Sorghum Research

Suggested Grade Level: 6-8

Time: 3-5 45-minute classes

Subject: Language Arts, History, Government & Social Studies - See Academic Standards below.

Overview: This interdisciplinary lesson combines Language Arts, Social Studies, and Agriculture as students research the diverse uses of sorghum, its role in the economy, and its global impact. Through collaborative inquiry and presentation, students build skills in research, critical thinking, and communication.

Objectives:

1. Evaluate sources for reliability and relevance.
2. Collaborate to design and present a multimedia report on sorghum.
3. List at least 5 uses of sorghum.
4. Explain why sorghum is grown in Kansas.
5. Describe how sorghum is used in other countries.

Background Information:
Sorghum is a member of the grass family that grows wild in tropical and subtropical regions of the world. It is recognizable by its distinctive white-to-brown flower head. Sorghum is a tall plant, reaching heights of three to six (sometimes sixteen) feet. Depending upon the variety, it can be annual or perennial (Masats).

Farmers have been cultivating sorghum since around 8,000 B.C in Africa. That's because Sorghum prospers in hot, dry climates, making it popular in the Sorghum Belt. That is, from South Dakota to southern Texas. Straight in the middle of the Sorghum Belt, Kansas is the largest sorghum producer in the United States, with an average of 3 million acres harvested. Following Kansas is Texas, with 1.8 million acres; Colorado, with 370,000 acres; Oklahoma, with 305,000 acres; and South Dakota, with 210,000 acres. Sorghum is highly versatile and can be applied to various industries. Currently, sorghum supports the export, livestock feed, ethanol, pet food, and food industries the most. Exports are the driving force for the sorghum industry right now. Countries such as Mexico, China, and Japan have used sorghum for livestock feed, food, and ethanol production. In the livestock industry, sorghum is used in feed rations for poultry, beef, dairy, and swine. Furthermore, almost one-third of U.S. sorghum is used for ethanol! It is interchangeable with corn and produces the same amount of ethanol per bushel.

Approximately one-third of the grain used in ethanol production is subsequently used as distillers' grains, a high-nutrient livestock feed.

Finally, sorghum has recently seen some popularity in the food industry. Crucially, sorghum is composed mainly of starch and does not contain gluten. Additionally, sorghum is high in fiber and antioxidants, high in protein, iron, vitamin B6, niacin, magnesium, and phosphorus, and provides energy from 75% complex carbohydrates. These health benefits make sorghum popular for those seeking a healthy energy boost without gluten. Notably, sorghum can now be found in over 350 food products in the United States alone (The).

Kansas Connections:
Kansas accounts for 50% of the United States' grain sorghum production. Grain sorghum production in Kansas started in the early 1900s at the Kansas State University Agricultural Research Center in Hays, Kansas. It sold the first variety of grain sorghum in 1909. Around 1920, researchers developed shorter plants that could be harvested by combining rather than cutting, bundling, and threshing by hand. They also created grain sorghum varieties with different maturity rates (Kansas). This was important in Kansas due to the state's varied growing seasons. One advantageous characteristic of sorghum is that it can dry out after it has begun seed production and stall; when it rains, it can resume growth and complete seed production. A single plant can produce more than one stalk. Each stalk produces a single head, and 750 to 1,250 seeds form on the head (Kansas). The grain is ready for harvest when the seeds ripen and harden.

In Kansas, grain sorghum is harvested in the fall, between September and the end of November. However, the plant remains green and alive after producing grain until it is killed by freezing temperatures, tillage, or herbicides. Although grain sorghum is the predominant sorghum grown in Kansas, the state also produces other types of sorghum. Grassy sorghums, like sudangrass, are grown for feed and hay. Sweet sorghums are also grown to make sorghum syrup and molasses. Another type of sorghum, broomcorn, is grown for the branches and fibers of the seed clusters. It differs from other sorghums in that it produces heads with fibrous seed branches that may be as much as 36 in. long, which can be used to make whisk brooms.

Kansas is historically an agricultural state. Manufacturing and services have surpassed agriculture as sources of income, but farming remains crucial to the state's economy, and Kansas ranks only behind Texas and Montana in total agricultural acreage. Kansas produces $1.2 billion in sorghum annually. The grain sorghum industry employs almost 5,000 Kansans, and Kansas produces more grain sorghum than any other state in the country. Farmers plant approximately 2.6 million acres of sorghum annually for flour, biofuels, pasta, baked goods, molasses, syrup, and as a popped snack (Kansas). The Kansas Grain Sorghum Commission (KGSC) is dedicated to advancing the sorghum industry through targeted research, market development, and promotional efforts, both domestically and internationally. According to the KGSC's 2024 Annual Report, Kansas producers harvested approximately 2.8 million acres of sorghum, achieving an average

yield of 65 bushels per acre. In recent years, the Kansas sorghum industry has contributed an economic impact estimated at billions of dollars, underscoring its role as a vital component of the state's rural economy and the global grain supply (Kansas).

Materials:
Discussion
- Five or more stalks of sorghum, enough for one per group

Activity
- iPads or computers for research.

Instructional Format:
1. Review background information.
2. Conduct an engagement exercise.
3. Complete the activity.
4. Conduct an assessment activity.

Start Teaching Here
Engagement:
Watch this 8-minute video to introduce Sorghum.
https://www.youtube.com/watch?v=UBzpTTLH_Dk
Sorghum: The Ancient Supergrain That Could Feed the Future!
Discussion
1. Group students in pods of three or four. Place one sorghum stalk in each group.
2. Ask students to examine the grain and discuss within their group what they already know about sorghum (where it grows, what it is used for, etc.)
3. Explain to students that grain sorghum is used chiefly as a cereal grain and feed grain and is converted to ethanol.
4. Provide students with technology to research and ask them to explore the uses and production of sorghum in Kansas.
5. Each student in the group will be responsible for researching one way to utilize sorghum and incorporating the information into their group project. Students can choose from the following questions:
    - How is sorghum used as a cereal grain?
    - What nutritional value does sorghum have, and what food products include sorghum?
    - Why is sorghum so valuable to third-world countries?
    - How is sorghum used as a feed grain?
    - How is sorghum used to create ethanol?
    - Explain how sorghum is grown and harvested in Kansas.

Procedures:
Activity
1. As a group, the students will create a poster presentation to be delivered on a date determined by the instructor. The class could use this presentation opportunity to teach a younger group of students and/or display their posters at

the school for others to see (you could combine this project with a poster competition). You could use mini-lessons to provide instruction on preparing the project, such as learning the vocabulary, conducting a quick search, refining a search, taking notes, keeping references, citing sources, editing, working as a group, and supporting each other's work.

2. As students listen to the presentations, they should be able to answer the following questions.
    - What are some uses of sorghum?
    - Why is sorghum important to Kansas?
    - Why is sorghum important to third-world countries?

Vocabulary:
Sorghum: a widely grown cereal in warm regions, used for grain, livestock feed, and sometimes flour.
Growing season: the portion of the year in which local conditions (i.e., rainfall, temperature, daylight) permit normal plant growth.
Cereal grain: Cereal grains, like wheat, rice, and sorghum, are grass seeds that provide most of the world's protein and calories for humans and livestock.
Distillers' grain: a cereal byproduct of the distillation process, widely used as a low-cost, nutrient-rich feed for livestock and poultry, and produced in large amounts by the fuel ethanol industry.
Herbicides: chemicals used to manipulate or control undesirable vegetation that may compromise the growth or yield of desired crops.
Ethanol: an alcohol produced by fermenting sugars and starches or by chemical synthesis, used as a solvent, in explosives, and as an additive to or replacement for petroleum-based fuels.
Third-world countries: countries with high poverty rates, a lack of resources, and unstable finances.

Kansas Standards:
Language Arts
6th Grade
Writing
Research to Build and Present Knowledge
W.6.7 Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.
W.6.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
W.6.9 Draw evidence from literary or informational texts to support analysis, reflection and research.
Speaking and Listening
Comprehension and Collaboration
SL.6.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on sixth grade topics, texts and issues, building on others' ideas and expressing their own clearly.
SL.6.2 Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text or issue under study.
Presentation of Knowledge and Ideas

SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume and clear pronunciation.
SL.6.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
Language in Speaking and Listening
SL.6.7 Demonstrate command of the conventions of standard English grammar and usage when speaking.
SL.6.8 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

7th Grade
Research to Build and Present Knowledge
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
W.7.9 Draw evidence from literary or informational texts to support analysis, reflection and research.
Speaking and Listening
Comprehension and Collaboration
SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on seventh-grade topics, texts and issues, building on others' ideas and expressing their own clearly.
SL.7.2 Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text or issue under study.
Presentation of Knowledge and Ideas
SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details and examples; use appropriate eye contact, adequate volume and clear pronunciation.
SL.7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
SL.7.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
Language in Speaking and Listening
SL.7.7 Demonstrate command of the conventions of standard English grammar and usage when speaking.
SL.7.8 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

8th Grade
Research to Build and Present Knowledge
W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
W.8.9 Draw evidence from literary or informational texts to support analysis, reflection and research.
Speaking and Listening
Comprehension and Collaboration

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on eighth grade topics, texts and issues, building on others' ideas and expressing their own clearly.
Language in Speaking and Listening
SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning and well-chosen details; use appropriate eye contact, adequate volume and clear pronunciation.
SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence and add interest.
SL.8.8 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

History, Government, and Social Studies
Standard 3: Societies are shaped by the identities, beliefs, and practices of individuals and groups.
3.1 The student will recognize and evaluate how societies are shaped by the identities, beliefs, and practices of individuals and groups.
3.2 The student will analyze context and draw conclusions of how societies are shaped by the identities, beliefs, and practices of individuals and groups.
3.3 The student will investigate and connect how societies are shaped by the identities, beliefs, and practices of individuals and groups with contemporary issues.
3.4 The student will use their understanding of how societies are shaped by the identities, beliefs, and practices of individuals and groups to make a claim or advance a thesis using evidence and argument.
Standard 5: Relationships among people, places, ideas, and environments are dynamic.
5.1 The student will recognize and evaluate dynamic relationships that impact lives in communities, states, and nations.
5.2 The student will analyze the context and draw conclusions about dynamic relationships.
5.3 The student will investigate and connect dynamic relationships to contemporary issues.
5.4 The student will use their understanding of dynamic relationships to make a claim or advance a thesis using evidence and argument.

National Agriculture Literacy Outcomes:
Agriculture and the Environment
- Discuss the comparative environmental pros and cons of populations relying on their local and regional resources versus tapping into a global marketplace (T1.6-8 e.)
- Recognize how climate and natural resources determine the types of crops and livestock that can be grown and raised for consumption (T1.6-8 g.)

Food, Health, and Lifestyle
- Explain how factors, such as culture, convenience, access, and marketing affect food choices locally, regionally, and globally (T3.6-8 d.)
- Identify sources of agricultural products that provide food, fuel, clothing, shelter, medical, and other non-food products for their community, state, and/or nation (T3.6-8 i.)

Science, Technology, Engineering, and Mathematics
- Discuss how technology has changed over time to help farmers/ranchers provide more food to more people (T4.6-8 d.)

Culture, Society, Economy, and Geography
- Consider the economic value of agriculture in America (T5.6-8 a.)
- Explain how agricultural production and trade led to the development of industrialized societies (T5.6-8 c.)
- Identify agricultural products that are exported and imported (T5.6-8 g.)

Supporting Resources:

Sorghum Fun Facts Poster,
Grain Sorghum Growth Stages,
Grain Sorghum Plant Part Labeling,
Kansas Connections Sorghum Magazine Connection
Sorghum Byproducts Poster
Sorghum Nutrition Facts
What Is Sorghum? And Why Is The South So Obsessed With It?

Career Information: Research Technician
A research technician works in a laboratory setting (which includes field or farm work) to assist a research scientist. They could research sorghum, wheat, corn, livestock, and other relevant topics. Research technicians commonly operate and maintain laboratory equipment, record and input laboratory data, assist in seeding and harvesting crops, identify damage caused by pests and diseases, and provide crop treatments. Research technicians typically require a bachelor's degree in agronomy, horticulture, animal science, poultry science, aquaculture, or laboratory technology. They often work at universities or for seed, animal health, or pharmaceutical companies.

Assessment:

1. Daily formative assessments will help students stay on track. These may include an exit slip, a teacher check-in with each student, a list of group accomplishments, observations, student notes, and other materials. Telling students about the type of assessment at the beginning of class helps them be more productive.
2. Use mini-lessons to provide instruction on preparing the project, including learning vocabulary, conducting a quick search, refining a search, taking notes, keeping references, citing sources, editing, working in groups, and supporting one another's work.
3. Use a rubric to assess student projects. Rubistar, PBL checklist, or RubiMaker offer rubric templates. You can also find customizable rubric makers and premade rubrics available online.

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