



Cotton

Audience: 9-12

Activity Length: Three to Four Weeks Combined with instruction and activities (pace depends on each classroom)

TEKS:

- ELA:
 - English I
 - 1.A, 1.B, 1.C, 1.D, 5.B, 5.C, 5.D, 5.E, 5.H, 5.I
 - English II
 - 1.A, 1.B, 1.C, 1.D, 5.B, 5.C, 5.D, 5.E, 5.H, 5.I
 - English III
 - 1.A, 1.B, 1.C, 1.D, 5.B, 5.C, 5.D, 5.E, 5.H, 5.I
 - English IV
 - 1.A, 1.B, 1.C, 1.D, 5.B, 5.C, 5.D, 5.E, 5.H, 5.I
- Agriculture, Food, and Natural Resources:
 - Principles of Agriculture, Food, and Natural Resources §127.2.D
 - 1.B, 1.E, 4.B, 4.C, 4.E, 6.A, 6.B, 7.A, 7.B, 10.A, 10.C, 11.A, 11.B, 11.C, 11.D, 11.E
 - Horticulture
 - 1.B, 5.A, 5.B
 - Advanced Plant and Soil Science
 - 1.B, 2.A, 3.H, 6.A, 6.B, 9.F, 15.C, 15.D, 18.A

Objectives:

- Students will develop an understanding of the phases of cotton production
- Students will exercise research and communication skills to gather information and draw conclusions
- Students will engage in career exploration

Materials Needed:

- Part 1: Planting
 - Cotton Lesson Presentation
 - Shovel or soil sampling rod
 - Ziploc bags
 - [Soil Testing Kit](#) or [AgriLife Soil Sample Mail In](#)
 - Soil Testing Conclusion and Summary handout
- Part 2: Growth Cycle
 - Cotton Lesson Presentation
 - Weed samples (optional)



- Interview Notes handout
- Digital microscopes (optional)
- Part 3: Harvesting
 - Cotton Lesson Presentation
 - Recording device for student videos
- Part 4: Ginning
 - Cotton Lesson Presentation
 - [Nearpod quiz](#)
 - Career Cluster handout
- Part 5:
 - [Nearpod Quiz](#)
 - Food Dollar Breakdown handout

Activity Outline:

Part 1: Planting

- In general, cotton is a drought-resistant crop, meaning it can thrive without an abundant water source, which makes it a good crop for the dry Texas climate in much of the state.
 - Show a map of Texas and ask if students are familiar with where cotton is grown in Texas. Challenge students to discuss why (i.e. what they know about the climate in those areas, etc.) they either know or think these things.
- Planting time varies depending on the location.
 - Utilize this [site](#) for an overview of the cotton producing regions of Texas.
- Planting requires a good awareness of the environmental conditions. For example:
 - Temperature
 - Freezing conditions
 - Soil temperature
 - Moisture/rain
 - Soil viability
 - Length of growing season
- Farmers utilize soil testing before planting to determine the soil viability and nutrient needs.

Activity 1

- Have groups of students research how/where to send soil for testing. Students should consider contacting the local Texas A&M AgriLife Extension office to further learn about and discuss this process. It is highly encouraged



for students to also speak with a cotton farmer to learn more about why soil testing is important from his/her perspective.

- Students should determine what soil testing reveals about the soil – what components are ideal for the soil to include when growing cotton (or all crops). Students should gather this information during their research on the soil testing process.
- Once students research the process, allow students to test the soil around the school or school garden (if the school has one). Or, coordinate with a local farmer to test his or her soil. Students should properly prepare the soil sample to be sent for testing. As a class, submit a soil sample for testing and analyze the results upon receipt.
 - Once the soil sample testing results are received, students should make conclusions and record a summary of their conclusions on the below “Soil Testing Conclusions and Summary” document.
- Facilitate a discussion with the class about what each group learned and what next steps might be. Did they learn anything new about the importance of soil testing? If so, what?

Photo 1: Example of soil sample using a sampling rod



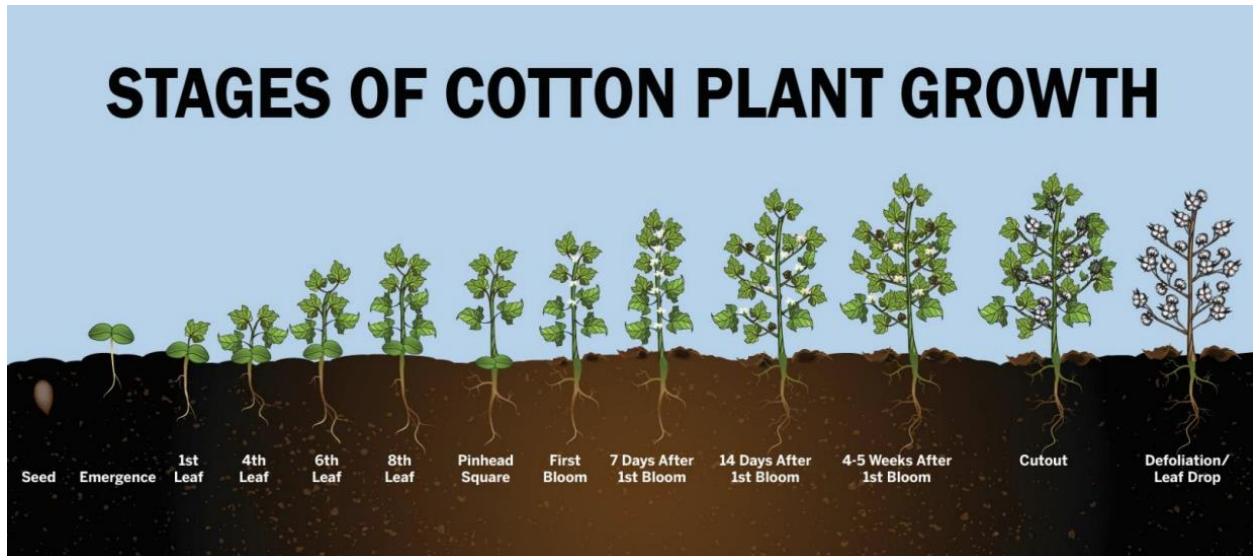
Photo Courtesy of Rachel Stoltzmann

Part 2: Growing Cycle

- Stages of Growth: (Source: [National Cotton Council of America](#))
 1. Germination and emergence



2. Seedling establishment
3. Leaf area and canopy development
4. Flowering and boll development Maturation (open boll)



- During the plant's growing cycle, one of the most important things to monitor is weed growth that competes for the nutrients in the soil that the cotton plant needs. Weeds are the most common issue present throughout the growing cycle; however, pests can also be present at different growing stages.
 - Weed management options to consider:
 - Preventative (i.e. pre-emergent spraying or stocking ratio of livestock)
 - Cultural (i.e. prescribed fire)
 - Mechanical (i.e. mowing, shredding, or plowing)
 - Biological (i.e. grazing livestock)
 - Chemical (i.e. herbicide)
 - The most common weeds found in Texas cotton fields are provided here ("[Cotton Weed Control](#)" document). Photos are also included. Have students study the document independently, then facilitate a discussion to go over what they learned while reading.
 - Provide weed samples if you're able to.
 - To deal with a weed problem (or infestation), farmers must first identify the weed that is causing the problem. Often, a dichotomous key is used to determine weed identity.
 - Practice this process utilizing the following [presentation](#) courtesy of the National Agriculture in the Classroom Matrix.



- If you were able to bring in weed samples, have students analyze and identify the weeds. Students might even use digital microscopes for an in-depth analysis.
- Weeds are managed through a variety of methods (see above), but when needed, farmers can and sometimes have to manage weeds with a responsible chemical program. Refer to the “Cotton Weed Control” document (linked above) from Texas A&M AgriLife Extension to learn about chemical use.

Activity 2

- Study a chemical program – students should speak to two farmers about their responsible chemical program and how technology such as drones and other imaging helps them identify issues in their fields. How does technology help and what limitations does such technology have? *Utilize the “Interview Notes” document below.
 - *NOTE: This can be a virtual meeting that the students set up and coordinate if an in-person meeting is not feasible)
- Ask students: Based on your conversations and knowledge gained from other research, what should your first step be when developing a chemical program to control weeds? (i.e. identify the issues, location of issue, identify the weeds, etc.)
 - **Sample Chemical Program Activity:** Have students create a sample chemical program based on the below information. Students should display their sample program in a PowerPoint or other creative outlet.

Mr. Smith farms cotton in Central Texas. After checking his fields, Mr. Smith noticed a weed issue in one of his fields. The issue is not present throughout the entire field; rather, the issue only seems to be present in three locations around the perimeter. To date, Mr. Smith has not utilized a consistent chemical program. It is June. What might the problematic weed be? Based on this information and what you learned through research, develop a plan to help Mr. Smith combat the weed problem from now until harvest. Your plan should also include a chemical program that Mr. Smith could follow during the next growing season (start to finish).

Part 3: Harvesting

- A cotton field is harvest ready when the leaves have been defoliated
 - Defoliated means the leaves are removed from the stalk of the plant
- Defoliation occurs either naturally (a freeze) or through the use of a chemical harvest aid.



- Harvest aid is sprayed on the plant to help it defoliate at a more rapid pace. Cotton is a perennial plant, so it would grow into a tree if a freeze didn't occur, or harvest aid wasn't used.
 - The use of chemical harvest aid is region specific.
- The government regulates cotton stalk destruction as part of the boll weevil eradication efforts.
 - The Boll Weevil is a major pest that feeds on the flowers and cotton buds.
 - Cotton stalk destruction is required in some areas to help control the boll weevil.
 - Cotton stalk destruction occurs naturally (freeze), mechanically (plowing/tilling) or chemically (harvest aid herbicide).
 - Source: [Cotton Stalk Destruction with Herbicides](#)
 - State regulated and the destruction date depends on the region/zone
 - [Texas Department of Agriculture Cotton Stalk Destruction Zones](#)
 - Some counties are not in a zone due to the colder climate where it freezes; therefore, stalk destruction isn't required because the freeze prevents regrowth.
- Cotton harvesting techniques:
 - There are two different cotton harvesters used to harvest cotton out of the field. See page four of the following [document](#) for information about each technique:
 1. Cotton Stripper
 2. Cotton Picker

Activity 3

- Divide the class into groups.
- Assign each group a Texas county.
- Each group should identify the cotton stalk destruction zone that the county is in (if the county is in a zone).
 - If the county is not in a zone, why not?
- Once students identify the zone, research the specific harvest details for that county (i.e. harvest date, harvest aid or no harvest aid, harvest technique, average yield for that area, and other information the group feels is interesting and pertinent to growing cotton in that area).
- Students will create a creative 3-minute educational video that could be used in a public setting to teach about cotton production in the area that they researched.

Part 4: Ginning



- Test your students' knowledge by asking the following questions. You can utilize the following [Nearpod quiz](#) to facilitate these questions if you choose. Create a free Nearpod account if you do not already have one. Students will join via join.nearpod.com and utilize the access code one you select (via the above link) the "live-participation" mode. If you choose not to utilize the Nearpod quiz, utilize slide 21 of the PowerPoint. Delete slide 20 if you choose to use the Nearpod quiz.
 1. Who invented the cotton gin? (Answer: Eli Whitney)
 2. What year was the cotton gin invented? (Answer: 1794)
 3. Where (city and state) is the largest cotton gin in the United States located? (Answer: Spearman, Texas)
 4. What is the fiber called that is left on the seed once the majority of lint is removed during the ginning process? (Answer: Linters)
 5. True or False: The cotton gin cleans the cotton AND separates the lint from the seed. (Answer: cleans the cotton and removes the lint from the seed)
 6. True or False: Cotton seed is used to feed cattle? (Answer: True)
 7. Some of the foods we eat contain cotton seed oil as an ingredient. Which of the following foods contains cotton seed oil? (Answer: All of the Above)
 - a) Peanut Butter
 - b) Milano Cookies
 - c) Cream of Mushroom Soup
 - d) All of the Above
- Show the following [video](#) that highlights the Adobe Walls Gin in Spearman, TX, the largest gin in the United States:
- Read about the ginning process [here](#)
- Ginning Steps:
 - Step 1: Module arrives from the field to the cotton gin
 - Step 2: Cotton is dried to decrease the amount of moisture (improves fiber quality)
 - Step 3: Cotton is cleaned to remove other objects such as limbs, leaves, etc. (improves fiber quality)
 - Step 4: Cotton moves to gin stands where the seeds are separated from the lint using circular saws
 - Step 5: The lint is then pressed into large bales that weigh about 500 pounds
 - Step 6: A sample is taken from each bale to grade the cotton to determine quality, which plays a role in how the farmer is paid
 - Step 7: After the entire process takes place, the bale of cotton is stored in a warehouse until it is shipped to its next destination



- Play the following ginning [video](#) for students to see the steps in the ginning process
- *Ask students to think critically when answering the following question.
What careers do you see, not see (i.e., those who might work behind the scenes or not directly in the gin), and think of when you watched the video that play a role in getting the cotton from the field to the store? Make a list on the board as students share their thoughts and engage in discussion.
 - Examples:
 - Farmers
 - Coders
 - Truck drivers
 - Inspectors
 - Laboratory technicians
 - Gin workers
 - Gin manager
 - Show students the career cluster handout.

Activity 4

- Groups of students should pick a career, research that career, and give a presentation to the class as if they work for the human resource department of a company hiring for this position. The students should role play and present why this job is one someone should consider. **The following information must be provided, but students are encouraged to be creative and provide all the information about the role and the company that might be of interest to a qualified candidate.*
 - Career:
 - Education Requirements:
 - Salary/Pay:
 - Location:
 - What is an employer looking for (i.e., expectations) in a person who fulfills this role?
- How does the farmer get paid?
 - Farmers must wait on the cotton to be ginned and graded before being paid.
 - The farmer's pay is dependent on the grade of the cotton – each bale of cotton is graded in a USDA laboratory. The better the cotton grades, the more the farmer is paid.
 - Where does the money go when we purchase food?



- Note: The following activity isn't directly related to cotton, but it provides a glimpse into what share of the food dollar the farmer actually gets. One major misconception is that when food prices increase in the grocery store, the farmer gets paid more. This isn't necessarily the case. For example, if fuel prices go up and cause an increase in food prices, farmers and ranchers do not benefit from the food price increase. How do you know about specific brands of food? The brands behind your favorite syrup, cereal, or ice cream use advertising to promote and garner interest from consumers, retailers, and purchasers in the restaurant industry. Advertising costs play into the price of food for the consumer and others. There are multiple different occupations and job opportunities available in getting the food from the farm to the grocery store or restaurant supplier.

Activity 5

- Utilize the following digital [Nearpod](#) matching activating OR the cards below to facilitate a matching game with the students. Create a free Nearpod account if you do not already have one. Students will join via join.nearpod.com and utilize the access code one you select (via the above link) the "live-participation" mode. If you choose not to utilize the Nearpod quiz, utilize the below cutouts and delete slide 30 of the PowerPoint.

Instructions: Cut the cards out and have groups of students match the amount of the food dollar with the correct industry. The correct answers are below.

- Finance & Insurance: 3.3 Cents
- Transportation: 4.1 Cents
- Advertising: 2.9 Cents
- Farm Production: 8 Cents
- Food Processing: 16.7 Cents
- Food Services: 27.9 Cents
- Wholesale Trade: 11.9 Cents
- Retail Trade: 14.2 Cents



Soil Testing Conclusion & Summary

*Worksheet should be added to other notes that are taken throughout all parts of the lesson

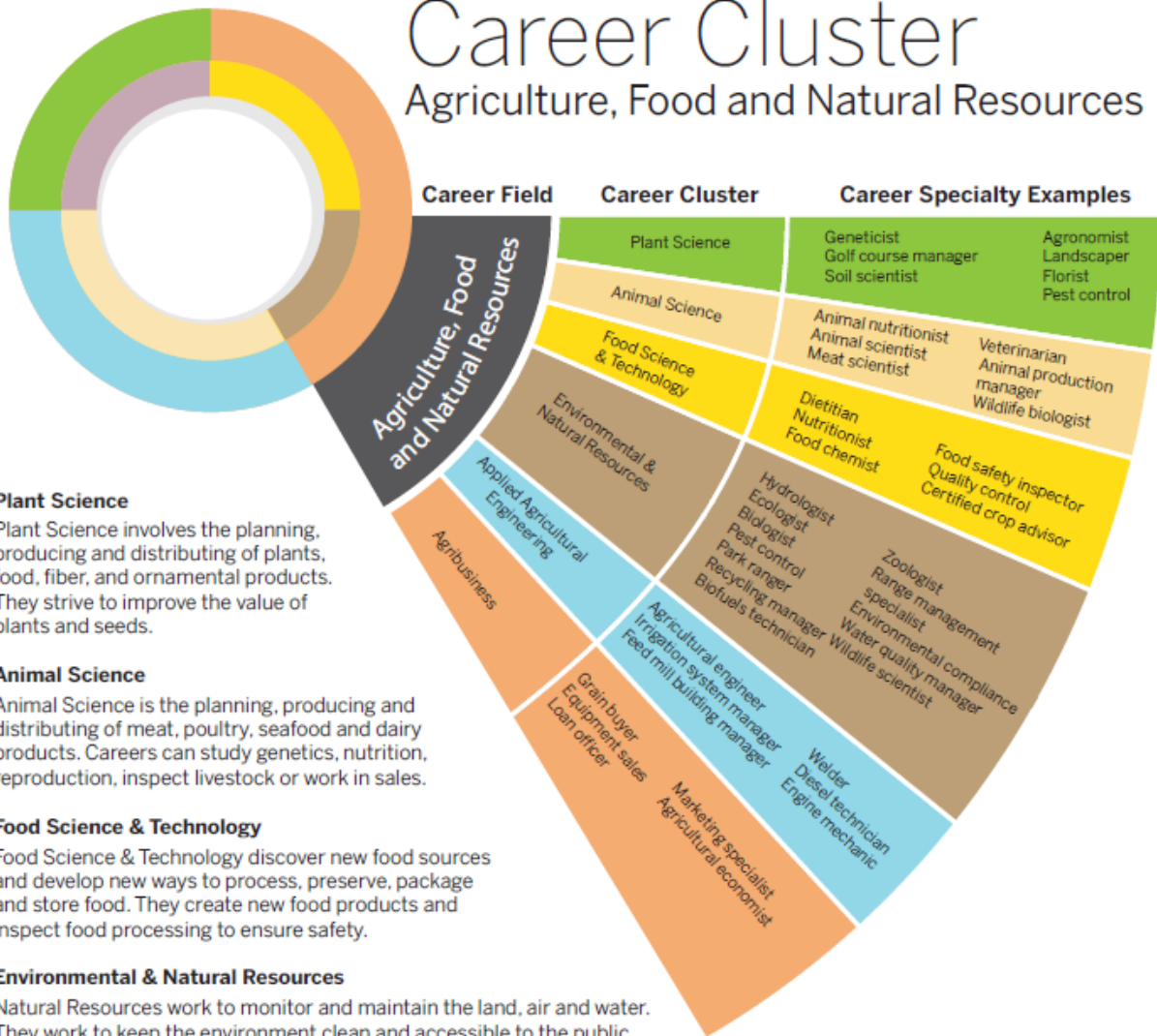
Conclusion/s:

Summary:



Career Cluster

Agriculture, Food and Natural Resources



Plant Science

Plant Science involves the planning, producing and distributing of plants, food, fiber, and ornamental products. They strive to improve the value of plants and seeds.

Animal Science

Animal Science is the planning, producing and distributing of meat, poultry, seafood and dairy products. Careers can study genetics, nutrition, reproduction, inspect livestock or work in sales.

Food Science & Technology

Food Science & Technology discover new food sources and develop new ways to process, preserve, package and store food. They create new food products and inspect food processing to ensure safety.

Environmental & Natural Resources

Natural Resources work to monitor and maintain the land, air and water. They work to keep the environment clean and accessible to the public. Environmental Resources work to preserve the environment by keeping it clean and accessible to the public.

Applied Agricultural Engineering

Applied Agricultural Engineering helps to design and maintain machinery used in agriculture by applying knowledge of engineering, hydraulics, electronics, power and structures. They develop ways to help conserve soil and water and improve agricultural products.

Agribusiness

Agribusiness uses technology to coordinate all activities that contribute to production, processing, marketing, distributing, financing and development of all agriculture commodities. They help to increase efficiency and profitability by using spreadsheets, satellite systems and other innovations.



Plant Science			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Nursery or greenhouse worker Seed sales Crop inspectors	Commercial horticulture Crop production Forestry Landscape/nursery	Conservationist Plant protection science Arboretum manager Sustainable designer	Agronomy consultant Biochemist Entomologist Horticulture specialist
Animal Science			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Animal caretakers Feed sales Animal trainer Farmer/rancher Artificial inseminator	Equine industry management Livestock industry management Swine management Vet technician	Grazing livestock systems Animal inspector Feedlot manager Food safety inspector	Geneticist Animal nutritionist Biochemist Integrative biomedical sciences Veterinary medicine
Food Science & Technology			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Butcher Meat processor Inspector Baker	Quality control USDA grader	Hospitality, restaurant and tourism management Mechanized systems management Meat sales/buyer Research and development Auditor	Food science and technology nutrition Meat scientist Test kitchen manager
Environmental & Natural Resources			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Emergency response technician Wildland firefighter Recycling manager	Soil and water conservationist Laboratory science technician Campground manager Wetlands specialist	Environmental studies Aquatic ecologist Texas Parks and Wildlife Soil scientist Zoologist Water quality manager Park Ranger	Wildlife biologist Regulatory entomologist Natural resources scientist Urban planner
Applied Agricultural Engineering			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Ag service trainee Ag equipment operator Electrician apprenticeship Plumbing apprenticeship Welding apprenticeship	Farm mechanics Irrigation technology Mechanized agriculture practices	Mechanized marketing Mechanized science Processing operations Electrical engineer	Agricultural and biological systems engineer Mechanized systems management
Agribusiness			
High School or On-the-Job Training	Associate's Degree	Bachelor's Degree	Master's/Doctoral Degree
Ag business clerk Ag warehouse worker Farmer/rancher	Ag sales Custom applicators Farm and ranch business management	Commodity trader Government agency employee Loan officer	Attorney/lawyer Political consultant Ag economist



Interview Notes

*Worksheet should be added to other notes that are taken throughout all parts of the lesson

A large rectangular area defined by a dashed black border, intended for taking interview notes.



**Food Dollar Breakdown: Where does the money go?
Matching Activity**

Teacher Instructions: Make several copies of these pieces, and have groups match the percentage of the breakdown with the corresponding industry.

16.7 Cents	3.3 Cents	Advertising
27.9 Cents	11.9 Cents	Farm Production
4.1 Cents	14.2 Cents	Food Processing
2.9 Cents	Finance & Insurance	Food Services
8 Cents	Transportation	Wholesale Trade
	Resale Trade	



THE FOOD DOLLAR

15.9¢ FARM SHARE

84.1¢ MARKETING SHARE

- FOOD PROCESSING
- WHOLESALE TRADE
- ENERGY
- PACKAGING
- RETAIL TRADE
- ADVERTISING
- TRANSPORTATION
- FOOD SERVICES
- FINANCE AND INSURANCE



2023 Food dollar: Marketing bill (nominal)
Source: 2023 USDA Economic Research Service, Food Dollar Series

The farm share is the portion of the food dollar that goes to farm establishments for the sales of raw food commodities.

The marketing share is the portion of the food dollar that goes to food supply chain establishments for post-farm activities that transform raw food into finished food products.

