

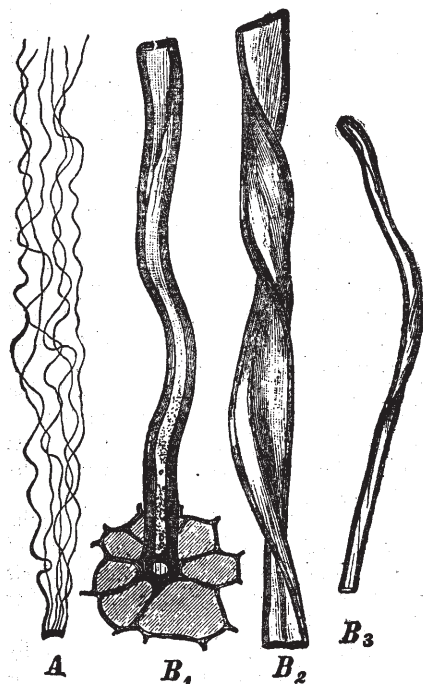
**COTTON** (Fr. *coton*; from Arab. *qutun*), the most important of the vegetable fibres of the world, consisting of unicellular hairs which occur attached to the seeds of various species of plants of the genus *Gossypium*, belonging to the Mallow order (Malvaceae). Each fibre is formed by the outgrowth of a single epidermal cell of the testa or outer coat of the seed.

*Botany and Cultivation.*—The genus *Gossypium* includes herbs and shrubs, which have been cultivated from time immemorial, and are now found widely distributed throughout the tropical and subtropical regions of both hemispheres. South America, the West Indies, tropical Africa and Southern Asia are the homes of the various members, but the plants have been introduced with success into other lands, as is well indicated by the fact that although no species of *Gossypium* is native to the United States of America, that country now produces over two-thirds of the world's supply of cotton. Under normal conditions in warm climates many of the species are perennials, but, in the United States for example, climatic conditions necessitate the plants being renewed annually, and even in the tropics it is often found advisable to treat them as annuals to ensure the production of cotton of the best quality, to facilitate cultural operations, and to keep insect and fungoid pests in check.

Microscopic examination of a specimen of mature cotton shows that the hairs are flattened and twisted, resembling somewhat in general appearance an empty and twisted fire hose. This characteristic is of great economic importance, the natural twist facilitating the operation of spinning the fibres into thread or yarn. It also distinguishes the true cotton from the silk cottons or flosses, the fibres of which have no twist, and do not readily

spin into thread, and for this reason, amongst others, are very considerably less important as textile fibres. The chief of these silk cottons is kapok, consisting of the hairs borne on the interior of the pods (but not attached to the seeds) of *Eriodendron anfractuosum*, the silk cotton tree, a member of the Bombacaceae, an order very closely allied to the Malvaceae.

**Classification.**—Considerable difficulty is encountered in attempting to draw up a botanical classification of the species of *Gossypium*. Several are only known in cultivation, and we have but little knowledge of the wild parent forms from which they have descended. During the periods the cottons have been cultivated, selection, conscious or unconscious, has been carried on, resulting in the raising, from the same stock probably, in different places, of well-marked forms, which, in the absence of the history of their origin, might be regarded as different species. Then again, during at least the last four centuries, cotton plants have been distributed from one country to another, only to render



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FIG. 1.—Seed-hairs of the Cotton, *Gossypium herbaceum*. A, Part of seed-coat with hairs ( $\times 3$ ); B<sub>1</sub>, insertion and lower part; B<sub>2</sub>, middle part; and B<sub>3</sub>, upper part of a hair ( $\times 300$ ).

commercially important plants into five species, placing these in two groups according to the character of the hairs borne on the seeds. Sir G. Watt's exhaustive work on *Wild and Cultivated Cotton Plants of the World* (1907) is the latest authority on the subject; and his views on some debated points have been incorporated in the following account.

A seed of "Sea Island cotton" is covered with long hairs only, which are readily pulled off, leaving the comparatively small black seed quite clean or with only a slight fuzz at the end, whereas a seed of "Upland" or ordinary American cotton bears both long and short hairs; the former are fairly easily detached (less easily, however, than in Sea Island cotton), whilst the latter adhere very firmly, so that when the long hairs are pulled off the seed remains completely covered with a short fuzz. This is also the case with the ordinary Indian and African cottons. There remains one other important group, the so-called "kidney" cottons in which there are only long hairs, and the seed easily comes away clean as with "Sea Island," but, instead of each seed being separate, the whole group in each of the three compartments of the capsule is firmly united together in a more or less kidney-shaped mass. Starting with this as the basis of classifica-

tion, we can construct the following key, the remaining principal points of difference being indicated in their proper places:—

- i. Seeds covered with long hairs only, flowers yellow, turning to red.
  - A. Seeds separate.
    - Country of origin, Tropical America—(1) *G. barbadense*, L.
  - B. Seeds of each loculus united.
    - Country of origin, S. America—(2) *G. brasiliense*, Macf.
- ii. Seeds covered with long and short hairs.
  - A. Flowers yellow or white, turning to red.
    - a. Leaves 3 to 5 lobed, often large.
      - Flowers white.
        - Country of origin, Mexico—(3) *G. hirsutum*, L.
      - b. Leaves 3 to 5, seldom 7 lobed. Small.
        - Flowers yellow.
          - Country of origin, India—(4) *G. herbaceum*, L.
    - B. Flowers purple or red. Leaves 3 to 7 lobed.
      - Place of origin, Old World—(5) *G. arboreum*, L.

1. *G. barbadense*, Linn. This plant, known only in cultivation, is usually regarded as native to the West Indies. Watt regards it as closely allied to *G. vitifolium*, and considers the modern stock a hybrid, and probably not indigenous to the West Indies. He classifies the modern high-class Sea Island cottons as *G. barbadense*, var. *maritima*. Whatever may be its true botanical name it is the plant known in commerce as "Sea Island" cotton, owing to its introduction and successful cultivation in the Sea Islands and the coastal districts of South Carolina, Georgia and Florida. It yields the most valuable of all cottons, the hairs being long, fine and silky, and ranging in length from  $\frac{3}{8}$  to  $2\frac{1}{2}$  in. By careful selection (the methods of which are described below) in the United States, the quality of the product was much improved, and on the recent revival of the cotton industry in the West Indies American "Sea Island" seed was introduced back again to the original home of the species.

Egyptian cotton is usually regarded as being derived from the same species. Watt considers many of the Egyptian cottons to be races or hybrids of *G. peruvianum*, Cav. Egyptian cotton in length of staple is intermediate between average Sea Island and average Upland. It has, however, certain characteristics which cause it to be in demand even in the United States, where during recent years Egyptian cotton has comprised about 80% of all the "foreign" cottons imported. These special qualities are its fineness, strength, elasticity and great natural twist, which combined enable it to make very fine, strong yarns, suited to the manufacture of the better qualities of hosiery, for mixing with silk and wool, for making lace, &c. It also mercerizes very well. The principal varieties of Egyptian cotton are: *Mitafifi*, the best-known and most extensively grown, hardy and but little affected by climatic variation. It is usually regarded as the standard Egyptian cotton; the lint is yellowish brown, the seeds black and almost smooth, usually with a little tuft of short green hairs at the ends. *Abassi*, a variety comparatively recently obtained by selection. The lint is pure white, very fine and silky, but not so strong as Mitafifi cotton. *Yannovich*, a variety known since about 1897, yields the finest and most silky lint of the white Egyptian cottons. *Bamia*, yielding a brown lint, very similar to Mitafifi, but slightly less valuable. *Ashmouni*, a variety principally cultivated in Upper Egypt. The lint is brown and generally resembles Mitafifi but is less valuable.

Other varieties are *Zifiri*, *Hamouli* and *Gallini*, all of minor importance.

2. *G. brasiliense*, Macf. (*G. peruvianum*, Engler), or kidney cotton. Amongst the varieties of cotton which are derived from this species appear to be Pernambuco, Maranhão, Ceara, Aracaty and Maceio cottons. The fibre is generally white, somewhat harsh and wiry, and especially adapted for mixing with wool. The staple varies in length from 1 to about  $1\frac{1}{2}$  in.

3. *G. hirsutum*, Linn. Although *G. barbadense* yields the most valuable cotton, *G. hirsutum* is the most important cotton-yielding plant, being the source of American cotton, i.e. Upland, Georgia, New Orleans and Texas varieties. The staple varies usually in length between  $\frac{3}{4}$  and  $1\frac{1}{4}$  in. According to Watt there are many hybrids in American cottons between *G. hirsutum* and *G. mexicanum*.

4. *G. herbaceum*, Linn. Levant cotton is derived from this species. The majority of the races of cotton cultivated in India are often referred to this species, which is closely allied to *G. hirsutum* and has been regarded as identical with it. Amongst the cottons of this source are Hinganghat, Tinnevely, Dharwar, Broach, Amraoti (Oomras or Oomrawattee), Kumta, Westerns, Dholera, Verawal, Bengals, Sind and Bhaunagar. Watt dissents from this view and classes these Indian cottons as *G. obtusifolium* and *G. Nanking* with their varieties. The Indian cottons are usually of short staple (about  $\frac{3}{4}$  in.), but are probably capable of improvement.

5. *G. arboreum*, Linn. This species is often considered as indigenous to India, but Dr Engler has pointed out that it is found wild in Upper Guinea, Abyssinia, Senegal, etc. It is the "tree cotton" of India and Africa, being typically a large shrub or small tree. The fibre is fine and silky, of about an inch in length. In India it is known as Nurma or Deo cotton, and is usually stated to be employed for making thread for the turbans of the priests. Commercially it is of comparatively minor importance.

The following table, summarized from the *Handbook to the Imperial Institute Cotton Exhibition, 1905*, giving the length of staple and value on one date (January 16, 1905), will serve to indicate the comparative values of some of the principal commercial cottons. The actual value, of course, fluctuates greatly.

	Length of Staple. Inches.	Value Per lb.	
		s.	d.
Sea Island Cotton—			
Carolina Sea Island . . . . .	1.8	1	3
Florida " " . . . . .	1.8	1	0
Georgia " " . . . . .	1.7	11	$\frac{1}{4}$
Barbados " " . . . . .	2.0	1	3
Egyptian Cottons—			
Yannovitch . . . . .	1.5	9	$\frac{1}{4}$
Abassi . . . . .	1.5	8	$\frac{1}{4}$
Good Brown Egyptian (Mitaffi) . . . . .	1.2	7	$\frac{1}{2}$
American Cotton—			
Good middling Memphis . . . . .	1.3	4	$\frac{2}{5}$
Good middling Texas . . . . .	1.0	4	$\frac{1}{5}$
Good middling Upland . . . . .	1.0	4	
Indian Cottons—			
Fine Tinnevely . . . . .	0.8	4	$\frac{1}{4}$
Fine Bhaunagar . . . . .	1.0	3	$\frac{1}{2}$
Fine Amraoti . . . . .	1.0	3	$\frac{1}{2}$
Fine Broach . . . . .	0.9	3	$\frac{1}{4}$
Fine Bengal . . . . .	0.9	3	$\frac{1}{4}$
Fine ginned Sind . . . . .	0.8	3	$\frac{1}{4}$
Good ginned Kumta . . . . .	1.0	3	$\frac{1}{2}$

The close relationship between the length of the staple and the market price will be at once apparent.

*Cultivation.*—Cotton is very widely cultivated throughout the world, being grown on a greater or less scale as a commercial crop in almost every country included in the broad belt between latitudes 43° N. and 33° S., or approximately within the isothermal lines of 60° F.

The cotton plant requires certain conditions for its successful cultivation; but, given these, it is very little affected by seasonal vicissitudes. Thus, for example, in the United States the worst season rarely diminishes the crop by more than about a quarter or one-third; such a thing as a "half-crop" is unknown. Various climatic factors may cause temporary checks, but the growing and maturing period is sufficiently long to allow the plants to overcome these disturbances.

Cotton requires for its development from six to seven months of favourable weather. It thrives in a warm atmosphere, even in a very hot one, provided that it is moist and that the transpiration is not in excess of the supply of water. An idea of the requirements of the plant will perhaps be afforded by summarizing the conditions which have been found to give the best results in the United States.

During April (when the seed is usually sown) and May frequent light showers, which keep the ground sufficiently moist to assist germination and the growth of the young plants, are desired. Three to four inches of rain per month is the average. The active growing period is from early June to about the middle of August. During June and the first fortnight in July plenty of

sunshine is necessary, accompanied by sufficient rain to promote healthy, but not excessive, growth; the normal rainfall in the cotton belt for this period is about 4 $\frac{1}{2}$  in. per month. During the second portion of July and the first of August a slightly higher rainfall is beneficial, and even heavy rains do little harm, provided the subsequent months are dry and warm. The first flowers usually appear in June, and the bolls ripen from early in August. Picking takes place normally during September and October, and during these months dry weather is essential. Flowering and fruiting go on continually, although in diminishing degree, until the advent of frost, which kills the flowers and young bolls and so puts an end to the production of cotton for the season.

In the tropics the essential requirements are very similar, but there the dry season checks production in much the same way as do the frosts in temperate climates. In either case an adequate but not excessive rainfall, increasing from the time of sowing to the period of active growth, and then decreasing as the bolls ripen, with a dry picking season, combined with sunny days and warm nights, provide the ideal conditions for successful cotton cultivation. In regions where climatic conditions are favourable, cotton grows more or less successfully on almost all kinds of soil; it can be grown on light sandy soils, loams, heavy clays and sandy "bottom" lands with varying success. Sandy uplands produce a short stalk which bears fairly well. Clay and "bottom" lands produce a large, leafy plant, yielding less lint in proportion. The most suitable soils are medium grades of loam. The soil should be able to maintain very uniform conditions of moisture. Sudden variations in the amount of water supplied are injurious: a sandy soil cannot retain water; on the other hand a clay soil often maintains too great a supply, and rank growth with excess of foliage ensues. The best soil for cotton is thus a deep, well-drained loam, able to afford a uniform supply of moisture during the growing period. Wind is another important factor, as cotton does not do well in localities subject to very high winds; and in exposed situations, otherwise favourable, wind belts have at times to be provided.

*Cultivation in the United States.*—The United States being the most important cotton-producing country, the methods of cultivation practised there are first described, notes on methods adopted in other countries being added only when these differ considerably from American practice.

The culture of cotton must be a clean one. It is not necessarily deep culture, and during the growing season the cultivation is preferably very shallow. The result is a great destruction of the humus of the soil, and great leaching and washing, especially in the light loams of the hill country of the United States. The main object, therefore, of the American cotton-planter is to prevent erosion. Wherever the planters have failed to guard their fields by hillside ploughing and terracing, these have been extensively denuded of soil, rendering them barren, and devastating other fields lying at a lower level, which are covered by the wash. The hillsides have gradually to be terraced with the plough, upon almost an exact level. On the better farms this is done with a spirit-level or compass from time to time and hillside ditches put in at the proper places. In the moist bottom-lands along the rivers it is the custom to throw the soil up in high beds with the plough, and then to cultivate them deep. This is the more common method of drainage, but it is expensive, as it has to be renewed every few years. More intelligent planters drain their bottom-lands with underground or open drains. In the case of small plantations the difficulties of adjusting a right-of-way for outlet ditches have interfered seriously with this plan. Many planters question the wisdom of deepbreaking and subsoiling. There can be no question that a deep soil is better for the cotton-plant; but the expense of obtaining it, the risk of injuring the soil through leaching, and the danger of bringing poor soil to the surface, have led many planters to oppose this plan. Sandy soils are made thereby too dry and leachy, and it is a questionable proceeding to turn the heavy clays upon the top. Planters are, as a result, divided in opinion as to the wisdom of subsoiling. Nothing definite can be said with regard to a rotation of crops

upon the cotton plantation. Planters appreciate generally the value of broad-leaved and narrow-leaved plants and root crops, but there is an absence of exact knowledge, with the result that their practices are very varied. It is believed that the rotation must differ with every variety of soil, with the result that each planter has his own method, and little can be said in general. A more careful study of the physical as well as the chemical properties of a soil must precede intelligent experimentation in rotation. This knowledge is still lacking with regard to most of the cotton soils. The only uniform practice is to let the fields "rest" when they have become exhausted. Nature then restores them very rapidly. The exhaustion of the soil under cotton culture is chiefly due to the loss of humus, and nature soon puts this back in the excellent climate of the cotton-growing belt. Fields considered utterly used up, and allowed to "rest" for years, when cultivated again have produced better crops than those which had been under a more or less thoughtful rotation. In spite of the clean culture, good crops of cotton have been grown on some soils in the south for more than forty successive years. The fibre takes almost nothing from the land, and where the seeds are restored to the soil in some form, even without other fertilizers, the exhaustion of the soil is very slow. If the burning-up of humus and the leaching of the soil could be prevented, there is no reason why a cotton soil should not produce good crops continuously for an indefinite time. Bedding up land previous to planting is almost universal. The bed forms a warm seed-bed in the cool weather of early spring, and holds the manure which is drilled in usually to better advantage. The plants are generally left 2 or 3 in. above the middle of the row, which in four-foot rows gives a slope of 1 in. to the foot, causing the plough to lean from the plants in cultivating, and thus to cut fewer roots. The plants are usually cut out with a hoe from 8 to 14 in. apart. It seems to make little difference exactly what distance they are, so long as they are not wider apart on average land than 1 ft. On rich bottom-land they should be more distant. The seed is dropped from a planter, five or six seeds in a single line, at regular intervals 10 to 12 in. apart. A narrow deep furrow is usually run immediately in advance of the planter, to break up the soil under the seed. The only time the hoe is used is to thin out the cotton in the row; all the rest of the cultivation is by various forms of ploughs and so-called cultivators. The question of deep and shallow culture has been much discussed among planters without any conclusion applicable to all soils being reached. All grass and weeds must be kept down, and the crust must be broken after every rain, but these seem to be the only principles upon which all agree. The most effective tool against the weeds is a broad sharp "sweep," as it is called, which takes everything it meets, while going shallower than most ploughs. Harrows and cultivators are used where there are few weeds, and the mulching process is the one desired.

The date of cotton-planting varies from March 1 to June 1, according to situation. Planting begins early in March in Southern Texas, and the first blooms will appear there about May 15. Planting may be done as late as April 15 in the Piedmont region of North Carolina, and continue as late as the end of May. The first blooms will appear in this region about July 15. Picking may begin on July 10 in Southern Texas, and continue late into the winter, or until the rare frost kills the plants. It may not begin until September 10 in Piedmont, North Carolina. It is a peculiarity of the cotton-plant to lose a great many of its blooms and bolls. When the weather is not favourable at the fruiting stage, the otherwise hardy cotton plant displays its great weakness in this way. It sheds its "forms" (as the buds are called), blooms, and even half-grown bolls in great numbers. It has frequently been noted that even well-fertilized plants upon good soil will mature only 15 or 20% of the bolls produced. No means are known so far for preventing this great waste. Experts are at an entire loss to form a correct idea of the cause, or to apply any effective remedy.

Cotton-picking is at once the most difficult and most expensive operation in cotton production. It is paid for at the rate of from 45 to 50 cents per cwt. of seed cotton. The work is light, and

is effectually performed by women and even children, as well as men; but it is tedious and requires care. The picking season will average 100 days. It is difficult to get the hands to work until the cotton is fully opened, and it is hard to induce them to pick over 100 lb a day, though some expert hands are found in every cotton plantation who can pick twice as much. The loss resulting from careless work is very serious. The cotton falls out easily or is dropped. The careless gathering of dead leaves and twigs, and the soiling of the cotton by earth or by the natural colouring matter from the bolls, injure the quality. It has been commonly thought that the production of cotton in the south is limited by the amount that can be picked, but this limit is evidently very remote. The negro population of the towns and villages of the cotton country is usually available for a considerable share in cotton-picking. There is in the cotton states a rural population of over 7,000,000, more or less occupied in cotton-growing, and capable, at the low average of 100 lb a day, of picking daily nearly 500,000 bales. It is evident, therefore, that if this number could work through the whole season of 100 days, they could pick three or four times as much cotton as the largest crop ever made. Great efforts have been made to devise cotton-picking machines, but, as yet, complete success has not been attained. Lowne's machine is useful in specially wide-planted fields and when the ground is sufficiently hard.

*Cotton Ginning.*—The crop having been picked, it has to be prepared for purpose of manufacture. This comprises separating the fibre or lint from the seeds, the operation being known as "ginning." When this has been accomplished the weight of the crop is reduced to about one-third, each 100 lb of seed cotton as picked yielding after ginning some 33 lb of lint and 66 lb of cotton seed. The actual amounts differ with different varieties, conditions of cultivation, methods of ginning, &c.; a recent estimate in the United States gives 35% of lint for Upland cotton and 25% for Sea Island cotton as more accurate.

The separation of lint from seed is accomplished in various ways. The most primitive is hand-picking, the fibre being laboriously pulled from off each seed, as still practised in parts of Africa. In modern commercial cotton production ginning machines are always used. Very simple machines are used in some parts of Africa. The simplest cotton gin in extensive use is the "churka," used from early times, and still largely employed in India and China. It consists essentially of two rollers either both of wood, or one of wood and one of iron, geared to revolve in contact in opposite directions; the seed cotton is fed to the rollers, the lint is drawn through, and the seed being unable to pass between the rollers is rejected. With this primitive machine, worked by hand, about 5 lb of lint is the daily output. In the Macarthy roller gin, the lint, drawn by a roller covered with leather (preferably walrus hide), is drawn between a metal plate called the "doctor" (fixed tangentially to the roller and very close to it) and a blade called the "beater" or knife, which rapidly moves up and down immediately behind, and parallel to, the fixed plate. The lint is held by the roughness of the roller, and the blade of the knife or beater readily detaches the seed from the lint; the seed falls through a grid, while the lint passes over the roller to the other side of the machine. A hand Macarthy roller gin worked by two men will clean about 4 to 6 lb of lint per hour. A similar, but larger machine, requiring about 1½ horse-power to run it, will turn out 50 to 60 lb of Egyptian or 60 to 80 lb of Sea Island cleaned cotton per hour. By simple modifications the Macarthy gin can be used for all kinds of cotton. Various attempts have been made to substitute a comb for the knife or beater, and one of the latest productions is the "Universal fibre gin," in which a series of blunt combs working horizontally replace the solid beater and so-called knife of the Macarthy gin.

Opposed to the various types of roller gins is the "saw gin," invented by Eli Whitney, an American, in 1792. This machine, under various modifications, is employed for ginning the greater portion of the cotton grown in the Southern States of America. It consists essentially of a series of circular notched disks, the so-called saws, revolving between the interstices of an iron bed

upon which the cotton is placed: the teeth of the "saws" catch the lint and pull it off from the seeds, then a revolving brush removes the detached lint from the saws, and creates sufficient draught to carry the lint out of the machine to some distance. Saw gins do considerable damage to the fibre, but for short-stapled cotton they are largely used, owing to their great capacity. The average yield of lint per "saw" in the United States, when working under perfect conditions, is about 6 lb per hour. Some of the American ginnerers are very large indeed, a number (*Bulletin of the Bureau of the Census on Cotton Production*) being reported as containing on the average 1156 saws with an average production of 4120 bales of cotton. Saw gins are not adapted to long-stapled cottons, such as Sea Island and Egyptian, which are generally ginned by machines of the Macarthy type.

The machine which will gin the largest quantity in the shortest time is naturally preferred, unless such injury is occasioned as materially to diminish the market value of the cotton. This has sometimes been to the extent of 1d. or 2d. per lb and even more as regards Sea Island and other long-stapled cottons. The production, therefore, of the most perfect and efficient cotton-cleaning machinery is of importance alike to the planter and manufacturer.

*Baling.*—The cotton leaves the ginning machine in a very loose condition, and has to be compressed into bales for convenience of transport. Large baling presses are worked by hydraulic power; the operation needs no special description. Bales from different countries vary greatly in size, weight and appearance. The American bale has been described in a standard American book on cotton as "the clumsiest, dirtiest, most expensive and most wasteful package, in which cotton or any other commodity of like value is anywhere put up." Suggestions for its improvement, which if carried out would (it is estimated) result in a monetary saving of £1,000,000 annually, were made by the Lancashire Private Cotton Investigation Commission which visited the Southern States of America in 1906.

The approximate weights of some of the principal bales on the English market are as follows:—

United States . . . . .	500 lb
Indian . . . . .	400 lb
Egyptian . . . . .	700 lb
Peruvian . . . . .	200 lb
Brazilian . . . . .	200 to 300 lb

With baling the work of the producer is concluded.

*Cultivation in Egypt.*—Climatic conditions in Egypt differ radically from those in the United States, the rainfall being so small as to be quite insufficient for the needs of the plant, very little rain indeed falling in the Nile Delta during the whole growing season of the crop: yet Egypt is in order the third cotton-producing country of the world, elaborate irrigation works supplying the crop with the requisite water. The area devoted to cotton in Egypt is about 1,800,000 acres, and nine-tenths of it is in the Nile Delta. The delta soil is typically a heavy, black, alluvial clay, very fertile, but difficult to work; admixture of sand is beneficial, and the localities where this occurs yield the best cotton. Formerly in Egypt the cotton was treated as a perennial, but this practice has been generally abandoned, and fresh plants are raised from seed each year, as in America; one great advantage is that more than one crop can thus be obtained each year. The following rotation is frequently adopted. It should be noted that in Egypt the year is divided into three seasons—winter, summer and "Nili." The two first explain themselves; Nili is the season in which the Nile overflows its banks.

	Winter.	Summer.	Nili.
First year . . . . .	Clover	Cotton	..
Second year . . . . .	Beans or wheat	..	Corn or fallow

For cotton cultivation the land is ploughed, carefully levelled, and then thrown up into ridges about 3 ft. apart. Channels formed at right angles to the cultivation ridges provide for the

access of water to the crop. The seeds, previously soaked, are sown, usually in March, on the sides of the ridges, and the land watered. After the seedlings appear, thinning is completed in usually three successive hoeings, the plants being watered after thinning, and subsequently at intervals of from twelve to fifteen days, until about the end of August when picking commences. The total amount of water given is approximately equivalent to a rainfall of about 35 in. The crop is picked, ginned and baled in the usual way, the Macarthy style action roller gins being almost exclusively employed.

*Cotton Seed.*—The history of no agricultural product contains more of interest and instruction for the student of economics than does that of cotton seed in the United States. The revolution in its treatment is a real romance of industry. Up till 1870 or thereabouts, cotton seed was regarded as a positive nuisance upon the American plantation. It was left to accumulate in vast heaps about ginhouses, to the annoyance of the farmer and the injury of his premises. Cotton seed in those days was the object of so much aversion that the planter burned it or threw it into running streams, as was most convenient. If the seed were allowed to lie about, it rotted, and hogs and other animals, eating it, often died. It was very difficult to burn, and when dumped into rivers and creeks was carried out by flood water to fill the edges of the flats with a decaying and offensive mass of vegetable matter. Although used in the early days to a limited extent as a food for milch cows and other stock, and to a larger extent as a manure, no systematic efforts were made anywhere in the South to manufacture the seed until the later 'fifties, when the first cotton seed mills were established. It is said that there were only seven cotton oil mills in the South in 1860. The cotton-growing industry was interrupted by the Civil War, and the seed-milling business did not begin again until 1868. After that time the number of mills rapidly increased. There were 25 in the South in 1870, 50 in 1880, 120 in 1890, and about 500 in 1901, about one-third being in Texas.

Experience shows that 1000 lb of seed are produced for every 500 lb of cotton brought to market. On the basis, therefore, of a cotton crop of 10,000,000 bales of 500 lb each, there are produced 5,000,000 tons of cotton seed. If about 3,000,000 tons only are pressed, there remain to be utilized on the farm 2,000,000 tons of cotton seed, which, if manufactured, would produce a total of \$100,000,000 from cotton seed. In contrast with the farmers of the 'sixties, the southern planter of the 20th century appreciates the value of his cotton seed, and farmers, too remote from the mills to get it pressed, now feed to their stock all the cotton seed they conveniently can, and use the residue either in compost or directly as manure. The average of a large number of analyses of Upland cotton seed gives the following figures for its fertilizing constituents:—Nitrogen, 3.07%; phosphoric acid, 1.02%; potash, 1.17%; besides small amounts of lime, magnesia and other valuable but less important ingredients. Sea Island cotton seed is rather more valuable than Upland: the corresponding figures for the three principal constituents being nitrogen 3.51, phosphoric acid 1.69, potash 1.59%. Using average prices paid for nitrogen, phosphoric acid and potash when bought in large quantities and in good forms, these ingredients, in a ton of cotton seed, amount to \$9.00 worth of fertilizing material. Compared with the commercial fertilizer which the farmer has to buy, cotton seed possesses, therefore, a distinct value.

The products of cotton seed have become important elements in the national industry of the United States. The main product is the refined oil, which is used for a great number of purposes, such as a substitute for olive oil, mixed with beef products for preparation of compound lard, which is estimated to consume one-third of cotton seed oil produced in the States. The poorer grades are employed in the manufacture of soap, candles and phonograph records. Miners' lamp oil consists of the bleached oil mixed with kerosene. Cotton seed cake or meal (the residue after the oil is extracted) is one of the most valuable of feeding stuffs, as the following simple comparison between it and oats and corn will show:—

Average Analyses.	Proteins or Flesh Formers.	Carbo-hydrates or Fuel and Fat Suppliers.	Fats.	Ash or Bone Makers.
Cotton seed meal	43.26	22.31	13.45	7.02
Corn . . . . .	10.5	70.0	5.5	1.02
Oats . . . . .	17.0	65.0	8.0	1.2

Cotton seed meal, though poor in carbohydrates, the fat- and energy-supplying ingredients, is exceedingly rich in protein, the nerve- and muscle-feeding ingredients. But it still contains a large amount of oil, which forms animal fat and heat, and thus makes up for part of its deficiency in carbohydrates. The meal, in fact, is so rich in protein that it is best utilized as a food for animals when mixed with some coarse fodder, thus furnishing a more evenly-balanced ration. In comparative valuations of feeding stuffs it has been found that cotton seed meal exceeds corn meal by 62%, wheat by 67%, and raw cotton seed by 26%. Cotton seed meal, in the absence of sufficient stock to consume it, is also used extensively as a fertilizer, and for this purpose it is worth, determining the price on the same basis as used above for the seed, from \$19 to \$20 per ton. But it has seldom reached this price, except in some of the northern states, where it is used for feeding purposes. A more rational proceeding would be to feed the meal to animals and apply the resulting manure to the soil. When this is done, from 80 to 90% of the fertilizing material of the meal is recovered in the manure, only 10 to 20% being converted by the animal into meat and milk. The profit derived from the 20% thus removed is a very large one. These facts indicate that we have here an agricultural product the market price of which is still far below its value as compared, on the basis of its chemical composition, either with other feeding stuffs or with other fertilizers. Though it is probably destined to be used even more extensively as a fertilizer before the demand for it as a feeding stuff becomes equal to the supply, practically all the cotton seed meal of the south will ultimately be used for feeding. One explanation of this condition of things is that there is still a large surplus of cotton seed which cannot be manufactured by the mills. Another reason is found in the absence of cattle in the south to eat it.

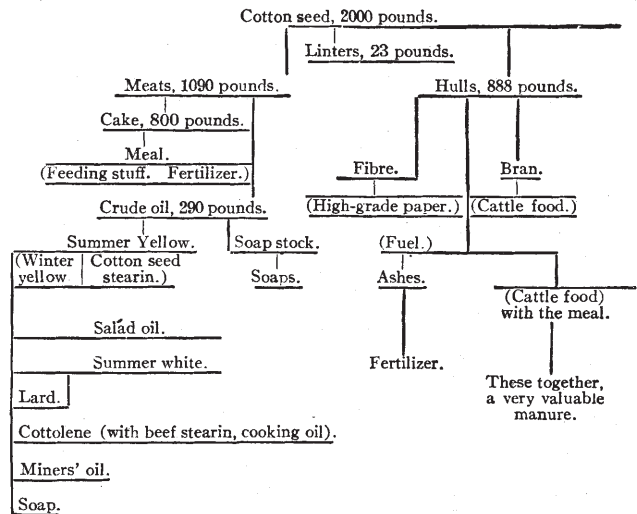
With the consideration of cotton seed oil and meal we have not, however, exhausted its possibilities. Cotton seed hulls constitute about half the weight of the ginned seed. After the seed of Upland cotton has been passed through a fine gin, which takes off the short lint or linters left upon it by the farmer, it is passed through what is called a sheller, consisting of a revolving cylinder, armed with numerous knives, which cut the seed in two and force the kernels or meats from the shells. The shells and kernels are then separated in a winnowing machine. This removal of the shell makes a great difference in the oilcake, as the decorticated cake is more nutritious than the undecorticated. For a long time these shells or hulls, as they are called, were burned at oil mills for fuel, 2½ tons being held equal to a cord of wood, and 4⅓ tons to a ton of coal. The hulls thus burned produced an ash containing an average of 9% of phosphoric acid and 24% of potash—a very valuable fertilizer in itself, and one eagerly sought by growers of tobacco and vegetables. It was not long, however, before the stock-feeder in the South found that cotton seed hulls were an excellent substitute for hay. They are used on a very large scale in the vicinity of oil mills in southern cities like Memphis, New Orleans, Houston, and Little Rock, from 500 to 5000 cattle being often collected in a single yard for this purpose. No other feed is required, the only provision necessary being an adequate supply of water and an occasional allowance of salt. Many thousands of cattle are fattened annually in this way at remarkably low cost.

Careful attention is now given to the employment of the seed in new cotton countries, and oil expression is practised in the West Indies. Hull is the principal seat of the industry in Great Britain, and enormous quantities of Indian and Egyptian cotton seed are imported and worked up.

The following diagram, modified from one by Grimshaw, in

accordance with the results obtained by the better class of modern mills, gives an interesting *résumé* of the products obtained from a ton of cotton seed:—

*Products from a Ton of Cotton Seed.*



*Pests and Diseases of the Cotton Plant.*

**Insect Pests.**—It is common knowledge that when any plant is cultivated on a large scale various diseases and pests frequently appear. In some cases the pest was already present but of minor importance. As the supply of its favourite food plant is increased, conditions of life for the pest are improved, and it accordingly multiplies also, possibly becoming a serious hindrance to successful cultivation. At other times the pest is introduced, and under congenial conditions (and possibly in the absence of some other organism which keeps it in check in its native country) increases accordingly. Some idea of the enormous damage wrought by the collective attacks of individually small and weak animals may be gathered from the fact that a conservative estimate places the loss due to insect attacks on cotton in the United States at the astounding figure of \$60,000,000 (£12,000,000) annually. Of this total no less than \$40,000,000 (£8,000,000) is credited to a small beetle, the cotton boll weevil, and to two caterpillars. The best means of combating these attacks depends on a knowledge of the life-histories and habits of the pests. The following notes deal only with the practical side of the question, and as the United States produce some seven-tenths of the world's cotton crop attention is especially directed to the principal cotton pests of that country. Those of other regions are only referred to when sufficiently important to demand separate notice.

The cotton boll weevil (*Anthonomus grandis*), a small grey weevil often called the Mexican boll weevil, is the most serious pest of cotton in the United States, where the damage done by it in 1907 was estimated at about £5,000,000. It steadily increased in destructiveness during the preceding eight years. Attention was drawn to it in 1862, when it caused the abandonment of cotton cultivation about Monclova in Mexico. About 1893 it appeared in Texas, and then rapidly spread. It is easily transported from place to place in seed-cotton, and for this reason the Egyptian government in 1904 prohibited the importation of American cotton seed. Not only is the pest carried from place to place, but it also migrates, and in 1907 it crossed from Louisiana, where it first appeared in 1905, to Mississippi. That the insect is likely to prove adaptable is perhaps indicated by the fact that in 1906 it made a northward advance of about 60 m. in a season with no obvious special features favouring the pest. Its eastern progress was also rapid. "The additional territory infested during 1904 aggregates about 15,000,000 sq. m., representing approximately an area devoted to the culture of cotton of 900,000 acres" (*Year-book, U.S. Dept. Agriculture, 1904*). In 1906 the additional area invaded amounted to 1,500,000 acres (*Ibid.*, 1906).

The adult weevils puncture the young flower-buds and deposit eggs; and as the grubs from the eggs develop, the bud drops. They also lay eggs later in the year in the young bolls. These do not drop, but as the grubs develop the cotton is ruined and the bolls usually become discoloured and crack, their contents being rendered useless.

No certain remedy is known for the destruction on a commercial scale of the boll weevil, but every effort has been made in the United States to check the advance of the insect, to ascertain and encourage its natural enemies, and to propagate races of cotton which resist its attacks. Special interest attaches to the investigations made by Mr O. F. Cook, of the U.S. Dept. of Agriculture, in Guatemala. The Indians in part of Guatemala raise cotton, although the boll weevil is abundant. Examination showed that although the weevil attacked the young buds these did not drop off, but that a special growth of tissue inside the bud frequently killed the grub. Also, inside the young bolls which had been pierced a similar proliferation or growth of the tissue was set up, which enveloped and killed the pest. Probably by unconscious selection of surviving plants through long ages this type has been evolved in Guatemala, and experiments have been made to develop weevil-resistant races in the United States. Mr Cook also found that the boll weevil was attacked, killed and eaten by an ant-like creature, the "kelep." Attempts have been made to introduce this into the infested area in Texas; but owing to the winter proving fatal to the "kelep" its usefulness may be restricted to tropical and subtropical regions.

The cotton boll worm (*Chloridea obsoleta*, also known as *Heliothis armiger*) is a caterpillar. The parent moth lays eggs, from which the young "worms" hatch out. They bore holes and penetrate into flower-buds and young bolls, causing them to drop. Fortunately the "worms" prefer maize to cotton, and the inter-planting at proper times of maize, to be cut down and destroyed when well infested, is a method commonly employed to keep down this pest. Paris green kills it in its young stages before it has entered the buds or bolls. The boll worm is most destructive in the south-western states, where the damage done is said to vary from 2 to 60% of the crop. Taking a low average of 4%, the annual loss due to the pest is estimated at about £2,500,000, and it occupies second place amongst the serious cotton pests of the U.S.A. The boll worm is widely spread through the tropical and temperate zones. It may occur in a country without being a pest to cotton, e.g. in India it attacks various plants but not cotton. It has not yet been reported as a cotton pest in the West Indies.

The Egyptian boll worm (*Earias insulana*) is the most important insect pest in Egypt and occurs also in other parts of Africa. Indian boll worms include the same species, and the closely related *Earias fabia*, which also occurs in Egypt.

The cotton worm (*Aletia argillacea*)—also called cotton caterpillar, cotton army worm, cotton-leaf worm—is also one stage in the life-history of a moth. It is a voracious creature, and unchecked will often totally destroy a crop. In former years the annual damage done by it in the United States was assessed at £4,000,000 to £6,000,000. Dusting with Paris green is, however, an efficient remedy if promptly applied at the outset of the attack. The annual damage was in 1906 reduced to £1,000,000 to £2,000,000, and this on a larger area devoted to cotton than in the case of the estimate given above. It is the most serious pest of cotton in the West Indies. The Egyptian cotton worm is *Prodenia littoralis*.

The caterpillars ("cut worms") of various species of *Agrotis* and other moths occur in all parts of the world and attack young cotton. They can be killed by spreading about cabbage leaves, &c., poisoned with Paris green.

Locusts, green-fly, leaf-bugs, blister mites, and various other pests also damage cotton, in a similar way to that in which they injure other crops.

The "cotton stainers," various species of *Dysdercus*, are widely distributed, occurring for example in America, the West Indies, Africa, India, &c. The larvae suck the sap from the young bolls and seeds, causing shrivelling and reduction in quantity of fibre. They are called "stainers" because their excrement is yellow

and stains the fibre; also if crushed during the process of ginning they give the cotton a reddish coloration. The Egyptian cotton seed bug or cotton stainer belongs to another genus, being *Oxycarenus hyalinipennis*. Other species of this genus occur on the west coast of Africa. They do considerable damage to cotton seed.

*Fungoid Diseases*.—"Wilt disease," or "frenching," perhaps the most important of the fungoid disease of cotton in the United States, is due to *Neocosmospora vasinfecta*. Young plants a few inches high are usually attacked; the leaves, beginning with the lower ones, turn yellow, and afterwards become brown and drop. The plants remain very dwarf and generally unhealthy, or die. The roots also are affected, and instead of growing considerably in length, branch repeatedly and give rise to little tufts of rootlets. There is no method known of curing this disease, and all that can be done is to take every precaution to eradicate it, by pulling up and burning diseased plants, isolating the infected area by means of trenches, and avoiding growing cotton, or an allied plant such as the ochro (*Hibiscus esculentus*), in the field. Fortunately the careful work of the U.S. Department of Agriculture and of planters such as Mr E. L. Rivers of James Island, South Carolina, has resulted in the production of disease-resistant races. In one instance Mr Rivers found one healthy plant in a badly affected field. The seed was saved and gave rise to a row of plants all of which grew healthily in an infected field, whereas 95% of ordinary Sea Island cotton plants from seed from a non-infected field planted alongside as a control were killed. The resistance was well maintained in succeeding generations, and races so raised form a practical means of combating this serious disease.

In "Root rot," as the name implies, the roots are attacked, the fungus being a species of *Ozontium*, which envelops the roots in a white covering of mould or mycelium. The roots are prevented from fulfilling their function of taking up water and salts from the soil; the leaves accordingly droop, and the whole plant wilts and in bad attacks dies. It has yearly proved a more serious danger in Texas and other parts of the south-west of the United States, and the damage due to it in Texas during 1905 was estimated at about £750,000. No remedy is known for the disease, and cotton should not be planted on infected land for at least three or four years.

"Boll rot," or "Anthracnose," is a disease which may at times be sufficiently serious to destroy from 10 to 50% of the crop. The fungus which causes it (*Colletotrichum gossypii*) is closely related to one of the fungi attacking sugar-cane in various parts of the world. Small red-brown spots appear on the bolls, gradually enlarge, and develop into irregular black and grey patches. The damage may be only slight, or the entire boll may ripen prematurely and become dry and dead.

Many other diseases occur, but the above are sufficient to indicate some of the principal ones in the most important cotton countries of the world.

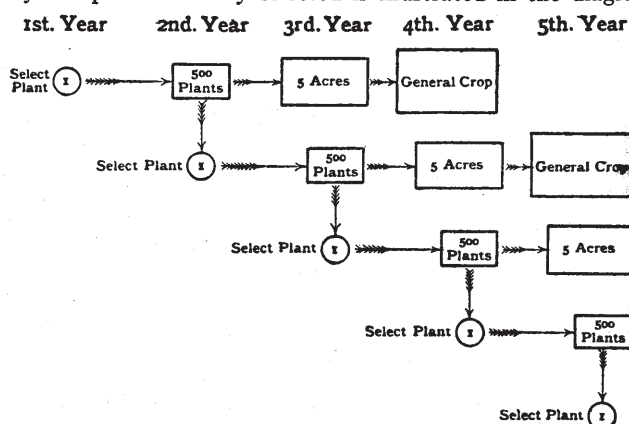
#### *Improvement of Cotton by Seed Selection.*

In the cotton belt of the United States it would be possible to put a still greater acreage under this crop, but the tendency is rather towards what is known as "diversified" or mixed farming than to making cotton the sole important crop. Cotton, however, is in increasing demand, and the problem for the American cotton planter is to obtain a better yield of cotton from the same area,—by "better yield" meaning an increase not only in quantity but also in quality of lint. This ideal is before the cotton grower in all parts of the world, but practical steps are not always taken to realize it. Some of the United States planters are alert to take advantage of the application of science to industry, and in many cases even to render active assistance, and very successful results have been attained by the co-operation of the United States Department of Agriculture and planters. With the improvement of cotton the name of Mr Herbert J. Webber is prominently associated, and a full discussion of methods and results will be found in his various papers in the *Year-books* of the U.S. Department of Agriculture. The principle on which the work is based is that plants have their individualities

and tend to transmit them to their progeny. Accordingly a selection of particular plants to breed from, because they possess certain desirable characteristics, is as rational as the selection of particular animals for breeding purposes in order to maintain the character of a herd of cattle or of a flock of sheep.

Inspection of a field of cotton shows that different plants vary as regards productiveness, length, and character of the lint, period of ripening, power of resistance to various pests and of withstanding drought. A simple method of increasing the yield is that practised with success by some growers in the States. Pickers are trained to recognize the best plants, "that is, those most productive, earliest in ripening, and having the largest, best formed and most numerous bolls." These pickers go carefully over the field, usually just before the second picking, and gather ripe cotton from the best plants only; this selected seed cotton is ginned separately, and the seed used for sowing the next year's crop.

A more elaborate method of selection is practised by some of the Sea Island cotton planters in the Sea Islands, famous for the quality of their cotton. A field is gone over carefully, and perhaps some 50 of the best plants selected; a second examination in the field reduces these perhaps to one half, and each plant is numbered. The cotton from each is collected and kept separately, and at the end of the season carefully examined and weighed, and a final selection is then made which reduces the number to perhaps five; the cotton from each of these plants is gained separately and the seed preserved for sowing. The simplest possible case in which only one plant is finally selected is illustrated in the diagram.



After Webber, *Year-book, U. S. Dept. of Agriculture, 1902.*

#### Improvement of Cotton by Seed Selection.

From the seeds of the selected plant of the 1st year about 500 plants can be raised in the next year. One plant is selected again from these 500, and the general crop of seed is used to sow about five acres for the 3rd year, from which seed is obtained for the general crop in the 4th year. One special plant is selected each year from the 500 raised from the previous season's test plant; and in four years' time the progeny of this plant constitutes the "general crop." The practice may be modified according to the size of estate by selecting more than one plant each year, but the principle remains unaltered. This method is in actual use by growers of Sea Island cotton in America and in the islands off the coast of S. Carolina; the greatest care is taken to enhance the quality of the lint, which has been gradually improved in length, fineness and silkiness. Mr Webber, in summing up, says, "When Sea Island cotton was first introduced into the United States from the West Indies, it was a perennial plant, unsuited to the duration of the season of the latitude of the Sea Islands of S. Carolina; but, through the selection of seed from early maturing individual plants, the cotton has been rendered much earlier, until now it is thoroughly adapted to the existing conditions. The fibre has increased in length from about  $1\frac{1}{4}$  to  $2\frac{1}{2}$  in., and the plants have at the same time been increased in productiveness. The custom of carefully selecting the seed has grown with the industry and may be said to be inseparable from it. It is only by such careful and con-

tinuous selection that the staple of these high-bred strains can be kept up to its present superiority, and if for any reason the selection is interrupted there is a general and rapid decline in quality."

When selection is being made for several characters at the same time, and also in hybridization experiments, where it is important to have full records of the characters of individual plants and their progeny, "score cards," such as are used in judging stock, with a scale of points, are used.

The improvements desired in cotton vary to some degree in different countries, according to the present character of the plants, climatic conditions, the chief pests, special market requirements, and other circumstances. Amongst the more important desiderata are:—

1. Increased Yield.
2. Increase in Length of Lint.—Webber records the case of Stamm Egyptian cotton imported into Columbia, in which by simple selection, as outlined above, during two years plants were obtained uniformly earlier, more productive, and yielding longer and better lint.
3. Uniformity in Length of the Lint.—This is important especially in the long-stapled cottons, unevenness leading to waste in manufacture, and consequently to a lower price for the cotton.
4. Strength of Fibre.—Long-stapled cottons have been produced in the States by crossing Upland and Sea Island cotton. These hybrids produce a lint which is long and silky, but often deficient in strength: selection for strength amongst the hybrids, with due regard to length, may overcome this.

5. Season of Maturing.—Seed should be selected from early and late opening bolls, according to requirements. Earliness is especially important in countries where the season is short.

6. Adaptation to Soil and Climate.—High-class cottons often do not flourish if introduced into a new country. They are adapted to special conditions which are lacking in their new surroundings, but a few will probably do fairly well the first year, and the seeds from these probably rather better the next, and so on, so that in a few years' time a strain may be available which is equal or even superior to the original one introduced.

7. Resistance to Disease.—The method employed is to select, for seed purposes, plants which are resistant to the particular disease. Thus sometimes a field of cotton is attacked by some disease, perhaps "wilt," and a comparatively few plants are but very slightly affected. These are propagated, and there are instances as described above of very successful and commercially important results having been attained. Special interest attaches to experiments made in the United States to endeavour to raise races of cotton resistant to the boll weevil.

8. Resistance to Weather.—Strong winds and heavy rains do much damage to cotton by blowing or beating the lint out of the bolls. In some instances a slight difference in the shape, mode of opening, &c., of the boll prevents this, and accordingly seed is selected from bolls which suffer least under the particular adverse conditions.

Attention has been paid in the West Indies to seed selection, by the officers of the imperial Department of Agriculture, with the object of retaining for West Indian Sea Island cotton its place as the most valuable cotton on the British market.

In India, where conditions are much more diversified and it is more difficult to induce the native cultivator to adopt new methods, attention has also been directed during recent years to the improvement of the existing races. Efforts have been made in the same direction in Egypt, West Africa, &c.

#### *The World's Commercial Cotton Crop.*

It is impossible to give an exact return of the total amount of cotton produced in the world, owing to the fact that in China, India and other eastern countries, in Mexico, Brazil, parts of the Russian empire, tropical Africa, &c., considerable—in some cases very large—quantities of cotton are made up locally into wearing apparel, &c., and escape all statistical record. It is estimated that the amount thus used in India exclusive of the consumption of mills is equivalent to about 400,000 bales. Neglecting, however,



these quantities, which do not affect the world's market, the annual supplies of cotton are approximately as follows:—

Country.	Approximate Production. Bales of 500 lb.	Percentage.
United States of America . . . . .	11,000,000	68.75
India . . . . .	3,000,000	18.75
Egypt . . . . .	1,000,000	6.25
All other countries . . . . .	1,000,000	6.25
Total . . . . .	16,000,000	100.00

In 1905 the world's crop closely approximated to 16,000,000 bales, whilst in 1904 it was nearly 19,000,000 bales and in 1906 nearly 20,000,000 bales. The United States produced very nearly seven-tenths of the total "visible" cotton crops of the world. This, however, is quite a modern development, comparatively speaking. "During the period from 1786 to 1790 the West Indies furnished about 70% of the British supply, the Mediterranean countries 20%, and Brazil 8%; whilst the quantity contributed by the United States and India was less than 1% and Egypt contributed none. In 1906 the United States contributed 65% of the commercial cotton, British India 19%, Egypt 7%, and Russia 3%. Of the countries which were prominent in the production of cotton in 1790, Brazil and Asiatic Turkey alone remain" (*U.S.A. Bureau of the Census, Bulletin No. 76*). The actual figures for the chief countries for 1904-1906, taken from the same source, are as follows:—

*The World's Commercial Cotton Crop. (In 500 lb Bales.)*

Country.	1904.	1905.	1906.
United States . . . . .	13,085,000	10,340,000	13,016,000
British India . . . . .	2,843,000	2,519,000	3,708,000
Egypt . . . . .	1,258,000	1,181,000	1,400,000
Russia . . . . .	554,000	585,000	675,000
China . . . . .	468,000	415,000	418,000
Brazil . . . . .	210,000	258,000	275,000
Mexico . . . . .	114,000	125,000	130,000
Peru . . . . .	40,000	55,000	55,000
Turkey . . . . .	100,000	107,000	107,000
Persia . . . . .	45,000	47,000	47,000
Japan . . . . .	16,000	15,000	11,000
Other countries . . . . .	70,000	100,000	100,000
Total . . . . .	18,803,000	15,747,000	19,942,000

This table serves to indicate the principal countries contributing to the world's supply of cotton. The following notes afford a summary of the position of the industry in the more important countries.

*United States of America.*—The cultivation of cotton as a staple crop in the United States dates from about 1770,<sup>1</sup> although efforts appear to have been made in Virginia as far back as 1621. The supplies continued to be small up to the end of the century. In 1792 the quantity exported from the United States was only

<sup>1</sup> It is related that in the year 1784 William Rathbone, an American merchant resident in Liverpool, received from one of his correspondents in the southern states a consignment of eight bags of cotton, which on its arrival in Liverpool was seized by the custom-house officers, on the allegation that it could not have been grown in the United States, and that it was liable to seizure under the Shipping Acts, as not being imported in a vessel belonging to the country of its growth. When afterwards released, it lay for many months unsold, in consequence of the spinners doubting whether it could be profitably worked up.

equivalent to 275 bales, but by the year 1800 it had increased to nearly 36,000 bales. At the close of the war in 1815 the revival of trade led to an increased demand, and the progress of cotton cultivation in America became rapid and continuous, until at length about 85% of the raw material used by English manufacturers was derived from this one source. With a capacity for the production of cotton almost boundless, the crop which was so insignificant when the century began had in 1860 reached the enormous extent of 4,824,000 bales. This great source of supply, when apparently most abundant and secure, was shortly after suddenly cut off, and thousands were for a time deprived of employment and the means of subsistence. In this period of destitution the cotton-growing resources of every part of the globe were tested to the utmost; and in the exhibition of 1862 the representatives of every country from which supplies might be expected met to concert measures for obtaining all that was wanted without the aid of America. The colonies and dependencies of Great Britain, including India, seemed well able to grow all the cotton that could be required, whilst numerous other countries were ready to afford their co-operation. A powerful stimulus was thus given to the growth of cotton in all directions; a degree of activity and enterprise never witnessed before was seen in India, Egypt, Turkey, Greece, Italy, Africa, the West Indies, Queensland, New South Wales, Peru, Brazil, and in short wherever cotton could be produced; and there seemed no room to doubt that in a short time there would be abundant supplies independently of America. But ten years afterwards, in the exhibition of 1872, which was specially devoted to cotton, a few only of the *thirty-five* countries which had sent their samples in 1862 again appeared, and these for the most part only to bear witness to disappointment and failure. America had re-entered the field of competition, and was rapidly gaining ground so as to be able to bid defiance to the world. True, the supply from India had been more than doubled, the adulteration once so rife had been checked, and the improved quality and value of the cotton had been fully acknowledged, but still the superiority of the produce of the United States was proved beyond all dispute, and American cotton was again king. Slave labour disappeared, and under new and more promising auspices a fresh career of progress began. With rare combination of facilities and advantages, made available with remarkable skill and enterprise, the production of cotton in America seems likely for a long series of years to continue to increase in magnitude and importance. The total area of the cotton-producing region in the States is estimated at 448,000,000 acres, of which in 1906 only about one acre in fifteen was devoted to cotton. The potentialities of the region are thus enormous.

Cotton is now the second crop of the United States, being surpassed in value only by Indian corn (maize). The area devoted to this crop in 1879 was 14,480,019 acres, and the-total

States and Territories.	Upland Cotton.		Sea Island Cotton.		Total Value.
	Quantity.	Value.	Quantity.	Value.	
	lb	\$	lb	\$	\$
Alabama . . . . .	603,651,989	60,425,564	..	..	60,425,564
Arkansas . . . . .	450,991,361	45,144,235	..	..	45,144,235
Florida . . . . .	17,876,133	1,789,401	9,031,896	2,587,638	4,377,039
Georgia . . . . .	750,762,910	75,151,367	9,950,634	2,850,857	78,002,224
Indian Territory . . . . .	196,648,765	19,684,542	..	..	19,684,542
Kansas . . . . .	9,844	985	..	..	985
Kentucky . . . . .	1,008,290	100,930	..	..	100,930
Louisiana . . . . .	473,222,310	47,369,553	..	..	47,369,553
Mississippi . . . . .	732,755,978	73,348,874	..	..	73,348,874
Missouri . . . . .	26,040,093	2,606,613	..	..	2,606,613
New Mexico . . . . .	74,340	7,442	..	..	7,442
North Carolina . . . . .	276,215,506	27,649,172	..	..	27,649,172
Oklahoma . . . . .	233,396,905	23,363,030	..	..	23,363,030
South Carolina . . . . .	415,386,362	41,580,175	2,723,859	999,656	42,579,831
Tennessee . . . . .	146,569,434	14,671,600	..	..	14,671,600
Texas . . . . .	2,001,181,289	200,318,247	..	..	200,318,247
Virginia . . . . .	6,609,963	661,657	..	..	661,657
Total—United States	6,332,401,472 (= 12,644,803 bales)	633,873,387	21,706,389 (= 43,413 bales)	6,438,151	640,311,538

commercial crop was 5,755,359 bales. In 1899 the acreage had increased to 24,275,101 and the crop to 9,507,786 bales. In 1906 the total area was 28,686,000 acres and the crop 13,305,265 bales.

The preceding table gives the quantity, value and character of the crop for each of the cotton-growing states in 1906, as reported by the Bureau of the Census.

*Mexico.*—Cotton is extensively grown in Mexico, and large quantities are used for home consumption. The cultivation is of very old standing. Cortes in 1519 is said to have received cotton garments as presents from the natives of Yucatan, and to have found the Mexicans using cotton extensively for clothing. From 1900 to 1905 the crop was about 100,000 bales per annum; the whole is consumed in local mills, and cotton is imported also from the United States.

*Brazil.*—The cotton-growing region in Brazil comprises a belt some 200 m. in width, in the north-eastern portion of the country, and a strip along the valley of the San Francisco, where a large amount of the present crop is produced. The cotton is known in commerce under the name of the place of export, e.g. Maceio, Pernambuco or Pernam, Ceãra, Rio Grande, &c. The export fluctuates greatly.

	Bales of 500 lb.	Approx. Value.
1901 . . . . .	53,002	£500,000
1902 . . . . .	143,963	1,200,000
1903 . . . . .	126,896	1,300,000
1904 . . . . .	59,413	800,000
1905 . . . . .	107,887	1,000,000
1906 . . . . .	142,972	1,500,000

The total production in 1906 was estimated at about 275,000 bales, but only a portion was available for export, there being an increasing consumption in Brazil itself.

*Peru.*—Cotton is an important crop in Peru, where it has long been cultivated. Most of the crop is grown in the irrigated coastal valleys. With more water available, the output could be considerably increased, e.g. in the Piura district. "Rough Peruvian," the produce of one of the tree cottons, has a special use, as being rather harsh and wiry it is well adapted for mixing with wool. Egyptian cotton is also grown. The annual export is about 30,000 bales.

*British West Indies.*—Cotton was cultivated as a minor crop in parts of the West Indies as long ago as the 17th century, and at the opening of the 18th century the islands supplied about 70% of all the cotton used in Great Britain. Greater profits obtained from sugar caused the industry to be abandoned, except in the small island of Carriacou. In 1900 the Imperial Department of Agriculture and private planters began experiments with the object of reintroducing the cultivation, owing to the decline in value of sugar. The department was actively assisted by the

Cotton Production in the British West Indies: 1905-1906.<sup>1</sup>

Island.	Area in Acres.	Yield = Bales of 500 lb.	Average Price in Pence per lb.	Value of Lint and Seed.
Barbados . . . . .	2,000	959	15.2	£33,557
St Vincent . . . . .	790	330	18.0	13,557
Grenada (mostly <i>Marie galante</i> cotton) . . . . .	3,600	623	5.0	8,400
St Kitts . . . . .	1,000	241	15.0	8,380
Nevis . . . . .	1,700	240	13.0	8,364
Anguilla . . . . .	1,000	161	15.0	5,280
Antigua . . . . .	700	200	14.2	6,522
Montserrat . . . . .	770	196	15.0	6,789
Virgin Islands . . . . .	40	14	..	400
Jamaica . . . . .	1,500	123	..	4,025
Total . . . . .	12,900	3087	..	£95,274

British Cotton Growing Association, and the results have been very successful, as was shown at an exhibition held in Manchester in 1908. A supply of seed of a high grade of Sea Island cotton was obtained from Colonel Rivers's estate in the Sea Islands, S. Carolina, and so successful has the cultivation been that from some of the islands West Indian Sea Island cotton obtains a

<sup>1</sup> Taken with some modifications from the *Agricultural News* (1907), vi. p. 38.

higher price than the corresponding grade of cotton from the Sea Islands themselves.

In 1902 the total area under cotton cultivation in the British West Indies was 500 acres. The industry made rapid progress. In 1903 it was 4000; in 1905-1906 it was 12,900; and for 1906-1907 it was 18,166 acres. The table indicates the chief cotton-producing islands, the acreage in each, yield, average value per pound and total value of the crop in 1905-1906.

The whole of this crop was Sea Island cotton, with the exception of the "Marie galante" grown in Carriacou. Marie galante is a harsh cotton of the Peruvian or Brazilian type. The low yield per acre in this island, and also the low value of the lint per lb compared with the Sea Island cotton, is clearly apparent.

In 1906-1907 the acreage was substantially increased in many of the islands, e.g. Barbados from 2000 to 5000; St Vincent 790 to 1533; St Kitts and Anguilla 1000 to 1500 each; Antigua 700 to 1883. In Jamaica, on the other hand, it was reduced from 1500 to 300 acres.

*Spain.*—Cotton was formerly grown in southern Spain on an extensive scale, and as recently as during the American Civil War a crop of 8000 to 10,000 bales was obtained. It is considered that with facilities for irrigation Andalusia could produce 150,000 bales annually. The former industry was abandoned as other crops became more remunerative. The government is encouraging recent efforts to re-establish the cultivation.

*Malta.*—Cotton has long been cultivated in Malta, but the acreage diminished from 1750 acres in 1899 to 670 acres in 1906. A considerable quantity of the produce is spun and woven locally; e.g. in 1904 the export was equivalent to about 120 bales out of a total production of 330 bales, and in 1905 to 258 out of 333 bales (of 500 lb each).

*Cyprus* has a soil and climate suited to cotton, which was formerly grown here on a large scale. The rainfall is uncertain and low, however, never exceeding 40 in., and on the supply of water by irrigation the future of the industry mainly depends. The exports dwindled from 3600 bales in 1865 to 946 in 1905; great fluctuations occur, the export in 1904, for example, being only 338 bales. The cotton grown is rather short-stapled and goes mainly to Marseilles and Trieste. Some is used locally in the manufacture of cloth.

*Egypt.*—The position of Egypt as the third cotton-producing country of the world has already been pointed out, and the varieties grown and the mode of cultivation described. The introduction of the exotic varieties dates from the beginning of the 19th century. The industry was actively promoted by a Frenchman named Jumel, in the service of Mehemet Ali, from 1820 onwards with great success. The area under cotton is about 1,800,000 acres.

Cotton Production in Egypt.

1850 . . . . .	87,200 bales of 500 lb.
1865 . . . . .	439,000 " "
1890 . . . . .	798,000 " "
1904 . . . . .	1,258,000 " "
1905 . . . . .	1,250,000 " "
1906 . . . . .	1,400,000 " "

*The Egyptian Sudan.*—Egyptian cotton was cultivated in the Sudan to the extent of 21,788 acres in 1906 chiefly on non-irrigated land. The exports, however, are small, almost all the crop being used locally. The chief difficulties are the supply of water, labour and transport facilities. Lord Cromer in his report on the Sudan for 1906 remarks that: "There seems to be some reason for thinking that the future—or at all events the immediate future—of Sudan agriculture lies more in the direction of cultivating wheat and other cereals than in that of cultivating cotton."

*West Africa.*—Cotton has long been grown in the various countries on the west coast of Africa, ginned by hand or by very primitive means, spun into yarn, and woven on simple looms into "country cloths"; these are often only a few inches wide, so that any large cloths have to be made by sewing the narrow strips together. These native cloths are exceedingly durable, and many of them are ornamented by using dyed yarns and in other ways.

Southern Nigeria (Lagos) and northern Nigeria are the most important cotton countries amongst the British possessions on the coast. From the former there has been an export trade for many years which fluctuates remarkably according to the demand. Northern Nigeria is the seat of a very large native cotton industry, to supply the demand for cotton robes for the Mahomedan races inhabiting the country. The province of Zaria alone is estimated to produce annually 30,000 to 40,000 bales, all of which is used locally. Northern Nigeria contributes to the cotton exported from Lagos. The country offers a fairly promising field for development, especially now that arrangements have been made for providing the necessary means of transport by the construction of the new railways. The profits obtained from ground-nuts (*Arachis hypogea*) in Gambia, gold mining in the Gold Coast, and from products of the oil palm (*Elaeis guineensis*) in the palm-oil belt serve to prevent much attention being given to cotton in these districts.

*Exports of Cotton from Lagos.*

1865	868 bales of 500 lb.
1869	1785 " "
1900	48 " "
1901	15 " "
1902	25 " "
1903	582 " "
1904	1725 " "
1905	2578 " "

*Exports of Cotton from British West Africa, 1904, 1905 and 1906.*

	1904.	1905.	1906.
	Bales (500 lb.)	Bales (500 lb.)	Bales (500 lb.)
Gambia	120	5	0
Sierra Leone	56	139	176
Gold Coast	115	50	186
Southern Nigeria and Lagos	2296	2771	5392
Northern Nigeria	574	250 <sup>1</sup>	712
Total	3161	3215	6466

*Nyasaland (British Central Africa).*—The cultivation of cotton on a commercial scale is quite new in Nyasaland, and although general conditions of soil and climate appear favourable the question of transport is serious and labour is not abundant. The exports were equivalent to 2 bales of 500 lb in 1902-1903, 114 bales in 1903-1904, 570 bales in 1904-1905, 1553 bales in 1905-1906 and 1052 bales in 1906-1907. In the lower river lands Egyptian cotton has been the most successful, whilst Upland cotton is more suited to the highlands.

*British East Africa and Uganda.*—In these adjoining protectorates wild cottons occur, and suitable conditions exist in certain localities. Experimental work has been carried on, and in 1904 Uganda exported about 43 bales of cotton, and British East Africa about 177 bales. In 1906 the combined exports had risen to 362 bales, including a little from German East Africa. In 1904-1905 there were some 300 acres under cotton in British East Africa. Lack of direct transport facilities is a difficulty. Some of the native cottons are of fair quality, but Egyptian cotton appears likely to be best suited for growing for export.

*India* is probably the most ancient cotton-growing country. For five centuries before the Christian era cotton was largely used in the domestic manufactures of India; and the clothing of the inhabitants then consisted, as now, chiefly of garments made from this vegetable product. More than two thousand years before Europe or England had conceived the idea of applying modern industry to the manufacture of cotton, India had matured a system of hand-spinning, weaving and dyeing which during that vast period received no recorded improvement. The people, though remarkable for their intelligence whilst Europe was in a state of barbarism, made no approximation to the mechanical operations of modern times, nor was the cultivation of cotton either improved or considerably extended. Possessing soil, climate and apparently all the requisite elements from nature for the production of cotton to an almost boundless extent, and of a

<sup>1</sup> Approximately.

useful and acceptable quality, India for a long series of years did but little towards supplying the manufactures of other countries with the raw material which they required. Between the years 1788 and 1850 numerous attempts were made by the East India Company to improve the cultivation and to increase the supply of cotton in India, and botanists and American planters were engaged for the purpose. One great object of their experiments was to introduce and acclimatize exotic cottons. Bourbon, New Orleans, Upland, Georgia, Sea Island, Pernambuco, Egyptian, &c., were tried but with little permanent success. The results of these and similar attempts led to the conclusion that efforts to improve the indigenous cottons were most likely to be rewarded with success. Still more recently, however, experiments have been made to grow Egyptian cotton in Sind with the help of irrigation. Abassi has given the best results, and the experiments have been so successful that in 1904-1905 an out-turn of not less than 100,000 bales " was prophesied in the course of a few years " (Report of Director, Land Records and Agriculture). The average annual production in India approximates to 3,000,000 bales. The area under cotton in all British India is about 20,000,000 acres, the crop being grown in a very primitive manner. The bulk of the cotton is of very short staple, about three-quarters of an inch, and is not well suited to the requirements of the English spinner, but very large mills specially fitted to deal with short-stapled cottons have been erected in India and consume about one-half the total crop, the remainder being exported to Germany and other European countries, Japan and China. In 1906 the United Kingdom took less than 5% of the cotton exported.

*Cotton Production in British India.*<sup>1</sup>

1859	1,316,800 bales of 500 lb.
1904	3,172,800 " "
1905	2,848,800 " "
1906	4,038,400 " "

About 50% of the cotton produced is consumed in Indian mills and the remainder is exported.

*China.*—Cotton has not been cultivated in China from such early times as in India, and although cotton cloths are mentioned in early writings it was not until about A.D. 1300 that the plant was grown on any considerable scale. There are no figures obtainable as to the production, but it must be very large, considering that the crop provides clothing for a large proportion of the population of China. During recent years a considerable quantity of cotton has been exported, but more than a compensating amount of raw cotton, yarns and textiles, is imported. An estimate of the crop puts it at about 1,500,000 bales.

*Korea* is stated to have originally received its cotton plants from China some 500 years ago. Conditions are well adapted to the cultivation of the plant, and since the cessation of the Russo-Japanese War the Japanese have undertaken the development of the industry. Figures are difficult to obtain, but an official report from the Japanese Residency General in 1907 estimated the crop at about 214,000 bales, all being used locally. In the future Korea may become an important source of supply for Japan, especially if, as appears likely, Korea proves suited to the cultivation of American cotton.

*Japan* received cotton from India before China, and the plant is extensively grown, especially in West and Middle Japan. The production is not sufficient to meet the home demand; during the five years of normal trade before the war with Russia Japan imported annually about 800,000 bales of cotton, chiefly from British India, China and the United States, and during the same period exported each year some 2000 bales, mainly to Korea.

*Dutch East Indies.*—In Java and other Dutch possessions in the East cotton is cultivated. A considerable amount is used locally, and during the six years ending in 1907 the surplus exported ranged from about 24,000 to 40,000 bales per annum.

*Russia.*—Some cotton is produced in European Russia in the southern Caucasus, but Turkestan in central Asia is by far the

<sup>1</sup> Cotton Production 1906, U.S.A. Bureau of the Census, Bulletin No. 76.

more important source of Russian-grown cotton. In this region cotton has been cultivated from very early times to supply local demands, and to a minor degree for export. Since about 1875 the Russians have fostered the industry, introducing American Upland varieties, distributing seed free, importing gins, providing instruction, and guaranteeing the purchase of the crops. The Trans-Caspian railway has been an important factor; almost all the cotton exported passes over this line, and the statistics of this trade indicate the progress made. The shipments increased from 250,978 bales in 1896-1897 to 495,962 bales in 1901-1902—part, however, being Persian cotton. The production of cotton in Russia in 1906 was estimated at 675,000 bales of 500 lb each. About one-third of the cotton used in Russian mills is grown on Russian territory, the remainder coming chiefly from the United States.

*Asia Minor.*—Smyrna is the principal centre of cotton cultivation in this region. A native variety known as "Terli," and American cotton, are grown. The general conditions are favourable. According to the *Liverpool Cotton Gazette*, Asiatic Turkey produced in 1906 about 100,000 bales, and Persia about 47,000 bales. Cotton was formerly cultivated profitably in Palestine.

*Australasia.*—The quantity of cotton now produced in Australasia is extremely small. Queensland, New South Wales and South Australia possess suitable climatic conditions, and in the first-named state the cotton has been grown on a commercial scale in past years, the crop in 1897 being about 450 bales. Considerable interest attaches to the "Caravonica" cotton raised in South Australia, which has been experimented with in Australia, Ceylon and elsewhere. It is probably a hybrid between Sea Island and rough Peruvian cotton, but lacks most of the essential features of Sea Island.

In *Fiji* the cotton exported in the 'sixties and 'seventies was worth £93,000 annually; but the cultivation has been practically abandoned. In 1899 about 60 bales, and in 1900 about 6 bales, were exported. During 1901-1903 there were no exports of cotton, and in 1904 only 70 bales were sent out.

Into the *Society Islands* Sea Island cotton was introduced about 1860-1870. Up to the year 1885 there was an average yearly export equivalent to about 2140 bales of 500 lb, after which date the export practically ceased. The industry has, however, been revived, and in 1906 over 100 bales, valued at £1052, were exported. (W. G. F.)

MARKETING AND SUPPLY

In the days of slave-grown cotton, the American planters, being men of wealth farming on a large scale, consigned the bulk of their produce as a rule direct to the ports. Now, however, a large proportion of the crop is sold to local store-keepers who transfer it to exporting firms in neighbouring cities. The cultivators, whether owners of the plantations, as is usual in some districts, or tenants, as is customary in others, are financed as a rule by commission agents. The decline of "spot" sales at the ports, partly but not entirely in consequence of the appearance of the small cultivator, has proceeded steadily. Hammond<sup>1</sup> has constructed a table from information supplied by the secretaries of the cotton exchanges at New York, Charleston, Savannah, Mobile, New Orleans and Galveston, showing the sales of "spot" cotton at those ports for the twenty-two years between 1874-1875 and 1895-1896, and in all cases an absolute decline is evident. The receipts of cotton in the season 1904-1905 at the leading interior towns and ports of the United States are given below.

Receipts of Cotton at 28 Interior Towns.

(In Thousand Statistical Bales of 500 lb each.)

Brenham, Tex. . . . .	17	Memphis, Tenn. . . . .	984
Dallas, Tex. . . . .	96	Nashville, Tenn. . . . .	19
Shreveport, La. . . . .	256	Selma, Ala. . . . .	126
Little Rock, Ark. . . . .	219	Montgomery, Ala. . . . .	211
Helena, Ark. . . . .	91	Eufaula, Ala. . . . .	29
Vicksburg, Miss. . . . .	100	Columbus, Ga. . . . .	74
Columbus, Miss. . . . .	57	Macon, Ga. . . . .	87
Natchez, Miss. . . . .	76	Albany, Ga. . . . .	35

<sup>1</sup> *Cotton Culture and the Cotton Trade*, p. 298.

Atlanta, Ga. . . . .	134	Houston, Tex. . . . .	2,423
Rome, Ga. . . . .	72	Meridian, Miss. . . . .	133
Augusta, Ga. . . . .	446	Cincinnati, Ohio . . . . .	167
Columbia, S.C. . . . .	68	Yazoo City, Miss. . . . .	65
Newberry, S.C. . . . .	17		
Charlotte, N.C. . . . .	21	Total . . . . .	6712
Raleigh, N.C. . . . .	19		
St Louis, Mo. . . . .	672	Crop. . . . .	13,565

Receipts of Cotton at American Ports.

(In Thousand Statistical Bales of 500 lb each.)

Galveston, Tex. . . . .	2,879	Boston, Mass. . . . .	84
New Orleans, La. . . . .	2,690	Philadelphia, Pa. . . . .	14
Mobile, Ala. . . . .	330	Brunswick, Ga. . . . .	200
Savannah, Ga. . . . .	1,877	Pensacola, Fla. . . . .	187
Charleston, S.C. . . . .	225	Minor Ports . . . . .	518
Wilmington, N.C. . . . .	375		
Norfolk, Va. . . . .	820	Total . . . . .	10,295
Baltimore, Md. . . . .	62		
New York . . . . .	34	Crop . . . . .	13,565

Galveston and Savannah have risen considerably in relative importance of late years.

Before the Civil War each planter would have his own gin-house. Now, however, ginning is a distinct business, and one gin will serve on an average about thirty farmers. Moveable gins were tried for a time in some places; they were dragged by traction engines from farm to farm, like threshing machines in parts of England, but the plan proved uneconomical because, among other reasons, farmers were not prepared to meet the cost of providing facilities for storing their cotton. In addition to the small country ginneries, large modern ginneries have now been set up in all the leading Southern market towns. The cotton is pressed locally and afterwards "compressed" into a very small compass. The bales are usually square, but cylindrical bales are becoming more common, though their cost is greater. In the latter, the cotton is arranged in the form of a rolled sheet or "lap." Owing to complaints of the careless packing of American cotton, attention has been devoted of late to the improvement of the square bale.

Ginning and packing.

London used to be the chief cotton port of England, but Liverpool had assumed undisputed leadership before the 19th century began. Some arrivals have been diverted to Manchester since the opening of the Manchester ship canal; shipments through the canal from the 1st of September to the 30th of August in each year for the decade 1894-1895 to 1904-1905 are appended—six to eight times as much is still unloaded at Liverpool.

English ports of entry.

A Manchester cotton-importing company was recently formed for increasing deliveries direct to Manchester, and establishing a "spot" market there, an end to which the Manchester Cotton Association had directed its efforts for some time past. The latter association was established at the end of 1894, with a membership of 265, in the interests of those spinners who desired importations direct to Manchester. The objects of the association are officially stated to be: (1) to frame suitable and authoritative forms of contract, and to make rules and regulations for the proper conduct of the trade; (2) to supervise and facilitate the delivery of the importations of cotton at the Manchester docks to the various consignees; (3) to provide and maintain trustworthy standards of classification; (4) to procure and disseminate useful information on all subjects pertaining to the trade; (5) to act in concert with chambers of commerce and other bodies throughout the world for mutual protection; (6) to establish a market for cotton at Manchester. Spinning members preponderate, but almost all the Manchester cotton merchants and cotton brokers have also joined the association. The importance of the original spinners' representation on the association is shown by the fact that they worked over 14,000,000 spindles: in December 1905 the spindles represented by members had risen to nearly 20,000,000. Some 73,000 looms are also represented. As most of the Lancashire cotton mills lie far from Manchester, direct importations to that city do not usually dispense with a "handling," and frequently save little or nothing in freight rates, though in some cases the economy derived from direct importation is considerable. One gain accruing to Lancashire from the

Canal, however, is that its competition has brought down railway rates.

Fundamental alterations have been made in the structure of the leading cotton markets, and in methods of buying and selling cotton, in the last hundred years. We shall not attempt to trace the changes as they appeared in every market of importance, but shall confine our attention to one only, and that perhaps the most important of all, namely, the market at Liverpool. This selection of one market for detailed examination does not rob our sketch of generality, as might at first be thought, since broadly the history of the development of one market is the history of the development of all, and on the whole the economic explanation of the evolution that has taken place may be universalized.

**Cotton market methods.**

with less easy terms for payment than were usual in Manchester, prevented any great numbers from departing from the beaten track. Cotton dealers up to this time had regularly financed the spinners, who were frequently men of little capital, by allowing long credit, and had even employed them to spin on commission. As men of substance increased among the ranks of the spinners, the Manchester cotton dealers found it impossible to retard a movement set on foot by the prospects of such appreciable advantages. Ultimately many of the old Manchester cotton dealers became brokers for their old customers. In 1875 there were said to be upwards of 100 cotton dealers in Manchester, but from that time onward their members steadily declined. It is interesting to observe that a later development of transport between Manchester and Liverpool, namely, the Manchester

*Cotton landed at the Port of Manchester since the Canal was opened.*

(In thousand Bales.)

The season is from the 1st of September to the 31st of August each year.

	Jan. 1894, to Aug. 31, 1894.	Season 1894-1895.	Season 1895-1896.	Season 1896-1897.	Season 1897-1898.	Season 1898-1899.
American . . . . .	21	32	121	211	245	311
Egyptian . . . . .	1.4	34	68	88	98	84
East Indian . . . . .	..	..	..	..	..	..
West African . . . . .	..	..	..	..	..	..
Total . . . . .	22	66	189	299	344	395
Total American Crop <sup>1</sup> . . . . .	7,549	9,901	7,157	8,757	11,199	11,274
Total Egyptian Crop (in bales of 7½ cantars) <sup>2</sup> . . . . .	657	615	703	783	872	745
	Season 1899-1900.	Season 1900-1901.	Season 1901-1902.	Season 1902-1903.	Season 1903-1904.	Season 1904-1905.
American . . . . .	415	442	421	478	365	552
Egyptian . . . . .	136	107	125	145	148	183
East Indian . . . . .	..	..	..	2.5	6	1.3
West African . . . . .	..	..	..	..	..	.1
Total . . . . .	551	549	546	626	519	736
Total American Crop <sup>1</sup> . . . . .	9,436	10,383	10,680	10,727	10,011	13,565
Total Egyptian Crop (in bales of 7½ cantars) <sup>2</sup> . . . . .	868	723	849	778	867	846

Originally cotton was imported by the Liverpool dealer as an agent for American firms or at his own risk, and then sold by private treaty, auction, or through brokers, to Manchester dealers, who retailed it to the spinners. This statement is, of course, only roughly correct. Some Manchester dealers imported themselves, and some spinners bought direct from Liverpool importers, but the rule was the arrangement first described. Early in the 19th century it became customary for Manchester dealers and Liverpool importers to carry on business with one another through representatives known as "buying" and "selling" brokers. About this time the broker of cotton only began to specialize from the ranks of the brokers who dealt in all kinds of colonial produce. Previously there had not been enough business done in cotton to make it worth any person's while to devote himself to the buying and selling on commission of cotton only. The evolution of the distinct business of cotton broking is readily comprehensible when we remind ourselves that the requirements, as regards raw material, of all spinners are much alike generally, and that no spinner could afford to pay an expert to devote himself entirely to purchasing cotton for his mill.

So far change had been gradual, but the success of the Manchester and Liverpool railway undermined beyond repair the old system of doing business. Spinners could easily run over to Liverpool and buy their cotton from the large stocks displayed at that port. Before the railway was opened some spinners had been in the habit of making their purchases of raw material in Liverpool, but the great inconveniences of the journey, combined

Ship Canal, has drawn back into Manchester a part of the cotton market which was attracted from Manchester into Liverpool by the famous improvement in transport opened to the public three-quarters of a century ago.

The centralization of the cotton market in Liverpool fixed firmly the system of buying through brokers, for the Liverpool importer, or his broker, was in no sense a professional adviser to the spinners, informally pledged to advance the latter's interests, as the old Manchester dealers had been. The system was rendered comparatively inexpensive by the drop in commissions from 1 to ½% which had followed the adoption of selling by sample. This custom of buying and selling through brokers continued unshaken until the laying of the Atlantic cable tempted selling brokers occasionally, and even some buying brokers, to buy direct from American factors by telegraph and thus transform themselves into quasi-importers. The temptation was made the more difficult to resist by the development of "future" dealings. When the agents of the spinners, that is, the buying brokers, by becoming principals in some transactions, had acquired interests diametrically opposed to those of their customers, the consequent feeling of distrust among spinners gave birth to the Cotton Buying Company, which, constituted originally of twenty to thirty limited cotton-spinning companies, represents to-day nearly 6,000,000 spindles distributed among nearly one hundred firms. Its object was to squeeze out some middlemen and economize for its members on brokerage. This company, it is said, helped to attract the brokers back to the spinners, and an informal understanding was arrived at that the buying broker should not figure both as agent and principal in the same transaction.

<sup>1</sup> Commercial crop.

<sup>2</sup> A cantar is 99.05 lb avoirdupois.

By 1876 "forward" operations had become so vast and complicated that a cotton-clearing house had to be established to deal with the confusing networks of debits and credits created by them. Its principle was exactly that of the clearing houses used by the railways and the banks, the cancellation of indebtedness and discharge simply of balances. The final settlement of a "future" contract involved usually a crowd of persons, and the passage of large sums of money backwards and forwards, so that the amount of cash required for circulation on the exchange became unreasonably excessive and an annoying waste of time was entailed. The cotton-clearing house substituted book-keeping for the bulk of these payments. The establishment of the Cotton Bank naturally followed. Now debts are discharged in the first instance by vouchers. Dealers pass their debit and credit vouchers into the Cotton Bank and pay or receive the balances which they owe or are entitled to. In order to protect dealers against the losses due to the insolvency of those with whom they have had transactions, weekly settlements on the exchange have been made compulsory; between brokers and their clients they are also usual. At the settlement, every member of the exchange receives the "differences" owing to him and pays those which he has incurred. Thus if a person holds futures for 10,000 bales which stood at 5·20 on the last settlement day and now stand at 5·30, and in the course of the previous week has sold 5000 bales of "futures" at 5·10, he receives 10,000 ×  $\frac{1}{100}$ d. on his old holding, and has to pay 5000 ×  $\frac{2}{100}$ d. on his sales, and therefore on balance neither receives nor pays. Differences may be very large sums. The unit of a "future" being 100 bales, an alteration in the price of cotton of ·01d. causes a difference on each unit of £2. Periodic settlements are obviously periodic tests of the solvency of dealers. If the test of the settlement were not frequently applied, speculators who were unfortunate would be tempted to plunge deeper until finally some became insolvent for large sums. As it is, the speculator who has incurred losses beyond his means tends to be discovered before his creditors are heavily involved. Settlement days fall on Thursday, and the closing prices on the preceding Monday are taken as the basis of the settlement. From all differences interest at 5% is deducted for the time between settlement day and the tenth day of the second month on which the "future" elapses, since settlement terms mean that money is paid in instalments before it is actually due. To the admission of periodic settlements there was for a time vehement opposition on the ground that the door would be opened to gambling on "differences." Hence at first, in 1882, they were used only by a section of the market constituted of members who had voluntarily agreed to do business with one another upon these terms alone. By 1884, however, the advantages of "settlement terms" became so evident that they were adopted by the Cotton Association, at first for fortnightly periods, with the saving clause originally that they should not be compulsory.

**Cotton-Clearing house, Cotton Bank and periodic settlement of "differences."**

As soon as the clearing house was set up it became evident that "futures" were an impossibility away from it. At the same time "futures" were becoming an increasing necessity to importers, because through "futures" alone could they hedge on their purchases of cotton, or buy when the market seemed favourable, and they were not prepared to assume heavy risks. Now from the clearing house importers were rigorously excluded, and on invoking the aid of "futures," therefore, they were penalized to the extent of double broker's commission, one commission being charged on the sale of the "futures" and one on their purchase back. The importers, therefore, found it necessary to establish a club of their own, the Liverpool Cotton Exchange, which they as rigorously guarded against brokers. The split in the market so caused was so damaging to both parties that a satisfactory arrangement was eventually agreed upon, and both institutions were absorbed in the Liverpool Cotton Association.

A condition of specialist dealers working to the public service is that they should not act in the dark. They must watch demand, be able to form reasonable anticipations of its move-

ments, and at the same time know the existing stocks of cotton, the sales taking place from day to day, and the best forecasts of the coming supplies. A man accustomed to devote the whole of his time to the study of demand and supply in relation to cotton, after some years of experience, will be qualified ordinarily to form fairly accurate judgments of the prices to be expected. His success depends upon his ability to interpret rightly the facts and intangible signs with which he is brought in contact. The information at the disposal of dealers has steadily enlarged in volume and improved in trustworthiness, though some of it is not yet invariably above suspicion, and the time elapsing between an event and the knowledge of it becoming common property has been reduced to a fraction of what it used to be, in consequence chiefly of the telegraph and cables. All sales that take place on the Exchange must be returned. Estimates are published of the area under cotton cultivation, and conditions of the American crop are issued by the American agricultural bureau at the beginning of the months of June, July, August, September and October of each year. To represent the standard of perfect healthiness and exemption from injury due to insects, or drought, or any other causes, one hundred is taken. The estimates for 1901 to 1905 are given, to illustrate their variations:—

**Publication of information relating to demand and supply.**

Year.	June 1st.	July 1st.	Aug. 1st.	Sept. 1st.	Oct. 1st.
1901	81·5	81·1	77·2	71·4	61·4
1902	95·1	84·7	81·9	64·0	58·3
1903	74·1	77·1	79·7	81·2	65·1
1904	83	88	91·6	84·1	75·8
1905	77·2	77	74·9	72·1	71·2

These estimates are the averages of separate estimates which are published for the states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Tennessee. The official figures are supplemented from time to time by numerous private forecasts, for instance those in "Neild's circular." Ellison, in his work on the cotton trade of Great Britain, traces in detail the increase in the volume of information collected and made public. At the close of the 18th century there was a tacit understanding among brokers to supply one another with information. There were no printed circulars, except the monthly prices current of all kinds of produce, but brokers used to send particulars of business done to their customers in letters. These letters were the origin of circulars. Messrs Ewart and Rutson pioneered in 1805 by issuing a weekly account of the sales and imports of cotton, and three years later three such circulars were on the market, though Hope's alone was confined to cotton. For the first associated circular of any importance, the market had to wait until 1832. The issue of this circular by subscribing firms, on the basis of particulars collected by brokers appointed at a weekly meeting, gave rise in 1841 to the Cotton Brokers' Association, to which the development of the market by the systematizing of procedure is largely due. The rest of the tale may be told in Mr Ellison's own words:—

"Down to 1864 the leading firms continued to issue weekly market reports, but in that year the association commenced the publication of an associated circular. This was followed in the same year by the *Daily Table* of sales and imports, which in 1874 was succeeded by the present more complete *Daily Circular*. To these publications were at various times added the annual report, issued in December, the American crop report, issued in September, and the daily advices by cable from America, issued every morning."<sup>1</sup>

We shall now enter upon a detailed analysis of "forward" operations. The term "futures" is used broadly and narrowly: broadly it is a generic term denoting "futures" in the narrow sense, and also "options" and "straddles"; narrowly it implies merely contracts for future delivery at a price fixed in the present. Again we must distinguish between the "future" contracts for the delivery of a particular kind of cotton, which may be entered into by spinners and their brokers, and are real purchases in the sense that the spinners want delivery of the cotton referred to, and the "futures," which always relate

**Futu: es.**

<sup>1</sup> *The Cotton Trade of Great Britain*, by Thomas Ellison, p. 186.

to the same grade of cotton, and are drawn up according to certain forms and circulate on the exchange as media for the shifting of risks connected with purchase and sale. The latter are not "real" purchases in the sense given to that term above, but fictitious because delivery of the cotton is not desired. It will no doubt aid the understanding of the functions of the latter if some explanation is offered of the needs met by the former, which are sometimes known technically as "deferred deliveries."

When a spinner is required to quote prices of yarn for delivery in the future he is fixed on the horns of a dilemma. If he does not at once buy cotton, but quotes on the assumption that price will remain steady, he may be involved in serious loss through his estimate being mistaken. If he determines to buy cotton at once, others who risk more, and trust their judgment of the future, may secure the contract. On first thoughts it would seem desirable that all spinners should buy cotton outright to cover their contracts, but on second thoughts the social disadvantage of their doing so becomes apparent. Much buying might take place when stocks were scanty, with the result that prices would be needlessly forced up; and when stocks were plentiful demand might be weak and prices, therefore, be unduly depressed. It is evident that the buying of cotton on the principles suggested would be calculated to cause great unsteadiness of prices, especially as cotton is not continuously forthcoming, but is produced periodically in harvests. Demands for yarn cannot be expected to come always at the most favourable time socially for the distribution of the cotton. One way out of the difficulty is that the spinner should exercise his judgment and buy his raw material at what seems to him the most suitable times. But to this course there are three objections. The first is that spinners would be performing the two functions of industrial management and cotton buying (together with others perhaps), and that in consequence the best industrial men would not necessarily be able to maintain their position in the trade because as buyers of cotton they might be unfortunate. The second is that spinners being required to give attention to two distinct classes of problems would be less likely as a body to become complete masters of either. The third, which is not distinct in principle from the two preceding, is that such limited speculation in cotton buying on the part of spinners worried with other matters would not be likely to steady the cotton market in any high degree. It may be assumed as desirable that the demand for cotton should be so spread as to keep its price as steady as possible—"steadiness" will be defined more exactly later—and that to this end it is essential that specialists should devote themselves to the task of spreading it. Such specialists have appeared in the cotton brokers and dealers who make their living out of bearing the risks connected with anticipating demand and supply in relation to cotton. To-day a spinner who is asked to quote for deliveries of yarn for, say, the next six months, may obtain from a broker quotations for deliveries of the cotton that he needs, in quantities as he needs it, for the next six months, and upon these quotations he may base his own for yarn. If a spinner is pressed by a shipper to make quotations with refusal for two or three days to give time for business to be settled by cable, it is evidently not impossible for the spinner to shift the risk involved by getting in turn from his broker refusal quotations for cotton. But spinners do not try always to take the safest course.

Now it is evident that brokers in turn require some means of passing on the risks that they are bearing, or some portion of them from one to another, or of sharing them with other market experts, as they find themselves overburdened, and as their judgment of the situation changes. The means have been provided in the "futures" which circulate on the Cotton Exchange. The risks of anticipating are carried by those who create or hold "futures" without a hedge. In order to facilitate business, "futures" are all drawn in the same unit (100 bales), and are all based on the same class of cotton, namely Upland cotton of middling grade of "no staple" (*i.e.* with a fibre of about  $\frac{3}{8}$  in.) and of the worst growth. American cotton, we may remind the reader, is graded into a number of classes, both on the Liverpool and New York Ex-

**The spinner's risks.**

**Method of distributing risks.**

changes, and an attempt is made in each market to keep the grades as fixed as possible. But what, it may be inquired, is the value of "futures" relating to "middling" cotton to a broker whose contracts with spinners are not in "middling" cotton? The answer is that though the ratios between the prices of the various grades alter, the prices of all of them move generally together, and that the "futures" of the Exchange at least provide a hedge against the latter movements. Other things being equal, the broker would be better off if he could hedge with equal ease against all his risks. But other things are not equal: the market would be more confusing and quotations would be complicated if "futures" were in use for all grades.

We may now examine the exchange "futures" in minuter detail. They are quoted as a rule for about ten months ahead. Thus in January the futures quoted will be January (technically termed "current," "present month" or "near month," "futures"), January-February, February-March, March-April, April-May, May-June, June-July, July-August, and perhaps two or three more. Each group, it will be observed, except "current futures," culminates in two defined months. The rule is that on the first of the two months the seller of "futures" may, and before the last day of the second month must, deliver cotton against them, or, what comes to the same thing, buy back the "futures" on the basis of the price of "spot" cotton of middling grade. Various grades of cotton are tenderable against "futures": if this were not so "futures" would be in danger of defeating their object, because the price of the grade upon which they were founded would probably at times be thrown widely out of relation to the general level of prices in the cotton market. The lowest grade tenderable used to be "low middling," but since October 1901 "good ordinary" has also been accepted. Arbitrators report on deliveries and award allowances on those of grades above "middling" and deductions of price from those below. A sample is taken from each bale and the "points on or off" are fixed for each bale separately. If either party is dissatisfied with the award, he may appeal to an appeals committee on paying £3:3:0: which is refunded to him by the other party if the appeal be upheld. The detailed arrangements described above are those of the Liverpool market. The great bulk of "futures," however, are bought back and not delivered against.

Beneath are the official Liverpool quotations of "futures," as they appeared on the morning of the 19th of April 1906:—

*American Deliveries, any port, basis of middling, good ordinary clause (the fractions are given in 100ths of a penny).*

	Yesterday's Close.	To-day's Early Sales.	Values 12.15.
April . . . . .	6.05		6.03
April-May . . . . .	6.05		6.03
May-June . . . . .	6.05	6.06, 5, 4, 3, 2, 1, 2, 3	6.03
June-July . . . . .	6.05	6.05, 2, 1, 3	6.03
July-August . . . . .	6.04	6.05, 4, 3, 2	6.03
Aug.-Sept. . . . .	5.98	5.99, 8, 6	5.97
Sept.-Oct. . . . .	5.34	5.85, 4	5.84
Oct.-Nov. . . . .	5.76	5.77, 6	5.76
Nov.-Dec. . . . .	5.75	5.75, 4 <sup>1</sup>	5.75
Dec.-Jan. . . . .	5.74	5.75 <sup>1</sup>	5.75
Jan.-Feb. . . . .	5.75	5.75 <sup>1</sup>	5.75

	Late Business.	Closing Values.
April . . . . .	6.03 <sup>1</sup>	5.98
April-May . . . . .	6.03	5.98
May-June . . . . .	6.03, 4, 3, 2, 1, 2, 0	5.99
June-July . . . . .	6.04, 3, 2	5.99
July-Aug. . . . .	6.03, 4, 3, 2, 1, 0, 1, 1, 2, 1, 0, 5.99, 6.0, 1, 5.99, 6.0, 5.99, 8	5.98
Aug.-Sept. . . . .	5.98, 1, 6, 5, 4, 5	5.92
Sept.-Oct. . . . .	5.84, 2 <sup>1</sup>	5.78
Oct.-Nov. . . . .	5.76, 1, 5, 1, 4, 3, 4, 3, 1, 2, 1, 0	5.70
Nov.-Dec. . . . .	5.70 <sup>1</sup>	5.69
Dec.-Jan. . . . .	5.72, 1, 2 <sup>1</sup>	5.69
Jan.-Feb. . . . .		5.69

<sup>1</sup> Transactions of 100 bales only.

**Characteristics of "futures."**

**Quotations.**

Egyptian Deliveries, fully good fair (in 64ths of a penny).

	Yesterday's Close.	Business before Noon.	To-day's Business Afternoon.	Closing Values.
April . . .	10-11	..	..	10-1
May . . .	10-12	9-62, 3, 10-0	10-2 <sup>1</sup>	10-1
June . . .	10-11	9-63, 2, 10-0	..	10-0
July . . .	10-9	9-60, 1, 0 <sup>1</sup>	9-63, <sup>1</sup> 10-0, <sup>1</sup> 9-63, 2 <sup>1</sup>	9-62
Aug. . . .	10-0	..	..	9-54
Sept. . . .	9-58	..	..	9-48
Oct. . . .	9-24	..	..	9-18
Nov. . . .	8-58	8-52, <sup>1</sup> 0, 49	..	8-52
Dec. . . .	8-50	8-39 <sup>1</sup>	..	8-42
Jan. . . .	8-44	8-36	..	8-35

Egyptian futures, it will be observed, run out in single months. As the cost of dealing in "futures" is only one shilling on each transaction for a member of the Cotton Exchange (the outsider is charged in addition a commission by his broker), it is not surprising that the transactions taking place in "futures" number legion.

The methods of dealing in cotton are very intricate, and it is necessary here to interpolate an explanation of the relations between the prices paid by spinners for cotton and the quoted "spot" prices. We begin by giving the official quotations of "spot," and statement of business done, published on the morning of the 19th of April 1906.

Quotations.

	G.O.	L.M.	Mid.	G.M.	F.G.M.	M.F.
American . . .	5·87	6·05	6·21	6·41	6·49	6·71
		Mid Fair.	Fair.	Gd. Fair.		
Pernam . . .	5·95			6·35	6·61	
Ceara . . .	6·02			6·40	6·62	
Paraiba . . .	5·94			6·32	6·56	
Maceio . . .	5·96n			6·34n	6·56n	
	Fair.	Gd. Fair.	F.G.F.	Good.	Fine.	
Egyptian br'n . . .	8 <sup>7</sup> / <sub>8</sub>	9 <sup>7</sup> / <sub>8</sub>	10 <sup>1</sup> / <sub>8</sub>	11	11 <sup>3</sup> / <sub>8</sub>	
" Upper . . .	—	9 <sup>1</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>8</sub>	9 <sup>7</sup> / <sub>8</sub> n	10n	
	Gd. Fr.	F.G.F.	Gd.	G.F.	Fine.	S'fine.
M. G. Broach . . .	..	..	5 <sup>7</sup> / <sub>8</sub>	5 <sup>3</sup> / <sub>8</sub> n	5 <sup>3</sup> / <sub>8</sub>	..
Bhownuggar . . .	4 <sup>7</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	5 <sup>1</sup> / <sub>8</sub> n	..
No. 1 Comra . . .	4 <sup>7</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	4 <sup>1</sup> / <sub>8</sub> n	5 <sup>1</sup> / <sub>8</sub> n	..
Bengal . . .	3 <sup>3</sup> / <sub>8</sub>	3 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4 <sup>7</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>2</sub>
Tinnevely . . .	5 <sup>1</sup> / <sub>2</sub>	5 <sup>7</sup> / <sub>8</sub>	5 <sup>1</sup> / <sub>8</sub>	..	..	..

Cotton Ships arrived.

Boston: Canadian S. Hamburg: Iceland S.

	Sales.		Speculation and Export.		Imports including Hull, &c.	
	To-day.	Previous this Week.	To-day.	Previous this Week.	To-day.	Week's Total.
American . . .	6330	18,050	500	1500	17,665	53,684
Pernam, &c. . .	150	200	..	..	..	..
Paraiba, &c. . .	460	130	..	..	..	2
Ceara and Arac'ty . . .	..	30	..	..	..	..
Egyptian . . .	500	1200	..	..	321	7,983
Peruvian . . .	460	350	..	..	32	32
W. I. and African . . .	50	20	..	..	..	..
Surat . . .	..	..	..	..	3,664	3,829
Madras . . .	50	20	..	..	..	..
Bengal . . .	..	..	..	..	608	608
Sundries . . .	..	..	..	..	..	..
Total . . .	8000	20,000	500	1500	22,290	66,138
		8,000		500		
Since Wednesday . . .		28,000		2000		

Purchases for "speculation" remain in the market and therefore figure again in the sales. These official prices are sometimes prices actually paid, and sometimes prices settled by

<sup>1</sup> Transactions of 100 bales only.

a committee according to their notions of the prices that would have been realized at the close of the market had business been done. The work of the committee is by no means simple, as frequently very few transactions take place "Points on or off." in the kinds of cotton of which quotations are given. As regards "middling" American, the committee fixes "spot" by allowing so many "points on or off" present month futures. The variations of the gaps between "spot" and "present month futures" are somewhat mysterious, a matter to which we shall recur. "Spot" quotations, the reader will now understand, are partly nominal, and must therefore be taken as affording a general idea only of movements in the prices of cotton. While quoted "spot" remained low, the prices paid by most spinners for the special kinds of cotton that they needed might rise. When the spinner has informed the dealer exactly what quality of cotton he needs, the dealer quotes so many "points on or off" the "future" quotations prevailing in Liverpool at the time of the purchase, which refer to Upland cotton of "middling grade," of "no staple" and of the worst growth. Then, according as the spinner wants immediate delivery or delivery in some future month, he pays the price of current "futures," or of "futures" of the month in which he requires delivery, plus or minus the "points on or off" previously fixed.

The considerations which determine the "points on or off" charged to the spinner may be taken roughly as three:—

1. The grade, *i.e.* the colour, cleanliness, &c., of the cotton. These are of importance to the spinner owing to the necessity of his cleaning machinery being adapted to the condition of the cotton. The lower the grade the more elaborate and expensive is the machinery required to clean it, and consequently a spinner is willing to pay a certain amount extra for high grade cotton in order to save expenditure on preparatory machinery.

2. The length of the staple. This determines to a large extent the fineness of the yarn which can be spun. Only the very lowest counts can be spun from cotton with "no staple," that is, with a fibre of about three-quarters of an inch. The longer the staple above the minimum the higher the counts that can be spun.

3. The growth. The best American cotton (Sea Island and Florida cotton are always considered quite apart) is grown in the Mississippi valley, the next best in Texas, and the poorest on the Uplands (*i.e.* in Georgia and Alabama). Considerations of growth determine to a great extent the hardness or softness, and strength or weakness, of the fibre, and thus, indirectly, whether the cotton is suitable for warp or weft.

Some spinners cover their yarn contracts merely by buying

"futures," but the cover thus provided is frequently most inadequate owing to variations in the "points on or off" for the particular cotton that they want. For example, after the size of 1904-1905 crops became known, and the Americans attempted to hold back cotton, the "points on" for many qualities rose considerably owing to artificial scarcity, though the price of cotton, as indicated by "spot," remained low. There is a tendency for cautious spinners in England to run no risks and fix the prices of their yarn in accordance with quotations for actual cotton of specified qualities made by their brokers.

We now return to exchange "future" transactions regarded as a genus. In addition to "futures" proper there are "options" and "straddles." Options are single ("puts" or "calls") or double (that is, alternative "puts" or "calls").

The "put" is a right to sell cotton within some specified time in the future at a price fixed in the

present, which need not, of course, be exercised. The "call" is similar, but relates to buying. It will be evident that the "put" is a hedge against prices falling, and the "call" a hedge against their rising. The basis of "options" is the same as that of



ordinary "futures," *i.e.* middling American cotton of "no staple," &c. Whether the purchaser of an option gains or loses depends upon the price that he has paid in relation to the gain, if any, that he makes out of his power. The price of options of course varies: that of double options is always highest, but they are little used. A "straddle" is a speculation on the difference between the prices of nearer and more distant futures, which varies from time to time, or on the difference between the prices of different kinds of cotton. An example will make the nature of the straddle clear. Suppose a dealer buys April-May "futures" at 4d. a lb and sells the same quantity of May-June "futures" at  $4\frac{1}{4}$ d. a lb. Then, whether prices rise or fall as a whole, he gains if the difference between the two prices becomes less than  $\frac{1}{4}$ d., but if it becomes more, he loses. On the other hand, had the dealer bought May-June at  $4\frac{1}{4}$ d. and sold April-May at 4d. he would have gained in the event of the difference increasing, and lost in the event of its decreasing.

A question which has met with a good deal of attention is whether the speculation, which has been encouraged by the various arrangements made for facilitating operations in "futures," has steadied or unsteadied prices. Before we are prepared to answer this question we must be furnished with a precise conception of what is meant by "steadiness" in prices. It is sometimes assumed that this is measured perfectly by the standard deviation,<sup>1</sup> which is obtained by taking the squares of the differences between the average and the individual prices, summing them and extracting the square root. But obviously the information given by the standard deviation is limited: the frequency of movement cannot be inferred from it; two series might have quite different average oscillations and yet the same standard deviation; and the range of movement, or spread of the variations from the average price (though allowed for in the standard deviation more than in the average error), is hidden. Now frequency of movement, average daily price variation, and range of price movements are matters of fundamental importance to the public. Hence for practical purposes we require several kinds of measurement of price movements, and it is impossible to weigh exactly the one against the other in respect of importance. Observe that an increase of the frequency of movement, or even of the average daily movement, is not necessarily objectionable, since changes are less harassing when they take place by small increments than when they are brought about by a few big variations. The difference between the highest and lowest price, we may observe, is a very imperfect indication of the range of movement (though, taken in conjunction with the standard deviation, it is the best at our disposal), because either of the extreme prices might be accidental and quite out of relation to all others. An investigator must be on his guard against using quotations of this kind. There is also a difficulty about the frequency of movement, because as a rule many movements take place in one day the total over a period sufficiently lengthy to yield general results is enormous, and many are unrecorded. In one day, for instance, when the net drop was 33 points and the range of variation 59 points (namely, 8.45 to 7.86), 150 price fluctuations were recorded. However, the count of frequency of movement from daily closing prices would probably afford a roughly satisfactory comparative measurement in markets in which prices sometimes remain the same for a day or two together. The points just noted apply also to the average fluctuation and the standard deviation, but it is probable in these cases that daily or even weekly quotations would be sufficient to yield the information sought for with sufficient exactness for purposes of comparison.

Now, supposing dealing to be confined to experts, what effects upon the course of prices would one expect from the specialism of the cotton market and improved facilities for dealing, on the assumption that dealers were governed wholly in their actions by the course of prices and never tried to manipulate them? The frequency of movement ought to increase because the market

**Effect of speculation on steadiness of prices.**

of movement ought to increase because the market

would become more sensitive, but, other things being equal, the range of movement ought to diminish, and ultimately the average daily movement also, though at first the latter might not fall appreciably if, indeed, it did not rise, owing to the increased frequency of movement. These results would prove beneficial to the community. May we infer deductively that they have been attained because of the increase of speculative transactions? By no means, and for two reasons. In the first place, the public speculates to a large extent on the cotton exchange, and its speculation (taken as a whole) is sheer gambling. But, it may be replied, the outsiders, being as a whole completely ignorant of the forces at work, so that they cannot form rational anticipations, cannot have any effect either way: by the law of chance their influences would neutralize one another. This would be so if people acted independently and without guidance, but actually they are sometimes misled by published advice and movements in the market intended to deceive them, and, even when they are not, they watch each other's attitudes and tend to act as a crowd. The mass becomes unduly sanguine or weakly surrenders to panic. Hence the law of error does not apply, and speculation by the public may unsteady prices. Again, dealers sometimes try to create corners and form powerful syndicates for that purpose: the dealing syndicate of late years has become a force to be reckoned with. Many large-scale operations are entered into, not because prices are relatively high or low, but to make them high or low for ulterior purposes; *i.e.* the market is deliberately "bullied or beared." In consequence of this tampering with the market no certainty can be felt about the effect even of expert dealing.

What, then, we may profitably inquire next, has actually happened to price movements generally as the market has developed? This question can readily be answered as regards the past forty years or so, for which material **Movement of prices.** has been collected, but the reader must bear in mind that if improvement can be traced it cannot logically be attributed unhesitatingly to the perfecting of the machinery of speculation, whereby a larger use has been made of "futures," since many other economic changes have taken place concomitantly and they may have wrought the major effect. The world may be steadying and steeling its nerves. Now, turning to the actual effects, we discover somewhat remarkable facts. Expressed both absolutely and as percentages of the price averaged from the 1st of October to the 31st of July, the range of movement, standard deviation, and mean weekly movement calculated between the times mentioned above (October 1st to July 31st), after diminishing significantly for some years after the later 'sixties, have risen appreciably on the whole of late years. The figures in the table below are from the *Journal of the Royal Statistical Society*, June 1906: quotations for August and September were omitted to avoid the transition movements between the price levels of two crops.

In this table measurements of price movements stated both absolutely and as percentages of price levels are given, because authorities have expressed doubts as to whether the former or the latter might be expected to remain constant, other things being equal, when price rose. On the one hand, it is argued that speculators are affected only by the absolute variations in price, while on the other hand it is contended that a movement of one "point," say, is less influential when the price is about 8d. than when it is about 4d. In response to the first view it might be argued that if speculators are influenced only by the differences for which they become liable, a "point" movement would have a somewhat slighter effect on their action, other things being equal, when price was high, because, supplies being relatively short, each of them would tend to be engaged in a smaller volume of transactions measured in quantity of cotton, than when supplies were larger. But the point need not be discussed further here, since both percentage and absolute indices of unsteadiness have risen of late years. The explanation of this change in the direction of indices of steadiness cannot be proved to consist in any peculiarity in the supplies of recent years. But the dealing syndicate has probably been of late more common and more powerful—that is, the syndicate which exists to make profits out

<sup>1</sup> See article on "Dealings in Futures in the Cotton Market," in the *Journal of the Royal Statistical Society*, vol. lxi, p. 325.

Table calculated from Weekly Prices between the 1st of October and the 31st of July in each Year.

Year.							Expressed as Percentage of Average (1st Oct. to 31st July) Weekly Prices.		
	Average Price.	Lowest Price.	Highest Price.	Range of Movement.	Standard Deviation.	Mean Weekly Movement.	Range of Movement.	Standard Deviation.	Mean Weekly Movement.
1867-1868	9 $\frac{1}{2}$	7 $\frac{3}{8}$	12 $\frac{1}{2}$	5 $\frac{1}{2}$	1.74	0.31	57.1	18.1	3.22
1868-1869	11 $\frac{1}{2}$	10 $\frac{1}{2}$	12 $\frac{3}{8}$	2 $\frac{1}{2}$	0.58	0.19	18.5	5.0	1.65
1869-1870	11 $\frac{1}{2}$	7 $\frac{1}{2}$	12 $\frac{3}{8}$	4 $\frac{3}{8}$	0.92	0.23	41.6	8.3	2.07
1870-1871	8 $\frac{1}{2}$	7 $\frac{1}{8}$	9 $\frac{3}{8}$	2	0.65	0.17	24.6	8.0	2.09
1871-1872	10 $\frac{1}{2}$	9 $\frac{1}{2}$	11 $\frac{1}{2}$	2 $\frac{1}{2}$	0.75	0.15	19.5	6.9	1.38
1872-1873	9 $\frac{1}{2}$	8 $\frac{1}{2}$	10 $\frac{1}{2}$	2 $\frac{1}{2}$	0.53	0.10	16.0	5.7	1.08
1873-1874	8 $\frac{1}{2}$	7 $\frac{1}{2}$	9 $\frac{1}{2}$	2 $\frac{1}{2}$	0.32	0.10	16.5	3.9	1.20
1874-1875	7 $\frac{1}{2}$	6 $\frac{1}{2}$	8	1 $\frac{1}{2}$	0.26	0.07	13.8	3.4	0.89
1875-1876	6 $\frac{1}{2}$	5 $\frac{1}{2}$	7 $\frac{1}{2}$	2	0.37	0.08	19.2	5.7	1.23
1876-1877	6 $\frac{1}{2}$	5 $\frac{1}{2}$	7	1 $\frac{1}{2}$	0.33	0.11	17.8	5.2	1.74
1877-1878	6 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.21	0.07	11.0	3.4	1.12
1878-1879	6	4 $\frac{1}{2}$	7 $\frac{1}{2}$	3	0.67	0.13	37.5	11.2	2.17
1879-1880	7	6 $\frac{1}{2}$	7 $\frac{1}{2}$	1 $\frac{1}{2}$	0.24	0.12	10.7	3.4	1.71
1880-1881	6 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.34	0.08	16.8	5.4	1.27
1881-1882	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	1 $\frac{1}{2}$	0.15	0.07	10.4	2.3	1.06
1882-1883	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.31	0.07	20.4	5.3	1.20
1883-1884	6 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.20	0.08	11.3	3.3	1.32
1884-1885	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.19	0.07	11.8	3.3	1.20
1885-1886	5 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	1 $\frac{1}{2}$	0.18	0.07	14.5	3.5	1.35
1886-1887	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6	0	0.28	0.05	16.1	5.2	0.92
1887-1888	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	0	0.14	0.05	9.1	2.5	0.91
1888-1889	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	0	0.23	0.06	15.0	4.0	1.04
1889-1890	6 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	0.34	0.08	18.4	5.5	1.31
1890-1891	5	4 $\frac{1}{2}$	5 $\frac{1}{2}$	1 $\frac{1}{2}$	0.36	0.06	27.5	7.2	1.20
1891-1892	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	1 $\frac{1}{2}$	0.36	0.07	33.3	8.7	1.70
1892-1893	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	1 $\frac{1}{2}$	0.37	0.09	25.0	7.8	1.89
1893-1894	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	1 $\frac{1}{2}$	0.22	0.04	18.4	5.2	0.94
1894-1895	3 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	1 $\frac{1}{2}$	0.30	0.06	26.9	8.9	1.79
1895-1896	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	1 $\frac{1}{2}$	0.28	0.07	25.0	6.4	1.60
1896-1897	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	1 $\frac{1}{2}$	0.22	0.07	21.6	5.2	1.67
1897-1898	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	0	0.18	0.05	18.5	5.3	1.47
1898-1899	3 $\frac{1}{2}$	3	3 $\frac{1}{2}$	0	0.15	0.04	14.3	4.6	1.22
1899-1900	4 $\frac{1}{2}$	3 $\frac{1}{2}$	6 $\frac{1}{2}$	3	0.63	0.12	43.6	12.8	2.48
1900-1901	5 $\frac{1}{2}$	4 $\frac{1}{2}$	6 $\frac{1}{2}$	2 $\frac{1}{2}$	0.53	0.13	42.7	10.3	2.54
1901-1902	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	1 $\frac{1}{2}$	0.24	0.09	22.4	5.0	1.89
1902-1903	5.35	4.42	7.12	2.70	0.78	0.13	50.5	14.6	2.43
1903-1904	7.04	5.78	8.92	3.14	0.91	0.33	44.4	12.9	4.83
1904-1905	4.86	3.63	6.01	2.38	0.71	0.15	48.9	14.6	3.09

of manipulating the market—and the public has probably been speculating increasingly. It is plausible, then, to suppose that the dealing syndicate primarily, and the speculations of the public secondarily (secondarily, because in all likelihood the effect of its operation would be much less in magnitude), may account for the change.

“Futures” are not used in all markets—for instance, they are not to be found at Bremen; and in those in which they are used they play parts of different prominence—at Havre, for instance, the transactions in “futures” are of incomparably less relative importance than they are at Liverpool. But it is futile to seek the effect of much dealing in “futures” in the differences between price movements in the various markets, because (1) demand expresses itself in different ways—in Germany, for example, spinners buy to hold large stocks—and (2) the markets are in telegraphic communication, so that their price movements are kept parallel. Mr Hooker has shown with reference to the wheat market how close is the correlation between prices in different places,<sup>1</sup> and the same has been observed of the cotton market, though the

Conceivably some indication of the working of “futures” might be gleaned from observation of the relations of near and distant “futures” to one another and of both to “spot.” The complete explanation of changes in these relations is still a mystery.<sup>3</sup> Probably an infinitude of subtle influences came into play, and among these there seems reason to include the intentional and unintentional “bulling” or “bearing” of the market. Some examples of the diverse relations to be found, even when all the “futures” fall in the same crop year, may be quoted here—quotations running into the new crop year are obviously affected by anticipations of the new crop.

As we pass from the “future” of the month in which the quotation is made to the most distant “future” it will be observed that in the first and second cases price rises continuously, in the second case even passing “spot,” whereas in the third case it falls first and then rises. Instances might be given of its falling intermittently. It seems a plausible conjecture that if “futures” were “bulling” the market in the first case, they were at least “bulling” it less in the second case *ceteris paribus*, and probably

	Spot.	Jan.-Feb.	Feb.-March	March-April.	April-May.	May-June.	June-July.	July-Aug.	Aug.-Sept.	Sept.-Oct.	Oct.-Nov.	Nov.-Dec.	Dec.-Jan.
Nov. 18th, 1895 . . .	4.34	27	28	28 $\frac{1}{2}$	29 $\frac{1}{2}$	31	32	33	..	..	..	27	27
Jan. 18th, 1899 . . .	3.8	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	11 $\frac{1}{2}$	12	12 $\frac{1}{2}$	..	..	6 $\frac{1}{2}$
Sept. 14th, 1899 . . .	3.36	24 $\frac{1}{2}$	25	25 $\frac{1}{2}$	26	27	..	..	30	28	26 $\frac{1}{2}$	25	24 $\frac{1}{2}$

correlations have not been worked out.<sup>2</sup> It is worthy of note that Liverpool “futures” are largely used for hedging by continental cotton dealers.

<sup>1</sup> *Journal of the Statistical Society*, 1906.

<sup>2</sup> See paper in the *Journal of the Statistical Society* for June 1906.

“bearing” it in the last case. A closer examination will reveal further that the magnitude of these gaps varies a great deal; and

<sup>3</sup> Attempts to explain them were made in an article in the *Economic Journal* in December 1904, and in the paper already referred to read to the Royal Statistical Society.

if the "futures" do "bear" and "bull," as has been supposed, they probably influence these magnitudes. It might be thought that the "futures" of different months, being substitutes in proportion to their temporal proximity to one another, should vary together exactly; but it would seem to be a sufficient reply that as they are not perfect substitutes they are in some slight degree independent variables. The "spot" market might be judged generally as too high, in view of crops and the probable normal demand of the year, but it might not therefore drop immediately, owing partly to the pressure of demand that must be satisfied instantaneously. "Current futures" would be affected more than "spot" by this impression as to the relation of "spot" to a conceived normal price for the year, and they might therefore be expected to drop more than "spot" when this impression was at all widely entertained. But the fall of "current futures" would be checked by the demands that must be satisfied in the near future. Probably the prices of the more distant "futures" are determined in a higher degree by far-reaching imagination than the prices of nearer-futures. This explains what has been called above the unintentional "bearing" of "spot" by "futures." And it is immediately evident that the deliberate "bear" works by selling "futures," and that the effect of his sales is propagated to "spot." These statements are equally true of "bulling." The influence of expectations of the new crop on "futures" running into the new crop is plain on inspection; but owing to the gap between the two crop years it would be astonishing if "futures" against which cotton from a new crop could be delivered were not appreciably independent of "spot" at the time of their quotation. However, it is noticeable that they are still so closely bound up with "futures" culminating in the old crop year that the daily movements of the former are closely correlated with those of the latter. Concluding cautiously, we may admit the probability of the relations between near and distant "futures" and "spot" (even in respect of "futures" running out in the same crop year) indicating sometimes at least the intentional or unintentional "bulling" or "bearing" or "spot" by "futures." But nothing has yet been proved from these facts as to the effect "futures" are having upon the steadiness of prices. In the case of any crop year, if the relations which are suggested as indicating the "bulling" work of "futures" usually corresponded with "spot" prices being below the normal price of the crop year, or of what was left of the crop year, while the relations which are suggested to indicate the "bearing" work of "futures" on the whole corresponded with a relatively abnormal height of "spot," it would be a legitimate inference that "futures" were tending to smooth prices. However, it is made clear as the result of an elaborate examination that the generality of these correspondences cannot be affirmed.<sup>1</sup> The outcome of the whole matter is that the investigator is still baffled in his attempt to discover what effect the use of "futures" is having upon prices to-day. The sole piece of evidence, from which probable conclusions may be drawn, is that three separate measurements of price fluctuations over some forty years reveal a growing unsteadiness of late, whether they be expressed absolutely or as percentages of price.

The uneasiness caused by the excessive dependence of Great Britain upon the United States for cotton, coupled with the belief that shortages of supply are more frequent than they ought to be, and the fear that diminishing returns may operate in America, occasioned the formation in England of the British Cotton Growing Association on the 12th of June 1902. The proportions of England's supplies drawn from different fields is indicated in the table below.

British dependence on American supplies is greater even than that of the continent of Europe, for Russia possesses some internal supplies, and more Indian cotton is used in continental countries than in England.

<sup>1</sup> See the paper already mentioned in the *Journal of the Royal Statistical Society* for June 1906, where the several points noticed briefly above are fully discussed.

*Average Quantities of Raw Cotton imported Annually into the United Kingdom from the following Countries in the Periods 1896-1900 and 1901-1904.*

Country.	1896-1900. Million lb.	1901-1904. Million lb.
United States . . . . .	1436	1424
Brazil . . . . .	13.8	31.5
Peru . . . . .	8.5	8.6
Chile (including the Pacific coast of Patagonia) . . . . .	.8	2.2
Venezuela and Republic of Colombia . . . . .	.5	.5
British West Indies and British Guiana . . . . .	.3	.6
Turkey (European and Asiatic) . . . . .	.5	1.1
Egypt . . . . .	295.7	314.4
British possessions in the East Indies . . . . .	40.7	61.9
Australasia . . . . .	.035	.041
All other countries . . . . .	2.3	3.8
Total . . . . .	1800	1849
Re-exported . . . . .	223	260

The annual average shipments from Bombay to the European continent and to Great Britain in 1900-1904 were as follows:—

To the continent . . . . .	600 bales of 3½ cwt.
To Great Britain . . . . .	50 " " "

At the end of the 18th century the bulk of British cotton was obtained from the West Indies. Approximately the supplies were as follows in million lb:—

British West Indies . . . . .	6.6
French and Spanish settlements . . . . .	6
Dutch settlements . . . . .	1.7
Portuguese " . . . . .	2.5
East Indies " . . . . .	.1
Smyrna or Turkey . . . . .	5.7

The British Cotton Growing Association works under the sanction of a royal charter and has met with valuable official support. Financial assistance and assurances as to sales and prices have been given liberally by the association where they are needed; ginning and buying centres have been established; experts have been engaged to distribute seed and afford instruction; and some land has been acquired for working under the direct management of the association. The governments of some colonies have aided the efforts of the association. Professor Wyndham Dunstan of the Imperial Institute, on a reference from the government, made favourable reports as to the possibilities of extending cotton cultivation. The results may be seen in the approximate estimates below of cotton grown more or less directly under the auspices of the association.

*Bales of 400 lb.*

	1903.	1904.	1905.	1906.
Gambia . . . . .	50	100	300	..
Sierra Leone . . . . .	50	100	200	250
Gold Coast . . . . .	50	150	200	250
Lagos . . . . .	500	2,000	3,200	6,300
Nigeria . . . . .	100	200	650	1,200
West Africa . . . . .	750	2,550	4,550	8,000
West Indies . . . . .	1,000	2,000	4,000	6,000
East Africa . . . . .	150	850	2,000	3,500
Sind . . . . .	..	..	500	2,000
Sundries . . . . .	..	100	250	500
Total . . . . .	1,900	5,500	11,300	20,000
Approximate value	£29,000	£75,000	£150,000	£270,000

In the West Indies results are most favourable, both as regards quantity and quality of the crops. West Indian grown cotton has realized even higher prices than American grown Sea Island. In West Africa also prospects appear encouraging. In Sierra Leone little success has been met with, but on the Gold Coast some cotton better than middling American has been grown, and the association has concluded an agreement with the government for an extension of its work. In Lagos crops increased rapidly. The cotton is almost entirely grown by natives in small patches round their villages, and generally it

has sold for about the same price as middling American, though some of it realized as much as 25 to 30 "points on." The quality in greatest demand in England, it should be observed, is worth about  $\frac{1}{4}$ d. to  $\frac{1}{2}$ d. per lb. above middling American. In Southern Nigeria the association has met with only slight success; in Northern Nigeria, a working arrangement was entered into with the Niger Company, and a small ginning establishment was set to work in February 1906. In British Central Africa, the results on the whole have not been satisfactory. Though planters who confined their efforts to the lower lying grounds—of which there is a fairly large tract—succeeded, all the cotton planted on the highlands proved more or less a failure. In Uganda the association took no steps, but activity in cotton-growing is not unknown, and some good cotton is being produced. Arrangements were concluded with the British South Africa Company for the formation of a small syndicate for working in Rhodesia.

The general movement for the extension of cotton cultivation was welcomed by the International Congress of representatives of master cotton spinners and manufacturers' associations at the meeting at Zurich in May 1904. It placed on record "its cordial appreciation of the efforts of those governments and institutions which have already supported cotton-growing in their respective colonies." England is pre-eminent but not alone in the matter. Germany and France, and in a less degree Belgium, Portugal and Italy, have taken some steps. Russia, too, is developing her internal supplies.

The advantages that might accrue from the wider distribution of cotton-growing are mainly fourfold. (1) Greater elasticity of supply might be caused. It is probably easier to extend the area under cotton rapidly when crops are raised from many places in proximity to other crops than when the mass of the cotton is obtained from a few highly specialized districts. Possibly the advantages of specialism might be retained and yet the elasticity of supply be enhanced. (2) Greater stability of crops in proportion to area cultivated is hoped for. The eggs are now too much in one basket, and local disease, or bad weather, or some other misfortune, may diminish by serious percentages the supplies anticipated. Were there numerous important centres the bad fortune of one would be more adequately offset by the good fortune of another. (3) Desirable variations in the raw material might conceivably eventuate from the introduction of cotton to spots in the globe where its growth was previously unknown or little regarded. The results of the enterprise of Mehemet Ali and Jumel in Egypt prove such an idea to be not altogether fanciful, and warn us also against hastily arguing that the plan is too artificial to succeed on a large scale. Without the active intervention of a strong body of interested parties it is sometimes unlikely that new industries will be undertaken even in places well suited for them. (4) Lastly, the countries to which cotton-growing is carried should gain in prosperity.

The general difficulties in the way of the British Cotton Growing Association are many and will be sufficiently evident.

Lessons of value may be learnt from the fate of similar work undertaken by the Cotton Supply Association, which was instituted in April 1857. According to its fifth report, it originated "in the prospective fears of a portion of the trade that some dire calamity must inevitably, sooner or later, overtake the cotton manufacture of Lancashire, whose vast superstructure had so long rested upon the treacherous foundation of restricted slave labour as the main source of supply for its raw material."<sup>1</sup> Its methods were stated to be: "To afford information to every country capable of producing cotton, both by the diffusion of printed directions for its cultivation, and sending competent teachers of cotton planting and cleaning, and by direct communication with Christian missionaries whose aid and co-operation it solicits; to supply, gratuitously, in the first instance, the best seeds to natives in every part of the world who are willing to receive them; to give prizes for the extended cultivation of cotton; and

The Association published a weekly paper known as *The Cotton Supply Reporter*.

to lend gins and improved machines for cleaning and preparing cotton." Though the association brought about an extension and improvement of the Indian crop, in which result it was enormously assisted by the high prices consequent upon the American Civil War, it sank after a few years into obscurity, and soon passed out of existence altogether, while the effects of its work dwindled finally into insignificance. Much the same had been the ultimate outcome of the spasmodic attempt of the British government to bring about the introduction of cotton to new districts, after it had been pressed to take some action a few years prior to the formation of the Cotton Supply Association. A Mr Clegg, who afterwards interested himself keenly in the activities of the Cotton Supply Association reported that in the course of a tour in 1855 through the Eastern countries bordering on the Mediterranean he had found none of the gins presented by the British government at work or workable.

**BIBLIOGRAPHY.**—On the question of cotton supplies, as treated in this article, the reader may be referred to Brook's *Cotton, its Uses, &c.*; Dabney's *Cotton Plant* (Department of Agriculture of the United States); Foaden's *Cotton Culture in Egypt*; Dunstan's *Report on Cotton Cultivation* for the British government; Ooppel's *Die Baumwolle*; Leconte's *Le Coton*; publications of the British Cotton Growing Association; *Report of the Lancashire Commission* on the possibility of extending cotton cultivation in the Southern States of North America; Watt's *Lancashire and the Cotton Famine*; publications of the old Cotton Supply Association (many will be found in the Manchester public library in the volume marked "677 I. C. ii."), including their weekly paper, *The Cotton Supply Reporter*; Hammond's *Cotton Culture and Trade*. On methods of marketing to certain portions of the above must be added: Ellison's *Cotton Trade of Great Britain*; Chapman's *Lancashire Cotton Industry* (ch. vii.); articles by Chapman and Knoop in the *Economic Journal* (December, 1904) and the *Journal of the Royal Statistical Society* (April, 1906); Emery's *Speculation on Stock and Produce Exchanges of the United States* (small portions of which relate to cotton). Many statistics will be found in the works mentioned, and these may be supplemented from the trade publications of different countries. Many valuable figures of cotton imports, &c., in early years will be found in Baines' *History of the Cotton Trade*. Recent statistics bearing upon cotton are collected annually in the two publications, Shepperson's *Cotton Facts* and Jones's *Handbook for Daily Cable Records of Cotton Crop Statistics*. For current information the following may be added: Nield's, Ellison's and Tattersall's circulars; *Cotton* (the publication of the Manchester Cotton Association); and daily reports and articles in the local press. Price curves are published by Messrs Turner, Routledge & Co. (S. J. C.)

#### COTTON GOODS AND YARN

The two great sections of the cotton industry are *yarn* and *cloth*, and in Great Britain the production of both of these is mainly in South Lancashire, though the area extends to parts of Cheshire, Yorkshire and Derbyshire, and there is a Scottish branch, besides certain isolated ventures in other parts of the country. Though there are local rivalries there is nothing in competitive division to compare with the northern and southern sections in America, and the British industry is, for its size, more homogeneous than most of the European industries. Both operatives and employers are highly organized and both parties are able to make articulate contribution to the solution of the various problems connected with the trade.

*Cotton Yarn.*—The yarn trade is mainly in the hands of limited companies, and a private firm is looked upon as something of a survival from the past. The two great centres of production are Oldham, in which American cotton is chiefly, though not exclusively, spun, and Bolton, which spins the finer counts from Egyptian or Sea Island cotton. Spinning mills are established, however, in most of the large Lancashire towns as well as in some parts of Cheshire and in Yorkshire, where there is a considerable industry in doubling yarns. The centre of trade is the Manchester Royal Exchange, and though some companies or firms prefer to do business by means of their own salaried salesmen, managers or directors, most of the yarn is sold by agents. Frequently a single agent has the consignment of the whole of a company's yarn, but many spinners, especially those whose business connexion is not perfectly assured, prefer to have more outlets than can be explored by an individual. At times of bad trade even those who usually depend on their own resources seek the aid of experienced agents, who sometimes find a grievance if their

services are rejected when trade improves and sales are made easily.

Yarn is sold upon various terms, but a regular custom in the home trade is for the spinner to allow 4% discount, for payment in 14 days, of which  $2\frac{1}{2}$  goes to the buyer, who is commonly a manufacturer, and  $1\frac{1}{2}$  to the agent for sale and guaranteeing the account. In selling yarn for export it is usual to allow the buyer only  $1\frac{1}{2}$ % for payment in 14 days, or in some cases the discount is at the rate of 5% per annum for 3 months, which is equivalent to  $1\frac{1}{4}$ %.

The great bulk of the yarn spun in Great Britain ranges between comparatively narrow limits of count, and such staples as 32<sup>s</sup> to 36<sup>s</sup> twist and 36<sup>s</sup> to 46<sup>s</sup> weft in American, 50<sup>s</sup> to 60<sup>s</sup> twist and 42<sup>s</sup> to 62<sup>s</sup> weft in Egyptian, make up a large part of the total. It is nevertheless the experience of yarn salesmen that Lancashire produces an increasingly large amount of specialities that indicate a continued differentiation in trade. The tendency to spin finer counts has been to some extent counteracted by the development of the flannelette trade, for which heavy wefts are used, and there has been again a tendency lately to use "condensor" or waste wefts, which has worked to the disadvantage of the spinners of the regular coarse counts spun at Royton and elsewhere. The demand for cloths which require careful handling and regularity in weaving has helped to develop the supply of ring yarns which will stand the strain of the loom better than mule twists. A great amount of doubled and trebled yarn is now sold, though it does not appear that recent expansions have added much to doubling spindles, and considerable developments continue in the use of dyed and mercerized yarns.

Yarns are sold according to their "actual" counts, though when they are woven into cloth they frequently attain nominal or brevet rank. There has been a long-continued discussion, which between buyer and seller sometimes degenerates into a dispute, on the subject of moisture in yarns, and the difficulty is not confined to the Lancashire industry. The amount permissible, according to the recommendation of the Manchester Chamber of Commerce, is 8%, but while it may be assumed that yarns at the time of their sale rarely contain less than this, they frequently contain a good deal more. It is a matter of experience that cotton yarns which when spun contain only a small percentage of moisture will absorb up to about 8% when they are exposed to what may be rather vaguely described as natural conditions. The exigencies of competition prompted the discovery that if yarn were sold by weight fresh from the spindle its comparative dryness made such early sale less profitable than if it were allowed to "condition." Between loss and delay the spinner found an obvious alternative in damping the yarn artificially. As it was often clearly to the advantage of the buyer that he should receive immediate delivery he did not object to water in moderation, but art soon began to run a little ahead of nature. The essentially dishonest practice of deluging yarn with water, which has sometimes even degenerated into the use of weighting materials deleterious to weaving, has been recognized as a great nuisance, but while various attempts have been made to protect the buyer the question seems to have pretty well settled itself on the principles which commonly rule the sales of commodities between those who intend to do business continuously. The spinner who persists in over-weighting his yarn finds it difficult to obtain "repeat" orders.

A remarkable point in the Lancashire yarn trade is the looseness of the contracts between spinner and manufacturer. Doubtless some kind of sale note or acknowledgment usually passes between them, but in the home trade at least it is quite usual to leave the question of delivery an open one. It would not be

correct to say that this system or want of system is satisfactory, but the trade manages to rub along very well with it, although inconveniences and disagreements sometimes arise when prices have advanced or declined considerably. Thus when prices have advanced the manufacturer may find it difficult to obtain delivery of the yarn that he had bought at low rates, for some spinners have a curious, indefensible preference for delivering their higher-priced orders; and, on the other hand, when prices have fallen the manufacturer sometimes ceases to take delivery of the high-priced yarn and actually purchases afresh for his needs. Yet positive repudiation is very rare though compromises are not uncommon, and a good many illogical arrangements are made that imply forbearance and amity. Litigation in the yarn trade is very unusual, and Lancashire traders generally have only vague notions of the bearing of law upon their transactions, and a wholesome dread of the experience that would lead to better knowledge.

The average yearly values of the exports of cotton, yarn and cloth from Great Britain for the decades 1881-1890 and 1891-1900 respectively, are given by Professor Chapman in his *Cotton Industry and Trade*, in million pounds:—

	1881-1890.	1891-1900.
Cloth	£60.4	£57.3
Yarn	12.3	9.3
Total	£72.7	£66.6

During the earlier decade the prices of cotton were comparatively high. The whole of the cloth exports represent, of course, a corresponding home trade in yarns. The following table, taken from the *Manchester Guardian*, gives in thousands of lb the amounts of cotton yarns exported from Great Britain during 1903, 1904 and 1905 respectively, according to the Board of Trade returns, together with the average value per lb for each of the countries:—

	1903.		1904.		1905.	
	lb. <sup>1</sup>	Price per lb.	lb. <sup>1</sup>	Price per lb.	lb. <sup>1</sup>	Price per lb.
		d.		d.		d.
Russia	814	30.22	713	30.71	557	30.66
Sweden	1,526	11.00	1,486	12.55	1,512	11.12
Norway	1,656	9.54	1,511	11.05	1,606	9.73
Denmark	2,429	8.91	2,368	10.18	2,860	9.51
Germany	27,239	16.05	40,295	16.27	39,513	16.38
Netherlands	29,591	9.10	29,384	10.48	37,341	8.93
Belgium	3,970	15.89	5,864	16.50	7,205	16.12
France	3,974	17.59	3,084	20.01	3,518	22.64
Italy	204	21.78	174	24.70	204	22.21
Austria-Hungary	2,662	11.60	3,329	14.36	3,066	13.36
Rumania	4,608	8.55	5,072	10.13	7,856	9.73
Turkey	12,966	8.93	14,253	10.05	17,389	9.37
Egypt	4,590	8.66	4,381	9.83	4,382	8.59
China (including Hong-Kong)	4,660	9.45	2,457	10.24	8,441	8.70
Japan	1,406	12.98	681	11.46	4,071	13.99
British India—						
Bombay	6,286	10.80	8,145	11.88	13,112	10.86
Madras	6,683	11.07	8,288	12.48	10,930	11.91
Bengal	6,777	11.04	6,596	12.82	11,068	11.20
Burma	5,611	12.17	3,388	12.39	4,211	12.31
Straits Settlements	1,945	10.81	1,137	11.57	2,149	10.71
Ceylon	33	11.92	44	16.51	42	13.55
Other countries	21,129	12.39	21,252	13.28	23,970	12.43
Total and average	150,758	11.79	163,901	13.11	205,001	12.08

It should be understood, however, that in some cases the Board of Trade figures represent only an approximation to the ultimate distribution, as the exports are sometimes assigned to the intermediate country, and in particular it is understood that a considerable part of the yarn sent to the Netherlands is destined for Germany or Austria. The large business done in yarns with the continent of Europe is in some respects an extension of the British home trade, though certain countries have their own specialities. A considerable business is done with European countries in doubled yarns and in fine counts of Egyptian, including "gassed" yarns, which are also sent intermittently to Japan. "Extra hard" yarns are sent to Rumania and other Near Eastern markets, and Russia, as the average price indicates, buys sparingly of very fine yarns. The trade with the Far East, which, though not very large for any one market, is important in the aggregate, is a good deal specialized, and since the

<sup>1</sup> 000 omitted.

development of Indian and Japanese cotton mills some of the trade in the coarser counts has been lost. The various Indian markets take largely of 40<sup>s</sup> mule twist and in various proportions of 30<sup>s</sup> mule, water twists, two-folds grey and bleached, fine Egyptian counts and dyed yarns. China also takes 40<sup>s</sup> mule, water twists and two-folds. The general export of yarn varies according to influences such as tariff charges, spinning and manufacturing development in the importing countries and the price of cotton. A particular effect of high-priced piece-goods is seen in various Eastern countries that are still partly dependent on an indigenous hand-loom industry. The big price of imported cloths throws the native consumer to some extent upon the local goods, and so stimulates the imports of yarn. It appears that as the native industries decline the weaving section persists longer than the spinning section.

*Cotton Goods.*—Cotton goods are of an infinite variety, and the titles that experience or fancy have evoked are even more numerous than the kinds. Descriptions of the following fabrics, which are not of course invariably made of cotton, will be found in separate articles: BAIZE, BANDANA, BOMBAZINE, BROCADE, CALICO, CAMBRIC, CANVAS, CHINTZ, CORDUROY, CRAPE, CRETONNE, DENIM, DIMITY, DRILL, DUCK, FLANNELETTE, FUSTIAN, GAUZE, GINGHAM, LONGCLOTH, MOLESKIN, MULL, MUSLIN, NANKEEN, PRINT, REP, TICKING, TWILL, VELVETEEN. The following are notes on other varieties.

*Grey cloth* is a comprehensive term that includes unbleached cotton cloth generally. It may be a nice question whether "yellow" would not have been the more nearly correct description. A very large proportion of the Lancashire export trade is in grey goods and a smaller yet considerable proportion of the home trade.

*Shirting*, which has long since ceased to refer exclusively to shirt cloths, includes a large proportion of Lancashire manufacture. Grey and white shirtings are exported to all the principal Eastern markets and also to Near Eastern, European, South American, &c. markets. Certain staple kinds, such as 39 in. 37½ yd. 8½ lb. 16×15 (threads to the ¼ in.), largely exported to China and India, are made in various localities and by many manufacturers. The length quoted is to some extent a conventional term, as the pieces in many cases actually measure considerably more. The export shirting trade is done mainly on "repeat" orders for well-known "chops" or marks. These trade marks are sometimes the property of the manufacturer, but more commonly of the exporter. Generally the China markets use rather better qualities than the Indian markets. The principal China market for shirtings and other staple goods is Shanghai, which holds a large stock and distributes to minor markets. A considerable trade is also done through Hong-Kong and other Far Eastern ports. The principal Indian markets are Calcutta, Bombay, Karachi and Madras.

*Shirt-cloth* is the term more commonly applied to what is actually used in the manufacture of shirts, and it may be used for either plain or fancy goods.

*Sheeting* has two meanings in the cotton trade: (1) the ordinary bed sheeting, usually a stout cloth of anything from 45 in. to 120 in. wide (the extremes being used on the one hand for children's cots or ship bunks and on the other for old-fashioned four-posters), which may be either plain or twilled, bleached, unbleached or half-bleached; (2) a grey calico, heavier than a shirting, sent largely to China and other markets, usually 36 in. by 40 yd. and weighing about 12 lb. American sheetings compete with Lancashire goods in the China market. The *Cabot* is a kind of heavy sheeting, and for the Levant markets the name as a trade mark is said to be the exclusive property of an American firm, although the general class is known by the name and supplied by other firms.

*Mexican* is a plain, heavy grey calico, sometimes heavily sized. The origin of the word is doubtful, and it seems to be an arbitrary term. Mexicans are exported to various markets and also used in the home trade. For export the dimensions are commonly 32 or 36 in. by 24 yd., and a usual count is 18×18. In the Mexican the yarns were originally of nearly the same weight and number of threads to the ¼ in., an arrangement which gave the cloth an even appearance, thus differing from the "pin-head" or medium makes. Now, however, Mexicans are

often made with lighter wefts, though the name is usually applied to the better class of cloths of the particular character. *Punjum* is a Mexican, generally 36 yd. in length, sent mainly to the South African market.

*T Cloth* is a plain grey calico, similar in kind to the Mexican and exported to the same markets. There is no absolute distinction between the two cloths, but the T cloth is generally lower in quality than the Mexican. The name seems to have been originally an arbitrary identification or trade mark.

*Domestic*, a name originally used in the sense of "home-made," is applied especially to home-made cotton goods in the United States. In Great Britain it is employed rather loosely, but commonly to describe the kind of cloth which if exported would be called a Mexican. It may be either bleached or unbleached.

*Medium* is a plain calico, grey or bleached, of medium weight, used principally in the home and colonial trade. The word is sometimes particularly applied to cloths with a comparatively heavy weft, the distinction being made between the even "Mexican make" and the "pin-head" or "medium-make."

*Raising-cloths* are of various kinds and may be merely mediums with a heavy weft, or "condensor" weft made from waste yarns. The essence of the raising-cloth is a weft that will provide plenty of nap and yet have sufficient fibre to maintain the strength of the web.

*Wigan* is a name derived from the town Wigan and seems to have been originally applied to a stiff canvas-like cloth used for lining skirts. Now it is commonly applied to medium or heavy makes of calico.

*Double-warp*, as its name implies, is a cloth with a twofold warp. It is usually a strong serviceable material and may be either twilled or plain. Sheetings for home trade are often double-warp, and double-warp twills and Wigans were and are used for the old-fashioned type of men's night-shirts.

*Croydon*, which seems to be an arbitrary trade name, is a heavy, bleached, plain calico, usually stiff and glossy in finish. It used to be sold largely in the Irish trade as well as in the English home trade, but it has been supplanted a good deal by softer finishes.

*Printing-cloth* is a term with a general significance, but it is also particularly applied to a class of plain cloths in which a very large trade is done both for home trade and export. The chief place in Lancashire for the manufacture of printing-cloths is Burnley, and in the United States, Fall River. The Burnley cloths range in width from 29 in. to 40 in., and are usually about 120 yd. in length. The warp is commonly from 36<sup>s</sup> to 44<sup>s</sup>, the weft from 36<sup>s</sup> to 54<sup>s</sup>, and the threads from 13×13 to 20×20 to the ¼ in. Cheshire printers, which are made at Hyde, Stockport, Glossop and elsewhere, are commonly 34 in. to 36 in. wide, the warp is from 32<sup>s</sup> to 36<sup>s</sup>, the weft 32<sup>s</sup> to 40<sup>s</sup>, and the counts 16×16 to 19×22.

*Jaconet* is understood to be the corruption of an Indian name, and the first jacconets were probably of Indian origin. They now make one of the principal staple trades of Lancashire with India. The jacconet is a plain cloth, lighter than a shirting and heavier than a mull. When bleached it is usually put into a firm and glossy finish. A *nainsook* is a jacconet bleached and finished soft. It also goes largely to India.

*Dhootie* is a name taken from a Hindu word of similar sound and referred originally to the loin-cloth worn by Hindus. It is a light, narrow cloth made with a coloured border which is often so elaborate as to require a dobbie loom for its manufacture. The finer kinds, made from Egyptian yarns, are called mull-dhooties. The dhootie is one of the principal staples for India and is exported both white and grey.

*Scarf* is a kind of dhootie made usually with a taped or corded border.

*Madapolam* or *Madapollam* is a name derived from a suburb of Narsapur in the Madras presidency where the cloth was first made. It is now exported grey or white to India and other countries. In weight it is lighter than a shirting, and it is usually ornamented with a distinctive coloured heading.

*Baft*, probably of Persian derivation, and originally a fine cloth, is now a coarse and cheap cloth exported especially to Africa.

*Sarong*, the Malay word for a garment wrapped round the lower part of the body and used by both men and women, is now applied to plain or printed cloths exported to the Indian or Eastern Archipelago for this purpose.

*Jean*, said to be derived from Genoa where a kind of fustian with this title was made, is a kind of twilled cloth. The cloth is woven "one end up and two ends down," and as there are more picks of weft per inch than ends of warp the diagonal lines pass from selvage to selvage at an angle of less than 45 degrees. The weft surface is the face or wearing surface of the cloth. Jeans are exported to China and other markets, and are also used in the home trade. *Jeanette* is the converse of jean, being a twill of "two ends up to one down"; the diagonal passes from selvage to selvage at a greater angle than 45 degrees and the warp makes the wearing surface.

*Oxford* is a plain-woven cloth usually with a coloured pattern, and is used for shirts and dresses. The name is comparatively modern, and is, no doubt, arbitrarily selected.

*Harvard* is a twilled cloth similar to the Oxford.

*Regatta* is a stout, coloured shirt cloth similar in make to a jeanette. It was originally made in blue and white stripes and was used largely and is still used for men's shirts.

Fancy cotton goods are of great variety, and many of them have trade names that are used temporarily or occasionally. Apart from the large class of brocaded cloths made in Jacquard looms there are innumerable simpler kinds, including stripes and checks of various descriptions, such as Swiss, Cord, Satin, Doriah stripes, &c. *Mercerized cloths* are of many kinds, as the mercerizing process can be applied to almost anything. *Lace* and *lace curtains* are made largely at Nottingham. Various light goods are made in Scotland, such as *book muslin*, a fine light muslin with an elastic finish, so called from being folded in book-form.

Among the fancy cloths made in cotton may be mentioned: *matting*, which includes various kinds with some similarity in appearance to a matting texture; *matté*, which is in some degree an imitation of French dress goods of that name; *piqué*, also of French origin, woven in stripes in relief, which cross the width of the piece, and usually finished stiff; *Bedford cord*, a cheaper variety of piqué in which the stripes run the length of the piece; *oatmeal cloth*, which has an irregular surface suggesting the grain of oatmeal, commonly dyed cream colour; *crimp cloth*, in which a puckered effect is obtained by uneven shrinkage; *grenadine*, said to be derived from Granada, a light dress material originally made of silk or silk and wool; *brilliant*, a dress material, usually with a small raised pattern; *leno*, possibly a corrupt form of the French *linon* or lawn, a kind of fancy gauze used for veils, curtains, &c.; *lappet*, a light material with a figure or pattern

produced on the surface of the cloth by needles placed in a sliding frame; *lustre*, a light dress material with a lustrous face sometimes made with a cotton warp and woollen weft; *zephyr*, a light, coloured dress material usually in small patterns; *bobbinet*, a machine-made fabric, originally an imitation of lace made with bobbins on a pillow.

Some fancy cloths have descriptive names such as *herringbone stripe*, and there are many arbitrary trade names, such as *Yosemite stripe*, which may prevail and become the designation of a regular class or die after a few seasons.

Cotton linings include *silesia*, originally a linen cloth made in Silesia and now usually a twilled cotton cloth which is dyed various colours; *Italian cloth*, a kind of jean or sateen produced originally in Italy. Various cotton cloths are imitations of other textures and have modified names which indicate their superficial character, frequently produced by finishing processes. Among these are *sateen*, which, dyed or printed, is largely used for dresses, linings, upholstery, &c.; *linenette*, dyed and finished to imitate coloured linen in the north of Ireland and elsewhere; *hollandette*, usually unbleached or half-bleached and finished to imitate linen holland; and *interlining*, a coarse, plain white calico used as padding for linen collars.

Various cotton imitations share the name of the original, such

Country.	1903.		1904.		1905.	
	Thousands of Yards.	Price per Yard.	Thousands of Yards.	Price per Yard.	Thousands of Yards.	Price per Yard.
Germany . . . . .	60,650	3.77	60,129	4.02	65,842	3.98
Netherlands . . . . .	47,570	3.57	46,187	3.68	56,639	3.47
Belgium . . . . .	52,199	4.34	56,237	4.42	67,509	4.41
France . . . . .	17,552	4.61	17,759	4.39	14,875	4.65
Portugal, Azores and Madeira .	32,824	2.70	29,440	2.92	29,867	3.03
Italy . . . . .	6,363	5.07	7,904	5.19	8,746	5.31
Austria-Hungary . . . . .	2,405	3.44	2,102	3.40	1,905	3.60
Greece . . . . .	40,973	2.64	32,658	3.11	28,190	3.20
Turkey . . . . .	305,611	2.45	379,557	2.53	376,209	2.53
Egypt . . . . .	229,704	2.41	283,521	2.57	272,737	2.53
Algeria . . . . .	700	2.74	438	2.71	455	2.63
Morocco . . . . .	52,368	2.28	51,262	2.44	44,407	2.44
Foreign West Africa . . . . .	64,589	2.92	55,131	3.12	69,163	3.08
Persia . . . . .	34,859	2.46	33,119	2.67	38,647	2.59
Dutch East Indies . . . . .	156,905	2.45	185,196	2.72	226,586	2.57
Philippine Islands . . . . .	25,558	2.59	25,969	2.86	42,876	2.66
China, including Hong-Kong .	477,691	2.83	548,974	3.34	799,732	3.06
Japan . . . . .	67,315	3.08	42,373	3.34	128,725	2.99
United States of America . . .	72,360	6.80	52,391	7.18	65,563	7.40
Foreign West Indies . . . . .	86,349	2.08	98,797	2.21	80,679	2.24
Mexico . . . . .	19,327	3.10	21,679	3.42	21,028	3.31
Central America . . . . .	40,879	1.97	53,018	2.21	49,523	2.29
Colombia and Panama . . . . .	44,299	2.25	44,648	2.54	31,798	2.41
Venezuela . . . . .	52,330	1.87	52,934	2.07	32,717	2.11
Peru . . . . .	28,962	2.66	32,430	2.85	39,035	2.78
Chile . . . . .	84,118	2.50	80,836	2.57	96,996	2.62
Brazil . . . . .	152,402	2.64	134,841	2.89	131,504	2.50
Uruguay . . . . .	44,062	2.79	35,670	2.85	56,770	2.95
Argentine Republic . . . . .	151,003	2.91	186,022	3.04	159,115	3.24
Gibraltar . . . . .	11,961	2.39	10,578	2.47	3,960	2.73
Malta . . . . .	4,065	3.11	3,659	3.45	4,006	3.31
British W. Africa . . . . .	69,795	3.27	69,308	3.43	74,392	3.40
"    S.    "    . . . . .	61,778	3.61	29,670	4.03	50,592	3.69
British India—						
Bombay . . . . .	678,684	2.07	818,261	2.23	908,619	2.24
Madras . . . . .	132,825	2.48	141,675	2.63	131,145	2.62
Bengal . . . . .	1,122,004	1.97	1,215,607	2.18	1,280,314	2.18
Burma . . . . .	64,654	2.84	79,765	3.10	72,528	3.13
Straits Settlements <sup>1</sup> . . . . .	112,006	2.61	100,230	2.84	121,690	2.71
Ceylon . . . . .	17,395	2.75	19,336	2.95	24,991	2.94
Australia . . . . .	106,000	3.83	128,247	4.01	136,481	3.85
New Zealand . . . . .	38,499	3.58	33,538	3.81	32,315	3.63
Canada . . . . .	47,439	4.15	49,903	4.25	45,189	4.47
British West India Islands, Bahamas and British Guiana .	49,614	2.49	43,487	2.61	47,173	2.21
Other countries . . . . .	188,662	2.84	197,339	3.14	226,971	3.03
Total . . . . .	5,157,316	2.57	5,591,822	2.75	6,198,200	2.74

as lawn, batiste, serge, huckaback, galloon, and a large number of names are of obvious derivation and use, such as umbrella cloth, apron cloth, sail cloth, book-binding cloth, shroud cloth,

<sup>1</sup> Including Federated Malay States.

butter cloth, mosquito netting, handkerchief, blanket, towelling, bagging.

Among the miscellaneous cloths made or made partly of cotton may be mentioned: *waste cloths*, made from waste yarns and usually coarse in texture; *khaki cloth*, made largely for military clothing in cotton as well as in woollen; *cottonade*, a name given to various coarse low cloths in the United States and elsewhere; *lasting*, which seems to be an abbreviation of "lasting cloth," a stiff, durable texture used in making shoes, &c.; *bolting cloth*, used in bolting or sifting; *brattice cloth*, a stout, tarred cloth made of cotton or wool and used for bratticing or lining the sides of shafts in mines; *sponge cloths*, used for cleaning machinery; *shoddy* and *mungo*, which though mainly woollen have frequently a cotton admixture; and *splits*, either plain or fancy, usually of low quality, which include any cloth woven two or three in the breadth of the loom and "split" into the necessary width. Cotton is used too for many miscellaneous purposes, including the manufacture of lamp wicks and even of billiard balls.

*British Cotton Cloth Exports.*—The main lines of the Lancashire export trade in cotton goods are indicated in the Board of Trade returns. The table on p. 150 compiled from them is taken from the *Manchester Guardian*. It gives in thousands of yards the quantities of cotton goods exported from Great Britain during 1903, 1904 and 1905 respectively, together with average value per yard for each of the countries.

The following table gives, approximately, in thousands of yards the quantities exported of the four main divisions of cotton cloths:—

	1903.	1904.	1905.
	Thousands of Yards.	Thousands of Yards.	Thousands of Yards.
Grey or unbleached . . .	1,880,321	2,033,895	2,336,018
Bleached . . . . .	1,326,255	1,528,165	1,710,742
Printed . . . . .	1,027,925	1,036,901	1,053,900
Dyed and coloured . . .	922,735	993,009	1,097,540

In the case of cloth, too, the Board of Trade returns must not be taken as an absolute record of imports to the particular countries, as the ultimate recipient is not always determined. The development of the Eastern trade has been one of the most remarkable features of the cotton trade in the 19th century. Professor Chapman writes in his *Cotton Industry and Trade*: "In 1820 Europe received about half the cotton fabrics which were sent abroad, while the United States received nearly one-tenth and eastern Asia little more than one-twentieth. By 1880 Europe was taking less than one-twelfth, the United States less than one-fiftieth, and eastern Asia more than a half."

Naturally a trade tends to find out the most direct means of distribution, and Manchester merchants are now generally in direct connexion with native dealers in India. Bombay was the pioneer in the custom, followed now by Calcutta and Karachi, by which deliveries of goods from British merchants remained under the control of the banks until the native dealers took them up. Manchester business with India, China, &c., is done under various conditions, however, and a good many firms have branches abroad. The regular "indent" by which most of the Manchester Eastern business is conducted now implies a definite offer for shipment from the dealer abroad, either direct or through the exporter's agents, and commonly includes freight and insurance. The term "commission agent" is now discredited, and buying done by Manchester houses on simple commission terms is unusual though not unknown. This has been so since the famous law case of *Williamson v. Barbour* in 1877, when it was established that whatever might be the custom of the trade a commission agent was not entitled to make a profit over his commission on the various processes, such as handling and packing, which are a necessary part of the exporter's work. A good deal of business is done, however, for South America and other markets in which the goods are bought for delivery in the Manchester warehouse, all charges for packing, &c., and carriage being extra.

Transactions with distant markets are now done almost entirely by cable, and a remarkable development of the telegraphic code has enabled merchants to pack a good deal into a brief message. A cable sent to India in the evening may bring a reply next morning, and in these days of rapid cotton fluctuations mail advices are confined mainly to general discussion, hypothetical inquiry, advice, admonition and complaint. Some Manchester export business is done through London, Glasgow, and continental towns, of which Hamburg is the principal. Glasgow buys largely of yarns and cloth, some considerable part of which is dyed or printed, for India and elsewhere, and has an indigenous manufacture and trade in fine goods such as book-muslins and lappets, a somewhat delicate department of manufacture which necessitates a slower running of machinery than is usual in Lancashire.

Besides the indent business there is, of course, purely merchant business by Manchester exporters, who buy on their own initiative at what they consider to be opportune times or on recommendations from their houses or correspondents abroad. In the Indian trade, especially in the Calcutta trade, a large proportion of the total amount is done by a few houses who buy in this way, and there is some difference of opinion as to whether the method, which had fallen out of fashion, may not further develop. It is more speculative than the indent business, but the dealing with large quantities which it involves gives the opportunity to buy very cheaply. A good many firms venture occasionally to buy in anticipation of their customers' needs, especially when they expect a rising market. During the great trade "boom" of 1905 there was a good deal of buying by exporters in advance of their indents because manufacturers continued to contract engagements which threatened to exclude dilatory buyers. On the whole, however, what may be called the speculative centre of gravity of Great Britain's export business in cotton goods is not in Manchester but abroad.

The terms on which business is conducted are various even in a single market, and it is sometimes a reproach that British firms are old-fashioned in their reluctance to give credit. The so-called enterprising methods of some German traders are, however, condemned by many experienced English traders, and it is said that in China, for instance, the seeming successes of the newcomers are delusive. The Tientsin developments of German business on credit terms are said to have proved unsatisfactory, and heavy losses were suffered in Hong-Kong some years ago by merchants who endeavoured to initiate a bolder system of trading. The very common complaint of British consuls that British firms neglect to send out travellers may have some foundation, but a commercial house naturally follows the line of least resistance to the development of its trade, and cannot be expected to work remote and barren ground when better opportunities are near at hand. On the whole it appears that the British cotton trade continues to increase to a satisfactory degree in fancy and special goods, which require for their production a comparatively high degree of technical skill, and are more lucrative than some of the simpler products in which competitors have been most formidable. Various finishing processes, and particularly the mercerizing of yarn and cloth, have increased the possibilities in cotton materials, and while staples still form the bulk of our foreign trade, it seems that as the stress of competition in these grows acute, more and more of our energy may be transferred to the production of goods which appeal to a growing taste or fancy.

*British Home Trade.*—The home trade in cotton cloths is a great and important section, but it is not comparable in volume to the export trade. It involves more numerous and more elaborate processes, and the qualities for home use are generally finer and more costly than those for export. Of course by far the larger part of the yarn spun in Lancashire is woven in Lancashire, but of the cotton cloth woven in Lancashire it is roughly estimated that about 20% is used in Great Britain. Not only is the average of quality better, but the variety of kinds and designs is greater in the home trade than in the export trade. A good home trade connexion is considered an extremely valuable asset, and as the trade is highly differentiated the profits are usually good. Some manufacturers devote themselves exclusively to the home trade,



and some exclusively to foreign trade, but there is a large class with what may be called a margin of alternation, which serves to redress the balance as business in one or other of the sections is good or bad.

Certain kinds of light goods made for India and other Eastern markets are not used in the home trade, and the typical Eastern staples are not generally used in their particular "sizings," but with these exceptions and various specialities almost every kind of cotton cloth is used to some extent in Great Britain. Grey calicoes for home use, except the lowest kinds, are comparatively pure, and of late years the heavy fillings which used to be common in bleached goods have become discredited. The housewife long persisted in deceiving herself by purchasing filled calicoes, and the movement in favour of purer goods owes a good deal, strangely enough, to the increase in the making-up trade and the consequent inconveniences to workers of sewing machines, whose needles were constantly broken by hard filled calicoes.

This development of the making-up trade has become an important element in the home trade, and it has greatly reduced the retail sale of piece-goods. The purchase of ready-made shirts, underclothing, &c., corresponds to a change in the habits of the people. The factories which have been erected in the north of Ireland, on the outskirts of London and elsewhere turn out millions of garments that would, under the old conditions, have been made at home. It is not necessary here to balance the advantages and disadvantages of the two systems, and it must not be supposed that made-up cotton garments are necessarily cheap and inefficient.

The chief distributing centre of cotton made-up goods is London, though a considerable trade is done through wholesale houses in Manchester and elsewhere. Large warehouses in the city of London carry on the trade and frequently supply Lancashire with her own goods. Of course the partial loss of the piece-goods trade by the shops is not a loss in aggregate trade, as they are the ultimate distributors of the made-up garments, which are probably at least as profitable to retail as calico or flannelette sold in lengths.

The normal course of home trade piece-goods is from manufacturer to bleacher, dyer, printer or finisher, either on account of a merchant to whom the goods are sold or on the manufacturer's own account. By far the majority of Lancashire manufacturers sell their goods as they come from the loom, or, as it is called, in the "grey state," but an increasing number now cultivate the trade in finished goods. Usually the manufacturer sells either directly or through an agent to a merchant who sells again to the shopkeeper, but the last twenty or thirty years have seen a considerable development of more direct dealing. Some manufacturers now go to the shopkeeper, and this has made it difficult for the merchant with a limited capital and therefore a limited assortment to survive. The great general houses such as Rylands's, Philips's and Watt's in Manchester, and Cook's and Pawson's in London, some of which are manufacturers to a minor degree, continue to flourish because under one roof they can supply all that the draper requires, and so enable him to economize in the time spent in buying and to save himself the trouble of attending to many accounts. Some general merchants, indeed, supply what are practically "tied houses," which give all their trade in return for pecuniary assistance or special terms.

The tendency to eliminate the middleman has not only brought a good many manufacturers into direct relation with the shopkeeper, but in some exceptional cases the manufacturer, adopting some system of broadcast advertisement and postal delivery, has dealt with the consumer. Naturally, the merchant resents any developments which exclude him, and some mild forms of boycott have occasionally been instituted. In the United States there has been an arduous struggle over this question, and combinations of merchants have sometimes compelled favourable terms. In England, though the merchant has maintained a great part of the trade with shopkeepers, the developing trade with makers of shirts, underclothing, &c., is mainly done by the manufacturers directly, and perhaps the simplification of relations by direct dealing in the cotton trade has now reached

a point of fairly stable compromise. The tendency to direct trading is naturally controlled by the exigencies of capital. Those manufacturers who act as merchants aim to retain the merchant profit and must employ a merchant capital in stocks. There has been a tendency, indeed, to make the manufacturer the stock-keeper, and some merchants do little more than pass on the goods a stage after taking toll. The great improvement in trade during 1905 and 1906 checked this tendency, and probably the manufacturing extensions owed something to the capital set free by the reductions of stocks.

It must be noted, however, that while most of the spinning concerns are worked by limited companies or individuals with a considerable capital, a good many small manufacturers exist who have little capital and are practically financed by their agents or customers. This is so in both the export and home trades.

The home trade merchant or merchant-manufacturer works largely through agents and travellers, and though railway facilities continue to improve, some shopkeepers rarely visit their markets. The difficulty that is naturally experienced by a traveller in finding sufficient support on a sparsely populated "ground" has brought into vogue the traveller on commission who represents several firms. The traveller with salary and allowances for expenses survives, but the quickening induced by an interest in the amount of sales has caused many firms to adopt the principle of commission, which may, however, be an addition to a minimum salary. Of course, such travellers are not peculiar to the cotton trade, but cotton goods in various forms are an important factor in the home trade.

The profits of manufacturers, merchants and shopkeepers are commonly very much less on the lower classes of cotton goods than on the higher ones. Thus while there may be a difference of 1d. per yd. between the qualities on a manufacturer's list, the difference in cost may not be more than a farthing; and, again, while the shopkeeper sometimes pays 2½d. or even 2¾d. per yd. for a calico to retail at 2¾d., his next selling price may be 3¼d. for one which costs him only 2¾d. or 3d. per yd. It appears, therefore, that if the poorer classes of the community have the discretion to avoid the lowest qualities they may obtain very good value in serviceable goods. In the matter of profits, however, there is a good deal of irregularity.

*The Manchester Royal Exchange.*—There are not many cotton mills or weaving sheds in Manchester, which is, however, the great distributive centre, and its Exchange is the meeting-place of most classes of buyers and sellers in the cotton trade and various trades allied to it. As buyers of finished goods for London and the country do not attend it, certain departments of the home trade are hardly represented, but practically all the spinners and manufacturers and all the export merchants of any importance are subscribers. Transactions between spinners and manufacturers are largely effected on Tuesdays and Fridays, the old "market days," when the manufacturing towns are well represented, but a large amount of business is transacted every day. Besides the persons immediately concerned in the cotton trade and connected with allied trades, a large number of members find it convenient to use this great meeting-place as a means of approach to a body of responsible persons. Thus not only bleachers, carriers, chemical manufacturers, mill furnishers and accountants find their way there, but also tanners, timber merchants, stockbrokers and even wine merchants. Since the Ship Canal made Manchester into a cotton port there has been a steady development of the raw cotton trade in Manchester, and many cotton brokers and merchants have Manchester offices or pay regular visits from Liverpool.

The various expansions and developments have made it difficult to maintain the ratio between accommodation and requirements, and although overcrowding is troublesome only during some three or four hours a week, at "high 'Change" on market days, various complaints and suggestions provoked in 1906 an appeal from the chairman of directors to the Manchester corporation. This took the form of a suggestion that the Exchange should be worked as a municipal institution on a new site, and though such a development met with opposition it was

apparent that Manchester must presently have a new or an enlarged Exchange. The present building is, however, the largest of the kind in the world, and the history of the various exchanges coincides with the expansion of the Lancashire industry.

According to semi-official records "the first building in the nature of an Exchange" was erected in 1729 by Sir Oswald Mosley, and though designed for "chapmen to meet and transact their business" it appears that, as to-day, encroachments were made by other traders until cotton manufacturers and merchants preferred to do their business in the street. In 1792 the building was demolished, and for a period of some eighteen years there was nothing of the kind. In 1809 the new Exchange was opened, and terms of membership were fixed at two guineas for those within 5 m. of the building and one guinea for those outside this radius. In the following year plans for enlargement were submitted to the shareholders, and various extensions followed, particularly in 1830 and 1847. The present building was opened partly in 1871 and partly in 1874. The area of the great room is 4405 sq. yds. The subscription was raised on the 1st of January 1906 from three guineas to four guineas for new members, but the number of members continues to increase and early in 1906 amounted to 8786.

Of course in this great mart a large variety of types is to be found and the members fall into some kind of rough grouping. Export buyers, attended by salesmen, are commonly more or less stationary and prominent; Burnley manufacturers abound in one locality and spinners of Egyptian yarns in another. The importance of the Exchange as a bargaining centre is fairly maintained, though buyers are assiduously cultivated in their own offices, and the telephone has done a good deal to abbreviate negotiation. As to the amount of business transacted on the Exchange there is no record. The market reporters make some attempt to materialize the current gossip, and doubtless catch well enough the great movements in the ebb and flow of demand, but the sum of countless obscure transactions cannot be estimated. Some few years ago an attempt was made to mark more clearly the course of business in Manchester, and a scheme was prepared for the recording of daily transactions. This could only have been a somewhat rough affair, but its originator maintained reasonably that it would be of interest if some indication of the daily movements could be obtained. For some time a memorandum of the total of daily sales reported was posted on 'Change, but the indifference of traders, together with the distrust that makes any innovation difficult, caused the scheme to be abandoned.

It would be difficult in any attempt to estimate the volume of British home trade to distinguish what may be called the effective movements of goods. There is a considerable amount of re-selling both in yarn and cloth, and, though the bulk of cotton goods finds the way through regular and normal channels to the consumer, these channels are not always direct. A good many transactions on the Manchester Exchange are intermediate, without fulfilling any useful function, and could be accomplished by the principals if they were brought together. Agents, of whom there are many, sometimes occupy a precarious position, but they are protected in some degree by law as well as by the custom of the trade and the point of honour. Points of honour in the Manchester business may seem to be arbitrarily selected, but they are an important part of the scheme. An immense amount of business is done without any apparent check against repudiation. It is, of course, the verbal bargain that binds, and large transactions are commonly completed without witnesses, though before the contract or memorandum of sale passes the fluctuations of the market may have made the bargain, to one side or the other, a very bad one.

(A. N. M.)