



Botanical Garden Programs: Discovering Plants

WEAVING COTTON



Grades K–3

I. Introduction

This lesson explores the journey that cotton makes from boll to fabric. Along the way, students will become aware of the large role cotton plays in their everyday lives. In addition, students will have a hands-on experience of simple weaving.

II. Objectives

- ◆ Students will observe using sight and touch
- ◆ Students will compare different textures
- ◆ Students will understand the process that is involved in cotton processing
- ◆ Students will realize that much of our clothing is made of cotton

III. Standards Assessed

Science Standards

Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998), California State Board of Education

- ◆ Students know objects can be described in terms of the materials they are made of (e.g., cloth, paper) and their physical properties (e.g., color, size, shape, texture, etc.)

Science Framework

Science Framework for California Public Schools: Kindergarten Through Grade Twelve (1990), California Department of Education

- ◆ Students understand that humans use plants and animals for food, clothing,

and paper; living things and essential resources need to be respected (Grade 3, page 125)

Geography Standards

Geography for Life: National Geography Standards (1994), National Geographic

- ◆ Students know the role that resources play in our daily lives (resources used to produce medicine, clothing, and food) (Grades K-2, page 137)

IV. Background

Cotton touches our lives from the moment we get up in the morning to the time we go to bed at night. We find cotton products in our food, clothing, and in other items. Cotton has been part of human life for at least 7,000 years. Fragments of cotton fabrics have been found by archeologists in Mexico (from 3500 B.C.), in India (3000 B.C.), in Peru (2500 B.C.), and in the southwestern United States (2500 B.C.). Where does cotton come from and how does it turn from a fluffy white boll on the cotton plant into the fabric that we wear?

Cotton is planted between February and June in warm tropical or sub-tropical areas. It takes about five months to grow a cotton-bearing plant from seed. After germination, flower buds emerge and open. The flowers' petals fall off, leaving the ovary on the plant to ripen and grow into a cotton boll. These bolls open up, allowing the fibers inside to fluff up (these fibers help to distribute seeds using the wind just like dandelions and kapok). Harvesting machines pull the whole boll off of the plant. At the gin, leaves and other debris are removed, and then circular saws pull the fibers through closely spaced ribs that separate the seeds from the cotton. The cotton is now considered "lint." At the textile mill, the lint is carded to get fibers going in one direction (like combing your hair), forming a long, ropelike strand. The cotton rope is pulled and twisted into a thinner strand that is then fed into the combing machine that cleans and straightens the rope even more. The rope is twisted and pulled so that it is thin and tight enough to become thread or yarn that is then dyed and woven.

V. Materials Needed

For Cotton observation exercise

- Different grades of cotton fabric (terrycloth, cotton knit, broadcloth, cheesecloth)
- Magnifying lens (optional)

For weaving with paper (for each student):

- Two 9 x 12" sheets of contrasting colored construction paper
- Glue or paste
- Ruler
- Pencil
- Scissors

For weaving with yarn (for each student):

- Scissors
- Cardboard (the thick corrugated stuff) cut into a 5 ½ x 7" piece and a ¾ x 7" piece.
- Thick fuzzy craft yarn in two contrasting colors (one cut 4' long and another 8' long in a different color, or see the extension activity to have students calculate lengths needed)
- Ruler
- Pencil

VI. Preparation

1. Cut up fabric pieces to be passed around (an example of each for each group should suffice).
2. Divide the class in three fairly even groups.
3. Precut paper strips before class to save time, or if students are too young to measure and cut accurately.
4. Make a paper-weaving example to show students.
5. Write the instructions on the board for the students to follow and draw and label diagrams so students will be able to understand weaving terms
6. Cut out the cardboard pieces for the looms and little ½" x 7" pieces for a shuttle (optional)
7. Draw on the chalkboard a diagram of the cardboard loom and label its parts to show students when weaving with yarn (it would also be helpful to do this along with the students)
8. Precut the pieces of yarn needed for each student (optional)

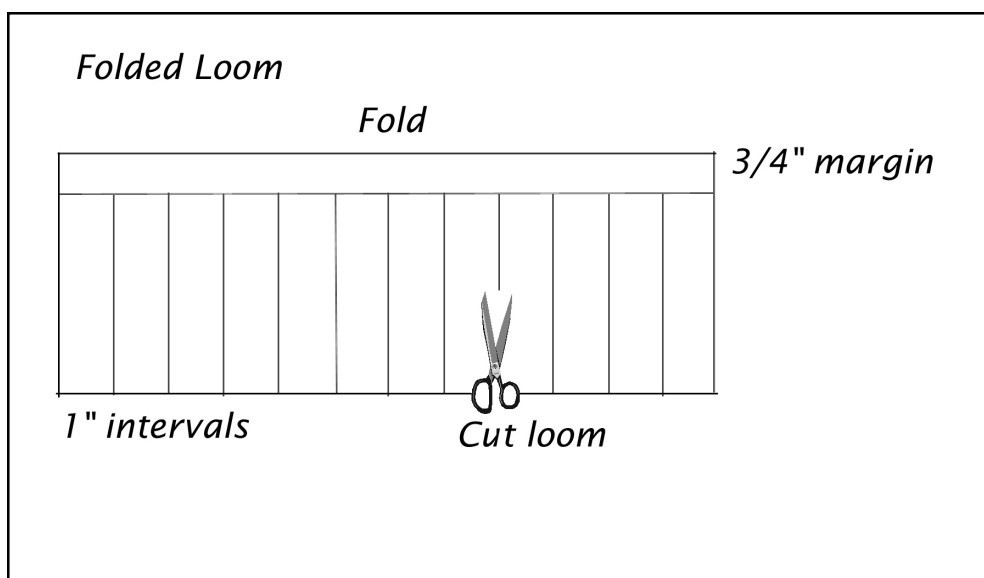
VII. Lesson Activities

Activity 1: Observation Exercise

1. Ask students if anyone in the room is wearing cotton. Have them, within their groups, read the labels in the collars of each other's shirts to see the fiber content of their clothes. Have each group make a chart that shows how many people are wearing 100% cotton, blends, and no cotton.
2. Pass out fabric and cheesecloth pieces to each group, asking them take turns looking at the cheesecloth and the fabric samples. Ask the students to feel each piece of cloth. Ask the students to look closely at the threads that make up each piece. Encourage them to unravel a few strands of thread from the piece of cheesecloth so they can see how the threads are woven together.
3. Explain that today they are first going to weave paper or yarn instead of thread so they can better see how weaving works close up. Introduce weaving vocabulary (warp, weft, loom, etc.) by pointing out the parts on a simple diagram that you can copy on the board.

Activity 2: Weaving with Paper

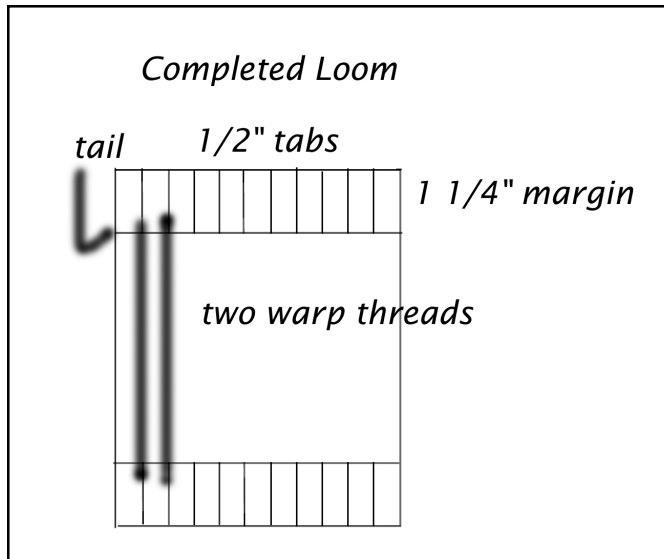
1. Hold up a sample of paper weaving that was made in advance and point out the parts (warp, weft, loom)
2. Pass out the construction paper, rulers, and scissors. It would be very helpful to make a weaving along with the students.
3. Have students fold one sheet of paper in half horizontally, long sides together. Then with the ruler, draw a line about $\frac{3}{4}$ inches from the open edge.



4. From the fold, draw eleven parallel lines, one inch apart, up to the original line. Cut along each short line starting at the fold and stopping when you get to the top pencil line. Do this all the way across. Your warp and your loom are now complete.
5. Measure and cut the second sheet of paper into one-inch wide by eight-inch long strips. You now have your seven weft strips and one extra.
6. Begin weaving by threading one weft strip over one warp strip, and then under the next. Repeat this pattern until you have woven the weft strip all the way across. Continue the process alternating over and under with each weft strip. (If the previous weft strip went over the warp strip, the following row will begin by going under the warp.) Repeat until the loom is full (seven strips are used).
7. Your weaving is nearly done! To keep the weft strips in place and looking nice, carefully glue down the loose weft ends on both sides of the paper.
8. Have students hold up their weavings to show them off to each other. Next, review the steps and parts of fabric weaving.

Activity 3: Weaving with Yarn

1. Pass out the 5 ½ x 7" pieces of cardboard. Have everyone mark a 1 ¼" margin along both short sides. These ends will be the top and bottom of the loom.
2. Again, using their rulers, have students lines perpendicular to the edge of the cardboard, at ½" intervals along the top of the loom, just long enough to touch the line that was drawn in step 1. Students should now have eleven ½ x 1 ¼" rectangles along the top of the loom. Have students repeat this steps on the other end of the cardboard. Everyone should now have rectangles on both the top and the bottom of their cardboard piece.
3. With their scissors, have students cut along the perpendicular lines that they just made, making sure that they only cut up to the margin line (1 ¼"). They now have their loom. The tabs along the top and bottom will be used to string the warp threads onto the cardboard for weaving.
4. Before you start weaving, make a ¾ x 7" shuttle to make it a bit easier and faster to weave (if you do not use a shuttle, a knot at the end of the weft yarn is useful because you can hold onto it and the yarn does not fray so much). Punch a centered hole with the tip of your scissors on one long end of the shuttle about ½" away from the end.
5. Pass out the yarn pieces, making sure that each student has one 4' warp piece and one 9' weft piece. Thread one end of the long weft yarn through the hole, pulling enough through so that you can tie a knot around the end of the shuttle. Cut off the excess little tail so the loop through shuttle is less



bulky. (Winding the yarn around the shuttle makes it too bulky to go between the warp threads.)

6. With one end of the shorter warp piece of yarn, stick the yarn into the first upper left hand split so that there is about a 6" tail hanging out in the back (unmarked) side of the loom. Make sure the yarn is wedged tight in the split because you don't want the warp threads to come undone.

7. Using the long part of the warp yarn, pull the yarn down toward the lower left hand split and stick it

through this split so that the long end of the yarn is now in the back. This is the first warp thread.

8. Next, take the long end of the warp yarn and pull it from the back through the slit right next to the one you just put the yarn through (bottom left) so that the end of the yarn is now on the front side. Pull the yarn up to the top of the loom and slid it into the slit next to the one you started with (upper left).
9. Repeat step 7 and 8 until the entire loom is full. There should be ten lines of yarn going up and down across the short sides of the loom. Turn the loom over on its back to make sure there aren't any stray warp yarns accidentally strung along the back. The warp is now complete.
10. With the second, longer piece of weft yarn (14' in a different color), knot one end of the yarn around the top part of the first warp yarn (one the upper left side of the loom). Make sure to leave a few-inch tail. Now that the weft yarn is tied to the warp, you can begin weaving.
11. Thread the weft yarn across the top from left to right, going over one warp thread and under another. Do this all the way across. The shuttle and its yarn should now be on your right side.
12. Starting on the right this time, go over the first warp yarn and the under the next, continuing on like this all the way across toward the left side of the loom.
13. Starting on the left, go over the first warp yarn and under the next, continuing all the way across. You will now have three completed rows. Using your fingers like a comb, gently push the weft threads up towards the top so that they are close together. Also, make sure that the rows are not too tight or too loose because you do not want your weaving to be bumpy or crooked along the sides.

14. Continue weaving by repeating steps 12-14 until you are about an inch so from the bottom of the warp yarn, continuing to comb the weft close together. You will have to cut off the shuttle and tie a knot on the end so that you can weave easier in a tighter space. Keep weaving until you fill the warp.
15. Tie a knot around the last warp thread with the loose weft thread so your weaving does not come undone. You are now finished weaving!
16. To remove your weaving from the loom, gently bend the tabs along the top and the bottom of the loom toward the center so that you can gently slip the warp off.
17. Your weaving might be a little crooked after removal, so take one long side in each hand and, pulling gently away from the center, flatten the piece. Your weaving is now complete. Cut off any excess loose ends, being careful to tie them to a different color thread first so the yarn does not come undone.

VIII. Discussion Questions

Relate paper weaving to fabric samples. Look at the cheesecloth carefully and compare it to the paper weaving and/or yarn weaving.

1. What other uses do you make of cotton in your life besides clothes? (Bed sheets, towels, dollar bills, cotton swabs, cotton balls, etc.)
2. If we did not have cotton, what other natural fibers could we use to make clothes? (Wool, flax, and sisal.)

IX. Extension Activities

1. Incorporate a math lesson in the "Weaving with Yarn" activity by asking the students to figure out how much yarn they will need to complete their project. To figure the length of the warp yarn, measure the length of the warp threads, multiply by the number of warp threads, and then add 12" to allow two ends to tie in. To figure the length of the weft, measure the width of the warp, multiply by twice the number of warp threads, then add 12" to allow two ends to tie in.

X. Vocabulary

<i>boll</i>	the seedpod of the cotton plant that contains the seeds and fiber
<i>carding</i>	the process of separating and cleaning cotton fibers to prepare them for spinning
<i>fiber</i>	a natural strand that can be spun into thread or yarn or woven into cloth
<i>flower</i>	the often-colorful part of a plant that produces seeds
<i>gin</i>	a machine used to remove seeds and to clean dirt from cotton when it is harvested from the field
<i>lint</i>	(1) cotton fibers that have had their seeds and debris removed, (2) fibers of any type trapped in the clothes dryer (not the same thing!)
<i>loom</i>	a frame for weaving yarn or thread into cloth or fabric
<i>ovary</i>	the part of a flower that develops into the seed or seeds
<i>shuttle</i>	an instrument used in weaving for passing the weft threads through the warp threads
<i>spinning</i>	the process of making yarn from cotton fibers by drawing out and twisting the fibers into a thin strand
<i>warp</i>	threads running lengthwise on the loom, placed on the loom prior to beginning the weaving process
<i>weft</i>	threads that are woven across the warp threads to form cloth or fabric
<i>weaving</i>	the process of forming cloth or fabric on a loom by interlacing yarn or thread

For more cotton vocabulary, see:

<http://www.gendex.com/users/Keates/glencoe/library/doc4.htm>

XI. Bibliography

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Weaving Cotton

Facts

California is second to Texas as the greatest-cotton producing state. The greatest cotton-growing counties in California are Fresno, Kern, Kings, Tulare, and Merced. California produces over 667,200 tons of cotton a year, which is worth one billion dollars.

What can be produced from one 500-pound bale of cotton?

- 1,217 men's T-shirts
- 313,600 \$100 bills
- 215 pairs of men's jeans
- 379 sweaters

How much cotton do U.S. textile mills use?

- 10 million bales per year, which is equal to 3 billion pairs of jeans or 8 billion dress shirts.

What other parts of the cotton plant are used by humans besides the fiber?

- Cottonseed oil made from crushed seeds is used to make cooking oil, shortening, and salad dressing.
- Linters (the fuzz stuck to the seeds) are used for padding in furniture and automobiles, for absorbent cotton swabs, and for manufacture of many cellulose products like rayon, plastics, and lacquers.
- The hulls or husks are used as feed cattle along with the squeezed kernels.
- The sediment left by cottonseed oil refining provides fatty acids for industrial products.

Cotton comes in colors other than white! Colors include light greens, light browns, and reds. (See www.foxfibre.com)

The average per capita consumption of cotton in the U.S. is 27 pounds a year.

Where else is cotton grown besides the U.S.? China, India, Pakistan, Brazil, and Turkey, to name a few.

Cotton comes from the mallow family, so it is related to hibiscus, okra, and swamp mallows.

For more interesting cotton facts, look on the National Cotton Council site (www.cotton.org).

For more interesting California cotton information, see the California Department of Food and Agriculture Web site for kids (www.cdfa.ca.gov/kids).