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Working With Plant Fibers

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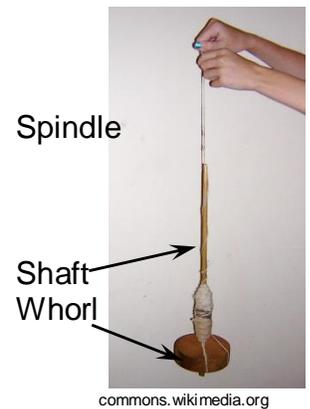
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NAME _____

Bio 401: Applied Plant Science

Working with Fibers

Spinning was developed independently by many cultures who adapted it for different types of fibers. Spindle whorls (the round weights attached to shafts) dating back to the Neolithic period have been found by archeologists. This type of spinning technology did not change until medieval times when the spinning wheel and flyer were developed. For much of human history the long process of spinning and weaving cloth was done by all members of society. This changed with the industrial revolution when modern spinning mills began to cheaply produce large quantities of thread or yarn during a short period of time. Today hand spinning fibers is an art form.



Spinning in Mythology and Folklore:

Spindles and spinning have been an integral part of mythology and folklore in many cultures. In Plato's "Spindle of Necessity" he likens the axis of the universe to the shaft of a spindle with the starry heavens as the whorl. The Bible mentions spindles and spinning. Spider Woman in the Navaho culture taught the art of spinning. In Greek mythology Arachne challenged the goddess Minerva to a spinning and weaving contest and was turned into a spider. In Germanic and Teutonic cultures the three Fates spin, measure and cut the threads of life of mortals. Even our modern fairy tales such as Sleeping Beauty, Rumpelstiltskin, and East of the Sun and West of the Moon all mention spinning. Despite archaeological evidence, myths, and stories, the exact location and time period when hand spindles were first used is not known. Spinning is recorded in the Middle East by the Neolithic period.



Spider Woman in the Navajo tradition teaches how to spin and weave. <http://commons.wikimedia.org>



Greco-Roman mythology: Arachne was a mortal weaver who boasted that her skill was greater than that of Minerva, the goddess of crafts. Arachne refused to acknowledge that her knowledge came from Minerva. In a contest between the two Minerva became envious of Arachne's magnificent tapestry and was offended by the choice of subjects (loves & transgressions of gods). Minerva destroyed the tapestry and loom and slashed Arachne's face. Minerva turned Arachne into a spider. Arachne means "spider" in Greek. commons.wikimedia.org



Sleeping Beauty Darstellung von Alexander Zick (1845-1907) commons.wikimedia.org



Rumpelstiltskin: Andrew Lang's *The Blue Fairy Book*, ca. 1889 commons.wikimedia.org

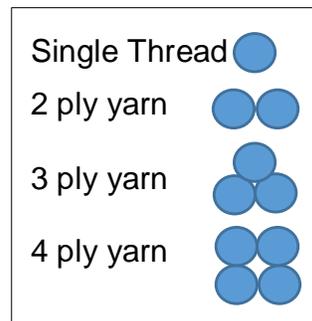


East of the Sun and West of the Moon: Norwegian Folk Tale in which spinning & weaving play an important role. Theodor Kittelsen (1857-1914) commons.wikimedia.org

Fibers and Preparation:

Plant fibers are prepared for spinning by several methods. Cotton is ginned to remove the seeds. Flax is prepared by retting (rotting the fibers), breaking (breaks up the straw into short segments), scutching (removal of the straw), and heckling (pulling the fibers through a bed of nails to straighten the fibers and remove the last of the straw).

Spinning tightly wraps the fibers around each other turning them into thread or yarn that can be woven into cloth on a loom. If unspun fibers are held in one hand and pulled out from the bunch, the fibers will break apart. However, if the fibers are twisted as they are pulled from the bunch they will form a thread. The single twisted thread can be stabilized by wrapping two single threads together in a process called plying. Different size threads or yarns can be formed by combining different numbers of threads, which gives us two, three, or four ply yarn.



Many different kinds of plant fibers can be spun including bast (or phloem) fibers like flax (linen), hemp, jute, ramie, and nettle; and seed fibers like cotton. Each of these fibers varies in staple (cell fiber) length, quality, and strength. Each of these plant fibers requires a different kind of spinning tool.

Spinning History:

Fibers have been spun for over 10,000 years for use in woven cloth. Spinning was initially done without the use of any tools. Fibers were held in one hand, and the other hand was used to pinch off a portion of the fiber and twisting it between the fingers while simultaneously being pulled out to create longer lengths of thread. Thread made in this manner is referred to as twisted yarn, rather than spun yarns. The oldest actual “tool” for spinning were rocks. A leader thread would be spun by twisting the fibers between the fingers to a desired length, then the resulting thread would be tied around a rock. The rock could then be rotated to spin the fibers as they are played out between the fingers. Spinning with rocks is still done in remote parts of Asia among the nomadic tribes. A spinning stick is another ancient “tool” used for spinning. The stick was rolled horizontally along the length of the thigh to put twist into the fibers. The first sticks may have been straight, and were a natural outgrowth of rolling the fiber along the length of their leg to twist the fibers. As with the rock, the time and place of the origin of this spinning tool is unknown. Eventually the rock and stick were combined to create a spindle. The whorl (clay, bone or a soft rock) was attached to the shaft to create the spindle. Ancient Egyptians used drop spindles to process flax into linen. The drop spindle is a weighted stick onto which yarn was wound with a twist as the spindle was dropped downward, pulling thread from the pack of unspun fibers. All threads and yarns were created from hand spindles until the Middle Ages when the spinning wheel was invented. Hand spindles were used to spin all the threads for clothing and fabrics from Egyptian mummy wrappings to tapestries, and even the ropes and sails for ships. At one point, hand spinners in India were able to spin almost half a million yards of yarn from a single pound of cotton (Hochberg, B. 1993. Handspindles. 6th Printing. Published by Self-published., Santa Cruz, CA ISBN 10: 0960099042).



Egyptian Drop Spindle
commons.wikimedia.org
The_American_Indian_Fig_14.jpg

Bead-Whorl Spindles were designed to add a lot of twist to fine yarns. They were in widespread use throughout Asia, Middle East, and Africa where cotton was used. Today in the laboratory session we will use a Takli, similar to the Bead-Whorl Spindle, which is a high speed spindle designed for spinning cotton.

Another type of weighted spindle is the cross-arm spindle, where a piece of wood or bone is attached to the bottom of the hooked spindle instead of a rounded whorl. This Turkish drop spindle was used in the Middle East.

The most common form of drop spindle in use today is the Hooked High-Whorl spindle. This type of drop spindle developed in the 20th century BCE in Egypt. This type of spindle was in common use throughout the Middle East, Asia and Africa. Drop spindles where the whorl was placed at the bottom of the spindle dominated Europe and Greco-Roman areas. Low-whorl spindles were commonly used to spin longer-staple fibers such as linen, silk and wool, and are still widely used in India, Indonesia, Peru and the Philippines.

Medieval spinners often used a Distaff (a stick with a fork or ornate comb on the top). The Distaff was held in the left hand if or supported on the floor. The Distaff held long-staple fibers like flax which were fed to the spindle or spinning wheel with the right hand. The 12th day of Christmas January 7th, the day following Epiphany, was known as St. Distaff's Day. It was not really a holiday, nor is there a "St. Distaff". But the marking this day by common people indicated the importance of spinning in the days before the industrial revolution. The Distaff was the medieval symbol of women's work of which spinning was a year round never-ending chore. During the 12 day Christmas holiday season, both men and women took a break from many chores. On January 7th the festivities were officially ended for women who would resume their daily household tasks such as spinning. Men did not resume work until Plough Monday, when their ploughs were blessed.

It is uncertain as to where the spinning wheel was developed. China had spinning wheels as early as the 6th-century for silk and ramie spinning. Artwork depicting a spinning wheel comes from China around 1270 and depicts a "wheel" with long bamboo spokes. Wheels developed later in India for spinning cotton. Indian wheel are known as charkha wheels. They do not have rimmed wheels, but rather have string running through holes in the tips of the spokes connecting them in a zig-zag fashion which supports the drive band.

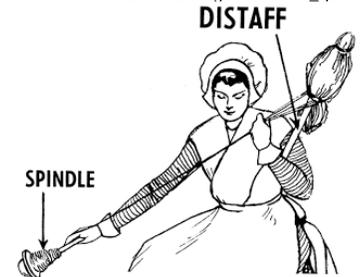
Western spinning wheels developed over the centuries. Hoop rimmed spinning wheels were the most popular by the 14th century. Great Wheels or Walking Wheels for use with wool were known by the 16th century in the British Isles. These wheels had large driving wheels used while standing up and walking the fibers away from the wheel.

Smaller wheels, like the Saxony and Castle were developed late in the medieval period to allow spinners easier handling of the longer staple fibers like linen and combed wools.

Spinning wheels were one of the first craft tools to be industrialized. In the mid 18th century Richard Arkwright, an English industrialist, developed a method for machine spinning cotton. Samuel Slater, an American, brought this system to Rhode Island where he founded Slater Mill. Slater Mill began producing the first water powered machine-spun thread in the New World.



Turkish Drop Spindle
commons.wikimedia.org File:Turkish_spindle.jpg



Distaff holds raw fibers to be spun
commons.wikimedia.org File:Distaff_%28PSF%29.png



Gandhi spinning with a charkha
commons.wikimedia.org File:Gandhi_spinning.jpg



Great Wheel commons.wikimedia.org
File:%22Another_view_of_Mrs._James_Watson_at_her_spinning_wheel_in_her_mountain_cabin_near_Gatlinburg,_Tennessee.%22_-_NARA_-_532768.jpg

NAME: _____

Biology 401: Applied Plant Science. Cotton

1. The cotton fruit is called a _____
2. The name of the fiber that is attached to the seed is _____
3. Briefly describe how a cotton picker like the John Deere works in the process of harvesting cotton.

4. Until 1930-1940 cotton was picked by _____
5. What is a Cotton Module Builder? _____. What improvements in cotton harvesting have occurred with this machine?

6. What element will cotton deplete in the soil? _____
7. Briefly describe the steps in cotton ginning.

8. What is the standard weight of 1 cotton bale? _____
9. How many countries in the world grow cotton? _____
10. How many countries process cotton? _____
11. How much cotton is produced per year worldwide? _____
12. What is unique about cotton fiber? _____
13. Where did the four cotton domestications occur? _____
14. Briefly describe the historical relationship between Great Britton, India, and the U.S. in relation to the cotton industry.

15. In 1793 before the invention of the cotton gin how many bales of cotton were being produced in the south? _____. In 1835 how many bales of cotton were being produced in the south?
16. What is warp and weft?
17. How did the cotton gin change society?
18. How did the cotton gin change industry?
19. What is cotton's greatest enemy? _____
20. How was the boll weevil finally controlled?
21. What is carding? _____
22. What is a sliver? _____
23. What is roving? _____
24. What happens to the cotton seeds after ginning?
25. What products come from the linters and cotton seed?
26. What happened to the dominance of cotton in the late 1950's?
27. What percentage of the world use of pesticides is used on cotton? _____