

HEMP CULTURE.

By CHAS. RICHARDS DODGE,

Special Agent in Charge of Fiber Investigations, U. S. Department of Agriculture.

In the literature of the fiber-producing plants of the world the word hemp appears frequently, applied oftentimes to fibers that are widely distinct from each other. The word is usually employed with a prefix, even when the true hemp is meant, as manila hemp, sisal hemp, Russian hemp, etc. In this article will be considered the hemp plant proper, the *Cannabis sativa* of the botanists, which has been so generally cultivated the world over as a cordage fiber that the value of all other fibers as to strength and durability is estimated by it. In many of the experiments of Roxburgh and others we find "Russian hemp" or "best English hemp" taken as standards of comparison.

The Sanskrit name of the plant is bhanga; in Hindostan it is called ganja; the Arab name is kinnub, from which, doubtless, its Latin name, cannabis, is derived; in Persia it is known as bung, while in China it is chu ts-ao, and in Japan, asa.

Its native home is India and Persia, but it is in general cultivation in many parts of the world, both in temperate and more tropical climes, though only in Russia and Poland in large quantities for export. French hemp is much valued, but the finest quality comes from Italy, and is pronounced fine, soft, light colored, and strong. Hemp grows in all parts of India, and in many districts flourishes in a wild state. It is but little cultivated for its fiber, although Bombay-grown hemp "was proved to be superior to the Russian." In portions of India, as well as other hot countries, it is cultivated for its narcotic products, the great value of which makes the India cultivators indifferent about the fiber. Hemp is largely grown in Japan for the manufacture of cloth. This industry is very old, as prior to the introduction of silk weaving it was the only textile fabric of the country.

Its cultivation is an established industry in the United States, Kentucky, Missouri, and Illinois being the chief sources of supply, though the culture has extended as far north as Minnesota and as far south as the Mississippi Delta, while California has recently become interested in its growth.

Several varieties are cultivated in this country, that grown in Kentucky, which has a hollow stem, being the most common. China hemp, with slender stems, growing very erect, has a wider range of

culture, and Smyrna hemp is adapted to cultivation over a still wider range, but is not so well known. A small quantity of seed of the Piedmontese hemp of Italy was distributed by the Department of Agriculture in 1893, but the results of the experiments were not fully successful.

Formerly large areas were devoted to the cultivation of the plant in the United States, and thirty-five years ago nearly 40,000 tons of hemp was produced in Kentucky alone, while now hardly more than a fourth of this quantity is produced in the whole country. There are several reasons for the decline in production in the United States, but it dates back, primarily, to the decline in American ship-building and to the introduction of the Philippine Island hemp (*Musa textilis*), the manila hemp of commerce, and later to the large importation of jute. Quite recently there has been a further falling off in production, and it is worthy of note that this is largely due to the overproduction of this same hemp of Manila, brought about by the high prices of the latter fiber in 1890-91, a direct result of the manipulation of the fiber market by certain binding-twine manufacturers.

Formerly the hemp of Kentucky was not only used for the rigging of vessels, and in twines or yarns, and bagging, but it was spun and woven into cloth, just as to-day it is manufactured into fabrics in portions of Brittany.

About 1890, when the Department of Agriculture became interested in extending the cultivation of hemp, and when the consumption of binding twine amounted to 50,000 tons annually, it was shown that, at the prices then prevailing, if one-half of the binding twine were made of common hemp grown at home, and not from manila or sisal, there would be a clear saving to the consumers of \$1,750,000 in a year, with the further advantage that American farmers would produce the raw material. There was a cry that "soft twines" would not work in the self-binders, though the Office of Fiber Investigations was able to show that common hemp twine could be employed quite as satisfactorily as the stiffer twines, and that the prejudice had no substantial foundation.

In the past two years there has been an increasing demand for information relating to hemp culture, and experiments looking to its production have been carried on in localities where previously its culture was unknown, notably in extreme Southern States, which are large producers of cotton.

SOIL SELECTION.

As in Brittany, so in Kentucky, limestone soils, or the alluvial soils such as are found in the river bottoms, are best adapted to this plant. The culture, therefore, is quite general along the smaller streams of Brittany, where the climate is mild and the atmosphere humid. In

Kentucky the best lands only are chosen for hemp, and the most favorable results are obtained where there is an underlying bed of blue limestone. In certain portions of the State, Shelby County for example, it is claimed that a finer and tougher fiber is produced than in other sections, and this is thought to be due to a mixture in the soil of a whitish, oily clay. As a general rule, however, light or dry soils or heavy, tenacious soils are most unfavorable.

Hemp is not considered a very exhaustive crop. In a former report it was stated by a successful Kentucky grower that virgin soil sown to hemp can be followed with this crop for fifteen to twenty years successively; sown then to small grain and clover, it can be grown every third year, without fertilizers, almost indefinitely.

In France a rotation of crops is practiced, hemp alternating with grain crops, although competent authorities state that it may also be allowed to grow continuously upon the same land, but not without fertilizers. Regarding this mode of cultivation, they consider that it is not contrary to the law of rotation, as by deep plowing and the annual use of an abundance of fertilizers the ground is kept sufficiently enriched for the demands which are made upon it. If the soil is not sufficiently rich in phosphates or the salts of potassium, these must be supplied by the use of lime, marl, ground bone, animal charcoal, or ashes mixed with prepared animal compost. Even hemp cake, the leaves of the plant, and the "shive," or "boon," may be returned to the land with benefit. This high fertilizing is necessary, as "the hemp absorbs the equivalent of 1,500 kilos of fertilizers per every hundred kilos of fiber obtained."

In Japan, where most excellent hemp is produced, the ground is given a heavy dressing of barnyard manure before it is plowed in November. After the soil has been well pulverized and reduced to fine tilth, the seed is drilled and the land given a top dressing composed of one part fish guano, two parts wood ashes, and four parts animal manure. The proportions and the quantities used differ, of course, upon different soils.

In New York, where hemp was formerly grown, barnyard manures or standard fertilizers are used, as it is considered essential to put the soil in good fertility to make a successful crop. In Illinois, with the method of cultivation in vogue, it is not regarded as in any way exhaustive to the soil, though the refuse must be returned if possible. A Kentucky practice is to burn the refuse and spread the ashes over the land.

As in flax culture, a careful and thorough preparation of the seed bed is important, for the finer and more mellow the ground the better will be the fiber. This is better understood in Europe than in America, however, for American hemp is coarse, and its chief use, in a cordage fiber, does not make fineness an essential; in fact, American hemp is more nearly like the hemp of Russia, with which it competes.

Soil preparation in the blue-grass region of Kentucky consists in a fall or early spring plowing, and a short time before seeding, which in general terms is about corn-planting time, the ground is thoroughly pulverized by means of an improved harrow, such as the disk harrow, after which it is made smooth. The date of planting varies according to whether the soil is wet or dry, and may range from the last week in March to the last week in April, or even the 1st of May.

In Brittany, after the harrow and roller are used, small lines of trenches or furrows are dug about 10 feet apart for drainage purposes, after which the surface is cleared of weeds and the seed sown in drills. The drill is likewise used in Illinois, though the most common practice in Kentucky is to sow broadcast, followed by a light harrowing and sometimes by a light drag to level the surface.

A correspondent states that many farmers in Shelby County, Ky., use the ordinary grain drill for broadcast seeding. The rubber pipes are removed from the drill, and a board is attached directly beneath the hopper. The seed falling upon the board is scattered in front of the drill hoes, which do the covering. A light drag passed over the field levels and evens the surface, after which nothing is done until the hemp is ready for the harvest.

The quantity of seed sown to the acre varies. One large grower says 33 pounds of seed per acre is the proper amount. Another states that 1 to 1½ bushels is his rule. In New York 1 to 3 bushels have been sown (in past time), 1 bushel giving better results than a larger quantity. In Illinois it varies from 1 to 2½ bushels.

In France a difference is made regarding the use to which the fiber will be put, a third more seed being sown for spinning fiber than for cordage fiber. On a farm in Sarthe, visited by the writer, a little less than 3 bushels to the acre was the usual quantity sown, but as high as 4 bushels are sown on some farms.

There will be little trouble with weeds if the first crop is well destroyed by the spring plowing, for hemp generally occupies all the ground, giving weeds but little chance to intrude. For this reason the plant is an admirable weed killer, and in flax-growing countries is sometimes employed as a crop, in rotation, to precede flax, because it puts the soil in good condition. In proof of this, a North River farmer a few years ago made the statement that thistles heretofore had mastered him in a certain field, but after sowing it with hemp not a thistle survived, and while ridding his land of this pest the hemp yielded him nearly \$60 per acre where previously nothing valuable could be produced.

HARVESTING.

In Kentucky the hemp stalks are considered ready to cut in one hundred days, or when the first ripe seed is found in the heads. The cutting is usually done with a hooked implement, or knife bent at

right angles about 24 inches from the hand. In recent years, however, the work is sometimes done by machines adapted to the purpose, and particularly when the stalks are slender.

In France there are two modes of harvesting, dependent upon the use to which the fiber will be put. If the fiber is for cordage, the stalks are cut with a sharp instrument resembling a short scythe, and laid upon the ground in sheaves, where they are left to dry from one to three days. The leaves are then stripped and the stalks removed to the sheds, to be assorted, and then placed in piles horizontally, the lower ends of the stalks being pressed firmly against a wall, so that the inequalities of their length may plainly appear. Upon each pile there is placed close to the wall a weight, to prevent deranging the stems while drawing them out in assorting. This is done by handfuls; first the longest stems, then the medium, and then the short ones. They are bound into sheaves, several of which are put together, forming bundles, each containing stalks of equal length. The tops of the sheaves are then cut off, and only the portion preserved that will make good fiber.

When the hemp is grown for use in spinning—that is, for fabrics—the stalks are not cut, but are pulled like flax. The operator first removes the leaves by passing his hand from top to bottom of the stalk, it being important to return the leaves to the soil where they were grown. Six to fifteen stalks are pulled at one operation, according to the ease with which they can be drawn out of the ground, and the earth shaken off. These handfuls are made into bundles about 6 inches in diameter, and the roots and tops are then removed by means of an ax and chopping block. The clipped stalks are then made up into larger bundles a foot or more in diameter, and are sent to be retted at once, as it is claimed that the hemp is not so white if it is dried before retting.

Hemp is probably never pulled in this country. When the stalks are cut they are laid in rows, even at the butts, and are allowed to remain on the ground, not over a week, to dry—only long enough, as one correspondent expresses it, to get a rain on the leaves, so that they will drop off readily. Where the rain is too long deferred, however, the hemp should be put in shocks, or small stacks, having been first made into bundles of convenient size for easy handling.

Hemp is dew retted in this country; that is, spread evenly over the ground to undergo the action of the elements which dissolve or rot out the gums holding the filaments together. Formerly pool, or water, retting was practiced in a very small way in Kentucky and to a slight extent later in Illinois. It is said that Henry Clay introduced the practice into the former State, but it was not followed. It is true, however, that the manufacturers formerly preferred water-retted hemp, and the Navy Regulations required it, but the price of cordage hemp hardly warranted the extra labor and consequent expense.

The hemp is allowed to remain in stack until November or December, or about two months, when it is spread over the ground until retted. No rule can be given regarding the proper length of time that the hemp should lie, as this varies according to the weather, sudden freezing, followed by thaws, hastening the operation. It is usually allowed to lie until the bast separates readily from the woody portion of the stalk. When there is a large crop, there may be an advantage in spreading the hemp earlier than November, in order that the breaking may be done in the winter months. Winter-retted hemp is brighter, however, than that retted in October. It is usually stacked and spread upon the same ground upon which it is grown, and when sufficiently retted, as can be determined by breaking out a little, it is again put into shocks. If the hemp be dry, the shocks should be tied around the top tightly with a band of hemp to keep out the rain. The shocks are made firm by tying with a band the first armful or two, raising it up and beating it well against the ground. The remainder of the hemp is set up around this central support. By flaring at the bottom, and tying well, a firm shock can be made that will stand firmly without danger of being blown over by the wind.

Dew retting is practiced to some extent in France, though water retting gives better results. The practice, called "rouissage," is accomplished both in pools and in running streams. The river retting seems to accomplish better results, although taking a little longer time than the pool retting, the duration of immersion varying from five to eight days. If the weather is cool, it retards the operation two or three days longer than if warm. This accounts, too, for the shorter time occupied when the immersion takes place in pools. This work is usually done in the latter part of August. The bundles of hemp are floated in the water, secured if in a running stream, and are covered with boards kept in place by stones or any weight that will keep them under. There appears to be little pool retting in the Sarthe district, although public opinion is generally against river retting on the score of its rendering the waters of the streams foul and detrimental to health, as well as destructive to all animal life with which they would otherwise abound. It is understood that there are very stringent police regulations against the use of streams for this purpose, and as long ago as 1886, in a brochure published by M. Bary, a hemp spinner of Le Mans, attention was called to the desirability of introducing an improved method of retting which would accomplish all the beneficial results of retting in running water artificially, and therefore render unnecessary the polluting of streams. While many attempts have been made to bring about a better system, none have been successful, and, police regulations to the contrary notwithstanding, the best hemp fiber produced in the Sarthe district is still retted in the running streams. Where pool retting is followed, the pools are specially constructed, dug out of the

earth to the depth of a yard or more, walled up or the sides made solid, and lined and floored with cement usually in order that the water shall remain clean and the hemp retain its color. The stalks are watched very closely after the third or fourth day, the farmer breaking and examining a few at intervals to guard against over-retting, which weakens the fiber.

When sufficiently retted, whether the work is done in streams or pools, the hemp bundles are removed from the water, but first agitated to remove all waste matter that may be adhering to the stalks. They are then drained, and the bundles, opened at the bottom, are set up in conical sheaves to dry, this operation being accomplished in two or three days. Considerable of the hemp grown, in the Sarthe district at least, is further dried in brickkilns.

The Japanese method of retting differs so materially from the practices followed in western countries that a brief statement will prove interesting. The raw hemp produced in Japan is usually sold in the form of thin, smooth ribbons, which are of a light straw color, the frayed ends showing a fiber of exceeding fineness. Some beautiful samples of this hemp were secured by the writer at the World's Columbian Exposition, with an account of the peculiar treatment of the stalks to produce the fiber.

In Japan hemp is ready for harvesting about one hundred and twenty days after sowing, or about the 20th of July. In harvesting; the plants are pulled, leaves and roots are cut off with a sickle, and the stems sorted into long, medium, and short lengths and bound in bundles. These bundles are steamed for a few minutes in a steaming bath specially constructed, and dried in a sunny situation for three days, when they are fit for keeping to be manipulated according to the condition of the weather, if favorable or unfavorable. If good, settled weather is anticipated, three bundles of the stems above mentioned are made into one bundle, exposed to the sun by turning upside down once a day for about three days, then dipped into water and exposed again to the sun for a number of days, until they are completely dried, when they are kept in a dry place for future work. For preparing the best quality of hemp fibers, the drying process takes thirty days, and for second and third qualities, fifteen and twenty-five days, respectively, are required. For separating hemp fibers from the stalk, the bundles treated as above mentioned are immersed in water and moderately fermented by heaping them upon a thick bed of straw mats in a barn specially built for the purpose. The number of hours depend much upon the temperature at that time; in short, the fermentation requires great skill. When the stalks are fermented to a proper degree, the fibers are separated by hand and immersed in water, the outer skin is scraped off by hand tools specially constructed, and dried in well-ventilated places by hanging the fibers on bamboo, without exposing to the sun.

BREAKING THE HEMP.

It is said that nearly 300 patents have been issued in the United States for machines for breaking hemp, many of them having proved absolute failures, while none of them have filled the requirements of an economically successful hemp-cleaning device. The fact remains, therefore, that the Kentucky hemp grower of to-day relies upon the rude and clumsy five-slatted hand brake of his grandfather's time, a device similar in all respects to that used for the same purpose at the present time by the hemp farmers of Brittany. In Kentucky the breaking is an expensive operation, costing \$1 to \$1.25 per short hundred pounds of fiber. The work is performed in the winter by negroes, and the best workers will not average more than 150 pounds in a day. In a former report on this subject a homemade machine employed for the purpose in Illinois was described as a very large brake with fluted rollers, the flutes being from 1½ to 2 inches deep. The cleaning cylinders were 5 feet in diameter of any desired width, with crossbars alternating with loose wings. In the crossbars were pins that acted as combs, these being about three-quarters of an inch long and bent back slightly. Under the cylinders were slats 2 inches apart through which the refuse fell. One cylinder was used close behind the brakes. The other two cylinders had each one pair of rollers in front to hold the fiber while the shive, or waste, was being cleaned out. The fiber was not delivered straight, but it was claimed that twine manufacturers preferred this product to straight Kentucky hemp fiber on account of its superior strength.

A number of patented machines possessing more or less merit have been brought to public notice in the past four or five years, several of which have been examined by this Department. In this brief account of the cultivation of hemp it is not important, however, to go into details concerning their merits or demerits, and the subject is left for future consideration. For the same reason no mention has been made of recent experience in the cultivation of hemp in the South and in California, though many facts of general interest might be presented.

The market prices for American rough hemp at the present time may be stated at \$70 to \$80 per ton for Missouri, and \$125 per ton for Kentucky. No recent figures are at hand showing cost of production, but in 1890, counting a man and team worth \$3.50 per day, the cost of producing an acre of hemp in Kentucky was shown to be about \$24. The average yield is about 1,000 pounds per acre, but this is frequently exceeded by several hundred pounds.