Type: Magazine Article

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Source: *Improvement Era*, Vol. 65, No. 10 (October 1962)
Published by: The Church of Jesus Christ of Latter-day Saints
Page(s): 722–724, 751–753

Abstract: This article gives evidence that indicates that cotton seeds from the Old World were transported across the ocean and interbred with wild cotton plants to produce a superior New World plant that was then cultivated.

COTTON AND THE BOOK OF MORMON

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Cotton, one of the four most important crops in the United States, has played a relatively unknown but dramatic role in the history of our nation and the world.[1] Once thought by visitors in India to be wool growing in tufts on shrubs, cotton today has become well-recognized as the chief material used in our clothing and the source of dozens of products we regard as modern necessities. It has changed the destinies of countries and continents. Cotton was a major factor in producing the industrial revolution that elevated England into a position of world power. More than a century ago it helped precipitate the Civil War in our own United States.

In India cotton has been cultivated and woven into cloth for at least five thousand years[2] and has been an item of commerce in that area for many centuries. Cotton did not come to America with Columbus but on the landing of the *Santa Maria, Niña,* and the *Pinta,* the exploring party from Spain found the Indians wearing clothes made of cotton. This contributed to the belief that Columbus had reached India. That cotton was spun into fabrics by the inhabitants of this hemisphere long before Columbus is shown by the fact that cotton fabric has been found in excavations of pre-historic civilizations in Utah, Arizona, and Peru.[2 4] Dates from radioactive carbon have placed the age of cotton fabrics in Peru well into the pre-Christian period.

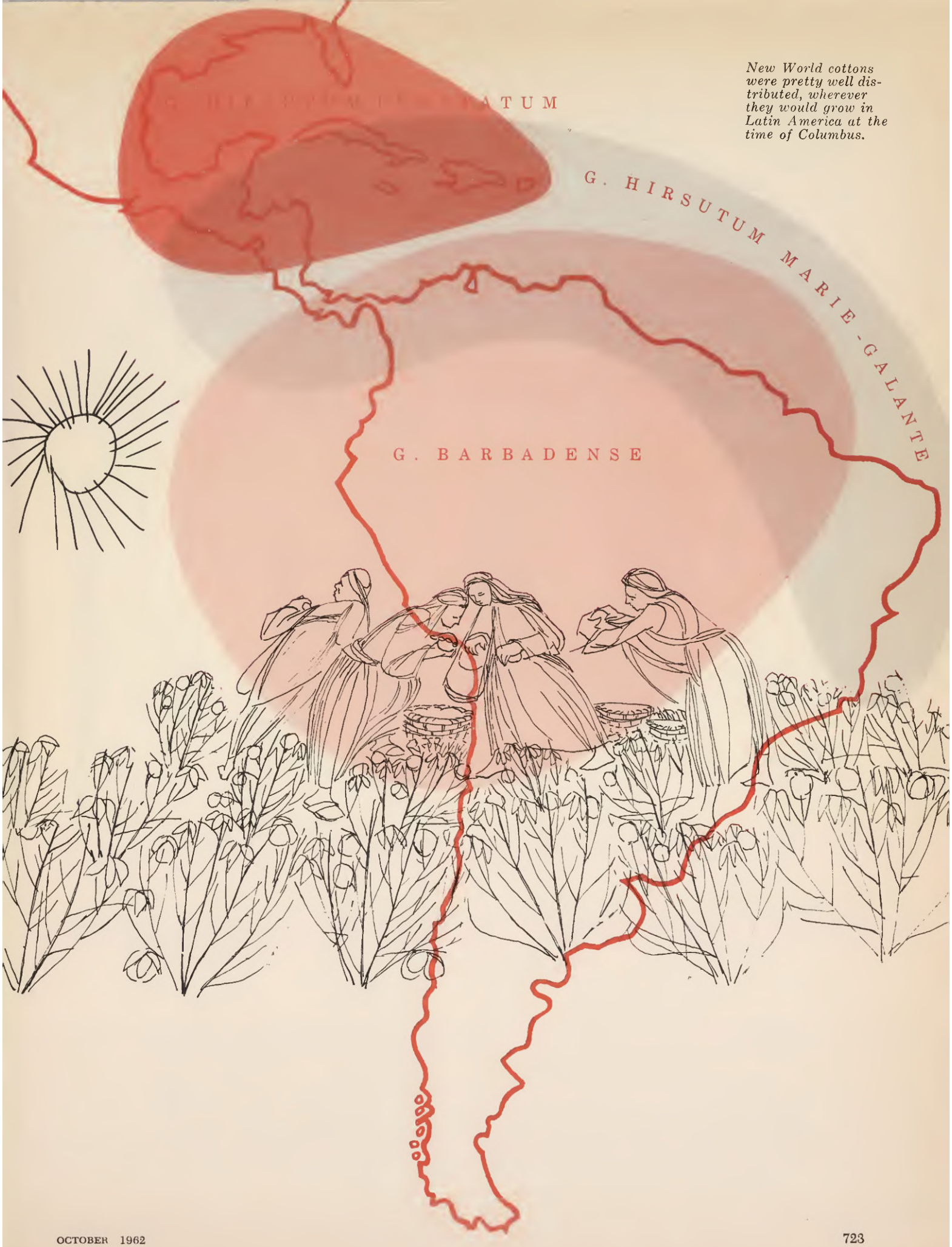
How did the cotton used and cultivated and the knowledge of weaving of its lint come to America at such an early date? Perhaps an answer to this question might shed light on some basic questions raised by the account given to the world by an unlettered youth back in the early part of the nineteenth century. This account, the Book of Mormon, related that three groups left southwest Asia during pre-Christian times, and after building ships sailed across the ocean, landing in the Western Hemisphere.

Let us start our quest by reading a statement found in the eighteenth chapter, sixth verse of First Nephi. ". . . we did go down into the ship, with all our loadings and our seeds, . . ." This statement is part of the account of Nephi concerning their preparations for the sailing that was to take them across the Pacific to the New World. Concerning the Jaredites, the following is recorded in the book of Ether, chapter two, verse three, ". . . and thus they did carry with them . . . seeds of every kind." Although these statements do not indicate the kind of seeds referred to, there is evidence that cotton was brought by man from Southern Asia across the Pacific to the Western Hemisphere during the approximate period indicated in the Book of Mormon and was here cultivated by man. Furthermore, the evidence seems to indicate that cotton, sometime after being introduced into the New World by civilized man, was introduced from the west into the Hawaiian Islands.

Wild species of cotton may be found in southern Asia, Africa, Australia, America, and some of the islands of the Pacific. These plants survive in competition with other vegetation only in tropical and sub-tropical semi-desert conditions. Since young cotton plants will not stand shading, they soon die in uncontrolled plant communities where available water permits abundant plant growth in a climax population.

Investigations have shown that all forms of life, be they animal or plant, are composed of very small basic units called cells. When we examine them closely under the microscope, we find that although the shapes and sizes of these cells may vary, all seem to possess one thing in common, a more or less spherical nucleus somewhere within the cell. It is to the nucleus that we must turn our attention for the physical basis of inheritance.

By the use of stains and high magnification it has been learned that there is present in



New World cottons were pretty well distributed, wherever they would grow in Latin America at the time of Columbus.

each nucleus a group of long coiled structures called chromosomes. These chromosomes contain the genes which are the hereditary factors of each organism. In man, for example, we find that there are 24 pairs of chromosomes in each of our body cells and 24 single chromosomes in each reproductive cell. In corn plants there are 10 pairs and in cotton there are 13 or 26 pairs depending on the species involved.

Two gametes (reproductive cells containing one daughter chromosome from each pair of chromosomes), one from each parent, fuse in a process called fertilization. All of the millions of cells in our body come into existence by subsequent division and growth from the products of this fusion.

In cell divisions in which body cells are produced, the chromosomes shorten and thicken. They then split down the middle, each giving rise to a new chromosome precisely like the original. Each of the two identical chromosomes then migrates to an opposite area of the cell. The cell divides with each of the two daughter cells then containing exactly the same hereditary factors as the mother cell. In the preparation for division the two chromosomes of each pair line up side by side. This is followed by a splitting lengthwise of each chromosome. This gives four similarly shaped chromosomes for each pair that originally occurred in the nucleus. Two special cell divisions then occur in rapid succession. Four daughter cells are thus formed each of which contains one set of chromosomes, or half as many chromosomes as the body cells. By the fusion of two reproductive cells (gametes) in fertilization, the chromosome number is restored to the number characteristic of the species.

Cytogeneticists have discovered that many of our important plants originated as a result of crossing two closely related species. The offspring of such a cross may show considerable hybrid vigor but is often sterile due to the fact that the chromosomes of the two parental species are dissimilar and do not pair together in preparation for the cell divisions giving rise to the reproductive cells. The plant scientist has discovered a means of doubling the chromosome number of the sterile hybrid. This allows each chromosome to pair normally in preparation for the cell divisions, giving rise to the reproductive cells. The polyploid thus formed may be fully fertile. Such a process does occur rarely in nature and has given rise to such important crop plants as wheat, oats, and the New World cultivated cottons.

Now that we have added a little information on genetics perhaps we are ready to start examining some of the facts in the case.

During the past few decades plant scientists have made intensive studies of the existing species of wild and domesticated cotton plants. Using modern techniques of genetics and cytogenetics, they have discovered that the many species of cotton can be divided into three groups.

1-(a) The cultivated cottons of the Old World, all of which contain the A genome (a genome consists of a set of chromosomes occurring in the genets of a diploid plant), possess 13 pairs of large chromosomes in each cell. These cottons have been cultivated for approximately 5,000 years in India and have been important items of commerce in many areas of the Old World since pre-Christian times.

(b) The wild species of cotton found in the Old World possess either the B, C, or E genomes. These cottons, which are endemic to Asia, Africa, and Australia have 13 pairs of large chromosomes in their cells. They do not have a spinnable lint.

2. The wild cottons of the New World contain the D genome and have 13 pairs of small chromosomes, and these cottons do not possess spinnable lint.

3. The cottons of the New World which have been cultivated here since pre-historic times, possess not only the D genome of the wild American cottons but also the A genome of the cultivated cottons of the Old World. These superior cottons, or their descendants, have 26 pairs of chromosomes (13 large and 13 small) and currently produce the majority of the world's cotton.

These cytogenetic characteristics of the New World cottons immediately attracted the attention of a number of capable plant scientists and during the past three decades much effort has been expended to determine their origin and relationships. In 1937 Skovsted[7 8 9] advanced the hypothesis that the New World cultivated cottons had originated from a crossing of cultivated cotton endemic to southern Asia and a New World species. In that same year the colchicine technique of doubling the chromosome number was discovered. Using this technique which allows the scientist to synthesize polyploids (an individual possessing a multiple of the normal chromosome number) at will, Beasley[1 7] working in Texas, and Harland[6 7] in Trinidad each in 1940 independently verified Skovsted's hypothesis. They crossed an Asiatic cultivated cotton with an American wild species and obtained a sterile hybrid possessing 26 single chromosomes. By the use of the chemical colchicine, these chromosomes were caused to double resulting in a new hybrid possessing 26 pairs of chromosomes, 13 large and 13 small. These plants are nearly identical to and are cross fertile with the New World cultivated cottons. Thus plant scientists have succeeded in duplicating a feat accomplished by nature many centuries ago in Ancient America. Not only did this provide the answer to the puzzle of the origin of the New World cultivated cotton, but subsequently opened up an important new field of plant improvement. Gametes for (*Continued on page* 751)

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disease resistance and other valuable characteristics are presently being transferred from the wild ancestors of cotton to the cultivated varieties by this technique.

Subsequent studies have given further confirmation of the fact that the A genome of the American cultivated cottons was obtained from the Old World cultivated cottons. Harland and Atteck[7] demonstrated that the American cultivated polyploid cotton was colored as the result of two gene series for color. They further demonstrated that one of these gene series occurs in and is allelomorphic (situated at the same location in homologous chromosomes) with those controlling color of the American wild diploid cottons. They also demonstrated that the other series of alleles regulating color are allelomorphic with those of the cultivated diploid cottons of southwestern Asia.

This as well as a number of other studies have demonstrated that the large chromosomes present in the American cultivated cottons are homologous with the 13 large chromosomes of the cultivated cottons of southwest Asia and the small chromosomes of the American cultivated cottons are homologous with the 13 small chromosomes of the wild American cottons.

With the parentage of the American cultivated species thus far determined, the questions that remain are: 1- Which of the seven American wild species was involved in the cross? and 2- How did cultivated cotton from the Old World find its way to our shores?

In answer to the first question, a number of lines of genetic and morphological evidence point to *Gossypium raimondii,* a wild cotton from Peru, as the American parent. This may indicate that the Asiatic cotton which was to become a parent of the cultivated American species was introduced into the New World by way of Peru. This then leaves the big question: How did the cotton plant that was to become a parent of early American cultivated cottons find its way to the western shore of South America? Since southwestern Asia is separated from the coast of Peru by about ten thousand miles of

ocean, this crossing to find its American mate was no small feat.

The possibility of heavy cotton seeds or even pollen grains floating this distance in ocean water or being carried by air currents or birds in flight, are so improbable as not to have enlisted serious consideration by students of this question. Nor is a crossing of the Bering Strait from Siberia to Alaska worthy of serious consideration. Cotton is a tropical and semi-tropical plant and has not been grown in the Siberian and Alaskan areas. The complete absence of the cotton plant and the two-barred loom from the northern areas of Asia and America leave no supporting evidence for such a theory.

A hypothesis advanced by Harland[5,7] in 1939 to explain this dilemma, was that the crossing was made by way of a land bridge joining the two continents back in the Cretaceous or early Tertiary times. This theory is open to objections that appear to be insurmountable. In reviewing this hypothesis Hutchinson, Silow, and Stephens[7] state that Paleobotanical evidence indicated that the bridge referred to had disappeared, if it ever existed, before the parent cotton species with which we are concerned had developed. In addition, if the Asiatic cotton migrated across a ten thousand mile bridge by natural means, one would expect that such a well-adapted and vigorous colonizer as this would require, would have left behind related traces of cotton on the island relics of the bridge. Such is not the case. No such cotton is found in all the islands of the Pacific. In addition, if a species of cotton sufficiently vigorous to have migrated the ten thousand miles were to be introduced into Peru, why has it now completely disappeared from the New World? And then there is genetic evidence to show that the cultivated cottons of the New World are of recent origin. These arguments seem to rule out the theory of natural spread to our shores. How then did Asiatic cotton come to Peru? On this question Hutchinson, Silow, and Stephens[7] suggest the following: "Only one alternative remains, that they were carried across the Pacific by man among the seeds of his crop plants and with the tools of his civilization."

On this same point Carter[3] stated "Land bridges cannot account for the plant picture. Man did cross the Pacific bearing domesticated plants. Genetics suggest cotton was carried by man to America. That man carried Asiatic domestic cotton to the New World at an early date is the simplest reasonable explanation."

May I again read to you from the Book of Mormon. My text this time will be 1 Nephi, chapter 18, verse 24. This is the account of the doings of Lehi and those that were with him on their arrival in the promised land. "And it came to pass that we did begin to till the earth, and we began to plant seeds; yea, we did plant all our seeds into the earth, which we had brought from the land of Jerusalem. And it came to pass that they did grow exceedingly; wherefore, we were blessed in abundance."

That cotton was brought to this hemisphere from southern Asia by civilized man is further shown by the fact that there have been found in desert graves of pre-Inca Peru the spinning and weaving instruments that were used in the making of cotton cloth. Of the spindles found, Crawford[3] records that the same spinning device was used in Peru as was used in southwest Asia. The two-barred cotton loom was used in the Old World and also in the promised land. In addition to the above, a method of producing a color pattern, called resist dyeing, that was in use in southern Asia during the last centuries before the birth of Christ, was also used by the early textile experts of the Western Hemisphere. Man not only brought cultivated cotton seeds from the Old World but tools to spin the lint, and dyeing techniques as well. Evidence that is accumulating also suggests that other plants[3] such as the bottle gourd (*Lagenaria siceraria*) and the yam (*Dioscores alata*) were brought from southern Asia to the Western Hemisphere in the prehistoric past.

The only conquests which are permanent and leave no regrets are our conquests over ourselves.

Conclusions

The evidence presented here indicates: 1. That the cotton plant cultivated in America in the pre-

historic past originated from a cross between the cultivated cottons of southwestern Asia and a wild American species, probably *G. raimondii*, which is native to the area now known as Peru.

2. The evidence strongly suggests that the Asiatic cotton was brought across the Pacific ocean to America by civilized man. Along with the cotton, the two-barred loom used in southwestern Asia, and a knowledge of resist dyeing were also brought to this hemisphere. Evidence indicates that plants other than cotton were also brought across the Pacific at an early date. Remnants of the bottle gourd (*L. siceraria*) which originated in India are found along with cotton in graves in Peru that date back several centuries before Christ.

3. Cotton is a tropical or semi-tropical plant and has not been grown in northern Asia or northern America. Since this is so it could not have been brought to America by slow migrating people by way of the Bering Strait. This would seem to prove that at least once in the prehistoric past, contact between Asia and America was made by a route other than the Bering Strait.

4. Since civilized man brought cotton from Asia to America, the civilization that flourished in the cotton using area of the New World may not have originated here but could have been transplanted from southern Asia.

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