Grade 6 – South Carolina Science

SOUTH CAROLINA STANDARD 6-1

Standard 6-1: The student will demonstrate an understanding of technological design and scientific inquiry, including process skills, mathematical thinking, controlled investigative design and analysis, and problem solving.

Indicators:

- 6-1.4 Use a technological design process to plan and produce a solution to a problem or a product (including identifying a problem, designing a solution or a product, implementing the design, and evaluating the solution or the product).

Grade 6 – South Carolina Science

SOUTH CAROLINA STANDARD 6-2

Standard 6-2: The student will demonstrate an understanding of structures, processes, and responses of plants that allow them to survive and reproduce. (Life Science)

Indicators:

- 6-2.2 Recognize the hierarchical structure of the classification (taxonomy) of organisms (including the seven major levels or categories of living things—namely, kingdom, phylum, class, order, family, genus, and species).
- 6-2.5 Summarize each process in the life cycle of flowering plants (including germination, plant development, fertilization, and seed production).

Grade 6 – South Carolina Science

SOUTH CAROLINA STANDARD 6-8

Indicators:

- 6-8.1 Cite specific textual evidence to support analysis of science and technical texts.
- 6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- 6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

(Day 1-2) Prewriting/Homework: Reading About Cotton (Satisfies 6-8.1 and 8.2) The Literature Circle book "The Biography of Cotton" will be designated as required reading prior to the beginning of this lesson.

- Class Discussion – The sections "What is Cotton? (p. 4-5)" and "The Cotton Gin (p.18-19)" will be focused upon. Plastic cotton will be defined and a brief overview of how Legare intended to use his creation will be lectured upon as well (Refer to page 38 of Mack's "Hidden History of Aiken County"). The sample of plastic cotton will then be passed around the class.
    - After the discussion, the students will be given a handout entitled "What Is Cotton and How Does It Grow?" It is a prelude to the following activity. Students will be asked to write down on a separate sheet of paper all of the emboldened vocabulary words within the handout for the following day.

(Day 3-5) Activity: The Growth of the Cotton Plant (Satisfies 6-2.2 and 6-2.5)

- Students will be asked what facts they found most interesting from the previously assigned handout
- The growth and parts of the cotton plant will be detailed in the previously distributed handout and taught as a lecture. The vocabulary terms highlighted within the handout will be expected to be memorized. Within a couple of days, there should be a quiz given to them where they must define this vocabulary as well as detail the growth cycle of the cotton plant.
    - List of Vocabulary Words:
        - staple length, planting, germinate, cotyledons, photosynthesis, true leaves, squares, bracts, pollinate, boll, cellulose, carpels, locks, bur

(Day 6-8) RAFT One Act Play (satisfies 6-1.4, 8.1, 8.2)

This activity is meant to parallel the interactions James Matthews Legare had with James Henry Hammond and complement a discussion of how Legare capitalized upon the surplus cotton generated from the invention of Eli Whitney's cotton gin (Refer to p.39-40 of Mack's "Hidden History of Aiken County and p.126-128 of Davis' "That Ambitious Mr. Legare"**)** After explaining this relationship, pass around the provided photo album so that students can see what Legare designed with his invention.

Prewriting/Homework – Reading Eli Whitney A day prior to this assignment, the class will be asked to read "Eli Whitney" as homework. Additionally, ask the students to think of a way that plastic cotton could have been used that Legare did not design.

Before beginning this activity, the teacher must provide examples of what an investor looks for in a new invention. Then all but three or four members of the class will gather into small groups to create an argument for their use of plastic cotton. The remaining students are designated to act as investors.

Requirements:

- The students will be split into groups of three.
    - Students groups that have been designated the role of inventors will convene to discuss how they will individually argue the importance of their invention.
    - Student groups who have been designated the role of investors will congregate to discuss the questions they believe will prove or disprove the usefulness of the invention soon to be presented.
    - These discussions will last five minutes.
- Each one act play will be limited to five minutes to provide the class a chance to discuss how the argument was presented and how it was countered

The overall length of this lesson is intended to be 2 fifty minute periods.

(Day 9-14) Activity: Multimedia Research: (Satisfies Language Arts requirement 6-6.6; Satisfies Science requirements 6-8.2 and 8.7)

After distributing and talking about the handout "HOW COTTON IS GINNED AND MARKETED," students will learn about the versatility of cotton, which appears in many of the things they wear, use, and eat every day. Students will also gain an understanding of how raw materials are transformed through various processes into finished products.

- In class, ask students to name a few items that are made out of cotton.
    - **Homework—That's Made of Cotton?!** Tell students to find an object made at least partially with cotton that they did not initially believe had any cotton as a component. Follow this with a brief discussion the next day so that all students can have a wide variety of knowledge upon the subject of cotton products.

a. After the brief discussion, divide students into teams and assign each team one item made of cotton.
    i. Ask each team to conduct research into their chosen product and learn all about the process of manufacturing it, from seed to factory.
    ii. After a week or so, have the teams showcase how their chosen product is made.
        1. This will be done through the use of a PowerPoint.

(Day 15) Review/Final Test

- Students will be given a list of items that they have to determine are or are not made at least partially of cotton/ plastic cotton.
- Questions pertaining to the intended use and eventual failure of Legare's plastic cotton will be provided in the form of short answer or multiple choice questions.
- Students will be asked to recall the parts of the cotton plant and will be expected to provide a short description of its growth process.
- Information from the covered sections of "The Biography of Cotton" will be posed as short answer or multiple choice questions.

What Is Cotton and How Does It Grow?

Kingdom: Plant

Phylum: Gossypium

Class: Magnoliopsida

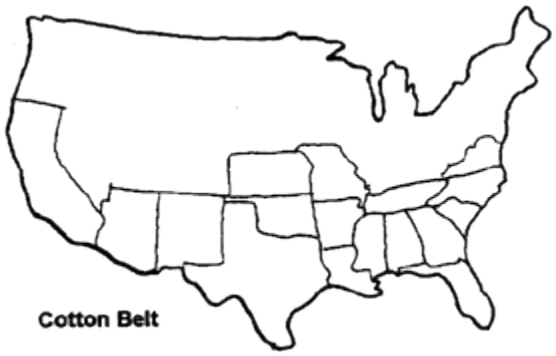
Order: Malvales

Family: Malvaceae

Genus: Cotton Plant

Species: Various

In the U.S. there are fourteen major cotton growing states that produce Upland cotton. They are Alabama, Arizona, Arkansas, California, Georgia, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Virginia. Some cotton is also grown in Florida, Kansas and New Mexico. American Pima cotton is grown in Arizona, California, New Mexico and Texas. All of these states form a region in the United States known as the ***Cotton Belt*** and have three things in common, lots of sunshine, water and fertile soil, very important to growing a good cotton crop.

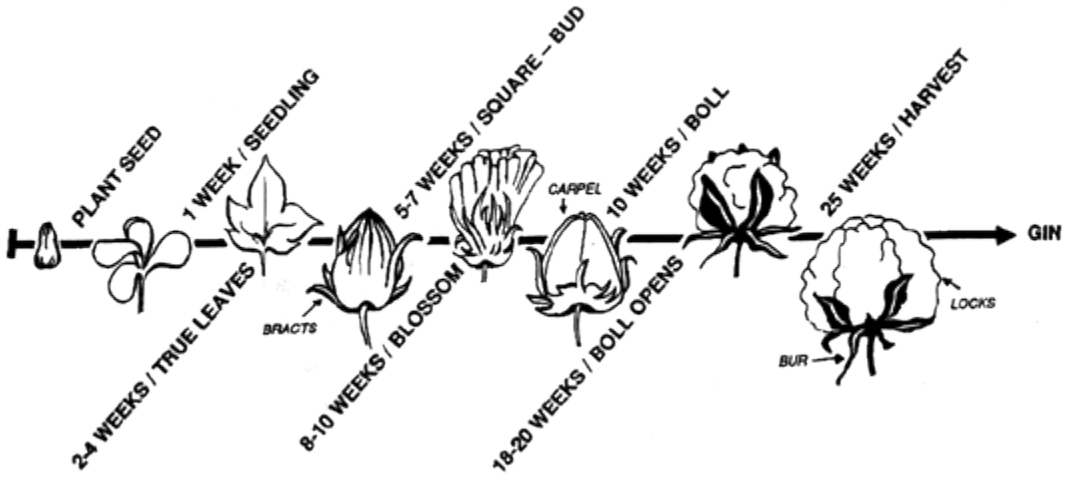


Upland cotton being the most common type in the U.S. has a ***staple length*** (length of fiber) of 13/16 to 1 ¼ inches. The American Pima has a staple length of 1 5/16 to 1 ½ inches. These plant types grow and mature at different rates and lengths of time, but basically mature within a 30 day period of each other.

Cotton plants have a general time frame in which they grow and produce after ***planting*** (introducing the seed to moist soil). With ideal conditions, the planted cotton seed will ***germinate*** (to begin to grow) or sprout and emerge in about five to ten days. The first 2 leaves that are visible on the young cotton plant are seedling leaves called ***cotyledons*** (cot-a-lee-dons). They are useful for absorbing sunlight into the plant. The sunlight is then converted through a process known as ***photosynthesis***, into nourishing carbohydrates that will help the plant grow.

In about two to four weeks they turn over the photosynthetic task to ***true leaves*** (leaves produced subsequent to the cotyledons) which continue the feeding process for the duration of the plants life. The plant continues to grow, adding leaves and height, and in approximately five to seven weeks, small flower buds called ***squares*** (a small flower bud covered with fringed leaf-like parts called***bracts***) will appear on the cotton plant. As this square develops, the bud swells and begins to push through the bracts until it opens into an attractive flower. Within three days, the flower will ***pollinate***(the transfer of pollen from the anther to the stigma of the same or another flower)

itself, change from a creamy white or yellow color to a pinkish red, and then wither and fall, exposing a small, green, immature cotton ***boll*** (a segmented pod containing 32 immature seeds from which the cotton fibers will grow). This boll is considered a fruit because it contains seeds. As the fibers continue to grow and thicken within the segmented boll, it enlarges until it becomes approximately the size of a small fig. Now, the cotton fibers have become mature and thickened with their primary growth substance,***cellulose*** (a carbohydrate, the chief component of the cell wall in most plants). An average boll will contain nearly 500,000 fibers of cotton and each plant may bear up to 100 bolls



In about 140 days after planting or 45 days after bolls appear, the cotton boll will begin to naturally split open along the bolls segments or ***carpels*** and dry out, exposing the underlying cotton segments called ***locks***. These dried carpels are known as the ***bur***, and it's the bur that will hold the locks of cotton in place when fully dried and fluffed, ready for picking.

The growth cycle of the various cotton species vary in length, but the sequence of fruit production remain the same. Weather, insects and moisture can adversely affect optimum conditions for plant growth and it is the farmer's responsibility to adjust to these conditions to optimize yield.

HOW COTTON IS GINNED AND MARKETED

After harvesting, cotton is either stored at the edge of the field in big mounds called “modules” or loaded on trailers or trucks and transported to the gin. Powerful pipes suck the cotton into the building and through cleaning machines that remove the “trash” such as burs, dirt, stems, and leaf material from the cotton. Then it goes to the gin stand where circular saws with small, sharp teeth pull the fiber from the seed. From the gin, fiber and seed go different ways. The ginned fiber, now called lint, is pressed together and made into great bales weighing about 500 pounds. To determine the value of the cotton, samples are taken from each bale and classed according to fiber length (staple), strength, width, color, and cleanness. Growers usually sell their cotton to a local buyer or merchant who, in turn, sells it to a textile mill either in the United States or a foreign country. The seed usually is sold by the grower to the gin. The ginner either sells the seed for feed or to an oil mill where the linters (downy fuzz) are removed in an operation very much like ginning. Linters are baled and sold to the paper, batting, and plastics industries, while the seed is processed into cottonseed oil, meal, and hulls.