COTTON

New Mexico Cotton

In 2003, there were 59,100 acres of cotton planted in New Mexico. This planting produced 83,200 bales, which weighed 480 pounds each, for a total of 39.9 million pounds of cotton.

Planting begins when soil temperatures reach 65 to 70 degrees for five consecutive days. This fosters seed germination. In our state, this usually occurs by the end of April.

While the cotton matures in September and could be harvested at this time, some farmers wait until the first killing freeze so that the leaves fall off the plant, making mechanical harvesting easier. This usually occurs around November 5.

Because exposure to the weather may cause a decrease in the quality of the cotton, other farmers do not wait until the freeze. They use a chemical defoliant to remove the leaves. This allows them to harvest the cotton earlier.

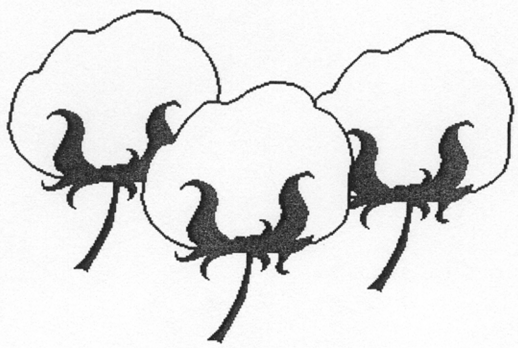
There are two types of cotton grown in New Mexico -- Pima and Upland. Eighty percent of the cotton acreage planted in this region is Upland cotton. The primary difference between Pima and Upland cotton is the length of the fiber, called staple length. Pima cotton has a staple length of 1 5/16 to 1 ½ inches, while Upland cotton is 13/16 to 1 ¼ inches long.

Because of the fineness and longer length of Pima cotton, more fibers can be spun into a yarn, which enhances the softness of the fabric. During ginning, machines remove burrs, dirt and leaf trash from the cotton. The gin stand contains circular saws with small, sharp teeth that pull the fiber from the seed. The ginned fiber, now called lint, is pressed together into bales that weigh 480 pounds, are covered with plastic for protection, and are held together with metal bands.

A bale of cotton weighs about 480 pounds. The cotton in one bale can be made into 1,217 t-shirts or 2,000 pairs of socks. It also can make 690 terry-cloth bath towels or 249 pairs of jeans. A by-product of cotton is cotton seed oil. Cotton seed oil, made by crushing the seeds removed during ginning, is used for frying many products including potato and corn chips.

American-Pima Cotton:
Acreage, Production, Price, and Value

Crop Year	Acreage: Planted	Acreage: Harvested	Yield Per Acre	Production (480-Pound Net Weight Bales)	Price Per Pound	Value of Production
	1,000 Acres	1,000 Acres	Net Pounds	1,000 Bales	Cents	1,000 Dollars
1975	13.3	12.5	195	5.1	80.50	1,971
1980	7.1	7.0	464	6.8	105.00	3,427
1985	8.0	7.9	687	11.3	98.80	5,359
1990	19.3	19.3	609	24.5	117.00	3,759
1995	15.0	15.0	605	18.9	118.00	10,705
1999	7.5	7.0	734	10.7	88.70	4,556
2000	4.2	4.1	539	4.6	93.80	2,071
2001	5.2	5.2	969	10.5	87.70	4,420
2002	7.1	7.1	1,041	15.4	84.10	6,217
2003	6.1	6.0	1,056	13.2	106.00	6,716



American-Pima Cotton:
Acreage, Yield, and Production by County

District/County	Planted (Acres) 2002	Planted (Acres) 2003	Harvested (Acres) 2002	Harvested (Acres) 2003	Yield Per Acre (Pounds) 2002	Yield Per Acre (Pounds) 2003	Production (480-Pound Net Weight Bales) 2002	Production (480-Pound Net Weight Bales) 2003
DISTRICT 90	**7,100**	**6,100**	**7,100**	**6,000**	**1,041**	**1,056**	**15,400**	**13,200**
Doña Ana	6,600	5,100	6,600	5,000	1,033	1008	14,200	10,500
Other Counties	500	1,000	500	1,000	1,152	1,296	1,200	2,700
STATE	7,100	6,100	7,100	6,000	1,041	1,056	15,400	13,200

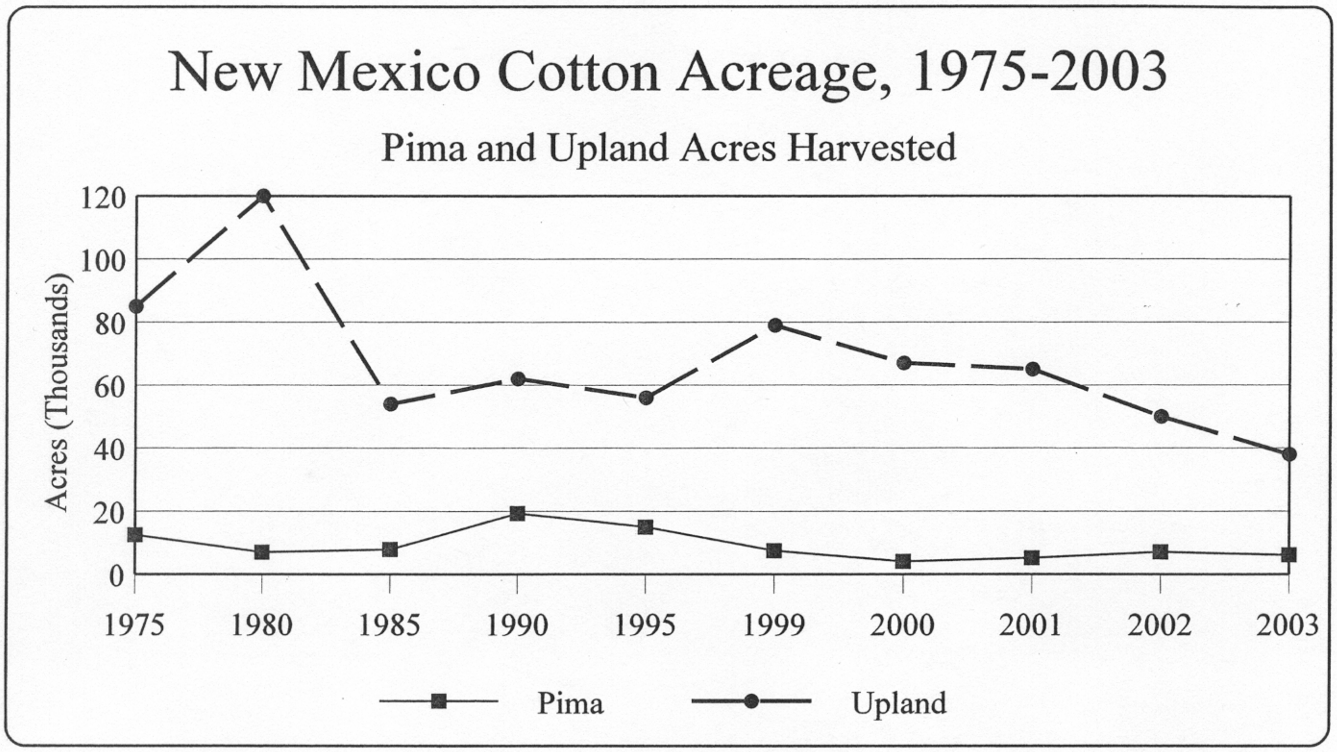
Upland Cotton: Acreage, Production, Price, and Value

Crop Year	Acreage: Planted	Acreage: Harvested	Yield Per Acre	Production (480-Pound Net Weight Bales)	Price Per Pound	Value of Production
	1,000 Acres	1,000 Acres	Net Pounds	1,000 Bales	Cents	1,000 Dollars
1975	95.0	85.0	382	68.0	54.60	17,821
1980	151.0	120.0	428	107.0	81.00	41,602
1985	70.0	54.0	631	71.0	57.60	19,630
1990	69.0	62.0	735	95.0	70.90	32,330
1995	61.0	56.0	609	71.0	81.70	27,843
1999	84.0	79.0	662	109.0	47.10	24,643
2000	72.0	67.0	724	101.0	53.10	25,743
2001	68.0	65.0	916	124.0	34.10	20,296
2002	54.0	50.0	816	85.0	53.20	21,706
2003	53.0	38.0	884	70.0	63.20	21,235

Upland Cotton: Acreage, Yield, and Production by County

District/County	Acreage: Planted		Acreage: Harvested		Yield Per Acre		Production (480-Pound Net Weight Bales)	
	Acres		Acres		Pounds		Bales	
	2002	2003	2002	2003	2002	2003	2002	2003
DISTRICT 30	**18,500**	**17,000**	**16,600**	**7,400**	**651**	**636**	**22,500**	**9,800**
Curry	7,000	6,000	6,600	2,300	691	689	9,500	3,300
Quay	2,500	---	2,000	---	288	---	1,200	---
Roosevelt	9,000	11,000	8,000	5,100	708	612	11,800	6,500
DISTRICT 70	**2,500**	**2,600**	**2,500**	**2,600**	**1,075**	**1,071**	**5,600**	**5,800**
Hidalgo	500	500	500	500	1,056	960	1,100	1,000
Luna	2,000	2,100	2,000	2,100	1,080	1,097	4,500	4,800
DISTRICT 90	**33,000**	**33,400**	**30,900**	**28,000**	**884**	**933**	**56,900**	**54,400**
Chaves	1,700	2,000	1,700	1,900	904	985	3,200	3,900
Doña Ana[1/]	8,200	9,800	8,200	9,800	1,229	1,176	21,000	24,000
Eddy	5,100	4,900	5,000	4,800	979	950	10,200	9,500
Lea	18,000	16,700	16,000	11,500	675	710	22,500	1,700
STATE	**54,000**	**53,000**	**50,000**	**38,000**	**816**	**884**	**85,000**	**70,000**

[1/]Sierra County is included in Doña Ana County.

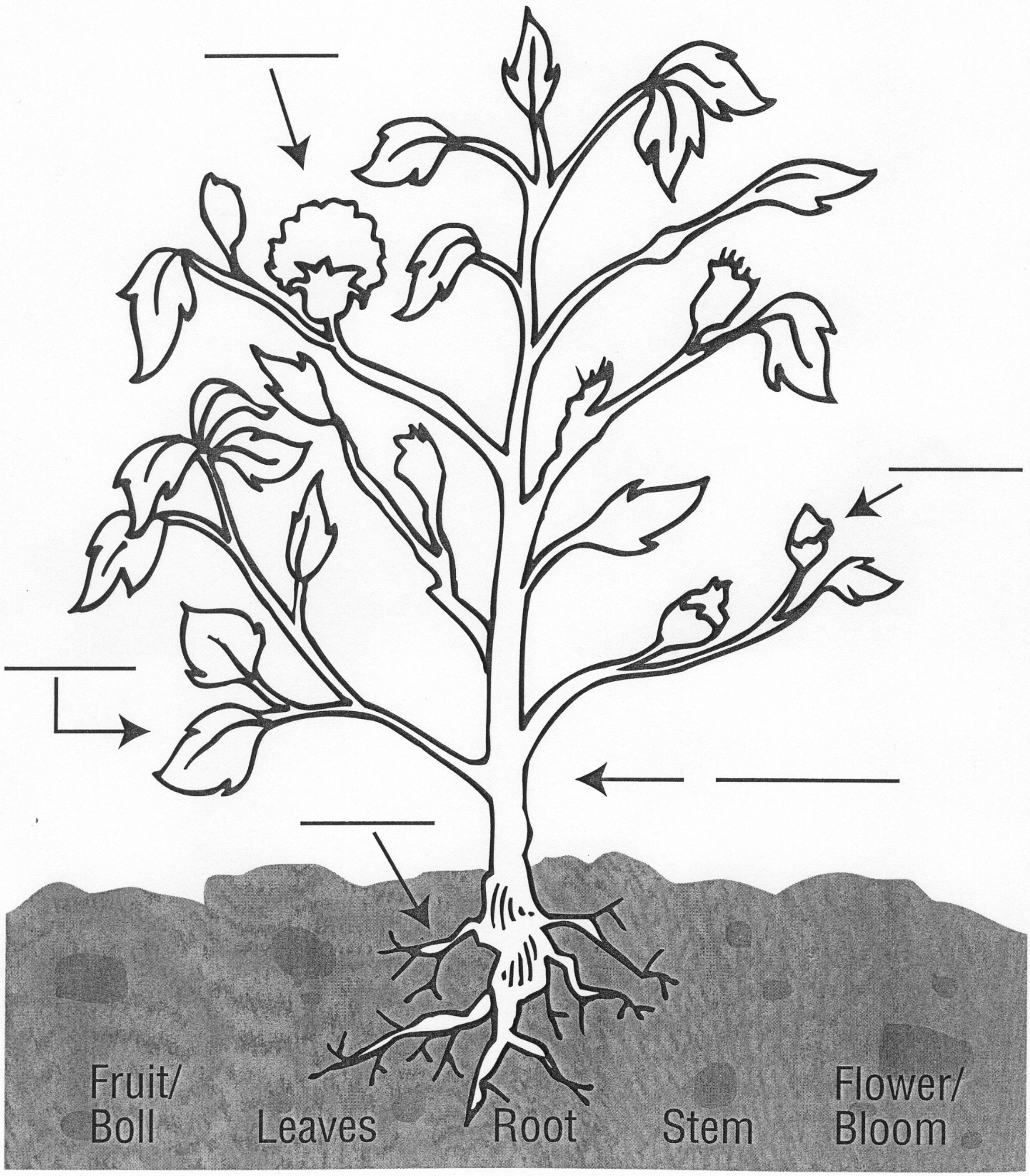


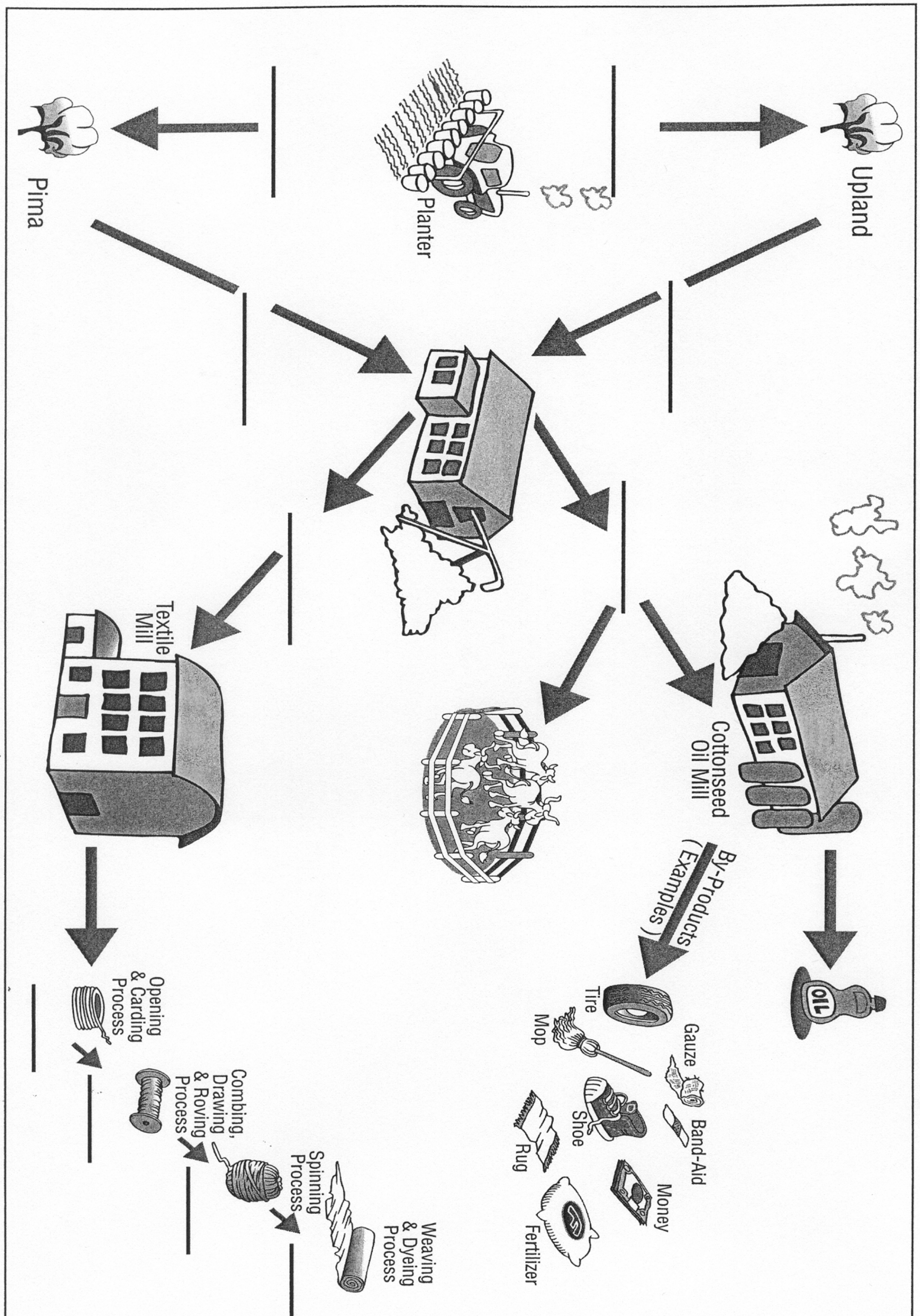
Cottonseed: Production, Farm Disposition, Price, and Value

Crop Year	Production	Farm Disposition: Sold to Oil Mills	Farm Disposition: Other[1/]	Season Average Price Per Ton	Value of Production
	---1,000 Tons---			Dollars	1,000 Dollars
1975	28.0	24.0	4.0	99.90	2,797
1980	45.0	40.0	5.0	124.00	5,580
1985	31.3	20.0	11.3	61.00	1,909
1990	48.0	13.0	35.0	143.00	6,864
1995	33.4	3.1	30.3	137.00	4,576
1999	50.5	2.2	48.3	97.50	4,924
2000	39.7	6.3	33.4	120.00	4,764
2001	47.8	15.6	32.2	112.00	5,354
2002	35.5	15.3	20.2	106.00	3,763
2003	31.6	3.8	27.8	145.00	4,495

[1/]Includes planting seed, exports, interfarm sales, shrinkage, losses, and other uses.

COTTON PLANT STRUCTURES





Cotton Production Flow Chart
Upland
Planter
Pima
Cottonseed Oil Mill
Textile Mill
OIL
By-Products (Examples)
Tire
Gauze
Band-Aid
Money
Mop
Shoe
Rug
Fertilizer
Opening & Carding Process
Combing, Drawing & Roving Process
Spinning Process
Weaving & Dyeing Process

ONE BALE'S BOUNTY

Item	# per bale
Men's woven handkerchiefs	8,000
Men's knee socks	3,400
Men's pajamas	400
Men's dress shirts	800
Men's sport shirts	725
Men's sweatshirts	500
Men's knit sweaters	500
Men's & boy's sport trousers	450
Men's & boy's jeans	325
Men's & boy's work trousers	375
Men's & boy's shorts & briefs	2,600
Ladies' blouses & shirts	850
Ladies' knit & woven dresses	350
Ladies' handkerchiefs	22,000
Diapers	3,000
Sheets, flat, full size	200
Pillowcases	1,200
Bath towels	690
T-shirts	1,220

Origins of Cotton

Scientists have determined cotton fiber and boll fragments found in the Tehuacan Valley of Mexico to be about 7,000 years old. The Greek historian Herodotus in the 5th century BC reported that a plant that bore fleece as its fruit grew there. Cotton has been grown and worn in India and Egypt for at least 5,000 years. Highly skilled cotton weaving dating back to 2,500 BC has been found at monumental ceremonial mounds in the Chicama Valley of Northern Peru. In the first century BC, Pliny wrote that the peasants of Egypt wore cloth made from cotton that grew along the Nile River.

History of Cotton Textile Production

As European and American populations grew in the 18th century, the demand for cheap clothing grew, too. This led to an astonishing expansion of the spinning and weaving industry. Within one person's lifetime, it changed from small-scale, part-time work for cottagers into a vast full-time career for an army of factory hands. This huge change was largely the result of new machinery and new supplies of the vital raw material—cotton.

American colonists had the abiity to produce much cotton but were restricted by the mechanical know-how to process the fiber into textiles. **Tench Coxe**, a Philadelphian who was to become Assistant Secretary of the Treasury, did much to encourage the cultivation and manufacture of cotton. He operated the nation's first spinning jenny and provided jobs in spinning and weaving cotton. In 1786, he ordered brass models of textile machinery from England. In England during the height of the British Empire, it was against the law to either import or manufacture cloth from cotton fiber. These laws were enacted to protect the powerful English sheep and wool industry of that time. British blockades and secrecy regarding their textile inventions further hampered colonial competition. **Samuel Slater**, an English textile mill worker, migrated to the American colonies in 1790 and built the first American textile mill from memory. A huge waterwheel with a system of cogs and gears powered all of the machines in cotton mills.

The demand for cotton soared. It was simple enough to grow cotton, but difficult to clean the bolls. In 1792, recent Yale graduate **Eli Whitney** headed south to assume the position of a private tutor on a plantation in Georgia. His employer, **Catherine Greene** (whom some credit with the invention of the cotton gin), encouraged Whitney to find a solution to separate the seed from the cotton lint more efficiently.

Whitney put aside his plans to study law and created a small, hand-cranked gin in 1793. This was a wooden drum stuck with hooks. As it turned, the hooks pulled the cotton fibers through a mesh. The seeds would not fit through the mesh and fell outside. Lint volume was increased fifty-fold with the advent of Whitney's gin.15 However, Whitney profited little because farmers made their own versions and claimed them as new inventions under a loophole in the 1793 patent act.

Once the answer had been found, cotton went onto become the most important product in the world. After the invention of the cotton gin, the yield of raw cotton doubled each decade after 1800.
Demand was fueled by other inventions of the Industrial Revolution, such as the machines to spin, weave, print and sew it, chlorine to bleach it and the steamboats to transport it. By mid-century, America was growing three-quarters of the world's supply of cotton, most of it shipped to England or New England, where it was manufactured into cloth.

For the first time in history, good clothes, hats and even shoes could be bought more cheaply; however, the cottage textile industry disappeared as displaced rural workers migrated to large cities and became part of the urban workforce.

Harvesting the cotton by hand was another limitation of productivity. An experienced labor could pick approximately 450 pounds of seed cotton by hand per day. A picking device was first patented in 1850, and a machine that strips both open and unopened bolls and trash from the plant was developed in 1871. In the early 1930's, after years of development and modification, the Rust Brothers of Mississippi used a one-row mechanical cotton picker that could pick approximately 8,000 pounds of seed cotton in one day.

Cottonseed

More seed than fiber is produced by the cotton plant. Until the crushing industry developed, cottonseed had little cash value. In fact, disposal of it was such a problem that some states passed laws to regulate the accumulation of large quantities on gin premises. Increased cotton production after the invention of the cotton gin challenged farsighted entrepreneurs to find a mechanical way to crush cottonseed on a large scale. Many mills were established but most failed due to unsuccessful attempts to produce marketable oil and livestock feed products. In 1857, just before the civil War, **William Fee** of Cincinnati developed machinery that effectively removed linters and hulls from seed kernels. This equipment made the processing of cottonseed economically feasible. By 1875, cottonseed oil was being exported to Mediterranean ports where it was often sold as olive oil.

All parts of the cottonseed are useful:

Cottonseed linters:

Dissolving pulp is an essential component in plastics, smokeless gunpowder, food casings, rayon, cosmetics and photographic films; Felts are used in padding for automotive and furniture upholstery, comforters and mattresses; Yarns are processed for candle wicks, twine and mopes; Absorbent cotton medical grade fibers are used in paper and cotton swabs, balls and gauze; and Fiber pulp is used in producing currency and other security papers.

Cottonseed hulls:

Used for livestock feed, mulch and soil conditioners, plastics and synthetic rubber.

Cottonseed kernels:

Meal and cake is used for home garden fertilizers, livestock and poultry feed and fish feed and bait; and Crude oil is either refined for salad/cooking and baking/frying oils or used in the manufacture of items as diverse as explosives, pharmaceuticals, fungicides and rubber.

Development of the Cotton Gin

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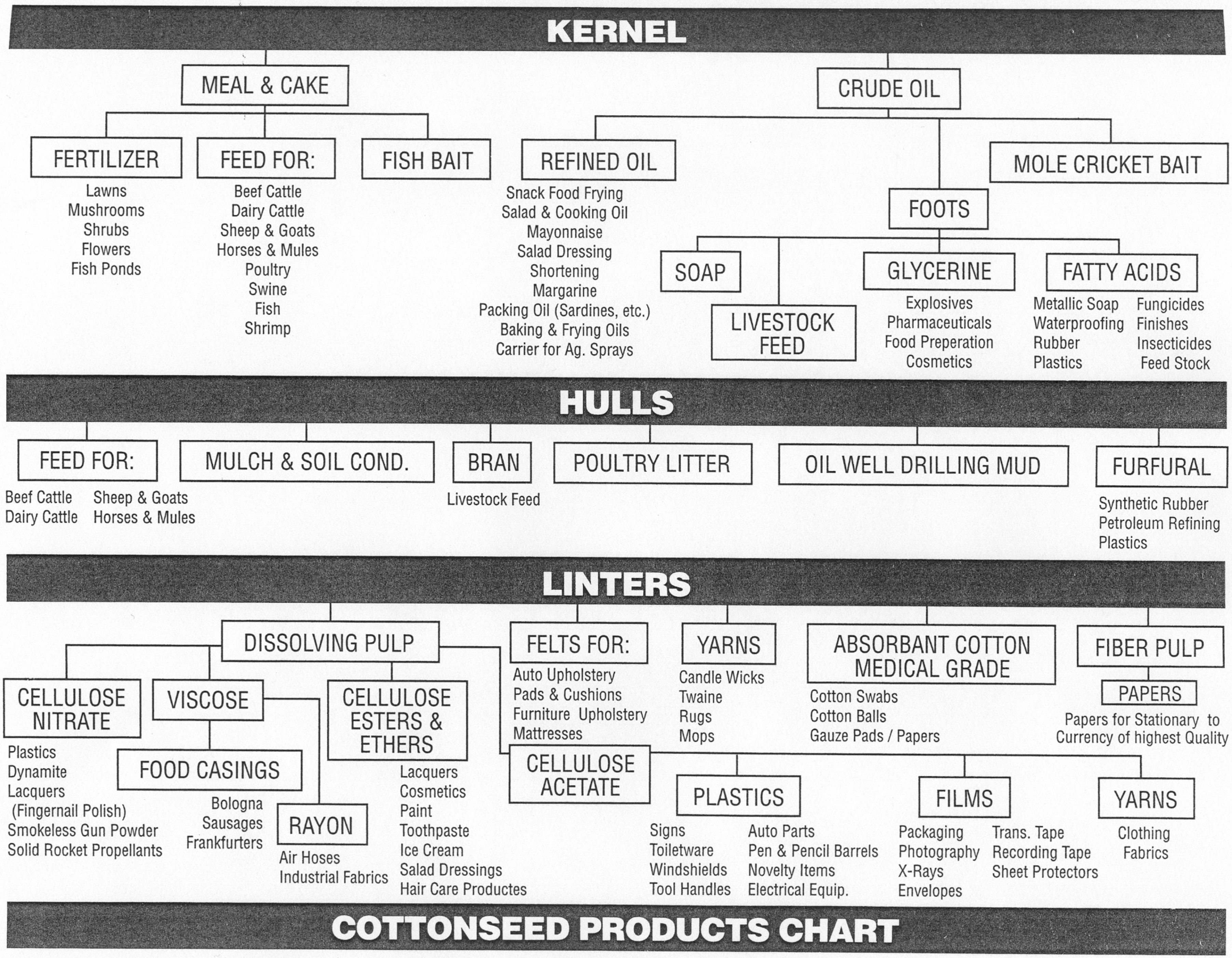
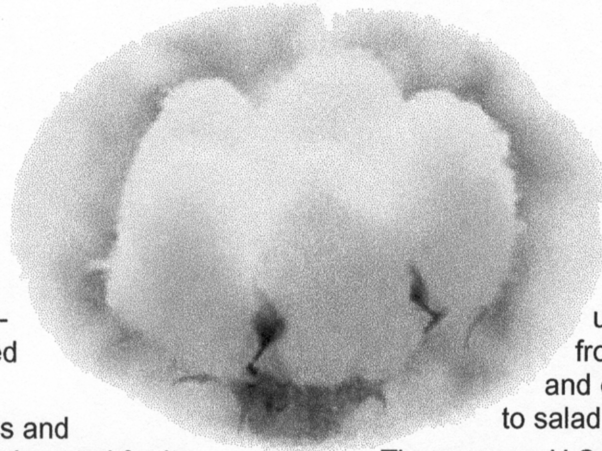

KERNEL
MEAL & CAKE
CRUDE OIL
FERTILIZER
Lawns
Mushrooms
Shrubs
Flowers
Fish Ponds
FEED FOR:
Beef Cattle
Dairy Cattle
Sheep & Goats
Horses & Mules
Poultry
Swine
Fish
Shrimp
FISH BAIT
REFINED OIL
Snack Food Frying
Salad & Cooking Oil
Mayonnaise
Salad Dressing
Shortening
Margarine
Packing Oil (Sardines, etc.)
Baking & Frying Oils
Carrier for Ag. Sprays
MOLE CRICKET BAIT
FOOTS
SOAP
LIVESTOCK FEED
GLYCERINE
Explosives
Pharmaceuticals
Food Preperation
Cosmetics
FATTY ACIDS
Metallic Soap
Waterproofing
Rubber
Plastics
Fungicides
Finishes
Insecticides
Feed Stock
HULLS
FEED FOR:
Beef Cattle
Dairy Cattle
Sheep & Goats
Horses & Mules
MULCH & SOIL COND.
BRAN
Livestock Feed
POULTRY LITTER
OIL WELL DRILLING MUD
FURFURAL
Synthetic Rubber
Petroleum Refining
Plastics
LINTERS
DISSOLVING PULP
CELLULOSE NITRATE
Plastics
Dynamite
Lacquers
(Fingernail Polish)
Smokeless Gun Powder
Solid Rocket Propellants
VISCOSE
FOOD CASINGS
Bologna
Sausages
Frankfurters
RAYON
Air Hoses
Industrial Fabrics
CELLULOSE ESTERS & ETHERS
Lacquers
Cosmetics
Paint
Toothpaste
Ice Cream
Salad Dressings
Hair Care Productes
FELTS FOR:
Auto Upholstery
Pads & Cushions
Furniture Upholstery
Mattresses
CELLULOSE ACETATE
YARNS
Candle Wicks
Twaine
Rugs
Mops
ABSORBANT COTTON MEDICAL GRADE
Cotton Swabs
Cotton Balls
Gauze Pads / Papers
FIBER PULP
PAPERS
Papers for Stationary to
Currency of highest Quality
PLASTICS
Signs
Toiletware
Windshields
Tool Handles
Auto Parts
Pen & Pencil Barrels
Novelty Items
Electrical Equip.
FILMS
Packaging
Photography
X-Rays
Envelopes
Trans. Tape
Recording Tape
Sheet Protectors
YARNS
Clothing
Fabrics
COTTONSEED PRODUCTS CHART

Cotton: From Field to Fabric



Cotton

Cotton remains the most miraculous fiber under the sun, even after 8,000 years. No other fiber comes close to duplicating all of the desirable characteristics combined in cotton.

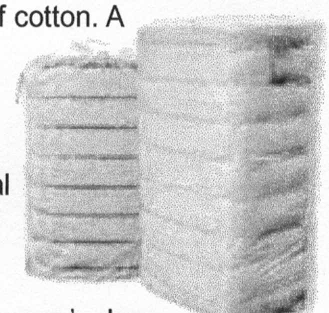
The fiber of a thousand faces and almost as many uses, cotton is noted for its versatility, appearance, performance and above all, its natural comfort. From all types of apparel, including astronauts' in-flight space suits, to sheets and towels, and tarpaulins and tents, cotton in today's fast-moving world is still nature's wonder fiber. It provides thousands of useful products and supports millions of jobs as it moves from field to fabric.

Economics of Cotton

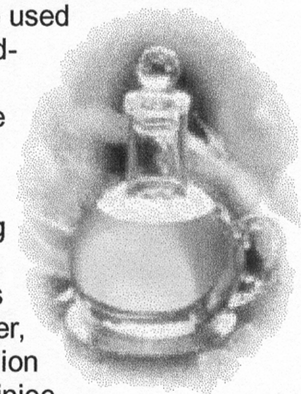
A National Cotton Council analysis affirms that today's modern cotton production system provides significant benefits to rural America's economy and environment.

Healthy rural economies are based on stable farm income, and cotton yields and prices are often among the healthiest of all field crops, vegetable or fruit.

Cotton continues to be the basic resource for thousands of useful products manufactured in the U.S. and overseas. U.S. textile manufacturers use an annual average of 7.6 million bales of cotton. A bale is about 500 pounds of cotton. More than half of this quantity (57%) goes into apparel, 36% into home furnishings and 7% into industrial products. If all the cotton produced annually in the U.S. were used in making a single product, such as blue jeans or men's dress shirts, it would make more than 3 billion pairs of jeans and more than 13 billion men's dress shirts.



An often-overlooked component of the crop is the vast amount of cottonseed that is produced along with the fiber. Annual cottonseed production is about 6.5 billion tons, of which about two-thirds is fed whole to livestock. The remaining seed is crushed, producing a high-grade salad oil and a high protein meal for livestock, dairy and poultry feed. More than 154 million gallons of cottonseed oil are used for food products ranging from margarine and cooking oils to salad dressing.



The average U.S. crop moving from the field through cotton gins, warehouses, oilseed mills and textile mills to the consumer, accounts for more than $35 billion in products and services. This injection of spending is a vital element in the health of rural economies in the 17 major cotton-producing states from Virginia to California.

The gross dollar value of cotton and its extensive system of production, harvesting and ginning provides countless jobs for mechanics, distributors of farm machinery, consultants, crop processors and people in other support services. Other allied industries such as banking, transportation, warehousing and merchandising also benefit from a viable U.S. cotton production system.

Annual business revenue stimulated by cotton in the U.S. economy exceeds $120 billion, making cotton America's number one value-added crop.

The farm value of U.S. cotton and cottonseed production is approximately $5 billion.

Overseas sales of U.S. cotton make a significant contribution to the reduction in the U.S. trade deficit. Annual values of U.S. cotton sold overseas have averaged more than $2 billion. Recently, the U.S. has supplied over 10.5 million bales of the world's cotton exports, accounting for about 37% of the total world export market. The largest customers for U.S. cotton are Asia and Mexico.

Exports of yarn, denim and other U.S.-manufactured cotton products have increased dramatically since the early 1990s, from 1.38 million bale equivalents in 1990, to more than 4 million bale equivalents in 1998.

Crop Production

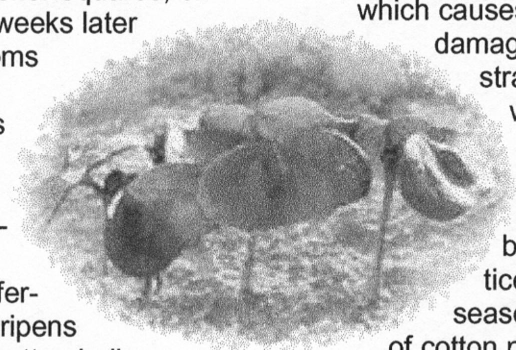
The Cotton Belt spans the southern half of the Unites States, from Virginia to California. Cotton is grown in 17 states and is a major crop in 14. Its growing season of approximately 150 to 180 days is the longest of any annually planted crop in the country. Since there is much variation in climate and soil, production practices differ from region to region. In the western states, for example, nearly the entire crop is irrigated.

Planting begins in February in south Texas and as late as June in northern areas of the Cotton Belt. Land preparation actually starts in the fall, shortly after harvest. Stalks from the old crop are shredded to reduce food supplies for over-wintering pests. Usually, this residue is left on the surface to protect the soil from erosion. The use of heavy mechanical harvesters compacts the soil, sometimes requiring tillage to loosen the soil for the next crop's roots.

Planting

Planting is accomplished with 6, 8, 10 or 12-row precision planters that place the seed at a uniform depth and interval. Young cotton seedlings emerge from the soil within a week or two after planting, depending on temperature and moisture conditions. Squares, or flower buds, form a month to six weeks later and creamy to dark yellow blossoms appear in another three weeks. Pollen from the flower's stamen is carried to the stigma, thus pollinating the ovary. Over the next three days, the blossoms gradually turn pink and then dark red before falling off, leaving the tiny fertile ovary attached to the plant. It ripens and enlarges into a pod called a cotton boll.

Individual cells on the surface of seeds start to elongate the day the red flower falls off (abscission), reaching a final length of over one inch during the first month after abscission. The fibers thicken for the next month, forming a hollow cotton fiber inside the watery boll. Bolls open 50 to 70 days after bloom, letting air in to dry the white, clean fiber and fluff it for harvest.



Weed Control

Cotton grows slowly in the spring and can be shaded out easily by weeds. If weeds begin to overpower the seedling cotton, drastic reductions in yield can result. Later in the season, cotton leaves fully shade the ground and suppress mid-to-late season weeds. For these reasons, weed control is focused on providing a 6 to 8-week weed-free period directly following planting.

Producers employ close cultivation and planters that place the cottonseed deep into moist soil, leaving weed seeds in high and dry soil. Herbicides or cultivation controls weeds between the rows.

Insect Management

The cotton plant has evolved with numerous damaging insects. These insects, if left unattended, would virtually eliminate the harvestable crop in most cotton-producing areas. Plants infested with leaf-feeding insects are able to compensate somewhat by producing more leaves. Many of cotton's insects, however, feed on squares and bolls. This reduces the yield and leads to delays in crop development, often into the frost or rainy season.

The cotton industry utilizes a multifaceted approach to the problem of insects. Known as Integrated Pest Management (IPM), it keeps pests below yield-damaging levels. IPM is dependent on natural populations of beneficial insects to suppress damaging pests. Additionally, some cotton varieties are genetically bred to be less attractive to insects.

Some plants are improved by modern biotechnology, which causes the plant to be resistant to certain damaging worms. Other modern biocontrol strategies also are used. For example, where populations of damaging pink bollworm insects break out, sterile insect releases are used to target the pest and minimize disruption to the beneficial insects. Also, cultural practices that promote earliness and short-season production reduce the vulnerability of cotton production to pests. Plant protection chemicals are often used to prevent devastating crop losses to insects. All plant protection methods used on plants in the U.S. are thoroughly evaluated by the Environmental Protection Agency (EPA) to assure food safety and protection to humans, animals and to the environment.

Plant Diseases

Cotton diseases have been contained largely through the use of resistant cotton varieties. Rotation to non-host crops such as grain or corn also breaks the disease cycle. Nematodes, while not truly a disease, cause the plant to exhibit disease-like symptoms. Nematodes are microscopic worm-like organisms that attack cotton's roots causing the plant to stop growing, and as a result, causes reduced yield. Crop rotation is the primary method of managing for nematodes.

Soil Conservation

Cotton producers expend extra efforts to minimize soil erosion. Cotton is sensitive to wind-blown soil because the plant's growing point is perched on a delicate stem, both of which are easily damaged by abrasion from wind-blown soil. For that reason, many farmers use minimum tillage practices which leave plant residue on the soil surface thereby preventing wind and water erosion.

Conservation tillage, the practice of covering the soil in crop residue year 'round, is common in windy areas. A growing number of producers also are moving to minimum tillage, or a no-till system, to reduce soil movement. In the rain belt, land terracing and contour tillage are standard practices on sloping land to prevent the washing away of valuable topsoil.

Irrigation

The cotton plant's root system is very efficient at seeking moisture and nutrients from the soil. From an economic standpoint, cotton's water use efficiency allows cotton to generate more revenue per gallon of water than any other major field crop.

Most of the U.S. cotton acreage is grown only on rain moisture. A trend toward supplemental irrigation to carry a field through drought has increased in acreage and helped stabilize yields. Cotton's peak need for water occurs during July, when it is most vulnerable to water stress. A limited supply of irrigation water is being stretched over many acres via the use of highly efficient irrigation methods such as low energy precision applications, sprinklers, surge and drip irrigation.

Not only has irrigation stabilized yields for many growers, it also has allowed production in the desert states of California, Arizona and New Mexico.

Harvesting

While harvesting is one of the final steps in the production of cotton crops, it is one of the most important. The crop must be harvested before weather can damage or completely ruin its quality and reduce yield.

Cotton is machine harvested in the U.S., beginning in July in south Texas and in October in more northern areas of the Belt.

Stripper harvesters, used chiefly in Texas and Oklahoma, have rollers or mechanical brushes that remove the entire boll from the plant. In the rest of the Belt, spindle pickers are used. These cotton pickers pull the cotton from the open bolls using revolving barbed spindles that entwine the fiber and release it after it has separated from the boll.

Seed Cotton Storage

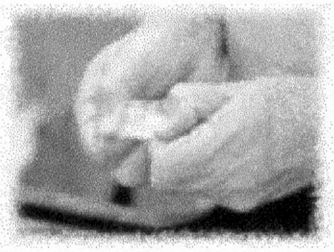
Once harvested, seed cotton must be removed from the harvester and stored before it is delivered to the gin. Seed cotton is removed from the harvester and placed in modules, relatively compact units of seed cotton. A cotton module, shaped like a giant bread loaf, can weigh up to 25,000 pounds.

Ginning

From the field, seed cotton moves to nearby gins for separation of lint and seed. The cotton first goes through dryers to reduce moisture content and then through cleaning equipment to remove foreign matter. These operations facilitate processing and improve fiber quality. The cotton is then air conveyed to gin stands where revolving circular saws pull the lint through closely spaced ribs that prevent the seed from passing through. The lint is removed from the saw teeth by air blasts or rotating brushes, and then compressed into bales weighing approximately 500 pounds. Cotton is then moved to a warehouse for storage until it is shipped to a textile mill for use.

A typical gin will process about 12 bales per hour, while some of today's more modern gins may process as many as 60 bales an hour.

Classing



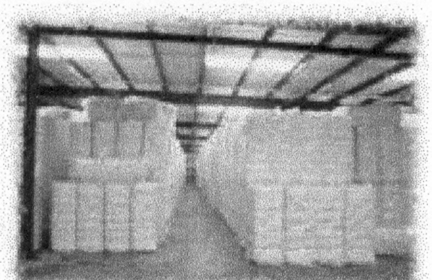
After the lint is baled at the gin, samples taken from each bale are classed according to fiber strength, length, length uniformity, color, non-fiber content and fineness using high volume instrumentation (HVI) and the aid of an expert called a Classer. Scientific quality control checks are made periodically to ensure that instrument and Classer accuracy is maintained.

Cotton of a given variety produces fibers of approximately the same length. Since the fibers may vary within a bale, length uniformity allows a determination of the variability within that bale.

Other quality factors also are important. The fiber's fineness is important for determining the type of yarns that can be made from the fiber—the finer the cotton fibers, the finer the yarns. Color or brightness of the fibers also is important. Cotton that is very white generally is of higher value than cottons whose color may have yellowed with exposure to elements before harvesting. Cotton, being a biological product, typically contains particles of cotton leaves called trash. The amount of trash also influences the cotton's value since the textile mill must remove trash before processing. The fiber's strength also is an important measurement that ultimately influences the fabrics made from these fibers. The U.S. Department of Agriculture (USDA) establishes classing standards in cooperation with the entire cotton industry.

Marketing

Cotton is ready for sale after instrument classing establishes the quality parameters for each bale. The marketing of cotton is a complex operation that includes all transactions involving buying, selling or reselling from the time the cotton is ginned until it reaches the textile mill.



Growers usually sell their cotton to a local buyer or merchant after it has been ginned and baled, but if they decide against immediate sale they can store it and borrow money against it. Since it is a non-perishable crop, cotton stored in a government-approved warehouse provides a secure basis for a monetary loan.

Cottonseed

Cotton actually is two crops, fiber and seed. About one-third of the cottonseed produced from a typical crop is crushed for oil and meal used in food products and in livestock and poultry feed.

For each 100 pounds of fiber produced by the cotton plant, it also produces about 162 pounds of cottonseed. Approximately 5 percent of the total seed crop is reserved for planting; the remainder is used for feeding as whole seeds or as raw material for the cottonseed processing industry.

After being separated from the lint at the gin, the cotton's seed is transported to a cottonseed crushing mill. There it is cleaned and conveyed to delinting machines which, operating on the same principle as a gin, remove the remaining short fibers which are known as linters. The linters go through additional processing steps before being made into a wide variety of products ranging from mattress stuffing to photographic film.

After the linters are removed, the seed is put through a machine that employs a series of knives to loosen the hulls from the kernel. The seeds are then passed through shakers and beaters. The separated hulls are marketed for livestock feed or industrial products, and the kernels are ready for the extraction of oil, the seed's most valuable by-product. Solvent extraction or presses remove the oil. After further processing, the oil is used in cooking or salad oil, shortening and margarine. Limited quantities also go into soaps, pharmaceuticals, cosmetics, textile finishes and other products.

The remaining meat of the kernel is converted into meal, the second most valuable by-product. High in protein, it is used in feed for all classes of livestock and poultry.

Cottonseed meal makes an excellent natural fertilizer for lawns, flower beds and gardens.

Yarn Production

Modernization efforts have brought major changes to the U.S. textile industry. Equipment has been streamlined and many operations have been fully automated with computers. Machine speeds have greatly increased.

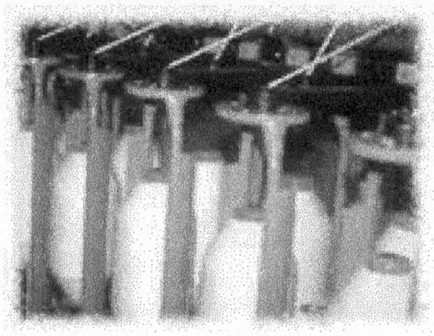
At most mills the opening of cotton bales is fully automated.

Lint from several bales is mixed and blended together to provide a uniform blend of fiber properties. To ensure that the new high-speed automated feeding equipment performs at peak efficiency and that fiber properties are consistent, computers group the bales for production/feeding according to fiber properties.

The blended lint is blown by air from the feeder through chutes to cleaning and carding machines that separate and align the fibers into a thin web. Carding machines can process cotton in excess of 100 pounds per hour. The web of fibers at the front of the card is then drawn through a funnel-shaped device called a trumpet, providing a soft, rope-like strand called a sliver (pronounced SLY-ver).

As many as eight strands of sliver are blended together in the drawing process. Drawing speeds have increased tremendously over the past few years and now can exceed 1,500 feet per minute.

Roving frames draw or draft the slivers out even more thinly and add a gentle twist as the first step in ring spinning of yarn.



Ring spinning machines further draw the roving and add twist making it tighter and thinner until it reaches the yarn thickness or "count" needed for weaving or knitting fabric. The yarns can be twisted many times per inch.

Ring spinning frames continue to play a role in this country, but open-end spinning, with rotors that can spin five to six times as fast as a ring spinning machine, are becoming more widespread. In open-end spinning, yarn is produced directly from sliver. The roving process is eliminated.

Other spinning systems have also eliminated the need for roving, as well as addressing the key limitation of both ring and open-end spinning, which is mechanical twisting. These systems, air jet and Vortex, use compressed air currents to stabilize the yarn. By removing the mechanical twisting methods, air jet and Vortex are faster and more productive than any other short-staple spinning system.

After spinning, the yarns are tightly wound around bobbins or tubes and are ready for fabric forming. Ply yarns are two or more single yarns twisted together. Cord is plied yarn twisted together.

Fabric Manufacturing

Cotton fabric manufacturing starts with the preparation of the yarn for weaving or knitting. Annually, textile mills in the U.S. normally produce about eight billion square yards each of woven and three billion square yards of knitted cotton goods.

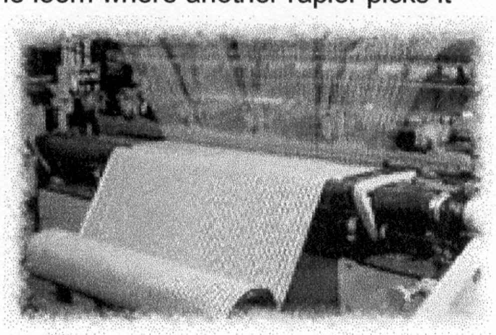
Woven Fabrics

Weaving is the oldest method of making yarn into fabric. While modern methods are more complex and much faster, the basic principle of interlacing yarns remains unchanged.

On the loom, lengthwise yarns called the warp form the skeleton of the fabric. They usually require a higher degree of twist than the filling yarns that are interlaced widthwise.

Traditionally, cloth was woven by a wooden shuttle that moved horizontally back and forth across the loom, interlacing the filling yarn with the horizontally, lengthwise warp yarn. Modern mills use high-speed shuttleless weaving machines that perform at incredible rates and produce an endless variety of fabrics. Some carry the filling yarns across the loom at rates in excess of 2,000 meters per minute.

The rapier-type weaving machines have metal arms or rapiers that pick up the filling thread and carry it halfway across the loom where another rapier picks it up and pulls it the rest of the way. Other types employ small projectiles that pick up the filling thread and carry it all the way across the loom. Still other types employ compressed air to insert the filling yarn across the warp. In addition to speed and versatility, another advantage of these modern weaving machines is their relatively quiet operation.



There are three basic weaves with numerous variations, and cotton can be used in all of them. The plain weave, in which the filling is alternately passed over one warp yarn and under the next, is used for gingham, percales, chambray, batistes and many other fabrics.

The twill weave, in which the yarns are interlaced to form diagonal ridges across the fabric, is used for sturdy fabrics like denim, gabardine, herringbone and ticking.

The satin weave, the least common of the three, produces a smooth fabric with high sheen. Used for cotton sateen, it is produced with fewer yarn interlacings and with either the warp or filling yarns dominating the "face" of the cloth.

In some plants, optical scanners continuously monitor fabric production looking for flaws as the cloth emerges from the weave machine. When imperfections appear, computers immediately print out the location of the flaw so that it can be removed later during fabric inspection.

Knitted Fabrics

Knitting is a method of constructing fabric by using a series of needles to interlock loops of yarn.

Lengthwise rows of these loops, comparable to the warp yarn in woven goods, are called wales. Crosswise rows, comparable to filling yarns, are known as courses.

There are numerous similarities in knitting done by hand and machine, but there are also some marked differences.

Most cotton is knit on circular machines which have needles fixed to the rim of a rotating cylinder. As the cylinder turns, the needles work their way from stitch to stitch producing a tubular fabric. Its width is regulated by the size of the cylinder, which usually ranges from 9 to 60 inches in diameter.

A hand knitter uses two needles forming one stitch at a time.

Depending on the width of fabric desired, a modern knitting machine might use over 2,500 needles.

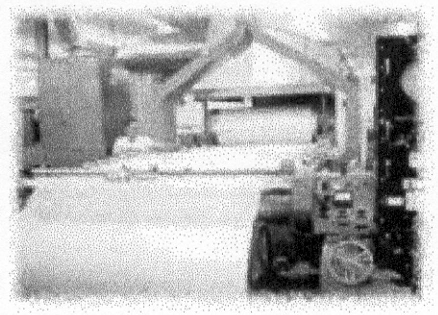
Instead of a single cone of yarn, a knitting machine may have up to four cones per inch of fabric width. For example, a machine with a 32-inch cylinder can have over 2,700 needles and 128 cones of yarn feeding simultaneously. These are typical statistics for a machine used in making underwear knits, but figures vary according to the type of machine used and the fabrics produced.

The flat knitting machine is another basic type. Designed with a flat bed, it has dozens of needles arranged in a straight line and produces a knit fabric that is flat, similar to woven fabric.

A flat knitting machine makes over one million stitches a minute, and can be set to drop or add stitches automatically in order to narrow or widen the fabric at certain points to conform to specific shapes.

Knitting machines can be programmed to produce a wide variety of fabrics and shapes.

Fabrics



Cotton fabrics, as they come from the loom in their rough, unfinished stages, are known as greige goods. Most undergo various finishing processes to meet specific end-use requirements.

Some mills, in addition to spinning and weaving, also dye or print their fabrics and finish them. Others sell greige goods to converters who have the cloth finished in independent plants.

Finishing processes are numerous and complex, reflecting today's tremendous range and combination of colors, textures and special qualities.

In its simplest form, finishing includes cleaning and preparing the cloth, dyeing or printing it and then treating it to enhance performance characteristics.

To produce a smooth surface in preparation for dyeing and finishing, the greige goods are passed rapidly over gas-fired jets or heated copper plates to singe off lint and loose threads.

Moving at speeds that can be greater than 200 yards a minute, the material is scoured and bleached in a continuous process that involves the use of hydrogen peroxide. The time for the chemicals to do the preparation reactions occurs from piling the fabric on conveyor belts that pass through steaming chambers, or stacking in large steam-heated, J-shaped boxes before the goods are withdrawn from the bottom.

If a more lustrous cloth is desired, the goods are immersed under tension in a caustic soda solution and then later neutralized. The process, called mercerizing, causes the fiber to swell permanently. This gives the fabric a silken sheen, improves its strength and increases its affinity for dye. Mercerizing also can be done at the yarn stage.

Dyeing

The most commonly used processes for imparting color to cotton are piece dyeing and yarn dyeing.

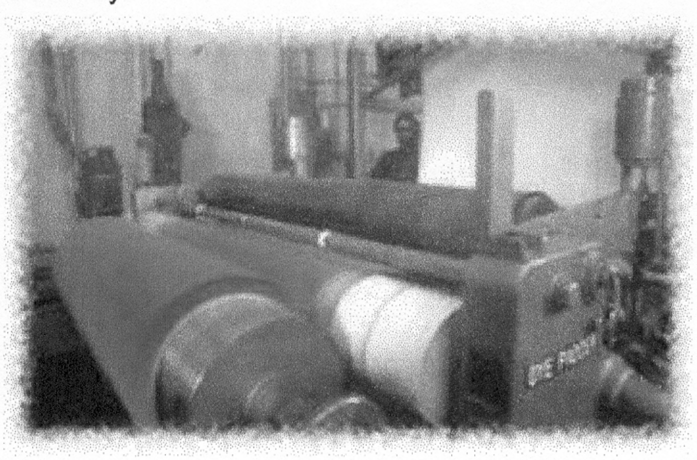
In piece dyeing, which is used primarily for fabrics that are to be a solid color, a continuous length of dry cloth is passed full-width through a trough of hot dye solution. The cloth then goes between padded rollers that squeeze in the color evenly and removes the excess liquid. In one variation of this basic method, the fabric, in a rope-like coil, is processed on a reel that passes in and out of a dye beck or vat.

Yarn dyeing, which occurs before the cloth is woven or knitted, is used to produce gingham checks, plaids, woven stripes and other special effects. Blue dyed warp yarns, for example, are combined with white filling yarns in denim construction.

One of the most commonly used yarn dyeing methods is package dyeing. In this system, yarn is wound on perforated cylinders or packages and placed on vertical spindles in a round dyeing machine.

Dye solution is forced alternately from the outside of the packages inward and from the inside out under pressure.

Computers are used increasingly in dyeing processes to formulate and match colors with greater speed and accuracy.



Printing

Printing colored designs on cotton cloth is similar to printing on paper.

Long runs of the same fabric design are produced on a roller print machine operating at speeds between 50 to 100 yards a minute. As many as of 10 different colors can be printed in one continuous operation.

A typical printing machine has a large padded drum or cylinder, which is surrounded by a series of copper rollers, each with its own dye trough and doctor blade that scrapes away excess dye. The number of rollers varies according to the fabric design, since each color in the design is etched on a separate roller. As the cloth moves between the rotating drum and rollers under great pressure, it picks up color from the engraved area of each roller in sequence. The printed cloth is dried immediately and conveyed to an oven that sets the dye.

Automatic screen-printing is another principal method for imparting colored designs to cotton fabrics. Although slower than roller printing, it has the advantage of producing much larger and more intricate designs, elaborate shadings and various handcrafted effects.

In flat bed screen-printing, the fabric design is reproduced on fine mesh screens, one for each color. On each screen, the areas in the design that are not to be penetrated by the dye are covered with lacquer or some other dye-resistant coating. The screens are coated with dye on the back and mounted in the proper sequence above a flat bed. As a belt carries the fabric along from screen to screen, a squeegee or roller presses the dye through the open area of the screen onto the fabric.

The new flat bed machines can have speeds of up to 1,200 yards per hour for a fabric with a 36-inch design repeat.

Faster by far are the recently developed rotary screen printing machines with production speeds of up to 3,500 yards an hour. The system combines roller and screen printing, utilizing perforated cylinders instead of flat screens. The color paste is fed inside the cylinders and a small metal roller forces the color through the pores of the cylinder onto the fabric which is moving continuously under the cylinders. As many as 16 colors can be printed on one fabric using this method. Use of this technique is increasing since the screens or cylinders can be produced less expensively than the engraved copper rollers used in roller printing.

Finishing

Finishing, as the term implies, is the final step in fabric production.

Hundreds of finishes can be applied to textiles, and the methods of application are as varied as the finishes.

Cotton fabrics are probably finished in more different ways than any other type of fabrics.

Some finishes change the look and feel of the cotton fabric, while others add special characteristics such as durable press, water repellency, flame resistance, shrinkage control and others.

Several different finishes may be applied to a single fabric.

Cotton's Major Uses

U.S. textile mills presently consume approximately 7.6 million bales of cotton a year. Eventually, about 57% of it is converted into apparel, more than a third into home furnishings and the remainder into industrial products.

Cotton's competitive share of U.S. produced textile end-uses shows a steady increase, presently standing at approximately 34%. Cotton's share of the retail apparel and home furnishings market has grown from a historic low of 34% in the early 1970s to more than 60% today.

Cotton is used for virtually every type of clothing, from coats and jackets to foundation garments. Most of its apparel usage, however, is for men and boys' clothing. Cotton supplies over 70% of this market, with jeans, shirts and underwear being major items.

In home furnishings, cotton's uses range from bed-spreads to window shades. It is by far the dominant fiber in tow-els and washcloths, supplying almost 100% of that market. Cotton is popular in sheets and pillowcases, where it holds over 60% of the market.

Industrial products containing cotton are as diverse as wall coverings, bookbindings and zipper tapes. The biggest cotton users in this category, however, are medical supplies, industrial thread and tarpaulins.

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