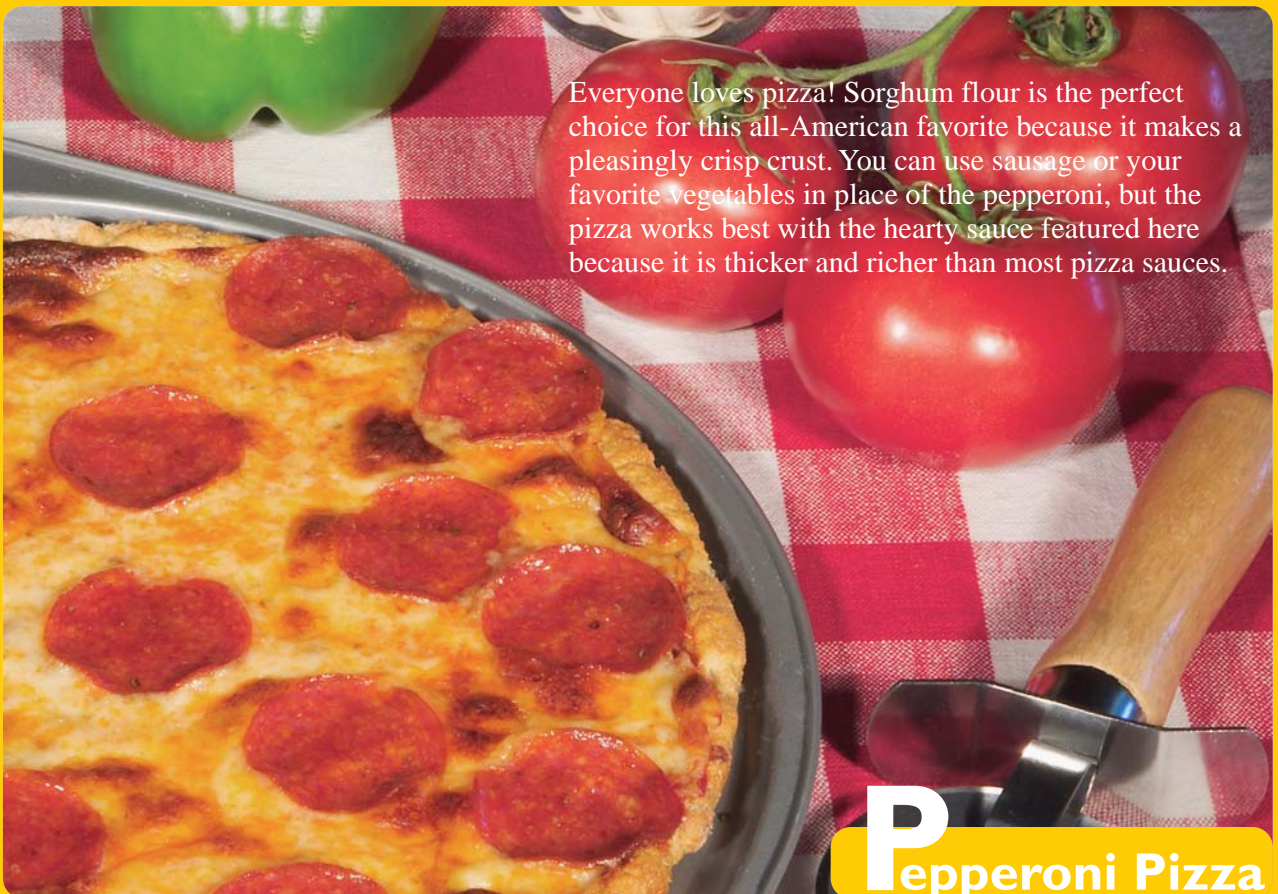
note: 1 cup sorghum grain = 200g / 1 cup sorghum flour = 100g

Tabbouleh is a traditional Middle Eastern salad that is becoming increasingly popular on American menus. It is typically made with bulgur wheat and served cold or at room temperature. With its wholesome chewiness, sorghum makes a fabulous substitute for bulgur wheat in this dish.



Sorghum Tabbouleh

Everyone loves pizza! Sorghum flour is the perfect choice for this all-American favorite because it makes a pleasingly crisp crust. You can use sausage or your favorite vegetables in place of the pepperoni, but the pizza works best with the hearty sauce featured here because it is thicker and richer than most pizza sauces.



Pepperoni Pizza



C hocolate Chip Cookies



Who can resist warm chocolate chip cookies, fresh from the oven! Sorghum flour lends an appealing crunch to these old-fashioned delights. They freeze well and make wonderful treats for lunch boxes, school parties, after-dinner dessert, or a delicious after-school snack with a cold glass of milk.

Sorghum Tabbouleh

- 1 cup uncooked sorghum grain, rinsed
- 3 cups water
- 3/4 teaspoon salt, divided
- 1/4 cup lemon juice
- 2 tablespoons olive oil
- 1/8 teaspoon white pepper
- 1 cucumber, seeded and chopped
- 3 green onions, cut diagonally in 1/4 inch pieces
- 1 large red bell pepper, diced
- 1/2 cup each chopped fresh parsley, cilantro, and mint
- 1/4 cup pine nuts, toasted
- 1/4 cup crumbled feta cheese
- Sprigs of fresh cilantro or mint for garnish

1. Place rinsed sorghum grain, water, and 1/2 teaspoon of the salt in large, heavy pan over high heat.
2. Bring to boil. Cover and reduce heat to low, simmering for 30-40 minutes or until liquid is absorbed and grains are tender. Drain thoroughly in strainer, transfer to large bowl.
3. Combine lemon juice, olive oil, remaining 1/4 teaspoon salt, and white pepper in screw-top jar. Shake vigorously to blend. Toss thoroughly with hot cooked sorghum.
4. Add cucumber, onions, bell pepper, and parsley, cilantro, and mint. Toss well. Refrigerate 4 hours. Let stand for 20 minutes before serving. Sprinkle with toasted pine nuts and crumbled feta cheese. Garnish with fresh cilantro or mint. Makes about 4 cups Serves 8 as a side dish (1/2 cup each).

Pepperoni Pizza

- Pizza Crust**
- 3/4 cup warm whole milk (110°F, 40°C)
 - 1 tablespoon dry yeast
 - 1/2 teaspoon sugar
 - 2/3 cup sorghum flour
 - 1/2 cup tapioca flour
 - 2 teaspoons xanthan gum
 - 1/2 teaspoon salt
 - 1 teaspoon unflavored gelatin powder
 - 1 teaspoon Italian seasoning
 - 1 teaspoon olive oil
 - 1 teaspoon cider vinegar
 - White rice flour for sprinkling
- Pizza Sauce**
- 1 can (8 ounces) tomato sauce
 - 1 1/2 teaspoons Italian seasoning
 - 1/2 teaspoon fennel seeds
 - 1/4 teaspoon garlic powder
 - 2 teaspoons sugar
 - 1/2 teaspoon salt
- Topping**
- 1 1/2 cups mozzarella cheese
 - 1/4 package (about 25 slices) Hormel gluten-free pepperoni slices
- Pizza Sauce**
1. Combine all ingredients in small saucepan and simmer over low heat 10-15 minutes, stirring occasionally.
- Pizza Crust**
1. Preheat oven to 400°F(200°C). Dissolve yeast and sugar in warm milk and let foam 5 minutes.
 2. In bowl of food processor, combine all pizza crust ingredients including yeast-milk mixture. Blend until dough forms ball. Scrape down sides of bowl and blend until dough forms ball again. Dough will be soft.
 3. Put dough on 12-inch nonstick greased pizza pan. Liberally sprinkle rice flour onto dough. Press dough into pan with your hands, continuing to sprinkle dough with flour to prevent sticking to your hands. Make edges thicker to contain toppings.
 3. Bake pizza crust 10 minutes in lower third of oven. Remove from oven. Spread pizza crust with pizza sauce and toppings. Bake another 20-25 minutes or until toppings and crust are nicely browned. Makes a 12-inch pizza. Serves 6. (1 slice each)

Chocolate Chip Cookies

- 3/4 cup sorghum flour
- 1/2 cup tapioca flour
- 1/4 cup potato starch
- 1 teaspoon xanthan gum
- 1/2 teaspoon baking soda
- 1/4 teaspoon salt
- 1/4 cup margarine (room temperature)
- 3/4 cup brown sugar, packed
- 1/3 cup granulated sugar
- 2 teaspoons vanilla extract
- 1 extra large egg
- 1 cup gluten-free chocolate chips
- 1/4 cup chopped nuts

1. Preheat oven to 350°F(180°C). Mix together flours, baking soda, xanthan gum, and salt. Set aside. Grease large (12 x 15-inch) baking sheet or line with parchment paper. Set aside.
2. In large mixing bowl, beat margarine with brown sugar, granulated sugar, vanilla extract, and egg until fluffy, scraping sides of bowl frequently. Beat in flour mixture on low speed, mixing thoroughly. Stir in chocolate chips. Dough will be stiff.
3. Drop 12 tablespoonfuls of dough on baking sheet at least 2 inches apart.
4. Bake 10-12 minutes on center rack of oven or until lightly browned. Cool 2-3 minutes before removing from baking sheet.
5. Repeat steps 3 and 4 with remaining half of cookie dough. Makes 24 cookies. Serves 24, 1 cookie each.



Sorghum's light color and delicate, neutral flavor make it the perfect choice for a basic yellow cake. Use this recipe in a multitude of ways such as a layer cake, a sheet cake, cupcakes, or—as pictured here—baked in individual heart-shaped cakes and lightly dusted with powdered sugar.

A photograph showing four heart-shaped cakes, golden-brown and dusted with powdered sugar, arranged on a red ceramic plate with a white floral pattern. A single bright red strawberry is placed in the center of the cakes. In the background, three white daisies with yellow centers are visible. A larger, round cake is partially visible in the top left corner.

Basic Yellow Cake

This bread can be ready in one hour because it goes directly into a cold oven without any rising time. This procedure accentuates sorghum's naturally dry texture, producing a loaf with an artisan-like crisp crust. If this cold oven method doesn't work for you, place the dough in a French bread pan, let it rise to the top of the pan, and bake in a preheated oven at 425°F until nicely browned—about 25-30 minutes.

A photograph showing several thick slices of French bread, with a golden-brown crust and a soft, porous interior, arranged on a wooden tray. The tray is placed on a patterned tablecloth. In the background, a white ceramic cup with the text "ONE CUP" and "MADE BY ERICKSON DESIGNER" is visible.

Quick and Easy French Bread

Muffins are the perfect choice for breakfast or brunch. They can be frozen and reheated gently on low power in a microwave oven. Sorghum's light color and neutral flavor won't compete with the delicate lemon undertones or the flavorful blueberries in this recipe.



A All-American Blueberry Muffins

Basic Yellow Cake

- 1/3 cup margarine, room temperature
- 1 cup sugar
- 2 large eggs
- 1 tablespoon grated lemon peel
- 1 cup sorghum flour
- 1/3 cup potato starch
- 2 tablespoons tapioca flour
- 1 teaspoon xanthan gum
- 1/4 teaspoon baking powder
- 1/4 teaspoon baking soda
- 1/4 teaspoon salt
- 3/4 cup buttermilk
- 1 teaspoon vanilla extract

1. Preheat oven to 325°F(160°C). Generously grease 9-inch nonstick round cake pan (lined with waxed paper), or two 5 x 3-inch pans, or a 12-cupcake pan, or 11 x 7-inch pan, or a 6 cup individual cake pan (such as the hearts used here). Set aside.
2. Using electric mixer and large mixer bowl, cream margarine, sugar, and eggs on medium speed until thoroughly blended. Add lemon peel.
3. In medium bowl, combine flours, xanthan gum, baking powder, baking soda, and salt. In a measuring cup, combine buttermilk and vanilla. On low speed, beat dry ingredients into egg mixture, alternating with buttermilk, beginning and ending with dry ingredients. Mix just until combined. Spoon batter into pan(s).
4. Bake 9-inch round pan for 35-40 minutes; 5 x 3-inch loaf pans for 35-45 minutes, 12 cupcakes for 20-25 minutes, 11 x 7-inch pan for 25-30 minutes, or 6-cup individual mini-cake pan for 20-25 minutes or until top of cake is golden brown and toothpick inserted into center comes out clean. Cool cake in pan for 5 minutes, then remove from pan and cool on wire rack. Serves 12.

Quick and Easy French Bread

- 2 tablespoons dry yeast
- 1 1/4 cups warm water (110°F, 40°C)
- 1 tablespoon sugar
- 1 1/2 cups potato starch
- 1 cup sorghum flour
- 1/2 cup tapioca flour
- 1/4 cup dry milk powder (not Carnation)
- 1 teaspoon guar gum
- 1 teaspoon xanthan gum
- 1 1/2 teaspoons salt
- 1 tablespoon butter, room temperature
- 4 large egg whites, divided
- 1 teaspoon vinegar

1. Dissolve sugar and yeast in warm water. Set aside to foam for 5 minutes.
2. Grease nonstick two-loaf French bread pan or line with parchment paper.
3. In bowl of heavy-duty stand mixer, combine flours, dry milk powder, guar gum, xanthan gum, and salt.
4. Add yeast mixture to flour mixture. Still on low speed, blend in butter, 3 of the egg whites, and vinegar. Beat on high speed for 1 minute. Dough will be somewhat soft.
5. Spoon dough equally into the two indentations of French loaf pan. Brush with 4th egg white which has been thoroughly beaten to foam.
6. Place immediately on middle rack of cold oven. Set temperature to 425°F(220°C) and bake approximately 30-35 minutes, or until bread is nicely browned. Cover with foil if bread browns too quickly.
7. Remove bread from pans; cool completely on wire rack before slicing with electric knife or serrated knife. Makes 2 loaves. Serves 20 (1-inch slices).

All-American Blueberry Muffins

- 1 1/4 cups sorghum flour
- 3/4 cup potato starch
- 1/3 cup tapioca flour
- 3/4 cup sugar
- 1 tablespoon baking powder
- 1 1/2 teaspoons xanthan gum
- 1 teaspoon salt
- 1 cup milk
- 1/3 cup butter or margarine (room temperature)
- 2 large eggs
- 1 teaspoon vanilla extract
- 2 teaspoons grated lemon peel
- 1 1/4 cups blueberries
- 2 tablespoons sugar (for sprinkling on top)

1. Preheat oven to 400°F(200°C). Generously grease 12-cup nonstick standard-size muffin pan or use paper liners.
2. Blend together flour, sugar, baking powder, xanthan gum, and salt in large mixer bowl with electric mixer. Add milk, butter, eggs, vanilla extract, and lemon peel and blend on medium until ingredients are thoroughly moistened. Gently stir in blueberries. Spoon dough evenly into muffin pan. Sprinkle each muffin with 1/2 teaspoon sugar.
3. Bake 25 minutes or until tops of muffins are lightly browned. Remove from oven. Cool muffins in pan 10 minutes. Gently remove from pan and place on wire rack to cool for another 10 minutes. Serve warm. Makes 12.

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