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THEIR

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BY

E. SEBASTIAN DELAMER,

AUTHOR OF "PIGEONS AND RABBITS."

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Hemp seeds and plants in their early stage of growth.

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BY

E. SEBASTIAN DELAMER, pseud

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Edmund S. Dixon

With Illustrations.

LONDON:

G. ROUTLEDGE & CO., FARRINGDON STREET;

NEW YORK: 18, BEEKMAN STREET.

1854.

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E. SEBASTIAN DELAMER,

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With Illustrations.

LONDON:
C. ROUTLEDGE & CO., FARRINGDON STREET;
NEW YORK: 18, BEEKMAN STREET.
1864.

PREFACE.

VIX EA NOSTRA VOCO, "They hardly belong to us," is a motto doubly applicable to the book now in the reader's hand. In the first place, its subject, Flax and Hemp, in consequence of gradual neglect, can scarcely be admitted, except by courtesy, to enter the list of English agricultural produce. When they do appear upon the land, they are looked upon as curiosities rather than as crops. And secondly, its matter, derived from various sources of information, from practical men as well as from theoretical treatises, is therefore not to be claimed by the writer as the virgin produce of his own creation. He acts the part of a sober historian, in only pretending to relate and arrange existing facts and authorities, rather than that of a speculative politician, who imagines new events and combinations. Still, almost all the details described have been repeatedly performed before his eyes; while those with which he is less familiar have been verified by consulting competent persons. The implements for the preparation of flax, as here described and figured, are probably published for the first time. Of their utility, no more need be said than that they are the only ones which a good French workman will look at; and that they differ widely from those known at home.

That flax and hemp are not our own, is a deficiency in our yearly harvest, which is even less lamentable than to to be wondered at. If it were a question of producing

exotic plants unsuited to the British climate, like other attempts that have repeatedly been made, and have as repeatedly failed, and which no skill in acclimatising will ever render successful, the writer would not have wasted his time by putting pen to paper on so visionary a scheme.

Those differences of climate which appear to offer the principal obstacle to the propagation of foreign plants, have but little influence on the naturalization of hemp, especially, in almost every habitable country on the face of the globe. Extremes of latitude are of but little consequence with vegetable productions which come to perfection in a very short interval of time, and at a season of the year which differs but little from the same season in regions far removed. The height of summer offers no great dissimilarity of temperature between the equator and the polar circle; it is sometimes even hotter high in the north than under the tropics, while the continuity of genial sunshine makes up for the briefness of its entire duration. This singular advantage allows an immense extension to the culture of both flax and hemp; and they, perhaps, next to wheat, are the plants that have shown the greatest facility to make themselves at home in climates the most opposite.

Leaving flax to speak for itself, we may remark that hemp is an indispensable necessary to a nation that claims the sovereignty of the seas. No other plant can replace its absence, though several present themselves as useful auxiliaries. But an auxiliary is not a substitute. We leave undiscussed the question whether Russia can better do without coal, than we can without hemp; that is a point for statesmen and political economists, rather than for agriculturists, to settle. But we do insist upon the fact, that whilst Russia can

produce not an atom of coal for herself, we may, if we chose, grow our own hemp to quite an indefinite extent, and hold ourselves independent of foreign supply. The soil of Ireland alone is capable of sending forth an enormous export.

"British Husbandry" justly remarks, "It has excited the surprise of many writers upon agriculture, that the culture of flax and hemp has not been further extended in this county, and calculations have been brought forward showing the vast advantage which would accrue to the nation by the saving of the immense sum paid to foreigners for their importation. But putting aside the question regarding the supposed national gain, with the discussion of which we have no concern, and looking solely to the farmer's profit, it may yet be justly doubted whether they can ever be here made an object of general culture; for they not only require land of a peculiar nature, but the crops demand more minute attention than farmers generally choose to bestow on them, and, independently of the opinion that they are exhausting, they return nothing in the shape of manure to benefit the ground."

All this is perfectly true. It is an Englishman's privilege to entertain reasonable doubts, and to see his way a little before taking an important step. It is also true that farmers on a large scale require no addition to the details which they already have to attend to; we will only observe that, where there's a will, there's a way. But men's minds are more difficult to cultivate than land. Stubborn fields can be made to bear flax and hemp more easily than an indifferent, prejudiced, and routine-led neighbourhood can be taught to appreciate their value when grown. But the writer has no wish to appear as an advocate; it is merely his duty to describe

fully and fairly the objects presented to him to lecture upon. The profitableness of flax (when people know how to turn it to account), the utility of hemp, and the inappreciable national importance of both, are more than acknowledged—they are unquestionable. But still there are difficulties in the way of their increased cultivation in England. If English farmers will not submit to a greater division of labour in their profession; if they will not allow and encourage the existence of a class of flax-men and hemp-men, who will purchase and prepare their vegetable produce for the market, as they allow the butcher to prepare their animal produce; if the patrons of agricultural science will not generously aid in instructing labourers in the manipulation of flax and hemp, then flax and hemp cannot be grown in England; we shall remain dependent on others for much that we might produce ourselves; we shall continue to pay enormous sums which we might retain in our own pockets; and many a constant winter's wages will remain unearned by many a willing labourer, because neither the material nor the skill to work it are produced and placed within his power to attain.

The writer looks forward to a better prospect: under the circumstances in which Europe is situated, he feels confident that the textile plants will be restored to their due rank in the husbandry of the United Kingdom. Our book may be the humble cause of visits to the flax and hemp districts of the Continent. It will then be seen what is done abroad; the rest, in time, will follow at home. The great agriculturists of England are not deficient in either enterprise, shrewdness, or liberality.

CONTENTS.

FLAX.

HEMP.

FLAX.

VARIED ANALOGIES AND USES OF FLAX.

FLAX, say the fanciful disciples of Fourier, signifies "the industrious lover;" for its flowers are blue, the colour of love, the passion which animates him; its stem is straight and upright, like his honest course of uniform labour; the small and numerous leaves denote that his occupation is made up of many details trifling in themselves; the annual and fibrous root imply that he has no firm hold on the gifts of fortune, but is obliged to live by daily toil; while the elegance of the petals declares that his exertions are not left unrewarded.

In sober truth, it would be difficult to find a plant, even in the list of more pretending vegetables, which renders to Man such important, diversified, and widespread services as the fragile annual which is the subject of the present treatise. With the sole exception of not furnishing a stimulating beverage, it lends its aid, directly and indirectly, in furthering the whole life-long journey of the human race, from the cradle to the grave. In this respect it contrasts strongly with the vine, which supplies us with a cheering liquor, but aids us in nothing else besides. Not that we would depreciate the noble vine for the purpose of dignifying what are called humbler plants. The vine, according to the theory of the above-mentioned speculative philosophers,—the vine bears fruit of two colours, white and violet, thereby symbolising universal friendship. It is a plant which delights in clinging to trees and walls; it tries to love and embrace

everything which surrounds it. Its wood, which is as poor as its branches are liberal, indicates the generosity and unselfishness which belongs to all genuine friendship and brotherhood. Its fruit comes in aid of all our necessities, and is wholesome to every constitution. Its juice excites to friendly confidence, and, like sincere friendship, it improves with time. By its shade, its grapes, and the wine they give, the vine is acknowledged to be the universal favourite of all nations, ages, and epochs.

Both the vine and flax are most benevolent gifts from the hand of a bountiful Creator. But while the former symbolises ease and joy, flax is the emblem of temperance and love, combined with patience, labour, and economy. The one enhances the pleasures of the wealthy and the gay, not refusing meanwhile to solace the griefs of the aged, the downcast, and the heavily afflicted; the other enables the children of labour to look forward to a sure but hard-earned meal, and that seems its principal mission on earth; while it still condescends, through their instrumentality, to adorn the high-born dames of princes. The fastidious vine restricts its dwelling to the most favoured regions of the earth; the hardier and cosmopolitan flax boldly flourishes, and cheerfully displays its delicate blossoms, under the three months' summer of a northern sky, as well as beneath the unchanging uniformity of equinoctial light and darkness. "Flax and hemp," says Olivier de Serres, "are of extremest value to man, both in sickness and in health, in life, and even in death." The Scriptures make the flame of flaxen fibre the type of the short and ephemeral duration of all human joys and sorrows. "A bruised reed shall he not break, and smoking flax shall he not quench." (Matt. xii. 20.) That is, he will forbear to extinguish so brief a light as that of flax already smoking and half burnt out. At the coronation of the newly-elected pope, a crier walks in the procession before him, lighting from time to time small tufts of flax at a taper in his hand, and shouting as each last spark dies out, "Holy Father, thus passeth away the glory of all earthly things." But

leaving these allegories, acted as well as written, and confining ourselves to simple facts, we may observe, that to innumerable individuals of the great human family does flax supply the various items of clothing, writing materials, bedding, fuel, medicine, external as well as internal; manure, material to aid the painter's art, and, indirectly, animal food of the highest nutritive qualities; and above all, when duly appreciated and properly managed, it affords that inestimable blessing to a population,—a constant source of remunerative employment, which it is our present duty to detail and explain.

ANTIQUITY OF THE USE OF FLAX.

The historic succession of the articles employed to furnish human clothing, is probably this:—Skins and peltry may be safely allowed to take the first place in chronological order. Wool, which preceded hemp in Europe, sufficed for ages to clothe our forefathers. Before the establishment of the empire, the Romans were unacquainted with any other garments besides those manufactured from wool. Hemp had scarcely arrived from Asia to compete with this second material for human vestments, when the flax of Egypt immediately presented itself, to dispute with it the superiority; and its merits caused it to spread with such rapidity and with such advantage to those who employed it, that the value and estimation of fine hemp suffered a considerable diminution in consequence. In later times, cotton has appeared to compete with flax and hemp; and its abundance, the singularly cheap rate at which it is capable of being cultivated, the immense extent of country suitable for its production, and above all, its peculiar fitness for being manufactured by machinery, have rendered it so common, and consequently so cheap, that it has advantageously taken the place of both the original fibres for an infinite variety of purposes.

It would appear that flax is a native of the plains which overspread Persia, towards the east; at all events.

wild plants have been found growing there, apparently quite in a state of nature. This region, however, has always had the reputation of originally furnishing many, both of the plants and animals, which have proved the most serviceable for economical purposes. Flax is one of those creatures of the Almighty hand which varies but slightly, and only in unimportant particulars (as far as specific distinctions are concerned), from a certain type; otherwise, it is probable that its real origin would be quite as mysterious as that of wheat and the rest of the cereal grains. In the earliest records of the human race, we find it spoken of in the same sentences with them, and in equal terms. Thus, in the ninth chapter of Exodus, verses 31 and 32, we read, "And the flax and the barley was smitten; for the barley was in the ear, and the flax was bolled. But the wheat and the rye were not smitten; for they were not grown up." In the same book, some of the uses are mentioned for which flax was employed in those early days. In the ninth verse of the thirty-eighth chapter, we are told, "On the south side southward, the hangings of the court were of fine twined linen, an hundred cubits." Egyptian mummies, three thousand years old, are swathed in linen bandages; while before that time, "coats of fine linen of woven work" were made "for Aaron, and for his sons."

PROGRESS OF THE GROWTH OF FLAX IN THE WEST.

Flax has thus travelled gradually from the East to the western side of the old continent. The plant had long been cultivated in Flanders, when, towards the end of the thirteenth century, its growth was introduced into the north-west of France, that is to say, into the ancient provinces of Maine, Anjou, and Brittany. Beatrice de Gaure, countess of Fauqembergue, in Flanders, and wife of a lord, or seigneur, of Laval (now the chief town of the department de la Mayenne), taught the inhabitants of that neighbourhood to cultivate flax, which, *it was said*, grew there spontaneously. Having obtained work-

men and weavers from Bruges, they soon rendered Laval as celebrated as their own country itself for the excellence of its linen fabrics. In a short while, Maine, Anjou, and La Vendée, gathered abundant crops of flax; but its culture spread exceedingly slowly into other provinces of France, in many of which it is still scarcely known. At the present day, the departments du Nord and Pas de Calais are deservedly famous for their very considerable and well-managed growth and manufacture of flax, which are productive of great benefit to a large class of the inhabitants, while other departments and localities are anxiously striving to follow their example.

It is natural to inquire whether the flax first cultivated in France was really indigenous, or whether it sprang from seed originally brought from Bruges, which afterwards degenerated for want of proper changing and management. The exact truth can never be known; the latter hypothesis is the more probable one. In that age, pious frauds were so common, that the well-intentioned lady of Laval might secretly sow in way-side corners a few handfuls of flax-seed which she had brought from home, simply to excite the curiosity and industry of the uninstructed people whom she desired to benefit. One thing at least is certain, that the flax, of whatever sort, was not productive, and that the culture, then in its infancy, with regard to the best practical methods, passed for being extremely difficult. It will appear hereafter from the processes we are about to describe, that the case could scarcely be otherwise. The culture and subsequent manipulation of flax is a long series of agricultural and manufacturing details, the rules for which have been at last precisely laid down, only in consequence of numberless repeated experiments, as to which method is on the whole the best.

PAST AND EXISTING IMPEDIMENTS TO THE CULTURE OF FLAX IN ENGLAND.

Without occupying our space by tracing the progress of linen fabrics in various parts of the British empire, we

may state that in former reigns laws were enacted, premiums offered, and fines imposed, to enforce the cultivation of flax and hemp in England. Since then, the great impediment to the more extended growth of the former plant particularly, has been the protective duties on wheat, which rendered the cultivation of that grain so profitable, as to throw other crops into comparative neglect and obsoleteness. The late abolition of those duties, combined with the course of political events, have already turned the tables; holders of flax and hemp on the continent are unwilling to sell, expecting a rise in price; and there can be no doubt that in England also flax now promises to be the most remunerative crop that can be grown on land capable of producing it. It is easier, however, to desire the restoration of a long-lost art,—for such flax-farming actually is,—than to accomplish the wish, after old-experienced hands have long since mouldered in the grave, and their valued practical maxims and habits have been clean forgotten years and years ago. But it is scarcely necessary, at the present juncture, to thrust the subject forcibly and against the grain upon the attention of observant agriculturists. Flax must soon urge its own claims, and will establish itself in England by its sole unaided intrinsic merits. The measures of the late Sir Robert Peel will prove the ultimate cause of the reintroduction of the crop. Farmers will give it a permanent place in their rotation, and their labourers will reap the benefit as well as themselves.

In spite of the well-meant efforts that have been made by Mr. Warnes, of Trimingham, in Norfolk, and other adventurous agriculturists, flax-culture cannot yet be said to have made a fresh start in England, or to show symptoms of vigorous regeneration. We attribute the failure in great part to the circumstance that, with *this* crop, the English farmer has too many little details to attend to *after* it is grown. It is more than he can manage himself, with all his other complicated affairs, to grow flax, and then to prepare it to a proper state to be sold to the spinner. For all these after-processes, too, he has to

contend with the difficulty of finding a very great scarcity, if not an absolute deficiency, of skilled labourers. He has to educate a set of men and women to execute a series of nice and catching work, which they have never seen done, and of which they have not the slightest idea.

The instances of this nature mentioned by Mr. Warnes are sufficient to startle any one who has witnessed the benefits derived from the flax-crops by the French and the Flemings. "The progress of flax-culture," he truly observes, "has hitherto been much impeded by the total ignorance of the labourers respecting the management of the stalks, and the unwillingness of growers to incur the expense of instruction. Many excellent crops have been grown in different quarters upon every variety of soil, of which, in some instances, the seed only was turned to immediate account; the stalks being mostly restacked to await the chance of purchasers in their raw state, or of practical aid to render them fit for market. Tons also have been used for thatching, or thrown as litter into cattle-yards, thus at once destroying the means of employment and the most profitable part of the crop! As an illustrative fact, I purchased, a few months since, two tons thirteen hundredweight of Mr. T. Dolphin, of Knapton Hall, which that gentleman had determined to use as straw. The stalks were delivered at the steeping-pit, and I paid five pounds six shillings for them. The after-cost was eight pounds; the yield of flax sixty-four stones; the value, including refuse and tow, nineteen pounds two shillings; the profit, five pounds sixteen shillings. Had the fibre been fine, the profit would have been much greater."

The French flax-grower (with the exception of the peasant, who only grows a small patch in his garden or his patch of land), is relieved from the whole of the troublesome burden which the subsequent treatment of the crop entails. In the most prosperous flax-growing districts of France, these difficulties are obviated by an easy arrangement. It is the custom there for persons called *liniers*, or flax-

merchants, to buy the flax of the farmer as it stands in the field. After the weeding is completed, the farmer has nothing more to do with the crop, but to sell it and to cart it to the merchant after it is pulled. The linier pays for the pulling, thrashes the flax, and steeps it himself. *He* has to engage, oversee, and take the responsibility of all those later details which prove so embarrassing to the English flax-grower. The seed, consequently, always belongs to the linier, and not to the farmer; and hence, as we shall see, arises the great objection which English landlords and very many farmers make to the growth of flax. Mr. Warnes's plan of box-feeding with the seed, which, in justice to him, we shall further mention, goes some way to obviate the difficulty, by causing as little as possible to be carried off the land; but if in France the farmer can grow on land which he rents at forty francs the *mesure*, flax, which he can sell to the linier for from four to five hundred francs the *mesure*, and after paying for manure and oil-cake, besides ploughings, weedings, and seed, can still leave such a considerable surplus as to render the crop by far the most profitable in his whole rotation, much more so than beans and wheat—if he can do this, there can be no doubt that the English farmer is capable of arriving at the same result, unless prevented by restrictions in his lease. Mr. Warnes strongly, and we think wrongly, condemns "that particular species of factorship recommended by the Belfast Society, viz., the buying of the farmer's flax crops, and the removal of them, root and branch, from the land." He hopes that landowners will condescend to accept his advice, and "not permit their tenants to fall into plans so deteriorating to the soil and to its dependants."

In France, as soon as the flax is carted off the land, the linier undertakes its whole subsequent management and manipulation, until it is in a state *nearly* ready to spin, *i. e.*, until the scutching is finished. He does not usually do the combing, which is performed either at the flax-mill, or by the small purchaser, who buys it for his own household use. The scutchers employed by the

liniers are paid by him for their task at the rate of four *sous*, or two-pence, the *kilo*, or about two pounds and a half weight; and in that way the flax is delivered, either to private parties or to flax-mills, to be combed there, and then spun by hand or by machinery, according as the case may be. The advantages resulting from this division of labour are enormous, in a social point of view. It is the absence of the intermediate tradesman, who acts as a purchaser and preparer of flax, which is the main present difficulty attending its cultivation in England. The Belfast Society were right in their recommendation; and an attentive perusal of the following pages, we believe, will convince the reflective reader that such unavoidably is the case. We also believe that men who would devote themselves to this pursuit, who would spend a little leisure time in seeing how things are managed in France, and would then set up as merchants and preparers of flax, would not only realize a good income themselves, but would confer important benefits on the farmer on one side, and on the labourer on the other, by relieving the former of an inconvenient task, and by supplying the latter with never-ending work.

The ignorance generally prevalent in England respecting the value, uses, and application of the flax crop, was strongly instanced about ten years ago by an agricultural controversy between Norfolk and Suffolk gentlemen, touching the *comparative* merits of cameline, or gold of pleasure, and flax. They might as well have compared flax with beans or wheat, with turnips even, or with any other crop in their usual rotation. The leading error was, that flax was principally valuable for the fattening compound made from its seed; the fibre, as a source of employment and profit, was scarcely thought of in the course of the discussion. Cameline, or gold of pleasure, *Myagrum sativum* or *Camelina sativa*, is a plant that is useful enough in its way. It is cultivated on poor, light, or exhausted soils, in many parts of Germany, Belgium, and the north of France, sometimes to be ploughed in green as manure, sometimes to be fed off by sheep and cows, and some-

times to stand and ripen its seed. The seed is crushed in mills, and furnishes an oil for lamps and machinery, so good as to be preferred by many to rape and colza oil. The cake left after the oil is expressed is used for feeding cattle, and also for manure. The stalks are very largely employed in the manufacture of brooms for household purposes, and thus furnish light winter work to numbers of infirm peasantry. With the exception of the circumstance that the seeds of cameline and of flax also are both productive of valuable oil, the two plants are utterly dissimilar in nature, place of growth, and destiny. But even the special merits and qualities of cameline do not seem to be understood or appreciated. Messrs. Gibbs, the eminent seedsmen in London, state that they grew it largely some years ago for a trial. The field on which it was sown was a sand. They had a good return in straw and seed. *The former was used as litter for pigs, and the latter, at least the greatest portion, was rotted for manure.* It is a great misfortune when a community is ignorant how to make the best use of the productions it is capable of raising within the limits of its own territory. In the case of cameline, the matter is of minor consequence. The object of the present "Book for the Country," is to put the novice in the right path to discover the remunerative management of flax, and to point out incidentally the benefits to be derived by the neighbourhood in which it is so properly managed.

THE FLAX PLANT.

Common flax, *Linum usitatissimum*, or "most-used flax" in botanical language, *lin*, in French, is an annual plant with a tap root, which becomes fibrous and divided towards its extremity. From its French and Latin names is derived our word "linen;" and its seed is more frequently known as "lin-seed" than as flax-seed. The French have a special word *linevis* to denote the seed of flax or *lin*, as they have *chenevis* for the seed of *chanvre*, or hemp.

Botanists, who follow the natural system, have made

flax the type of a natural family of plants, which they thence call the *Linaceæ*. According to the Linnæan system, it belongs to the class *Pentandria*, and to the order *Pentagynia*; that is, each blossom contains five *stamens*, or fructifying organs, called the male parts of the flowers, and also five pistils, or terminating points of the embryo fruit, forming what are looked upon as the female organs. Each stamen is tipped with a little roundish head, called an *anther*, which when arrived at maturity sheds a fine dust, called the *pollen;* the pollen coming into contact with the pistils causes the seed to grow, and to become reproductive in its turn. In all plants the influence of the pollen upon the germ, through the absorbing medium of the pistils, is absolutely necessary to render them fertile. In flowers, like those of flax, in which both stamens and pistils are present, seed may be expected from every flower, except in case of accident and injury. In other plants all the male flowers grow upon one individual, and all the female upon another. Such is the case with hemp, the second subject of the present treatise. Unless the male or pollen-bearing plants are allowed to grow up together with the fruit-bearing, or female, until the anthers and the pollen they contain are ripe enough to be shed and wafted by the breeze, the immature seed withers and becomes abortive. Willows, and the date palm, are other well-known instances in which the male and female blossoms are always produced by separate plants; so that each individual willow or date-tree is either male or female for the whole term of its existence. The hazel and the filbert-tree bear blossoms of different sexes, but both are found growing upon the same tree, promiscuously dispersed amongst the branches. In the temperate zone, the majority of plants resemble flax, in bearing blossoms which contain both stamens and pistils, and are thence styled *hermaphrodite* flowers.

Flax starts from the ground with only its two seed-leaves, or *cotyledons*, developed. It then rises with an upright hollow stem, which divides into branches when

grown singly and exposed to light and air, but which runs up straight and slim, without scarcely branching at all, when it is crowded in its seed-bed. Its height, in ordinary ground, is from a foot-and-a-half to two feet; on better soils, under good cultivation, it reaches a yard; and extraordinary samples sometimes come to hand, which display a flax-stem four feet in height. The stalks are covered with a bark or rind, the filaments of which when separated from extraneous matter, supply the raw material from which every variety of linen fabric is made. The leaves are of a bright and delicate green, sessile, or *not* mounted on foot-stalks, and linear. The flowers are of a light sky-blue, solitary, that is, not clustered in bunches, but either produced at the tip of a twig, or seated in the nook between the leaf and the stem. Each flower is followed by a globular capsule, which ought to contain ten flat, shining, and tawny seeds.

A white-flowered variety of flax is found in the Pays de Waes, where it is mostly employed to be worked up with hemp. It is a coarse, productive, and vigorous plant; but its culture is so restricted that we only mention it here to avoid the charge of careless omission. Any further allusion to the numerous other species of the genus flax, some of which are grown as ornamental plants, but none for economical purposes, would be misplaced in the pages with which we are now occupied.

THE SO-CALLED VARIOUS KINDS OF FLAX, AND THEIR SEED.

Some French agricultural writers distinguish several supposed varieties of common flax, which, however, they truly acknowledge to be *entirely due to the mode of culture*. Although we feel it our duty to mention them, we request the reader not to pay too much attention nor to give too much faith to their presumed distinctness, but to devote his whole thoughts to the much more important points of soil and culture, with reference to any

expectations he may form respecting the flax crop which he proposes to cultivate. With this caution, we may proceed to state that the two principal sorts which those writers point out are, first, that known as *lin de fin*, *lin froid*, *lin ramé*, or *grand lin*, which may be Englished as *fine flax*, *cold flax* (from its season), *sticked flax* (from the mode of cultivation), or *tall flax*, which is the tallest and the latest, but also the slenderest and the least productive of grain, more cultivated in the north of France than anywhere else, and always on the most fertile and well-tilled soils; and, secondly, the *lin de gros*, also called *lin tétard*, *lin chaud*, *lin branchu*, in English, *wholesale flax*, *bull-head flax*, *hot flax* (from its season), *branched flax*, which is lower, earlier, fuller of branches, and consequently more productive of grain. This latter is asserted, in books, to be more generally cultivated. The truth is, that the soils which produce it are more common than those on which the taller sort can be raised. Between these there are a few intermediate sub-varieties of very variable and fleeting characters, resulting confessedly from the nature of the soil, climate, and culture, by which the progress of their growth is affected.

Notwithstanding these nice distinctions, practical flax-growers positively affirm that there really is but one kind, or race, of flax; and that all apparent differences are merely the temporary, though important, consequence of the time of year and quality of soil on which that particular generation of flax happens to be sown. The early French agriculturists used to practise the autumnal sowing of flax; hence, perhaps, the unsuspected cause of one of the difficulties experienced in the west of France in olden times. Olivier de Serres teaches us that "there are two seasons for sowing flax, one before and one after the winter. Spring flax gives less seed and fibre than winter flax, but that fibre is finer and more subtle, and for this quality the former is to be preferred to the latter. All flax bears seed indifferently (there being no distinction of male and female plants, as in hemp), except in the

case of a few plants that are accidentally prevented from bearing seed, either from being too much crowded, or any other cause. The one is sown in the month of September or October, the other in March; both should be sown with a waning moon. [This last agricultural rule is not yet obsolete on the continent.] Most people hold that there are particular races of flax, which have each their special season, as is the case with wheat; but others declare that all flax submits to be sown both in autumn and in spring. If the weather is very severe, the winter flax will suffer greatly, being tormented even to death by the excessive cold; the first remedy against which is to lodge it in a spot that is sheltered from the north-east wind, and also to sow it early, in order that having gained strength before the arrival of winter, it may be able by its innate vigour to resist in some degree the injuries of the season. Another mode is to cover the flax during the continuance of sharp frost; by means of which nursing it will fear neither cold nor frost, but will come out of the winter gaily. The covering is made of lattice-work, over which a slight sprinkling of straw is thrown. Fern answers the purpose even better."

The practice of protecting flax by covering it during winter is never employed at the present day, because no one in France or Belgium now thinks of sowing that crop before the spring. The passage is merely quoted, in the first place to show that all flax is probably the same flax, and secondly to warn the experimental agriculturist against the objectionable plan of autumnal sowing. In all countries, therefore, where the winters are not either extremely mild or as good as nominal (in such a climate, for instance, as the north of France, and still more in such as England), the wintering of a young flax crop should never be hazarded. The extreme limits of the sowing season as at present usually practised in France, namely, from the middle of February till the middle of May, added to the variety of soils so cultivated, are found to produce a great variety of sample. Thus in Brittany, and in many other provinces also, it is ob-

served that flax sown in May is more productive of woody stem than of fibre; nevertheless, circumstances often oblige the farmer to defer the sowing even to a later period of the year, and then it will principally depend upon the season and the weather to decide on the eventual success of the crop. An agricultural produce, the gathering of which can be shifted backwards or forwards over a certain space of time by deferring or hastening the time of sowing, is often made to yield a little to that important majority of crops which cannot be thus made to submit to the farmer's convenience.

The flax-growers of the principal countries of Europe unanimously declare that this plant produces seed which is less and less vigorous from year to year, unless the stock of grain is renewed by being brought from distant places of growth. The usual Flemish practice is to change the seed by a fresh importation from Riga every two years; others have thought that every three years would be sufficient to obtain a new supply from Russia; but it is found that if a change be but made, it is by no means a matter of necessity that the seed should be of Russian growth. The French farmers, although preferring Riga seed, still for economy's sake often make an interchange between village and village, from town to town, and from one department to that which borders it. In such cases, they find their flax crops succeed to their perfect satisfaction. This being the fact, it will be hard if England, Ireland, Belgium, and France, cannot continue to grow flax without Muscovite aid.

A change of seed, however, from some good quarter, must always be insisted on. In Flanders, as well as in Brittany and Ireland, it has ever been the established usage in time of peace, to import large quantities of seed from the north of Europe, especially from Riga, as well as from America and Holland. In the Département du Nord, such seed is usually called *lin de tonne*, or *tun flax*, because it comes in tuns or tubs; and the seed which is produced immediately from this after the first sowing

receives the denomination of *lin d'après tonne*, or *second-hand tun flax*, and is held in corresponding estimation.

At the present moment it is especially to the purpose to ask the question, whether it is always indispensably necessary to obtain our seed-flax from so great a distance in order to insure a first-rate crop. What might appear to confirm the usually affirmative opinion held by growers upon this subject, is the curious fact that this stranger seed, at first so vigorous, gradually declines from year to year; and that seed grown on the spot itself, or in its immediate environs, is never capable of replacing it completely. A circumstance corroborative of this assertion is to be found in what happened when a new variety of hemp was brought from China to France. At first, it grew vigorously, running up to an enormous and almost incredible height. Afterwards it insensibly diminished till it fell to the level of ordinary hemp. Lastly, a further confirmation, is the remark which many learned agriculturists have made, that several plants whose culture on a large scale is profitable, when it is suited to the climate, and when it is well executed (both which conditions are indispensable to its success,) grow there at first more vigorously than they afterwards do at the end of a period which is more or less removed from the original date of their first introduction. Perhaps the potato may be included in this category. But, what at once shows the necessity for a change of seed, and what also proves that there is *no* necessity that this seed should be Russian, and no other, is the assertion of M. Dubois de Donilac, who (after a long residence in Livonia, from whence we derive the Riga flax-seed, and where he examined with the most careful attention everything relating to the culture and manipulation of flax and hemp) tells us that there, exactly the same as elsewhere, a weakness and degeneracy is perceived in the seed, both of flax and hemp, after the third year; that they are obliged to renew it after the fifth harvest, at the very latest; that the fresh seed which the Livonians employ is mostly derived from Silesia, *but that they likewise procure it from*

France. In short, they have just as much need of an interchange with us, as we have of a reciprocity with them.

The degeneration of the Livonian seed appears to arise from its being grown on land that is too light to suit it. In Holland, it has been generally remarked, light and sandy soils produce flax which is delicate in sample, but small in quantity; the seed degenerates from the first or second year. On clayey, deep, and stiff soils, which are inclined to be moist, the quantity of flax yielded is greater, and the seed is excellent. The Dutch sow scarcely any flax in the province of Holland where the soil is light and sandy; but they grow as good flax and as good seed as any in Europe, on the clayey, deep, heavy, stiff, and somewhat wet land, of the province of Zealand. In Livonia this plant is never grown, except in fields whose surface is black, and whose subsoil is firm and rich.

Moreover, it is a notorious fact, in the first place, that the Dutch, who for a long while had almost exclusive possession of the trade in Riga flax-seed, often substituted, without the difference being discovered, seed which had been grown in Zealand (that is to say, in a country which borders on Flanders), and which had probably been cultivated on the best land, and according to the principles requisite to obtain the finest sample of seed; since the seed is equally liable to degenerate with them on all soils which are not essentially adapted to its culture, or when more regard is paid to the fineness of the fibre than to the perfecting the seed. In the second place, it is very well known, that both in France and in Italy, people have often succeeded in obtaining seed of a quality far superior to that which is obtained by the ordinary mode of culture, in which extreme fineness of the fibre is the essential, if not the only object, and *that* always by following these very same principles.

The inference from such positive and conclusive facts as these would seem to be, that it is *not* indispensably necessary to import seed from Riga, or from any other distant spot, in order to obtain a crop with the requisite degree of vigour. The reader will be the more disposed

to come to this conclusion, because it is the opinion of such men as Duhamel, Rozier, Bosc, and Tessier, the last of whom (the author of an excellent treatise on flax) assured himself by his own experience, that Riga seed, in the climate of Paris, does not produce better flax than the seed from many cantons of France, and other places of the south of Europe.

Nevertheless, although the result of the above facts and observations may be to prove that it is not absolutely necessary for French, Flemish, and English flax-growers to obtain all their seed from Riga (which in any case would be a very important truth to settle; for, as the Breton Society rightly observe, *agriculture cannot flourish in her perfect strength and energy, until she is able to dispense with all aid from a distance*); does it also follow that it would be of no advantage to renew the seed? That is the point into which we will now inquire.

Although it may be safely assumed that the renewing of the seed, after a longer or shorter lapse of time, may not be a matter of absolute necessity; although that opinion may be firmly maintained, as a point of theory, because it has been proved beyond question that seed well selected in the first instance, and properly treated afterwards, under every relation essential to its culture and its preservation, is capable of maintaining itself for a very long time in a perfectly normal and healthy state, and in a condition to give rise to an abundant and vigorous produce, without experiencing anything like a general deterioration; the belief may, nevertheless, be entertained, that in a very great number of cases such a renewal of seed may prove advantageous, on the principle that *land in general likes a change of crop*. Moreover, when a change of seed is determined upon, it is natural to suppose, that the endeavour will be always made to substitute such as is superior to the seed in hand, in weight, bulk, cleanness, and other desirable qualities. The question, therefore, considered in this point of view, must inevitably be decided in favour of a renewal of seed, because it is likely to be accompanied by other advan-

tages, such as the introduction of valuable varieties, and a greater assimilation of the innate quality of the seed to the local character of the soil. But the most powerful motive which ought to determine the grower to change his seed as often as he can, arises from the peculiar mode of culture, which is adopted to make the plant furnish *fibre principally*, and above all, to obtain that fibre of as delicate and fine a description as possible.

A slight glance at the three different modes in which flax is cultivated, each with a special object in view, will suffice to explain the whole mystery of the gradual degeneration of the seed. One mode only is capable of producing first-rate *seed;* and that mode is the very opposite to the system which farmers are obliged to adopt, in order to obtain a first-rate *fibre*. Flax, then, is cultivated: first, for the fibre only. Now, where *no* seed is produced, of course degeneracy cannot take place. Secondly, it is grown for the fibre *and* the seed, which is the system under which complaints of deterioration are made. Thirdly, the crop is devoted to the seed alone, by pursuing which object on a sufficiently large scale, and by interchanging the produce, Flanders, France, England, and Ireland, can all remain independent of a Russian supply.

The growth of flax for the fibre only is not a usual practice, and is only adopted for a few special purposes. It is mostly suitable for small farmers and peasant proprietors, on poor land, or in situations where it is difficult to obtain an abundance of manure. It does not require so much labour, and also exhausts the soil less.

But flax grown both for the fibre and the seed, demands more attention, and impoverishes the ground it grows on to a greater degree. The fibre is coarser than the former kind, but it is also stronger, and therefore better adapted for spinning by machinery. The return is more considerable in weight, and the value of the seed is an important source of profit.

It is but rarely, either in England or France, that flax is grown for the seed alone. This mode of culture

is chiefly practised in Russia, whence most of the imported seed (which on account of that very circumstance is the best), is obtained; though a large quantity of flax-seed comes to us both from the East Indies and from North America. The reason of the superiority of imported over native seed is, that at the time when the flax is gathered for its fibre, the seed is only partially or imperfectly ripened. To have a full crop of perfectly ripe seed, the stems must be allowed to stand till they are rigid and all but worthless. The compulsory immaturity of the seed is the cause of its degenerating, and involves the necessity of continued fresh importations. The practice and its effect are, however, merely a question of convenience and economy, of a division of labour; in fact, allotting different shares of the process to different nations in Europe, instead of to different individuals in a factory. By sacrificing the fibre of a portion of the crop, as good seed, though perhaps at a dearer cost, could be grown in England, France, and Belgium, as is grown in Russia. Hitherto it has been cheaper and more convenient to import the seed required; Western Europe has now to decide whether it be not wiser and more agreeable to grow it ourselves.

If it were necessary to insist any further on this point, it might be explained, that the most elementary acquaintance with vegetable physiology would suffice to convince us that plants which are thickly crowded together, etiolated, so to speak, wire-drawn, and run up to such a height that they are often obliged to be supported by sticks, to prevent them from falling and rotting on the ground, must not only produce a very limited proportion of seed, but also of a very imperfect quality, and unlikely, when employed in turn as seed, to furnish a second generation of plants of equal vigour with the primitive race. On the other hand, analogy would lead us to believe, that by sowing the seeds of a plant of flax which unites in itself every desirable quality, in such a way that the seedlings can enjoy all the air and light necessary for their complete development on land of superior

fertility, and under first-rate cultivation; it will be possible to maintain the stock constantly in the same advantageous position, without any need of renewing it, especially from foreign and distant countries. Such, at least, is the firm opinion of the ablest and most learned agricultural writers, although it may be opposed to the notions of many practical men, who, although well skilled in the cultivation of flax, have not made sufficient experiments to settle the point.

CHARACTERISTIC QUALITIES OF GOOD FLAX-SEED.

The choice of seed is a matter of considerable importance. Russian seed, or rather seed properly matured on plants that grow at proper intervals, ought to be plump, heavy, bright, of a clear brown hue, shining with a greenish lustre, and terminating at one end in a blunt little hook, which in fact is the dried up umbilical cord of the seed, as is seen more clearly when observed under a magnifier. We give wood-cuts of a few grains of flax-seed of the natural size, with another grain slightly magnified (*see fig.* A. *pl.* 1.). It should be smooth, slippery, and should sink in water; it should taste sweet, when chewed, and being broken it should appear of a light yellowish-green colour, and very oily. A good means of testing various samples of seed is to weigh equal *measured* quantities against each other. Experienced persons examine the seed by taking a handful of it, and letting it run out between their forefinger and thumb, in order to be able to observe it closely sidewise, and to be better able to judge of its plumpness and weight. Others moisten their forefinger, and dip it into the sample of seed, which sticks to it; they are thus able to examine each grain separately, and so form an opinion of its purity and goodness. Home-grown seed, *i. e.* seed from drawn-up or prematurely gathered plants, is flatter and broader in proportion to its thickness, extremely slippery, running between the fingers like so much quicksilver. It feels as if you were clutching a handful of magnified fluid, each

separate grain constituting an atom or elementary molecule. Russian seed is not so soft to the touch, and is more easily held in the hand. Good seed, too, should be very *even* in its quality, and free from all mixture with the smaller seeds of weeds. Most growers prefer to sow new seed, but, unlike hemp-seed, linseed preserves its vitality for several years. French growers assure us that home-grown flax-seed will grow just as well at the end of ten years as at first. It is probable that the vital power of foreign seed is more liable to injury during the packing and the journey.

The author of "British Husbandry," alluding to the generally-received opinion that the seed should be frequently changed, because it is believed that the plants, if grown from the same stock, become every year shorter and shorter, states, that "throughout Holland and Germany the growers uniformly import seed from Russia, which is grown in the provinces of Livonia, Courland, and Lithuania, and to this country it is brought under the name of 'Riga-kind.' To guard against imposition, it is there carefully marked by inspectors appointed by government, who brand the casks in which it is packed in order to distinguish the old from the new seed; for, although that of a former year may, if well preserved, be sown with some degree of safety, yet it is an experiment which should never be resorted to unless in cases of extreme urgency; and any one selling old for new seed is liable in damages to all loss arising from a failure in the crop."

Purchasers of foreign seed are subject to disappointment from other causes than the mere *age* of the seed; the easy remedy for which would be, that growers should think it worth their while to cultivate a certain breadth of flax for the sake of the seed alone.

APPROPRIATE SOILS, AND PREVIOUS PREPARATION.

Soils that are at the same time light and rich are the most appropriate for the growth of flax. We have seen it succeed well both on black bog-earth, and on tolerably

strong clayey loam. Sandy loams or loose marles, neither too wet, nor too dry, nor too poor, are by no means unfavourable. The best of all are rich alluvial bottoms, with a staple three or four feet thick, or thicker, when it is to be had. Upon poor clays, or dry gravelly soils, flax will not thrive satisfactorily. Large quantities of flax, it is true, are grown upon soils of a medium quality; but with the exception of the stiffest clays, all soils which possess the texture, the firmness, the depth, and the degree of moisture which would enable them to be considered good wheat lands, are appropriate to the growth of flax.

De Serres's observations on the soil to be devoted to flax are so pithy as well as so true, that we cannot refrain from translating them. "As flax takes the precedence of hemp in delicacy, so does it require to be more delicately lodged and treated; for which reason, if you desire to have a great quantity of fine flax, destine for its production the most fertile spot you have, and if possible let it be capable of being well watered. It will do well enough without water, but when you come to gather the crop, you will see how much the watered flax will surpass in value that which has suffered thirst during summer, such not being either fine or abundant, except very rarely. As to climate, *a temperate one inclining rather to cold than to heat* is that which best agrees with it. It exhausts the land on which it grows, differing in that respect from hemp; which land, on this account, must be heavily manured and carefully tilled. You may grow flax at pleasure and without limit on newly broken-up pasture; the same also where there has been a great deal of trefoil or clover, on the roots of which, as they rot in the earth, it supports itself well."

After all, it is not so much the soil alone, as the skill and attention employed, which will secure a good crop of flax. Flanders, for instance, boasts of a soil to which few are superior, and the flax produced there is notoriously of first-rate quality; but it must also be acknowledged that if the most profitable plant in the hands of

the Flemish farmer is his flax, it is also the crop to which the most attention is paid, to ensure the event of its turning out satisfactorily. There is not a single agricultural product of temperate climes which requires more pains and labour to be bestowed upon it than flax, and which stands more in need of the grower's patient care; nor is there a plant which is cultivated in a greater variety of modes,—the difference, however, almost always consisting in the manner of manuring the land, in accordance with the teachings of local experience. An intelligent flax-grower, who prepares and manures his land suitably to its nature and situation, will get good flax from almost every quality of soil, but especially from good light land, and from clays that are sufficiently intermingled with sand. But soils which are fertile naturally are much better adapted for flax, than those that are made so artificially by manure; because they insure a much more even growth. When lumps of manure are irregularly left in the earth, they supply nourishment to so many patches of excessive vigour, which overtop their brethren, send forth side shoots, and only serve to ruffle the future flaxen skein. To avoid this blemish in the sample, the crop *previous* to flax is sometimes heavily manured, none being given to the flax itself; or the manure is applied during autumn or winter, to become well amalgamated with the earth previous to the spring sowing; hence also the fondness of the most successful cultivators for liquid manures and those reduced to the state of powder, as readily admitting dilution, and therefore capable of being distributed so as to act with a more uniform effect than solid matters.

No crop more requires the land to be well worked and thoroughly cleaned, than flax does. Light lands should be deeply ploughed. On strong and wet lands, it is desirable to cross-plough deeply, or even better, to employ spade-husbandry. Flax seed must not be buried too deep; and therefore an aspect which is either too dry, too wet, or too cold, does not suit it. The soil ought to be soft and well pulverised; the manure, short and well

rotten. Many are fond of street-sweepings for the culture of flax on moderate and sandy soils; but others dislike them, on the ground that street-sweepings encourage a great deal of darnel to spring. But careful farmers do not on that account abstain from using them. They plough their land deeply as soon as the weather permits; they then lay on a liberal allowance of street-sweepings and other town muck; they plough it in shallow, and leave it so till the end of April. By that time the weeds have made their appearance. They then give the land a second ploughing, a little deeper than the former one; they give a top-dressing of liquid manure, cross-harrowing immediately afterwards. In this way, they get the better of the weeds, and their flax thrives well.

Others make in autumn dunghills of vegetable mould mingled with pig-muck and farm-yard manure. They turn and mix their dunghill well, and as soon as winter is over they plough it in at a slight depth as soon as possible, because the land will already have had a deep ploughing. Towards the middle of April they give another shallow ploughing, and a top-dressing either of night-soil from the nearest town, or of liquid manure from the farm-yard tank; then they pass the harrow over all, and proceed with the rest of the work in the usual way. The addition of ashes is a favourite practice.

Mr. Henderson, describing his mode of preparation on his farm in the county of Derry, Ireland, says: "After wheat, one ploughing is sometimes sufficient, but two are generally safest: one in autumn, and again before spring. After lea-land oats, two ploughings are indispensable, and a third is frequently advisable, for the *land must be perfectly pulverized and cleared of all roots of every sort*, or no crop. I do not plough deeper than the vegetable mould." After all, the special details of preparation for the flax crop must be left to the farmer's circumstances and common sense. Three points are requisite for success; the land must be thoroughly cleaned, well pulverised, and uniformly rich.

THE PLACE OF FLAX IN THE ROTATION OF CROPS.

Two maxims should never be lost sight of by the agriculturist: first, that *flax is an exhausting crop;* and, secondly, that *it does well on a grass or clover ley, taking the place of wheat in the Norfolk system;* in other respects, the order in which flax stands in the course of tillage must greatly depend on local circumstances.

The before-named Mr. Henderson says, "Without method, there cannot be success. Different soils require different rotation, and suit different crops. I will speak only of that I use. My farm is a strong and pretty deep clay croft, and has proved well suited to flax; therefore I use that crop more frequently (say twice in the course) than will be generally found advisable. First, potatoes or turnips, drilled, well cleaned, manured, and limed; second, wheat; third, flax, with which clover and grass-seeds are sown; fourth, hay, the ground being top-dressed with soot; fifth, grazing; sixth, grazing; seventh, oats; eighth, flax; and then the rotation recommences."

In those districts of the Pas de Calais in France, which are celebrated for their successful practice, flax is most frequently made to follow clover, and to be followed by wheat. In this rotation, seven years of cropping are followed by a fallow; beans, and winter, or four-rowed, barley, enter into the course; and every alternate crop is manured for, though occasionally two successive crops are manured to keep the land in thorough good heart. The practice of sowing clover-seeds with flax is also sometimes followed there, and of sowing carrots likewise, the latter mixture being preferred probably because less liable to dodder. After the flax is pulled, the carrots are well hoed; and the produce of the latter vegetable may be fairly calculated at ten *rasières* the *mesure*: in round numbers, at something like five and twenty bushels an acre.

According to "British Husbandry," "If the stems be pulled up for the sole purpose of producing yarn, without

allowing the seed to ripen, it does not exhaust the soil; though it is by many thought a bad preparation for wheat, and perhaps would be better followed by spring corn or peas. In Flanders, however, where the cultivation of flax is as well understood as perhaps in any part of Europe, wheat is generally made to succeed it, and it is there very properly manured with night soil; it is also generally preceded by turnips, though *many intelligent farmers disapprove of sowing it after them;* and in Scotland, the best plan that has yet been discovered, is to sow oats as a ley crop, and flax after it. Upon much land in England and Ireland it is, however, sown upon one ploughing after a clover ley, which is better for the purpose, if it has lain two years. The land is in this case broken up about Candlemas, after which it gets three or four harrowings, and is rolled previous to the sowing. The seed is then lightly harrowed in, and rolled rather heavily if the ground be dry, but, if it be very tenacious or moist, this may be omitted. Clover-seed is also sometimes sown along with that of flax, to form a succeeding crop; but, in that case, it is better to defer the sowing of the former until the time when the flax is weeded, when it may be effectually loosened, or, at all events, they should be sown separately."

Mr. J. B. Edmonds, of Stonehouse, Plymouth, a cultivator of flax to a large extent and for a long period, advises thus: "From a slight knowledge I have of the Norfolk soil, I am of opinion that it is admirably calculated for the growth of flax, if proper attention be given to it; but it is a very precarious crop, and a sandy soil is the *most certain* for it, but when a good crop *can* be obtained from *strong land*, it is best in quality. The first essential point to be observed is, that due care be taken to procure *good seed;* and to prevent disappointment in this instance, the most certain way is to get a barrel direct from Riga, through a merchant at London, where it is annually imported, generally about Christmas. When a superior sort of seed is obtained, it may be preserved a few years, by sowing yearly a quantity (in change

of soils) *thinner* than the usual crop, to make it produce more seed; but after the third or fourth year it will be found to degenerate. When Riga seed is purchased, it is generally found to be very foul, full of weed seeds, so that it is necessary to be cleansed by means of a sieve; nor is it usually *productive* the first year it is sown in England, but very good the second season. Many years' experience has proved to me that the best crops of flax follow the *severest* winters; the same holds good, I believe, in Flanders. Flax should never be sown after *turnips*, for should the *produce* be great, the *quality* will be inferior. The best land for its growth is after *grass*, to be ploughed VERY shallow early in the winter, and after being rolled with a very heavy roller, to be chopped over with mattocks, sufficiently deep to cover the seed with harrows, then the clods to be broken fine with beetles, and rolled with a *light* roller. Crops thus served are commonly the best and cleanest from weeds. The next best is after a lying-down crop of wheat; and the next, after potatoes, the land being folded with sheep in January and February. Flax will also succeed after barley, oats, and everything but *turnips*, and the turnip kind. The same land should not be sown with flax oftener than once in seven or eight years; nor should land be thus applied that has been *limed* within a few years. When it can be obtained, good old earth is an excellent manure for flax, to be laid on in frosty weather, but not when the weather is wet. It may be well to remark, that no crop is so desirable with which to grow grass-seeds as flax, as, in drawing the flax, the roots of the grass are loosened, and thereby encouraged to a great degree, the same being often injured by a corn crop. There is also great advantage to be gained to the farmer by sowing turnips after a flax crop, which should be done immediately after the land is cleared and ploughed; thus turnips will be produced almost equally good, if not so large, as if the flax had not been grown, and will be found useful in the spring, after other turnips are consumed.

"As an instance of the risk of sowing flax *after* turnips, I will mention, that a friend of mine, some years since, had a fancy to sow a field *alternately* (*in alternate stripes* is meant) with turnips and white peas, from each of which he had a good crop; in the following year, he appropriated the same field to flax, but at the harvest his field was in *stripes*; the land on which the peas grew having produced *good* flax, whilst the flax which followed the *turnips* proved good for nothing."

Von Thaër gives his ideas on the subject as follows:

"In those districts where the three-year course of husbandry prevails, flax is almost always put upon the fallow, or made to follow it immediately. This place appears to me exactly the most unsuitable that can be assigned to the crop. It is difficult, especially for early flax, to find time to put the land into that state of good cultivation which ought to precede the seed-time, especially when the soil has been poisoned with weeds and foul grass by several successive crops. Flax is considered to be a bad preparation for winter corn; and every practical agriculturist ought to reckon beforehand upon a diminution of the produce of whatever grain is made to follow flax. In the three-year course, I should much prefer to make the flax follow the spring corn, because it will be much more easy to prepare the land properly for its reception, especially if the fallow which preceded the winter corn has been thoroughly worked; if, in addition, the fallow has been well manured, the land ought still to retain a sufficient degree of fertility. In this case, as soon as the winter corn is carted off the land, the stubble ought to be slightly ploughed, and later in the autumn a deep ploughing must be given. If the land appears to require additional manure, during winter I would cart the stable-muck, fresh as it was made, upon the land, and would spread it, after having first given it a harrowing. The manure should remain in this state until, in spring, a spell of dry weather allowed me to rake off the straw, or, what would be easier on large occupations, to gather it into ridges by means of a drag-rake, when it could be

carried away to serve for other purposes. In this way, the land would obtain all the goodness of the manure, which the flax crop requires, without the straw's causing it to lie too light and hollow. Instead of this method, the land, no doubt, might be advantageously folded with sheep, and by means of a single ploughing it would be in a good state to receive the seed. Peas will succeed exceedingly well upon land which has borne flax the preceding year, and the winter corn which is made to follow the peas will give a better return than if it had been sown immediately after the flax. It may have been preferred, however, to sow clover amongst the flax; for clover does not succeed so well in combination with any other crop, unless it be with buck-wheat.

"But flax also succeeds perfectly *after* clover, on a single ploughing, and better even if the clover has been two years on the land. The clover ley is broken up in autumn or in spring, carefully and not too superficially, after which it is harrowed and rolled. Before sowing the flax, the ground is sharply harrowed, with the teeth of the implement pointing forwards; the *extirpator* answers even better. The seed is then harrowed in, and the roller follows and makes all smooth. If it is thought that the flax will require it, the above-mentioned mode of manuring can also be employed in the present instance; but it will be found more efficacious to employ a light dressing of lime, of soap-boilers' ashes, or of fowls' dung, especially that of pigeons, sown broadcast.

"As a set-off against this, according to the observations of the Belgian growers, flax does badly after leguminous plants, especially after peas. After crops that have been well weeded and abundantly manured, flax succeeds perfectly. It is grown with equal advantage after hemp; but the contrary turns out to be the case when hemp is made to follow flax."

A vast breadth of flax is grown in the valleys of the upper and lower Maine, where it is very productive, on first-rate land, qualified with quicklime and ashes; it is

there made to alternate with red clover and wheat, according to the method pointed out by Von Thaër. Flax is also cultivated, but only on a small scale, in most of the gardens, farms, and small holdings of La Sologne, where it is made to alternate with cabbages and cereal crops. This mode of husbandry, which is performed with the spade, requires a large quantity of well-rotted dung, and thus absorbs an important proportion of manure in places where its scarcity and the poorness of the soil make it imperative to economise every fertilising material for the sake of the fields destined to more wide-extending branches of agriculture.

"Flax," continues Von Thaër, "succeeds nowhere better than on rich and fertile ground that has been freshly broken up, or on land which has lain for several years in grass. I believe that it is difficult to employ such land in a more profitable way, the first year of its being brought into cultivation again. It is necessary to peel it to a greater or less depth, according to the thickness of the stratum of turf, which latter will have to be scrupulously turned. To effect this purpose, it will be needful to call in the aid of the fork and the spade in such places as the plough has imperfectly acted upon. The operation ought to be performed in autumn, or at the very commencement of spring; the harrow is set to work, and the roller is made to follow immediately afterwards, to prevent the grass from sprouting between the furrows. At the time of sowing, the surface is well harrowed; the flax is sown, covered with the harrow, and then pressed down hard with the roller. I have never seen a more vigorous plant of flax, with taller stems, or which carried itself more firmly erect, than flax grown on such fresh-broken land as this; it also has the additional advantage of not requiring to be weeded, the very most which makes its appearance are the roots of a few of the most hardy and obstinate weeds; and these roots can easily be extracted. The turf, which decays during the summer beneath the crop of flax, becomes so permeable and light, that no further preparation for the

ensuing winter corn is required than to give the land a single ploughing. Upon broken-up ground, that was naturally rich and fertile, I have thus obtained an excellent crop of wheat following after a crop of flax. What decided me to give the preference to this king of the cereals was, that the preceding year, after a similar crop of flax on fresh-broken ground, the rye was laid. I am aware of no crop under which a layer of tough and tenacious turf becomes equally friable and easy to work.

"When I have no pieces of broken-up ground, I merely devote to the culture of flax all the hollows in the fields of winter corn which I either fear will be covered by standing water during the coming winter, or which actually suffered from that inconvenience in the former season. If these spots are of no great size, I go to the expense of having them dug, and, shortly before sowing them, I dress them with compost mixed with lime, which I harrow in together with the seed. In this way, I contrive to obtain as much flax as I require, and even more, without employing more profitable land for the purpose; and I also retain in cultivation portions of ground which, without that, would soon become sterile patches, and would be covered with rushes and other marsh plants.

"Flax does not bear to be repeated on the same ground at short intervals of time. It is believed that the space of at least nine years ought to intervene between two crops of this plant, even in countries where the soil appears the most suitable to its culture, and where it is grown by the most successful methods, as for instance, in Belgium."

Van Aelbroëck, in his "Agriculture Pratique de la Flandre," says, "on light lands, flax is most frequently sown after turnips that have followed rye; on strong soils, it is generally made to succeed an oat crop. On light lands, after the rye is carried, and before the turnips are sown on the land destined to flax, some give a deep ploughing, manuring with cow's dung; they then sow the turnips, which are cleared off by Christmas; after-

wards, another dose of manure is given, the field is ploughed as if for a fallow, and is left in that state till the month of March; it is then ploughed again, cross harrowed, and thoroughly cleaned of couchgrass and weeds. Finally, about the 20th of April, it is ploughed a third time, and harrowed till the land is well pulverised, and all remains of weeds are completely extirpated. It is next dressed with Dutch ashes, and four or five days later with liquid manure. Ten days afterwards, the flax is sown, and is twice gone over with the reversed harrow, in such a way that the horse shall trace a set of parallel lines four feet wide from one end of the field to the other. The job is finished by pressing down all with the sledge.

"Those who intend sowing flax after oats, usually give the oats, with this intention, a third part more manure than they would in the ordinary course of culture. As soon as the oats are carried, they give the land a half-coat of manure, which they plough in with the stubble, and leave the whole as it is till seed-time, when they give a good top-dressing of liquid manure.

"In the environs of Courtray, on the first-rate clayey soils, perhaps the finest flax in Europe is grown, and no other fertilizers are made use of beside rape-cake and liquid manure. Where the land is dry, the cakes are thrown into the urine-tanks, and left there for ten days to soak and dissolve. For wet land, the rape-cake is pounded tolerably fine, and sown broad-cast on the land in the shape of a coarse powder."

The following is the course of cropping which Arthur Young proposed for Ireland. For light lands: 1st, turnips; 2nd, flax; 3rd, clover; 4th, wheat; or, 1st, potatoes; 2nd, flax; 3rd, clover; 4th, wheat. For strong soils: 1st, beans; 2nd, flax; 3rd, clover; 4th, wheat. This rotation is also perfectly suitable to the north of France. It is equally applicable to the southern districts; for in Italy, in the neighbourhood of Brescia, the following rotation has been employed from time immemorial: 1st, clover; 2nd, flax; 3rd, wheat; 4th, maize. Watering is practised

wherever they have the means of doing so. In Zealand, where the soil is strong, and where they grow a great deal both of flax and of madder, it is usual to make the former follow the latter, because the ground has been well cleaned of weeds during the three years that the madder has remained therein, and has been well worked by the mattockings and the diggings, which necessarily accompany the taking up the roots of that plant. This rotation is perfectly good, but can only be employed in few localities, from the circumscribed extent to which madder is cultivated.

Flax has been introduced successfully into every rotation upon the farm of Mr. Warnes, of Trimingham, Norfolk, and in the year 1850 was cultivated in the following order, viz. wheat, flax, turnips, barley, grass. The refuse wheat and barley, with the whole of the turnips, grass, hay, chaff, straw, and linseed, with the broken bolls, stalks, &c., were all to be consumed upon the farm.

SOWING.—THE TIMES; THE MODE; AND THE QUANTITY OF SEED.

The principal object in sowing a crop of flax may be threefold; and according to the object which the farmer has in view, will be the greater or less quantity of seed which the land will have to receive and support. If a long and fine quality of fibre be the point that is aimed at, it is absolutely necessary that the seed should be sown extremely thick. If, on the contrary, it is desired that the fibre should be strong rather than long and fine, the sowing ought to be thinner. And finally, when the main object is the quantity and quality of the seed, rather than of the fibre (which is almost always considered as the staple produce of the crop), the sowings must be made even thinner still.

The first and second of these cases, or perhaps something between the two, will have to be regarded as the average practice. "British Husbandry" says, "The

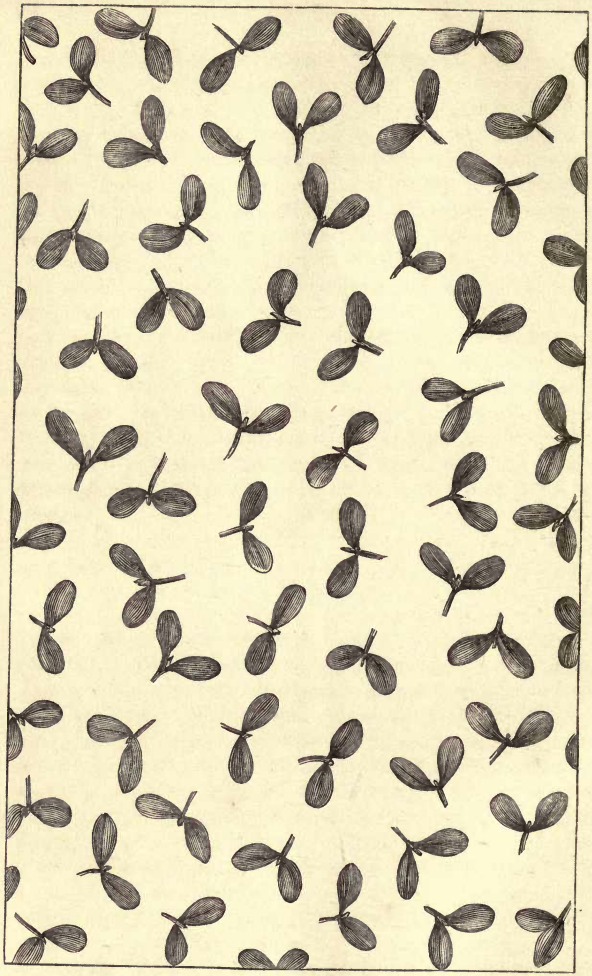


FIG. 2.

How thick the Flax should come up in a well-sown field, page 35.

quantity of seed sown is large, and is generally as much as three bushels per acre; though many intelligent farmers use only two-thirds of that quantity."

M. Van Aelbroëck, whom we have already quoted, states, that the usual Flemish practice is to sow about 180 *pounds* of flax-seed on the *mesure* of forty-five *ares* (somewhat less than an English acre), more or less, according to the quality of the seed and the goodness of the soil. He has observed, that it is much better to sow abundantly than too thinly; for in the latter case, the fineness of the flax is deteriorated or destroyed. The *pound* he mentions weighs two ounces more than the English pound.

In the Pas de Calais, they sow a *hectolitre* of flax-seed to the *mesure*, which corresponds as near as may be to three bushels per English acre. The French *hectolitre* is equal to a fraction more than two and four-fifths Winchester bushels. The *mesure* is a measure of land which varies in different districts of France. In the present case, it is equivalent to forty-two *ares* and twenty *centiares* (the *are* = 3·955 English perches), and is consequently less than an English acre. Three bushels an acre, therefore, is the smallest amount of seed we would venture to recommend. Parsimony in seed is the greatest practical mistake which a flax-grower can make. We, therefore, give a wood-cut representing a little bit cut out of a flax-field, of the natural size, to show *how thick* the plants ought to come up in a well-sown field (*see pl.* II.). Thinner sown than in this specimen, the flax would not prove so good a sample. Some English writers speak of sowing nine pecks, others *two* bushels of flax-seed to the acre; but it is not enough, in the opinion of French liniers, who hold such a small amount of seed to be very false economy.

On the continent, flax is always sown broad-cast, never drilled. Flax-sowing is a nice operation, to get the crop *even*, and requires considerable practice and steadiness of hand. For sowing, perfectly calm weather is the state of the atmosphere to be chosen, when possible; but if there

is a slight breeze, as will frequently happen at the time when other circumstances are favourable, the sower should always work *with the wind at his side*, blowing alternately on his left hand and on his right as he paces up and down the field with measured steps, and not at his back or in his face. Badly-sown fields come up in welts, or in waves like the ripple-marks on a sandy shore. with curved stripes of alternately thick and thin places, to the serious detriment of the future crop, which necessarily proves unequal in growth and quality. Flax might be sown advantageously, perhaps, by means of the broad-cast sowing-machine which is employed for grass-seeds in England. A still more uniform distribution of the seed would be insured by going over the ground twice, and sowing half the amount of seed each time.

If, as the season for flax-sowing approaches, it be very dry, the land should be well kept down by harrowing and rolling, in order to preserve its moisture, *that the plants may come up altogether*, which is a great point gained. We may observe that flax should not be grown in tree-bound fields; or, in such a case, the crop should be bordered with some other. When clover and grass-seeds, or carrot-seeds are sown with flax (after wheat), the person who sows them follows him who sows the flax-seed, and both are covered with a double turn of the grass-seed harrow, which is light but broad, the teeth thickly set and short. On the continent, the sowing of those seeds is often deferred till immediately before the weeding. The tearing up of the weeds by the labourers, and their kneeling on the ground, effectually bury the small seeds that have just been scattered over the surface of the field.

As to the time of sowing, an important point, for a general rule in England and France, we may state, that from the middle of March to the tenth of May, weather permitting, the seed is sown broad-cast as we have described, partially covered with the harrow, and entirely so with the roller; which two implements following each other on a fine sunshiny day of spring, break

the small lumps of earth into powder, and smooth the surface of the field to a level which, in France, is more nearly horizontal than the cottage-floor belonging to many of the labourers who have been working upon it.

According to our best *practical* French authorities, the best time to sow flax is in the course of the month of February, *if the weather be fine*, and in March if the weather has *not* been fine during February. Of course, climate and latitude will have a good deal to do with the date of sowing; what would succeed perfectly on the coast of the Mediterranean might not be advisable on the shores of the Baltic, or in the North of Scotland. But, the *earliest sown crops are the best*, if the season do not turn out quite too inclement. The second sowings take place in April and May; these are the consequence of unfavourable weather in March preventing the preparation of the land, or other untoward circumstances; for, flax ought to be sown on *fresh-worked land*. It will not do to till the land, let it lie, and then sow flax upon it after a long interval of repose. The entire season for sowing flax may therefore be said to run from the middle of February to the end of May.

In deciding on the time for sowing flax during the course of this period, it is necessary to be bold and to speculate a little. Late sown flax goes on with slighter checks, and has fewer enemies to contend with; whereas early flax, besides the casualties of the weather, is longer exposed to the attacks of quadruped, winged, and insect vermin at a time when they have little else to prey on. But, nothing venture, nothing have. It is true there is the greatest risk with early sown flax; but *if* you succeed, you have a much more valuable and heavier crop, with a longer fibre than the late sown, although not so fine in quality. Late sowing is the surer plan, and is also adopted where *fine* fibre is required.

M. Van Aelbroëck, criticising some agricultural innovators who deferred their sowing till the middle of May, shrewdly remarks: "The earliest possible time is the best for sowing flax; for in all the cantons which sow

early, they gather the best flax. *I believe that the seed-time for flax may be hastened a little in many localities, by working the land deeper, and breaking it up finely, in order to allow the moisture to penetrate more easily, and to facilitate the passage of the roots downwards.*" These roots, it is asserted, reach a depth equal to half the height which the flax attains above the surface of the earth."

Whether late or early sowing be adopted, it will be as well to have the field kept by women and children to scare away the birds till the crop is up.

The French growers say, that flax never comes so well as it ought when the land is manured with the *dung* of sheep, which has been carted away from the fold, the farm-yard, or the sheep-house, and then spread over the surface of the field. What is curious is, that flax *does* come well after a flock of sheep have been folded upon the spot. It is the *urine*, they correctly judge, rather than the dung, which does the good. The species of manure which is relied on beyond any other upon all the light soils throughout Flanders, is liquid manure, which they carefully preserve in cellars, cisterns, subterranean vaults, and even in covered tanks conveniently placed along the road sides. It is made to do wonders in the market gardens; for instance, at Rosendael, in the environs of Dunkerque. Even upon strong lands, originally so rich as to preclude the necessity for manure, it is now held in great esteem, being considered applicable to most crops, and to every variety of soil. The crop upon which it is, however, chiefly bestowed, is flax, for which they are profuse, usually allowing at the rate of 2,480 gallons, beer measure, to the English acre. The field after two or three ploughings and harrowings, is backed up in the centre, and ploughed round in but one set, so as to leave it without any furrow. A heavy roller is then drawn across the ploughing by three horses, the manure is spread equally over the entire surface, and, when well harrowed in by eight or nine strokes of the harrow, the seed is sown, which is also harrowed in by a light harrow,

with wooden pins of less than three inches, and the surface, to conclude the operation, is again carefully rolled, so that nothing can exceed the smoothness and cultivated appearance of the fields thus prepared. Any English farmer who has had the gratification of observing a well-grown flax-field either in French or Belgian Flanders, will be sure, on his return home, to pay greater attention to the important subject of liquid manure.

PROGRESS OF THE SEEDLING CROP.

The quicker the flax germinates and appears above ground, the better the crop is likely to turn out. On this account, it is a great advantage when the sowing can be effected immediately *after* a shower or a tempest. The seedlings then are sure to rise all at once, instead of appearing in patches, as will often happen in dry weather. Indeed, when there is any serious check from drought, it is a good plan to water till the evil is remedied, supposing that the situation of the field admits of it. For instance, a long narrow strip of flax, with a ditch on one or either side, as often is the case in alluvial districts, admits of easy watering *by means of a scoop*. The trouble and expense will be well repaid. But this is one of the minor details which unavoidably render flax peculiarly the small farmer's and the cottager's crop. From the very nature of things, it answers their purpose better than it possibly can that of the great agriculturist. Not that the great agriculturist *need* gain less, if a proper amount of capital, skill, and attention are employed, but that the small holder *may* gain more, because every additional atom or drop of manure, and every spare five minutes devoted to it, are sure to tell advantageously in the end. Some, certainly, of the late well-meant *experiments* of flax-growing in England, have been made on much too large a scale. A six or eight-acre field of flax, in a slovenly, irregular, and half-cultivated state, is neither more nor less than a pitiable sight, a certain source of disappointment, probably of loss, and a monster of farming ab-

surdity. Still, with sufficient means and hands, *large* fields of flax may be perfectly cultivated. While we write, we have numerous instances before our eyes. But in Scotland, Belgium, and the north of France, the *little* patches, not so big as many a rich man's drawing-room, are gems of more careful cultivation than an area of greater extent is likely to exhibit, except in well-practised hands.

A continued drought coming on soon after the flax is above ground, and while it has only its first two seed-leaves, will sometimes kill the entire crop, and oblige the farmer to sow again; sometimes the loss is only partial, when the crop remains patchy on the field. This is one of the serious risks which the early sower always has to incur. Occasionally, and more especially in warm situations, the young flax is eaten off by slugs and grubs,—another danger which early-sown crops have to encounter. We have seen fields with large patches laid bare in this way; and yet the additional value of the rest, in consequence of early sowing, was sufficient to overbalance the loss. Olivier de Serres recommends sowing ashes over the sprouting seeds, in order to put a stop to the ravages of those pests. A top-dressing of soot would have an equally beneficial effect. The services of half-a-dozen ducks turned out fasting are not to be despised.

The working of moles in early spring may also be productive of fatal injury. We would by no means advise the general and indiscriminate destruction of moles; for the good they do by devouring wire-worms and cockchafer-grubs pleads loudly in their favour. But in a field of germinating flax, it may be safely asserted that they do considerably more harm than good.

The parasitic plant, the dodder (*Cuscuta*, of three or four species), is a terrible scourge to a rising crop of flax. It is more likely to occur when clover is sown with flax, than in any other case. If a clover crop has been only slightly infested with dodder, flax should never be ventured on the layer the following season, although, as we have seen, there is nothing which is more suitable for

flax, in a general way. The dodders are a remarkable genus of plants, very peculiar in their mode of growth. They spring from seed which has dropped on the ground; they rise, and attach themselves to some neighbouring plant, in the choice of which they are somewhat capricious. Unfortunately, clover and flax are special favourites. Dodder will cling to the common ivy,—a real blood-sucking parasite upon a merely apparent one; and we have seen a common covered with furze which was almost entirely overhung with dodder. As soon as the dodder has fairly intwined itself upon its victim, it completely dissolves its connection with the earth, and feeds, like a vegetable vampire, on the sap of the plant to which it clings. It has no leaves; only flowers and stalks, which latter stream in the breeze, like so many reddish-green threads. When they touch a plant, tendril-like, they grasp it and fix themselves upon it, and the infection spreads over the field like wildfire. The dodder pest will enlarge itself in a circle, from a single plant which grew in the centre, exactly as, though not quite at so quick a rate, a circular wave will expand over a whole pond, when a stone is dropped on its placid surface. With three or four such centres of dodder, a small field would soon be ruined. The only remedy is, as soon as the plague is perceived, to pull up mercilessly every infected plant, and burn it, for fear of mischief elsewhere, or on a future day. The above may be considered as the principal enemies which threaten the prosperity of a rising crop. As a wise preliminary precaution, thorough draining ought to have been performed. On lands saturated with either underground or surface water, good flax cannot be expected. It is probable that nine cases out of ten of the failures of this crop in Ireland arise from the filtration of water too near the surface; and that of the numerous other reasons for missed crops usually assigned, almost every one is imaginary.

WEEDING AND STICKING.

The perfection of flax-growing would be to prepare the earth so that *no* weeding should be necessary; and extra care is bestowed by all good farmers in thoroughly cleaning the previous crop, whatever their course of husbandry may be. But with every precaution weeds will spring up; and the least part of the mischief they do is to rob the crop of the manure that has been bestowed upon it. If the weeds were suffered to grow up with the flax, some of them would choke it, whilst others would be intermixed with it at the time of plucking, in so intimate a way as to be separated with great difficulty, and not without considerable injury to the fibre.

The best time for weeding flax is when it has attained the height of about a couple of inches. It is then more pliable, as well as elastic, than either at an earlier or a later period. As the simplest way of giving the reader a clear idea on this point, we refer him to our woodcut of a group of flax plants, of the natural size, exactly at the time when they are fit for weeding (*see fig.* B. *pl.* I.). A fine day should be chosen for the purpose, when the young plants are neither brittle with moisture nor sodden with rain. It is best to employ a large number of weeders at once, in order to get the job over as soon as possible; and the task ought to be intrusted to women and boys of light weight, instead of to heavy and clumsy men, to avoid unnecessarily crushing the crop, as they advance slowly forward on their hands and knees, carefully pulling up every weed as they proceed. If they can be got to work without their shoes on, so much the better; the surface of the field will be less broken by their transit over it. They ought always, also, to face the wind, in order that after the work is done, the breeze may lift the plants up again. The farmer will do well to pay a little personal attention to this point, which is not a trifling one; because the workpeople, if they are not looked after, will be apt to do exactly the contrary, especially

FIG 1.

A Flax seed, natural size, page 21
B Do. do. magnified, page 21.
C Flax plants when fit for weeding, page 42.

if the north-east blasts of spring be prevalent at the time.

A writer in the "Home Companion" thus describes the process of flax-weeding from personal observation:—"Suppose that you had lost a single valuable pearl on the smooth-shaven grass-plot before your door. To find it, a good plan would be to get half-a-dozen sharp-eyed women and children to go down on their knees side by side, as close together as they could conveniently work, and to make them creep steadily forward in a rank, like so many soldiers, searching as they advanced for the lost pearl between every single blade of grass; and when they had thus finished one strip of your lawn, to order them to go over the contiguous portion in like manner, till the whole was finished. This is exactly the way in which flax is weeded, docks, charlock, and thistles being the object of search, instead of pearls and rubies. The gangs of weeders often consist of twenty, thirty, and even more persons; the more the better, because the quicker and the sooner over. While passing through Belgium one spring, I used to fancy that if a peasant, after retiring to rest, remembered that he had passed over one sprouting weed, in his new-sown flax, he would be unable to sleep upon his mattress, and would get up in the middle of the night, to search for it by moonlight. To unprofessional eyes, the plant looks too delicate to bear the pressure of this inquisitive crowd; but its natural elasticity raises it again,—and to help it, it is the custom for the weeders to advance *against* the wind, in order that the welcome breeze may aid the prostrate flax to hold up its head in the world once more. It appears that a calm is not conducive to the future prosperity of plants that have once been trampled on. On foul land, this operation has to be repeated. When once the weeding or weedings are finished, nothing more is done till the flax is ripe." But it cannot be too strongly insisted on, that land destined for the growth of flax, should be as nearly as possible *perfectly* clean.

In certain cases, however, one trifling piece of addi-

tional work has to be done at weeding-time, or immediately after, and that is *the sticking*. Sticking is not a general practice, and is not needed for ordinary crops of flax, still less for such as is thin-sown and is left to stand mainly for the seed. But when flax is sown for cambric and fine lawn, the land receives about double the usual quantity of seed. The extreme thickness of the crop, and the richness of the soil on which it is usually grown, cause it to spindle and run up, in an unnatural state of feebleness, to the height of from three to four feet; and the first heavy shower would inevitably cause it to be laid, were it not helped to stand upright by the aid of sticks, which are stuck in the ground with the same object as pea-sticks in a kitchen-garden, except that the flax has no tendrils wherewith to lay hold of the support that is offered to it. Immediately after the flax is weeded, forked sticks about an inch and a half thick, are stuck in the ground with the fork uppermost at four or five feet distance; poles are laid across these forks, about six or seven inches above the top of the flax, and distant from each other two, three, or four feet, according to the length of the brushwood that is to be laid across them. This brushwood ought to be laid close and even, rising in all about eighteen or twenty inches. The operation requires great care and attention, to avoid treading and crushing the flax too much in placing the sticks. The expense of sticking is so inconsiderable, and the loss is so great when a fine crop of flax is laid, that it is always prudent to adopt the plan when a thick and extra-luxuriant growth is anticipated. Even the simple plan of sticking branches, like single pea-sticks, at short irregular distances over a flax-field, will save the crop from being laid by high winds and sudden tempests, and from thereby receiving serious damage.

The French farmer now has nothing further to do, except to watch the crop with anxious assiduity. It is to him a matter of immense importance whether the flax look healthy and green, or sickly and yellow; whether the surface of the field is uniformly hidden by a thick

and even crop, or whether it is here and there disfigured by black, naked, and barren patches. After he has done, as he may think, all that lies in his power, unseen and unsuspected causes will now and then combine to work him mischief. If the whole field promises to come to nothing, he has no choice left but to plough it in, and to sow again either with flax or some other crop. But if the portions which have failed, especially on early sown flax, are of comparatively inconsiderable extent, while that which does grow, really grows well, he will hoe or dig the ugly plague-spots, and sow them with carrots or plant them with late potatoes, with as much assumed philosophy as he can muster. But it excites his most lively hopes and fears to read it quoted from the English newspapers, that in April, 1854, in consequence of the Russian war, the ton of flax which at the same time last year was worth only from £36 to £40, now brings £70.

The plants advance in growth, and the first blossoms begin to appear. The flowers are of a delicate pale blue; and though pretty in themselves when examined closely, are not produced in sufficient abundance at one time to have any striking effect in the landscape, like fields of sainfoin, colza, rape, or poppy (grown for oil), while they continue in bloom. The flowers of flax appear, not many at once, but in a long succession. During this blossoming period in France, the linier, or "flax-man," will arrive, inspect the crop carefully, and make his bargain with the farmer to take it off his hands. The time of payment is then settled, whether ready-money, three months' credit, or six, over a *canon* of beer, or a cup of coffee containing the *gloria*, or glass of brandy. The flax-man undertakes all the subsequent manipulation of the flax; and the French farmer's anxieties cease exactly at the moment when, in consequence of his inexperience, the English flax-grower's only begin. For, we repeat it, the absence of liniers (who, in fact, are a class of intermediate or preparatory manufacturers) is a serious impediment to the extension of the growth of flax in England.

PULLING AND HARVESTING.

When the leaves turn yellow, and the last blossoms have disappeared, the time of harvesting is come. Flax is torn up by the roots, not mown with a scythe. In France, this work is mostly performed by women. It is first spread thinly and regularly on the ground, and then tied in small bunches set on end leaning against each other, to dry in the open field. In a week or more, if the weather be fine, it is fit to be taken to the barn to be divested of its seed. Flax is not finally stored for the winter with the grain unthrashed, like wheat, and other kinds of corn; because having hitherto remained on dry land, it has now to pass a certain period under water; and the seed would take no good by participating in this aquatic retirement from the world. Without the steeping, or *rouissage*, as the French call it, the flax would be as useless as so much reed.

The signs of the fitness of the flax for pulling are best learned by actual inspection and practice. Mr. Henderson states: "I have found the test recommended by Mr. Boss (a Dutchman), to ascertain the degree of ripeness that gives the best produce, with the finest fibre, perfect. It is this:—try the flax every day, when approaching ripeness, by cutting the *ripest* capsule, on an average stock, across (horizontally), and when the seeds have changed from the white milky substance, which they first show, to a greenish colour, pretty firm, then is the time to pull. The old prejudice, in favour of *much* ripening, is most injurious, even as regards quantity; and the usual test of the stalk stripping at the root and turning yellow, should not be depended on. Where there is one man that pulls too green, five hundred over-ripen.

"I use the Dutch method of pulling, say, catching the flax close to the bolls; this allows the shortest of the flax to escape. With the next handful, the puller draws the short flax, and so keeps the long and the short each by itself, to be steeped in separate ponds. It is most essential to keep the flax even at the root end, and this cannot

be done without *time* and care; but it *can* be done, and should always be done. The beets should be small, evenly sized, straight, and even, and should never be put up in stocks or wind-rows, but taken to the pond the day they are pulled, or the day after at longest, especially in bright weather; for the discoloration produced by the sun on green flax will never be removed till it goes to the bleacher, and will give him some trouble also."

The latter sentence is given to show the Irish mode of treating flax for the finer fabrics. On the continent, it is not the *usual* practice to steep it anything like so soon after pulling. The seed, in such cases, would appear to be sacrificed; for there seem to be no means of saving it where steeping is hurried on so rapidly, nor are any mentioned.

When the crop grows short and branchy, it is esteemed more valuable for seed than for its fibrous bark, and then it is not gathered until the seeds are at full maturity. But if the stalks grow straight and long, then all care of the seed becomes a secondary consideration, and the flax is pulled at the most favourable period for obtaining good fibres. Experience has shown that when the bloom has just fallen, when the stalks begin to turn yellow, and before the leaves fall, the fibres are softer and stronger than if left standing until the seed is quite matured. It is well known that most seeds, though not quite mature when gathered, ripen sufficiently after being plucked, provided that they be not detached until dry from the parent plant; all the sap which this contains contributing towards further nourishing and perfecting the seed. The Dutch avail themselves of this fact with regard to their flax crop. After pulling the plants, they stack them. The seed by this means becomes ripe, while the fibres are collected at the most favourable period of their growth. They thus obtain both of their valuable products from their plants, and supply their less careful neighbours with the seeds.

In the Pas de Calais, flax sown in February and at the beginning of March, will be fit to pull from the 15th to

the 20th of July; that sown in the middle of April, will be ready quite at the end of July or the beginning of August; that sown so late as the middle of May, in the course of the month of August. The nature of the soil on which the crop is grown will hasten or retard the date of its fitness to pull. In general terms, maturity is indicated by the change of colour of the stalk, by a portion of the leaves falling off, and by the natural opening of the earliest formed capsules.

M. Matthieu de Dombasle, in his "Questions Agricoles," reports that the Yorkshire flax-growers declare that in order to have first-rate flax, they ought to select as the time for pulling it, the moment when the grain is *formed*, without being ripe: they say that, if it be allowed to ripen thoroughly, the quality of the flax is inferior, the filaments are less supple, and the linen made from them does not bleach well. "It is certain," he adds, "that in order to obtain a good sample of fibre, the flax ought to be pulled long before the perfect maturity of the seed, and when it is formed in the capsules, but still green and tender. I believe that this is the cause of the degeneration of flax, whenever such seed is employed for reproduction; and that this is the reason why, in those cantons where this branch of agriculture is best understood, they are forced to renew their stock from time to time, by importing seed from Russia, where it is probable the plants are allowed to reach a more complete stage of maturity, because *there* the seed is the principal object."

But the flax-growers of the north of France correctly observe that the above is an unnatural and unnecessary practice; and we strongly recommend the methods in use there as a guide to the English farmer who attempts to grow this valuable crop for the first time. There can be no doubt that by too early pulling, in order to obtain flax suitable for the finer fabrics, *strength* may be sacrificed *without* gaining a proportional improvement in the delicacy of the fibre. The main advantage will be a shorter and easier bleaching process, which, in point of fact, is dearly bought. The plan of the best French flax-

growers is this: as soon as the stalk is yellow up to the top, and all the leaves fall, and the seed-vessels begin to open in the sun, they pull it up by the roots, and lay it on the ground in not too thick rows, in order to let the sun penetrate it thoroughly. Afterwards, at the end of the week, it is turned with a pole or stick, and left four or five days longer with the other side uppermost; it is then lifted up in *brassées*, armfuls or sheaves, *not* bound together; two armfuls are set with their heads leaning together, leaving a vacancy at foot to allow a current of air to pass between them. It is left standing thus five or six days longer, and then tied together in *bottes*, bundles or sheaves, formed by the union of two *brassées*, or armfuls; it is then loaded on carts or wagons, to be stored for a while in barns, or other buildings under cover.

In England, unfortunately, the details of flax-growing are matter of experiment rather than of regular routine. Mr. Warnes has devoted his best energies to introduce flax into his native county, we therefore quote the result of his experience as to the best time for pulling the plant.

"With respect to pulling flax before the seed has arrived at sufficient maturity for preservation, I desired to test the experience of my Belgian workmen, and therefore produced authorities to prove the necessity of sacrificing that important part of the crop, in order to secure the finest fibre. They insisted upon the absurdity of the recommendation; observing, that unless the formation of the seed were completed in the bolls, the flax would be defective; but, if allowed to obtain the proper degree of ripeness, both could, under their treatment, be brought to perfection. I inquired when my flax would be ready for pulling? They replied, 'in two weeks.' I then directed them to pull some of the ripest and steep it immediately. About a hundred sheaves were accordingly placed in the water; the men declaring that good flax would be found only in the middle, and bad at both ends of the stalk.

"At the expiration of a fortnight, some more were pulled, and, except being stooked and thrashed, were

treated like the former; but when scutched it was thirty per cent. better, exclusive of the seed saved, both ends being perfect, while those of the other were precisely in the state foretold by the Belgians. The remainder of the field was dried in stooks, stacked, and the seed beaten out in winter.

"From the result of this experiment, I ascertained that there were four principal methods of pulling and steeping, as follow: First, the flax is pulled, and in a few hours steeped with the seed. Secondly, the bolls are rippled on the field, and the stalks steeped immediately. Thirdly, the flax is dried in stooks, seed thrashed, and stalks steeped. Fourthly, stooked, stacked, the seed beetled in the winter months, and the stalks steeped at pleasure." The *third* method here mentioned is the one followed in France, when circumstances permit.

THRASHING THE SEED.

The mode of divesting the flax of its seed differs considerably, as we have seen, according to the destination of the fibre and the locality in which it is grown. The most general plan is to crush the bolls, or capsules, with a *flat*-headed mallet, exactly like that to be figured for beating or beetling the flax previous to scutching, except that its face or under-surface is not cut into teeth. This mode may be called beating, or thrashing, the seed; rippling is the act of drawing the flax-heads through a close-toothed iron comb, which tears off the capsules (*see fig.*). The plan is advocated by some under the idea that the seed keeps better in that state, which may be true.

The best practice is as follows: the threshing of flax takes place as immediately as possible after harvest. Here again we see the value of the *linier's* intervention—the *farmer* is busy about other things. A bundle of flax is divided in two, spread out, and laid on the barn floor, with the two heads together, and then beaten with flat-headed mallets. Two men work together better than one

Rippling the Flax heads, pages 50—51.

Threshing the Flax, pages 50—51.

alone could do (*see fig.*). By this means, the seed-vessels, or bolls, are broken, and the seed falls out. The flax is well shaken by separate handfuls, to make every grain of seed fall out. As soon as each bundle is thrashed, the seed is pushed or swept on one side, in order that another bundle may be thrashed in its place.

The bundle of flax is then tied up, to be ready to be put into the water, in the following way: two bands of rye or other straw are laid on the barn floor side by side, thus (*see fig.* i.). S S are the bands of straw. One half of the thrashed bundle of flax is laid with its head, H, to the left, and the other half with its head to the right of the thrasher. The thick portion of each being reversed in place, the whole sheaf, as prepared for steeping, is cylindrical. All the flax is tied up thus, bunch by bunch, as it is thrashed, and put aside into its proper place. Every workman, at the end of his day's work, also carries the seed which he has thrashed to the granary.

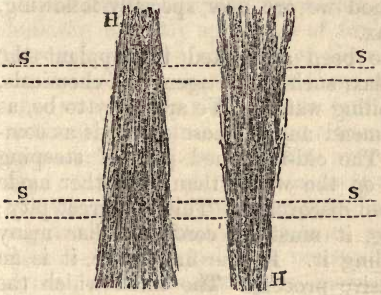


Fig. i.

THE STEEPING, RETTING, OR WATERING.

Without the steeping, or *rouissage*, as the French call it, the flax would be useless for textile purposes. The fibres which constitute the flax and tow of the manufacturers, or material to be spun, are contained in the bark of the plant, and are glued together by a gummy and resinous matter, which must be got rid of, not only in order to separate them from the stalk, or wood, but also to give them the pliancy requisite for their destined

uses. The method commonly employed to separate the fibre from this gummy resinous substance is decomposition by means of the fermentation of putrefaction. This is effected by steeping the flax in still or stagnant water. The necessary decomposition *may* be made to take place without immersing the flax in water at all, by exposing it on a meadow to the rains and the dews. But the plan is uncertain, depending entirely upon the whim of that fickle agent—the weather; it is also more tedious, and when made *very* tedious by the continuation of drought, the quality of the sample is seriously injured. The growers, whose method we are now specially following, always steep their flax.

Other means have been attempted to supplant the process of steeping flax, such as the agency of chemicals, and of steam and boiling water. We are sorry to be, as yet, unable to recommend any of these methods as completely successful. The old-fashioned plan of steeping still answers better on the whole than any other mode that has hitherto been discovered. This is a great pity; because flax-steeping, it must be confessed, has many disadvantages attending it. In the first place, it is an unhealthy and offensive process. The smell which the ditches and ponds occasionally emit, is all but unbearable; so also is the odour of the flax when taken out of the water. It is known that the exhalations from sodden and decaying vegetables are the cause of the miasms which sow the seeds of agues and all that fearful class of diseases. Some persons near Lille, who had the imprudence to bathe in a pond in which flax had been steeped, were almost immediately seized with intermittent fever. The water wherein flax has been steeped, if let out into a larger pond or stream, is also fatal to the fish. These are really serious evils; but happily the only ones connected with the growth of flax.

Secondly: not only are many farms which are most suitable for flax-growing, defective in the *quantity* of water necessary for steeping—they have not *enough* ponds and ditches in their neighbourhood, to be able to devote

several to this sole use,—but all waters are not considered equally good for flax-steeping; and though stagnant, it is desirable that the entire body should be renewed by a feeble stream entering at one end of the pond and escaping at the other. Quick-running water will not do at all.

Here again we see the usefulness of the liniers, or flax-men. The villages in which the liniers flourish most, are those where the waters are abundant and suitable. They buy up the flax, wherever grown, and bring it home to subject it to the treatment which it is often impossible for the farmer to apply, unless he goes to the expense of building a costly apparatus of tanks and cisterns. He also removes the *nuisance* of the steeping. He concentrates it on one spot (where there is often plenty of running water easily turned on to purify the place from time to time), instead of allowing a number of such nuisances to be dispersed here and there over the face of the country. A village of liniers is to the flax-grower what an *abattoir*, or large public slaughter-house, is to the butchering trade. It unites, regulates, and eases other spots from being annoyed by a process which, from its very nature, must necessarily be more or less offensive and insalubrious.

It will thus be seen that several distinct conditions require to be combined, in order to completely adapt any one locality for the successful cultivation and preparation of flax, *if* it be necessary for the farmer himself to undertake the manipulation of the flax he grows; and they ought not to be overlooked by those who are laudably desirous of introducing a new and profitable branch of agriculture into their own neighbourhood. Attempts that are made without due consideration of each one of these conditions, will only lead to disappointment.

It will instruct the reader to learn the conclusion at which Mr. Warnes arrived, after his various endeavours. There is nothing like experiment, made by oneself or by others, for giving information on any foreign, and little understood, art.

"The only real difficulty connected with the cultivation, growth, and preparation of flax in Norfolk, has arisen from the want of suitable steeping accommodation; and, consequently, much flax has been injured both in colour and quantity,—a difficulty which the Belgians obviate by sending their flax to places adapted to this particular branch of the business; distance being immaterial compared with the advantages derived. The water of the river Lys, to the extent of many miles along its banks, is the most celebrated depository for flax. Steeping is, to hundreds of men, a regular trade. Two, or more, unite in the possession of a number of crates, adapted to a given expanse of water, for which they pay no rent, and are protected by the Government from the interference of shipping. The crates are about twelve feet long, eight wide, and three deep. They are simply constructed, and made of common poles. One of my men, Joseph Fieux, was a joint owner of forty-five. He says that farmers send their flax as far as forty miles by land to be steeped; some, by water, from Holland, even much longer distances. The sheaves, tied with double, and oftener with triple, bands, are placed erect in the crates. The root-ends of one-half of a sheaf are tied to the boll-ends of the other, in order to make the bundle even and convenient for stowage in the crate, which, when filled, is floated into deep water, and sunk with stones to about six inches below the surface. After a short time, some of the stones are removed, to prevent the crate from touching the bottom of the river.

"When ready to be removed, the bundles are placed upon the banks a few hours, to drain. Afterwards they are untied, and formed into what are called caps, not unlike miniature soldiers' tents. The rapidity with which this operation is performed is perfectly astonishing; for in a few minutes a whole field will assume the appearance of a Liliputian camp. By this means, the stalks are quickly dried, collected into bundles, and sent home.

"Where the process of bleaching or grassing is conducted by the owner at his leisure,—that is to say, if not

convenient to prepare the flax for market immediately,—it is carefully stacked till the following spring, a delay that considerably enhances its value, particularly with respect to colour. On these accounts, the system of steeping flax one year and of grassing it the next, is now extensively adopted in those parts; a system that will, I think, be found best suited to the general routine of farm-business in this country.

"I had some flax steeped in water, approved by the Belgians, several miles from my own house, according to the above plan; and found in this, as in every other department, the superiority of their practice. I shall, therefore, in future, send my best flax to any distance rather than risk its value at home. By the rivers and streams that meander through our own country, many places might be found where competent persons could be located, who, at a reasonable charge, would steep the grower's flax upon the Belgian plan, and thus relieve him from the weight of that all-important operation; the after-processes of grassing and scutching being such as the unemployed juvenile population could easily perform at home."

Mr. Hardy, after describing the Courtrai mode of watering flax, which agrees with the above, adds: "After seeing so much of this system of managing flax, of which I have so often heard, I must say that it is the best I ever saw; but the great drawback to the Irish farmer would be, the length of time he would have to wait for his money. In fact, it cannot be fully carried out, in Ireland, until there be such people as are here, to buy it on foot, and make a regular trade of it."

Messrs. Marshall and Co., of Leeds, state as follows: "The effect of retting in running water is to produce flax of a light yellow colour. This always fetches a higher price in the market; but the same effect is produced in large ponds or lakes of fresh water. If there are such in your neighbourhood, we should recommend your adopting this mode of retting. The other mode of retting more usually followed is in ditches of stagnant

water; and the result is flax of a dark grey colour. The bundles are laid in one row, overlapping the next, and then weighted with sods, stones, &c. The retting takes from five to seven days. The flax is then taken out, dried, and if of good quality, laid by till the following spring, when it is spread on the grass to bleach. This flax does not come to market till the second year after it was grown; but this is only the case with the finest flax. In general, the bleaching immediately follows the retting; but keeping the flax-straw either before or after retting decidedly improves the quality.

"The chief difficulty in retting the flax is to decide the exact time when it should be taken out of the water. This is a very nice point, as by leaving it in the water a few hours too long, it may be over-retted; therefore we should recommend the example of the Irish Society to be followed in the first instance, either to send one or more young men to study the retting process abroad, or to engage a Belgian to superintend this stage of the preparation of the flax."

We also quote Mr. Henderson's practical and experienced directions:—"Flax is subject to injury from neglect, in every process, but in *the steeping especially*. The water brought to the pond should be pure from all mineral substances, clean and clear. The water of large rivers is generally to be preferred, but spring water, which has run some hundred yards, becomes soft, and will have deposited any mineral impurities it contained. Immediately from the spring it seldom does well. If the water be good and soft, it is injurious to allow it to stagnate in the pond before steeping. I put in two layers, each somewhat sloped with the root end of each downwards: one layer is said to be safer, and perhaps is so, though I have tried both, and seen no difference. It should be placed rather loose than crowded in the pond, and laid carefully, straight and regular. Having an abundant supply of water, I do not let it into the pond till the first layer is in. I cover with moss sods (from the turf banks), laid *perfectly close;* the sheer of each

fitted to the other. Thus covered, it never sinks to the bottom, nor is affected by air or light. It is generally watered in from eleven to thirteen days. A good stream should, if possible, always pass over the pond; it carries off impurities, and does not at all impede due fermentation—flood and all impure water should be carefully kept off. The Dutch test of being sufficiently watered is certain and perfect, as I never found it otherwise. It is this: try some stalks of average fineness, by breaking the woody part in two places about three inches apart, at the middle of the length; catch the wood at the lower end, and if it will pull out (downwards) for those three inches, freely, without breaking or tearing the fibre, it is ready to take out. This trial should be made every day, after fermentation subsides; for sometimes change is rapid. Flax is more frequently injured by too little than too much of the water. Great care and neatness are necessary in taking out. Broken or crumpled flax will never reach the market. Spread the day it is taken out, unless it is *heavy* rain,—light rain does little harm; but in any case, spread the next day, for it will heat in the pile, and that heating is destructive.

"It should be spread even, straight at its length, not too thick, and well shaken, so that there shall be no clots; indeed, if possible, no two stalks should adhere. I have ever found it injurious to keep it long on the grass; it is in the steep the wood is decomposed; on the grass the fibre is softened, and the wood little, if at all, affected. I rarely let it lie more than five days, sometimes only three. It should never, if possible, be spread on the ground flax grows on: it claps down, and the clay and weeds discolour it; clean lea or lately cut meadow is the best.

"The lifting of the flax, like all other operations, requires care and neatness, to keep it straight to its length, and even at the roots. This operation is too frequently hurried, and coarsely done.

"With regard to drying, if the steeping and the grassing have been perfect, flax should require no fire;

but, to make it ready for breaking and scutching, exposure to the sun should be sufficient; but if the weather be damp, the flax tough, and it *must* be wrought off, then it must be fire-dried. Such drying is always more or less injurious; the flax is absolutely burned before it is dry. All who can afford it should keep such flax over till the ensuing spring or summer, putting it dry in stack, then it will work freely *without* fire-heat."

For inexperienced hands, the great difficulty in steeping is to determine beforehand the time necessary for the flax to remain in the water; for its progress will depend upon the quality of the water, on the more or less rapid rate at which it is renewed, and upon the state of the atmosphere. The only certain way of proceeding, is to watch the effect of the operation on the flax itself. For this purpose, samples should be drawn from time to time from the middle of the mass, when it will be seen whether the fibre easily separates from the wood; but unless the operator has great experience, the best way is to test the state of the flax upon a few stalks that have been previously dried, namely, upon materials in exactly the same condition as they will have to be when worked by the scutchers. The fibre, in fact, always separates more readily from wet stalks than from dry ones. By way of test, crack the stalk across near the root, without breaking the fibre, and draw the latter towards the head of the stem, stripping it upwards. The fibre ought to come away easily, and should, moreover, hold together in ribbons; narrow and separate fibres would indicate the steeping to have gone too far.

Having thus detailed the most approved Belgian and Irish plans of steeping, we will now describe the simple and easy method which we have personally witnessed in successful operation. The flax being tied up in the cylindrical sheaves or bunches which we have described, is carried to the water, and simply thrown into it. No crates, nor anything of the kind, are made use of. The water must not be a running stream, but a ditch or pond, in which the water is soft, pure, clear, and not charged with

mineral or other matters in solution or suspension. The sheaves ought not to be laden with stones, or other weights to make them sink; but every day each bunch is turned with a pole, to make the uppermost side change to the undermost. There is no fixed time for the flax to remain in the water to be sufficiently steeped. The period will vary according to the temperature of the season, the quality of the water, and the nature of the flax itself. Its duration may be from four or five days to four or five weeks. The flax must be examined from time to time. When in breaking the stem in the middle with the fingers, the fibre separates easily from the woody part, the steeping has gone far enough, and it is time to take the flax out of the water. This is effected by an implement called a *tiroir*, or drawer, which admirably answers the purpose of landing the flax with as little disturbance as possible. It is a most useful contrivance; for, to repeat Mr. Henderson's observation, "great care and neatness are necessary in taking out. Broken or crumpled flax will never reach the market." But a heavy and water-logged mass of fragile material is not an easily-managed affair. The "drawer" obviates every difficulty.

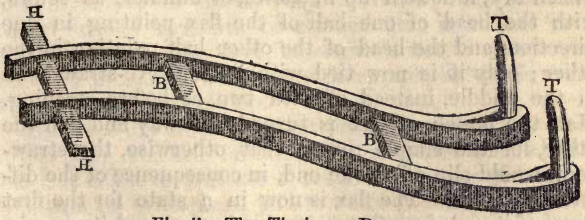


Fig. ii. The *Tiroir*, or Drawer.

The implement is stoutly made of elm-wood. Its extreme length, following the curve, is sixty-four inches (*see fig.* ii.). B B are cross bars to hold it together firmly. The length, H H, of the first bar, or handle, is twenty-three inches. The way in which the machine is used is obvious. The sheaf of flax being towed with a pole to

the water's edge, two men, holding at each side of the handle, slip the drawer under it, and it is propped up behind, not pierced as with a fork, by the stout wooden teeth, T T, whose length from the wooden *gum* or shaft is ten and a half inches. The sheaf once lifted out of the water and landed, is dragged by the drawer along the grass, as if it were upon a sledge, to its proper place on the meadow, and then gently deposited there by simply raising the drawer upright, and letting the sheaf roll off. The shafts of the drawer open a little as they approach the teeth. The breadth between them at the bottom is thirteen inches; at the top, eleven and a half.

When each bunch or sheaf of flax is drawn out of the water, it is set on end to drain for one day. On the morrow it is taken into a field (whether pasture or ploughed land is of no consequence), and each bundle is divided into four handfuls. Each handful is then set on end, and kept standing there by spreading out the foot and pinching the head, until it is a little dry. Then, each bunch is turned inside out; that is, it still remains standing as before, but the inside stems are brought outside to the air, and *vice versâ*. It is changed and turned in this way three or four times, till it is perfectly dry. When dry, it is tied up in *bottes*, or bundles, as before, with the head of one half of the flax pointing in one direction, and the head of the other half pointing in the other; only it is now tied with but one rye-straw band in the middle, instead of with two, as before steeping. Half the bunch of flax is turned one way and half the other, for the simple reason that, otherwise, the straw-band would slip off at one end, in consequence of the difference of size. The flax is now in a state for the first stage of it real manufacture to be begun, and it may be kept in this condition an indefinite time, according to the proprietor's convenience.

THE SCUTCHING.

When the flax is steeped and dried (we remind the reader that it is all the better for keeping afterwards),

it is ready for scutching, an important operation, which has for its object the separation of the fibre of the bark from the woody portions of the stalk or straw. If you were to take a stem of reed in your hand, and crush it regularly from one end to the other, you would have nothing left you but a handful of fragments; but if you serve a stem of flax in the same way, after the brittle part is broken and fallen to the ground, a little bundle of strong fine threads will be left. This, of course, is the only portion of the flax which is of any use for clothing purposes; and consequently the scutchers get rid of the rest as completely as they can, by thumping and crunching, and beating the poor plant in various ways, till you fancy it must be reduced to a mere mass of shreds and chaff. But it is a tougher article than you would think, to look at it.

After the scutching, which is bad enough, it has to undergo the combing, which is worse. It is drawn and torn through horrid things with brass and iron teeth in thrice triple row, till it is wasted to nearly half its former weight, and is little more than a tress of delicate threads, formed somehow by the wondrous mechanism of nature, as materials wherewith to exercise the industry and ingenuity of man. Flax that has undergone all these various torments, or combed flax, is at last in a state to spin. Our duty, however, is not to hurry over all these processes in a single paragraph, but to describe them clearly step by step.

However dry flax may be at the time when it is stored, after lying stacked for several months, or packed in a barn, it is apt to contract a sufficient degree of damp to diminish its brittleness, and to make it difficult to separate the woody part from the fibre, which is now the principal object. To restore it to the degree of dryness necessary for the subsequent manipulations, it must be *weathered*, that is, exposed to warmth sufficient to carry off the moisture which has been imbibed. Scutching, in the comprehensive sense understood by the French word *teillage*, actually comprises three different operations,

which are called the *hâlage*, or weathering, the *broyage*, or bruising, and the *écouchage*, or scutching proper.

Flax is weathered in various ways; in the sunshine, in bakers' ovens, and in stoves expressly made for the purpose. The French flaxmen dry their flax *only* in the sun. They set it upright against a sunshiny wall or hedge, where the ground is clean and the aspect airy, for four or five successive days. They take it in every night, being careful not to let it be exposed to the dew. Weathering in the sun, especially with flax which has been kept some little time, is the most advantageous and economical practice; the fibre so obtained is always both stronger and softer than that which is the result of any other process, and, moreover, incurs no risk of injury from fire. But as sunshiny days are unfortunately rare in certain seasons and certain climates, artificial modes of obtaining the same result have of necessity been adopted.

Some make use of bakers' ovens, putting the flax into them, in bundles, as soon as the bread is taken out. Others erect round and conical stoves either of clay or brickwork, with an opening at the top to allow the steam and smoke to escape. The dimensions of such stoves or ovens are about five feet in diameter at the base, and seven feet in elevation. They are divided horizontally at about half their height by a wooden trellis or grating, and on this trellis the flax is laid. A fire of flax-chaff is lighted beneath, and carefully tended, to make the flax dry equally, and to prevent it from catching fire. But both these methods are liable to great objections. In the bread ovens, the heat is often too fierce at first, and injures the fibre by affecting its natural qualities. Moreover, the vapour which is disengaged, having no outlet, is condensed again upon the flax when the oven cools; the stems become soft and flexible, and the fibre loses a portion of its brightness and its strength. As to the conical stoves, they only succeed in drying the flax imperfectly, while they often cause it to be smoked, and even scorched.

In order to weather flax effectually by artificial means,

it is requisite to have, as in Flanders and Germany, a small chamber specially devoted to the purpose, with a low ceiling, and an opening above, to allow the vapours to make their escape. The flax is set upright in little handfuls on convenient shelves, and the heating is effected by means of a stove whose door is outside the chamber, to avoid the risk of fire. At first, the fire is kept low, and maintained at a moderate heat for some little time. As soon as it is found that no more steam escapes from the upper opening, the temperature is raised for a while, and in a short time the operation is completed. The flax is taken out, and allowed to cool, and may then be submitted to the process of bruising.

The flax being weathered, or dried, either in the sunshine, which is by far the best mode, or artificially, which should be only adopted upon compulsion, is next submitted to the process of bruising, the first step of which is performed with the *mail*, or mallet. The workman unties a sheaf of flax, spreads *half* of it evenly on the barn-floor before him, only in exactly a reversed position to the flax as represented in our former cut of the thrashing. For bruising, the *head* of the flax lies towards the workman. He sets his foot upon the portion which is to receive the stroke, and then beats it, for *half its length*, from the root upwards, with a curved-handled, heavy-headed, indented mallet, of which we give a figure, with dimensions. The head of the mallet weighs about two pounds and a half, and is made of apple-tree or ash, the handle

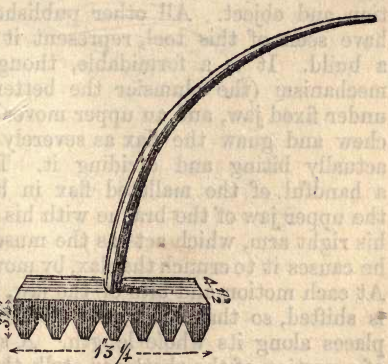


Fig. iii. Mallet for bruising flax.

being of willow. The first packet being beaten enough, he steps a few inches to the right or left, and beats the next portion, till the whole is bruised sufficiently. He then takes up the flax in separate handfuls, and disposes them in a row leaning against each other crosswise, like the letter X several times repeated; or sometimes in a circular heap, crossing each other like the spokes of a wheel (*see fig.* iv.), to keep each handful distinct, for convenience during the crushing and the scutching: till the scutching is finished and the flax is in a state ready to be weighed, it is carefully kept in separate handfuls.

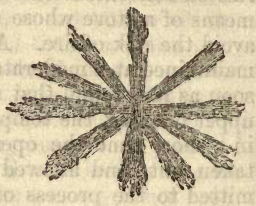
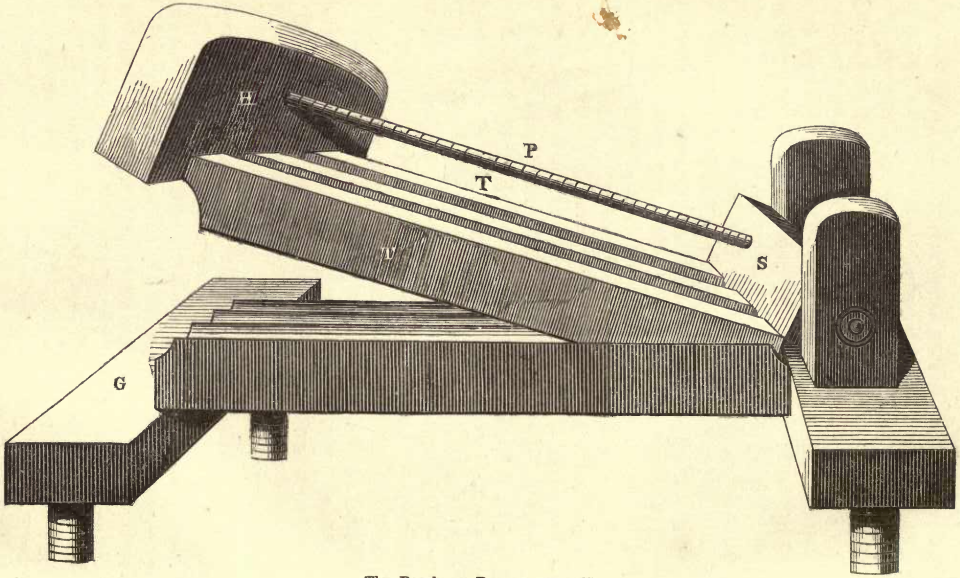


Fig. iv.

The next implement brought into play is called in English, a "break," or "breaker;" in some parts of France it is styled a *brie*, or a *broie*. In the most productive flax districts it is known by the appropriate term of a *braque*, *braques* meaning the pincers of a lobster's claw. Our woodcut will explain its construction and object. All other published figures which we have seen of this tool, represent it of much too slight a build. It is a formidable, though clumsy, piece of mechanism (the clumsier the better), consisting of an under fixed jaw, and an upper moveable one, contrived to chew and gnaw the flax as severely as possible, without actually biting and dividing it. The workman takes a handful of the malleted flax in his left hand, lifts up the upper jaw of the braque with his right, and then with his right arm, which acts as the muscle of the upper jaw, he causes it to crunch the flax, by moving it up and down. At each motion and bite of the jaw, the place of the flax is shifted, so that the woody stem is broken up in many places along its whole length. A shake or two gets rid of a portion of the shattered stalk, the fibre remaining all the while entire. When sufficiently *braqued*, or broken up, the handful of flax receives a slight twist, and is



The Break, or Braque, page 65.

thrown on one side, in a heap with others of its kind, to undergo the process of scutching. Meanwhile it is necessary to keep the flax as dry as possible. If, for instance, the workman intends to defer till to-morrow morning the scutching of the flax which he has braqued this afternoon, he covers it over with flax-chaff, and even with a cloth, or his working dress, to keep off any damps or dews.

In France, the *mail* and the braque, both tools for the general service of the scutchers, are the property of the master flaxman; the other implements, to be immediately described, belong to the several workmen. We purposely give the French names of these tools, in order to aid the reader who may wish to procure patterns or models from the continent. Both the "breaking" and the previous operation, the "malleting" of flax, have been compared to modes of purposely imperfect mastication. The *mail* is something like a heavy hearth-brush without any hairs and with a curved handle; but the lump of wood from which the bristles would proceed, being stout and ponderous, and cut at the bottom into grinder-like ridges, threatens to have an effect upon the flax similar to that of an elephant's tooth upon a branch of acacia. The workman, however, only beats and crushes the flax with his wooden molars; he does not quite chew it into fragments. When the mallet has munched it sufficiently, each separate handful is further crushed between the powerful jaws of the braque. The combined mumbling of the two breaks the woody internal stalks of the plants, but leaves the fibres of the bark uninjured and entire.

In order that our figure be perfectly intelligible, the upper jaw of the "break" is raised as in the act of breaking the flax. P is a stout round pole running from end to end, above the three teeth T T, which are wedge-shaped bars of wood four inches and three quarters deep, and an inch and a half thick at the top, and thirty-three inches and a half long, from their insertion in the head H, to their fixing in the socket S, which moves on a wooden pivot, between two solid wooden supporters.

The head H weighs eight pounds, or thereabouts, and is ten inches in length, and three inches and three-quarters thick. The lower jaw consists of four stout wooden teeth, not wedge-shaped, the intervals between which receive the three teeth of the upper jaw. When the braque is closed, the head H rests on the solid slab, or under gum, G. The whole machine is made of apple-wood, as being a hard, tough, and weighty material; and stands firmly on four wooden legs, which are fixed into blocks of stone, to resist the constant shock of the machine.

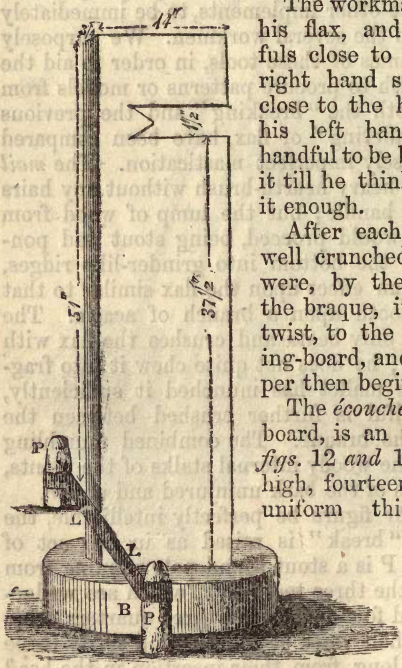


Fig. 12.—Front view of the Scutching-board, or *Ecouche-pied*.

The workman, having malleted his flax, and laid it in handfuls close to the break, with his right hand seizes the pole, P, close to the head, H, and with his left hand introduces the handful to be broken, and crushes it till he thinks he has pounded it enough.

After each handful has been well crunched and tasted, as it were, by the wooden palate of the braque, it is tossed, after a twist, to the foot of the scutching-board, and the scutching proper then begins.

The *écouche-pied*, or scutching-board, is an upright plank (*see figs.* 12 *and* 13), fifty-one inches high, fourteen broad, and with a uniform thickness of three-quarters of an inch throughout, firmly fixed in a solid block of wood, B. At the height of thirty-seven and a half inches from the foot, is a horizon-

tal slit an inch and a half broad. With his left hand, the scutcher introduces into the slit a handful, or tuft, of braqued, or malleted and broken, flax, so that it hangs down on the side of the scutching-board, which faces the reader in the cut. With his right hand he scrapes and chops at the flax with a tool called an *écouche*, or scutch (to be immediately described), something like a battledore, or a monstrous wooden butter-knife. A leather strap,

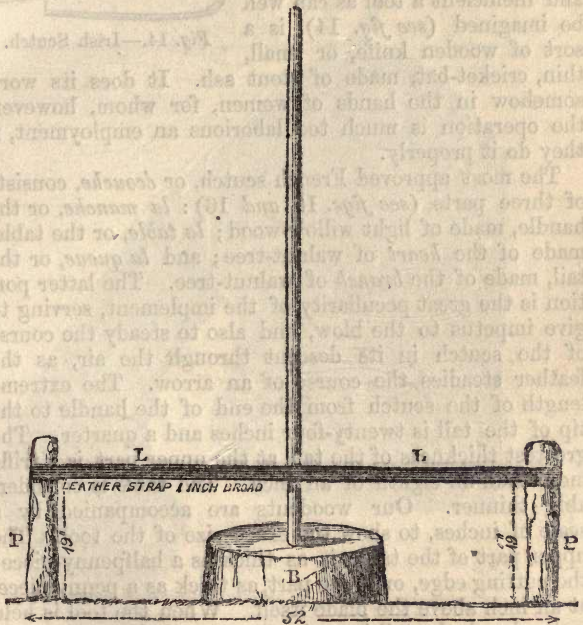


Fig. 13.—Side view of the Scutching-board, or *Ecouche-pied.*

L, L, an inch in breadth, stretches between two low posts, P, P, at the height of nineteen inches from the ground, just before the workman's legs, at the lower part of the scutching-board, in order that he may not

bark his own shins while scutching the flax. The strap, also, by its elasticity, causes the blow to rebound, and so aids the labourer in continuing his work. By these means, and by turning it about, the woody refuse is got rid of, and little else but the pure fibre remains.

The scutch itself is a tool whose form varies considerably in different countries. The Irish scutch, which is as primitive and inefficient a tool as can well be imagined (*see fig.* 14), is a sort of wooden knife, or small, thin, cricket-bat, made of stout ash. It does its work somehow in the hands of women, for whom, however, the operation is much too laborious an employment, if they do it properly.

Fig. 14.—Irish Scutch.

The most approved French scutch, or *écouche*, consists of three parts (*see figs.* 15 *and* 16): *la manche*, or the handle, made of light willow-wood; *la table*, or the table, made of the *heart* of walnut-tree; and *la queue*, or the tail, made of the *branch* of walnut-tree. The latter portion is the great peculiarity of the implement, serving to give impetus to the blow, and also to steady the course of the scutch in its descent through the air, as the feather steadies the course of an arrow. The extreme length of the scutch from the end of the handle to the tip of the tail is twenty-four inches and a quarter. The greatest thickness of the tail, at the upper part, is a trifle more than an eighth of an inch. The table is considerably thinner. Our woodcuts are accompanied by a scale of inches, to show the exact size of the tool. The upper part of the table is as thick as a halfpenny-piece; the cutting edge, or lower part, as thick as a penny piece, at an inch above the blade itself. When the tool is held in the hand, the tail is up in the air, and the edge of the table downwards. We give drawings of the two sides of the French scutch, to show how the implement is put together, as well as the difference of its surfaces. N, N, N, are iron nails or rivets. Besides these, the handle, tail, and table are fastened together with glue. The

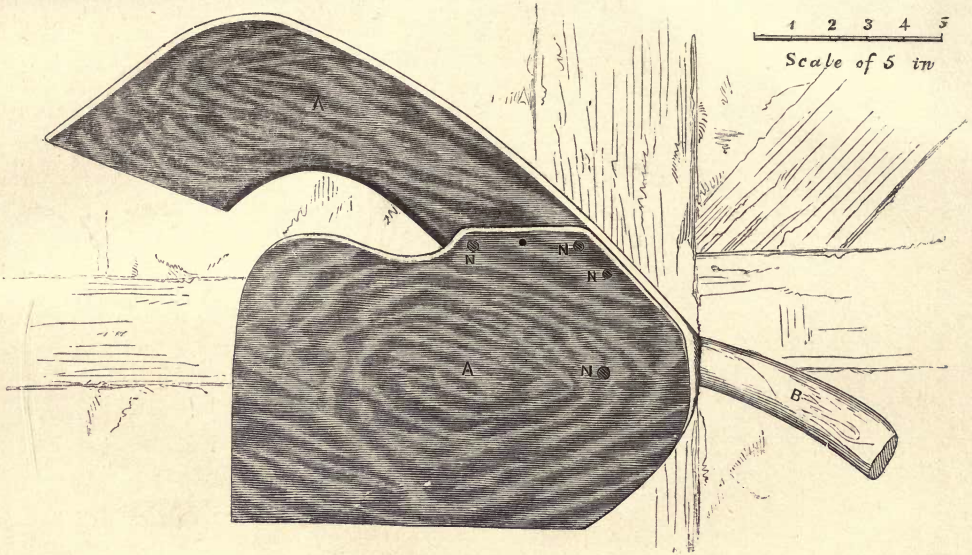


Fig. 16.

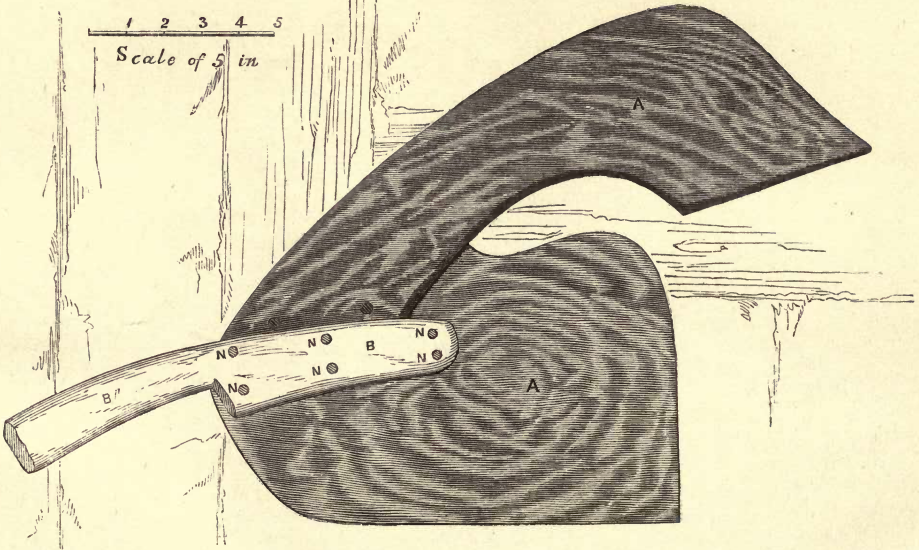


Fig. 16.

left, or front side of the French scutch, is as smooth, and as much in one plane, as the thinness of the wood, and its liability to warp, will admit.

We have thus minutely described the scutching implements, because the operation itself is a most important one, and requires a well-trained workman to perform it as it ought to be. On it mainly depends the value of the article produced. It will, therefore, be believed, that its execution can be but imperfectly learned from the fullest directions that can be given in print. The only way is, either to have foreign workmen over in England to instruct the native population, or, what is better, to send a few clever young men to France, to serve a sort of apprenticeship to the preparation of flax. The little practical details of the process are innumerable. Thus, the workman ought to hold the handful tightly in his hand, to prevent the fibres from being knocked out by the blow of the scutch; he ought to strike the fibre rather in the way of scraping and rubbing, than of knocking it; and the scutch ought not to descend perpendicularly on the flax, as it protrudes through the slit in the scutch-board, otherwise many of the fibres are broken, come away with the tow, and so occasion loss. When one-half of the handful is scutched, the ends change places in the workman's hand, and the other half is operated upon. It is shaken, and combed with the fingers several times; and often, when much tow comes away, two handfuls are put together.

In the act of scutching, tow is produced of two kinds, one more useful than the other. Both are laid aside separately. The finest tow is spun for making aprons, coarse cloths, work-day shirts, and pantaloons, for labourers, &c. The coarser is used to make packing-cloths, ropes, &c., &c. This tow is used up and spun at home, entirely for home purposes. The tow produced in combing is of a finer quality. In the flax-mills, it is carded by the great carding-machine, and afterwards spun. The time, and the amount of manipulation, required to scutch a given bundle of flax, varies considerably, according to circum-

stances, such as the quality of the flax itself, the way in which it has been steeped and dried, and even the state of the weather, much damp being unfavourable, as also would too sharp a drought, though the latter inconvenience is rare in Great Britian, and still more so in Ireland. To the scutcher, who is paid by the weight scutched, and not by the day, it makes a considerable difference in his earnings whether these circumstances are favourable or adverse. Thus, French scutchers, at two pence the *kilo* (short for *kilogramme*, and equal to 2·206 English pounds avoirdupois), can earn from eight pence to twenty pence a day, according to their skill and the quality of the flax they have to do with.

The niceness of the scutching operation is shown by the fact that its proper performance by machinery has never yet been accomplished. We do not say that it never will be; probably it will, for there is scarcely a limit to the powers of machinery. Hitherto, when flax is scutched by machinery, the two ends only are properly done, the middle remaining imperfectly finished off. In some cases, the loss occasioned by scutching by machinery, instead of by hand, has been as much as twenty-five per cent. Mr. Warnes, to whose praiseworthy attempts we have a pleasure in referring, says at first, that "we must wait with patience till our labourers have learned the art of using the scutching-mill, before we, or they, can fully reap the benefit;" but he afterwards declares, that having spared neither trouble nor expense in testing the comparative merits of hand and of mill scutching, he finds that the scale is at present in favour of the former. In fact, no foreign flaxman would listen for a moment to the proposition of scutching by machinery.

VALUE OF FLAX TO THE COMMUNITY AT LARGE.

The value of the flax crop, in a national point of view, arises from the unfailing employment which the scutching gives for many months in the year. When a young man has once learned the trade, if he subsequently thinks fit

to go out as a servant, or a gardener, or to follow any other handicraft, and subsequently finds those fail him, as they will sometimes, he can always return to his scutching work, and earn, if not a luxurious livelihood, always enough to keep him from starvation abroad, or the workhouse in England. In the French flax-growing village, with which we are best acquainted, a population amounting to nine hundred inhabitants, amongst them annually grow, and send forth, flax to the amount of eight thousand pounds sterling, even in the imperfect state in which it leaves their hands, that is, merely scutched. But not only are these villagers industrious men; the topographical features of the place are peculiar. The soil is a rich alluvial loam; and the leading points of the landscape are pollard willows, rich meadows, intermingled with patches of arable land, productive cottage-gardens, and plots of ground that have been dug with the spade. Little streams of soft and clear water wander hither and thither throughout the place, thereby affording plentiful opportunities of steeping the flax upon the spot. The humblest of workshops are all that is necessary. Wherever you go, you observe that almost every tenement has one or more rude clay buildings attached to it, in whose walls, instead of windows, a row of squarish holes are broken, at about the height of a man, through which you can see daylight from the other side. These wretched-looking hovels are the *écoucheries*, or scutcheries, in which the flax is prepared; and they not only are the sources of considerable wealth, but they also shelter a good deal of fun and merriment. The scutchers, to earn wages enough to keep themselves and their families alive, are obliged, in winter, to begin working long before daylight, and to continue their task some time after it has departed. The introduction of lamps or candles amongst such inflammable material is carefully avoided; nor are they necessary, as the operations can be conducted, though not with equal rapidity, as well by the aid of feeling as by sight. This fact suggests the hint that flax-scutching would be a profitable task on which to employ the blind

amongst the poor. A blind man in a scutchery, with a very little help from his neighbours, might earn enough to maintain himself, and the labour would be no greater hardship to him than to others. During these hours of industrious obscurity, the imps of darkness are kept at bay by patriotic, amatory, and comic songs. The holes in the opposite walls are made for the purpose of admitting a current of air to carry off the dust—the great nuisance of this part of the business. It is not possible to avoid the dust by working in the open air, even under the shade of a tree. The flax would get either too damp or too dry, and would not work so well. The woody part of the stem, which is knocked out in the act of scutching, is largely employed for fuel, to light ovens, &c., and is sold by the *liniers* to the workmen and others. That and the tow are flighty materials, carried about by the slighest breeze. As in sandy places, the sand gets everywhere in windy weather, even amongst the food and into the bed-rooms, so no French flaxman or scutcher is surprised to find chips and tow in his soup and his bread. It is impossible to keep them quite free from the intrusion, so long as he exercises his calling at home. There is nothing, however, at all injurious to the health in the admixture. The real evil is the dust in scutching, which sometimes seriously irritates the lungs.

The present point of our treatise appears the proper one to say a few words on the social bearing of the subject.

"Opinions," says Von Thäer, "are greatly divided respecting the inconveniences which would arise, both for the great agriculturist and for the small farmer, by considerably extending the growth of flax. It is impossible to deny that flax absorbs all the goodness which may be remaining in the land; that it requires a long and careful culture at the time of year when the farmer is already overburthened with occupations, and that it might thereby cause operations to be neglected which are more essential to the economy of the entire farm. In districts, therefore, where, in following the established

system of cultivation, economy is obliged to be observed both with regard to manure and the strength yet remaining in the land,—both in respect to the labour and the employment of time in summer, in consequence of the scarcity of hands,—it is impossible that any great benefits can be derived from the greatly increased extension of the cultivation of flax. On the other hand, on land which has been enriched by successive applications of manure, on occupations where a large quantity of manure is made and where labour is abundant (especially that of females), the crop may be widely cultivated with advantage.

"It is in those countries especially where spinning and weaving are the principal resource of the population during winter, that this plant ought to have the preference over other vegetables that are grown for commercial purposes. In such districts, it is often easy to sell the crop while yet standing, and so to derive from it a considerable clear ready-money profit, without having the trouble of undertaking the harvesting and subsequent manipulation. It might thus turn out a good speculation to establish spinning-mills and looms in many districts, in order to give employment during the winter months to numbers of work-people who might in summer-time devote themselves to the labours of the field. By such means, great benefit would be conferred on the population of the neighbourhood. Under those circumstances it is right to extend the growth of flax and its preparation for spinning, and it may then be done without inconvenience. If both these circumstances do not exist, the culture of other vegetables used in commerce seems to me preferable to that of flax, which should then remain within the limits of the demand which exists for it at the time and place."

Taking a general view of the subject, it is no doubt desirable that the growth of flax should be greatly extended in England, as matters stand at present. Not only might we relieve ourselves of the very heavy tax which we have hitherto paid to foreign countries for that

article, but, as Von Thäer remarks, the agricultural population would obtain a considerable increase of work and wages. We consequently here gladly devote a portion of our space to the enthusiastic and at the same time just remarks which Mr. Warnes lets fall in his advocacy of the growth of flax at home.

"The indirect advantages to be derived from flax culture are of greater importance than the direct, whether the profits be £9 per acre, according to my experience, or £4, according to that of a Hampshire gentleman. If land-owners in general could be induced to lend their aid, the necessity for prodigious workhouses and prison establishments would be obviated. There was a time when England produced flax largely, but, on account of corn becoming more remunerative, Belgium obtained the ascendancy. The scale, however, is now turned; flax has become the profitable crop. Flax has to pass through many processes and many hands before it is presented at the counter for sale, even for the commonest purposes. Still more costly, however, are the cambrics, lace, &c., formed from flax, which would afford profitable occupation to thousands of the female population, now reduced to want and impelled to crime. Herein, therefore, consists the great providence of the crop, viz.: it contributes to the employment, the maintenance, and the profit of many classes; it provides, at the same time, clothing, cattle-food, and manure; it contributes to the production of cheap bread, and confers upon mankind greater benefits than any other crop whatever.

"Unlike cotton, linen can be placed before the customer free from the taint and villany of slavery. For not only in every nook in England, Scotland, and Ireland, can flax be profitably cultivated, but in all those regions whither our emigrants are sent; hence, if initiated in the management of flax, they would naturally become contributors to the parent country, and, though absent, a reciprocity of interests be for ever cemented. It cost this country twenty millions to remove the guilt

of a direct participation in slavery, and it now costs millions annually to suppress it. Nevertheless, by our purchases of cotton, we continue the main instruments of upholding that abomination in Georgia, where the number of slaves has increased in fifty years from 29,264 to 253,532; a number evidently augmented, during the past ten years, in proportion to the increased demand for cotton. The maintenance of 997,796 paupers in England and Wales alone cost £5,792,963 in the year 1849. The annual expenditure upon prison establishments, and upon the endeavour to lessen crime, is proportionately enormous. Were the sums and the people comprised in the above category employed in the production of native linen, pauperism, in its malignant sense, would be abolished, crime diminished, and a blow given to slavery such as has not yet been inflicted. The great bulk of cotton grown in the United States is purchased by British merchants, and it is remarkable that, in proportion to their dealings, slavery abounds in various provinces. Surely, then, in vain are our fleets employed to exterminate that murderous practice, while merchant-ships are engaged in promoting it. A wide field for the advancement of every national interest and for the exercise of every branch of philanthropy is thus opened. By consolidating a system for the employment of free labour at home, we should necessarily lessen the demand for slave labour in Georgia. However alluring the incentives, or powerful the arguments, for instilling an inquiry into the capabilities of India to produce cotton, they may be employed with ten-fold effect in favour of native flax. It will then be seen that cheap linen would accomplish more towards the abolition of slavery in the United States, than armies and navies ever can; and that, by the employment of our own people in the production of cheap linen, we put a final extinguisher upon pauperism, and lay the axe at the root of the two most inveterate evils under the sun. Whatever may be the impediments to an immediate abolition of slavery,

none can possibly exist to that of pauperism, which an enlightened philanthropy may not overcome."

Our author is doubtless right in suspecting that the abolition of slavery in part, by superseding cotton with flax, is not likely to be effected at present. The truth is, that the two articles are so different in their nature and application, that one can never exactly take the place of the other. But he is also right in looking at home; in pointing to the privations suffered by the pauper population of the present day; and in advocating the culture of flax as a means of relief. Why should not flax, which in continental hands proves a sure source of wealth and prosperity, be equally a blessing to the English labourer, except that he is ignorant how to manage it, and is not encouraged or aided by his superiors in learning its proper management? We speak only of what we know; and repeat that in France and Belgium flax supplies the never-failing means of comfort, industry, content, and good conduct to thousands of our fellow-creatures. Proud and happy indeed should we be were the present book to be the instrument of spreading similar advantages over our native land. All that is wanted is the aid of capitalists, who will give the necessary preliminary instruction. It may be thought by some that Mr. Warnes puts the case too earnestly; but his statements at least deserve serious consideration.

"Pauperism," he says, in 1850, "instead of abating, rapidly increases; thousands being annually born in that condition, and the majority of the labouring classes experiencing melancholy forebodings of their impending fate. This unhappy state of society arises neither from the want of money, nor of sources of employment, for both on every hand abound; but from the want of a judicious combination of parties, whose duty and interest it is to educate the rising generation compatibly with their prospects, and to train them to industrial pursuits. In order to render the United Kingdom prosperous, the immense amount of our rates and of our charities should be expended in reproductive works. No other effort is

required than simply to avoid placing money into any but working hands. That a country like Great Britain, renowned for industry and intelligence, should expend so many millions in supporting people in idleness, is an anomaly that can only be explained by the determination of all parties not to act in unison. We reprobate idleness, and yet take no measures to check it, except such as compel the poor to accept a most inadequate rate of wages, and to supply the deficiency by theft, poaching, and prostitution. [A great advantage in the culture and manipulation of flax is that so much of it may be done by piece-work. The more a man is inclined to be industrious, the more money he has an opportunity of earning.] The case of those who know not where to turn for daily bread must be considered desperate; of those who must either be maintained in idleness, upon parish rates, or upon plunder; whose alternative is the prison or the workhouse. By a humane appropriation of the means employed to fill our prisons and our workhouses, the unfortunate inmates might be rendered contributors, rather than burdens, to the parish, the county, or the state. Were the time and money thus expended appropriated to the promotion of the flax cause, failure would be impossible.

"With respect to my own parish, idle hands, want, and intolerable rates are now unknown. I am confident, therefore, that were the growth of flax introduced in strict accordance with my recommendations, still greater results would be realised by the most populous and distressed districts. Trimingham at the last census contained 510 acres, and a population of 222. Several acres have since fallen into the sea, and the inhabitants have increased to 236. About 55 acres, also, have been formed into game-preserves, which, with ten acres of roads, and at least 15 per cent. of fences, sites of buildings, &c., reduce the quantity for cultivation to about 360 acres. Hence it will be seen that there is somewhat less than an acre and three quarters to each individual. Moreover, much of the land is gravelly and ordinary; a great pro-

portion stretches along the sea, at an elevation of about 200 feet, and the crops are generally injured by the winds more or less. The Beacon Hill is said to be 300 feet above the level of the sea, and to be the highest point in Norfolk; yet it is my intention next spring to sow flax thereon. Altogether, taking into account its isolated situation, exposure, game, backward climate, and inferior soil, Trimingham ranks amongst the most unfavourable places in the kingdom for the culture of the flax-plant. Nevertheless, it has flourished, and repaid, in every point of view, since first grown upon my land ten years ago. Through the use of the seed mainly, the number of bullocks fattened upon my farm has tripled; the gradual advancement, therefore, in general productiveness will not be doubted."

The report of the Special Commissioner of the *Morning Chronicle* (Dec. 22, 1849), fully confirms the above account, observing, "The land occupied by Mr. Warnes does not exceed eighty-five acres, and the number of persons employed upon it is seldom less than nine men and boys, while sixteen others are employed in the various processes of preparing the flax for market. In addition to the amount of employment which the cultivation of flax affords, it also possesses the additional recommendation of being highly remunerative to the grower. There is no instance in the whole county of Norfolk where so many cattle are fattened upon so small a holding as upon that at Trimingham. Mr. Warnes has at present twenty-three bullocks, which are being fattened entirely upon the produce of his farm, a portion being made into a compound, which supersedes the use of foreign oil-cake. The bullocks are seldom kept in the boxes more than six months; and by the adoption of this plan he is enabled to secure a double return in the year. The value of the manure from the cattle, and the increased fertility obtained thereby, show the immense fund of employment which would be given by the extensive cultivation of flax. If the growth of the plant can produce elsewhere results similar to those which I have witnessed at Trimingham,

there can be no doubt that the sooner it is cultivated to a greater extent, the sooner will the enormous amount of pauperism decrease, and comfort and contentment be more generally diffused among large masses of the labouring agricultural population."

If such happy results have been obtained by a single isolated experimentalist residing in a remote district, with numerous prejudices to overcome, with everything to teach, and almost everything to learn himself, and without the aid of the division of labour between the farmer and the flaxman which we advocate, and which succeeds so well on the continent, what may we not anticipate by-and-by when practice, custom, and familiar knowledge shall have smoothed the many difficulties which now beset the flaxgrower's progress? As the means of advancing in an onward course, we will suggest that it really would be a patriotic action on the part of any agricultural amateur, who had a moderate amount of wealth and leisure at command, to spend a few weeks in the flax districts of Belgium, or the Pas de Calais, and study the details as practised there. He will find no attempt at secresy, nor meet with any refusal to answer his inquiries. All that will be required of him will be a polite course of conduct, and a competent knowledge of the French language. Interpreters are but imperfect means of communication, especially when technical details have to be entered into. Many, however, are the cases in after-life in which a man regrets that a portion at least of the time devoted to Latin and Greek had not been spared to modern languages. When the amateur *linier* has thus prepared himself, he is recommended to try the experiment at home, the following season, on so small a scale that loss shall be of no consequence to him. A few rods of ground will be quite sufficient space on which to go through the whole process, from sowing the seed to delivering the fibre; and to make the trial more complete, it will be right to divide the crop into two sowings, one the first or second week in March, the other about the middle of May. The comparison between early and late

sowing will thus be made. Of course, the inquiring traveller will bring back with him models of the requisite tools, or better even, the tools themselves; for though some of them are cumbersome and heavy, none are expensive. It will then be a work of real kindness to call in the aid of a few handy lads; to make them, even at spare hours and over-time, assist in and amuse themselves by the broadcast sowing, the weeding, the plucking, the steeping, the drying, and the scutching. If then some dame could be found to comb and spin it, and send the thread, after due home preparation, to the weaver, a sheet or a tablecloth would be produced by playwork, and as a mere amusement, which might turn out a priceless lesson. Young people are often induced to divert themselves by keeping silkworms, growing tobacco, or raising other produce, which from its nature in respect to our climate can never become really and profitably indigenous, although it may be grown or kept alive. But flax is most suitable to the British Isles; and nothing but neglect and forgetfulness (which we believe will soon be dissipated by the all-powerful force of pecuniary interest) have prevented us from cultivating the very crop which is indisputably the most remunerative that can be grown within the range of the temperate zone. Had Cobbett patronized flax with the same ability with which he advocated Indian corn and acacia timber, the probability is that his name would now be revered as a real benefactor to the country labourer. It is true that difficulties stand in the way; but none such as may not be overcome with a little persevering energy.

"Hand-scutching," says Mr. Warnes, "ranks amongst the heaviest of manual operations; and few comparatively become expert, or able to sustain the labour, unless initiated in early life. The required instruction, upon which success mainly depends, must be conveyed by those who can earn a livelihood by their own hands before they attempt to teach others the use of theirs. It was only by the force of example *alone* that the Norfolk youths hereabouts acquired remunerative wages. We at

first tried the effect of verbal teaching, through a Belgian, whose directions, not being supported by the actual production by himself of the work that he expected from his pupils, they considered the performance of his injunctions impossible; nor, till other Belgians were employed to scutch at a stipulated price, did our own men discover that they possessed powers equal to the foreigners employed to instruct them.

"It is true that the direct cost for hand is more than for mill-scutching, perhaps double; but the economy of the former system fully compensates for the extra expense. Of this I was assured by an experiment upon my own premises last winter, when I engaged a first-rate Irish mill-scutcher for a month, who was also in other respects much experienced in flax affairs. During that time, equal quantities of flax-stalks were dressed both by the mill and by the hand-swingle. In every instance, the greatest weight of marketable flax was produced from the latter. I have also seen the destruction of flax by scutching-mills in Ireland, and believe that the evil cannot be removed except at an expense equal to that by hand-scutching. Such being the case, who would not prefer the human to the iron arm, and confer upon his neighbours the blessing of employment at adequate wages?

"Amongst the numerous instances of benefits conferred upon the working classes, and upon rate-payers, through the employment afforded by flax culture, the following stands pre-eminent; and the relation, I hope, will act as a stimulus to the poor of Ireland, and as an encouragement to provide the work.

"Richard Grey, a jobbing carpenter, with his wife and six children, was compelled last winter to resort to the union-house; after remaining there some time, at a cost of about 22*s.* per week, he obtained a little temporary work, and the two elder children returned to their former employment of flax-dressing. Becoming again destitute, he was on the point of demanding an order for re-admission to the union, when he was advised, rather than

remove his children from their occupation, to attempt the acquirement of the art himself. He readily assented, and, much to the surprise of the whole parish, the earnings of the three quickly amounted to about 20*s.* per week. This man, when not employed at his own trade, regularly fills up the intervals of time by working at flax; and, with his family, is thereby not only kept from the rates, but rendered a more contented and creditable member of society. The attempt to introduce the scutching of flax in work-houses has been unsuccessful in this part of the kingdom. It will doubtless prove equally so in Ireland, and wherever labour is not sweetened by reward."

THE FLAX-GROWER'S BALANCE-SHEET.

Any statement respecting the expenses and profits of flax-growing in England must, at present, be merely approximate, and no guide to what may be done by and by, when the management of the crop is settled upon a steady footing. It will be found most advantageous and satisfactory to all parties to adopt the French system of paying by piece-work, wherever possible, instead of by daily or weekly wages. Flax-weeders (women and children, and sometimes men) are paid from twelve to fourteen *sous*, or half-pence, a day, though the work is occasionally put out by the piece. In either case it is executed under strict supervision by the master. Flax-pullers, generally women, are paid by the *mesure*, or local acre; they can earn from twenty-five to forty *sous* a day. Seed thrashers are paid one *sou* the *botte*, or small sheaf; they can earn from thirty-five to fifty *sous* a day. We have mentioned how scutchers are paid, by the *kilo*. These earnings are doubtless low, and are even insufficient when bread is dear; but they are made to go further than we would at first imagine in a cheap country, and in the hands of a frugal and contented peasantry; and when we remember that such earnings are attainable, almost without fail, by every able-bodied willing person,

and when we contrast them with workhouse idleness, indoors, and insufficient employment out, the moral profits of the flax crop appear immense and incalculable. But, even in a money point of view, the advantage to be derived from it is indisputable.

Flax varies greatly in quality, and consequently in price, according to culture, season, and subsequent treatment. Before the late sudden rise of price, whose duration and limit it is impossible to divine, while ordinary flax was only worth about £40 per ton, superior samples obtained from £60 to £120, or even more. The finer stalks, however, invariably produce less seed than the coarse, thereby making it doubtful which kind is the most remunerative for the English market. "From letters before me," says Mr. Warnes, "it appears that, in some instances, flax is now realizing more than £35 an acre in Ireland. Mr. M'Carten, of Warringstown, sold his flax last year to Messrs. Dunbar and Co. of Guildford, at 13*s.* per stone; and he asserts, that by following the directions of the Royal Flax Improvement Society, he has obtained, on the average, 14*s.* per stone for the past five years.

A few figures, accompanied by the names which authorize them, will be satisfactory to the practical reader.

The late Captain Glasspoole, of Ormsby, Norfolk, in 1845 sent flax to Hull, which paid him £8 10*s.* per acre, clear of all expenses. Mr. George Hope, of Fenton Barns, "a novice at the business," in his own words, grew nine imperial acres of flax. The crop was sold at Perth and Dundee, where it fetched £60 per ton. The seed was also sold at a very high price, the quality being excellent. After deducting all expenses, it left a clear profit of £15 per acre.

Mr. William Porter, of Hembury Fort, Honiton, gives the debtor and creditor account of one acre of flax, as follows:—

	£	*s.*	*d.*
Ploughing, three times	1	0	0
Seed, two bushels.....	1	0	0

	£	s.	d.
Working in	0	2	6
Pulling	0	10	0
Dressing flax, two packs an acre	3	0	0
Rent	1	10	0
	£7	2	6
By seed, sixteen bushels at 7*s.*	5	12	0
Flax, two packs, at £6 per pack	12	0	0
	17	12	0
Deduct expenses	7	2	6
Profit	£10	9	6

We may here observe, that nothing is put down for weeding, an operation which ought never to be omitted.

According to an official document, for 1846, taken from the Fifth Annual Report of the Irish Flax Society, "presented by order of her Majesty," the profits upon one acre of flax, English measure, would be £29, as follows. Crop, 1845.

Produce of 1 acre, 1 rood, 39 perches, sold at 11*s.* 9*d.* per stone	£55	19	7½
Tow	0	8	0
130 bushels of bows, estimated at 8*d.* per bushel	4	6	8
	£60	14	3½

Expenses of Crop.

Five bushels of seed	£3	16	6
Weeding	0	10	0
Pulling, rippling, and steeping	4	3	8
Taking out of steep, spreading	2	1	4
Lifting and tying	1	2	8
Scutching	4	9	4½
	16	3	6½
Returns	60	14	3½
Balance	£44	10	9

or at the rate of £29. 13*s.* 10*d.* per acre, after deducting all expenses.

In another case, the flax-grower, the Hon. W. R. Rous, of Worsted, Norfolk, was desirous of sowing turnip-seed immediately after the flax was pulled, and of thereby securing two crops in the same year. Fourteen loads of manure were therefore applied to the land, and turnips were obtained of so excellent a quality that samples were exhibited at the North Walsham root-show. The acre in question was sown with linseed on the 2nd of April, 1843. The soil was a first-rate flax soil, rich light loam, in good heart. The crop was abundant, averaging from three to four feet in length. Some of the stalks exceeded four feet four inches, and were exhibited to the Council of the Royal Agricultural Society, at the Derby meeting. Mr. Rous's account, published in the *Norwich Mercury*, stands thus:—

	£	*s.*	*d.*
Rent, tithe, and rates	2	0	0
Two winter ploughings	0	12	0
Spring harrowing-down, ploughing, sowing, bushing	0	11	0
One thousand gallons of liquid manure	0	15	0
Three bushels of seed	1	0	0
Weeding and pulling crop	1	2	0
Steeping, drying, retying, &c.	1	0	0
Scutching 54 stones of flax, at 3*s.* per stone	8	2	0
	15	2	0
Fifty-four stones of flax, at 9*s.* per stone	24	6	0
Balance	£9	4	0

It was afterwards discovered that four stones of flax had been omitted, and that five stones of tow, ten bushels of seed, a quantity of chaff, and about a ton of broken stalks, ought to have been added, in order to render the report complete; also the after-crop of turnips, as the rent, rates, and tithe were charged to the flax-crop. Without the

aid of a very close scrutiny, it will be seen that several pounds might be placed to the acknowledged profit of £9 4*s*., and that a sum, clear of all expenses, was realized, greatly exceeding the profit from any other crop.

The foregoing statements, although incomplete, in consequence of the imperfect way in which flax-growing is understood in England, are still sufficient to show that the crop, with proper management, is capable of proving a mine of wealth. Any future modification of similar balance-sheets will be more likely to be in favour of the farmer and the flax-factor than against them, as soon as the routine of their business becomes more familiar to themselves and the men in their employment. The pecuniary profits thus held out, would appear tempting enough to stimulate the enterprize of British agriculturists. On the other hand, a few words on the immense amount of employment which this branch of culture originates, will suffice to recommend it to the attention of the statesman and philanthropist, and must close the subject, as far as our space can be devoted to it. The reader will perceive that we might, with ease, enlarge upon it greatly. We only urge him to inquire, and see, and experimentalise for himself. But we do not promise that flax-growing will insure a high rate of wages to the labourer or the operative. Competition in the labour market will probably ever keep down that. It does what, perhaps, is better; it insures a source of constant employment. And we insist upon the consideration that, in times of dearth and national difficulty, half a loaf, though hardly earned, is far better than no work and no bread at all.

The Messrs. Marshall and the Messrs. Wilkinson, of Leeds, were spinning, at a given date, thirty tons of flax each per week, which, supposing four acres of land requisite to produce a ton, would annually require 12,480 acres, and 3,640 experienced first-rate men, allowing each $3\frac{1}{2}$ acres, to pull, beetle, hand-scutch, or otherwise prepare the flax and seed. Were persons of both sexes and of various ages employed, double the number, or 7,280 individuals would be required, and their wages would

amount to £1,820 per week, or £94,640 a year. The yield of flax, at four tons per acre, would be 3,120 tons, and its value, at £40 per ton, be £124,800. The seed, at 16 bushels per acre, and at 5*s.* per bushel, would amount to £49,926; flax and seed to £174,720, from which deducting wages, the sum of £80,080 is left, from this also must be taken rent, tithes, rates, and tillage, at £3 per acre, and the remainder will be the net profit, viz.: £42,640 or £3. 10*s.* per acre—the value of the tow, broken bolls, and refuse, being set against the cost for manure. Ten shillings per week are allowed for first-class, and 8*s.* for second-class men; 5*s.* for women, or for young persons of both sexes; and 2*s.* for children.

The following remarkable statement of the produce of three statute acres of flax, was read at an Agricultural Market Dinner, at Market Hill, Armagh, on the 14th of December, 1843.

One hundred stones at 15*s.*=£75; each stone calculated to produce 5½lbs. of dressed flax,—in all 550lbs. spun to 30 hanks to the lb. will produce 16,500 hanks. About 158 females will be employed 12 months in spinning, at the rate of two hanks per week (six working days); wages for spinning each hank, about 1*s.* 8*d.*, or nearly 7*d.* per day for each spinner. This quantity of yarn would make 210 webs of cambric pocket-handkerchiefs, each web containing five dozen. About 18 weavers would be 12 months weaving this quantity, allowing each man a month for each web (17½ weavers exactly); wages per web £2, or from 9*s.* 6*d.* to 10*s.* per man per week. About 40 females would be employed 12 months in needlework (hemstitch or veining); each could do one handkerchief on each working day; wages, 8*s.* per dozen, or 8*d.* per day. The goods, when finished, would be worth £2. 10*s.* per dozen.

	£	s.	d.
158 spinners 12 months, or 52 weeks, at 3s. 4d. per week	1369	6	8
18 weavers 12 months, at £24 per annum	432	0	0
40 needle-women 52 weeks, at 4s. each per week	416	0	0
216 persons employed. Amount of wages	£2217	6	8
Cost of flax	75	0	0
Total expenses	£2292	6	8
Value of 1,050 dozen handkerchiefs at £2 10s. per dozen	2625	0	0
	£332	13	4

DELIVERING THE SCUTCHED FLAX, AND THE SUBSEQUENT PROCESSES.

There are various forms in which the article thus imperfectly prepared is delivered to the parties who continue its manufacture. They agree in one point, namely, in keeping the fibre in tightly-bound handfuls, each of a fixed and definite weight, twisted in a certain convenient square form, according to the custom of the locality, and in uniting those handfuls into bales containing a stipulated number, and, therefore, weighing a stipulated amount. In the Pas de Calais, scutched flax is always delivered in the shape of two *kilo* handfuls (about five pounds and a half, united), clapped together; and the purchaser may obtain these by the half-score, score, hundred, or thousand; a smaller quantity even than the first mentioned is easily obtainable, which is very convenient for poor people who buy flax to spin at home. In June, 1854, two *kilos* were worth from fifty to fifty-five sous.

One mode of making up a bale of flax, is to begin by taking two handfuls of fibre, ready twisted into shape, and clapping them together, head and tail in an opposite direction, and going on in the same way, placing the

handfuls alternately, upwards and downwards, to make them lie as close together as possible, till the determined number of handfuls are packed; the whole is then bound with three cords passing round the middle, and not far from the two ends.

In packing flax, the producer should be careful to avoid putting samples of a different quality into the same bale; as, besides the possibility of its being looked upon as a species of fraud, it is always better to sell each quality separately for what it is worth, than to endeavour to obtain a mean or medium price for the whole, which will always turn out lower than the mean of the lowest and the highest prices; for the buyer, in making his estimate of the value, very naturally, takes into consideration the time and labour he is obliged to employ in sorting the unequal samples which come into his hands. The British practice is to deliver flax in stones weight.

Scutched flax, however, is but an unfinished article, the fibres are still only imperfectly separated from each other, and a portion of useless substance remains, which has to be got rid of by the operation of combing; *sérancer* is the French verb for to comb flax and hemp, *séran* being the comb itself. Private house-keepers, for the manufacture of home-spun linen, make use of a comb which consists of two blocks of wood, B, B *b*, (*see fig.* 15), each five inches and a half square, and about two inches thick, which are firmly nailed to the middle of an oblong deal plank, half an inch thick, which is twenty-three inches in extreme length, and eight and a-half broad at each end, but is sloped away in the middle to five and a-half inches broad, or to the exact width

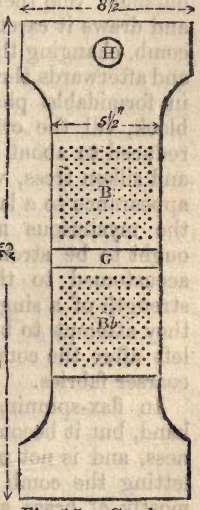


Fig. 15.—Comb, or *Séran*, for private use.

of the comb-blocks. The circular hole, H, is perforated in the plank merely for the purpose of hanging the instrument out of the way. G is a gap or interval between the blocks, about half an inch in breadth. The upper block, B, is covered with an iron plate, studded with iron teeth, an inch long, standing perpendicularly all over its surface, in quincunx order, but crowded more closely all round the outside. Counting the teeth straight across horizontally, there are about eight or nine teeth in each row; while the outside row on each *side* contains double the number. The lower block, B *b*, is covered with a brass plate, and studded with brazen nails, of the same length, and also perpendicular, but more closely crowded together. The operator, seated on her chair, sets the foot of the comb on the ground before her, in a slanting position, making the instrument lean against her knees, of course with the teeth pointing outside. She then takes a handful of the scutched flax, and draws it carefully first through the upper iron coarse comb, changing the ends of the flax from time to time, and afterwards through the brazen teeth, that are studded in formidable phalanx over the surface of the lower block, till the original handful of scurfy-looking flax is reduced to about one-half in weight, and becomes a soft and silken tress, which has sometimes been compared in appearance to a lady's back hair, after it has undergone the mysterious manipulations of the toilet. But it ought to be strong as well as soft. Those who are not accustomed to the process will be surprised at the strength of a single fibre of good flax in this state when they attempt to break it. The tow, which is the refuse left after the combing, is used for the manufacture of coarser fabrics.

In flax-spinning mills, the combing is also done by hand, but it becomes a man's instead of a woman's business, and is not performed in the somewhat lazy way of letting the comb lean against the knees. The combs, mostly of brass, and of various degrees of fineness, but always with at least two different degrees for each opera-

tive, are firmly fixed to a horizontal bench, before which the workmen stand in rows, with every convenience beside them for bringing and removing the material. Flax-combing, in such cases, becomes a separate trade; and the men, doing nothing else, and being paid by quantity, acquire great skill and rapidity of execution.

Combed flax is in a state to spin. An immense quantity of thread is spun by machinery at *filatures*, spinning-mills or factories, especially of late years; but there was in former days in England, and there still exists on the continent, so strong a prejudice in favour of home-spun articles, that housekeepers are content to pay as much for the mere spinning as they can buy ready-spun thread for at the *filature*, or the spinnery by steam. In many families in the north of France, from the sheets on the bed to the master's Sunday shirt, every bit of flaxen cloth is spun in the house.

Spinning by means of the *rouet*, or spinning-wheel, and the forefinger and thumb of the right hand, and the thumb and first two fingers of the left, is an operation not quite so simple as it looks; as is proved by the difficulty which mechanicians experienced when they first attempted to imitate it by machinery. The spinning-wheel is attached to one end of a frame, which is a sort of oblong three-legged stool. The spinner seats herself with the frame before her, having the wheel on her right hand. To the legs of the frame is attached a foot-board, by means of which, and the action of one foot or sometimes of both, a rotatory motion is given to the wheel. The wheel, by a cord or strap passing round it, and a whorl or small circular block, rapidly turns the axle or spindle on which is fixed the bobbin to receive the thread. The head of this axle carries, just below its extreme tip, the shafts of the spindle, a horse-shoe-shaped piece of box-wood, which revolves with the axle. One shaft or side of the horse-shoe is studded with little iron hooks, to direct the thread on its passage to the bobbin. The head of the iron axle is perforated, like a punch, for the thread to pass through. A piece of quill or straw at-

tached to the axle would answer the same purpose, were the material strong enough.

The course, then, of the thread, from its origin between the spinner's fingers to the place where it is deposited by being wound round the bobbin, is as follows:—the spinner has a light slim distaff (*quenouille*), eight or nine and twenty inches long. Round the head (which is purposely split, and kept open by the insertion of a circular piece of wood) is wrapped a small quantity of combed flax. She sticks the lower end of the distaff into her waistband or apron-string, on the left side, in a slightly slanting position, so that the head of the distaff is conveniently placed for her right hand to reach it. The spinner pulls a few fibres from her distaff, twists them into an imperfect thread, passes it through the perforated axle, and fastens it to it. She next touches the wheel with her finger, and keeps it going with her foot, till about half a yard of thread is thus spun. The end of the thread is then unfastened from the head of the axle and fastened to the bobbin, after being passed through the hole in it, and round one of the hooks on the horse-shoe. That is the commencement of every bobbin of thread. The first yard of thread thus once begun, the spinner has only to keep the wheel at work, which makes the axle and horseshoe and bobbin revolve together. By these the thread is both twisted and at the same time wound round the bobbin; and the spinner supplies the fresh demand for thread-material by pulling the flax in a continued streamlet from the head of her distaff. Tow is spun in exactly the same way, except that it is more difficult to make an even thread of it, and is never so fine. When the flax on the distaff is all spun off, the spinner stoops on one side, and reaches a skein of ready-combed flax, opens it lightly, pulls it about a little, and then winds it loosely round the head of her distaff, which she covers with a sort of pasteboard extinguisher, something like a miniature paper lamp-shade. The lower end of the distaff is stuck into her girdle, and spinning recommences again. Her toes press the "pedal" of the

spinning-wheel, and with a continual jig-jog motion keep it whirling round. The strap from the wheel causes the bobbin to revolve rapidly. On the bobbin is wound the thread, which passes smooth and regular through the spinner's fingers, as the fibres of flax are made to issue from the distaff.

The above description is as clear as we can contrive to make it, with a living spinster before us at work, sitting for her portrait in black and white. The reader is advised to see the thing done, reading our account of it at the same time. Spinning was once an amusement for ladies; and, in the revolutions of fashion and fancy-work, may yet be so again. We have seen spinning-wheels of ivory and ornamental wood, which were not inelegant articles of furniture; and spinning fine thread, it may be fairly urged, is quite as intellectual, entertaining, and useful an employment, as many of the curious forms of "work" to which well-educated females devote their time. The art of spinning is easily learned. A couple of days' apprenticeship is fully sufficient for those who feel any taste for the business. In humble life in Ireland during the winter season spinning-parties are formed, which are there called "camps." Every girl in the village in turn gives notice that she is going to hold her camp on a certain evening. They meet at seven or eight o'clock, each bringing her spinning-wheel with her and a sufficiency of flax, and continue till eleven, amusing themselves the while with gossip and singing. The zest of the meeting is, that as the hours pass on, the respective sweethearts of the ladies drop in, and make it a point of duty to accompany them home, of course assisting to carry the wheel and the produce of their merry labours.

Spinning by machinery is an intricate process, on which learned and scientific treatises are open to the serious student. The action of the thumb and fingers is imitated by iron cylinders. Their diameter and the rate at which they revolve regulate the fineness of the thread, which can thus be calculated with mathematical exactness. Finer fabrics can be spun by machinery than by hand;

but what is thus gained in beauty and lightness is often sacrificed in strength.

When the French spinner has filled the required number of bobbins with home-spun thread, she draws from out some dark recess a thing which she calls a *chien*, or dog. It is simply a small round log of rough wood, nine or ten inches long, raised in front on a couple of long nails by way of forefeet, and with a straight iron pin, or unicorn horn, projecting from its forehead (*see fig.* 16). Hind legs it has not; and needs none. It would be more appropriately called a seal, if it must be compared to an animal at all. On the projecting pin she sticks a bobbin, and taking in her left hand a reel or *harpe* (*see fig.* 17), with her right she assists the thread to unwind itself from the bobbin, and from a skein upon the reel. The two arms A A of the reel are fixed at the ends of the handle H (the middle of which is grasped in the reeler's hand), in directions crossing each other at right angles. The dotted lines show the direction of the thread. Each arm of the reel is ten inches long. The handle between the two arms is eight and a half inches long. When the mistress finds

Fig. 16.—*Chien,* or Dog.

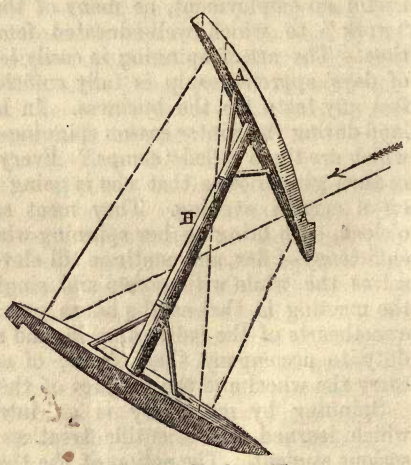


Fig. 17.—Reel, or *Harpe.*

that she has as many skeins as she wants, she makes preparations to set about the boiling.

The boiling is done to cleanse the thread from various impurities which remain still attached to the fibre after the steeping and the scutching. At the bottom of a large boiler, a bed of ashes is laid, then a stratum of thread in skeins, loosely arranged, above that another bed of ashes, and so on till the cauldron is full. Cold water is poured in, till all is well covered; and then either fire is put under the boiler, or the boiler is put over the fire; one or the other, it matters not which. The quantity to be boiled generally regulates that point. When it really boils, it is kept in that state two or three hours; at the end of which time the flax is fished out of the scalding mess with a stick, and is immediately carried off in a tub to be thoroughly rinsed in *running* water, if possible. After the rinsing, it is hung out to dry upon sticks; and as it dries, it is well rubbed with the hands to prevent the threads from sticking together, and is patiently shaken to get rid of any wooden particles that may remain. Once dry, it is properly tied and bunched, and then handed over to the weaver. The weaver soons returns as cloth what he received in the shape of thread; but still it is only a rough unfinished affair, somewhat stiff, and of a not particularly pleasing light-brown hue. It must therefore pay a visit to the bleacher; not, however, to the town bleacher at the *blancherie*, whose gases and washes, as he himself confesses, would make it as white as snow and as rotten as tinder. It must be spread in the meadows by the side of a clear stream, where the dews from heaven and the daily sprinklings from the brook will gradually pale its dingy aspect into a purer and a lighter tint. At last its complexion has attained a satisfactory degree of fairness, when it is tightly rolled up and delivered to its owner.

USES TO WHICH LINSEED MAY BE APPLIED.

As the French farmers mostly sell their standing crops of flax to the linier, who carries the whole away as

soon as it is pulled and dried, the seed of course, as well as all the refuse, is the property of the latter tradesman. The farmer, therefore, is unable to return any portion of the crop directly to the land in the shape of manure. This has been urged as a great objection to flax-growing (on the system of having flaxmen or factors act as the preparers of flax, instead of the farmers themselves), especially by English landlords; but it really is not a valid one. By indirect means, any exhaustion which the land may have suffered, is repaired. The ready cash which the farmer receives for his flax leaves him an ample margin to devote to the purchase of manure; and a proof that the system cannot be in the end a ruinous one, is adduced by the fact that very many large flax-growers are themselves the owners of the soil which produces it.

The linier sells the linseed that is thrashed out on his premises, first for seed-flax to such farmers as do not think it necessary, that year, to procure imported seed from Russia or elsewhere; and secondly, to a very large amount, to the oil millers, to make linseed oil. Oil-mills in the north of France are incalculable in number, and furnish employment to a large body of respectable men, by the means of very simple machinery. It is true there are here and there grand establishments, furnished with every ingenious contrivance which mechanical science is able to suggest; but the great majority are merely post windmills of rude construction, approached by ricketty wooden steps bounding at every blow of the internal machinery, but which, nevertheless, fulfil their office exceedingly well.

Exactly the same description of mill crushes the seeds of various plants, extracting oil indiscriminately from colza, cameline, and linseed. The whole apparatus is nothing but a system of apparently ungainly pestles and mortars. On entering a mill, you behold to the left a range of about half-a-dozen mortars, cut out of strong solid timber, and lined at the bottom with thick copper. In each of these is pounding, a pestle, a long beam of

stout oak, twenty feet high, or a trifle more, perhaps; for it reaches almost to the very top of the mill. The end of the pestle is shod with a piece of iron, channelled and cut in the way to make it act most efficiently upon the seed. The pestles have been compared to frightful molar teeth, each with a single ugly, endless fang. Motion is communicated to the entire set by very inartificial means, and each tooth can chew its portion independently of the rest. A catch on the axle of the mill-sails just lifts them up and lets them drop again; and there is a contrivance by which the progress of the labour of every individual pestle can be stopped, or re-continued, at pleasure. Suppose the miller has given the usual quantity of seed to one of these pestles and mortars to pound; the pounding goes on till the whole contents of the mortar are reduced to a pasty mass, called *marc*. That special pestle is then stopped for a while. The miller takes away the portion thus prepared, carries it into a small adjoining apartment, and with it fills some small woollen sacks, or bags, made of a coarse stuff which is known as *morfil*. A sample of foreign oil-cake shows the actual size of the *morfil* sack, as well as the impression of the texture of the material of which it is made. The sack thus filled is wrapped in a leathern case, which covers both the sides but is open at the edges. To use a familiar illustration, the sack exactly occupies the place which would be filled by a slice of tongue in a sandwich. To the left of the pounding-pestles two others are observed, somewhat slenderer, but of equal length with those that pound. Beneath them is a box, or oblong hole. This hole is filled with *marc*-and-*morfil* sandwiches, set upright, like books on a book-shelf. The miller has at hand a variety of wedges, of long rather than stout proportions. He inserts the point of one of these into the midst of his packet of sandwiches, and then sets the pestle overhead in motion. The pounding then begins again, very much like a pile-driving machine, only more rapidly. The wedge at last is driven home to its very head; and then, another; till the miller thinks that he

has squeezed the *marc* enough, and got as much out of it as he can, that time. The oil thus expressed runs out at a hole in the bottom, the bags are taken from the squeezing-box, and from each of them is removed a cake.

But whatever may be the mode of milling, it takes at least two acts of pressure to obtain a respectable yield of oil. The cakes are again put into the mortar, and are once more pounded as fine as may be. They are again carried into the back apartment after their second reduction to a pasty state; but before a second entrance into the bags they are gently warmed over a slow fire, in a flat and shallow warming-pan of iron. Inside the pan, a piece of machinery connected with the mill-work, and crookedly resembling the hand of a clock which indicates the hours only, keeps moving slowly round and round, stirring the powdered oil-cake, and preventing it from burning. The powder, when sufficiently warmed throughout, is again bagged, wedged, and squeezed, till it has parted with every drop of oil that can thus be extracted from it. The cakes are then mostly set aside, and put up to dry, to be subsequently sold to fatten cattle at home or abroad. In Flanders (both French and Belgian), a large amount of oil-cake is returned to the land, either in the shape of coarse powder, or after soaking and steeping in the liquid manure tanks, with which fertilizer it is made to combine.

The heat employed to aid in liberating the oil from the seeds containing it, also sets loose some other particles, which, either for medicinal or culinary purposes, it is desirable to get rid of; hence the preference given to "cold-drawn castor oil." The final treatment, therefore, of vegetable oil is its clarification, which is more generally performed by the oil-merchant than the miller. Seed oils, on escaping from the press, always contain a portion of mucilage, colouring matter, and resinous principles, which are all native to and latent in the seed, and which cause it to have a particular smell, taste, and appearance. They are partially removed by keeping the oil for a con-

siderable time in cool cellars, and so allowing the foreign matter, in suspension, to be precipitated. But this period of mere repose is often insufficient to complete the object in view; the oil is still charged with a variety of ingredients which render it unfit for many purposes. The subsequent treatment it is made to experience depends upon the object to which it is devoted.

To obviate the objection which many land-owners have made to the flax-crop, on account of its returning nothing to the land, and also to increase the quantity of fat cattle sent to market, Mr. Warnes conceived the happy idea of applying linseed to the maintenance and finishing-off of the live stock usually kept on a farm. His object had reference more to the fattening than to the rearing of cattle, and to proving that double, or even triple, the usual number may be profitably returned, through the medium of linseed compound, box-feeding, and summer-grazing. The system of feeding cattle in boxes had been long partially practised in various parts of the kingdom; and the growth of flax from time immemorial. The fattening of cattle with linseed was in full operation by the Hindoos, 1500 years ago; and in modern times in England, particularly in Norfolk, repeated attempts were made by the most expert graziers to establish the use of linseed, without success. Summer feeding also, in stalls or houses, has been long much practised on the Continent and in Ireland. To Sir Edward Stracey's experiments in boiling grain, Mr. Warnes added the linseed infusion, and thus produced his "incomparable cattle compound." He therefore merely claims for himself the merit of embodying the useful ideas and plans of others. He urges that, by adopting them, instead of being importers of barley and meat in the shape of oil-cake, we might annually export largely of barley in the shape of flax, and obtain, from the cultivation of this prolific plant, infinitely more tons of linseed to fatten our cattle, than were ever received of cake from foreign countries.

His first step is to prove that linseed is capable of

fatting live stock. But nothing, he says, can more clearly evince the fattening properties of linseed itself, than the striking effects produced by the offal, which is formed into cake when the oil is extracted. Repeated and extensive experiments have been made to fatten cattle with the seed itself, also with the oil; but on account of the inconvenience, trouble, and expense of preparing the food, with the uncertainty of a profitable return, the use both of seed and oil is nearly discontinued, and the prevailing opinion now is that the offal is superior to the pure seed. "There is nothing like cake!" exclaim many writers on this subject, and many farmers; indeed, the prejudices of some were carried so far at one time, as to pronounce the oil pernicious, and to recommend an article called double-pressed cake (we have seen that it is all double-pressed), at an extra cost of £2 per ton, instead of the cake commonly used. A little reflection would have shown how improbable it was that the seed-crusher would be so regardless of his own interests as to leave oil worth from £35 to £40 per ton, in the cake which he only sold for £10.

That linseed oil will fatten bullocks, experience has placed beyond a doubt. Amongst the fattest beasts ever sent to the London market, from Norfolk, was a lot of Scotch heifers, grazed entirely on linseed oil and hay; but neither the quantity given per head, nor anything relating to profit and loss, was ever made public: farmers seldom keep account of such matters—hence the frequent failure of experiments. A bullock may be allowed, in general, to eat as much cake in a day as he pleases, but a nice regard must always be had to the quantity of linseed placed before him, and especially to the oil. Neither oil nor linseed should be used in a crude state, but formed into mucilage by being boiled in water. The seed must be first reduced to fine meal; one pound and a half of which, stirred into twelve pounds of water while it is boiling, with four pounds and a half of barley, beans, or pea meal, and given to a bullock of between forty and fifty stone, every day, will, in addition to

Swedish turnips, be quite sufficient, or perhaps rather more, than he would be inclined to eat. This small quantity of linseed will act well on the stomach, and the bullocks will thrive and fatten to a degree that can scarcely be credited, except by the person who tries the experiment. In no instance has it failed. The quantity of seed may be increased after the animal has been accustomed to it for some time, but to no great extent. Mr. Warnes (from whose book we borrow these particulars), reduced this fact to a certainty by repeated tests. Therefore, as oil is stored so abundantly in linseed, the failure of those who have so freely condemned the use of both oil and seed, may be fairly attributed to a want of proper inquiry into, and a prudent and systematic employment of, their extraordinary fattening properties. The desirableness of fattening cattle on home-made food rather than on foreign produce, was a subject brought forward at one of the meetings of the Farmers'. Club, at North Walsham, Norfolk, in the autumn of 1840. Mr. Warnes, therefore, had coppers erected, and commenced a series of experiments, by incorporating linseed with corn or pulse, which ended in the production of the desired substitute for foreign oil-cake. The last of that gentleman's experimental bullocks, for 1841, was disposed of at Christmas for 8*s*. 6*d*. per stone; he weighed 60 stone, 5 lbs., at fourteen pounds to the stone, and cost £7. 17*s*. 6*d*. thirteen months previously; so that he paid £7. 10*s*. for little more than one year's keeping. His common food was turnips or grass; fourteen pounds a day of barley or peas compound (to be hereafter described) were given him for forty-eight weeks, and an unlimited quantity the last five weeks; when, considering the shortness of that time, his progress was perfectly astonishing. Altogether, the weight of compound consumed did not exceed two tons, four hundredweight, at the cost of only £3. 16*s*. per ton.

To make the linseed COMPOUND FOR SHEEP, let a quantity of linseed be reduced to a fine meal, and barley to the thinness of a wafer, by a crushing-machine with

smooth cylinders. Put 168 lbs. of water into an *iron* copper, and as soon as it boils—not before—stir in 21 lbs. of linseed meal; continue to stir it for about five minutes; then let 63 lbs. of the crushed barley be sprinkled by the hand of one person upon the boiling mucilage, while another rapidly stirs and crams it in. After the whole has been carefully incorporated, which will not occupy more than five or ten minutes, cover it down and throw the furnace-door open. Should there be much fire, put it out. The mass will continue to simmer, from the heat of the cauldron, till the barley has absorbed the mucilage, when the kernels will have resumed nearly their original shape, and may justly be compared to little oil-cakes, which, when cold, will be devoured with avidity.

For BULLOCKS the same process is to be observed; but the barley must be ground to the finest meal by mill-stones, and the quantity of water reduced to about 150 lbs. There is this difference also: in the former case the fire need not be extinguished, but in the latter it must, or at least be damped. The reason is obvious; for flattened barley requires heat to carry on absorption, while meal is sufficiently cooked by immersion.

The reason why the compound for sheep is not equally adapted for bullocks is, that sheep are close-ruminating animals, and pass nothing undigested; while with bullocks it is far otherwise. This the practical observer will soon discover. Nor let the amateur disdain the inquiry; because his success as a farmer mainly depends upon the fattening of cattle. He must now think and act for himself, and no longer be guided by antiquated maxims and customs founded upon idleness, ignorance, and prejudice. Therefore, it is not necessary for barley, or even linseed, to be reduced to fine meal for sheep; but for bullocks it is indispensable that linseed should be crushed, and barley ground as fine as possible.

On the compound being removed into tubs, it must be rammed down to exclude the air, and to prevent it from turning rancid. After a little practice the eye will be a sufficient guide to the proportions, without the trouble

of weighing. The compound will keep a long time if properly prepared. The consistency ought to be like clay when made into bricks.

Many farmers in the neighbourhood of North Walsham put the compound while hot into shapes like brick moulds (*see fig.* 18). The frame is about twenty-eight inches long,

Fig. 18.—Mould for Linseed compound.

and ten wide; it has neither top nor bottom; and when used is placed on a piece of board rather longer and wider than the frame. The compound is firmly pressed into the moulds with a gardener's trowel, and on the frame being lifted up will be formed into cakes. Another board is then placed under the frame, as before; and so on till the copper is empty. When cold, the cakes may be cut into pieces like bread, and given to the cattle. It will be seen that many boards are required, and a convenient place for stowing the cakes. Mr. Warnes, after trying the plan himself, pronounces it troublesome, expensive, and unnecessary. Observe, the inside of the moulds should be made rather larger at the bottom than at the top, in order to prevent the compound from sticking when the frame is lifted up.

In the spring and summer months, germinated barley might be made into compound with great advantage. Bullocks will eat it with avidity and thrive fast upon it. The process is simple. Let some barley be steeped about two days, and the water drained off. After the radicle or root has grown to nearly a quarter of an inch in length, it must be well bruised with the crushing-machine, and as much as possible forced into some boiling mucilage, containing the same quantity of linseed, but a fourth less of water than would have been prepared for dry barley. It will soon turn sour, but the cattle will not refuse it

on that account. Care must be taken lest the sprouts are suffered to grow beyond the prescribed length, or the quality will be materially injured; therefore it will be necessary to destroy their growth by passing the barley through the crusher; it may be then used at pleasure. The foregoing remarks equally apply to other grain and pulse, in forming which into compounds the same rules must be adhered to; but peas and beans require more water than either barley or oats. The proper proportions will easily be ascertained by practice. An admixture of grain and pulse with linseed will be found to act well together.

Pigs in a yard fatten upon the excrement of bullocks fed with oil-cake; but if the cake be reduced to a pulp, and incorporated with other materials, according to the receipts for making compounds, the cattle would derive the intended benefit instead of the pigs. This remark is equally applicable to corn not properly ground. These directions are given thus minutely, in order to urge the necessity of reducing linseed, grain, and pulse, to fine meal.

Either potatoes, carrots, turnips, or mangel-wurzel, boiled and incorporated with linseed meal, form a compound upon which cattle fatten with great rapidity. To make it, nothing more is required than to fill the copper with washed potatoes, or carrots, &c., sliced; supposing the copper would contain eight or nine pails of water, let only one be added. In a few minutes the water will boil, and the steam will speedily cook the roots; then a convenient portion should be put into a stout-bottomed trough, with a little linseed meal, and mashed with the rammer, while a boy turns it over; the remainder must be prepared in the same way. As the mass increases in the tub it should be pressed firmly down, in order that it may retain the heat as long as possible. The length and size of the rammer ought to be adapted to the height and strength of the persons employed (*see fig.* 19). It will be found convenient to

Fig. 19.

Rammer for the compound.

have two or three at hand, varying from eighteen inches to two feet long, tapering, and from four to six inches square at the bottom. A pin should be passed through the top for the convenience of being worked with both hands.

Nor let these compounds be despised on account of their simplicity. They are neat and convenient modes of placing artificial food before bullocks, which must be superior to foreign cake, if, as asserted, the latter is often adulterated with all sorts of rubbish. Mr. Warnes calculates that sixteen combs of linseed are required to make one ton of cake; and, multiplying the number of tons imported into this country by sixteen, questions whether the amount is not infinitely more than is grown on the whole continent of Europe. Foreign oil-cake, however, is confessedly made from other seeds, such as colza and cameline, besides linseed, and is considered as good cake nevertheless.

Great disappointment, it is further insisted, is often experienced in the use of oil-cake. Bullocks will refuse to eat it if previously fed with some of better quality; and it is but reasonable to suppose that their progress must be greatly retarded by a change for the worse. But no such inconveniences adhere to the use of the compound, for the degrees of fattening may be regulated in strict accordance with the convenience and intention of the farmer, by mixing up a small quantity of linseed at first, and increasing it at pleasure. Upon this principle the condition of cattle may be advanced or retarded, as circumstances require: and the grazier who has a store of linseed at command, will be protected from loss under any emergency, either from the want of grass, through the heat and drought of summer, or of turnips, through the frosts of winter. Also, in every case where milk is required, linseed will be found a powerful auxiliary, whether for calves, for lambs, or for *growing* pigs. Observe! linseed compounds are not adapted to the *fattening* of pigs: the result of an experiment purposely tried was that the pork was unsaleable.

In Norfolk generally, and in many parts of other counties, the use of linseed, to fatten bullocks and sheep, is beginning to be understood. Many suppose that they are sufficiently acquainted with its properties; but there is yet much to learn as to the extent of its value, particularly for rearing store-stock, in combination with box-feeding and summer-grazing. The direct advantage is seen in the rapid progress of the cattle; the indirect, in the superiority of the crops where the manure thus obtained has been applied. Formerly, through ignorance of management, linseed, as cattle-food, failed to remunerate, and consequently its use had long been discontinued in Norfolk; but in consequence of Mr. Warnes's efforts, the demand became greater than the supply.

We must refer the reader to that gentleman's work for plans of boxes, boiling-houses, &c., as being more closely connected with the grazier's trade than with our present subject—the culture of flax,—contenting ourselves with quoting the testimony which Sir Charles Burrell has given as to their efficiency. He thus writes to the *Sussex Herald*: "I cannot lose the opportunity of repeating my entire satisfaction derived from Mr. Warnes's box-feeding system, as set forth in his pamphlets, and brought into both summer and winter practice on my farm, the beasts thriving rapidly on the compound made of crushed linseed, with bean, barley, or other meal, boiled, and formed into a mass, with which my beasts have thriven more advantageously than others on oil-cake, and at less cost; and, as regards the excellence and flavour of the meat, it is superior, and specially tender and juicy. And if further proof were desirable, it is afforded in their ready sale to the neighbouring butchers, and in the intended increase, early in the spring, of the number of my cattle-boxes, from the roofs of which the rain-water will be saved in one or more spacious tanks, arched over, similar to one which wholly supplies my hot and green houses. With respect to particular statements of comparative cost in feeding, on Mr. Warnes's system, it seems to me prudent to state no corrected calculations

until I have completed two years' trial. Suffice it now, however, to add, that I have sound grounds for preferring the box-feeding system to every other mode, the food being cheaper, the cattle thriving faster, and the manure being made so much better, that we consider twelve loads thereof equal to twenty loads from oil-cake-fed beasts, whether tied up or otherwise."

It is pleaded by its enthusiastic advocate, that the system of feeding stock upon linseed is simple in practice, powerful in effect, and applicable to every grade of farmer; and that it is more important, if possible, to the breeder than to the grazier, if we may judge from the remarks of the duke of Buccleuch, at a meeting of the Dumfries Agricultural Association; and from the miserable spectacles that appear in our cattle-markets—spectacles at variance both with humanity and judicious management. His grace animadverted upon the deteriorating effect of keeping cattle upon straw in winter, and advised the adoption of some method that would, at least, retain the condition acquired in the summer, and improve the manure. Linseed meal boiled for a few minutes, and ultimately incorporated with straw, will achieve both objects. For instance, Mr. Partridge had twenty-one score of ewes, to which a peck only was given per day, at the cost of 1*s.* 9*d.*, or a penny per score, including the expense of crushing, boiling, &c. That so small a quantity of linseed should be divided amongst 420 sheep, must of course appear paradoxical; but the following explanation will remove all doubt: a peck of linseed reduced to fine meal is stirred into twenty gallons of water; in about ten minutes, the mucilage being formed, a pailful is poured, by one person, upon two bushels of cut hay thrown into a strong trough, while another mixes it with a fork, and hastens the absorption with a small rammer. The like quantity of chaff is next added with the mucilage as before, till the copper is empty. The mass being firmly pressed down, is after a short time carried in sacks to the fold, where the sheep will devour with avidity hay in this form which was

before so ordinary that they refused to eat it. As the lambing season advances, and circumstances require, the proportion of linseed will be increased—a method that all who are straitened for provender will find it their interest to adopt; remembering that this mixture is alike serviceable to lean cattle and to horses, and that the straw of peas and the stalks of beans are second only to hay. A few Swede turnips, mangel-wurzel, or carrots, sliced very small, and added to the water when first put into the copper, will much improve the compound.

Were horses, both in town and country, fed upon linseed according to this receipt, only using less water and more linseed meal, one-half at least of the corn now consumed in stables might then find its way to the dwellings of the poor. In some cases three parts of the oats, in others the whole, might be superseded by linseed, if we may believe Mr. Warnes. Expense, at the same time, would be considerably reduced. Linseed meal, sprinkled in small quantities upon grains hot from the brewery and intimately incorporated with the rammer, is excellent food, when mixed with chaff, for horses employed in slow work. Nor will this compound turn sour if properly consolidated.

Calves might, upon the compound system of feeding in boxes, be made to weigh thirty or forty stone each (of fourteen pounds), at a year old. Two returns of fat cattle in a year may be effected. But success will, in a great measure depend upon particularity of feeding, and cleanliness. A bullock ought never to be long without food, and a clean lock of straw to rest upon; for when he ceases to eat he will lie down and ruminate, seldom rising except to eat again. Let those who wish to try the experiment place their bullocks in boxes on the first of January, and return them at the end of June, when they will have consumed the last of the turnips, which are the worst, and the first of the grass, which is the best; then replace them with the others, which will consume the last of the grass, which is the worst, and the first of the turnips, which are the best, allowing them a liberal and equal proportion of compound.

It cannot be denied that the results obtained by cattle-feeding with linseed, as recorded by unquestionable authority, are very striking, and deserve the attention of every agriculturist in the United Kingdom. For instance, Mr. Warnes states, "I sold in November, 1843, three small bullocks, bred in the early part of the summer of 1842, one of which was purchased for £4, on the 11th of March, 1843; another for £3. 3*s*., on the 13th of April; the third was bred on the farm, and valued at £4. 10*s*., on the 11th of March. Two of them were Durham heifers, the other Norfolk bred; their ages eighteen months each when killed. The first weighed 46 stone 7 lbs.; the second 41 stone 2 lbs.; the third, 35 stone (of fourteen pounds to the stone), making 122 stone 9 lbs. which at sixpence per pound, the current price of beef in this neighbourhood at the time of writing, amounts to £44. 18*s*. 6*d*.; and, had I sold them by weight, would have afforded a balance of £31. 5*s*. 6*d*., and a profit unexampled in the agricultural history of this country—unexampled on account of the shortness of time, the size of the animals, the smallness of the outlay, and the food being entirely the produce of the farm. Should it be asked, what was their condition when purchased? I refer to the cost price, which the practical inquirer will perceive admitted only of what the chemical farmer would term 'a very minute development of flesh.' These bullocks, with about twenty others were, in 1843, fattened on my farm, consisting of seventy-six acres only. They were all kept in boxes during the summer as well as in the winter months, were treated in every respect alike, and made similar returns; some were disposed of within four, others eight months, averaging about six months each, and speaking volumes in favour of the cultivation of linseed, the fattening cattle upon native produce, box-feeding, and summer-grazing."

We quote from the report of the National Flax Association (read December 6, 1844, at Ipswich), another experiment in proof of the value of flax-seed:—

The North Walsham Farmer's Club offered, by a

challenge through the Norwich and London papers, to test the merits of the compound with oil-cake, which challenge not being accepted, Mr. Postle, of Smallburg, determined to try the experiment upon his own premises. Twelve bullocks being selected, and divided into two lots by competent judges, were weighed and placed in separate yards; one lot to be fed on native produce at a fixed amount per week, and the other on foreign oil-cake at the same cost—each lot to be allowed as many turnips, previously weighed, as they could eat per day, in order that the most accurate account, both of quantity and cost for food consumed, might be kept.

During the course of the experiment, every facility was afforded to the public to inspect the cattle and the new mode of grazing. In due time Mr. Postle advertised the day on which his bullocks were to be shown and weighed at Norwich. Numbers from distant parts came to see them; and, in order to arrive at the most correct conclusion, he sold all the twelve to one butcher.

When first selected, the six beasts fed on compound weighed 602 stone, and those on oil-cake 590 stone. When fat, the live weight of the former was 725 stone; of the latter, 705 stone, being a difference of eight stone (the twelve stone overweight at the first being deducted) in favour of those fed on compound. But it was in the dead weight of each lot that the greater difference was shown—the compound-fed yielding 44 stone 9 lbs. of meat more than those fed on oil-cake; but taking the loose fat and hides, the difference in favour of the former was 50 stone 6 lbs.; or 38 stone 6 lbs., deducting the twelve stone original extra live weight. While there is this increase of meat, there is a considerable decrease of expense between those fed on home produce and those fed on foreign oil-cake. The former consumed a smaller quantity of turnips than the latter; and the cost of the compound was only £19. 6*s*. 1½*d*.; whilst that of the oil-cake was £21. 14*s*. 9*d*.

The only apparatus required for the system recommended is a linseed-crusher, an iron copper, a hand-cup,

a stirrer, one or two half-hogsheads, two or three pails, and a wooden rammer. These will cost about £12; but if proper cylinders were attached to mills, as they are in the neighbourhood of North Walsham, the machine could be dispensed with, and the outlay reduced to about £2. Large coppers are found inconvenient for stirring when compounds are made with the meal of peas, beans, &c. The sizes most in use contain from thirty to forty gallons. Upon large farms it will be desirable to have two—one smaller than the other. The stirrer is an iron-ribbed spoon fastened to a shaft of wood four feet long, and somewhat less than the handle of a pickaxe. The rammer is three feet long, about five inches square at the bottom, and two and a half at the top, through which a pin fourteen inches long is passed, for the convenience of being used with both hands.

Winter-grazing may be commenced upon white turnips, grown after flax, the tops of which, being extremely luxuriant, are cut with pea-straw into chaff, compounded with linseed meal, and given to the bullocks on the following plan:—Upon every six pails of boiling water, one of finely-crushed linseed meal is spread by the hand of one person, while another rapidly stirs it round. In five minutes, the mucilage being formed, a half-hogshead is placed close to the copper, and a bushel of the cut turnip-tops and straw put in. Two or three hand-cupfuls of the mucilage are then poured upon it, and stirred in with a common muck-fork. Another bushel of the turnip-tops, chaff, &c., is next added, and two or three cups of the jelly, as before; all of which is then expeditiously stirred and worked together with the fork and rammer. It is afterwards pressed down, as firmly as the nature of the mixture will allow, with the latter instrument, which completes the first layer. Another bushel of the pea-straw, chaff, &c., is thrown into the tub, the mucilage poured upon it as before, and so on till the copper is emptied. The contents of the tub are lastly smoothed over with a trowel, covered down, and in two or three hours the straw, having absorbed the mucilage, will also, with the

turnip-tops, have become partially cooked. The compound is then usually given to the cattle, but sometimes is allowed to remain till cold. The bullocks, however, prefer it warm; but whether hot or cold, they devour it with avidity.

The cost for linseed, according to the above rate of feeding, was 2*s.* 3*d.* per week; which seed, though grown upon the farm, was placed to the account of artificial food; and it was calculated that in order to obtain the same effect through foreign oil-cake, the expense per week would be at least one moiety more. A bushel of good linseed at 5*s.* 6*d.*, weighing 48 lbs., if properly formed into compound with three or four times the weight of bean, pea, or ordinary wheat meal, and a little more than double the weight of the whole in water, will cost about £2. 15*s.* per ton. The superiority of this economical food to foreign oil-cake is explained by reverting to the fact, that one at the best is merely the refuse of linseed, while the other is made of the seed itself. The reason why bullocks will fatten upon cooked more than upon raw food, must be left to the chemical farmer to explain; but it is certain that linseed meal, given in a crude state, will scarcely produce half the effect; nor yet if the ingredients were mixed up with cold water, or put into the copper before the water boiled.

It will be seen that the real fattening properties of the above compound centre in the linseed; and that in order to produce a greater or less effect it is only necessary to regulate the quantity of that important ingredient. Also that wheat, oat, and barley straw, or bean-stalks, may be used either with or without turnip-tops, according to circumstances; nothing more being required than fibrous matter to act as a vehicle for conveying linseed to the stomach of the animal, and for reconveying it to the mouth for rumination. Experience has long since proved that linseed boiled without being crushed, or given in any way except by intimate incorporation with other ingredients, loses so much of its efficacy as to become an expensive rather than an economical method of feeding

cattle. Therefore, in order to render straw of service to *fat*, or yet more so, to *lean* stock, the quantity of linseed meal must be regulated. And, where *cost* is the object of inquiry, note that one pound of linseed meal, or five farthings' worth, per day, given according to Mr. Warnes's directions will be of great advantage to the animals; but if doubled in quantity, the improvement of their condition and efficacy of the manure will repay the extra expense. As a substitute for hay, this diet will be found equally useful for cart-horses and colts; and the knowledge of the fact is useful in order to meet the exigencies consequent on the loss of hay. But where that important crop has been preserved, it will, of course, be desirable to mix some with the straw when making the compound.

From the above statements and experiments some idea may be formed of the *direct* advantages to be derived from the use of linseed; but no calculation can be made of the *indirect* advantages arising from fattening cattle upon native produce, nor from the diffusion of manure thus obtained, as every description of farm produce yields a heavier crop when manure from compound-fed cattle has been applied.

HEMP.

GENERAL CHARACTERISTICS AND DESCRIPTION OF THE PLANT.

All the various articles of clothing worn by Man are a something of which he has previously denuded something else. He cunningly entraps innumerable individuals of the fox, weasel, and squirrel tribes, to strip them of their warm and valuable fur. He hatches and feeds legions of caterpillars, that he may rob them of the defensive padding which they spin to protect their helplessness while passing through the chrysalis state. He murders the mighty bull and bison, on no juster ground of provocation than that his victim is possessed of a hide eminently adapted to make mocassins. He pastures the sheep for its skin and its wool, occasionally setting so little store by the carcase as to melt it into tallow or burn it as fuel. The bird of paradise, the ostrich of the desert, and the swan frozen out from the Artic circle, are despoiled of their plumes and down, to bedeck our dames luxuriously. Even the depths of the ocean are made to pay this tribute; and whalebone is stolen from fishes' mouths to give strength to feebleness and grace to deformity. Mother earth herself is treated with no greater forbearance. By alternately feeding her up with manure, and teasing and tormenting her surface with tillage, she is coaxed and compelled to send forth a living vegetable down, which is shorn, plucked, and plundered from her bosom, in the shape of cotton, flax, and our present subject, Hemp.

Hemp is markedly distinguished from flax, although

we couple them together here in one and the same little treatise. Flax is soft and tender in its nature. As it grows, it bends submissively before the beholder, and delights the eye by the smoothness of its aspect and the delicate brightness of its colouring. It supplies us with necessaries, with luxuries, and with emollient medicines. Hemp has something martial in its appearance. It rises stiffly from the seed-bed, like a crop of lances, pointing upright in defiance to the sky, and often overtopping the stature of those to whose labours it owes its birth. Hostility and repulsiveness are the leading elements of its composition. It chokes every herb that grows beneath its shade. It is a robust plant, destined for robust purposes, becoming almost a weapon in the hands of man. It furnishes him with military and naval stores; with tents to live in, while making war on his enemies or his victims; with cordage and sails, enabling him to traverse the globe as a friend or a foe; with ropes and nets to entrap or hold the sanguinary tiger or the rapacious shark. The elephant, decoyed and bound in hempen bands, forthwith becomes an obedient slave. For clothing merely, as a means of warmth and covering, hemp must be weakened in its proportions and constitutions, by the restraint of specially crowded culture. It is cramped and imprisoned, even while fed and kept alive, like a captive savage of too ardent a temperament. With greater liberty allowed, it seems to take a perverse pleasure in arming man with the means of mischief as well as with those of useful toil. Hemp bears no flowers that please the eye: its healthy hue is a dark and sombre green; its stem is rigid and roughly bristly; its sharp and penetrating odour affects the head; its leaves are exceedingly acrid to the taste; and instead of yielding a sedative potion or a soothing liniment, it furnishes, in the shape of "bang," a poisonous as well as an intoxicating agent. Flax, lastly, heals the honourable wounds of the soldier; hemp disgracefully finishes the career of the hopeless criminal.

Hemp, *Cannabis sativa*, according to Linnæus, *chanvre* in French, and *canape* in Italian, is an annual plant,

HEMP.

A Male flowers.
B Female flowers.

belonging to the natural family, or the nettle tribe. In the Linnæan system, it belongs to the class *Diœcia* (two houses), and the order *Pentandria* (five males); that is, the male and female flowers grow on separate and distinct plants, and each male flower contains five stamens, or fructifying organs. In the female plant, the flowers are solitary in the axillæ of the leaves; in the male they grow in thin pendulous spikes, at the ends of the stem and branches. Some female flowers, however, are occasionally found amongst the males, and some males also amongst the females. It would, therefore, prove nothing contrary to the views which modern botanists hold, with respect to the functions of the anthers and their pollen, if instances could be adduced of female hemp-plants having produced perfect seed when there has been no male plant growing near them. Miller states that he tried the experiment for several years, by removing all the male plants before their blossoms opened, and although the female plants continued stong and flourishing, yet they never produced any good seed. Though both arising from the same seed, the difference of which is undistinguishable, yet the male plant is ripe five or six weeks sooner than the female. In both, the flowers are devoid of corolla, or petals. Each grain of seed produces no more than a single stem, which is occasionally called the "reed," and sometimes the "boon." The useful fibre is contained in the bark. When the plant is full grown, the difference in the aspect of the sexes is so great—the male being smaller, and more delicate than the female—as to be easily distinguished at a considerable distance. This point too, demands attention in the after management of the crop.

Hemp, like many other plants in long and general cultivation, is reputed to be a native of the East, to which part of the globe we may trace it with more or less certainty. Linnæus, in his Materia Medica, gives it to the East Indies and Japan. Thunberg says it grows here and there in Japan. Gmelin thinks it may be a native of Tartary, since he found it there, though the Tartars do

not cultivate it. In the species *Plantarum* it is said to grow wild in India; but in Richard's edition of the Systema it is assigned to Persia. Pliny and Dioscorides speak of it as a native of Europe. However that may have been originally, hemp has been grown in Europe from time immemorial, for the sake both of the cordage manufactured from its fibre and of the oil which is expressed from its seeds.

All cultivated hemp belongs to a single species; but there exists a number of so-called varieties, which, far from being permanent, are merely the temporary developments of soil, climate, manure, and treatment. Rope-hemp, namely such as naturally displays a tall, robust, and branching stem, furnished with dense and tenacious fibres, capable, in short, of making a vigorous growth, and bearing a heavy crop of seed, is the type of one of the most decided varieties of the species; cloth-hemp, whose stem is slenderer, more drawn up, less branched, and containing a finer fibre, may be taken as a general representative of the other. In Italy, Piedmont is celebrated for the first sort; the neighbourhood of Genoa for the second. The hemp of the Ukraine is in high repute, and, till the breaking out of the present war, has furnished Russia with a considerable article for exportation. English hemp, properly manufactured, stands unrivalled in its strength and beauty, and is superior, in both these respects, to the Russian. Considerable quantities of cloth used to be imported from that country for sheeting, merely on account of its strength, for it is coarser in the piece than other linen. Our own hempen cloth, however, is preferable, being stronger, from the superior quality of the thread, and, at the same time, becoming lighter in washing. The same may be said both of French and Belgian hempen cloth. The hemp raised in England is not of so dry and spongy a nature as what we have from Russia, and therefore requires a smaller proportion of tar to manufacture it into cordage; tar being cheaper than hemp, it is said that some rope-makers prefer foreign hemp to ours,

because they can make a better profit in working it; but cordage must certainly be stronger in proportion as there is more hemp and less tar in it, provided there be a sufficient quantity of the latter to unite the fibres. Von Thäer mentions, in terms of strong praise, Strasbourg hemp, which is grown in Alsace, and which attains, he says, the height of eight feet; but this is still very much less than that of the sort called Piedmont hemp, of all countries the most renowned amongst continental agriculturists. In the districts of which Bologna and Ferrara are the capitals, sixteen-feet hemp is not unusually tall, while the fibre remains unsurpassed in beauty. This power of luxuriant growth has been ingeniously taken advantage of by persons who, remarking that Piedmont hemp, sown upon strong and well-manured land, became too tall and coarse (for clothing purposes), sowed it therefore on inferior soils, giving it little or no manure, and thus obtained, from comparatively unproductive ground, hemp as good as the usual local variety proves on lands of the very first quality. The advantage of this plan is evident,—it often saves a great part of the expensive manure which hemp-fields require, provided, always, that the seed of Piedmont hemp be renewed every other year, for in the third year its vegetative vigour is found to be diminished when it is gathered from plants produced from the original stock, if they grow on less fertile land than their native valleys of Piedmont. The best way to save the trouble of making such frequent re-importations, and also to prevent the seed from degenerating too rapidly, would be to sow separately a small crop on a piece of the best land, and to maintain the peculiar merits of the variety for the longest possible period. It is sometimes profitable to cultivate hemp in this way for the sake of the seed only, leaving the fibre out of the question. In such cases, it ought to be sown in drills, from a foot and a half to two feet apart, in order to admit plenty of air and light, and to allow the opportunity of giving the crop one or two weedings. In the Jura it is the custom to sow hemp

along the hedges; it both protects them from being browsed by cattle, and also supplies an abundant harvest of excellent seed. In the departments of Indre-et-Loire and Maine-et-Loire, in France, a very superior variety called Bréhemont is cultivated, which is most probably a native of Piedmont, by which name it is also known. This sort often attains the height of from twelve to fifteen feet; but from nine to ten feet is nevertheless the ordinary height to which it rises on the rich soil of the valley of the Loire.

The root of the hemp plant is fusiform, or spindle-shaped, with but few fibres, white and woody. Although it usually grows six feet high, on an average, on good land, abounding in humus, or vegetable mould, or on spots which are freshly broken up, it is seldom taller than three or four feet on moderate soils. Its stem is quadrangular, hollow, covered with short hairs, harsh to the touch, and often branched. The lower leaves are opposite, the rest alternate; all grow on foot-stalks. Hemp, we have seen, differs from many of our cultivated plants in bearing the male and female flowers on separate individuals, as is the case with the date-tree, and the large genus of willows. The leaves are composed of five leaflets, the three middle ones toothed and lance-shaped, the two outer ones more entire and much smaller; all of these are rough and of a deep dark green. When hemp-plants are isolated, they divide into a great number of branches; but they rise with only a single stem to the top, when they are thickly sewn. The latter method is much more advantageous to improve the quality of the fibre.

In the language of modern botanists, the seed-bearing plants would be regarded as the female individuals, while the barren, or rather the merely pollen-bearing and fructifying ones, would be properly considered and called the males. But the female plant grows much taller and more robust than the male, and also remain longer on the ground before arriving at maturity. On this account probably the old writers, while they recognised the dis-

tinction of sexes in plants of hemp, acted contrary to the practice of modern botanists in calling that which bears the seed the *male*, and that which bears the pollen the *emale*. To avoid confusion, even when quoting them, we shall adopt the language of the present day. By male we designate sterile, by female, reproductive plants.

THE PROPER SOILS FOR THE GROWTH OF HEMP.

"The soil for hemp," says Olivier de Serres, "should be fat, fertile, easy to work, and in a temperate climate. Cultivated from autumn, and tempered by the frosts of winter, it will be rendered proper to receive the hemp-seed at the end of March, and thence throughout the whole of April, the veritable season for sowing it (in the central parts of France). The mode of properly preparing the land for this purpose is by hand, with mattocks, not levelling the surface, but raising it up in little mounts, in order that the weather penetrating through them may thoroughly concoct the earth. In January these hillocks are levelled, after having placed between them a good quantity of short manure, in order that it may be the more easily incorporated with the soil. In the last days of March, or the first of April, the moon being on the wane, the hemp will be sown, and incontinently covered with two or three fingers'-breadths of earth—not more—which may be done with the mattock crossing the furrow, but more subtilely, and better, with the harrow going over it several times. If, afterwards, a top-dressing of pigeons' manure is given, it will greatly aid the hemp, provided it be on the eve of rain, for without humidity, the great heat of this manure would burn the seed. Watering is rather useful than absolutely necessary to hemp; wherefore, this convenience will not be despised when the situation is favoured with a supply of water. For seed, choose new hemp-seed, since that of the preceding year sprouts very badly, and older grain remains entirely lost in the earth. The rind or fibre of fine hemp,

for fine cloths proceeds from such plants as are drawn up, and slender; and they spring up in that way from the ground when, in consequence of the seed being sown thick, they are compelled to press against each other during their growth. On the other hand, the hemp from stalks that are at a distance from each other, although the seed may be of a delicate kind, is of no use except for cordage and other coarse purposes; consequently, care will be taken to sow the hemp thickly or thinly, according to the use for which it is designed. Hemp that grows thin (whether intentionally, or because the seed has not vegetated), will be carefully weeded with the hoe, in order that being cleared of the weeds which would otherwise overspread the vacant spots, it may grow at its ease, both to make cloth (although of a coarser description), and principally for the seed. Now hemp is a plant which has two sexes, and that which produces the seed, having plenty of room, will bear all the more abundantly."

We quote at large the above respectable writer, because he says much in a few words, though he sometimes confuses a variety of things together. Light land, rich in vegetable remains, and at the same time deep and moist, is the only one that is suitable for hemp; this is the reason why its culture is limited to a few localities that are favoured by nature. It gives but a very unsatisfactory return on soils of too sandy or clayey a nature, on shallow soils, on those which are apt to be scorched by the sun, or are unable to receive their due share of atmospheric influences. Unfortunately, in instancing hemp-growing in England, we shall have to refer to the past rather than speak of the present. Of late years, but little has been grown in Suffolk, on tracts that once were famous for this crop. The cause of its neglect is no doubt the same as that of flax—that for a long period wheat paid better; there is also the same objection to hemp—that its coming in the midst of harvest is embarrassing, and that the attention it demands in every state of its progress is too great, where it is only

a secondary consideration. The details of its management, are, nevertheless, much less minute and troublesome than with flax; it is however of great consequence to the country, and appears likely to become of greater importance, and even to deserve encouragement from the legislature, both as a means of giving employment to the poor, and also as furnishing an independent supply of an article indispensable for the national use, which we mainly procure fron a hostile country.

Favourable soils in England are found in the tract called Holland, in the county of Lincolnshire, and the fens of Ely, where it has long been cultivated to great advantage, as it might be in many other parts of the kingdom where there is a similar quality of soil; but it will not thrive on clay or stiff cold land. It is found, however, that it will do very well after turnips on friable loams and good sands, provided it be well manured. Spalding Moor, in Lincolnshire, is a barren sand, and yet, with proper care and culture, it has produced as fine hemp as any in England, and in large quantities. In the Isle of Axholme, in the same county, the culture and management of it has long been the principal employment of the inhabitants; and according to Leland it was so in the reign of Henry VIII. In the county of Suffolk, in the district extending from Eye to Beccles, hemp has been cultivated on sandy loams with great success. On such soils the quantity is not so great as in a black rich mould; but the quality is much finer, and therefore better adapted to the fabric of hempen cloth. Hemp, in short, delights in valleys and the banks of rivers. Fresh broken lands in the midst of woods and forests are favourable to its growth; so also are gardens and other spots that have long been cultivated by the spade. The same is the case on a crop of broken-up lucerne, on land in good heart, after a crop of oats has been taken; on broken-up pasture land, and fresh-drained marshes, and newly-emptied pools. Count Gallesio, to whose treatise we shall have to refer hereafter, regards as the best composition of hemp-land that which is composed of one-

third of silex, one-third of lime and magnesia, and another third of clay. "This mixture," he says, "forms a light soil, which does not harden and form a crust. The seed, sown thickly on such land as this, rises perfectly; the plants, finding themselves crowded, are unable to increase in bulk and breadth, and therefore shoot up lank and slender. Well-rotted manure, acting immediately, favours and accelerates the development of the plant in an upward direction."

Hemp is esteemed a clearing crop; for it destroys all weeds that spring beneath it by overshadowing them and depriving them of their nourishment. As a general rule, it should not be too often repeated on the same ground. It may, however, be grown with success on the same land many years, by manuring annually; it is said that it has been sown on the same for seventy years together. There is no doubt that by the unsparing use of fertilizers, almost any result can be attained in gardening and agriculture. Hemp, if it stands for seed, is on all hands acknowledged to be an exhausting crop; but if it be cut or pulled without the seed, it is on the contrary supposed by many to improve the land, and to be an excellent preparation for wheat.

"British husbandry" testifies to nearly the same effect. "The soil best suited to hemp is a strong rich loam, and it is more grown in the deep moist rich fens of Lincolnshire and the Isle of Ely, than in any other part of the kingdom; for it is always strong in the fibre in proportion to the richness of the ground in which it has been grown. It indeed requires even richer land than flax, and is therefore generally grown upon alluvial soils, although they should not be too moist, and a cold wet clay will in no instance answer the purpose; but it is in other places grown upon ground of more ordinary nature, the quantity produced being smaller, though the quality is somewhat finer.

"Opinions differ in regard to its effect upon the soil, some considering it as a great exhauster, and others only in case of its being allowed to stand for seed; there are,

indeed, some old leases to be found in Cambridgeshire, which stipulate that the land shall be sown with hemp in the last two years of the term, while in others there are covenants absolutely prohibiting its growth; but all agree in admitting it to be an effectual cleanser of the land, for it grows with such promptitude and strength, that it destroys all the weeds which spring up under it. It therefore can never be sown along with grass-weeds; but, for the same reason, it is found to be an admirable preparation for a crop of wheat, as the land must be previously brought into a state of garden culture, and, if heavily dunged, when treated in this manner, alternate crops of wheat and hemp have been successively grown upon the same ground during a series of years. In some places it is not an uncommon practice to break up a stubble late in the autumn, and after it has had the benefit of the winter fallow, from twenty to twenty-five loads of spit dung are laid upon the land, which is then sown with hemp, after three ploughings. In the following year an excellent crop of wheat is generally obtained, and in the next a good crop of barley or flax, after which hemp is again sown with a similar dressing."

THE PLACE OF HEMP IN THE ROTATION OF CROPS.

The Baron de Morogues, in his essay on the means of improving agriculture in France, observes that as hemp is sown late in spring, the land may be made to bear two crops in the year, by causing the hemp to be preceded by green food of some kind or other. Thus, in the Department of Maine-et-Loire, hemp is sown in May immediately after a crop of *raves*, or large yellow field-radishes, which answer many of the purposes of turnips; and in the Department of the Pas-de-Calais, it is made to follow a crop of *escourgeon*, or four-rowed winter-barley, mowed green. Hemp may be succeeded by wheat, with the greater facility that it leaves the land clear early in the season, and so allows an opportunity of preparing it at leisure. In the north of France, where flax is

sometimes made to follow hemp, to be in turn followed by wheat, it appears that the hemp is so favourable to the subsequent crop, that it makes a very advantageous rotation on the really good land which is alone suitable to its culture.

Mr. Turbilly states that he has frequently sown wheat or winter oats after hemp, on newly-broken-up ground. It is his opinion that hemp does not exhaust the soil for plants of a different nature, when it is sufficiently kept in heart by tillage and manure. This does not authorise the continual sowing of hemp after hemp on lands which only produce by the aid of manure that has been stolen from the arable land, as is too often practised in Sologne, where, according to a very bad custom, although it sometimes appears to succeed, the hemp-fields are made insatiable consumers and abysses of manure.

It would not be difficult to introduce, on the good land which is often left after the draining of marshes, the triennial rotation of hemp, trefoil, and flax, which is employed in some of the valleys of Maine. It is applicable only to first-rate land, and requires every year an abundance of manure. But then, no system of culture is more remunerative than this. No plants are more profitable than hemp and flax to small growers, who do all their work themselves. Where this three-years' course is practised, the land is divided into three equal portions, the first of which is sown with flax combined with trefoil, the second bears a crop of trefoil, and the third of hemp. But, we repeat, this rotation, which is suitable only to little holders, tending greatly to impoverish the earth, is not only confined to strong soils, but the flax crop must be manured with farm-yard manure (and limed also, when the land is cold), and the hemp must be dressed with ashes. In Maine there is some excellent land, which has been cultivated in this way more than sixty years, and still produces excellent crops.

Combining hemp and flax with the Norfolk four-course system, always of course on rich and deep soils, a convenient rotation would run as follows: 1st. Turnips, fed

off on the land by sheep; 2nd. Barley, sown with grass or clover seeds; 3rd. Hay, or pasture, which in certain cases lie unbroken two years; 4th. Flax, which never does better than on the upturned sod; 5th. Turnips again, or beetroot, heavily manured themselves, resting the land, and helping to make manure in turn; 6th. Hemp; 7th. Wheat. Between the flax and the root crop which follows it, it would be easy to steal a crop of green food (vetches and rye), to be cut or eaten on the land in early spring. Reclaimed marshes and deep alluvial soils would bear this rotation admirably.

THE TIME OF SOWING AND CHOICE OF SEED.

The time of sowing hemp varies greatly according to the climate, and in the same climate according to the locality. It extends as widely as from the month of March to the month of June. The grand rule is to avoid all danger of severe spring frosts, as the plant is extremely liable to be affected by them. Still, early-sown hemp is always the best; and it is sometimes worth while risking a little precocity in the matter of sowing, if there is but a supply of seed at hand to recommence with in case of accident. Prudent agriculturists, who grow several fields of hemp in the same season, generally sow them a week after each other, but never when the weather is dry and cold. Great care must be taken to sow none but last year's seed; old seed will not come up at all, or at best very uncertainly. With hemp, as with flax, the question of thin or thick sowing must depend upon the object of the grower and the quality of the land. In fact, on middling land, hemp should be sown thinner than on heavy land. When it is wanted to procure a very long and fine sample of fibre, very thick sowing is necessary; because the stems then draw each other up, and even blanch each other to a certain degree; thereby causing the bark to be more delicate. Hemp which grows so wide apart as to throw out side branches, produces a large quantity of seed and a very strong fibre,

but which is only fit for ropes or the coarsest cloth. When the soil is rich, and fine fibre the object, one hundred plants to the square yard will be found a successful degree of thickness for them to stand. It has been found by experiments in England and America, that salt sown at the same time with the hemp-seed acted as a beneficial stimulant. In the neighbourhood of Bologna and Ferrara, in Italy, where the culture of hemp is probably carried to greater perfection than anywhere else, where it is not uncommon to see hemp-stalks rising from twelve to sixteen feet above the surface of the ground, it is usual to spread at the same time with the seed fecal matters, the dung and feathers of fowls, powdered oil-cake, and chips of horn and bone. They are buried by hand by means of hoes, and the surface of the soil is carefully levelled with rakes.

In the Department of the Pas de Calais, which approaches very nearly to the climate of England, the rule is to sow hemp from the 10th to the 20th of May, at the same rate as is usual there for wheat and flax, namely, a *hectolitre* to a *mesure* of forty-two *ares* twenty *centiares*, more rather than less, in case any portion of the seed should fail to vegetate. This answers as near as may be to the proportion of two bushels to the acre. It is sown broadcast by walking up and down the field in parallel rows two paces distant. Hemp seed is difficult to sow, on account of its extreme slipperiness. The sower grasps it by as large handfuls as he can possibly clutch, to do which more effectually he occasionally wets his hand. A *mesure* of hemp in that neighbourhood is considered of equal value with a *mesure* of wheat. It is usual there to make wheat follow hemp, because it cleans the land by completely choking every weed. The seed is harrowed in cross-wise, and afterwards rolled. The time of its appearance above-ground very much depends upon the weather. If rain with a tempest comes soon after the sowing, it sprouts quickly. Once up, it grows rapidly, sometimes rising at the rate of an inch a day. The crop

occupies the ground but a very little while; frequently not more than three months altogether.

Others recommend as much as three bushels, and even three and a half to the acre; but, if the seed is good, it is unnecessary. The smoothest, soundest, heaviest, and brighest-coloured seed should be selected, rejecting that which contains a large proportion of under-sized grains; and some of them should be cracked, to see if the kernel and the germ are perfect. The land on which it is sown must have had three ploughings, with harrowings sufficient to make the soil perfectly light and crumbling. It is laid flat, with as few furrows as possible. The manure, of which there should be a liberal supply, may either be ploughed in during autumn, immediately after wheat-sowing is finished, or a fortnight before the seed-time, when the last ploughing is given to the land. This will greatly depend on the quality of the manure at the farmer's command.

For the culture of hemp, M. de Pertuis prefers spade-husbandry to all the ploughs in the world. It takes a longer time: but it is deeper, and more suitable to the tap-root of the hemp-plant. The more deeply the land is broken up, the higher the hemp will rise. It is the hidden treasure of the goodman in the fable, which could only be found by searching in the earth. Land in a finely divided state is less liable to suffer from drought than any other. Land may be said to be deeply broken up, when the depth of nine or ten inches is attained. Spade-husbandry can reach as far as that; the plough will have a difficulty in executing the same task, and in ordinary cases will not go deeper than six inches. Unburnt turf crushed to coarse powder, and also the ashes of turf and wood, are excellent manures for hemp, on land that is deficient in vegetable remains. It is a well-known fact that the most substantial manures, if they are not well rotted, produce a less active effect on the growth of hemp than the simplest fertilizers, which have been reduced to a state of extreme division. Hemp has short and slender roots; it springs up, grows, and comes to

maturity, within a very brief space of time; it therefore requires to find its nourishment readily prepared and easily absorbed. When this is not sufficiently decomposed, either the plant languishes, starving in the midst of plenty, and remaining small, stunted, and weak, or it unduly prolongs its course of vegetation, and so gives more ligneous than fibrous substance. On this account, all sorts of vegetable manures are found to answer so well. The Italian hemp-growers are fond of ploughing-in green crops, such as field-radishes and lupines, as manure for their hemp, and thereby obtain both quantity and quality in their sample.

AFTER MANAGEMENT OF THE CROP.

If the weather, after sowing, turns out chilly, and the plants themselves do not spring, although weeds do, or if cold and heavy rains cake and harden the surface of the field, a slight weeding and raking may be given. But if, on the contrary, the weather is hot and moist, nothing need be done. The hemp will rise with such rapidity as utterly to choke every nuisance of the kind. As a general rule, the hemp crop requires no weeding. When the plants are about eight or ten inches high, their sexes are already distinguishable from their habit, though they are not yet in flower. The female plants are taller, and of a darker green at the leading shoot; the males are shorter, thinner in the stem, and with a greater tendency to a yellowish hue. As all sorts of granivorous birds are passionately fond of hemp-seed, it is indispensable to protect the new-sown fields by means of scarecrows and rattling-mills; or better, to have them watched by children. A few gunshots fired from time to time in the course of the day will help to put the marauders to flight. It will also be as well to keep an eye on field-mice and other quadruped vermin.

When hemp is sown on land that is moist, or moderate rain has fallen a few days afterwards, it is not long in making its appearance above ground; but if the earth is

dry, it sometimes lies a month without showing itself. The latter case is exceedingly adverse: for even if it germinated at a later period, which does not always happen, the plant would be deficient in the requisite vigour. Moreover, the longer it lies in the ground, the more it is destroyed by its various enemies. On that account it is often a matter of regret when the seed is not sown on the very day of the last ploughing; for the land has then sufficient freshness at its surface to cause the seed to germinate. For the same reason, when the hemp-field is contiguous to water, it is often a wise piece of economy to water with scoops, with garden-engines, &c. If the plant comes up too thick in patches, it may be slightly thinned; but whatever be done to it, it ought not to be touched after it is once six inches high. Violent winds, and the cataracts of rain which sometimes fall during severe thunder-storms, often do great damage to standing hemp, especially when it is tall and thick. Transverse poles fixed to upright posts, four feet high, are the only means of preventing the evil. M. Bose relates a curious and startling fact, which some would pronounce incredible. A Piedmontese farmer, M. Barberis, having a hemp-field seriously injured by hail, cut half of it to the level of the ground, and left the other half standing for the sake of comparison. The portion cut yielded a crop not only more abundant than the other, but more than the same extent of ground would yield in seasons when no hail had fallen. The experiment, which is said to have been repeated several times with success, certainly deserves the attention of hemp-growers, even if they feel no inclination to make the trial.

GATHERING THE CROP.

Olivier de Serres tells us that "the hemp will be gathered when it is ripe, which will be known by the whiteness of the stem, and by other signs to be learned by practice. But in pulling it, the male plants must be distinguished from the female, drawing the former first,

and leaving the latter in the ground till the seed is ripe. And not only is the sterility of the male plant the reason of its being gathered first, but in order that the rind may be more productive of fibre, than if it were left standing to harden. On the other hand, waiting for the seed to ripen causes the rind of the female to be harder than it otherwise would. Plucking it from the ground is the fashion of gathering hemp, as vegetables are plucked, with the additional proceeding of sowing turnip-seed amongst it, which, being favoured by rain falling soon afterwards, or by waterings by hand, cannot fail to fructify, in land which has been so well prepared by the hemp, whose strength will have killed all noxious plants and insects. No further trouble need be taken about these turnips than to throw the seed over and amongst the hemp before pulling it; for in the act of gathering, the earth is raised, which is all the tillage the turnips will require, if, after the hemp is pulled, the surface of the ground is smoothed with a rake. And although the whole hemp-field is not cleared at once, the female standing longer than the male, that is of no consequence, because more turnips or radishes can be sown when the female is pulled afterwards. In this way you will have turnips and field-radishes of diverse ages, and, in the long run, better than if they were sown at one single time, both in respect of the quality of the produce and its abundance. Add to this, that seasons are not all alike, but it almost always happens that, if the first sowing does not take, the second will succeed, or *vice versa*. By ordering in this way, it would appear that a failure is impossible.

"When the male hemp is pulled, it will be tied in bundles, and immediately carried to the water to steep, which will be done in seven or eight days, more or less, according to the nature of the water and the heat of the weather necessary for the preparation. On this account, a spot is selected where the sun, striking the water all day long, hastens the work; for the same reason, this process is hastened for fear that, the convenience of sum-

mer passing away, the inconveniences of autumn may succeed, with its cold and damps which hinder the work. But in case that the nature of the climate, or the chilliness of the season, prevents you from conveniently steeping your hemp, refrain from putting it into the water, and keep it till another year, when the heat of the sun in the month of May or June is favourable to the process. At that time of year, your hemp will steep exceedingly well, provided it has been kept all that time in a dry place without the least humidity. Both the male and female hemp is treated in this way. But to give the female plants longer leisure to ripen their seed, they are drawn from the ground later, and put later into the water; which is done after they are stripped of their seed. Being taken out of the water, they are carried to dry in the sun, and are finally sorted for the diverse employments to which they are destined, and according to them are beaten, combed, carded, spun, and converted into cloth and cordage.

"Land does not tire of bearing hemp several years in succession, as it does of almost every other thing, provided there is no spare of ploughing and manuring, by means of which it may be made to continue this service as long as you choose. The strong smell of hemp chases from the ground many noxious herbs and troublesome animals; a very useful thing in gardens. When they are attacked by these nuisances, hemp is grown in them a couple of years successively, which thus ameliorates and renovates the soil, to the great benefit of such herbs as affect fresh ground."

Our good old author herein comprises the principal details in the culture of hemp, besides his rude economical hint to sow a root-crop amongst the plants as they are gathered. It is our part to fill up his skeleton with a few more precise particulars.

The hemp crop is not all gathered at once, the male plants being always pulled a few weeks before the female or seed bearers. This usually occurs towards the middle of August. Their ripeness is known by their turning

yellow at the top and white at the root, and by the general tendency of the whole plant to wither. Those who are over anxious about the quality of their fibre are apt to pull the male plants too green. In this state, they produce a sample which is excellent for the manufacture of cloth; but if the hemp is to stand for seed, it is better to let the male plants remain till they have shed their dust, without the influence of which the seed will prove abortive, and remain worthless both for the oil-mill and for birds'-food. An acre of hemp on rich soil will produce something like three quarters of seed, a matter of some importance. If the crop be destined to make thread only, without any regard to the seed, the male and female plants are pulled together as "maiden hemp," about thirteen or fourteen weeks after seed-time; the plan has this advantage, that the crop comes off the ground sufficiently early in many seasons for turnips to follow it, or better, that the farmer is allowed full leisure to make due preparation for a crop of wheat. The separation, however, of the male and female plants is not universally, though it is generally observed. It is sometimes neglected, partly from the fear of the injury which the pullers would do to the remaining plants by crushing and breaking them when they stand thick, and also because the work has to be done at a busy time of year, when there are plenty of other things to think of. The time of the general maturity of the crop depends very much upon the season; the wetter the summer, the longer the hemp has to stand, and it bears a dry year better than a wet one. When allowed to ripen the seed, it sometimes has to remain on the ground till after Michaelmas. When the hemp is pulled, it is bound in small bundles of such a size as may be grasped in both hands, and tied together with bands, at each end; they are then set leaning head to head against each other in the field to dry. In the Pas-de-Calais, the female or seed-bearing plants when gathered after the males are disposed of, have their heads knotted into wisps to keep the seed from falling off (which it is very apt to do), and also to make it heat

slightly; for which purpose it is sometimes even wetted a little, after thrashing, and subjected to the same granary treatment as is practised on rape and colza seeds, to cause them to mature their oil. The different degrees of ripeness of the seeds which are found on the same plant of hemp, and consequently upon all the plants in the same field, render it more difficult to hit the exact moment which is best suited for the extraction of the oil, than is the case with poppy, colza, and linseed. If it is taken to the mill too soon, there is a loss of profit, because the mucilage has not had time to become converted into oil; if it is kept too long before being carried there, the oil is apt to be rancid and of inferior quality. Sometimes the heads of the shocks of hemp are covered with straw, to preserve them from the rain and the attacks of birds. The seed thus completes its ripening. If the weather turns out damp, the shocks ought to be opened the first sunshiny day, to dry the bundles; for any tendency to mouldiness, and still more the rotting of the leaves, affects the quality of the seed. In some districts, a large circular hole about a foot deep is dug in the ground; the bundles of hemp are put together into it upright, and their roots are covered with earth. This method is preferable to the former one, because the moisture is better retained around the bottom of the stems, and the seed is ripened more gradually, and consequently more completely. This fact is so incontestable as to forbid the adoption of the advice of those persons who would hastily dry the hemp-stalks in the sun, or cut off the heads as soon as the plant is pulled. There are many ways of thrashing the seed, or rather of removing it from off the stalk. In some places, large cloths are spread in the field, and the heads are laid on a bench standing on the cloth, and are beaten with sticks; in others, the heads are beaten over a tub with its head staved in. Sometimes the thrashing of the best and ripest seed is simply performed by knocking two heads together violently, one being held in each hand, as is done in getting the seed out of poppy-heads. This first yield of seed is used for

sowing. What remains is then rippled off by hand, by means of a sort of iron comb fixed on a bench. This method is a good one, but gives extra work, which might be avoided by leaving the hemp a little longer in the shock. Nowhere is the flail employed, lest it should crush the seed.

Hemp-seed is winnowed, like wheat, to cleanse it from fragments of leaves and husks, and also from sterile seeds which happen to be mingled with it. The latter are often very numerous, and may be known by their pale colour and lightness. They ought never to be left mixed with the good seed, as slovenly hemp-growers often allow them to be, because they serve no useful purpose; and when the seed is intended to be crushed for oil, they absorb a portion of what is expressed, and so occasion an actual loss. The refuse of the winnowing may be thrown into the poultry-yard, where whatever nutritious grains are left, are sure to be found by the fowls and the pigeons. The winnowed seed is carried to the granary, where it is laid in small heaps, which ought to be shifted at least once a week at first, to dry it thoroughly. For if fermentation takes place, it would turn black and good for nothing. It will be as well to keep a sharp look-out after rats and mice. At the end of a month's time, the hemp-seed will be fit to put into sacks, or into tubs that are open at one end.

In large towns, the consumption of hemp-seed for cage birds is very considerable in amount. Hemp-seed oil is excellent for burning in lamps; it is used in painting and the manufacture of soft soap. The oil-cake left after the crushing process is eaten with avidity by many domestic animals, and is often employed as manure.

The thrashing over, the hemp is ready to undergo the important operation of steeping, which requires to be detailed somewhat at length. One precaution before harvesting ought to be mentioned. As the hemp-seed begins to ripen, clouds of small birds will flock to prey upon it; rodent vermin are also very fond of it; and unless the farmer takes decisive measures, these parasites

will do him serious injury. In one respect hemp gives more trouble than flax, and requires a greater variety of management, according as it is of more or less gigantic stature. When hemp is of the tallest kind, the plan of pulling it ought to be rejected, because the fibres of the root are coarser than those of the stem. In that case it is absolutely necessary to mow it, to avoid spoiling the sample by the admixture of root fibres.

VARIOUS MODES OF STEEPING HEMP.

For hemp, as for flax, the most usual, and the best mode of steeping, or *rouissage*, is to immerse the plant in flowing or in standing water. In some few places, and mostly under the compulsion of adverse circumstances, the retting is effected by spreading it on a meadow, and turning it frequently, till the rains and dews have completed the putrid decomposition of the gummo-resinous substance contained in the bark, and the fibres separate with ease. This method, which is even more rarely employed with hemp than with flax, is known in France by the special term *rorage*, or dew-retting. And lastly, on still more uncommon occasions, the effects of steeping are arrived at by burying the hemp in trenches, and covering it with earth, without the intervention of water. Attempts have also been made to supersede both steeping, dew-retting, and dry *rouissage*, by the agency of chemical and mechanical means. But in whatever way the object is attained, the utmost care ought to be taken to make the putrid fermentation progress uniformly throughout all the stems, and to stop it at the very moment when the gummo-resinous matter is completely decomposed; for if the process is allowed to go beyond this point, the fermentation acts upon the fibre itself, and greatly impairs its strength and quality.

The usual mode of water-retting (the plan which is mostly adopted), is to tie up the hemp-stalks in small bundles or sheaves, and so to immerse them in the water, after having cut off the roots. The bundles ought to be

kept constantly under water, either by loading them with heavy stones, or by pressing them down with horizontal cross-bars. The best medium for steeping in, is water that is almost stagnant, but which nevertheless has its body gradually renewed by a feeble current passing through it. *Routoir* is the French word for ponds devoted to this operation. *Rouissoir*, derived from the same root *rouir*, is a synonym more commonly used in the Pas de Calais.

When the weather is warm, the day after the hemp has been put into the water, bubbles of air are seen to rise to the surface; these are the same as atmospheric air. But on the third day, the fermentation of the submerged plants causes carbonic acid gas to be disengaged; and on the fifth day, or sooner, when the steeping proceeds rapidly, the gas emitted is hydrogen. If the water is stagnant and small in quantity, it becomes discoloured and muddy. The disagreeable odour of the hemp in its natural state is converted into an insupportably fœtid stench, capable of spreading far and wide disease and death. If the water of the steeping-place is still, shallow, and stocked with fish, they are sure to be killed on the first approach of warm weather. In consequence of this, laws have been passed in France prohibiting the operation of steeping in all rivers and large public ponds.

An essential point, which is too much neglected, is to bunch the plants according to their length and ripeness; that is, to tie the tallest into bundles first, and then the next sized, the middling ones, and the smallest, and to proceed in the same way with the thickest and the thinnest stems. Without this precaution, the steeping of the latter will be complete before the former are fit to take out of the water. The general practice is to make two harvests only of the male and female hemp standing in a field, without any regard to these nice distinctions, (on which, however, the superior quality of the fibre depends), in pulling the individual plants of each sex. But in order to obtain an equal quality of fibre, would it not be desirable to let the male plants stand to attain a

greater degree of ripeness, and to pull the more robust female plants a little before reaching their perfect maturity? By this means, greater uniformity would be attained. Even if it be not thought worth while to separate the tall stalks from the shorter ones, at least attention ought to be paid to placing the ripest and the longest stems always in the middle of the bundle, to prevent their being bruised or broken when they are put into or are removed from the steeping-place. The benefit of such an arrangement will be perceived even in the operation of combing, although it takes place so long afterwards. If it is impossible to avoid steeping male and female plants at the same time, it would still be a piece of very bad management to suffer them to be mixed together.

It is equally advantageous to make a difference between the hemp which still remains green, although it may be ripe, and that which is white and yellow; between that which has grown in the shade, or on soils of a very opposite nature. Seed-bearing hemp always takes the longest time to steep, except when it is put into the water at the same time with the flower-bearing hemp, or when it is not completely ripe. The perfection of steeping consists in great part in paying proper attention to the sorting of the bundles, with reference to the length of time which they require to remain in the water; otherwise, some stalks in a bunch will be too forward, whilst others will remain very difficult to peel. This difference of time will run from twelve to thirty-six hours. A good hemp-steeper ought to copy the good vineyard master, who tastes several times in the course of the day the liquor which is fermenting in his vats, to ascertain the progress of the vinous fermentation, and to seize the true moment of its actual completion. In like manner, the steeper ought from time to time to draw single stalks from out the mass, and examine the state of the fermentation, to see whether the fibre begins to part easily from the stem. He will observe that green and coarse hemp is sooner steeped than green and fine; that green in general is quicker done than yellow; long sooner than short; the

root sooner than the head; and that hemp which has been pulled a long time and has become thoroughly dry, requires a much longer time to steep than that which, pulled the moment it is fit, is carried directly from the field to the water. If it is absolutely impossible to steep the hemp a few days after gathering it, it ought not to be delayed later than the middle of October, on account of the cold and rain; moreover, the rapid drying in the sunshine or in the open air, which is so strictly necessary after the steeping, is not easily attainable at a more advanced period of the season.

The time of steeping in different districts varies as much as the vintage and the fermentation of the expressed juice does. It is made to go on according to people's fancy; and is very often regulated by the custom of the country and the purpose for which the hemp is intended to be applied. As a general rule, it takes from four to five days in July and August, from five to eight in September, and from nine to fifteen in October, if the error has been committed of waiting till then.

The signs that the steeping is complete, are the easy separation of the bark from the woody stem, entirely from one end to the other, and the disappearance of the pith. Authorities are not agreed as to the number of ribbons into which the bark ought to separate when it is stripped off; some are satisfied with two, others require three. According to Rozier, two are best. These various details of practical observation cannot lay claim to an equal degree of importance; nevertheless, there can be no doubt that water-retting is a process which varies according to the nature of the water, the maturity of the plant, and the culture to which it has been subjected. Steeping can only be successfully practised by a careful reference to these three circumstances, which must be attentively noticed, and the subsequent treatment adapted to them. All merely general rules must be made subordinate to the above conditions.

Bad management in steeping diminishes the value of the crop to the amount of one-sixth, and often of one-

fourth. What remains is weak and rotten, it falls into tow under the comb; or, if the hemp has not been steeped enough, the residue which is left is harsh and untractable. The latter defect may be corrected; the former is irremediable. The stalks which turn out to be incompletely steeped, are exposed on pasture land to the dew and rain; it would even be possible to put them into the water again, if the trouble of a second drying, and the apprehension of showery weather, did not put considerable obstacles in the way.

The number of bundles that may be arranged one over the other, in the *routoir* or the ditch, depends upon its depth. The shortest ought to be placed at top, in order that the mass may form a slope which shall be better able to keep together. The shape of the pile, however, is a matter of indifference, when, on account of the strength of the current, the number of stakes to hold it together has been increased, the cross poles have been tightly bound to their plaes, at short intervals, and multiplied upon the surface, besides an increase of the ballast of stones. The stems, which require the most active steeping, ought to be placed in the middle, because that is the spot where the strongest fermentation takes place, and the best fibre is prepared, as it is also the position in which it soonest receives injury, if, through any neglect or mistake, the steeping goes on too long. In that case, the upper stratum is of better quality. When the steeping-place is so situated that there is no fear of sudden flushes or rapid torrents coming on, it is a great advantage to refrain from stopping the current of the water, in order to diminish the chance of malaria. A space ought to be left quite round the stack of steeping hemp, in order that, in case of any unforeseen derangement of the heap, the men who have to enter the water for the purpose may remedy the accident with greater facility. And, lastly, it is wise to prefer the situation which affords an opportunity of washing the bundles in running water, after the steeping. The fibre of hemp so treated will be easier to work, and will give out a smaller quantity of

that acrid and irritating dust which is so injurious when hemp is beaten in the mill or finished off with the comb.

Rozier justly remarks that all still waters are not suited to the purpose; some may be soft, although muddy, whilst others may be limpid and yet prove hard. Soft water may contain chalk and infusions of vegetable detritus; such are ponds and ditches near dung-heaps.

In those, hemp is steeped to perfection; they contain a natural leaven, which accelerates the fermentation. On the contrary, in hard waters, charged with selenite, steeping goes on but slowly. These latter increase the weight of the fibre from three to five per cent. more than running water; they act upon it like alum, and are preferred for the preparation both of cloth and thread intended to be dyed; but as they communicate a mordant which retains the colouring portion of whatever infusions or solutions they are laden with at the time the steeping is going on, the fibre, thus naturally dyed or dirtied, is bleached with greater difficulty. Sea-water, the water of salt-marshes, the borders of lakes and large pools, and low spots near the coast, are also used with advantage for steeping hemp. In Ireland, Scotland, and Holland, it is found that sea-salt, although more antiseptic than refined salt, does not hinder the requisite degree of fermentation. It is certain that the operation of steeping hemp would be more quickly performed, and in greater perfection, if the water were always alkaline. Such are the drainings of the dung-heap and the poultry-court; but liquid manure of this kind is always too scarce, and is wanted for other purposes, though in England we too often allow it to be wasted. Moreover, such water is always coloured, and would cause a depreciation of the fibre on account of the tinge which it has thereby received.

Rozier states that he found upon trial that he reaped considerable advantage by steeping hemp in an abundant spring of mineral water, which was alkaline and gaseous in its nature. "Why not make use of these local

advantages," he asks, "for bleaching and for completing the dissolution of the gluten in our fibre, thread, and cloth? The aid of water such as this has raised the bleaching-grounds of Haarlem to a great point of celebrity; bleaching is executed there quickly and well. There is plenty of similar water in France. Chalybeate, earthy, and hard water ought to be avoided with the greatest precaution. The spots caused by iron in the form of ochre are almost ineffaceable. Alkaline waters offer no obstacle to fermentation; when the steeping is over, the offensiveness of the smell they emit is very remarkable."

The importance which the culture of hemp has attained in the north of Italy is well known; and a detailed account of the mode of steeping which the hard-working peasants make use of there, will be interesting to lay before the reader. We translate them from the French of M. de Crud, who has described them in his "Economie de l'Agriculture."

"Hemp-ponds, or *routoirs*, are usually dug in the earth, sufficiently deep beneath the surface of the soil to keep them always full of water. These ponds are provided, over their whole extent, with stakes driven into the earth to the depth of seven or eight feet, to prevent their being pulled up by the effort which the hemp makes to rise to the surface of the water. They are also fixed in regular rows, about six feet apart; and as they support, not far from their top, wooden cross-bars, about six inches broad, and an inch and a half thick, which stretch from one to the other in the same direction, they form a sort of alleys in the water. These stakes ought not to rise higher than just a trifle below the usual level of the water, to prevent their decaying from the alternate action of dryness and moisture. The pond is ordinarily about five feet deep, except near the edge, where there is made a sort of bank of planks, which is covered with no more than from two and a half to three feet of water. On this bank the workmen walk, up to

their waist in water, for the purpose of washing the hemp before taking it out of the *routoir*.

"To steep the hemp, they place in these alleys the bundles as carefully sorted as possible. The bundles are laid *lengthwise* in the alleys; and as many are brought in as will fill the whole breadth of the alley a couple of bundles deep. They then take pieces of wood of the same dimensions as the cross-bars, and about a foot longer than the breadth of the alleys. One of the ends of the piece of wood is introduced beneath one of the cross-bars which enclose the alley, passing over the bundles of hemp; then, by pressing the other end down, they force the hemp to sink in the water, till the other end can be slipped under the cross-bar which is nearest to it. It is evident that the cross-bar performs the office of a lever, and obliges the hemp, in spite of its buoyancy, to sink in the water and to remain submerged. Each end of the bundles of hemp must be held down by one of these pieces of wood. Up to this point, all the operations connected with the steeping are performed by *men*, who walk upon the tops of the stakes, on the cross-bars, and on the hemp itself, without going into the water. These men make use of poles, furnished with iron hooks at their end, to lay hold of the bundles and arrange them in the water according to their convenience.

"There are a few ponds on a different plan; instead of driving in stakes and making wooden benches, no more is done than to pave the bottom, or to line it with bricks and masonry; all round it, the sides are kept up by walls, also of masonry, and the hemp is sunk in the water by means of great stones laid on the top of it. This is the plan adopted in Spain. In general, the hemp which is steeped in ponds like these is of still better quality than that which has been treated in those of the former description.

"When the hemp-grower has no pond, of either one sort or the other, he steeps his crop in runs of water, and in the bed of rivers, fastening it with ropes, for fear lest

any sudden flood should carry his property away with it; or sometimes in ponds that have been dug for the purpose, in which the bundles of hemp are made to sink by loading them with earth, which has been taken from the bottom of the pond itself. Hemp which has been steeped in this last-mentioned way is always much more dark coloured, and its fibre is often sold for one-sixth less than the other sort. In those ponds which are not fitted up with stakes, the workmen who set the hemp to steep are obliged to work in the water.

"Four days after steeping has commenced, it is necessary to inspect the hemp, and to try if the fibre comes away easily from the woody part. It is very essential to seize the moment when that change takes place; for twelve hours passed in the *rouissoir* beyond the necessary time, would considerably injure the quality and the strength of the fibre. About the sixth day the steeping is generally complete; but that depends greatly upon the weather and the temperature. If a very strong fibre is required, in preference to a very sightly sample, the hemp ought to be taken out of the water as soon as the fibre begins to detach itself, when the hemp-stalk is broken. If, on the contrary, good-looking, rather than strong, hemp is required, it is left in the pond for twelve or eighteen hours longer.

"The next step to be taken is the washing. A party of women, dressed in wretched rags, step into the pond, and stand upon the bank which has been purposely built; there they are up to the middle in water. Men (if the pond is staked, but if not, the women themselves) then unfasten the bundles of hemp, and break the bands with which they are tied, in order to separate the bunches from each other. The women then, seizing these smaller bunches with their two hands, and raising them several times as high as their arms can conveniently reach, dash them horizontally with their whole strength upon the water, turning them round a little each time, in order that every part of the bunch may feel the effects of the blow. This operation detaches almost the whole of the

fibre from the woody part of the hemp, and at the same time cleanses it from the mould and filth which hangs to it. After having repeated these knockings of the hemp on the water for three or four times, the workwoman seizes the bunch by the little end, and driving it through the water in the opposite direction, thereby causes the fibre to be detached from the lower extremity of the stem; then, rolling the bunch in the water, she causes the separated fibre to twist itself round the bunch, with the object that, when the hemp is set out to drain and dry, the fibre may not come in contact with the soil. All the steeping-ponds are surrounded by pasture-land, to serve at the proper season as drying-grounds for the hemp. After having washed each bunch in the way we have just described, the workwoman throws it on the green turf; a workman seizes it and sets it on its big end. It supports itself by leaning against the other bundles. In that position the hemp drains. Every day's work commences with the operation which I have just described. About one o'clock in the afternoon, the women come out of the *rouissoir*, dress themselves in dry clothes, eat their dinner, and then proceed to drying the hemp.

"The women, now, if they have not done so before, push, to the upper end of each bunch, the band with which it was tied round the middle; and opening every bunch at the bottom, they spread the stalks that are standing on the grass with their heads aloft and leaning together, almost in the same way as a pile of muskets. The hemp is thus perfectly exposed to the sun and air; nevertheless, even when no rain happens to fall—a circumstance greatly to be desired, especially to preserve the beauty of the fibre,—it takes two days at the very least to dry it completely. If high wind comes on, the bunches out drying are often blown down, and must be set up again as quickly as possible. Towards evening, the hemp which has attained the necessary degree of dryness is loaded on carts, and carried to the hemp-barn, mostly without the workmen taking any rest, except just to eat a morsel.

"It will be remembered that the hemp is often four yards long, and more, even after the top is cut off, because the fibre which that part would give is nearly worthless. This great length is necessarily accompanied by a certain degree of thickness, which makes it impossible to break the stems by means of ordinary scutches, like those used for flax, unless they were made of such a size and weight as would render their use impracticable in any other hands than those of a giant. Recourse is therefore had to the following method:—An upright wooden block is fixed in the earth, about a foot broad, and three feet long at its upper surface, which is cut out in such a way as to leave it of the form of a hollow crescent. Moreover, the edges of this rude crescent are smoothed and rounded so as to present to the fibre a completely even and regular surface. A workman then takes the bunches one after the other, and, beginning by presenting them by the thicker end, he lays them on the block and pushes them forward, so as always to have six or seven inches of unbroken stalk beyond the block. Meanwhile, a couple of women, armed with hard thick sticks, especially clumsy towards the end, something in the style of clubs, beat the end of the bunch as the workman pushes it forward. A single blow is sufficient to crush it, so that if the bunch is twelve feet long, it requires about ten blows from each woman to crush it, the upper extremity which the workman holds in his hand not being subjected to the operation. If the people are expert in this work, a minute will be more than time enough to crush three such bunches. As soon as the man who holds the bunch has advanced it nearly to the end, he leaves hold of it with one hand to seize another, in order to substitute it for the former one the moment he has finished it, and to continue the operation without interruption. Before laying down the beaten bunch, the workmen either shakes it himself with one hand, to get rid of the chips and chaff which have not already fallen in front of the block, or he passes it on to a woman who performs the operation, and disposes the fibre in a bundle. That the workman who

lays the bunches on the block may continue that task without interruption, the woman who brings him the bundles of hemp takes care to place them ready to his hand. The fibre often comes out of this operation completely divested of the woody stem throughout the whole of its length, except at the extremity which the workman held in his hand. Two other scutchings or beatings take place with smaller tools. At the last one, the workman is not content with beating the fibre; he pulls it while it is pressed with his tools, to soften it and clear it from any knots and bits of chaff that may still remain adhering to it. The fibre is then folded in two, and packed in bales to be delivered to the merchant."

To this very complete description we can only add a few judicious words from the Abbe Rozier, relative to the sanitory precautions desirable to be observed with steeping-ponds.

"Whether the water is stagnant or running, and in whatever spot the *routoir* may be situated, it is essential to plant rows of trees around it. Poplars are preferable to any others. One of the grand agents which nature employs for the purification of the atmosphere, is the vegetation of plants and trees. They feed upon the impure air given out by steeping-ponds, appropriate it, and in return give back pure air to the atmosphere. But even with this resource at hand, it will be seen that the establishment of *routoirs* in the vicinity of dwelling-houses is an extremely unhealthy and imprudent practice, since the trees cannot entirely absorb the enormous mass of mephitic air which escapes from hemp in a state of putrid fermentation. Spots ought to be selected which are exposed to the wind and open to violent currents of air.

"It is useless to make steeping-ponds too broad; at least they are very inconvenient. I should prefer extending them in length, whenever required, particularly if they are to serve for a community of hemp-growers. In that case, every individual finds his own place, without disturbing that of his neighbour; and a smaller quantity

of water is required. The bottom ought to be paved, with a slope towards the place where the water is let out. There ought, indeed, to be a double outlet, one at the surface and one at the bottom, either to be used as occasion may render convenient. The sides should slope with so steep an inclination as to allow the workpeople to approach with ease, and not be obliged to enter the water, in order to arrange or alter anything in the hemp-heap, as will be necessarily wanted from time to time. The sides, if not built of stone or brick-work, should be covered with cement of sufficient thickness. The mud taken every year out of the bottom of the steeping-place, makes excellent manure."

DEW-RETTING, OR RORAGE.

A month is the time ordinarily required for dew-retting hemp in the open air. It is impossible to make sure that during this interval, there will be no showers, tempests, or hail, and above all that the hemp will not be attacked by insects. High winds may ruffle it, or blow it away; heavy rains may dissolve unequally as well as too rapidly the gummy principle contained in the bark. Hemp, which at the beginning of its air-retting, is exposed to frequent or heavy showers, is apt to turn black, and mostly remains of a permanently dark grey colour. The fibres adhere together more firmly than in hemp which is retted without exposure to rain, nearly in the same way as the hairs of a painter's varnish-brush when it is dry. Twisting the hairs of such a brush, causes the resin of the varnish to fall off in a state of powder. Now, it ought never to be forgotten that the best performed retting still leaves a considerable amount of resin in the hemp; and we cannot too strongly insist on the fact, that *that* is the principal obstacle to the bleaching of thread and cloth. Such, too, is the origin of the annoying dust (as inflammable as powdered colophone, or fiddler's rosin) which fills the air of the workshops in which the beating and scutching of the fibre is performed, and which by

the virulence of its nature distresses the lungs of the persons employed therein. Hemp in all shapes, both in the stalk and the fibre, gives out more or less of it; but the workmen are only too well aware that dew-retted hemp is the most acrid and annoying of all.

To obviate this serious inconvenience, as well as to shorten the time of retting, Rozier tried the plan of moistening the hemp with slightly alkaline water before exposing it to the weather. The experiment succeeded. A slight mixture of potash, and, as we before observed, the drainings from dunghills and poultry-yards, would answer the same purpose. He also moistened the hemp with lime-water, and found that it answered even better. By this process, not only is the resinous gluten dissolved, but the hemp also acquires the property of attracting and retaining the atmospheric moisture, which is greatly in aid of the object proposed. The same result is obtained in Holland by sprinkling the hemp with sea-water as it lies on the meadow.

A defect which is the special consequence of retting in the open air, is the decided spottiness, of a lighter or darker brown, with which all the stalks are blemished. These spots, as has been before observed, only occur when the earth contains particles of iron, which are divided and distributed in the form of rust. They are so difficult to efface, that it almost baffles the bleacher's skill to bring to a good colour cloth that is manufactured of thread like this. Dew-retted hemp is therefore often rejected, in spite of the other good qualities which it undoubtedly possesses. The utmost caution ought to be observed never to rett hemp on soils which abound in ochre and gravel. Rocky, chalky, and marly land, is the only kind which is suitable.

It is evident from the above considerations that dew-retting is a long, troublesome, laborious, and even expensive process; it is quite unsuitable for large farmers, unless their occupation is almost entirely without water; in which case, it is scarcely probable that they have ground proper for the growth of hemp. Dew-retting is

not to be recommended to any except small proprietors; and then they will prefer water-retting, when the thing is possible and the season not altogether adverse. Hemp that has been dew-retted with the precautions we have pointed out, sometimes produces a superb sample of fibre, of brilliant and prepossessing appearance; it is rather weak, extremely flexible, fine, and silky. In the south of Europe, where the hempen fibre is both delicate and strong, the climate fine, showers rare, and the dews very abundant, this method is preferred, the more so as the length of time which the retting takes up subdivides the fibre, softens, and smooths it, but is unsuited to the north of France, and still more so to Great Britain, whose climate is inclined to be moist and showery, and where warm weather is seldom of long duration. Nevertheless, if one were compelled by circumstances to locate a steeping-place close to human habitations, it would be wiser to run the risk of loss from imperfect dew-retting, than to fall the victims of malaria. We do no more than allude to the other mode of retting which has been attempted, with a view to get rid of the offensive vapours, by putting the hemp in trenches, and covering it a foot or more deep with earth. In the first place, the process is extremely hazardous. Without in the least intending a pun, we may say that *rotting* is more likely to be the result than *retting*. And secondly, when the trench is opened, the noxious air escapes in a concentrated form, and must be extremely injurious to the persons employed.

MECHANICAL AND CHEMICAL CONTRIVANCES TO SUPERSEDE RETTING.

The inconveniences attached to the different methods of steeping and retting hemp which we have just described have long directed the attention of scientific men to the discovery of some simple method which should attain the same object, without its disadvantages. The means proposed have been either chemical or mechanical. Among the former, we will confine ourselves to those

recommended by M. Bralle; among the second, to those of M. Christian, as having attained the greatest notoriety.

M. Bralle's chemical plan of steeping requires for the execution of the process nothing more than a cylindrical copper vessel, resting upon a small brick furnace. A *routoir* of this description containing fifty gallons of water is sufficient to steep at one time more than forty pounds of hemp in the stalk; and, as the operation is completed in a couple of hours, two hundred pounds or more can be easily steeped in a single day.

The means employed by M. Bralle for steeping hemp, consist, First, in heating the water in a vessel to the temperature of from 72° to 75° of Reaumur's thermometer. Secondly, in adding a quantity of green soap in proportion to the weight of hemp which it is intended to steep. Thirdly, in immersing the hemp so that it is covered with the heated liquor; in closing the vessel and putting out the fire: and Fourthly, in letting the hemp remain in this sort of *routoir* for two hours before taking it out.

The weight of soap necessary for a complete steeping ought to be in the proportion of 1 to 48 to that of the hemp-stalks; and the weight of hemp to that of water in the ratio of 48 to 650. Several steepings may be performed one after the other; all that is required is to replace the quantity of soapy water which has been absorbed by the preceding operation, and to raise the temperature of the liquid to the above-mentioned degree. In this way, the same water may be made use of for a fortnight successively. When the bundles of hemp are taken out of the vessel, they ought to be covered with straw or other matting, to make them cool gradually, and to prevent the moisture from evaporating. Next day, the handfuls are spread upon a boarded floor, their bands being pushed upwards to the top of the stalks; they are rolled several times with a heavy stone or wooden roller laden with a weight, to flatten them and dispose the fibre to come away freely from the woody portion; which is effected by means of the *braque*, whether the

hemp is moist or dry. It scutches perfectly in either state. The upper part of the handful of wet-scutched hemp is tied in a knot; it is then laid out on the grass, and turned. In six or seven days it is ready to be taken up and carried to the warehouse. It is equally requisite to expose on the grass the handfuls of steeped and flattened hemp which it is wished to break and scutch in a dry state. Such exposure is absolutely necessary to bleach the fibre and facilitate its separation from the stalk. By making use of a portable steeping-vessel, it is easy to operate upon different quantities of hemp, to vary at pleasure the temperature of the soapy liquid, and to watch the state of the hemp during the course of each operation, the duration of which has been purposely more or less prolonged, in order to ascertain, First, the temperature which the liquor ought to have before the hemp is immersed in it; Secondly, the time necessary to effect a complete steeping at a given temperature; Thirdly, the quantity of soap absolutely necessary for a given weight of hemp-stalks weighed before immersion.

The result of a great number of experiments is; First, that the water in which the quantity of green soap directed by M. Bralle for a given weight of hemp has been dissolved, effects the steeping perfectly.

Secondly, that steeping is more rapidly completed in proportion as the liquor is nearer to the boiling point at the moment when the hemp is immersed in the vessel.

Thirdly, that if the hemp is kept in the vessel more than a couple of hours, the time mentioned by M. Bralle as sufficient to complete the steeping, the fibre separates equally well from the stem, but acquires a darker tinge and loses a portion of its strength.

Fourthly, that if the hemp is plunged into the soapy liquor while cold, and the two are then heated together, the steeping is not effected so thoroughly, to whatever degree of temperature the liquor is made to rise, and whatever may be the duration of the immersion.

Fifthly, that the bundles of hemp when plunged vertically into the vessel and kept there in an upright posi-

tion, are steeped more uniformly than if they were laid therein horizontally. Moreover, this position renders the work easier.

The following are the principal advantages which the above mode of steeping offers: First, steeping can go on all the year round, except during hard frosts, on account of the difficulty of drying the hemp afterwards. Nevertheless, if wet-scutching be employed, the cold is not an obstacle; it is then only requisite to take the precautions necessary to keep the hemp from being frozen while it remains wet. Secondly, as the duration of the steeping-process is only two hours, the farmer insures a valuable economy of time, especially during the harvest season. Thirdly, the labourer is relieved from all apprehension respecting his health; all he has to do is to cause a current of air to blow at the moment when the bundles are plunged in and taken out of the *routoir*. The handfuls of hemp, when they are afterwards laid out on the grass, either in the form of stalks or fibre, do not send forth any unpleasant odour, nor injure the purity of the air, whatever quantity of hemp may be put to dry at once upon the same spot. In order to expedite the operation of steeping by the new method, in districts where hemp is largely cultivated, instead of the portable *routoir* which served to make the experiments with, the following apparatus may be employed, composed of a cauldron, or boiler, and four wooden tubs to serve as steeping-vessels: after having heated the soapy water in the cauldron up to the boiling-point, it is made to flow, by turning a cock, into two of these steeping-tubs, which have been previously filled with hemp-stalks, and covered with a close-fitting lid. While the steeping is going on in the first two tubs, the requisite quantity of liquor is heated to fill the other two, which in like manner are filled with bundles of hemp, and covered with their respective lids. By means of this simple apparatus, a very large amount of hemp may be steeped daily without interruption. Fourthly, the expense of water-retting, compared with that required by M. Bralle's method, is pretty nearly the

same when the operation is performed with the little *routoir;* but if a good-sized cauldron and wooden tubs, like those we have just mentioned, be employed, the expense will be reduced by more than one half. In fact, the items of the former, or water-retting, are made up of the carriage of the hemp to be steeped, the time employed in making the bundles of hemp into a sort of rafts to make them sink, in loading them with stones, turf, clods of earth, and even mud, to keep the rafts steadily at the bottom by means of stakes that are driven into it,—a long and troublesome operation; for it is only able to effect the immersion of ten pounds of hemp-stalks by applying a weight of from fifteen to twenty pounds, besides having the task, after the steeping is complete, of removing all this weight of ballast, and taking the bundles out of the water and washing them. The expenses of the new plan consist principally in the cost of the solvent and the fuel employed. But supposing the expense of each mode to be the same, it cannot be denied that the new method merits the preference over the old one, inasmuch as it renders the manual labour much more light and expeditious. Fifthly, eight pounds of hemp-stalks steeped by the new process produce generally two pounds of pure fibre by means of wet-scutching; whilst hemp water-retted according to the old plan and *braqued*, afterwards, gives a considerably smaller portion of fibre. The dry-scutching of hemp steeped in the old way does not produce the same quantity as when the fibre is removed in a state of humidity. The breaking of the stalk in several places causes a greater waste of the fibre. From eight pounds of hemp-stalks there have been obtained by the new method two pounds of fibre, one pound of which was of first-rate quality; a result unknown to be obtained by any plan of manipulation hitherto practised. Sixthly, people dwelling in valleys and on the banks of rivers are at present almost the only persons who are able to cultivate hemp profitably. They owe this privilege to the vicinity of water and to the moisture of the soil. By

the new method, the growth of hemp is extensible to a great variety of localities.

In spite of the brilliant advantages held forth by M. Bralle's invention, and which seem to be scarcely disputable, his method is far from being generally practised; and hemp-growers in the neighbourhood of Paris, who adopted it at first, relinquished it afterwards. It is impossible to decide with certainty whether the cold reception his process has met with be the result of accidental circumstances, such as the temporary dearness of potash and soda, or of indifference on the part of the farmers and the instinctive power of the spirit of routine. But it is certainly desirable to call the attention of enlightened agriculturists and landowners to M. Bralle's plan, and to make renewed efforts to insure their adoption, if the advantages proclaimed by the learned men whom the French government deputed to examine it, are as great in reality as they are in appearance.

A smaller space will suffice to devote to the mechanical process proposed in 1818 as a substitute for the water-retting of hemp by M. Christian, director of the Conservatoire of Arts and Trades at Paris. Notwithstanding the ingenious construction of the machine which he invented to separate the filamentous parts of the stalks of hemp and flax by means of bruising them, instead of previously submitting them to the dissolving action of steeping, and notwithstanding the hopes to which this invention gave rise at its first appearance, its inefficiency was soon discovered. The reason why this and all similar machines must ever be incompetent to perform the office required of them, is clearly explained by the Count Gallesi, the author of an excellent Italian memoir on the culture and manipulation of hemp and flax. "Maceration," he says, "is an operation indispensable to obtain from the hemp-plant a tissue suitable for making cloth. It may be said that it can be dispensed with in the case of hemp for rope-making. I do not admit the supposition; but even granting it, the same thing cannot be admitted with regard to hemp destined for cloth. The

bark of the hemp is the portion which furnishes the tissue; it is composed of an infinity of longitudinal fibres, lying one over the other, and joined together not only by the force of adhesion proper to vegetable tissue, but still more strongly by a sort of gummy substance, which unites it to the woody part. No mechanism whatever can clear the rind from this substance, and still less the woody stem, which also contains it. I have tried several of the methods that have been proposed; and I have found that unmacerated hemp contains, first, a more flaccid wooden stem, which does not break in the same way as in hemp which has undergone the operation, and which is consequently more difficult to separate from the tissue; and, secondly, a denser kind of bark, adhering more closely to the woody part. The hemp breaks off during the processes of preparation, resists the action of the *séran*, or comb, and never acquires the softness and fineness necessary to make it into thread. Maceration is the only process capable of dissolving and decomposing this substance, and of giving to the tissue the flexibility, brilliancy, and disposition to subdivide to the greatest possible extreme, according to the nature of the fibres. This operation appears to act in two ways, by fermentation, and by solution. By the first, the gummy-resinous substance is decomposed, and loses its tenacity; by the second, it remains dissolved in the water, and is lost. Chemical processes are the only ones capable of obtaining from unmacerated hemp fibre of fine and supple quality. But it should be remembered that these processes obtain such a result only as far as they are exactly equivalent to the maceration for which they are substituted. The gummy substance remaining in the rind prepared by the different machines that have been invented, is dissolved in the chemical apparatus, and the hemp which is the produce experiences the same effects as it would have done from maceration before it was bruised. The only difference in the two cases consists in the greater loss which must necessarily occur in the second instance; because all the operations per-

formed on hemp that has not been softened by maceration, connot help spoiling a part of it, seeing the difficulties which they have to surmount in order to divide the threads, and to disunite them by mechanical means from the heterogeneous substances with which they are combined."

In all cases after hemp is steeped, and is dry again, it is in a fit state to work. In the Pas-de-Calais, where hemp grows only to the same moderate height which it attains in Great Brittain, the stems are not scutched or beaten, like flax, to obtain the fibre, but it is peeled off by hand. This work is performed, during their evenings, by workpeople, together with their whole families, who employ themselves in hemp-peeling when their day's work is done. A child of four or five years old is capable of executing the task. The head of the hemp-stalk is simply broken with the fingers, and the whole of the fibre comes away with it at once. The string of fibre is thrown on one side, and the denuded hemp-stalk is cast on the other, to make sulphur-matches with, for which purpose it is in great demand, the consumption for pipe-lighting being enormous in France. The match-makers buy their bundles of naked stalks in pairs, one bunch of male and one of female stems, that is, of shorts and longs. Each individual can earn two *sous*, or a penny, per evening by hemp-peeling. The people are satisfied if it pays them for their candle and their tobacco. It seems a very trifling sum; but suppose a man has six children: they alone will thus produce six-pence a night, or three shillings a week, at a task which is not laborious, and in a country where provisions are generally cheaper than in the neighbouring districts.

THE END.

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