

Cotton – More Than Just A White Fiber

Gossypium sp.



History and Lore

- The word 'cotton' is derived from 'qutun' or 'kutun', an Arabic word used to describe any fine textile.
- The genus name, *Gossypium*, comes from the Latin term for cotton, *gossypinus* or *gossypĭnus*. The genus was named by botanist Carl von Linnaeus (1707-1778).
- Plants in the genus are native to tropical and subtropical regions of the Old and New Worlds.
- Both Old World and New World civilizations independently domesticated cotton and developed tools to convert it into fibers and fabrics. The oldest cotton fabric in the Americas was found in Peru and dated to about 6000 BCE. Archaeological evidence in Pakistan dates early cotton cultivation and use there to 5000 BCE.
- Cotton fabric production was introduced to southern Europe by the Muslims in the 8th century and spread from there into the rest of Europe.
- Although cotton was grown primarily to produce cotton fiber, other parts of the plant have served as medical remedies and food products for humans and animals.

Plant Description & Cultivation

- The *Gossypium* genus is in the Malvaceae (mallow) family. Of the ~50 species in the *Gossypium* genus, only the 4 species shown below, all domesticated in antiquity, are commercially grown.

Name	Native Regions	% of World Production
<i>Gossypium hirsutum</i> (Upland cotton)	Central America, Mexico, the Caribbean and southern Florida	90%
<i>Gossypium barbadense</i> (Extra-long staple cotton)	Tropical South America	8%
<i>Gossypium arboreum</i> (Tree cotton)	India and Pakistan	Less than 2%
<i>Gossypium herbaceum</i> (Levant cotton)	Southern Africa and the Arabian Peninsula	Less than 2%

- While the other *Gossypium* species are unsuitable for fibers, experiments are ongoing to cross-breed various desirable traits of wild cotton species, such as drought tolerance and resistance to insects and diseases, into the commercial species.
- Most species have extrafloral nectaries located outside the calyx near its base, on the pedicel of the flower and the underside of foliage leaves, and on the midpart of the largest vein. They secrete a sugary substance that attracts insects, such as ants, to help control insect invaders. They also produce a substance that is toxic to many insects.
- The cotton blossom goes through several stages from flower to mature boll:
 - Initial bloom:** Bloom opens and is a white or a creamy yellow color. Within ~4 hours, the pollen is released and it self-pollinates.
 - Post-pollination:** The flower begins to turn pink, becoming a bright fuchsia in a few days.
 - Young boll:** As the pink bloom dries, the young boll pushes its way up, forcing the pink bloom to fall off. The boll continues to grow as the fiber and seed grow inside it.
 - Cracked boll:** As cotton fiber matures, cotton bolls open slowly as the bracts dry and separate.
 - Open boll:** Ready for harvest.
- Cotton fibers come in colors other than white, including brown, blue, pink, green, red, and tan. Most have a shorter fiber length than commercial varieties making them less desirable for commercial processing.
- Cotton is grown as an annual crop that requires a long, warm growing season to mature properly. In zones 8-10 it can be sown directly after the last frost. In zones 5-7 start seed indoors and transplant out after last frost. Plant 18-30 in. apart in rows 5 ft. apart in full sun. Plants start flowering in mid-summer, but bolls take a few more months to mature. Warm late summer weather is necessary for a good crop.
- **Virginia gardeners must acquire a permit to grow cotton.** For more information, contact your nearest extension agent.
- The main pest of cotton is the boll weevil, which entered the US from Mexico in 1892 and created 100 years of problems for the cotton industry. During that time, it is estimated to have caused \$22 billion in damages. In the late 1950's, the Boll Weevil Research Laboratory was established and developed detection traps and pheromone lures which significantly reduced pesticide use and eradicated the boll weevil in some areas.

Uses

Industrial

In addition to its wide use in various types of textiles, cellulose derived from cotton is treated with nitric acid and sulfuric acid to form nitrocellulose which is used in **explosives**. If treated with potassium nitrate, sulfuric acid and camphor it forms 'Celluloid' a highly flammable plastic used until the mid-20th century **for lacquers and photographic film**.

Cotton fibers are used to make **paper**, often called "rag paper". Cotton paper is superior to wood-pulp paper in strength, durability, and ink absorption. It is used in many countries for banknotes. (US banknotes are 75% cotton and 25% linen).

Cotton seeds have several uses. But in their natural state, cotton seeds are toxic to humans and most animals due to the presence of **gossypol**, an organic compound which must be removed before seed products are suitable for human and animal consumption.

Oil extracted from cotton seeds is called **cottonseed oil**. After refining, the oil has a mild taste and relatively high smoke point. It is high in tocopherols which contribute its stability and give products containing it a long shelf life and thus its use in a lot of packaged goods. Its fatty acid profile generally consists of 70% unsaturated fatty acids (18% monounsaturated, and 52% polyunsaturated), 26% saturated fatty acids.

Cottonseed meal, the residue remaining after extracting the oil, is high in proteins and oil and is used as **animal feed** but only for ruminants. The meal contains gossypol which must be removed before it can be used as feed for animals other than adult ruminants.

After being dried, cottonseed meal can be used as an **organic fertilizer**. Its nutrient composition is generally 7% nitrogen, 3% P₂O₅, and 2% K₂O. It is slightly acidic and great for acid-loving plants. In addition to its nutritional value, it improves soil texture and helps retain moisture.

As might be expected for such an important agricultural crop, researchers have been genetically manipulating cotton to make it more resistant to insects and herbicides and to reduce the gossypol content of the seeds, but keep it in other parts of the plant.

Medicinal

Cotton root bark was used as a folk remedy for numerous female conditions including inducing labor contractions. While it was used to make **childbirth** easier, cotton root bark was also taken as an abortifacient (to induce miscarriages).

Chewing on the roots was said to stimulate the sexual organs, giving cotton root the reputation of being an aphrodisiac, but there is no scientific evidence to support this.

Gossypol, found in a number of parts of the plant, acts as a natural defensive agent against insect predators by causing infertility. It has been used and studied as a male contraceptive in China. It supposedly blocks production of sperm without affecting a man's potency. But because it has been shown to have irreversible effects on male fertility and other undesirable side effects, it is not recommended for this use.

Gossypol is also being studied for treatment of various types of cancer.

As with any unapproved use, do not use these treatments without the supervision of a medical professional.

References

A wide variety of references were consulted. Here are a few that were particularly interesting.

Wikipedia sites providing summaries and starting points for further research:

<https://en.wikipedia.org/wiki/Cotton>

https://en.wikipedia.org/wiki/Cottonseed_oil

https://en.wikipedia.org/wiki/Cottonseed_meal

Extrafloral nectaries in cotton: <http://www-plb.ucdavis.edu/labs/rost/cotton/leaves/nectary.html>

Use of cotton root bark used by enslaved Africans: <https://www.americanherbalistsguild.com/gossypium-spp-cotton-root-bark-symbol-herbal-resistance-karen-l-culpepper>

Medicinal uses: <https://www.encyclopedia.com/medicine/encyclopedias-almanacs-transcripts-and-maps/cotton-root-bark>
<https://www.webmd.com/vitamins/ai/ingredientmono-416/cotton>
https://elmaskincare.com/herbs/herbs_cotton.htm

Cotton growth and development:

<http://cotton.tamu.edu/General%20Production/Georgia%20Cotton%20Growth%20and%20Development%20B1252-1.pdf>

Gossypol toxicity: <https://www.hindawi.com/journals/tswj/2014/231635/>
<https://www.merckvetmanual.com/toxicology/gossypol-poisoning/overview-of-gossypol-poisoning>
<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/gossypol>

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