Did you Know?

1. Cotton plays an important role in our lives. We are rarely very far away from something made of or containing cotton. In clothing, linens, furniture, mattresses, vehicles, dollar bills and much more, cotton is always around us.
2. Cotton is the most abundantly produced natural fiber in the world. Over 82 million tons of textile fibers were consumed in 2013, of which cotton accounted for 30%, chemical fibers, 68.6% and all other natural fibers less than 2%. In 2013, cotton represented 96% of all natural fibers consumed at the mill use level.
3. Cotton can absorb water up to 27 times its own weight and can be weaved into any desired density. This quality also enables cotton fabric to be dyed easily, offering designers the flexibility of making a wide variety of products.
4. It estimated that the following quantities of cotton are required to make the following 100% cotton items: one pair of jeans, 0.68 kg; one dress shirt, 0.28 kg; one T-shirt, 0.23 kg; one diaper, 0.07 kg; and one bath towel, 0.28 kg.
5. The Consultative Group on International Agriculture Research (CGIAR) has a chain of international research centers working on food crops. Despite the fact that cotton provides food, animal feed and fiber, it is only categorized as a fiber crop. There are no other international research institutes or centers dedicated to cotton along the lines of the CGIAR centers.
6. The cotton plant is a perennial tree that has been domesticated to grow as an annual crop. Cotton is planted towards the end of spring, nourished during the summer and harvested in the fall. Natural acclimatization processes have impacted cotton

throughout its history, but exactly when the specifically targeted domestication process actually got started is not known.

7. Cotton is currently planted in only a few tropical locations because many countries in Central America have had to abandon cotton production due to heavy infestation by insects, particularly the boll weevil Anthonomus grandis.
8. A few countries that are divided by the equator, such as Colombia and Kenya, have overlapping cotton-growing seasons: cotton is being planted in one region while it is being harvested in another.
9. Cotton belongs to the family Malvaceae and genus Gossypium. Some researchers claim that 51 species belonging to the genus Gossypium have been identified so far, while others affirm that there are 52 and that there are many more sub species. Of the known species, only four species are cultivated on a commercial scale and are referred to as the cultivated species.
10. Two of the cultivated species, G. arboreum and G. herbaceum are diploid, i.e. they have A and D genomes 2n = 26. They are mainly grown in Bangladesh, India, Myanmar and Pakistan on less than 1% of the world cotton area. Small quantities may also be produced in China, Iran and Thailand for indigenous uses. Sometimes they are also referred as Asiatic cottons.
11. The other two cultivated species are allotetraploid with AADD genomes, 2n = 56. G. hirsutum and G. barbadense, are grown respectively on about 96-97% and 2-3% of the world cotton area. The tetraploid cottons grown around the world are Upland, Egyptian, Sea Island, Tanguis and Pima. Only the Upland species is G. hirsutum. Egyptian, Sea Island, Tanguis and Pima cottons belong to the G. barbadense species.
12. The cotton plant is indeterminate in nature and can be grown all year round provided that suitable weather conditions exist for the plant to grow.

13. The cotton season may extend from less than 180 days to over 300 days. The Central Asian cotton producing countries, as a region, have one of the shortest growing seasons in the world. Low soil temperature does not allow early planting while low temperature cut out is eminent. Biotechnological research is currently under way to shrink the cotton-growing season to around 120 days.
14. The number of bolls formed on the plant is far below the number of fruiting points on the plant. Fruiting forms are shed as tiny flower buds, young flower buds, unfertilized flowers and bolls usually less than 10 days old. Short duration, heat tolerance, early maturity, and dwarf plants have helped to increase the productive bolls to fruiting points ratio.
15. The causes of fruit shedding are complex and impossible to be eliminated forever. There are physical causes, such as insect damage, physiological causes, such as genotypic interaction with growing conditions and chemical causes, such as hormone imbalance. No matter how suitable and perfect the growing conditions may be for fruit formation and growth, it is just not possible to retain each and every flower bud and convert it into a yielding boll.
16. Under optimum conditions cotton seeds planted in soil take less than a week to germinate. The optimum depth to plant cotton seed is 3-4 centimeters. Acid delinting of seed is on the increase in the world.
17. The cotton seed emerges from the soil with two cotyledonary leaves, which have a seed coat to protect them as they traverse the 3-4 centimeter distance. The cotyledonary leaves may be located directly opposite to one another or parallel to each other.
18. The cotyledonary leaves reach their maximum size soon after emerging from the soil. They cease to grow in size as the true

leaves start to emerge. The cotyledonary leaves drop at about 40 days and within about 3-4 days of each other.

19. Cotyledonary leaves and true leaves vary in shape and size. The true leaves are 5-6 pointed and palmatedly lobed, while the cotyledonary leaves have the same width from base to the end and round corners.
20. The cotyledonary leaves, some times also called seed leaves or first green leaves, are always two in number and located either on opposite sides of the stem or parallel to each other. Cotyledonary leaves reach their maximum size in about 10 days.
21. The cotyledonary leaves form the first node on the main stem of the plant, which is considered to be ‘node zero.’ Node numbers are counted above the cotyledonary node. True or normal leaves grow in a spiral arrangement around the stem.
22. The number of true leaves corresponds to the number of branches (including empty nodes) plus fruiting points. The leaf axil on the plant gives rise to a branch, a sub-branch or a fruiting form.
23. Many flower buds are shed even before they become visible. The loss of buds, squares, flowers and bolls early in the season stimulates vegetative growth, thereby creating an imbalance between vegetative and reproductive growth that may result in lower yields.
24. Excessive vegetative growth may enhance the rate of bud formation but not necessarily yield. Lack of productive bolls on the plant certainly increases internodal length resulting in a tall and bushy plant.
25. Bud shedding followed by square shedding is a major impediment for obtaining more productive bolls. Flowers and bolls are rarely shed.
26. It is also reported that antioxidant polyphenols, polyenes and carotenoids are higher in drought tolerant varieties, an interesting clue toward the development of drought-tolerant varieties.

27. The cotton plant has a tap root system. The root could be 30 cm long in two weeks and one meter at the squaring stage.
28. The cotton plant has two types of branches, monopodial and sympodial, but some varieties of cotton may not have any monopodial branches.
29. Monopodial braches can only be the first branches to appear on the plant. Once a sympodial branch is formed, no more monopodial branches appear.
30. A white open flower takes 50-55 days to develop to the stage where white and harvestable lint is showing. Higher heat accelerates boll maturation but does not result in genetic improvement.
31. In nature, cotton lint exists in only three colors: white, various shades of brown, and green. A very light blue shade has been reported in Uzbekistan, but it has never been grown commercially. Color develops only after the boll opens and exposes the lint to interaction with sunlight.
32. The diverse shades of light to dark brown, are due to phenolics and tannin vacuoles in the lumen of the fiber cells.
33. Green color in the lint is due to the presence of caffeic and cinnamic acids in the wax content of the outer layer of the fibers.
34. The brown and green colors fade, but the green color has a greater tendency to fade after repeated washing.
35. Picking of G. arboreum cotton is easier because of the poor capacity of burrs to hold locks for many days after the boll is open. In G. herbaceum the locks are more firmly embedded in the boll.
36. G. barbadense and G. hirsutum are in between the two diploid species. G. hirsutum has varieties that are easier to pick by hand than others.
37. The two most frequently used mechanical picking systems are stripping and spindle. Strippers have rollers or mechanical brushes that remove entire bolls from the plant and carry along with them a

lot of plant material i.e. leaves, burs and branches. Spindle pickers pull the cotton fiber from the open bolls using revolving barbed spindles that entwine the fibers and release them softly to be carried to the basket.

38. Almost 1/3 of the cotton produced in the world is mechanically picked. About 2/3 is picked by hand, but increasing labor costs are forcing more countries to consider machine picking.
39. A normal healthy person can pick 25-30 kilograms of seedcotton in one day.
40. The first mechanical picker was developed in 1850, but machine pickers were not commercialized for almost another century, when International Harvester in the USA produced a dozen of them for their initial marketing attempt.
41. Machine picking was introduced in the USA in 1942 and all cotton in the USA has been picked by machine for many decades. Australia also uses 100% machine picking.
42. Most cotton picking in Argentina, Brazil, Colombia, Greece, Spain and Turkey is also mechanized.
43. Among the major cotton-producing countries, all cotton in China, India and Pakistan is picked by hand.
44. The amount of trash in seedcotton may vary from zero (in hand-picked cotton) to as much as more than 20% in machine-picked cotton. The probability of bringing in trash along with the seedcotton is significantly influenced by the weediness of the field, the hairiness of the leaves, the bushiness of a given variety, poor defoliation, poor maintenance of picking machines and the method of machine picking.
45. The product harvested from the cotton field is known as seedcotton, which is separated at a ginning mill into lint and cotton seed. The lint fraction accounts for 38-40% of the weight of seedcotton while the seeds make up about 2/3 of the seedcotton

by weight. Seedcotton also caries unwanted trash that is inadvertently collected along with seedcotton.

46. In 1793, Eli Whitney invented the saw gin in order to improve efficiency. He received a patent for his technique in March 1794. Saw ginning made it possible to remove seeds from cotton fibers quickly and at lower cost than by manual removal of the lint. In the beginning, it was estimated that a single ginning machine could do the work of 50 laborers picking the seeds out by hand.
47. Later, much faster saw ginning machines were developed employing a greater number of saws and running at higher speed. The efficiency of roller gins has also improved greatly.
48. Lint is commercially sold in bales. Bale weights differ among countries due to variation in the pressing units. Under the conditions existing in cotton-producing countries today, it is totally unrealistic to expect uniform bale weight.
49. According to the study undertaken by the ICAC in 2008, Egypt produces the heaviest bales, weighing as much as 440 kg of lint. Cotton is repacked and baled in smaller sizes for export purposes.
50. Bale density also varies by country. In some countries, presses and pressures may vary from one gin to the next. Bale density is directly related to the amount of airspace inside the bale and the diffusion of air into and out of the bale. Lower density and greater amounts of air in the bale increases the risk of fire.
51. The recommended bale covering material is cotton. However, in some countries cotton continues to be packed in jute, plastic and polypropylene.
52. Bales are marked differently in various countries. The cotton industry is working toward a uniform bale identification system.
53. Dry fiber or lint is about 95% highly crystalline cellulose. The remaining 5% is typically composed of: protein (1.3%), pectic substances (1.2%), ash/minerals (1.2%), wax (0.6%), total sugars (0.3%) and other constituents (0.4%).

54. Over 50 million tons of cotton seed are produced annually, of which less than 1% is used to plant cotton. The rest goes to livestock feed as raw seed or is crushed to extract the oil.
55. In the USA, over two million tons of seed, almost half of the seed produced every year in the country, goes to crushing for oil. Linters account for about 11% on the gin run seed, of which around 8% is removed. The first cut amounts to about 18 kg/ton of seed and the second cut is about 55 kg per ton of seed. It is estimated that if all cotton seed produced in the world were processed to remove linters, over 3 million tons of linters, worth over US$700 million, would be produced on annual basis.
56. Cotton seed oil is trans-free because it does not contain linolenic acid and does not require hydrogenation. Its higher saturation and greater content of gamma- and delta-tocopherols make it more stable. Cotton seed oil does not impart its own flavor to food. (The Cotton Gin and Oil Mill Press, March 1, 2009)
57. According to the National Cotton seed Products Association of the United States, about 56% of the cotton seed oil consumed in the USA is used in salad dressings and cooking oil. About 36% goes into baking and frying fats, and a small percentage goes into margarine and other uses.
58. In its natural state, cotton seed oil has a light golden color and the level of refining certainly has an impact on the color. Technologies are being developed to add natural colors to cotton seed oil.
59. Non–species, non–cotton-plant genes may be successfully inserted into cotton with specific objectives and used for years without any deleterious effects on the cotton genome.
60. As of 2013/14, Argentina, Australia, Brazil, Burkina Faso, China, Colombia, India, Mexico, Myanmar, Paraguay, Pakistan, South Africa, Sudan and USA have all commercialized biotech cotton. Australia, Mexico and the USA were the first countries to commercialize biotech cotton in 1996/97.

61. The first transgenic cotton varieties to have two independently acting insect resistant biotech genes were introduced in Australia and the USA in 2003.
62. Biotech cotton was planted on 23 million hectares or 68% of the world cotton area in 2012/13. In the same year, 72% of the cotton produced and 73% of the cotton traded internationally originated from biotech varieties, either insect-resistant or insect-resistant plus herbicide-tolerant.
63. Arthropods and a number of weeds have developed resistance to insect-resistant and herbicide-resistant biotech cotton respectively.
64. According to Cropnosis Ltd., plant protection chemicals worth US$56.3 billion were sold in the world in 2013. Herbicides accounted for 45%, insecticides 20%, fungicides 20% and seed care and specialized chemicals such as growth regulators/ desiccants/defoliants, etc., accounted for 7%.
65. Cotton consumed 5.7% by value of all the plant protection chemicals sold in 2013.
66. Cotton used 16.5%, by value, of all insecticide sales in 2013.
67. Only 1% of the fungicide sales by value were used on cotton in 2013.
68. The share of pesticides (by value) used on cotton has declined from 11% in 1986 to the current level of 5.7%. This decline is expected to continue due to higher levels of awareness of the toxic effects of the chemicals used in agricultural production.
69. Sale by value of insecticides used on cotton declined significantly in the beginning of this century, from almost 19% in 2000 to 14.8% in 2010. In two of the five major cotton-producing countries, a specific pest brought about an increase in the share of insecticides used on cotton in the last two years to 18.7% in 2011 and 16.5% in 2013. No further increases in this share are expected.
70. The cotton boll weevil, also called Mexican boll weevil, Anthonomus grandis, is only a pest in the Americas. The boll

weevil is also the most destructive pest in the Americas and no biotech cotton resistant to the boll weevil has yet been developed.

71. The Central American countries quit cotton production because of the inability to protect their crop from the boll weevil. Despite the fact that yields were still higher than the world average in some countries, insecticide use intensity increased to the point that it became uneconomical to continue producing cotton.
72. According to Weed Science Society of America, herbicide resistance is defined as “the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type.” Resistance to herbicides may occur naturally or may be induced by techniques such as genetic engineering or selection of variants produced by tissue culture or mutagenesis.
73. Tolerance or resistance to herbicides in cotton is so far only a transgenic feature of herbicide-tolerant biotech cotton.
74. Much has been published on many commonly occurring pests on cotton. The mealybug is a comparatively new pest on cotton. Lately, mealybugs have become a highly significant pest in India and Pakistan. Mealybug Solenosis trials in Australia have shown that mealybug damage is most common on the base of the leaf (where petiole and leaf blade meet) but it can affect the entire leaf, buds and bolls.
75. Mealybug eggs hatch in one hour: the nymphs take another 5-10 days to become adults and a further 5-7 days to start laying eggs.
76. The mealybug winters in the form of large and small nymphs under the soil within the root zone. Thus, cotton fields with a history of mealybug infestation are more likely to be affected by mealybug.
77. Cotton fiber length varies greatly among species and varieties. Among cultivated species, G. barbadense has the longest and finest fibers. The two diploids species G. arboreum and G. herbaceum have short and rough (high micronaire) fibers. The

fourth cultivated species, G. hirsutum, has a wider range of fiber length (in excess of 25.4 mm or one inch), but is shorter than G. barbadense.

78. The cotton fiber, a tuberous outgrowth from the seed coat, is a single cell and the largest cell in the plant kingdom. The fibers grow in length after fertilization of an ovule and reach their maximum length in 16-25 days, depending on varieties and growing conditions.
79. Formation of the secondary wall begins before the fibers have grown to their full length.
80. The cotton fiber does not divide into cells under field conditions but the cells surrounding the hair (fiber and fuzz) forming cells on the ovule divide and multiply as a fertilized ovule grows into a seed.
81. All hairs formed on the epidermal layer of the ovule do not develop as fibers. Fuzzy fibers fail to grow and even remain stuck to the seed coat during ginning. Fuzzy hairs, called linters, may or may not be removed after ginning.
82. The cotton fiber takes about 50 days to develop and mature inside the green boll, which then cracks open to reveal the white harvestable lint. These are called “open bolls”.
83. The cotton boll is first formed as a flower bud called a square. The square becomes a bud and ultimately a white flower on the day of anthesis. After pollination, the ovules, which are arranged linearly in the ovary of the flower, develop into seeds.
84. Among the cultivated types, G. arboreum has fewest number of locks, mostly 3 and occasionally 4. G. herbaceum usually has four locks, which is also true for G. barbadense. G. hirsutum commonly has four locks and many varieties may have even five locks. The same plant may have four and five lock bolls. Three lock bolls are extremely rare in G. hirsutum.
85. All fiber quality parameters that determine a ‘grade’ and instrument readings are largely impacted by environmental and agronomic

conditions. In most cases the genetic expression is either suppressed or aggravated by extreme conditions.

86. Cotton is usually planted on about 34-35 million hectares in the world, with a maximum and minimum range of 30-36 million hectares. Since 1951/52 the world cotton area has exceeded 36 million ha on only three occasions: 1951/52, 1995/96 and 2011/12. The increase over the 36 million hectare mark did not represent even half a percent of the total area. Since 1951/52, cotton was planted on less than 30 million hectares only once, in 1986/87.
87. The greatest volume of cotton ever produced in the world was 28.04 million tons in 2011/12. Only 6.7 million tons of cotton was produced in 1950/51.
88. Cotton production increased by over 54% during 1950s, 12% during 1960s, 20% during 1970s, 25% during 1980s, only 1% during 1990s and by 14% during 2000s.
89. All increases in production have come from increases in yields. There are periods of slow growth in yields and the highest yield ever achieved was 793 kg/ha of cotton in 2007/08 and 2012/13 compared to 234 kg/ha in 1951/52.
90. In the last 60 years or more, the average world cotton yield has increased by 4% per hectare every year or 9 kilograms of lint per hectare per annum.
91. Fiber quality improvements have also occurred on a continuous basis, but far short of the productivity gains. The over threefold increase in productivity has not been matched in any of the parameters of fiber quality. Fiber quality improvement is complex and direct selection may not result in a significant enhancement. Negative correlations among parameters and productivity further complicate the achievement of an enhanced progress rate.
92. Currently, the highest cotton yields in the world occur in Australia, 2,138 kg lint/ha in 2012/13. Cotton yields in Australia have usually

been more than double the world average, but the gap has increased in recent years.

93. China was the top cotton producing, importing and consuming country in the world in 2012/13.
94. World mill consumption of cotton peaked in 2006/07, reaching 26.6 million tons.
95. In 2012/13, mill consumption in China stood at 8.3 million tons or 36% of total world consumption. India was the second largest consumer of cotton (4.9 million tons) followed by Pakistan with 2.4 million tons. China, India and Pakistan together shared 58% of world production and almost 2/3 of world consumption in 2012/13.
96. Ever since cotton statistics became available, the USA has been the largest exporter of cotton in the world. Almost 80% of cotton produced in the USA in 2012/13 was exported. Conversely, mill consumption of cotton halved in the USA in the seven years from 2000/01 to 2006/07 and expected to half again by 2016/17.
97. The cost of cotton production is continuously increasing. According to ICAC statistics, the average net cost of production increased to US$1.50 per kg of lint in 2012/13. Net cost assumes that farmers own the land, so does not include land rent, and that they sell the cotton seed after ginning.
98. The cost of the fertilizers applied to produce a kilogram of lint doubled since 2000/01.
99. Emphasis on weed control is rising and the cost of weed control almost tripled from 2000/01 to 2012/13.
100. During the same period, only 13-17 US cents were spent on insecticides to produce a kg of lint, compared to 21 cents in 1994/95, which means that the share of insecticide costs has drastically declined.