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Plates at end of document.

THE HEMP PLANT

The hemp plant (*Cannabis sativa*) is an annual, belonging to the nettle family. It grows to a height of from 5 to 15 feet, and when cultivated for fiber (Pl. LXXIX, fig. 1) produces only a few small branches near the top of the slender stalk. Its leaves, of a rich dark-green color, are composed of 5 to 9 lanceolate, serrate, pointed leaflets, 2 to 5 inches in length and about one-sixth as wide. The staminate, or pollen-bearing flowers, and the pistillate, or seed-producing flowers, are on separate plants (Pl. LXXIX, fig. 2), both plants being nearly alike, but the staminate plants maturing earlier. The stems are hollow, and in the best varieties rather prominently fluted. The fiber consists of numerous series of long cells in the inner bark, firmly knitted together, which, when cleaned from the surrounding tissues, form tough strands nearly as long as the entire plant. This is a bast fiber, and is classed commercially among the soft fibers, with flax, ramie, and jute.

The hemp plant originated in central Asia, but it is now widely distributed, especially in the North Temperate Zone, growing spontaneously where it has been accidentally introduced with bird seed or cultivated for the fiber.

OTHER PLANTS CALLED HEMP

The name "hemp" was first applied to the plant above described, but in recent years it has unfortunately been used to designate the sisal plant, or henequen, a species of agave producing a leaf fiber, and the manila fiber plant, or abaca, a kind of banana plant producing structural fibers in the leaf petioles. *Sansevieria*, a tropical genus belonging to the lily family, includes three or four fiber-producing species, often called bowstring hemp, and an East Indian species, *Crotalaria juncea*, is commonly known as Sunn hemp. The name is also applied to several other species of less importance.

PRINCIPAL USES OF HEMP FIBER

Hemp fiber is long, soft, very strong, and capable of almost as fine subdivision as flax. It is especially adapted for use where strength is required. It is used in the manufacture of fine twines, carpet thread, carpet yarns, sailcloth, and for

homespun and similar grades of woven goods. Nearly all of the best grade of long fiber, "dressed line," is used for making twines, yacht cordage, etc.; cheaper grades are made into binder twine. The tow is used for threads and for yarns to be woven into carpets, homespuns, and linen goods, and the refuse fiber combed from the tow is used as oakum for calking ships. The average annual consumption of hemp fiber in the United States is about 18,000,000 pounds, of which only about 8,500,000 pounds are raised in this country, the remainder being imported.

REGIONS OF CULTIVATION

FOREIGN HEMP

In foreign countries hemp is cultivated most extensively in Russia, China, Japan, Italy, Austria, and France. The tallest and best hemp plants are produced in China and Japan, but the best grades of fiber are imported from Italy, where it is prepared by water-retting. It is not cultivated commercially for the production of fiber in the Tropics.

DOMESTIC HEMP

In the United States the production of hemp is almost confined to Kentucky (fig. 43). Three-fourths of the American hemp fiber is produced in that State in the counties of Fayette, Woodford, Jessamine, Garrard, Clark, Bourbon, Boyle, Scott, and Shelby. These nine counties are in the famous blue-grass region, of which Lexington, the principal hemp market, is the center. The most important secondary hemp markets in this region are Nicholasville, Versailles, Lancaster, Danville, Winchester, Paris, Georgetown, Shelbyville, and Frankfort. Small scattered areas of hemp are cultivated intermittently in other parts of the State, and there are probably few counties in Kentucky in which an attempt has not been made at some time to establish the hemp-growing industry.

There are two centers of hemp cultivation in Nebraska--Fremont and Havelock. During the past two or three seasons about 100 acres have been grown at each of these places. In California, hemp is cultivated at Gridley, in Butte County. The industry has been gradually established there during the last half dozen years, and having passed the stages of experiment and loss due to new and untried conditions, there is now a tendency to develop and increase the acreage. Trials in hemp cultivation have been made on Ryers Island, near Rio Vista, in the Sacramento Valley, and in San Benito County. During the past two years hemp has been grown successfully on a small scale near Houston, Texas., and with improved methods of handling the crop it seems probable that it may become a profitable industry in that region. Hemp has been grown in the vicinity of Champaign and

Rantoul, in Eastern Illinois, and along the Missouri River, between St. Joseph and Kansas City, but its cultivation in these localities has been almost discontinued, except at Rantoul, where about 400 acres are still cultivated each year.

SOILS SUITABLE FOR HEMP

In Kentucky, as stated, hemp is cultivated most successfully in the blue-grass region, where the soil is chiefly a yellow clay loam or a rich sandy loam, rather firm in texture and usually underlaid with a sub-soil of yellow clay. The land is gently rolling, affording excellent drainage. Exceptionally fine crops are produced on the bottom lands along the Kentucky River and its tributaries, although it is regarded as risky to cultivate it where it is subject to overflow. A good stand of well-developed hemp plants is rarely obtained in undrained hollows in the uplands, although the soil in these hollows seems more fertile than that on the surrounding hillsides.

In Nebraska hemp is cultivated on rich, black, friable prairie loam, comparatively loose and light in texture and lying high, with good drainage. Repeated efforts to cultivate hemp on the "gumbo" and other low-lying soils there have demonstrated that while these soils may produce some large hemp plants it is practically impossible to secure on them a good, even stand of hemp stalks of the proper size for fiber. In Texas good crops of hemp have been produced on rich dark prairie soil, but on upland soils, subject to drought, the crop has proved a failure. In California hemp is grown on alluvial soils in the bottom lands along the rivers. In the testing gardens of the Department of Agriculture, where several European and Japanese varieties of hemp have been tested during the past two years, the plants have attained a good height, but they have been uneven in size, and the fiber produced is not as tough as that produced in Kentucky and Nebraska. The soil of the testing garden is alluvial, composed chiefly of sand and silt, and almost devoid of clay.

An ideal hemp soil must be rich in available fertilizing elements, especially nitrogen and potash, to insure a rapid growth; deep and sufficiently loose in texture to permit the development of the root system and also to allow good drainage; sufficiently friable to make a good, mellow seed bed, so as to insure uniform germination of seed, yet with clay enough to give it a good body and firm texture. A good supply of humus (decaying vegetable and animal matter) is necessary, not only to furnish plant food, but to retain moisture. Very few farm crops require so much water as hemp, yet it will not endure standing water about its roots. It is not grown commercially under irrigation, and the effects of

inundation on crops in river bottoms indicate that it would not thrive if subjected to the ordinary methods of flooding practiced in the irrigation of broadcast crops. In soils of good capillarity, where the general level of the soil water is within 10 feet of the surface, there is little danger of injury from drought after the first thirty days, during which the root system of the hemp plant will become well established.

PREPARATION OF LAND

ROTATION OF CROPS

In Kentucky, hemp sometimes follows hemp on the same land for two or three years, and if the stalks are retted on the same land and fertilizer applied to make up for the fertility taken off by the crops, no serious injury may result. It is the general practice, however, and doubtless the better practice, to cultivate a series of crops in rotation. A common five-year rotation is clover, hemp, corn, wheat, clover. Clover seeded in the growing wheat in spring occupies the land two years. Hemp follows clover whenever this is practicable. The stubble and roots of the clover, rich in stored-up nitrogen, furnish the desired fertilizing elements well distributed, and also the humus necessary for the development of a rapid-growing crop like hemp in soils long under cultivation.

In California and Nebraska no crop rotation is practiced for hemp, and on the deep, rich prairie soils of Nebraska, where there seems to be an almost inexhaustible supply of humus, it is claimed that the best results are obtained where hemp follows hemp through a long series of years. Hemp prevents the growth of weeds and other vegetation which would be found on such soils in most other crops or after other crops are laid by, and its cultivation also seems to make the soil more uniform in character.

FERTILIZERS

In California and Nebraska the hemp is retted on the land where it is grown, and in this manner a portion of the fertilizing elements in the crop is returned to the soil. No other fertilizer is used in those States, and none seems necessary as yet on the deep, rich soils. In Kentucky, hemp is cultivated in a region noted for its horses and fine herds of cattle and sheep, as well as for its blue grass and hemp. The soils throughout this region have been kept in a high state of fertility, as is nearly always the case where stock raising is an important element in mixed farming. Barnyard manure is applied to corn and wheat, the crops preceding hemp in the rotation, but no fertilizer is applied to the hemp crop itself. Fresh stable manure applied as a top dressing produces an uneven growth of hemp plants, and

when plowed under just before seeding it has a tendency to dry out the soil.

Fertilizers, to produce satisfactory results with hemp, must be thoroughly and uniformly mixed with the soil, and should have a tendency to retain moisture. Barnyard manure and clover sod, therefore, being humus formers, may be expected to give better results in the long run than commercial fertilizers, which tend to deplete the humus. In the Southern States, where clover does not succeed and where stock raising has not yet received due attention, cowpeas and cotton-seed meal will make good fertilizers for hemp. Alkaline chlorides like chloride of sodium (common salt) tend to increase the cellulose in plants at the expense of starch and sugar. The application of salt may therefore be expected to increase the quantity and also to improve the quality of fiber in the hemp plant, and in experimental cultures this has been proved to be true. Salt must be used with caution, however, since it is likely to prove very injurious on light soils or soils lacking in fertility. Muriate of potash has an effect similar to that of common salt.

PLOWING AND HARROWING

The best results are usually secured from deep fall plowing, followed by thorough harrowing in the spring. In practice, however, the land is plowed at all seasons through the fall, winter, and early spring, when the weather and conditions of the soil will permit. The hemp spread for retting often remains on the ground nearly all winter, and this prevents fall plowing when hemp is retted on land to be used for the same crop. In Kentucky the hemp is usually spread for retting on permanent pasture land, so as not to interfere with plowing. Thorough, deep plowing is necessary to fit the soil to retain moisture and to give opportunity for the development of the roots. Harrowing before the seed is sown is generally necessary to make the surface seed bed fine and uniform. Harrowing is advisable even in loose, friable soils which are pretty well pulverized by the plow, since the rough furrows left by the plow will result in uneven covering of the seed and lack of uniformity in germination.

SEEDING

For the best results the seeds should be sown in spring at about the time for sowing oats. In Kentucky, hemp seed is sown from the middle of March to the last of April; in Nebraska, from April to June; in California, in February and March . The best hemp crops are obtained by drilling and cross drilling with a force feed drill. This distributes the seed evenly and covers it at a uniform depth. An even stand of plants, uniform in size, is one of the principal objects to keep in mind in nearly every operation in hemp culture. It is well-nigh impossible to make good fiber from a mixture of stalks of various sizes. Unevenness in size of stalks will result from a lack of homogeneity of soil or from a lack of uniformity in the

surface, in the distribution of the seed, or in the depth at which the seed is covered. A bushel of seed per acre is the quantity usually sown. If the seed is fresh (from crop of previous year), is small-sized, and germinates well, this quantity is ordinarily sufficient; but on very rich soils a heavier seeding and on poor soils a lighter seeding is advisable. Good hemp seed should germinate 85 to 95 per cent within ten days. Before sowing it is advisable to make a test to determine the percentage of germination, and to use the data thus obtained in determining what amount of seed per acre to sow.

WEEDS

If the land has been properly prepared before seeding and the soil is suitable for hemp, weeds will rarely grow sufficiently to injure the crop. In some instances it may be advisable to pull out pokeweed, smartweed, and tall ragweed, when these overtop the hemp before it is 2 feet high, but it is best not to tramp through the crop more than is necessary, for bending and breaking the young plant will cause uneven growth. Broom rape (*Orobanche ramosa*), an annual plant parasitic on hemp roots, is the most injurious weed in hemp fields. It is disseminated by its very abundant small seeds, similar in size to those of tobacco, which adhere to the resinous coverings of hemp seed. It is most injurious in Kentucky and Illinois, sometimes causing almost complete ruin in hemp crops. No complaints of it have been received from California, and although it has been introduced in Nebraska, it has not caused any damage to the hemp crops there. Broom rape is an inconspicuous plant, growing not more than 6 to 12 inches high at the base of the hemp stalks, and is usually not noticed until the hemp plants suddenly begin to turn yellow and die a few weeks before harvest time. In some instances a partial crop is saved by cutting the hemp as soon as the first effects of broom rape are observed, but the fiber thus obtained is usually rather weak. The seeds of this weed retain for a long time their ability to germinate, lying dormant in the soil, and control or eradication is thus rendered extremely difficult. It can develop only on the roots of a few crops like tobacco, hemp, and tomatoes, and the best remedy is to leave these crops out of the rotation on infested land for a period of at least twelve or fifteen years. Aside from broom rape, which, being parasitic, does not require light, there are few weeds which can persist in the dense shade produced by the hemp as grown for fiber. The hemp grows so rapidly and attains such a height that it overtops all ordinary weeds and chokes them out. It is generally regarded as an excellent crop for clearing land of annual or biennial weeds, and it has been suggested as a good crop for subduing the growth of wild vegetation on reclaimed river bottom lands. Unless such soils could be well prepared by thorough cultivation, it is not likely that a satisfactory yield of fiber could be secured.

HARVESTING

TIME OF HARVESTING

Hemp is cut when the staminate plants are in flower. The time of harvest varies from eighty to one hundred and forty days from the date of seeding, the period of growth depending on the mean temperature and the supply of moisture, and on the variety. When sown at the proper season hemp is usually cut late in August or September (in July in California and Texas).

In some instances good fiber has been secured in Nebraska from hemp cut before flowering, but ordinarily the fiber is best when the crop is harvested just before the staminate plants are in full flower. If cut too early the fiber will be fine, but lacking in strength, deficient in yield, and wasting at every operation in its preparation. If allowed to become too mature the fiber will be coarse, harsh, and brittle.

METHODS OF HARVESTING

In California hemp is cut with self-rake reapers or mowing machines. In Nebraska mowing machines have been superseded by self-rake reapers (fig. 44). Reapers have been used quite extensively in Kentucky during the past two years, and they seem to be growing in popularity there. Most of the hemp in Kentucky, however, is still cut by hand with the primitive reaping knife or hemp cutter, which is something between a corn cutter and a bush scythe, but unlike either (Pl. LXXX, fig. 1). An experienced hand with a reaping knife will cut about one-half acre per day. With a sweep-rake reaper, under favorable conditions, from 5 to 7 acres may be cut in a day, and with a mowing machine, 7 to 10 acres. Hemp does not lodge like grain or heavy clover, but on windy days it is impossible to cut with either reaper or mower in the direction that the wind is blowing, for instead of falling back of the cutting bar the stalks drop down between the guards, where they are repeatedly cut off. The heavy, green, woody stalks, one-eighth to one-half inch in diameter and 8 to 14 feet tall, are much more difficult to handle than grass or grain, and they cause a much greater strain on the machine. Ordinary grain reapers are not entirely satisfactory for harvesting hemp; they are rarely strong enough. The experience of those who have used reapers indicates that a successful hemp-harvesting machine of the self-rake type should be made especially strong, having a cutting bar not more than 3 1/2 feet long, arranged to cut within 2 inches of the ground, extra heavy sections with rapid motion, and driving wheel with broader rim and larger lugs than are usually made for self-rake machines. Opinions differ as to whether two or three rakes give the best results. A

team of four good farm horses is generally regarded as necessary for cutting hemp with a self-rake reaper, and in Kentucky an extra hand is employed to drive. In California and Nebraska one man attends to both horses and machine. Some form of harvesting machine must soon take the place of the hemp knife, since it is ever more difficult to secure the skilled labor necessary to cut the crop by hand, and where hemp is raised on a large scale it is impossible with the slow hand methods to get it all cut at the proper season.

DRYING AND STACKING

After the hemp is cut it is allowed to lie on the ground from four to eight days to dry. The unbound bundles are usually turned, so as to dry both sides. To turn them a stick or fork handle is run under the tops and they are thrown endwise over the butts. When dry the hemp is usually bound in small bundles with cheap twine or the small hemp stalks and set up in shocks (Pl. LXXX, fig. 2) or stacked. If it is soon to be spread for retting on the same land it is placed in shocks without binding. When cut with a mowing machine the tangled stalks are raked into windrows like hay. In stacks properly built (Pl. LXXX, fig. 3) the hemp will remain uninjured for a period of two or three years; furthermore, the quality of the fiber is improved, and the processes of breaking and cleaning it are made easier by a kind of sweating or fermentation that the stalks undergo in the stack. In spite of the advantages to be gained in stacking, it is often omitted on account of the extra handling and the lack of skilled labor to make the stacks, which must be constructed with even greater care than stacks of wheat or oats.

RETTING

Retting, or "rotting, " is a process in which the vegetable gums surrounding the fiber are dissolved and the fiber is at the same time freed somewhat from the woody interior portion of the stalk and also from the thin outer cuticle. These gums are not soluble in water, but they are destroyed by a kind of putrefaction which takes place when the stalks are immersed for some time in soft water or are exposed to the weather.

WATER RETTING

Retting by immersing the stalks in water is largely practiced in France and Italy, and it was practiced in this country until the middle of the last century, before hemp was so completely superseded by cotton in the manufacture of fine woven goods. Water-retted fiber is lighter in color and finer in texture, and it commands a higher price than dew-retted fiber, but it requires a large amount of labor and expensive retting tanks. No process has yet been devised in America by which hemp can be water-retted so as to make it yield as great a profit as when

dew-retted.

Investigations in Europe have demonstrated that certain micro-organisms are always present in flax when retting, and these agents play a most important part in the retting process. It is suggested that pure cultures of these amylo-bacteria can be made to facilitate the retting in much the same manner that fermentation is started in making wine and vinegar. In experiments conducted on a small scale flax was retted much more rapidly when the bacteria were supplied. The process of retting hemp is exactly the same as that of retting flax, and it is possible that by making use of the necessary bacteria the length of time and labor required for water-retting may be reduced to within the limits of profitable production. It seems impracticable, however, on account of the great bulk of the crop, to attempt to carry on the operation of retting under cover, as would be necessary in order to have the conditions under control. It may be possible to use the bacteria in a solution to spray on the hemp as it is spread for retting in the field.

DEW-RETTING

Nearly all the hemp now produced in the United States is dew-retted. It is spread in long rows on the ground during the fall and early winter and exposed to the weather until the bark, including the fiber, readily slips from the inner woody portion (Pl. LXXXI, fig. 2). In Nebraska and California the hemp is spread in the stubble fields where it has been cut. In Kentucky it is usually spread in closely cropped blue-grass pasture land, and is sometimes hauled 2 or 3 miles from the hemp fields to the retting grounds. The plants are turned at least once to secure even retting, the tops being thrown over in the same manner as when turned in drying.

In Kentucky most of the hemp is spread for retting during the month of November, but owing to unfavorable weather and inability to secure retting lands or labor at the desired time, the retting period often extends from soon after the harvest until the following spring. The time required for dew-retting hemp depends upon the weather, and varies from two to ten weeks. Warm, rainy weather causes the hemp to ret rapidly, but it increases the danger of loss, since it is often difficult or even impossible to turn the hemp while the rains continue, and it is retted unevenly or much of it is overretted. The process which seems necessary to destroy the vegetable gums surrounding the fiber injures the fiber itself if permitted to continue too long. A period of warm rains setting in after the hemp has been spread several days and has reached an advanced stage of retting is almost sure to prove injurious to the fiber. The best fiber is obtained from hemp retted slowly during the fall, since it is then easier to secure uniformity and also to

check the process before it becomes injurious. Light warm rains soon after the hemp is spread are beneficial to start the retting process. Water charged with the specific bacteria for retting and applied with spraying apparatus might perhaps be substituted for these uncertain showers. When the hemp has been retted sufficiently for the fiber to be readily separated, the stalks are raked together and set up in loose shocks to dry, or hauled to the place where they are to be broken.

BREAKING

Breaking is the process by which the fiber is separated from the stalk and roughly cleaned. It prepares the fiber for market as rough hemp, and is usually the last operation performed on it by the farmer or hemp grower. The work of breaking begins as soon as the retted hemp is ready, and often continues until late in the spring. The greater part is broken during January and February.

HAND BREAKS

Nearly all of the hemp is broken by hand breaks (Pl. LXXXI, fig. 1), such as have been in use many centuries. The crude heavy wooden breaks are all made by carpenters after one very simple pattern, and cost only $5 to $6 each. With one of these an experienced hand under most favorable circumstances can clean out about 250 pounds of fiber in a day. The average day's product of breaking is about 100 pounds of clean fiber. The usual wages paid for breaking 1 cent per pound of fiber. The work is performed by alternately crushing or breaking the stalks between the long jaws of the break and beating and whipping them over the break to free the hurds from the fiber. It is a slow process, requiring not only strength, but skill. The value of the product depends largely upon the skill of the laborer. There is considerable loss of fiber in beating it against the break to shake off the hurds, and with new and unskilled laborers this loss is often an item of importance. The principal objections to hand breaking are its slowness and cost. To break an average crop of 50 acres requires the services of 10 skilled hemp breakers for two months and costs at least $500. The hand break must give way to machinery.

HEMP BREAKING MACHINES

Several machines have been devised for breaking hemp, but they have not given complete satisfaction. Very few of them have succeeded at all in breaking hemp in commercial quantities.

A machine consisting of a series of coarsely fluted rollers followed by a rapidly revolving spiked cylinder has been in use for some years in California and Nebraska. It breaks the hemp and delivers the fiber in the form of tow. This

machine seems to be particularly well adapted to the preparation of fiber from tangled hemp stalks cut with a mowing machine.

In the hemp factories at Lexington there are machines consisting essentially of long series of corrugated rollers which are occasionally used for softening the fiber. It is said that these machines may be used for breaking hemp, but they are not actually so used. These and also the break used in California are too heavy to be taken into the field, and they require more power than can be furnished by an ordinary thrashing engine.

During the past season three decorticators have been in operation near Lexington, by which the hemp stalk is crushed in passing between rollers, corrugated for unretted hemp, and smooth for retted. The hurds are then loosened by a rapidly vibrating mechanism, and the fiber is partly cleaned by a kind of carrier, which gives a rapid scraping motion. These machines break the hemp well and without waste or injury to the fiber, but do not clean out the hurds as well as is desired. They are portable, weighing only 2,000 pounds, and require only 6 horsepower for operation. An ordinary thrashing engine furnishes sufficient power to run two breaks. The hurds are used as fuel for the engine. The average day's output from each of these machines is 2,000 to 3,000 pounds of rough hemp. Attention is called to these machines especially, since they are the first portable machines that have proved successful, working out in the field and producing untangled long-line fiber similar to that cleaned on the hand break.

BREAKING UNRETTED HEMP

Several hundred tons of unretted hemp stalks have been broken on the decorticators used at Lexington during the past season. The fiber thus produced is degummed and prepared for spinning by a chemical process. The finished fiber produced in this manner is of fine quality, and is used for the same purposes as the better grades of imported flax. The process is not yet in general use, however, and there is only a limited market for unretted hemp fiber. It would effect a decided improvement in the industry if the farmer could break his hemp successfully and find a ready market for the fiber without the tedious and uncertain process of retting.

MARKET

The rough hemp fiber is tied in bales weighing about 150 pounds each, and most of it is sold to dealers in the local markets. In some instances where it is cleaned better than usual it is shipped to the manufacturers, but most of it is hackled by the local dealers. This work is nearly all performed by hand, and

consists in combing the fiber by drawing it across clusters of upright, sharp steel needles. The long fiber, nearly as long as the hemp stalks, combed out in this manner, is known in the market as "Kentucky single-dressed hemp." If the fiber is of especially good quality, it is combed still further upon a finer hackle, and it then becomes "Kentucky double-dressed hemp," which is the highest grade of American hemp quoted on the fiber market. (Pl. LXXXI, fig. 3.)

The price of hemp varies to a considerable degree, depending on the demand and supply of other fibers almost as much as on the production of the hemp itself. Most of the rough hemp is sold by the farmers during the winter soon after it is broken. The prices during the winter of 1901-1902 are regarded as comparatively high, being 4 1/4 to 5 cents per pound. The approximate average prices paid to farmers by local dealers in Lexington, Kentucky, during the month of February for the past seven years have been as follows:

Per ton (2,240 pounds).	
1896	$60.00
1897	70.00
1898	75.00
1899	90.00
1900	100.00
1901	112.00
1902	105.00
Average	87.42

The minimum limit of profitable production, according to present methods, is regarded as about 3 1/4 cents per pound. With the present values and profits in other farm productions, a price considerably above this limit must be paid to induce farmers to grow hemp rather than devote their lands to stock raising and corn and tobacco. Even at the present time hemp is giving place to tobacco in Kentucky on many rich farms in the blue-grass region. The average production for five-year periods for the past twenty-five years, based on reports of the commissioner of agriculture of Kentucky, is as follows:

Pounds of rough hemp.

1876 to 1880	10,793,427
1881 to 1885	6,843,367
1886 to 1890	12,541,145
1891 to 1895	7,263,713
1896 to 1900	6,354,543
Approximate average for twenty-five years	8,700,000

The generally decreasing production is not due to a diminishing yield, but to a reduced acreage. A larger acreage was planted in 1901 than during the previous two years, and allowing for loss due to drought, the 1901 crop is estimated at about 8,000,000 pounds.

Under fair average conditions an acre of hemp yields about 1,000 pounds of rough fiber, or about 6,000 pounds of dry retted stalks. At 5 cents per pound for the fiber it is a very good paying crop. It is a reasonably safe crop, aside from the uncertainties of retting. It is not often seriously injured by fungous diseases or insects. Its most serious enemy is the parasitic weed branched broom rape, mentioned under "Weeds."

SEED AND VARIETIES

Hemp seed is produced on plants grown in checks or sometimes in drills, and cultivated like corn. These plants grow stout and coarse, with numerous branches, and they are worthless for fiber. No horticultural varieties are recognized in this country. Nearly all of the hemp grown here in recent years is of Chinese origin. The seed is obtained in small quantities from American missionaries in central China, and this is usually cultivated for two generations for seed production before it is sown broadcast for fiber. This method is pursued not only to secure a sufficient quantity of seed, but also because better fiber plants are produced after the seed has been acclimated by cultivation in this country. The hemp growers of Kentucky generally agree in the opinion that the best hemp is produced by small dark-colored seed. In Japan, on the contrary, the best varieties have comparatively large light-colored seed.

The Chinese and Japanese varieties of hemp are very similar in character. They

grow to a height of 9 to 15 feet, with slender stalks, few branches, and usually with internodes 8 to 12 inches in length. The pistillate flowers on the plants grown for seed are in rather small clusters, scattered on branches of the long slender limbs. (See Pl. LXXIX, fig. 2.) The European varieties, including the Piedmont, Neapolitan, Hungarian, and Russian, while sufficiently different in character to be readily distinguished, all conform to a general type, sometimes called the Smyrma type. (See Pl. LXXIX, fig. 3.) This differs from the China-Japan type in a more compact growth, shorter plants, shorter internodes, and shorter and more rigid limbs, bearing the seeds in rather large, dense clusters. These European varieties reach maturity from ten to thirty days earlier than the China-Japan varieties under similar conditions.

Until comparatively recent times hemp seed of European origin was used in Kentucky, and its effects are still plainly seen in the mixed character of plants too often found in the hemp fields. These plants are so prolific in seed that the growers hesitate to throw them out when harvesting their hemp seed.

An ideal hemp plant should be 10 to 12 feet in height, one-fourth to three-eighths inch in diameter near the base, with internodes 10 inches or more in length, and stems prominently fluted, with comparatively large hollows, making them thin-shelled and more easily broken. The fiber is generally tougher on the thin-shelled stalks. The Chinese and best Japanese varieties approach most nearly this ideal. Starting with these as a foundation and practicing a rigid seed selection for a half dozen generations or longer would undoubtedly result in improved varieties of uniform plants adapted to cultivation in this country.

FIG. 1.—YOUNG HEMP, ABOUT 4 FEET HIGH, GROWING FOR FIBER.

FIG. 2.—HEMP PLANT OF CHINA-KENTUCKY TYPE, GROWN FOR SEED.

[Plant with leaves, pistillate; leafless plant, staminate.]

FIG. 3.—HEMP PLANT OF SMYRNA TYPE, GROWN FOR SEED (PISTILLATE).

Plate LXXIX Fig. 1-3

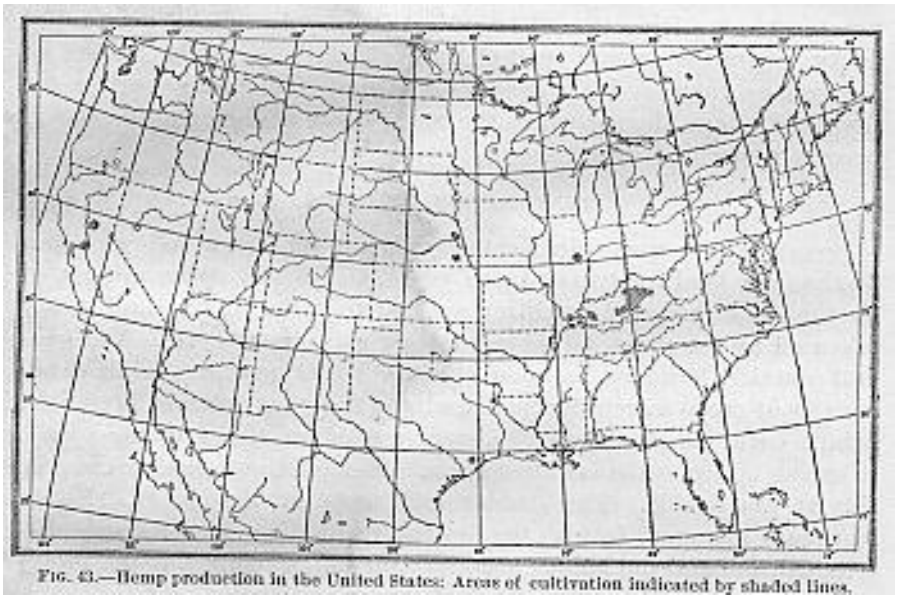

FIG. 43.—Hemp production in the United States: Areas of cultivation indicated by shaded lines.

Plate 43

FIG. 44.—Cutting hemp with self-rake reaper in Kentucky.

Plate 44

FIG. 1.—CUTTING HEMP BY HAND.

FIG. 2.—HEMP SHOCKS.

FIG. 3.—HEMP STACK.

Plate LXXX Fig. 1-3

FIG. 1.—BREAKING HEMP ON HAND BREAK.

FIG. 2.—HEMP SPREAD FOR RETTING.

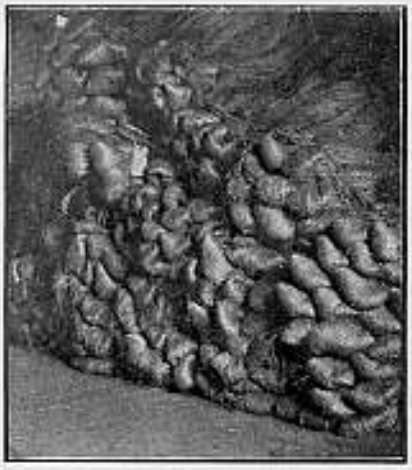

FIG. 3.—HEMP FIBER "DRESSED" (HACKELED) AND TIED IN BUNDLES FOR MARKET.

Plate LXXXI Fig. 1-3