AGRICULTURE

Nature Paints Cotton

Cotton plants with brown and green lints, instead of white, have been grown. In the future, there may be even more colors, producing rainbow-tinted cotton fields.

By MARTHA G. MORROW

See Front Cover

➤ COTTON FIELDS of the future may be rainbow-tinted instead of snowy white. Scientists, seeing that some cotton has already been painted by nature either brown or green, have begun to wonder just how many colors the cotton plant can be made to produce.

Soviet scientists report that they have developed natural-colored lints in red, green, auburn, brown, blue and khaki. Bolls of fibers tinted brown or green are being grown at the Delta Experiment Station at Stoneville, Miss., in cooperation with the U. S. Department of Agriculture.

Colored cotton has been spun and hand-loomed into novelty fabrics by the women of Fayetteville, Ark., and Abbeville, La. But Nature has not yet done as well as the chemist in producing sun-fast colors, for the fibers are uneven in shade and soon fade. So the day has not yet come when the exact colors desired for a uniform or dress can be selected while the cotton is still on the stalk.

Although the colored lints are not practical for commercial use, they are important in scientific study. Cotton geneticists have found the color in the lints to be valuable characteristics to use as "markers" in inheritance studies. A particular lint color may be found to be linked in heredity with some other characteristic that is important economically, but which is not so easily observed.

Visible When Opened

Varieties of cotton with brown fibers are found in every known species of wild or cultivated cotton that bears lint. The pigmentation, which is not visible until the boll opens, is located largely in the hollow inside, or lumen of the fiber cell.

During the period of fiber growth the lumen is filled with living protoplasm. In the mature, dried fiber, the dead protoplasm containing the coloring matter shrinks to a slender strand. A hollow tube is thus formed throughout the length of the fiber. The cotton fiber resembles an empty garden hose of diminutive proportions, only it is more twisted.

At least eight varieties of cotton having brown lint have been grown in a single collection here in the United States, but the exact origins of most of these varieties are unknown.

A single branch of a plant bearing white cotton has been observed with brown lint, and from this a pure breeding strain of brown-lint cotton was established. A few years ago a brown-lint plant was found to have one branch bearing white cotton. There is thus good reason to believe that some brown-lint cottons may have originated as spores on plants of white cotton, and in other cases that certain species were originally brown and that white strains arose in those species.

Originated in Mutation

All the green cotton we now have is believed to have originated as a mutation in a cultivated field of upland cotton. It could have been a bud spore, or a change in the reproductive tissues of the plant. The fibers of the green-lint cotton are short and irregular, and soon fade to a mottled brown when exposed to light.

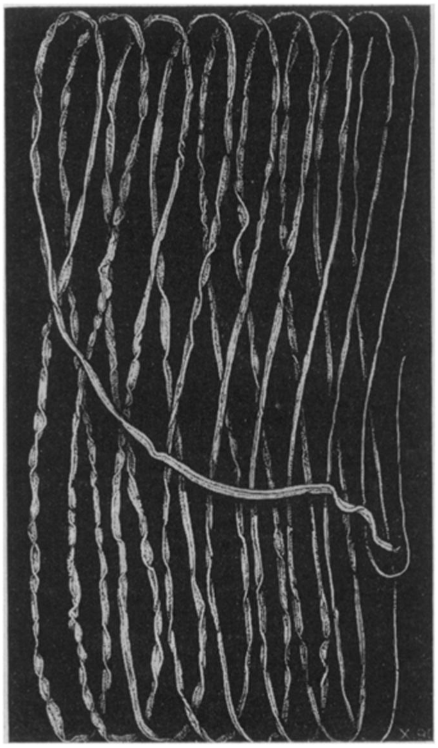
The green coloring is in the fiber wall and may be seen soon after the fibers begin to thicken. By the 25th day after the flowers first appear the coloring is quite apparent.

When the seed and lint produced by ordinary white cotton plants are separated, the lint weighs approximately one-third of the total combined weight. In the case of green-lint cotton, however, the yield is extremely low, the ginned lint weighing only about one-sixth of the combined weight of the seed and lint. Studies reveal that the low lint percentage and green pigmentation are due to the same factors of inheritance.

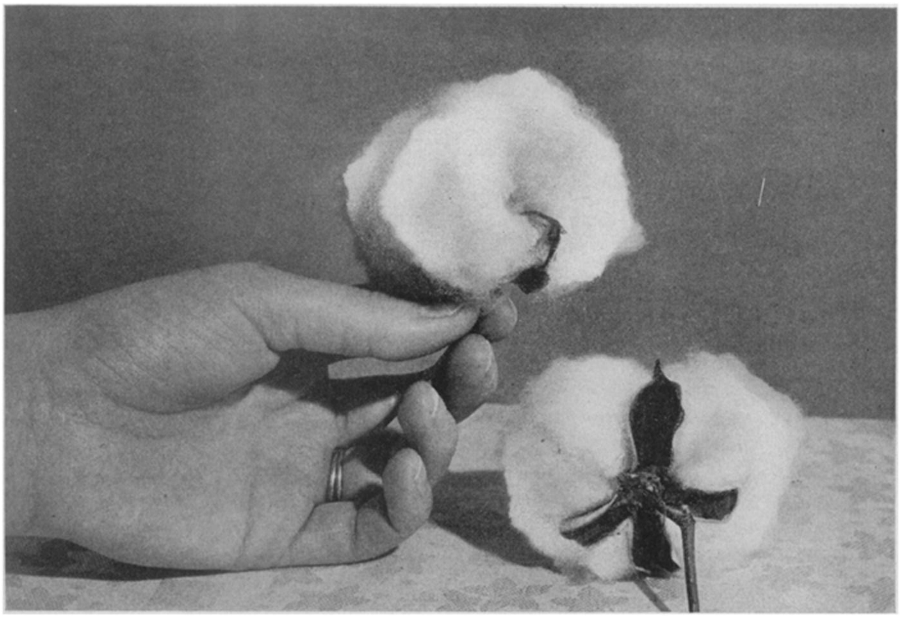
The green lint, strangely enough, contains about 30 times as much wax as the ordinary white cotton, about one-sixth of the weight of the lint being due to wax. The wax is of a type for which there is considerable commercial demand due to war conditions, but the high cost of extraction and low yield per acre makes production of the wax from green cotton impractical.

Brown and green fibers have been under investigation not only here in the United States, but also in the British Empire, since early in the century. Various shades of brown could be considered as red, auburn and khaki. But as yet the Russians are the only scientists reported to have developed blue fibers.

Cotton fibers for commercial use are either white or light cream. When the bolls in which the cotton is borne first open, the lint is a beautiful snow white. But the fiber is usually allowed to remain on the stalk for a while, becoming dingy. Physical and chemical changes, such as stain from the leaves, account for this as well as dirt, bits of leaves and other field material which cling to the



SINGLE FIBER—Often the length of a two-inch twisting cotton fiber is 2,000 times its width, as shown in this U. S. Department of Agriculture photograph.



OPEN BOLL—Bursting like popcorn from its brown boll, the lint is what gives a snowy appearance to the cotton field. If it were tinted, we might have rainbow fields.

fibers. Cotton dresses and shirts are made to look fresh and clean by chemical bleaching between the time the cloth leaves the weaving loom and reaches market.

Every fiber of cotton is produced by the outgrowth of a single epidermal cell. The number of fibers arising from the outer layer of one seed is estimated to be between 10,000 and 20,000. Although commonly referred to as "fibers," they are quite different in origin and structure from the long-bast fibers which are extracted from the stems of flax, hemp, jute and many other plants.

Some of the epidermal cells of the seed start to elongate on the day that the flower blooms. Others can be found in the initial stage of fiber development as late as 10 to 12 days from the date of blooming. At the end of 20 to 25 days the fiber has reached its full length.

The walls of the fiber thicken throughout the entire period of fiber growth, but it does not become marked until after the 20th day. The wall is thickened by materials produced in the living protoplasm of the fiber. They are deposited in successive layers upon the inner surface of the fiber walls and are responsible for its strength and flexibility.

Commercial cotton fibers vary in length from three-quarters of an inch to two inches, but most of the cotton grown in this country averages about an inch in fiber length. The length ranges from 1000 to 3000 times the diameter of the fiber, the average diameter being about 1/1310 inch.

There are 90,000,000 individual fibers in an average pound of cotton. Thus if the fibers were laid end to end, they would reach from Memphis to St. Paul, or from New York to Chicago.

Cotton is recognized as the world's most important fiber. For the quarter-century preceding the war, each citizen of the United States used approximately 26 pounds of lint cotton each year. Enough cotton is consumed in the United States each year to make a bolt of cloth 6,800,000 miles long. But the chances are that little if any of that cloth will be made of natural-colored fibers—at least for many years to come.

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If you would like to have samples of brown and green cotton, as well as a cotton boll, to experiment with and show your friends, you can secure the Cotton Unit of THINGS of science, a kit prepared by Science Service, by sending 50 cents to SCIENCE NEWS LETTER, *1719 N Street, N. W., Washington 6, D. C., and asking for Things unit No. 44.*

Langbeinite, a rare potash-magnesia mineral used as a source of fertilizers, is found only in five countries—the United States, India, Germany, Austria and Poland.

BIOGRAPHY

Dr. C. G. Abbot Resigns As Smithsonian Secretary

➤ RESIGNATION of Dr. Charles G. Abbot as secretary of the Smithsonian Institution, effective July 1, has been announced. Dr. Abbot, who is now 72 years of age, joined the Smithsonian staff in 1895, and has been its chief administrative officer since 1928.

Although giving up heavy executive responsibility, the retiring secretary is not severing his connection with the Institution. He will retain a staff position as research associate, which will enable him to devote more time to certain investigations which he has had in hand for some years.

Dr. Abbot's entire research career has been devoted to the study of physical conditions on the sun. In recent years he has paid particular attention to the correlation between fluctuations in solar radiation and changes in weather on the earth. He has also developed apparatus for the direct utilization of solar energy in the production of usable forms of power and heat.

Dr. Abbot is a trustee of Science Service.

Until a new secretary is chosen by the Smithsonian Institution board of regents, Dr. Alexander Wetmore will serve as acting secretary.

Science News Letter, July 8, 1944

CHEMISTRY

Toluene May Be Made From Fractions of Petroleum

➤ TOLUENE, basic material for TNT (which in chemical longhand is tri-nitro-toluene) can be made synthetically from two cheap, abundant substances found in oil and natural gas, by a new process on which U. S. patent 2,352,199 has just been issued to Prof. Vladimir N. Ipatieff and George S. Monroe, both of Chicago.

The substances are benzene, which is one of the common light fractions of petroleum, and methane, simplest of the hydrocarbon gases, which is one of the chief constituents of most natural gases and is also produced in quantity in certain petroleum-cracking processes.

In the Ipatieff-Monroe synthesis, benzene and methane are subjected to high pressure, between 50 and 450 atmospheres, at a temperature of from 350 to 750 degrees Centigrade, in the presence of a catalyst. With the toluene, diphenyl is also synthesized; this co-product has a number of industrial uses.

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