S B

59

48

LIBRARY OF CONGRESS.

Chap. SB 259

Shelf .L48

UNITED STATES OF AMERICA.

CULTURE AND MANUFACTURE
OF
RAMIE AND JUTE
IN
THE UNITED STATES.

BY
EMILE LEFRANC,
OF NEW ORLEANS.

114
9305 ✓
PUBLISHED BY THE DEPARTMENT OF AGRICULTURE. U.S.

WASHINGTON: 4
GOVERNMENT PRINTING OFFICE.
1873.

DEPARTMENT OF AGRICULTURE,

Washington, December 11, 1873.

Within the last few years the Agricultural Department has taken much interest in the subject of ramie and jute, the seeds of which were originally introduced by it into the country and extensively distributed in the Southern States. The effect of this has been to make the impression that the cultivation of these plants is about to become one of the most important industries, and especially valuable because it will give a profitable employment to the planters and lands of a portion of the country where a larger production of cotton so lessens the price as to make any new production desirable.

Experiments lately made in the State of Louisiana in the cultivation and preparation of both ramie and jute seem to settle the question that it is both practicable and profitable. The Department has sought to gather all the information which can be gained on the subject; and, at its instance, a treatise has been prepared by EMILE LEFRANC, of the "Southern Ramie-Planting Association," whose experience, both in the cultivation of these plants and preparation of their fibers, enables him to speak confidently of the success that company has met with.

Although it is the purpose of the Department to publish this information, with plates and drawings of the machinery used, in the forthcoming annual report, yet the Commissioner deems its earlier publication so important, in anticipation of the approaching planting-season in the Southern States, that he takes this mode of putting it into the possession of planters who may be disposed to prosecute this industry.

FREDK. WATTS,
Commissioner of Agriculture.

RAMIE AND JUTE.

BY EMILE LEFRANC, OF NEW ORLEANS, LOUISIANA.

RAMIE.

At last this remarkable textile plant is enabled to leave the harassing and expensive phase of experimental struggle; it can now safely enter into the broad and rich sphere of productive cultivation, and open a new source of prosperity in the industrial area of the New World.

It has just been delivered from the heavy impediments which have, so far, prevented its useful development.

After having been the object of years of laborious and costly efforts in many quarters, and by many searching minds, the arduous problem of separating economically that fine textile from its green coating has been satisfactorily solved in New Orleans. The difficulty of applying the proper treatment to the fiber is now radically removed by the completion of an improved decorticating-machine patented in 1870 and finally perfected in 1873, that is to say, a few months ago.

The machine was put publicly in operation last September, on the farm of the "Southern Ramie-Planting Association of New Orleans."

It has worked for weeks in the regular decortication of ramie and jute in green stalks. Undeniable evidence has been there furnished of the long sought-for discovery of a successful method for setting free the rich fiber from its tenacious bark and pithy envelope.

Introduced into Louisiana toward the fall of 1867, the ramie has had ample time to prove its vitality and toughness as a perennial growth. With little or no care it has thriven alone since then, and wherever attention has been given to it its propagation has been considerable. In some rich and elevated soils the plant has stood and propagated without the least cultivation for the last six years. The stems die in winter, and multitudes of others shoot forth every spring. Where the bushes are regularly cut three or four times a year, the more vigorous and luxuriant is the growth. All these facts sufficiently prove the perennial and hardy vitality of the plant, as also its adaptability to our soil, and the congeniality of our climate. Therefore the agricultural problems and the questions of acclimation are also solved and settled. If the ramie industry did not unfold sooner the advantages of the plant, it was solely on account of the unprofitable or inefficient methods of extracting the fiber. When first introduced on this continent, the treatment of the ramie-plant was erroneously assimilated to that of the nettle family. The universal opinion was that it should be treated like jute, flax, hemp, and other textiles of the cannabis variety, which are disintegrated lengthwise from the stems by the simple process of water fermentation.

The error was soon discovered. Ramie-fiber admits of no rotting action on the stalks. Steeped and fermented in water or exposed to the air, it is decomposed and reduced to a short and weak fiber, saturated with tannic acid and spotted with tan-bark. Moreover the process is tedious and anti-economical. It has been

found that the envelope of the ramie-fiber contains some sulphuric and carbonic elements, which dissolve the joints of the cellulose when the stem is subjected to the acetic degree of fermentation or rotting. Then, some chemists resorted to the process of neutralizing those dissolving elements by means of an acidulated bath for the plants.

But those different systems were of no avail because they required the additional intervention of machinery to break and hackle the filament, which was otherwise more or less injured in its quality by the unnatural treatment to which it was subjected. In face of the despotic exigencies of economy in labor, and the absolute necessity of a large production, none of those methods was practicable.

But another road lay open to logical and searching intellects. They were guided by the investigation of the following points:

First. What is the process of the Chinese, who for centuries have monopolized the ramie-fiber trade? Their process consists in stripping the ramie-plant and scraping the bark containing the filament.

Second. Why do they not proceed by rotting the stalks as they do for their other long textiles? Because they know that the nature of the ramie-plant does not permit it; they are aware that this fine fiber can only be obtained by separating first the injurious bark, which, being removed, permits the ordinary process of rotting and bleaching on the uncoated and free filament.

The questions being so propounded and answered, there was but one way to solve the problem—to construct a machine capable of doing what the Chinese do by hand. They skin the stalk and clean the outer bark off with a knife, and each hand obtains in this manner one or two pounds per day of a marketable raw product. A machine had, then, to be invented that would supply daily one thousand pounds of a similar product. Such was the task, and it has been accomplished!

But inventions of that kind, with no precedent, no basis in existing machinery, are not the work of a day; they are the result of years of persistent experimentation and concentrated thought.

Sound and useful contrivances have ever been of slow growth. It seems that a certain experimental and painful stage is the necessary tribute paid in advance to the benefits of progress.

Practical persons familiar with the treatment of textiles know the impossibility of cleaning thoroughly any fiber, dried or green, by the continuous action of machinery. Either with drums or beaters the cleaning instruments cannot turn out the filament without a certain quantum of chaff and other refuse entangled in the fiber. All experiments on this point have failed, and proved the insuperable difficulty of expelling by continuity of friction all the particles of pith that have penetrated into the fiber. It is only through a scraping process, acting in a backward and forward direction, that a perfect cleaning can be obtained.

The contrivance that cleans ramie, and furnishes a product similar to that of China, is founded on that true principle, as follows:

Revolving cleaners, provided with a peculiar sort of knives, receive gradually, by means of a circular carrier, bunches of stems, which are doubled down and hooked in the middle. The carrier withdraws them from the rotary action of the cleaners, and delivers them in the form of clear ribbons, of a light yellow color, as fine as the imported China grass.

That crude ramie-staple is worth from £65 to £70 per ton in Europe, but American manufacturers offer 20 or 25 cents a pound for it provided a large supply be secured. On account of the aforesaid difficulty of decortication by machinery, it has hitherto been impossible to comply with this condition, and consequently

the cultivation of the plant has remained stationary in America. This impediment is now about to disappear, and a flourishing trade will, no doubt, be soon inaugurated. Then there will be no reason for confining the value of the fiber to what it is worth in its crude condition. Properly ungummed and bleached by the process hereafter described, ramie-fiber acquired a double and triple market value. Then, if dressed and combed smoothly, it has the beauty and value of a lustrous staple which is classed next to silk for strength and brilliancy. The tissues called "Japan silk," "Canton goods," "grass-cloth," "Nankin linen," and many other varieties of dry-goods, are generally made of ramie material, more or less mixed with other fiber.

English manufacturers have monopolized the ramie or China-grass trade in Europe and America, and kept somewhat secret the process of finishing and weaving the fiber. Almost all the dress-goods—mixed with brilliant materials and imitating silk fabrics—are made in part of ramie. Leeds and Bradford are the principal manufacturing centers that use that staple as a substitute for silk in many sorts of goods. It is a common error to consider ramie as a substitute for cotton.

None of the *Bohemaria* or *Urtica* grasses have the necessary requirements for dethroning that useful king. The effect produced by the ramie-fiber is cooling rather than warming, and it cannot for that reason take the place of the indispensable cotton-staple. Flax will, perhaps, feel its competing influence, because the ramie-tow, called cottonized ramie, enters into the manufacture of fine linen and cambric imitations. But the long ramie-staple has a higher destiny; it is in the rich domains of the silk trade that it will predominate as an ally more or less officially recognized. Like certain sorts of wines, such as champagne, port, sherry, Madeira, and others, whose consumption exceeds considerably the genuine produce, the so-called silk products greatly surpass in volume the actual amount of silk that could be obtained from all the cocoons of the whole world. Evidently there is some precious substitute more or less openly introduced into the pretended silk stock. What is this contraband material? Lancashire and Lyons manufacturers could probably answer the query. But, resorting to no such indiscreet question, we can derive some light and information from the following figures of the eastern exporting trade. In a pamphlet recently published on the subject of ramie by Baron Jean de Bray, we find that the export of China-grass from Shanghai alone amounted in 1865 to 3,240,000 kilogrammes—about seven millions of pounds. It is reasonable to infer that this exportation has increased ever since, and that India and Japan have furnished also to the outside trade a certain share of the staple. Whatever may be the consumption now, it is certain that the demand for this fine article will for a long period exceed the supply. The limited surplus over and above the home consumption of the crowded populations of Asiatic countries has been a drawback to the diffusion of ramie in other parts of the world. The cleaning process of the Chinese permits to each hand an average of only 1½ pounds a day—hence the limited production.

It is a well-known fact that, if American manufacturers have not yet displayed their usual enterprising spirit and ingenuity by availing themselves of the advantages without number offered by the ramie, it is because they could not secure a regular supply of the fiber. But the decortication of the plant being now easy and economical, its cultivation will receive its due development, and permit our industrial institutions to check the foreign monopoly of ramie goods. We have now on hand all the necessary elements for the rapid progress of its cultivation and production; abundance of plants and roots as acclimated seed; lands and climate per-

fectly suitable; practical knowledge derived from six years of experiment; and, finally, the mechanical means of harvesting this valuable product.

Having thus exhibited the actual standing of ramie as the element of new branches of manufactures on this continent, and demonstrated that, instead of being abandoned as a failure, which many thought it was, it has silently prepared its way to success, we deem it proper to state briefly the past status of the plant, and the use made of it by its original producers.

If ramie is a novelty for the New World, it has been in use from remote antiquity in the Old. Japan, China, India, and almost all the islands of the East have, for centuries, made of it the basis of their home fabrics, and an object of foreign trade. The Greeks and the Romans used, as silk clothing, ramie goods imported from the countries of Southern Asia. Virgil mentions the fact, and admires those rich tissues, in his *Georgics*. He calls them the brilliant product of the silk countries of the East. Several learned Jesuits, when missionaries in Japan and China, discovered that "this brilliant product," so admired by the Roman poet, was the nettle-fiber called "kara" in Japan, "ma," or "chu-ma," in China, "rhea" in the East Indies, and "ramah," or "ramie" in Java. All these denominations in the languages of the countries producing the plant have some meaning in regard to the varieties in the nettle family. The generic name of the plant is "*Urtica*," of the Bohemaria tribe. But in its numerous varieties there are different qualities classed under two principal types: *Urtica nivea*, (the English China grass,) and *Urtica utilis*, or *tenacissima*, which is the ramie. The latter is the better of the two. We have both varieties in Louisiana, and we can confirm Dr. Decaisne's assertion of the superiority of ramie over China grass. Thus *Urtica nivea*, with the leaves green on one side and silvery on the other, is inferior both in productiveness and in quality. Its fiber remains greenish, stiff, and brittle. It is the reverse with the ramie, or *Urtica tenacissima*. It is partly for that reason that the English government of East India promotes by all possible means the production of that variety in Hindostan. It is named *rhea* there and ramie here. The Asiatic etymology of the two names corresponds logically to the meaning of "high branches."

Roxburgh in England, Decaisne in France, and the Department of Agriculture in America are the principal introducers of the plant into the scientific spheres of their respective countries. They have personally verified the industrial value of ramie as the genuine kind of Bohemaria, and recommended its adoption to agriculturists. Decaisne, professor of the Museum of Natural History in Paris, has published a notice in which he traces the use of the textile in Europe as far back as the seventh century. "Russia," he says, "received it from the Tartar and the Chinese as damask silk; Holland received it from her Asiatic establishments, and trades still with it, under the name of *nettledock*; England, under Queen Elizabeth, learned from the botanist Lobel the value of the article, and has since labored to monopolize its trade throughout the civilized world.

In Europe, especially in France, new ideas and discoveries are promptly investigated and sifted out by scientific volunteers laboring ardently to keep their minds in activity, or to have the pleasure and the honor of contributing to the progress and the welfare of mankind. They do there in theory what our Department of Agriculture does here in practice. They study, think, and write on any agitated subject, and send the result of their mental efforts to some academy or institute, whence it is publicly disseminated throughout the world.

The ramie question has been turned over and over again, for years, by writers on industry and economy. Numerous memoirs, pamphlets, and books have

appeared in the wake of the learned Roxburgh and Decaisne. But few of those publications possess the tangibility of accurate facts and of practical knowledge. The majority are merely vague repetitions of old reports, and convey no instruction of a solid nature. One of the rare good treatises on the matter is that of Ramon de la Sagra, member of the French Institute. It has been published in the *Bulletin de la Société d'Acclimation* of 1869, which is similar in its object to the monthly report of the United States Department of Agriculture. That treatise is a clear and reliable exposition of the Chinese methods employed in the cultivation and treatment of the plant, but the writer concludes, in harmony with all those that are properly enlightened on the points in question, that the profitable cultivation of ramie is doubtful in European latitudes, or, at all events, not to be attempted until the cleaning can be performed by efficient machinery. In the Union the plant has a wide field and an ample margin in regard to the latitudes congenial to its growth. The Gulf States and California have in that respect the requisite qualities, particularly Louisiana, where the plant was first introduced from Mexico, in 1867, and subjected since to various tests. To two persons is due the credit of its introduction into the United States, viz, Monsieur Ernest Godeaux, in that year consul of France in New Orleans, and Benito Roezl, a Bohemian botanist, once a resident of Santa Comapan, in Mexico. M. Godeaux, who was consul at Shanghai before coming to New Orleans, had brought from China fine white clothing made of "ma." It was remarked and admired by every one for its various qualities. Having observed that the latitude and soil of Louisiana could not be uncongenial to the plant, M. Godeaux ordered some ramie seed from China. But it failed to come in proper condition. By a curious coincidence Roezl arrived at that time from Vera Cruz with a lot of ramie roots for sale. He had also a few plants growing in flower-pots. M. Godeaux identified and recommended the plant as being the same he had attempted to introduce into Louisiana as a profitable article of cultivation. The Department of Agriculture, then superintended by Gen. Horace Capron, also recognized the identity of that Bohemaria and officially proclaimed its merits, as the Hon. Frederick Watts now does in regard to jute.

The New Orleans press, the "Picayune," the "Times," the "Bee," the "Renaissance Louisianaise," &c., studied elaborately the value and utilization of this textile, and recommended its adoption. Roezl sold his roots in small quantities to numerous experimenters, and the initiation of the plant was effected with varied success in different quarters of Louisiana, Mississippi, Texas, South Carolina, Georgia, Alabama, &c. Thus a few hundreds of sickly ratoons, transplanted from Mexico, where a dozen roots had been previously imported from Java, rapidly produced millions of plants in these States. But the vicissitudes of the country, the want of efficient machinery, as also insufficient care and attention caused the decay of a great portion of this first growth. Louisiana is probably the only spot where the propagation of the plant was maintained. All sorts of experiments on the various points to be studied made the writer of this memoir familiar with the ramie cultivation and its requirements. The successful cultivation of the ramie is not exactly an easy task, as many suppose it to be, nor can the plant adapt itself to any kind of soil indiscriminately, as it has been reported. Experience has demonstrated that a durable stand requires a judicious choice of land and situation, also intelligent and attentive labor at the outset. Bearing in mind that ramie is a perennial growth of great productiveness, which can last for years and years, it will logically be admitted that a selected and well-prepared soil is indispensable to secure the benefit of frequent cuttings and a lengthened stand. Therefore the

observation of the following rules will be absolutely necessary for the cultivation of ramie, and for drawing from the rich plant all it can yield :

First. Whether for nursery purposes or for cultivation, the land must be sufficiently elevated to receive the benefit of natural drainage, because the roots will not live long in a watery bottom.

Secondly. The soil must be deep, rich, light, and moist as the sandy alluvia of Louisiana. Manure supplies the defects in some lands in these respects.

Thirdly. The field must be thoroughly cleared of weeds, plowed twice to the depth of 8 or 10 inches if possible, harrowed as much as a thorough pulverizing requires, and carefully drained by discriminate lines of ditches. Water must not be allowed to stand in the rows of the plant.

The land being thus prepared, planting becomes easy and promising. December, January, and February are the best months in which to plant. Roots, ratoons, and rooted layers are the only available seed. They are generally 4 or 5 inches long, carefully cut, not torn, from the mother-plant. The dusty seed produced by ramie stalks in the fall can be sown, but it is so delicate and requires so much care during the period of germination and growth that it seldom succeeds in open land. The regular germinating power of that dusty seed is also questionable. The Department of Agriculture vainly tried, a few years ago, to diffuse this seminal cultivation by distributing imported seed, which never germinated.

In the presence of these difficulties, and of the sure propagation obtained from fractional roots, sowing has been abandoned and replanting adopted as follows :

Furrows 5 or 6 inches deep and 5 feet apart are opened with the plow. The roots are laid lengthwise in the middle, close in succession if a thick stand of crop is desired, but placed at intervals if nursery propagation is the object in view.

The first mode will absorb 3,000 roots per acre, but will save the labor of often filling the stand by propagation. The second mode will spare three-fourths of that amount of roots, but will impose the obligation of multiplying by layers. Being placed in the furrow closely or at intervals the roots are carefully covered with the hoe. Pulverized earth and manure spread over the roots insure an early and luxuriant growth in the spring. When the shoots have attained a foot in height they are hilled up like potatoes, corn, and all other plants that require good footing and protection from the fermenting effect of stagnant water. The intervals between the rows being deepened by the hilling have also a draining influence, which can be rendered still more effective by ditches dug across from distance to distance, say 15 feet.

Good crops are obtained by thickening the stands. The stems are then abundant, fine, straight, and rich in fiber. Close planting is then necessary, inasmuch as it prevents the objectionable branching of the stalks. Crooked and branchy ramie is unfit for mechanical decortication; it causes waste and yields an inferior quality of fiber. The period at which the plant is ripe for cutting is indicated by a brownish tinge at the foot of the stems. At that early stage the plant, though greenish, yields a fine and abundant filament; it also produces three or four crops, according to soil and climate. The first cutting may be unprofitable on account of the irregularity and sparseness of the growth; but if the stand is well razed and manured over the stubbles the ensuing cuttings will be productive. For that purpose the field must be kept clear of grass until the growth be sufficiently dense to expel the parasites by its shade. That necessary density is obtained by means of the important laying process. This consists in bending down, right and left along the growing stand, the highest switches, and in covering them with earth up to the tender tip, which must not be smothered. One of the

causes of the perennity and of the vigor of the plant is the nourishment it draws from the agencies of the atmosphere. Consequently the leaves of the layers should never be buried under ground. When properly performed, laying is very profitable; it creates an abundance of new roots, and fills up rapidly the voids of the stand.

After two years the plants may be so thick as to spread out in the rows. Then the plow or the stubble-cutter has to chop in a line, on one side, the projecting ratoons. If well executed this operation leads to notable advantages:

First. It extracts roots or fractional plants suitable for the extension of the cultivation elsewhere.

Secondly. It maintains, as a pruning, a vigorous life and develops a luxuriant growth in the stand.

Thirdly. If always applied on the same side of the row, this sort of stubble-cutting has the remarkable advantage of removing gradually the growth toward the unoccupied land in the intervals, and of pushing it into a new position without disturbance.

That slow rotation preserves the soil from rapid exhaustion, and the ramie from decay, through the accumulation of roots under ground. Of course this lateral plowing will not prevent the opposite row from receiving the benefit of hoeing after each crop. Experiments made in Louisiana have demonstrated the efficiency of that method; to which are due the preservation and propagation of the plant in that State, while it has been destroyed in other sections for want of similar care.

It is through such judicious methods that the old land of China has preserved sufficient fertility to produce constantly the ramie for many centuries. After each cutting Chinese planters plow on one side and make cleanly the stand; then they cover it with a thick coat of manure. That maintains the moisture and fertility of the soil, and, at the same time, preserves the plant from excessive heat or extreme cold. That protective system permits in winter ramie cultivation in latitudes corresponding to those of Maryland and Virginia. It could even be undertaken farther north by another Chinese application.

In some cold regions of the northwestern parts of the celestial empire China-grass is cultivated like potatoes. Planters dig up the stand every fall, after the last cutting, and store the roots in cellars to replant them in the spring; yet they generally obtain two crops by that unfavorable process.

Let us now close this notice with a description of the harvesting operations. As we have already said, the cutting must commence when the stalks, in dense bushes, become brownish at about a foot above the ground.

The American Mower, World No. 1, with the new short blades, will mow ramie easily and rapidly. The reaper will permit the stems to be gathered in sheaves like wheat. Men and women walking behind the mower tie them and equalize the ends. Thus they build them in stacks from distance to distance on the ground. After a few days the leaves wither and fall under the handling and the shaking they undergo while they are being carried to the machine. Ramie may remain cut from eight to fifteen days, according as the weather is dry or damp, before it is decorticated.

There is also between the first and last degree of maturity a space of time which leaves a sufficient margin for the harvesting of 50 acres per machine. The yield of ramie fiber per acre varies according to the density of the growth. A plantation with regular thick stands will produce from 400 to 500 pounds of crude fiber per acre at each cutting.

The process of decortication is simple and easy. The bunches coming from the

field, with as few leaves as possible, are placed one by one in succession in the compressing aperture of the feeder of an endless circular carrier. The stalks brought under the influence of the attractive rotation of cleaners, revolving with great velocity, are crushed at their entry and scraped at their exit by the peculiar effect of the horizontal carrier, which turns out the cleaned fiber on the opposite side of the feeder.

The yield of the machine will be in proportion to its size and power. The cleaning is incessant if the machine is fed constantly by a quick handling. Its principle offers the facility of such an expansion that the apparatus can be made large enough to clean one ton of fiber per day with a twenty-horse motive power. It is not only to ramie, but also to jute, flax, hemp, and all strong textiles, in green plants, that this new machine can be successfully applied. It is demonstrated by theory and practice that the textiles extracted in a green state retain all the natural qualities of strength and color, which lose always 50 per cent. by the ordinary process of rotting in stalks. The avoiding of that loss is one of the great advantages of the machine, besides the important economy in labor. Now comes the disintegration of the decorticated fiber.

The yellowish ribbons produced from the plant engaged in the machine are the crude fibers. Albumen keeps them undivided, but being dried in the shade they acquire in that state a marketable value, which will double and triple by subjecting the filament to the bleaching treatment. However, ramie-planters need not push so far as the industrial preparation of the product, inasmuch as they can sell it in its raw condition to bleachers and manufacturers, as brown sugar is sold to the refiners. But should they desire to bleach and refine the article, they could do it by the appliance of the ordinary process in use for flax-bleaching. The best method is that of Bethollet, which has been the most extensively used. It consists in first steeping the fibers or vegetable tissues in boiling water, and then in rinsing them in a copious supply of water in order to disengage them from soluble matter. When the water has entirely dropped off they are plunged into a bath of alkaline lye, which is raised to the boiling-point; they are then immersed in a solution of hypochlorite of lime or an alkaline hypochlorite. The tissues are washed in a copious supply of water, and then immersed in water acidulated by sulphuric acid; washed with soap and water; then rinsed in water and dried. Now, much labor is spared by bringing the chlorite into immediate contact with the fibers washed in hot water and still damp, or by plunging them into a bath saturated with chlorate.

In conclusion, the ramie cultivation for southern planters and the application of the machine to the operations of the western hemp and flax growers deserve in every respect the most serious attention. They contain undoubtedly some elements of beneficial improvement.

However, there may be one objection to ramie enterprise in the present financial embarrassment of the country. It lies in the capital required to start a regular plantation. The root-seed costs from \$20 to \$25 a thousand, and at least 3,000 roots are required for each acre.

That condition may not be accessible to many. At this juncture we have another new, profitable, and cheaper industry to recommend as being within the reach of the impoverished millions of our planting districts. That is the cultivation of *jute*, so warmly advocated during the last few years by our worthy Department of Agriculture. The following notice on the subject of jute will be, it is expected, as the above on ramie, of some advantage to the national interests of the country.

JUTE.

Jute (*Corchorus capsularis*) is a filamentous plant of the *Hibiscus-Malvacea* family. It is a native of Hindostan, and has been used for many years in the textile fabrics of Asia. Its importance as an exportable product dates principally from the cotton crisis created by the war of secession. Then the British trade took advantage of the cotton scarcity to develop the resources of jute as a cheap staple applicable in many European fabrics.

It was largely imported, brought forward as an auxiliary to the existing staples, and introduced into various spun goods. Though it has been proved unfit to take the place of cotton, the numerous experiments then made through necessity have considerably enlarged the area of jute consumption. Millions of bales are now imported and used where only thousands were employed before. It is mixed with other fibers, as wool, flax, hemp, cotton, &c., and causes the remarkable cheapness of certain tissues. A more direct and extensive use to which this long fiber has been put is in the ground of carpets, in oil-carpetings, twines, cordage, sacks, bagging, &c.

The great center of jute specialties is Dundee, (Scotland.) There nearly one hundred mills, occupying thousands of hands, work the article into various goods. All over Europe jute is applied in numerous products. Of late years France has considerably increased her consumption of jute. The assessment of the additional tax on imported textiles amounts for jute only to over 200,000 francs. Other countries consume it in proportion. England, whose consumption of the article exceeds that of all other countries, has the monopoly of the product through her eastern possessions, where she has developed its cultivation to an enormous and annually-increasing extent. In order to secure for a long time to come the continuation of that important source of wealth for the national trade, the British government has forced by all possible means the extension of jute-culture, even at the risk of a breadstuff scarcity, as is testified by the present famine in Bengal.

Last year a royal commission was appointed to examine the subject of jute-cultivation, and inquire into the practicability of extending the production, in order to retain in the hands of the British its exclusive supply to the world. That agricultural industry being in the power of English capital, keeping in a sort of bondage millions of Hindoo producers, jute is for England what cotton is to the United States of America—the commodity which constitutes the principal portion of the national exchange. The Old and the New World are tributaries for enormous sums to Bengal, the principal jute-producing section.

The American trade disburses every year millions of dollars in gold to pay for the manufactured and unmanufactured jute received from Bombay and Calcutta. Though some sorts of canvas are designated in market reports under the denomination of American jute-bagging, there is no jute produced in America. The first trial of a regular jute-culture has just been made in Louisiana.

Desirous of relieving his country from the heavy tribute paid in that respect to India, the Hon. Frederick Watts, Commissioner of the Department of Agriculture, has taken to heart the patriotic task of introducing jute into our agricultural industry. Having obtained from Congress an appropriation for the purchase of some seed from India, Mr. Watts has distributed that seed in the Southern States, and acquired the certainty that the plant can grow and prosper in those having, to a certain extent, some similarity in latitude and soil to the jute districts of India.

Louisiana seems to be remarkably congenial to the plant. Experiments made there on a fair scale have demonstrated, by facts and production, the facility of making jute a very profitable object of cultivation.

The Southern Ramie-Planting Association of New Orleans has planted it two seasons in succession, and by various methods, with the view of testing the adaptability and the yield of the imported seed. It has succeeded remarkably well, and the reproduced seed has proved to be fully as good as the former, and even superior in some cases. It was so well acclimated the second year that it has grown and developed most luxuriantly in the various spots where it has been tried. In general, the domesticated seed has been more vigorous than the seed received from Calcutta. In the parishes of Saint James and Saint John Baptist that prolific plant has attained an average of 8 and 9 feet in height, with a thickness of growth similar to that of wheat; and in inferior soils around New Orleans it has furnished an average of 6 and 7 feet. That and many other facts conclusively demonstrate that jute finds itself at home in the alluvial and moist soil of Louisiana equally as well as in the old and half-exhausted lands of Hindostan.

Texas and Florida have also made successful experiments.

Before describing the mode of culture and of production applied in the experiments made in Louisiana, let us insert a report from a Boston merchant now residing in Calcutta, who has taken the trouble of examining the jute question. The following is what that gentleman, Mr. N. Goddard Fuller, writes on the cultivation of that plant in India:

“The quantity of jute fiber and seed produced to an acre depends greatly on the richness of the land. It is planted in Serajgunge, Naranigunge, (Dacca,) and other northeastern districts, where about four-fifths of the total crop is raised; the product is from two thousand to three thousand pounds of jute on an average; in some cases, however, as much as four thousand pounds are produced. The yield of seed is about one thousand to one thousand two hundred pounds per acre. In places, say about fifty miles around Calcutta, the production of which is called dessee, or country jute, the yield is smaller, being only about six hundred to one thousand pounds of fiber, and more seed, say one thousand five hundred to one thousand six hundred pounds per acre; but on rich, damp lands the product is almost as much as in the northeastern provinces. The dessee description was used only for local consumption until about five years ago, when shipments of it to England began, and both the shipments and productions of it are increasing every year. Jute is sowed broadcast, and about twenty-two to twenty-eight pounds of seed is required to an acre. In the northeastern provinces it is planted in February and March, and is cut about the end of June and beginning of July. The dessee is sown in July and August, and cut in August and September. On rich land it grows and ripens quicker. In the northeastern districts, when grown on rich soil, the diameter of the stalk at the bottom is from three-fourths of an inch to one and a quarter inches, and the length from seven to ten feet, and sometimes, but rarely, longer and thicker.

“The country jute around cities is from four to seven feet long and one-half to three-fourths of an inch in diameter. The plants are cut about three inches above the ground, excepting dowrah, which is uprooted. The butts are cut at the time of baling the jute for export to Calcutta. When the stalks are cut they have a green bark, which, after going through certain processes, becomes fiber; the planters cannot tell at the time of cutting the stalks whether any or how far from the bottom will be hard. The stalks are cut about a month before the seed ripens, and the poorer plants are generally let go to seed. Jute made out of the plants

producing seed is hard and barky; the unripe seed, cut with the stalks, is of no use. It grows best on rich, moist ground, but not on low ground. Castor-oil cake is the best for it, and next to that cow-manure, but the country planters, as the ground is naturally rich, use no manure whatever. An acre of cotton costs much more than an acre of jute. Jute and cotton do not interfere with each other in the least. Cotton grows in the northwestern provinces, Central and Southern India, while jute is raised in Bengal. The little cotton that Bengal produces, and the little jute that the cotton districts produce are of poor quality, and only used for local consumption. For the last few years jute has been encroaching on the linseed crop, as the same ground is suitable for both."

It was in the presence of such inciting reports, and of the encouraging counsels of the Department of Agriculture, that experiments were earnestly made in Louisiana. The selection of the soil and the methods of planting were diversified in order to discover the best applications. The most favorable and economical system sifted out of these various tests is the following:

To obtain good fiber-crops the land must be elevated, rich, moist, and well drained, as in India; to raise seed, low lands may be used, provided that favorable weather allows sowing and enables the growing plants to keep above the points of overflow. However, when the growth is fully started, water is not to be feared, so long as the tips remain above the surface of submersion.

In the first case, jute is sown broadcast; in the second, in drills five feet apart. That interval is to facilitate the branching, and, at the same time, the destruction by plowing of the tall weeds which generally occupy low lands. In both methods the soil must be as well prepared as for ramie; plowed as deep as possible in January or February, then left exposed to atmospherical influences until the planting period. That period commences with April and terminates with June, in monthly succession. To prepare for sowing a second plowing is required, and as fine a harrowing as can be effected. The "circular pulverizer," applied before the harrow, shortens the labor. Then the sowing for fiber-crop is performed broadcast with a Calhoun sower. With that instrument, costing \$8 or \$10, a man can sow ten acres of jute per day. The quantity of seed required for each acre is from 12 to 15 pounds. That is amply sufficient, and, if the Hindoos put more in their land, there must be some accountable reason for that excess. Either the condition of their seed or of their land is inferior to that of America, or they are singularly prone to go to waste. We have repeatedly observed that, when the growth is thicker than what is allowed by the aforesaid quantum of seed, some natural destructive agent enters into the stand and thins the space to the limit demanded by the plant. This fact was verified in several spots of jute-plantation in Louisiana. Therefore no advantage at all can be derived from prodigality in sowing. The equal distribution obtained by the mechanical sower may account also for the economical difference existing between us and the Hindoo planters, who, having no machinery whatever, do all their work by hand.

The ground being well tilled and the seed properly sown, on wet days if possible, the jute is left alone like wheat. No other care than that of drainage is necessary until maturity.

The cost of that first operation cannot exceed \$4 per acre, if the material is adequate and the management judicious. That expense, of course, does not include the value of the seed, because, after the first outlay, planters will provide themselves with it from the low lands, or from the weak spots of the plantation. In the bottoms, when we plant in drills for seed, a subsequent plowing or two

will be necessary in the intervals to neutralize the encroachments of grass. In Louisiana the labor is a necessity principally for the purpose of combating the tall weed called "wild indigo," which occupies the low grounds. That tall weed, which is also fibrous, is the only vegetable that keeps pace in growth with jute; all other plants are distanced and smothered by the shade of the corchorus.

In the field planted broadcast no parasite can resist the vigorous and absorbing influence of jute. Even the hardy and noxious gramineal plant, commonly called "coco" in Louisiana, is destroyed after two seasons of broadcast cultivation. Another peculiar advantage of jute-planting is the antagonistic influence it exerts over insects, especially the lepidoptera tribe, which generates the caterpillar. It having been stated in some reports of the Department of Agriculture that cotton-fields surrounded by jute-plantations were respected by the devouring worms, the director of the Ramie-Planting Association made special experiments to test the reported fact. Three different fields, planted with various sorts of cotton, were belted by jute. None of them were visited by the caterpillar, while the cotton of adjacent plantations was partly destroyed by the insect. That protection is attributed to the above-mentioned influence hostile to insects. It was observed that flies and butterflies kept away from jute-fields, especially at the blossoming period. The peculiar odor of the flower and the bitter exudation of the leaves seem to be strongly repulsive to them, if not poisonous. So important a fact deserves to be demonstrated once more on a larger scale. It would cost but little to plant belts of jute around the regular cotton-plantations which have been heretofore invaded by these injurious insects.

The best period for cutting good crops of jute is during the stage that precedes the blossoming, or, at least, the seeding. The fiber is then fine, white, and strong. The monthly sowing graduates the maturing of the successive crops, which facilitates labor. April planting can be harvested in July, May planting in August, and June planting in September. Any late growth can be harvested in October, and even after if no frost interferes. The plant stands green until frost dries it up; but even then it can furnish a good material for paper. The cutting operation is done with a mowing and reaping apparatus. The mower, World No. 1, easily cuts jute of the largest size and thickest stands. The alblumen of the plant makes it easier to cut than dry wheat. The reaper gathering the stems, bundles are made and carried as fast as possible to the mill, where the textile is rapidly separated as described in our notice on ramie. Then comes the rotting operation. As fast as the fiber is turned out by the decorticating-machine it is plunged into large vats filled with pure water, and left exposed to the heat of the atmosphere. Kept under at least one foot of water, the filament is disintegrated by the dissolution of the gums or resins which united it in a sort of ribbon. That process of fermentation or rotting takes about a week in summer. With care and attention to the proper degree of rotting the fiber comes out almost white, lustrous, and fine like flax. The disintegration is known to be complete when the fiber assumes a pasty character. Then the rotted hanks are withdrawn, carefully washed in clear water, and hung up to dry in the shade. Care must be taken that the filament be well covered with water during the fermenting period, because atmospheric agencies tend to communicate to it a brownish color. After a few days of good weather it is ready to be shaken and twisted for baling like other textiles. That new process of rotting the separated filament instead of whole stalks, combines different profitable results—the advantages of economy in labor, in value, and in integrity of product. With this great progress in the manipulation,

the India jute competition will surely be defeated if American agriculturists avail themselves of the chance offered exclusively to them at present.

The Hindoo planters cut their jute by hand, and subject it to the old system of ditch-rotting; they steep the plants in their draining canals and putrid water-pools until fermentation is generated in the bark; then they strip and wash by hand the rotted filament on each stalk. All this is done with a great loss of time and of value in the product. The various sizes of the stalks put to rot cause great inequalities in the disintegration; tips are rotted before the butt-ends, and while the former are weakened by over-rotting, the latter remain yet undivided through an insufficient action of the ferment. Hence the inferiority of India jute as a filament, and the large amount of butts and other rejected parts which have to be deducted from the regular staple.

The jute-textile is naturally stronger than it is as it comes from India. The imperfect system of disintegration weakens and spoils it in the proportion of at least 50 per cent.

There is no such loss in the decortication by machinery; stripped from the green envelope, and reduced to a uniform ribbon, the fiber receives the direct and equal action of rotting ferments, without the injurious influence of excessive or of insufficient disintegration.

The Hindoo process of rotting the stalks is expensive, though it seems simple and easy. The work of manipulation is considerable, and is entirely wasted on 80 per cent. of refuse. Besides all its anti-economical drawbacks, it has the great inconvenience of infusing into the fiber the tannic coloring of the bark. The brown tinge with which it is permeated depreciates considerably the staple; it prevents easy bleaching and mixture in white and colored goods.

Fortunately for the United States, all these difficulties are removed by the mechanical decortication applied from ramie to jute. The decortication-machine has operated publicly on the two plants and demonstrated the facts above stated.

Having tested the yield by the decortication of several acres, and verified in various manners the practicability of making this culture an abundant source of profit, the experimenters have purposely ceased cutting in order to save as much seed as possible for future development.

Samples of the fiber have been sent to different manufacturers, who have reported most favorably. Cordage made in New Orleans with the material has been considered superior to any made of the ordinary stock. The raw filament, produced directly by decortication, is already a marketable material. Extracted from young plants, that is to say, plants not yet in blossom, it makes an excellent strong stock for rope. When it becomes appreciated by use it may be classed as valuable as Sisal or Manila hemp. No doubt it will, sooner or later, be adopted in company with, if not in the place of, the imported fiber. It is a well-known fact that fiber obtained from its green stem is naturally strong and durable. That explains the qualities of the raw article, inasmuch as we, by our system, can rot it to the degree required for the purpose in view.

The long, soft staple made from it by water-rotting is remarkable in every sense. It has been pronounced equivalent to Italian hemp for many purposes, especially for packing yarns. As it can be thoroughly bleached and mixed with the other staples, it will soon exceed the value of the best India jute. Ropes made for home consumption of the two sorts—the raw and the retted—have been estimated at an average wholesale price of 20 cents per pound. Deducting 6 cents for waste and making, 14 cents would remain for the fiber. That result would leave a consider-

able profit to the producer, the average cost of production not being over 3 cents a pound, where the cultivation is well managed. Let us add that the refuse, after the cleaning, furnishes 50 per cent. of good material for paper-making, the other 50 per cent. furnishing a good manure.

It is the same case with ramie, the cultivation of which can be easily associated with that of jute. The two cultures will ultimately be the most profitable of the country—especially in Louisiana, where the decaying cultivation of sugar-cane demands a substitute.

The plants whose introduction is here advocated will become for sugar-planters a timely relief, inasmuch as the large capital invested in their machinery can be utilized in ramie and jute production. Then, but a small outlay for seed and the decorticating apparatus will be necessary.

There are two species of jute, as of ramie, the *dacca* and the *dessee*. The difference between them is notable. The first grows higher in stalks, but thinner in stands. It is the reverse with the second, which, however, grows and matures faster. The yield and quality of fiber in each are nearly the same. They are distinguished by the seed. One is inclosed in a pod, the other in a bean. The seed of the *dacca* variety is brown; that of the *dessee* green. We have cultivated both varieties, and we think that the last named could furnish two crops a year on account of its rapid growth. The *dessee* crop can be made within two months after sowing.

Besides the "Ramie-Planting Association of New Orleans," several Louisiana planters have experimented on the jute. M. de Lobel-Mahy, of Saint James Parish, a gentleman of intellectual culture, has planted some for seed, and he expresses his opinion as follows:

"I am convinced that the jute-cultivation can perfectly succeed in Louisiana. Most probably that plant will produce better results than the sugar-cane cultivation, which is rendered more and more difficult by high wages," &c.

Dr. B. Laplace, a planter of ability in Saint John Baptist Parish, has also tried the jute. "There is not a more profitable cultivation," he says, "if only 6 cents can be obtained for the water-rotted product."

Mr. Revillion, of Lac Arthur, Calcasieu Parish, reports a remarkable growth, and the successful destruction of coco by jute; of which he speaks, like Dr. Laplace, with enthusiastic confidence.

Mr. F. Sanfroid, merchant, of New Orleans, has obtained such a prolific growth of jute in a garden that he thinks it destined to restore the prosperity of our agricultural industry if extensively cultivated.

Dr. Landry, of New Orleans, has observed the influence of jute-growth on insects, and writes as follows: "I have seen, on the first of October, a cotton-field in full foliage, flowers and bolls, without a single insect-bite. That cotton was surrounded by a jute-growth. All the other cotton-fields, far and around, were more or less devastated by worms. If this fact does not conclusively prove the protective influence of jute over cotton, it at least contains a great presumption in favor of the affirmative, as the emanations from the jute-flower are injurious to the insects. Paris-green has succeeded generally in saving the cotton, wherever it was properly applied; but the jute would cost less and be more reliable, on account of the uncertainty of negro labor in disseminating the green poison over the cotton-leaves."

Besides these, and many other opinions expressed in favor of jute-planting, besides, also, the repeated recommendations of the Hon. Frederick Watts, many merchants, manufacturers, and gentlemen of standing and intelligence in the North warmly advocate jute-production in the United States. The Hon. E. H. Derby,

of Boston, has for years past earnestly fostered the idea of its introduction. He has studied the question, and, by publications, has disseminated a knowledge of the subject with perseverance and talent.

Having visited jute manufactories in Dundee, that gentleman has described in some official reports the working of the article, and shown how easy it would be for Americans to establish such factories in the Union.

Thomas H. Dunham, esq., another Boston gentleman of high patriotic sentiments, has also, for a long period, recommended the same object, and has spoken with competency on the matter. "Our Government," he writes, "should do all in its power to encourage the growth of jute in the country. How immense would be the trade! Manila paper is nine-tenths jute; gunny-bags, oil-cloth, burlap, gunny-cloth—what vast use we make of each and all. Sacking for wheat in the California market alone is an immense trade for jute. What is wanted in the United States is a special worker to go into the carrying out of its growth, taking such practical steps as will insure its universal growth where it is possible in this country, making the matter a special bounty to encourage and stimulate the growth of jute. No one man can prepare the work unless he has that and nothing else to attend to. A pamphlet may give facts, but it brings so much care; one has to give time, patience, care far beyond his means. I hail with great satisfaction the specimens of American jute sent to me; they are worthy of all praise and encouragement. The country is indebted to the producer, and I would have his labor remunerated. I will do all I can to further the labor in this culture. The policy of the British government is to hold the jute trade; our policy is to bring every facility to its growth and culture here. The great use of jute in all branches will give it a constant demand fully equal to one-half of our cotton-crop. It is good for a variety of purposes."

The above opinions express the sentiments of all competent economists and enlightened citizens desirous of promoting the national welfare. Every one familiar with this important question thinks the Government should take immediate steps to popularize the cultivation of jute throughout the Union.

1st. A knowledge of the culture and production should be diffused by means of a short treatise distributed free.

2d. Premiums of sufficient amount to attract capital should be offered for the largest and best cultivation.

3d. A model jute-plantation should be established and managed by the Government, under the superintendence of the Department of Agriculture, to start the great work, to impart the initial teaching, and, at the same time, to produce seed for the people. We have now in the country all the necessary elements for a successful and rapid development of jute-cultivation; lands adapted to the purpose; climate congenial; seed domesticated; practical knowledge of the culture, and all the mechanical requisites for a valuable production. But little effort and outlay on the part of Government would be necessary to develop jute and ramie culture so as to suppress foreign monopolies and save millions of dollars to the country, and to establish new industries which would give employment to millions of laborers. In every sense the matter is worthy of the patriotic attention of our national Congress.

NEW ORLEANS, LA., *December, 1873.*

CULTURE AND MANUFACTURE
OF
RAMIE AND JUTE
IN
THE UNITED STATES.

BY
EMILE LEFRANC,

OF NEW ORLEANS.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE.

WASHINGTON: 4
GOVERNMENT PRINTING OFFICE.
1873.

LIBRARY OF CONGRESS

00009318781