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THE

FARMER'S GUIDE,

OR

A NEW THEORY OF AGRICULTURE;

FOUNDED ON

PHILOSOPHICAL AND PRACTICAL PRINCIPLES,

AND

ADAPTED TO ALL CLIMATES.

BY JAMES GASKINS.

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1838.

TO THE

AGRICULTURAL INTEREST OF THE U. STATES.

GENTLEMEN:—

HAVING, after the expiration of more than thirty years, spent in the pursuit of practical Agriculture, arrived at certain conclusions entirely at variance with the old established doctrines, it is my sincere desire that I may be successful in imparting to my fellow citizens, that knowledge on the improvement of the soil. It is my object also to shew, why lands are so soon exhausted by the cultivation of certain crops, and the mode to be pursued for its preservation and resuscitation. The plan which this work proposes, will insure the cultivation of your different crops of grain and vegetables without exhausting the soil, and also will insure the restoration of those lands which have been exhausted by the following crops, viz: wheat, corn, oats, rye, barley, tobacco and any of the vegetable products. By the process here recommended, lands may be made very rich in eight or ten years, though a crop of grain, tobacco, or the grasses, be taken from each field every year. By this entirely new system of husbandry, all

species of property would necessarily rise in value, and the tide of emigration to distant lands would cease. It is hoped that the people will open their eyes to their own interest, and no longer impoverish their lands, when it is equally easy to improve them.

I submit this work to the impartial consideration of an enlightened community, firmly believing that an adherance to the principles here laid down, will not disappoint the expectations either of the community or of the author.

Who very respectfully subscribes himself,

The public's very humble servant,

JAMES GASKINS,

Proprietor of the American Hotel,

And Virginia House,

Baltimore.

INTRODUCTION.

THE true art of cultivating the earth, is to cause it to produce the greatest possible quantity of sustenance for man and beast, with the least possible injury to the land. This art is the foundation of all other arts; at once the most useful, healthful, and agreeable. Snatch from man this glorious art, and he at once sinks to a level with the savage, who roams the forest, and dwells in rudely constructed huts or caverns. Being the most ancient, as well as the most useful, Agriculture is not only a national blessing in one respect, that it feeds man and the animals which he governs; but that it gives employment to seven-eighths of the people of all civilized countries, and at the same time humanizes and harmonizes the mind.

The first account we have of the rise or of the existence of Agriculture, we find in the writings of Moses. Cain, we are there told, was a "tiller of the ground," and that his brother Abel made a sacrifice of the "firstlings of his flock." Again, we are told that Noah "began to be a husbandman, and planted a vineyard."

The Egyptians carried their veneration for Agriculture to a high pitch of enthusiasm; so much so, that they worshipped the ox in gratitude for his services in tilling the soil.

The Chinese, as well as many others of the ancient oriental nations, held the art of husbandry in high estimation, considering it the most honorable and the most lucrative.

Many works were written on Agriculture by distinguished ancient authors, though the greater number of them were lost in the long midnight of time, during the dark ages, when war was the only accomplishment which could elevate one individual above another. The Greek author, Hesiod, who flourished about the time in which Homer wrote, is said to have given to the world a poem on Agriculture, with the singular title of "Weeks and Days," in allusion to the fact that days and seasons are observed in husbandry.

The Carthagenians, perhaps, carried Agriculture to a higher state of perfection than any other ancient people. A certain Carthagenian general is reported to have written more than twenty-five books on husbandry, and in such estimation were they held, that, according to several ancient authors, the Roman Senate, the most renowned body in the world, ordered them to be translated into Latin for the use of the people of the Roman empire. The Roman people deserved great praise for their devotion to the plough.

At one period a citizen of that mighty empire could not be rendered more illustrious than to be called a skilful husbandman. Virgil, in his immortal poem, has corroborated the fact, that men were distinguished by their love of this science. M. Cato, the great orator, warrior and statesman, was more proud in speaking of an agricultural work he had written, than when he beheld triumphal arches rise to commemorate his brilliant exploits in the field. Pliny, and Varro, were also illustrious men who wrote upon, and admired the subject of husbandry. The celebrated Columella, who lived during the reign of the emperor Claudius, gave to the world twelve books on Agriculture, which were highly prized.

But, unfortunately for the present day, as observed before, the dark ages have buried in their eternal gloom the proud monuments of many a glorious genius. But such is the fate of man. He builds, as he vainly supposes, imperishable mementos to his renown; yet, alas, they are touched by the noiseless tooth of time, and they crumble into dust—they pass away like the flickering shadows of a summer's evening.

Yet though the noblest works of ancient genius perish, and the remembrance of them only lives in tradition, Agriculture shall still triumph, and shed its light upon the world, when even the proudest potentates of Europe have tumbled from their thrones, and are lost in the solitude of the grave.

It will be the object of this work to show, however, that the most distinguished Agriculturists have mistaken the true path, and that they have groped in utter darkness. That this assertion is true, I need only point the reader to the worn out lands of many parts of this otherwise flourishing country. Improper tillage has reduced them to what they are, though nature never designed that they should wear out. It is unreasonable, it is unnatural to suppose so. As well might we say that many or all the laws of nature are fickle and unstable, as to say that nature intended that the soil, which was intended to feed all animate nature, should soon by a law become incapable to fulfil its office. No; it is the mistaken notions, it is the improper culture of man. Therefore, as observed before, it will be the especial object of this work to explode all such unnatural theories.

JAMES GASKINS.

Baltimore.

A NEW THEORY

FOR THE IMPROVEMENT OF THE SOIL,

IN WHICH IT WILL BE SHOWN THAT AGRICULTURISTS HAVE HERETOFORE OPERATED AGAINST NATURE, INSTEAD OF AIDING HER. ALSO, IT WILL BE PROVEN, THAT LAND MAY BE RENDERED RICH WITHOUT THE APPLICATION OF A PARTICLE OF STABLE OR COMPOST MANURE.

THE landed estate is the most sacred interest that we have in the United States; whatever concerns Agriculture concerns every inhabitant of the globe, for its interests are the interests of the world; and, therefore, every effort that is made to advance the success of the farmer, must spring at once from a pure spirit of philanthropy and patriotism. He who introduces into the art of Agriculture any thing new and useful, renders himself at once a greater benefactor to mankind, than he who thunders at the gates of cities, and achieves a thousand victories in the field. I hold the doctrine to be incontestible, that the man who advances in any manner whatever the art of husbandry, is more deserving of fame than was the mad Macedonian when he conquered the world, and saw

the nations of the earth kneeling before him;—yes, he is far more worthy of renown than was Napoleon, though thrones trembled and crowns crumbled at his approach. Alas, that the benefactors of mankind should so often have met the cold indifference of the world, and have been left to pine in penury, and perish unnoticed and disregarded. To the warrior who destroys thousands of his fellow beings, and makes so many mothers mourn, the marble monument is erected, and his renown is recorded on the imperishable pages of history. To him who invents a many chambered rifle to destroy the human race by the wholesale, thousands of money are given, and his name recorded in the temple of fame. But how did poor Whitney, the inventer of the Cotton Gin, live and die? Alas! though his invention has given millions to the Southern States, yet he died a beggar, after crawling through existence in the most abject poverty.

In presenting novel views, upon a subject which has elicited the profoundest attention of the Geologist, we well know that we must subject ourselves to the cavils of the ignorant, as well as the prejudices of the inexperienced. Relying, however, on the patient observation and experience of threescore years, we fearlessly present our views, having seen the practical effects growing out of what others will term a dangerous innovation, or novel theory. There is evidently a strong tendency in the human mind to start at

any new system which may be advanced, and it has been the case from time immemorial. When Christopher Columbus first advanced his splendid theory of the necessity of a fourth quarter of the globe, the kings of Europe, to whom he applied for aid, ridiculed the project, and denounced him as a dreamer, an enthusiast or a maniac. He was at last indebted to a woman, queen Isabella of Spain, for his outfit; which resulted in the brilliant discovery of America. This is mentioned to shew how prone men are to ridicule and undervalue any thing that does not bear the stamp of age. Such was the fate of Fulton, when he projected the plan of steam navigation. The idea of moving any thing by the mere steam of boiling water, was perfectly ridiculous to the minds of thousands; and, consequently, no purse was open to aid him in his grand and glorious enterprise. But when the thousands who came on the wharf at New-York to hiss, saw the boat move on the water like a thing of life, their hissing was changed to shouting. What a triumph of genius was there! The above facts are brought to show, that no theory, however novel, should be rejected without deep and candid examination. Many facts are elicited, and many discoveries made in the world, that incredulous persons never could have conceived. Thirty years ago, what man would have believed that in 1838 steam cars would be running on railroads at the rate of twenty, forty, and even sixty miles per hour?

We assume, then, as a proposition, that land is not exhausted by its products; but that its exhaustion arises from the exposure of the land to the sun during the period of making the crop, together with the consequences growing out of the naked or unclothed condition of the land during winter.

To prove this, take a view of lands that are richly timbered and which are generally found to be the richest. It is evident that the heavy growth of timber does not weaken the soil in fifty years, for the trees flourish, and the land is strengthened; and the leaves which fall protect the soil in winter. Reverse the matter, and take a view of a tract of land which has not been sown in grain for many years, but which has been used for pasture ground. It will become impoverished; hence it follows, that the products of the soil do not weaken it.

In order to sustain the above proposition, we shall offer a few illustrations which must come home to the mind of every practical farmer in the country. If you place a small coat of grass on your land, will the sun have the same power to extract the nitre from the soil and cause it to become dry? Certainly not.—No man who has observed the operations of nature will contradict the position here assumed. Then if your soil remain moist, having a coat of grass upon it, it will not only be placed in a situation to receive the moisture of the atmosphere, or the dews of the evening, but it will retain them. By this mode your

lands must become enriched, for the rains, dews and snow are replete with nitre, and by placing this coat of grass upon your land during the Fall and Winter, you not only keep your land warm, but you retain the nitre which would otherwise have left the frozen earth. The affinity between the moist grass and the nitre would retain it until the following day, when it would melt and fall back upon the soil, enriching and improving it. For the nitre never leaves the soil in a frosted state, but becomes so when exposed so to the atmosphere.

Take for example, to elucidate the above, a plank ten or twelve feet long and twelve inches wide; lay it on the naked surface of the ground when frozen; turn it over next morning, and you will find the under part of the plank white as snow. This result is produced every night, and a constant evaporation and exhaustion is carried on through the winter. Whence arises this frost? I answer, from the soil; and it is this which impoverishes, exhausts, and weakens the soil, just as the rising of cream on new milk leaves the milk destitute of its original strength.

The proper mode, then, is to put all your land in timothy and clover, except that portion you retain for the production of Indian corn, wheat, oats or tobacco, and by this mode, simple as it is, you not only protect your land from the heat of Summer and the cold of Winter—you not only preserve its inherent heat and fertility, but in the course of a few years your

land will become positively enriched. Every farmer should divide his farm into six parts or fields, two of which should be in wheat, corn, oats, tobacco or any other vegetable productions. The other four fields should be in clover, timothy, or any of the grasses. The fields should be numbered one, two, three, &c. For instance, No. 1 should be in corn; No. 2 in grasses; No. 3 in grasses; No. 4 in wheat, tobacco, or such like production; No. 5 in grasses, and No. 6 in grasses. Now in order to give the land that rest which it absolutely requires, the fields before numbered, must be cultivated in regular routine; that is to say, No. 1, that is this year in corn, must be left in clover; and No. 2, that is this year in clover, must next year be planted in corn. Also, No. 4, that is this year in wheat, must be left in clover; and No. 5, which is in grass, must next year be seeded with wheat, oats, or tobacco. This routine should be regularly followed, by which the greater portion of the farm, say two thirds, would be in a state of rest; and being shielded from the rays of the sun by the coat of clover, evaporation would be greatly lessened, the earth would retain all the fatness it possesses, and would be continually increasing in fertility, from the abundance that falls from the clouds.

No intelligent farmer should take more than one crop of grain or clover in one year from any one of the fields, as the old plan of cutting several successive crops of clover the same year, leaves the land

exposed, and the consequent impoverishment which ensues, more than counterbalances the extra profit which he derives. It should be enough that he derives the benefit of a crop from every field. The four crops of clover will be as profitable as the two crops of grain, after deducting the expenses of cultivating the latter. Evaporation is the great enemy to land; a much greater enemy than mankind have yet conceived it to be. That the system advanced in this book may be the better understood, I shall describe the manner in which water is taken up into the higher regions; how clouds are formed, and the rain thrown down upon the earth.

PHILOSOPHICAL EXPOSITION OF EVAPORATION —OF THE ASCENT OF VAPOUR—OF THE FORMATION OF CLOUDS—AND OF THE CONDENSATION AND FALL OF RAIN.

IT is a fact well known in Natural Philosophy, that all the water of the earth, seas, lakes, rivers, &c. is alternately raised by the heat of the sun, and thrown down from the clouds to the earth. This beautiful process, this wise provision of nature, is constantly going on day and night, Winter and Summer. It is from this cause that the earth is not drowned by the vast quantities of water which fall upon it. It is a well known truth, that there is not one

drop more or less of water now, than there was at the creation of the world.

It is a law in philosophy, that heat expands and cold contracts all bodies. It is said that there is but one exception to this rule, but whether it is really so or not I am not prepared to say, as the greatest philosophers are at variance on the subject. The exception I allude to, is the freezing of water. It is well known to every individual, that water expands in freezing, and to such a degree as often to burst asunder the vessel which contains it. Now whether it actually absorbs heat in the act of freezing, I am not prepared to say. If it does, it is no longer an exception to the general rule. Some authors have contended, that the expansion of water in the act of freezing, is owing to the awkward arrangement of the particles.

But to proceed. In the beginning of the world, when God said, "Let there be light, and there was light," the first golden ray which fell from the glorious orb,—the sun,—on the earth and ocean, by expanding the particles of water, it became vapour, and being lighter than the atmospheric air, it ascended by a well known law into the regions of space. Now all bodies have a tendency to approach the centre of the earth, in proportion to their weight, or in proportion to the great quantity of matter in a small compass. An ounce of gold, which is next to the heaviest of all metals, will never rise in the atmosphere

while it remains in a solid cube or bar; but when the gold beater has hammered it into thin leaves, it rises and floats in the air. Its great surface gives the air power to support it, and hence the attraction of gravitation is destroyed.

It is thus with water. Heat expands the dense particles of water, which becoming lighter ascend to the higher regions. If the atmosphere, which ascends forty miles above the earth, were every where of the same density, the vapour of the earth and sea would rise to the top; but nature designed it otherwise. The density of the air decreases in proportion to the squares of the distances from the earth. Consequently, so soon as the vapour rises to a region where the air is equally rarified, it ceases to ascend; but floats in beautiful white clouds over the earth, or appears in the West in darkness and storm, its bosom occasionally illuminated with the livid lightning.

As was observed before, the vapours arising from the earth accumulate in the upper regions, where the atmospheric air is of the same specific gravity. Here, by the great accumulations of vapours, clouds are formed; which by coming in contact with a cold current of air, are condensed into water; and which by the law of gravity or weight, falls to the ground. The principle of condensation any one may observe in Winter, by blowing his breath against a cold pane of glass. Every person on a frosty morning must have observed the column of smoke-like breath which issued from his mouth.

The manner in which drops of rain are formed is this. The cold stratum of air coming in contact with the vapour, condenses into water the minute particles, which coming within the sphere of each other's attraction, are united in the form of *drops*. Becoming solid, their weight is increased, and they must descend on the fields and flowers of the earth.

How wonderful, how beautiful, are the works of nature! How much should we lift our minds to the great Author of such wonders! How nicely he has adapted every thing to its proper use. If the vast reservoirs of the earth were never emptied by evaporation, vegetation would perish from the abundance of water, and on the contrary, if all the waters were drawn off by evaporation, the vegetable kingdom must droop and die. Again, were the vapours which are carried up from the earth always to remain in a state of vapour, the principle or law of evaporation would be of no service; and on the contrary, were the power of attraction increased, the water instead of coming down from the clouds in drops, would fall in solid masses and crush the vegetable creation beneath its mighty mass.

Thus, to recapitulate, we find that the water, which we find in the ocean to-day, is to-morrow carried up by evaporation in the clouds, and descends in the form of rain, hail, snow, frost, or dew, according to the height which it ascends, and the coldness of the current of air with which it comes in contact.

Here, then, I come to the point necessary to elucidate the subject under consideration. When rain is formed, it is by the simple condensation of the vapour into drops. When hail is formed, it is first by condensation of the vapour into drops, which by a very cold current are frozen into hail stones as they fall. Snow is nothing more than half condensed vapour, frozen just before it falls, by attraction, into drops. Dew is fine vapour which has not ascended high into the atmosphere, and falls before attraction renders the drops large, by bringing many of the particles together.

Now all these, by percolating or filtering through the earth, leave the nitre which they contain in the soil, and render it rich when the land is screened from the sun by a coat of clover or any of the grasses. As was observed before, this is effected in the same manner that a spot of earth becomes rich when covered with a plank or pile of stones.

ON THE

CULTIVATION OF WHEAT.

Permit me to give you my opinion as to the proper and best manner of cultivating wheat. In the first place, procure the best seed wheat you can obtain, and instead of ploughing your fallow in the months of June, July, or August, you should seed your wheat in the months of September and October, on the top of your clover, and on the hard ground. Plough your clover wheat in about four inches together, and as soon as you turn them under, seed the same ground down in buckwheat. Then apply a large fallow harrow and pulverize the ground. Use the harrow in the same direction that you ploughed it; then seed the ground in timothy or orchard grass, and the clover will seed itself from the crop you have turned in. Clear out your furrow, so as to drain the land, and then take as heavy a roller as you can obtain and roll the land crossways. You may see from this mode of seeding wheat, that it is all manured in the hill. I have turned under the clover and the soil together, which manures the wheat. The buckwheat will come up in six or eight days, and cover the land from the sun. The clover and timothy will do likewise,

and by the time the frost takes the buckwheat, it will be from eighteen inches to two feet high. The frost will kill the buckwheat, but the straw will remain, which will keep the land warm and the wheat will remain beautifully green all Winter, with the clover and timothy. Your wheat will branch from ten to fifteen times, and will branch again in the Spring following. By this mode of seeding, your wheat will be as thick as it can stand, and as high as your chin.

It is an undeniable fact, that you will never fail to make a crop by this mode of procedure. The Winter cannot kill your wheat, clover or grass, for the straw which remains on the land from the buckwheat will preserve and keep them warm, as was observed before.

If there should be a small fall of snow together with a wind, the snow will lodge in the straw, which will retain it and keep it from blowing off. The crop of straw will prevent the evaporation of the frosts in winter, for as the Nitre that leaves the earth which makes the frost on the underside of a plank which lies on the ground would evaporate in the air, if the plank were not there, so it is the case with all lands which are left in a naked and exposed state. If your lands are covered with grass they will retain the Nitre until next day, when it will dissolve and fall back into the soil, thus rendering your land constantly richer.

In the Spring, so soon as the hard frosts are over, your land should again be rolled, so as to set the

wheat and grass back into the soil. Then your crop will proceed to grow vigorously, and your soil to improve rapidly. Your wheat land is left under clover and timothy, and you should not turn any kind of stock on your stubble field; but have your stubble raked as carefully as possible, by which means you will save all your scattered wheat. You should by no means pasture any of your lands which you intend for cultivation and wish to improve; for the cropping of the clover or grass exposes the lands to the direct rays of the sun, which, as before observed, carry off by evaporation the richness of the soil.

NOTE.—I have known one gallon of wheat raised from a single grain, in the garden of Wm. Brinckley, of Milford, State of Delaware. The reader, no doubt, will be anxious to know how it was effected. I will gratify so laudable a curiosity. The grain of wheat was planted early in the Spring, and continued to grow until the month of June, when it was taken up, seperated into ninety branches, and then transplanted one foot apart each way. It was then cultivated with a hoe through the summer, and that wheat branched as luxuriantly as the first; so that the whole space of ground was filled up the next Summer. The wheat was cut and threshed, and measured, to the astonishment of many, one gallon.

From this the frugal farmer may see how much may be raised by putting in wheat carefully, and by taking good care to have the land covered in Winter with the same kind of straw.

ON THE CULTIVATION OF CORN.

Flush your field, which has remained in clover and grass for the two last years, about six inches deep; checker the ground at the distances you wish to plant your corn. While you are checkering off your ground, you should not suffer your plough to run deeper than four inches. By this means you leave the rich part of the earth two inches lower down than you drop your corn. Cover your grain out of the furrow, and you have the rich part of your land at the bottom of the hills.

Your land having been covered all Winter with clover and grass, vegetation will spring and grow with great rapidity; and the richness of the soil will have been increased in consideration of its having been rested for two years. It is an incontrovertible fact, that the growth of grain is twice as rapid when the soil has previously been covered, as when it has been exposed to frost, which causes evaporation to take place, and your land becomes clammy and dead, until the land receives the Nitre again by the dews and rains in the Spring.

So soon as your corn comes up, you must commence the cultivation of it with the harrow; which should go over it twice in succession. Then take your small plough and cross plough your corn, and by that time your presence will be needed in the harvest field. So soon as you get through your harvest, you should return to your corn field; and if the season should prove dry, you should work your corn the

faster, say twice a week, and proceed until you find the silk is dead, and turned black at the end of the ear; for so long as there is new silk coming out of the ear or husk, you must continue to work your corn, inasmuch as the cob is growing larger, and new grains forming.

By this mode of cultivating your corn, you will be sure of a full crop, if not a double one. You must pick your best corn for seed; break your ear in the middle, and take the best end for your seed. If your land is wet, you should soak your corn by passing hot water through it the night previous; as it is a well known fact, that if the ground is wet and the corn dry, the latter will rot, and *vice versa.*

If the season should prove wet, you must endeavor to keep your land well drained, and work it once or twice a week with your harrow. So soon as the silk of the corn becomes black or appears dead, you should commence taking down your *fodder;* and so soon as you get it secured, you should commence cutting off by the ground the stalks, and have them shocked against the fence of your barn yarn, or some other convenient place.

You may now seed your corn ground down in buckwheat with a harrow; then seed the same ground in clover and grass; roll the ground with your roller, and the buckwheat will come up in six or eight days, which will cover and give security from the sun to the land, clover and grass. By the time the frost nips the

buckwheat, it will be from eighteen inches to two feet in height; the straw of which will remain on the land, and give to it as well as the clover and grass, all the warmth they require from the cold of Winter.

In the ensuing Spring, so soon as the hard frosts are over, you should roll your grass and clover, and settle them into the earth. The next harvest you will have a full crop of hay, and by this mode you will not any year lose a crop from any of your fields.

You should never plough your land in the Summer or Fall, unless you cannot avoid it; which must be done in the seeding of your wheat. You should never plough your land more than six inches deep, as it will sink the richer part of the soil so deep as to require one or two years to bring that soil again to the surface, and yield nourishment to vegetation. If I were at present a practical farmer as I have been, I would not use any plough larger than a nine inch plough, and from that size to one of six inches. The small plough can be made to plough up the most grassy land, by giving it the double singletree; that is to say, if your plough cuts nine inches, your double singletree must be twenty-seven inches long. If your plough cuts eight inches, your double singletree must be twenty-four inches. By having your double singletree three times the length that your plough cuts, your plough will always run easy to the horses, and turn the furrow in the very best manner.

ON THE CULTIVATION OF RYE.

You should have your seed clean and of the best quality, and seed your rye on the top of your clover in the months of October and November. You should plough your clover and the rye all in together, about four inches; and then seed your ground behind the plough in buckwheat. The next process is to take your fallow harrow and pulverize your ground as finely as possible, and afterward clean out your furrows. The same land should be seeded in timothy, and the clover will seed itself.

Obtain a roller if you have none, and roll the ground crossways as well as you can. In six or eight days your buckwheat will come up, and cover your ground from the sun in the Fall. The buckwheat will grow from 15 to 18 inches by the time the frost takes it. There will be straw enough on the ground to shelter the rye, clover and timothy, from the Winter, and there will be no fear but you will be able to make a double crop.

By this mode of cultivating your land, it must become rich; for the frosts cannot draw the Nitre from the earth, and by keeping the earth warm in Winter, and cool in Summer, your land will improve faster than by the aid of manure raised on the same ground. It is my opinion that nothing raised from the earth impoverishes it. Look, as was observed before, at

the lofty woodlands of the West, that have stood for ages. Now, according to the common doctrine, so many large oaks would suck up all the substance of the soil and render it as poor as silex itself. Look again at the Prairies of the West. They are an evidence at once that my doctrine is true. They are eternally covered with sedge or grass, and are as rich as land can possibly be.

The nakedness of the land during Winter and Summer is the cause of its impoverishment, and another grand cause is the constant tillage without giving the land rest. It is as natural for the soil to require rest as man. In the State of Delaware, particularly the lower counties, a ruinous mode of culture has been pursued for years. The land is mostly held by the wealthy, and tenants seldom take or rent a farm for more than one year. His object then is to get all off the land he possibly can, and of course tills all he can. They practise entirely on the old plan.

I beg of the farmers of Maryland, and of the United States, to follow my advice as it respects the mode of tilling, and put their farms in six or eight fields; and my word for it, you will see the benefit which will follow. You will discover that you are becoming rich as well as your land, and your regret will be, that you did not know this mode of cultivation sooner.

The action of the sun on the naked land, is like the power of the rays which come through a lens or

sun glass. The focus, which is formed by the refraction of the rays in passing through the double convex lens, sets on fire the segar or any other object presented; but if a piece of muslin or any other substance is interposed between the lens and the segar, no effect is produced. It is precisely the case with land. If the sun shines down on its naked bosom, the gasses which arise from it, carry off into the atmosphere the richest particles of its substance. But on the contrary, if the soil be covered with a thick coat of grass or clover, the sun's rays are excluded, and instead of losing, the earth is continually abstracting nitre from the rains, hails, dews, snows, &c. Strip those rich Prairies of the West, expose the surface to the direct action of the sun, and my word for it, they will every year become poorer, though no crop of any grain may be reaped from them. I repeat it again, and I will repeat it a thousand times, that the soil is not impoverished by what is taken off of it, only that when cultivated it is necessarily more or less exposed to the sun. If land could be cultivated, and at the same time covered with clover from the sun's rays, I should have no hesitation in saying, that so far from becoming poor, it would become rich.

There is a piece of woodland in Delaware once turned out as a common, and now grown up in oaks, which has become rich. I recollect having noticed the wheat ridges, where fifty or sixty years ago grain was cultivated. It became exhausted and was turned

out, but was when I saw it, rich. From what cause was it enriched? From the growth of timber? No.

ON THE CULTIVATION OF OATS.

I will, in the present chapter, give my mode of raising a double crop of oats. In the first place, you should seed your oats on the ground that remained in clover the last Fall, and one thing should be particularly observed; the oats should be seeded on top of the ground, and ploughed in about four inches. Leave your land in ridges, and then take your large fallow harrow and harrow the ground the same way you ploughed it, and pulverize the land as thoroughly as possible. After which, clean out your furrows, and seed the land with clover, timothy, or orchard grass. The roller should then be passed over the ground crossways.

You now have turned in the soil together with the oats in the manner they should be. The roller passing over the land leaves it packed hard, which prepares it to resist the action of the sun, and prevents the evaporation of the Nitre; which is the strength of the land. Your oats in this condition will soon come up, cover the ground, and shade the clover and grass. The clover and grass will thus be screened from the rays of the sun, and the danger of being killed; and you will be sure to realize a double crop

of oats. This is not imagination, but fact from experience.

When you have harvested your oats, you should by no means pasture your oat stubble, inasmuch as your stock will eat down the stubble and expose the earth to the sun, which I have repeatedly said is ruinous to any land, be its quality ever so good. Not only will the land be injured, but the clover and grass will be killed. It is evident to the reason of any man, that the earth should not be exposed to the frosts of Winter, any more than to the sun of Summer. The land, I contend, is not exhausted by what grows out of it, but by the evaporation which is constantly going on Winter and Summer. Wet your hand for example, and mark how soon it becomes dry again; but if you cover your wet hand with putty, it will require hours to dry. Why is this? Because in the first instance, the hand is exposed to the heat of the atmosphere, which vaporizes the water and causes it to fly off in the form of fine steam. But in the case of the covered hand, the heat of the atmosphere is excluded; and hence evaporation cannot take place; or if it does, it is in a very imperfect manner. It is precisely thus with the land when covered or uncovered. To have an idea how rapidly water is evaporated by heat, examine the tea-kettle or the steam engine. In the latter machine, gallons of water are evaporated in a few hours. The quantity which arises from a single acre of ground in twenty-four hours, has been ascertained to be immense.

How wonderfully and how wisely is every thing in nature formed! Observe, for instance, the process of evaporation. Were evaporation stopped, the heavens would soon exhibit no clouds to our view; no rainbow would span the great arch above, and the earth would retain all its water. Hence no rain, no dews, no frosts would fall to nourish and cherish the products of the earth. The washerwoman might hang out her clothes, but they would never dry; and even the sweat which pours forth on the body of man, would always remain to render him wet and miserable. How wisely formed then are the works of that sublime Being, who spoke the universe into existence! How wisely he has framed every thing for the enjoyment of man! But man, ungrateful man, pays no regard to His gifts, but destroys them as he has the land, which the Deity intended never should wear out.

Now that the land should never be left naked either in Winter or Summer, may be proven by taking one acre of land and planting it in corn, while you suffer another acre to lie idle and uncultivated in any grain; yet you are to work the land as though something were raised on it. The acre which is cultivated according to my plan, will every day grow richer and richer; whilst the other acre, which is worked every day without any product, will every day become poorer and poorer. Is not this a proof of the position assumed? Is not this a proof that the land is not exhausted by what is grown upon it?

Let it be impressed upon your mind, that you are never to take but one crop from your land each year, the balance to remain on the land to preserve it from the sun in Summer, and the frosts in Winter. Every other process will tend to impoverish your land, and render you poorer in purse.

ON SEEDING

AND RAISING THE GRASS CROP.

Among the many improvements and advantages yet to be studied by the Agriculturists of this and other States, there are none more important than those which concern the cultivation of the grass or hay crop; I mean the modes which I recommend. Notwithstanding the evident benefit and great advantages in point of saving, it appears exceedingly difficult to persuade our planters of the value of my plans, and the truth of my theory. I am of opinion, however, that one experiment described will entirely remove their obstinacy; and I trust for the benefit of all concerned, that there are few who will refuse one effort, no matter on how small a scale, to remove all prejudice. I am perfectly satisfied that the period will very soon arrive, when every intelligent agriculturist will acknowledge the truth of my theory.

The proper time for seeding grass or clover, is

whenever the ground is in order; that is, whenever you seed your wheat, oats, &c. So soon as corn is ripe and fit to take from the ground, the field should be seeded down in clover and timothy. Buckwheat should be sown upon the field, for the purpose of more effectually shielding the land from the sun, and also of protecting the clover and timothy.

Clover, timothy, and indeed all kinds of grasses which are intended to be cut for hay, should never be scattered out of the swarth; because in addition to the labour of scattering and again raking it up, the hay is greatly injured. If indeed the weather be favorable, it should not be scattered; for the action of the sun destroys the sweetness of the hay and grass. The action of the air is all that is necessary when the hay is curing. The less it is exposed, the greater will be its value, and less the labour required. Suffer the hay to lie in swarths, until about two-thirds of the upper part be sufficiently cured. This, in good weather, will be accomplished in eight or ten hours; and if the swarth be light, in a less time.

When the top is cured, turn the swarth bottom upwards; let it lie until cured like the first, and then throw three swarths together, and place regularly in rows. When carting in, drive between the two rows and load from each. It is hardly necessary to observe, that all these operations must be performed after the dews have dried off. It should be recollected that clover will keep with less drying

than almost any other grass, by applying a layer of clover and a sprinkle of salt; and then there is no fear of your horses having what is called the *water-brash*, or a running at the mouth.

Your layers, sprinkled with salt, should rise to about eight to twelve inches thick, each layer. These should be continued on top of each other, until all your hay is prepared.

If desirable, you may apply a layer of wheat straw between every two layers of clover, by which your straw will imbibe the juice of the clover, and become almost equal to some kinds of hay.

The proper test when clover is cured, is to take up a handful and give it a twist; if no juice issues, it is cured. I have often cut clover in the morning and hauled it in, in the evening; and generally the succeeding day, unless bad weather prevented. When the above mode is pursued of salting clover or any kind of grass, cattle are extremely fond of it. Farmers will find, that clover hay is the cheapest food on which they can keep their stock in good order during the Winter; especially if put up in good order, and sheltered from bad weather. Both horses and cattle will keep fat on it throughout the Winter, without the aid of grain, except when worked.

Clover, when put up in stacks, will not resist the rays as well as timothy and other grasses. Clover should be cut for hay when one half of the head becomes of a brown color. If cut earlier, it is be-

lieved that it will not be so nutritious. If cut later, the stem will become hardened and it will lose its substance.

For hogs and stock that are young, clover may be cut so soon as in full bloom; of which they are excessively fond. They might I think be wintered on it.

When the farmer can do it, he will find it advantageous to provide himself with long narrow sheds, open all round for the preservation of hay of all kinds. Under these sheds, let the hay be put down in layers as mentioned above. By this mode you will be able to preserve your hay in a much better manner than in cocks or stacks. As yet there are few persons in this country sufficiently expert in the art as to insure its preservation without narrow sheds. All farmers who have no sheds or barns, should cap the top of their stacks of clover with some other kind of hay, which will insure its preservation.

ON THE

CULTIVATION OF VEGETABLES.

The ground which you intend for a *Truck Patch* the next Spring, if not in clover the present Fall, should be covered with some kind of hay or leaves from the woods, and brush. The brush is to prevent

your leaves from blowing away. From six to ten inches deep you should cover the ground, for the purpose of preventing the Nitre from evaporating during the time the land is frozen; for that is the time the land loses its strength. By preventing its freezing during the Winter season, it will improve on the principles advanced in former pages. The rains and snows will run down through the hay and leaves, and thus enrich the soil.

So soon as the Spring is open, you should rake off the hay or other covering, and set fire to it. You are then prepared to proceed in the cultivation of your vegetables, in your own favorite manner. When your crop is ended, you should seed your land down in clover or timothy, as you have been recommended to do your corn land. The next harvest you will be able to reap a crop of clover and timothy.

As an experiment, you should plant a quantity of vegetables on the south side of your fence, which has been standing for a number of years and has become rich, by being covered and shaded from the sun in the Summer, and the frosts in the Winter, by the grass and weeds which grow under the fence. After your fence has stood a few years in the same place, you will rake up the manure from under those fence locks, and consider it good; and then you will divide it on your other lands, which you have suffered to lie exposed by your very improper mode of cultivation. This you have done while in the corn crop

in the summer, and you have also left it naked in winter.

But if you adopt my plan, your fields in a few years will become as rich, and even richer, than the soil under your fences; and you will need no more manure than is made on your farm by the genial hand of nature. It must be here understood that there must be a soil, or my system falls to the ground. If the land is composed of nothing but silex or sand, nature can do nothing in enriching it. But there are none of our farms but have a soil, and by a soil I mean earthy substance, in which more or less vegetable matter is mixed. The next chapter will more fully explain what I mean by vegetable matter.

PHILOSOPHICAL DISQUISITION ON VEGETATION.

A plant or a tree as well as man, is an organized body, endowed by nature with particularly constructed parts, which perform certain functions, from which proceed the principle we call life. Mineral bodies, in contradistinction to these, appear to be more the creatures of chance, formed by chymical and mechanical attraction. Design is marked on every arrangement of the animal or vegetable parts, and that unknown principle of *life*, which has puzzled philosophers from the foundation of the world. How life

causes the animal and vegetable organs to perform their wonderful functions, will perhaps never be known to any but the great Author of Life and Architect of the Universe.

Nature deals in simple substances, as well as simple operations. All organized bodies, whether of the animal or vegetable kingdom, are made up of a great many compounds, which however result from a few elementary principles. Animals are composed of carbon, oxygen, hydrogen and nitrogen; while the composition of vegetables is carbon, oxygen and hydrogen. These are the component or constituent parts of animals and vegetables, yet there are many other substances; but which, as they are not essential to organized life, are not component parts. These substances are silex, sulphur, lime, phosphorus, iron, &c. It is recorded as a fact, that there is sufficient iron in the blood of forty-eight men, to make a ploughshare weighing twenty-seven pounds.

So long as life exists in the animal or vegetable, the simple bodies which enter into their composition are susceptible of only certain combinations; but the moment life ceases and death ensues, new combinations are formed. A new order of attraction ensues, the moment the old one is destroyed; and hence comes putrefaction and decay. Were it not that these effects are produced, the dead vegetable or animal would always retain its natural appearance and form. But this is not the case, and though we embalm,

dry or preserve in any manner the animal or vegetable, yet finally in the course of time, it will crumble to dust. How wisely has the Great Disposer of Events ordered this! By this universal decay of animal and vegetable matter, by thus returning to original principles, which go back into the earth, the new plant and the new animal are nourished and sustained. Thus one vegetable rises out of the earth, flourishes, decays, dies, and returns to first principles, from which another plant is nourished, and that plant nourishes another animal. Who knows but the dust of the mighty Cæsar, or the famed Alexander, may have stopped the chink of some peasant's log cabin, or have nourished some gay flower or noxious weed? It is not at all improbable. The bones of the heroes who fell upon the field of Waterloo, when the star of Napoleon's glory went down in blood, have been sold by the load to feed and fatten the soil. No doubt but many an ear of corn has sprung from the relics of those, to whom Napoleon once spoke and pointed to the path of fame. O Tempora! O Mores! What is human glory! What the blast of fame!

There is a mutual reciprocity throughout nature. From the dead animal and vegetable spring the living ones; and there is, besides, a mutual dependence existing between man and the vegetable kingdom. It is well known, that neither flame nor animal life can exist without oxygen; and it is equally well known, that plants, trees, &c. are continually throwing off in-

to the atmosphere the oxygen gas, which man breathes. He, on the contrary, throws off from his lungs carbonic acid gas, which is breathed in by the leaves of trees, plants, &c. Here, then, is one reason why we are exhilirated in a flower garden. Living flowers are healthy, but dead ones are quite the reverse, and should never be kept in a bed-room, as they throw out noxious gasses or effluvia.

It is to be understood by the reader, that the object of this work is practical, and, therefore, I shall dwell only on those parts of the philosophy of vegetation, which will have a tendency to elucidate this work, and throw light upon the new theory which I have advanced, and which I have no doubt will be adopted when better understood. I wish the reader particularly to understand, that the author has not advanced his theory from the stores of his imagination merely, but from the practice of many years in the State of Delaware, where he possessed every facility for experiment.

It has been asserted in this work, that the soil is not exhausted by what is taken from it in the form of product; but by the exposure of the surface to the sun in Summer, and the frosts in Winter. The woodland is an example of this. If the old theory be correct, there would not be nourishment sufficient in the earth to supply so many lofty oaks, placed so near each other. On the contrary, we find that wood land becomes gradually rich, and if covered with clover, would more rapidly become so.

The roots of a tree constitute evidently the stomach, corresponding to that of man. This stomach, or the fine fibres of the roots, takes up vegetable matter, which is very minutely dissolved in water, and conveys the fluid, which is like the chyle when it leaves the animal stomach, up the *alburnum*, or heart wood, to the lungs or leaves; for it is evident that the leaves of a plant or tree constitute the lungs. Now when the chyle, (or milky fluid,) leaves the stomach of the animal, it is not blood, and has not the power to nourish and do the offices of blood, until it enters the lungs and becomes oxydized by absorbing the oxygen from the atmosphere, when it becomes red, and is sent to all parts of the body. It is precisely so with the sap or blood of the tree. So soon as it reaches the leaves, it is elaborated or changed in its properties by the action of the air; and it is for this purpose that Nature formed the leaf so large and thin, giving a large surface to the action of the air. When the sap is properly changed by the action of the atmosphere through the surface of the leaf, it is sent down the tree between the *cortical layers*, and deposits as it goes the woody matter, which gradually hardens into wood.

Here we see the wisdom of God in the wonders of the vegetable creation. I mean, the great similitude or resemblance between the animal and the vegetable creation; particularly in the circulation of the blood, in each. The roots represent the stomach in the an-

imal; the holes or pores in the *alburnum*, are the veins; the leaves are the lungs, and the delicate *cortical layers*, the veins. The only difference is, that the organs and functions of the animal are much more complicated than those of the vegetable. In Winter, when the circulation of the tree ceases, and the leaves are no longer required as lungs, they drop off, and give back to the earth vegetable matter, spreading before man as they fall, a beautiful emblem of mortality.

ON THE CULTIVATION OF THE SWEET POTATO.

The seed of the sweet potato should be selected in the Fall, when the crop is housed. Potatoes in Winter should be put away in dry sand, in a hole made for the purpose under the kitchen floor, near the hearth, where they can neither be frosted nor freeze. About the first of March, a hot-bed should be made large enough to contain whatever quantity of seed you should wish to plant. The piece of ground you intend for a hot-bed, should be in a warm place on the south side of your house or fence. Dig up the ground from fifteen to eighteen inches deep, remove that dirt, and then fill up the space thus made with the best rotted stable manure, nearly to the top; say within four inches.

Now take your sweet potato, and place them nearly touching each other; then cover them with rich mould about four inches deep, and by the middle of May, or the first of June, your potatoes will sprout and come through the ground from eight to ten inches. Potatoes at this time will have no roots. Your ground should be prepared and put in perfect order, and if a sandy soil, manure it with hog manure. Make your hill about eighteen or twenty inches high, and so soon as your ground is in order, then go to your hot bed and break up one side, from which take up the potatoes carefully. The sprouts should not be broken off. Take them to the hill, dig a hole in the top deep enough to set in the potato, and leave the top of the sprout about three inches above the top of the hill. Then the potato will commence growing again, and as soon as your hills become grassy, you should pick it off carefully from the top and weed down the sides two or three times, or until the vines begin to cover the hills. Then take your hoe and hill up those hills, until you nearly cover the tops of the vines. Treat your hills in this manner two or three times, and your cultivation will be finished. By the first of September, if the weather be seasonable, your potatoes will be large enough for the table. So soon as the frost kills the tops of the vines, you may dig them, as they will then cease to grow. It appears that frost is fatal to all vegetation, and if so powerful on vegetation, why not on the soil which produces that vegetation?

ON THE

CULTIVATION OF IRISH POTATOES.

I now intend to draw the reader's attention to my plan for cultivating Irish potatoes. In the first place, it is necessary to show the difference in the growth of the Irish and sweet potato. The former grows upward from the side, the latter downwards; therefore, it is necessary to plant your Irish potatoes as deep as you can; say from twelve to fifteen inches. This crop is for your Fall and Winter potatoes.

When you prepare your land, plough your furrows two or three times in the same place, so as to make the furrow as deep as you can; say from fifteen to eighteen inches. Then drop your potatoes in the bottom of the furrow. If they are cut, they should be split lengthways; then put about six inches of stable manure on the potatoes, after which cover the whole with five or six inches of rich mould.

So soon as your potatoes come up, work the dirt to the hill; and by so doing, you will cover up the grass, which will destroy it. By this process, the soil will always remain light round the potatoes, and they will always be well covered. The cooler they are kept the better, while growing. Kept reasonably cool, they grow larger, dryer, and the skin is remarkably thin. Potatoes raised in this manner, are so mealy that they fall to pieces when boiled.

In cultivating early potatoes, I should plant the first of December; and would prepare my ground in the following manner: I would take a piece of land that was in clover, and plough one furrow; then drop or plant my potatoes in that furrow. I would then collect some coarse stable manure and cover the potatoes about three inches thick, then turn the next clover sod on the potatoes, and then go on to flush the clover until time for another row; say about three feet six inches. The next row should be planted in the same manner. The potatoes should be dropped about three inches apart. As before observed, split your potatoes lengthways, and make four quarters.

When you have planted your crop, take your roller and roll the ground as hard as you can; after which, take your cart and haul a quantity of old hay or straw from your barn yard, or leaves from the woods, and cover your potato patch all over, about six or eight inches thick. In the next place you should haul some kind of brush, which will serve to prevent the wind from blowing away the hay or leaves. In doing this, you not only enhance the value of your land, but your potatoes will be protected from the frosts of Winter; and you will have new potatoes on your table from one month to six weeks sooner than your neighbor, who plants his in the Spring. So soon as the genial breeze of Spring returns, and the hard freezing of Winter is over, you should have the leaves taken from over the potatoes and carried to your cow-

yards, where they will undergo decomposition, and be resolved into good manure. Thus the leaves will subserve a double purpose.

The common potato, the *Solanum Tuberosum* of Natural History, was originally found in the woods of America, from whence it was carried to Ireland, and afterwards to England, where it flourished so well that it took the name of Irish potato. Its introduction into these countries, was about the beginning of the Seventeenth Century. There are many species of the Irish potato, but it is useless to enumerate them here.

There are a variety of insects, worms, grubs, &c., which commit their ravages on the potato; but besides these, it is subject to several diseases, among which is the *curl*, which affects the root. Agriculturists have long endeavored to account for this disease; some thinking it a blight, others that it is caused by frosts, after being planted, or by improper planting. The disease is divided, by some authors, into three stages. *First*, the *half curl*, in which the leaves are long and curled. The season must be very good, or the potatoes are small and watery. *Second*, the *full curl*, in which stage the potatoes scarcely attain the height of seven inches; arrive soon at maturity, and soon decay. The potatoes are of a dark red color, and are not so large as a nutmeg. In the *third* stage, they are called corrupted potatoes. In this stage they do not appear above the ground, are very small and very

few. After the curl, comes another disease called the *scab*, by which is meant excrescences, and then the *canker*, caused by little cavities, which make their appearance in wet weather. These by some, are considered to be the cause of the curl, and they become worse when the potato remains long in the earth, after time for harvesting.

The proper time for digging potatoes is in autumn, when the weather is dry, and when the stems and leaves begin to decay. If fields are planted in potatoes, they should be ploughed up, taking care to take off the coulter of the plough to prevent cutting them. When those which are turned up by the plough are carried away, a drag may be used to obtain those potatoes which remain covered up. But if the potatoes are cultivated on a small scale, they may be dug with the hoe, or other implement.

The potato is a great vegetable luxury, and forms a great part of the food of the Irish people. Potatoes, when boiled, are excellent food for hogs and poultry. The fattest fowls I ever beheld, were fed almost exclusively on them. For farm horses, potatoes are very good. Mr. Bradley, in his Notes on Husbandry, proves their superiority over Indian corn.

Many modes have been suggested, for preserving in winter, this valuable vegetable. The most common way, is to deposit them in pits dug in the earth, and to cover them first with dry straw, and then with

earth. They keep in this manner a long time, provided they are kept dry. Another plan is, to pile them up in the form of a roof, to cover them as before with straw and afterwards with earth. There are many other modes of preserving potatoes; these appear to me to be the simplest and best. In Pennsylvania, they are kept in a vault, under the barn; but, according to my experience, they become green when laid upon a floor, or in any way exposed to the air. They should in all cases be kept dry, and as much excluded from the atmosphere as possible. Could they be put up in jars, and stopped tightly, I have not a doubt but that they would keep good for years. It is said that they are kept for sea stores, by slicing them, baking them slightly, and then packing them down in jars.

A beautiful starch is made from Irish potatoes, far superior to that which is made from wheat. The potatoes are first rasped, after being peeled, and the pulp placed in a cloth and subjected to pressure. The juice, which is caught in a basin, is mixed with an equal quantity of water, and set away in a shallow vessel where it will not be disturbed. In a few hours the sediment will be deposited at the bottom of the vessel, which to render it beautifully white, should be washed two or three times, to free it from the impurities which it may contain.

ON ARTICHOKES.

There are many articles which might be cultivated to great advantage by the farmer, were there not that fear existing of going out of the path which their fathers trod, and of trying new experiments. Among the number may be enumerated the artichoke.

The artichoke is as easily cultivated as the potato, and the cultivation is the same, with this difference, that the artichoke should be planted earlier, the latest period being not later than March. It produces a beautiful shade, especially the Jerusalem artichoke, under which no weeds will thrive. Nearly all animals are fond of it, even more so than of the potato when cooked.

Some culturists have declared, that the potato is superior to turnips or beets as food for cattle, and, if so, the artichoke is superior to them all; for, when cooked, it is certainly superior to the potato. And then the expense of cultivation is only the same; it is proof against injury from frost, is more nutritious to animals, leaves the land clean, and yields from twenty to forty per cent. more than potatoes. There is but one thing to be opposed to its cultivation, and that is the care which is necessary in digging them, it being well known that if any are left in the ground, they will vegetate the next year. This, however, is no great inconvenience.

It is a fact well authenticated, that cattle will eat them with greater avidity than the potato, and that they will thrive faster upon them. I have seen calves eat them without refusal. Then the beauty of the matter is the great yield. The experiment being tried upon a quarter of an acre, it was found that the artichokes yielded at the rate of upwards of 600 bushels, whilst the potatoes came out a little more than half. In a very dry season, the experiment was again tried, and the artichoke gave one hundred and fifty bushels, while the potatoes produced nothing. Five hundred and seventy bushels were produced in the following year on an acre. A half acre of the same land, highly manured, produced in turnips less than three hundred bushels.

From this it will be seen, that the crop of artichokes was the most plentiful, as well as most profitable; and I would recommend the enterprising farmer to use some of his land in this product, instead of reaping a meagre crop of wheat, corn, or other grains.

ON GROUND NUTS.

Among the many articles to which the farmer could turn his attention, there is none which would prove more profitable than the cultivation of ground

nuts; or, as they are sometimes called, pea nuts. They are of easy cultivation, and require comparatively but little attention. Thousands of bushels are imported from the West Indies, and yet they are frequently so scarce as to sell at from three to four dollars per bushel. They require a warm sandy soil, and there are thousands and thousands of acres in Maryland, Delaware, Virginia, and other Middle and Southern States, which do not produce five dollars in value per acre, which might, if cultivated in ground nuts, bring an amount which would astonish the cultivator.

Wherever the sweet potato thrives, there also will the ground nut flourish luxuriantly; for both grow best in a light sandy soil. There is one peculiarity attending the cultivation of the ground nut, which is, that the nut comes from the blossom, though it grows like the potato under ground. This is different from any other production with which I am acquainted.

The ground intended to be planted in ground nuts, should be dug up and perfectly mellowed, without a tree or any other object to cast a shade upon it, for the sun's rays are absolutely necessary. The nuts may be planted somewhat like corn, only not so far apart. Put two or three nuts in a hill, and let the hills be about eighteen inches or two feet apart each way. When the vines run, they will meet and fill the ground. They should be planted as early in the Spring as possible, to avoid frost; say in April, or the first of May.

After the vines spread, they require no attention further than to go among them every morning, and with a hoe cover up every blossom that is to be seen. For convenience, the ground should be in long beds, so that the cultivator may walk between them without treading on the vines. When all the vines are covered, a considerable bed of earth will have been raised on the original one, and in this bed, and from the blossoms so covered up, will spring a mass of nuts as thick together as they can grow. In half a yard square of ground, I have raised a peck of very large nuts. An acre of ground would produce to the amount of several hundred dollars. The nuts are much larger and better than those brought from the West Indies.

CULTIVATION OF MELONS.

As the watermelon is one of the most delicious luxuries of our Summer season, it is proper that all the light which experience has gathered concerning its cultivation, should be given to the community. There is no production of the earth which improves more by cultivation than the watermelon. From a small worthless article, it may by cultivation be brought to a large delicious fruit, frequently weighing from twenty to thirty pounds. I shall give the best mode of cultivating them with which I am acquainted.

To prepare the ground, holes should be dug about one or two feet square, and about as deep, and fill them half full of long manure and garden mould, packed down hard, and made very wet. The holes should then be filled to the top with rich mould, into which should be put about a dozen seed taken from the best watermelon. Cover them with a layer of well rotted manure. Over all put a thin layer of pure sand, which should be kept watered. These holes or *hills* should be ten or twelve feet asunder, and when the plants have come up and have put forth four or five leaves, they should be seperated; that is, the worst plants should be taken out, leaving but three or four of the best plants in a hill. The sand mentioned, is put over the seed to prevent the ravages of the yellow bug, which may be removed and rich earth put in its place, so soon as the bug disappears. If the season be dry, use water liberally.

When the plant has put forth six or eight leaves, the centre shoot should be taken off, so as to cause the vine to spread laterally. The lateral shoots, however, should also be taken off, when six or eight inches long. This will cause the vine to spread still more. A very good plan is, to put some earth on a leaf joint about every four feet, taking care not to cover up the leaf. The joint covered, if well watered, will take root; which will give strength to, and cause the vine to spread over the whole ground. No male blossoms should on any account be taken off; but all improperly formed melons should be thrown

away. Let the vine run as far as it will, but if any of the lateral branches shew a tendency to turn up, they should be extracted ten or twelve inches from the main vine. Be particular to suffer no melon to form within four feet from the root. One melon only should grow on a side branch, and three or four to one plant. But when the melon has attained nearly its full size, a second series may be suffered to grow.

It is recommended to plant pumpkin seed near the melons to attract the bugs; though, of course, they should be removed so soon as the bugs are gone. Melon seed should never be planted in the neighborhood of gourds, nor indeed of pumpkins, squashes, musk melons, nor any thing of the kind, if it is intended that they shall flower; for the *pollen* will mix, and if hybrid varieties are not produced, the melon is injured by the flavor of the gourd, or reduced in size.

One thing I would particularly mention, concerning the preparation of land intended for melons. If it is desirable to have early melons, at least one month earlier, the spot of ground should be covered by hay, straw, fodder stacks, manure, or something else, which will entirely prevent the freezing of the ground. Now it requires a month or more in the Spring for the frost to get entirely out of the earth, and if this plan is pursued, your ground is ready as soon as the frosts are over in the Spring.

By pursuing the plan laid down above, watermelons

may be had not only earlier, but of the finest and largest kind. A little more labor is all the difference between this and the common careless mode, but the difference in the number and size and flavor of the melons will be great, and will amply compensate the cultivator.

ON MAKING CIDER.

When you wish to make your cider to put away for Winter, you should cull your apples and have them all sound and all of one kind. The trough that you grind your apples in should be scrupulously clean, and the cask which is to receive your cider should be well scalded and then rinsed with cold water. Have the straw clean through which your cider runs. Strain the cider through straw, and then through flannel. Then pour it into your hogshead or cask, which should be put in the cellar. Put into each hogshead about three pounds of lard or about five pounds of fat pork, stop the bung, and clay it over closely. Your cider manufactured in this manner, will keep sweet until the next harvest. Never suffer any water to be put in your cider, as it will render it flat and stale.

Inattentive farmers frequently collect their apples when wet, and throw them in a pile, exposed to the

sun and wet weather. This is a miserable practice. The whole mass becomes sour, and if delay ensues in pressing the pumice, fermentation takes place, a small quantity of which juice will spoil a large quantity.

The apples should always hang on the trees until they are fully ripe, and instead of being threshed off, they should be gathered by hand when the weather is dry. They should in no case be bruised, or suffered to become wet. They should be assorted, and placed in seperate piles, where they should remain from eight to ten or twenty days, to *sweat*. This process improves them, and the length of time they should sweat, should be in proportion to the inferiority of the apples; those of a hard and crude nature requiring much longer than the best kinds. The apples should be piled where the air will have free access to them, and should any rot, they should be carefully picked out and thrown away, as they give a bitter disagreeable taste to the cider.

The apples should, in the next place, be ground, and the pumice spread over the trough to take the air, by which the cider will acquire a fine color and be much improved in flavor. It is asserted by some, that the longer the pumice lies thus exposed to the air the better, provided fermentation does not take place before the operation of pressing is completed. "The following experiment," says a sensible author, "will prove this. Bruise a tart apple on one side,

and let it lie until brown; then taste the juice of each part, and it will be found that the juice of the bruised part is sweet and rich: so if sweet and tart apples are ground together, and put immediately on the press, the liquor which they produce will have the taste of both kinds of fruit; but if permitted to lie until the pumice become brown, the cider will be greatly improved."

Some farmers are opposed to pressing cider through straw, because they say, the straw when heated in the stack gives the cider a bad taste. I have never known any such effect produced, when the straw was sweet and clean, and that it should always be.

After the operation of pressing is over, the cider, as before observed, should be put into clean, sweet casks. When the casks are full, they should be placed in the shade, and after fermentation takes place, they should be filled up once or more, so as to discharge as much as possible of the foreign matter from the bung. So soon as the white froth makes its appearance, the bung should be placed in loosely to check gradually the fermentation. After this, in the first clear cool weather, the cider should be racked off into other casks.

Some farmers are opposed to the use of fresh meat in fining cider, and recommend isinglass jelly. They steep the isinglass in white wine, dissolve it over the fire, and boil it in some of the cider which is to be

fined. It is a plan with others to dissolve the isinglass over the fire, and steep it several weeks in white wine, by which it becomes a jelly.

Cider should be watched very closely, as a slight change in the weather may injure it. Should it become tart, it is recommended to boil and hull half a peck of wheat, and put it into each hogshead. This is recommended in preference to animal substances, though I must confess, that I never saw any evil effects from putting a piece of pork or beef into cider.

During the heat of summer, cider is a very cooling and wholesome beverage, when properly fermented and free from deleterious ingredients. Cider which has been kept in leaden vessels, should always be avoided; for when drank, it produces violent colics and obstipation. It should not even be suffered to run through leaden tubes, as from the union of the lead with the acid of the fruit, *sugar of lead*, a deadly poison, is produced; destructive to life if taken in any quantities.

ON THE

PRODUCTION OF NATURAL HAY.

I have singularly called this natural hay, because the term is used generally to denote any thing out of the common order of things. The hay I here re-

commend, is intended as a substitute, when the farmer has no clover, timothy, or other kind of grass of his own raising. When you cut your wild grass, you should be sure not to cure it too much. I would recommend you to take it the next day after it is cut, if the weather is favorable, and have it stacked; and while stacking, to put a layer of hay and then a sprinkle of salt, and so on, until you have put away the quantity you desire. If the weather should prove wet, and you should be disappointed in curing your hay, and you should not have enough to serve your stock through the winter, I would recommend another mode of preparing and providing yourself with another kind of hay, which has seldom been thought of; it is equal to the best hay if properly attended to and cured. It is the leaves of all trees, of which cattle are fond, in a green state. Take the boughs of the Lombardy Poplar, of the Maple, and of most of the bushes in the woods and branch, while they are green; carry them to a place where they can be cured and stacked like timothy hay. A ton of this kind of hay is worth a ton of timothy, as food for stock. Cattle are known to leave green clover to eat the leaves of the Mulberry, which can be easily cured, and on which cattle will thrive. The experiment has been tried, and is, therefore, no matter of speculation.

You should not take too many branches off of one tree, lest the tree should be injured. The branches

should not be cut until the leaves have acquired their full size, for I have seen the stock that were in a clover field, and whenever a tree was felled the cattle would leave the clover, go to the tree, and eat the leaves as high as they could reach. This is a proof that the leaves of some trees, particularly the mulberry and maple, are good food for cattle; and if they are so when green, why not so when cured like clover or timothy?

Suppose an individual were to remove to a newly settled country, and set himself down in the midst of the wilderness. He commences clearing the land, and while he is falling his timber, if it be in the fall, he may collect the limbs and leaves, to secure for his horses hay enough to serve them for one year; which will be the best of hay, if properly cured and stacked away. This should be done in the same manner in which clover or timothy is cured, and stacked. This would be a blessing to thousands of men who go to those unsettled countries, and are not aware that the leaves of the woods will make hay. A great many leaves might be collected in a short time, by cutting off the twigs and ends of the branches, and even one tree would make considerable provender. Nature is kind to those gentlemen who sit themselves down in the wild woods, for they are abundantly supplied with horse food from the trees, without much labor.

ON TOBACCO.

The preparation of the ground for tobacco seed is very simple. If the cultivator has ever prepared ground for cabbage seed, he has an idea at once how it should be done. If the ground is new, brush should be burnt upon it for the purpose of cleaning it. To avoid burning, some recommend weeding the bed every year, after the crop comes off.

PLANTING.

The proper time for planting, is from the last week in May to the middle of July. In the first place, however, the seed should be sown. As it is uncertain as to the number of seed which will vegetate, a great many more should be sown than will be required; say about half a pint to a piece of land 12 feet square. When they come up, it is a custom to rake out the superabundance, with a rake made of sharp iron points or nails, placed about one-half or three-quarters of an inch apart. This rake is carried through the plants with an irregular motion, so as not to leave them standing in rows. Some do this by hand, as cabbage plants are thinned. The proper time for this operation is about the beginning or middle of May, a little before the time for *planting*, and when the plants are of the size of a fip or half-dime.

From the latter part of May to the middle of July, as observed above, is the proper period for planting. The plants should be about three inches broad; strong and healthy. They should be set out in hills, something in the manner of transplanting cabbages. Like these the tobacco plants should be worked, but much oftener with the hoe or plough.

TOPPING.

This operation takes place in common about the middle of August, and some of the crop later. The necessity for this is known, or the ripeness of the tobacco is pointed out by its buttoning and blossoming. All cultivation now ceases, and the culturist proceeds to topping or breaking off the blossoms to a leaf that will ripen as soon as the bottom leaves. The topping and priming should, according to my experience, be done high; for then more leaves will be turned out, the number of which should not be less than sixteen. The leaves will of course be smaller, but at the same time they will be richer and of a finer texture. There is another advantage in high topping; the leaves will be higher from the ground, and of course more clean, more free from dirt. The leaves, though smaller, will be greater in number; being longer growing, they will be richer, and the smaller size of the leaves will give them greater advantages from the light and air.

CUTTING.

Great loss ensues to the cultivator from performing this operation before the tobacco is perfectly ripe. Twenty-five per cent. and even more, is often tobacco lessened in value by being cut only a few days before the proper time. In cutting too soon, the rich flavor is destroyed, the weight is diminished, and the elasticity of the leaf lessened.

The flavor of tobacco is every thing; and, therefore, it should not be cut until it is fully ripe. Some cultivators say that the whole crop should be cut at once, but I cannot agree to this, for I have seen part of a field perfectly ripe, another part half ripe, and a third portion perfectly green. Now to cut it all at once would infallibly ruin a great portion of the crop. It should therefore be cut as it ripens.

The operation of cutting is done with an instrument resembling a butcher's cleaver. It should lie for a while on the field after it is cut, until the leaves wither, and there is no danger of breaking from being handled.

HOUSING AND CURING.

From the field it should be carted to the house for curing. Here a peg six inches long is driven into the butt, by which it is hung on sticks. Sometimes it is split, that is, the stalk is split down almost to the butt, before it is brought in. This split is placed across

the sticks, which are placed on standards about five or six inches apart, and the plants placed about the same distance asunder. Tobacco may be cured either by fire or by air, and the proper test of its being cured, is the perfect dryness of the stem of the leaf. The tobacco house should be close and tight, with numerous doors and windows. In houses not properly ventilated, the smoke gives a very disagreeable bitter taste to the leaves, and a nauseous flavor, which the tobacco never loses.

There are several ways of curing tobacco by fire, such as kiln-drying it as plank is dried. Others cut a ditch in the floor and arch it with bricks. In one end of this the fire is made, the heat from which escapes up into the room, while the smoke is conveyed along the arch into the open air. In general the air is sufficient to cure tobacco; yet in wet weather fire is necessary. The top leaves of tobacco are always the richest and the best.

STRIPPING.

Tobacco can never be stripped except in damp or moist weather, for it is only then that the leaves can be handled without crumbling under the pressure of the fingers. After being stripped, it is tied up in bundles and laid in a pile, when care should be taken that it does not ferment. After this, it is straddled again, and in moist weather taken down for packing. The hogsheads in which it is to be packed, should

never be made of green wood, or the tobacco will infallibly be injured. It is said that the acid of the wood is more injurious than the dampness. The loss is sometimes very considerable to the planter from ignorantly using green or damp hogsheads.

PACKING.

The process of packing is very simple, and scarcely needs a description. I shall, however, give it for the benefit of those who are not skilled in the matter. In Virginia, it is customary to place, in packing, the leaves parallel to each other, and never to have more than five or six leaves to the bundle. In this way they lie regularly in the hogshead, and are easily taken out without tangling and tearing. In the Western States, it is a bad custom to pack the tobacco in the hogsheads in a careless and irregular manner, to the great injury of good tobacco. One-half of the value and quality of tobacco depends upon the good management of it, or in other words upon the cutting, curing, packing, &c.

Tobacco is valued for quantity or quality, and they seldom go together. If the soil, like that of the Western States, is strong and rich, the tobacco will grow luxuriantly, the quantity will be great, and the quality inferior. But if the soil be light and sandy, the quantity will be small and the quality superior. Tobacco is perhaps one of the most troublesome of all crops. Unlike other crops, the new seed are put

in the ground before the old crop is disposed of. There is no vegetable which has so many enemies. Like the silk worm, every insect appears to be its enemy, and yet when tobacco is manufactured, no animal will use it besides man, with the single exception of the monkey.

I shall enumerate some of the enemies of the tobacco plant. The most voracious of all is the *horn worm*. Then come the *bud worm*, the *ground worm*, the *web worm*. There is also a fly which devours the plants while in the bed, and which follows them when they are carried to the field.

The most common method of ridding the plants of these enemies, is to pick them off by hand; but I have seen chickens, ducks, turkies, &c., turned into the field, where they soon *wake* war with the enemy.

It is a historical fact, that in the year 1622, only 20,000 pounds of tobacco were raised in Virginia. In the beginning of the Revolution 100,000,000 of pounds for four years were raised, from 1772 to 1775. In 1789, the quantity raised was 89,000,000 of lbs. The quantity increased until 1815, until which time the production of tobacco averaged 82,000 hogsheads, or upwards of 99,000,000 pounds annually. In the year 1834, there were exported from the United States 87,979 hogsheads of tobacco to different ports in Europe, and the exports of tobacco in the year 1836 amounted to something more than 12,000,000 of dollars.

From this we see that the tobacco trade is second in greatness and value, the exportation of cotton being greatest; it being no less in 1836, than 80,000,000 of dollars. We hear persons speaking against the use of tobacco, but they are not aware of the vast income from this trade, how much it builds up the interests of the country, and to how many thousands it gives employment. Strike from our exports the article of tobacco, and what a chasm would there be left? How many would be thrown out of employment? How many would be destitute of bread?

ON PLOUGHING.

You should never plough your land at any season of the year unless you are compelled by having to seed some kind of grain or vegetable; for the moment the soil is broken, you are preparing your land for exposure to the sun's rays, and also to the frosts of winter. I warn you against any larger plough than nine inches, for any kind of grassy land may be broken up with a plough of that size, as deep as any land should be broken in this part of the country. The consequence is, if it is ploughed any deeper than six inches, the better part of the soil is turned over and sunk, while the yellow dirt is thrown up. When this is the case, it will generally require two years

for the soil to rise to the top of the earth again. The less you take of the surface at a time, the easier it is broken in pieces, and the sooner it is pulverized.

When you commence ploughing, you should remember to have your double singletree of a length to correspond with the plough, or the plough will not run well. Your double singletree should be three times the length that your plough cuts; that is, if your plough cuts nine inches, your singletree should be twenty-seven inches in length from each staple at the end. If your plough cuts eight inches, your singletree would be twenty-four inches.

By observing the above directions, your plough will run flat and turn the furrow well over. The horse in the furrow governs the plough, therefore you should never move the clevis at the end of the beam. Observe this, and your plough will run steady without any trouble to the ploughman, and your plough will rise up at the end when your horses turn round, and will take the proper distance. If there are no stones or stumps, the plough will run to the end of the row without the ploughman having any necessity to touch her.

The proper test whether a plough runs well or not, is to throw her on her side; and if all is right, she will rise and take the proper distance herself. By this I have always judged, and it is a perfect test.

To recapitulate. The New York farmers, who are perhaps as good as any in the United States, have,

I am happy to see, adopted the plan of shallow ploughing; believing it to be the proper mode pointed out by nature. Reason and experience evidently go in favor of it, and that which is proven by experience should be immediately adopted. That it will be universally adopted, there is not the shadow of a doubt.

ON THE PRODUCTION OF FRUIT TREES.

I have been astonished, for a number of years, at hearing farmers speaking of raising trees of all kinds by the process of grafting scions on other stalks. This is not necessary to obtain the kind of fruit desired. I have come to the firm conclusion that grafting is not the best mode of obtaining the kind of fruit you want, and that it is not the soonest. The manner I recommend, is to take those sprouts which grow out of the trunk of the tree, at that point where the first limbs rise, and are conjoined. These should be cut off transversely with a smooth surface, and the ends covered with cement, made of beeswax and resin. Have your ground ploughed and in good order, and then lay off the rows with your plough, about four feet apart. Plough the furrows about four or five inches deep, and take of the best rotted stable manure, and put about two inches in each row. Then take those sprouts, and lay them down lengthways

in the furrow; one at the end of another. In the next place, fill the trenches where you have laid your cuttings, with rich mould or loam; and you will have a sprout for every bud on the cuttings. Roots will start out from around the buds, and when the trees are large enough to plant out, you should lay the cuttings bare, and saw or cut between the buds. Every tree will thus have its roots, and will be ready to be transplanted or sent to market. By this mode you may produce them more rapidly than any other way, and with the perfect assurance that they will be of the genuine kind desired. The seed of an apple will perhaps bring forth trees of all kinds, except the kind you want; but the cutting can never bring forth any but the genuine original kind.

In this way the largest and thriftiest fruit trees may be obtained. Every other year, those young fruit trees should be manured, except the plum and the peach; which require a very light soil. The first, if not the second winter, the roots of the young scions should be covered with straw to prevent them from freezing; and early in the spring, this straw should be carefully raked away and carried to the stable-yard.

ON WOODLANDS.

You should never cut down your timber in the spring, when the sap is up in the tree, unless the bark is the grand object; as you will injure your land, and the timber will not last half so long. You should clear your woods of the undergrowth, or bushes and briars; and suffer them not to encumber the ground. By doing so, the trees will grow faster and larger. Then seed your woods down in clover and herd grass, for the purpose of having pasture for your horses, cattle, sheep, and your sows and pigs, while the pigs are young.

If you should have any spare land, which you do not intend to cultivate, and improve by my mode of cultivation; and you should wish to introduce the pine, you must procure some of the seed, put them in a barrel full of water, and let them go through the fermentative process. Then sow them on the land that you have set apart, and with your large spike harrow, go over the ground, so as to cover them. If well done, they will soon come up. Beware of sowing them too thick, as it will give you the trouble of cutting up the superfluous scions. In ten years you will have a beautiful woods.

It appears that all living objects of the creation are subject to disease. Trees are no exception, for they too have their diseases in great variety; such as the

canker, moss, &c. The health of trees, whether forest or fruit trees, may be much promoted by cutting away all diseased and dead parts. Every rotten, hollow, or decaying limb, should be immediately removed, as soon as observed. And they should not be removed only, but they should be cut off until the axe comes to the sound wood, the surface of which should be left perfectly smooth. Mr. Forsyth, of London, gives the following composition, for putting on the stumps of limbs which have been amputated. To twenty-five gallons of human urine, and a peck of lime, mix as much cow dung as will bring it to the consistence of paint. This substance should be laid on with a brush, about the latter part of March, until a sufficient coat is on the stump to protect it from the weather. This is said to be effectual, though I have never had occasion to use it.

By properly trimming and cutting away the diseased parts, trees may be made to last much longer; nay, their very existence is often renewed. An acre of woodland, properly attended to, is worth two acres suffered to run to waste, to languish and die. Disease in trees, as well as in the human, destroys them, if not arrested by amputation or proper remedies.

ON LIME AS MANURE.

Though lime has been used for ages as a manure, there are thousands who shut their eyes to the testimony of the most enlightened nations, and in their pretended contempt for "*book-farming*," affect to know more about the matter than those who are experienced and know from practice. I do not believe every idle tale concerning the efficacy of lime, nor do I believe that it acts on the soil in every respect as others believe; yet there cannot be the shadow of a doubt that its proper application ameliorates the soil, as was taught by the ancient Roman writers of celebrity. Like marl, lime binds the sandy and renders more porous the clayey soil, attracting moisture at the same time from the atmosphere. My object, in writing upon the subject, is not so much to extol its merits as a manure, as to describe its merits in a true light.

There are two kinds of lime used as a manure for land. The first is procured by burning oyster shells, and the second by burning limestone in a kiln. The first is by far the best, inasmuch as it is much finer, purer, and acts more rapidly on the soil than the other.

The oyster shell lime is adapted to every soil, provided the soil is not too low and wet. Lime acts, as before observed, by absorbing moisture from the atmos-

phere, and it is, therefore, reasonable to suppose that a wet soil would only render the lime a mass of mortar. But as was observed of marl, it benefits clayey land by opening the pores of the soil, making it friable and giving free passage to water and the roots of vegetables. Now there is sometimes too great a quantity of acid in the soil, and the lime serves a good part by neutralizing this acid, and thereby benefitting the plants growing therein.

Lime is beneficial also to sandy and gravelly soils by binding their particles together, by which they retain whatever falls upon them. The heat of the sun vaporizes and carries off from sandy soils, the best and most nutritious portions of vegetable matters and gasses. When the soil is limed, great care should be taken that it be covered from the sun, so as to retain these juices and gasses.

Care must be taken how and when lime is applied. It is well known that quick lime is caustic, and that lime water destroys a plant when thrown upon it. But when lime is spread upon land, it unites itself chemically with vegetables, becomes a compost, dissolves in water, and in this way becomes nutritious to vegetation.

Land should properly be limed in the summer, say in June or July, when the soil is in fallow, by which it will be thoroughly incorporated with the soil before the sowing of the crop. This should be the case, if it is intended that turnips should be sown.

If the lime is to be spread upon an old field, some recommend that it should be applied to the sward before the plough enters, or the surface is broken.

Other writers on lime say, that it should be ploughed in a few days before seeding. But if the ground be new, they say it should be spread upon the surface, ploughed under in autumn, and ploughed to the surface again in the ensuing spring. I must confess that this strikes me as being a very good plan. In planting corn, I have not a doubt but that this is the very best plan that could be pursued.

Chemists have demonstrated the positive fact, that lime forms a part of the composition of nearly all vegetables, and hence we find that it has been known from time immemorial.

There is a great diversity of opinion with respect to the quantity of lime necessary to be spread upon a given number of acres. There appears to be no certain quantity used in England, varying from two to six hundred bushels. My opinion is, that where the soil is sandy, the quantity of lime should be in proportion to the quantity of vegetable matter contained therein. In France, they use small quantities, declaring that from twenty-five to thirty bushels are sufficient at one time. In America, also, the quantity varies from sixty to three hundred bushels per acre. Six hundred bushels have been applied to strong clayey soils, but this quantity would be too much for sandy lands.

Whether or not the benefits derived will balance the expense of such heavy applications, I am not prepared to say; but be this as it may, the shell lime is far preferable, and should in all cases be used, though not in any such quantities as here spoken of. Indeed if my system be correct, no lime is needed, and no other artificial manure, unless it be made into a compost, which should be made as follows:

To make a compost pile, take all the long manure you have, and all the vegetable matter that can be gathered on the farm, such as leaves, hay, grass from the hedges, and what else that may be found, and place them in layers in the field, sprinkling on each layer a good coat of lime. Let each layer of dung and vegetable matter be five or six inches thick, and on each alternately or successively spread a good coat of lime. When it has risen into a pile, and contains all the matter you possess, cover it over with dirt five or six inches thick, so that the gasses which do escape, may be caught and retained in the earth on the top, which they will serve to enrich. Heat will soon be generated, fermentation will ensue, and the vegetable matter be decomposed, or reduced to original principles; that state in which the dead plant becomes food for the living one. Thus life springs out of death and decay, for vegetable matter must be not only dead, but rotten, before the living plant can derive nourishment from it. The very roots of the living, riot in the dead matter of the dead

plant, which but last year sprung from the ruins of another. Nature continually deals in wonders.

Many farmers notoriously throw away many resources, which they might turn to great advantage. Does a horse die on the farm, straightway his hide is taken off and sold, and the more valuable part dragged out to feed the "bleaking buzzards of the night," as though the carcass were good for nothing. The same is performed when an ox, cow, sheep, or any other animal dies, or gets killed on the farm. And thus they labor, I mean all such injudicious farmers, to throw away the very best sources of manure on their farms. All dead animals, even to dogs, cats, and rats, should be turned to account, by making a compost of them with lime. Animal matter makes the best of manure, when decomposed or reduced to original principles. How many loads of the best manure are thus lost every year by injudicious management! Heaven has placed within our reach all that we need, if we will not blindly overlook our advantages, and despise the blessings which an all-wise God bestows upon us.

ON MARL.

Though my system of agriculture is based on the fact, that nature will manure the land if kept covered

from the sun; yet I do not condemn the use of Marl and other manures, when they can be obtained easily and without too much expense. But if marl is to be hauled from a distance of 5 or 10 miles, it is better to let it remain; for it costs more than it comes to. I advocate marl not as a manure, but as an ingredient to improve the texture of the soil; for there must be a soil, or my system cannot be brought into operation. Upon naked sand I can do nothing, and therefore I recommend the use of marl, as it has a tendency to bind together a sandy soil and to render a clayey one more porous, by which the rains can be received and retained. Clay marl for sandy land, and stone marl for a clayey soil should be used. With this necessary introduction, I shall proceed to speak of the subject proposed; the kinds and nature of marls.

The component parts of marl are clay, sand and calcareous matter. Sometimes two of them are united, but chalk or lime in some proportion is always found. Clay marls are found of various colors: blue, brown, reddish, yellowish white and yellowish grey. The blue clay marl is never found in conjunction with sand, and the shell marl is not often found combined with clay. There is in stone marl sometimes a superabundance of clay and sometimes of sand, though it is more frequently sand. As observed before, the sand marls, be it shell or shistus, should be put upon clayey soils and clay marls on a sandy soil, because in the first they render the soil more porous, and in the

second less so. The defect in each is thus remedied. Marl has somewhat the appearance of fine clay, but of a color considerably lighter, and like clays, seems to be of a greasy consistence; yet it is not tenacious like clay, but crumbles to pieces between the fingers. It has very little or no smell, and tastes very like chalk. It is found in many parts of our widely extended country; sometimes in wet flat lands, and at other times under sand banks, by the margin of rivers.

It is difficult to keep vegetable matter in a sandy soil, as it gives it up readily, not only to plants, but is vaporized and carried off by the heat of the sun's rays. Hence it is called a hungry soil, and hence, too, I recommend it to be covered by clover or grass to protect it from the volatilizing power of the sun. All sandy soils need clay and a portion of calcareous matter to improve their texture and increase their fertility. Marl at once answers this purpose, as it contains both clay and lime. The quantity put on the soil should be in proportion to the deficiency of these substances in the soil. It is said that the effect of marl on the sandy soil will be seen for twenty or thirty years. This arises from, and proves the fact, that the earths do not constitute the food of plants, but that the soil is only the stomach which digests, or assimilates the animal and vegetable matter which nourishes and enters into the composition of plants. The very best soil is that in which the three earths, sand, clay,

and lime are blended in certain proportions. Wheat cannot grow in a soil destitute of, or deficient in, calcareous matter, which is generally more or less the case with sandy land. Gypsum, or Plaster of Paris, is sometimes used. It is a sulphate of lime, or sulphuric acid (oil of vitriol) combined with lime. The lime binds the sand, and the sulphuric acid is a stimulus, and serves to attract moisture from the atmosphere, which, when covered, serves to enrich the soil.

Clay lands are denominated cold, because they are of a compact, solid texture, resisting more than sand the action of the sun's rays. The roots of plants cannot penetrate such a soil freely, and like all solid bodies its temperature is low, being too cold to carry on the process necessary to the health and rapid growth of plants. It is here that the stone or sand marl is beneficial, in rendering the soil more porous, by which heat and moisture are admitted to assist in digesting the food necessary to the growth of the plant.

It is a very easy matter to distinguish marl from mere clay, and also to discover whether it is marl or not. Put a piece or a portion pulverized into one of the acids, even vinegar, if strong, and if effervescence takes place, it is an evidence sufficient that it is marl, for clay will not effervesce in any of the acids. The effervescence is occasioned by the action of the acid on the lime contained in the marl.

How wisely has Nature adapted every thing not only to use, but as it respects location, and Providence never suffers them to be discovered until they are needed by man. When a country becomes scarce of wood, extensive coal mines, as in England, are discovered; or peat and turf, as in Ireland. So with respect to marl. Now it is a fact that beds of clay marl, the very substance needed, are generally found under sandy soils, and shell and stone marls under clayey soils. And how wisely has Nature designed it, that every thing which springs from the earth shall go back to it, a proof that Providence never intended the land to wear out, and it never would but for the ignorance and folly of man. All animal and vegetable matter that springs from, or exists on the earth, undergoes the chymical process of decomposition, and is resolved into water and air, in which forms they serve to nourish other animals and other vegetables, thus almost agreeing with the doctrine of transmigration of souls, held by some of the oriental nations.

There is a mode of making artificial marl, which is as follows: Place in a pile a layer of good clay, and upon it a layer of lime, and so on alternately, until it rises to a heap; there being equal quantities of clay and lime. Let this lie exposed all winter, and in the spring spread it upon a light soil and it will be beneficial; but if the soil is a heavy clay, then the composition should be lime, sand, and loam. These

mixtures will greatly resemble the true calcareous earth, and will repay the labor.

I spoke above of spreading the marl in the spring, but the proper time is in the summer, as the marl is then very dry. The farmer, however, can use his pleasure, and put it on the land even in winter, when he has nothing else to do.

The ground should be put in proper order before the marl is spread upon it. All weeds should be exterminated, and the ground rendered level by the use of the harrow. This is necessary, because then the marl may be equally spread over the soil, and have an equal effect on every part of it. In the spring it should be harrowed into the soil, but with great caution; as from its weight, it has a tendency to sink too deep into the soil, and thus by falling in the furrow made by improperly ploughing it in, its virtue is lost, and the ignorant farmer condemns it as a valueless substance. The great object should be to incorporate the marl thoroughly with the soil, so that it shall become a part and parcel of it. In its thorough incorporation with the soil lies all the benefit; if it remain upon the top, or in the furrow, the effects are but partial.

The quantity of marl which should be spread upon land is another matter of importance. I would recommend too small a portion rather than too large, as it is much more easy to add to than take from. On a sandy soil a thick coat may be spread with safety,

as it will tend to bind the land, and cause it to retain every thing that falls upon it. On stiff soils a thin coat should be spread, sufficient to render it more porous, by which it may receive and retain whatever falls upon it.

"To find the composition of marl," says the Domestic Encyclopedia, "pour a few ounces of diluted muriatic acid into a Florence flask; place them in a scale, and let them be balanced; then reduce a few ounces of dry marl into powder; and let this powder be carefully and gradually thrown into the flask, until after repeated additions, no farther effervescence is perceived. Let the remainder of the powdered marl be weighed; by which, the quantity projected will be known. Let the balance be then restored. The difference of weight between the quantity projected and that requisite to restore the balance, will shew the weight of air lost during effervescence. [That air proceeds from the calcareous earth alone, which contains 44 per cent. of this carbonic acid air. Suppose 500 grains of marl lose 44 grains by the escape of air, then that marl contained 100 grains, or one-fifth of its whole weight of limestone.—T. C.] If the loss amount to twenty or twenty-five per cent. of the quantity of marl projected, the marl assayed is calcareous marl, or marl rich in calcareous earth. Clayey marls, or those in which the argillaceous ingredient prevails, lose only 8 or 10 per cent. of their weight by this treatment, and sandy marls about the same proportion.

The presence of much argillaceous earth may be judged by drying the marl, after being washed with spirit of salt, when it will harden and form a brick.

"To determine with still greater precision, the quantity of calcareous earth in marl, let the solution in muriatic acid be filtered and mixed with a solution of carbonate of potash, till no further precipitation appear. Let the sediment subside; wash it well with water; lay it on a filter, previously weighed, and dry it. The weight of the dry mass will show how much carbonate of lime, the quantity of marl, submitted to experiment, contained."

There have been a variety of opinions held at different periods of the world, concerning the efficacy of marl as a manure; for it is certainly of very ancient date. Lord Bacon defines marl to be the best compost in use; having fatness, and being nutritious to the earth. An ancient author declares, that a piece of land once marled continued fertile eighteen years, while Anderson's statement is thirty years, without further improvement. These are no doubt exaggerations.

The word marl signifies in its original meaning, *marrow*, or fatness, from the supposition that it imparted fatness to the earth; though, as has been shown, it acts from binding or opening the pores of the soil, and from attracting moisture from the atmosphere. The *lime* has also the power of decomposing vegetable and animal substances in the earth.

ON THE MODE OF
RAISING AND TRAINING HORSES.

You should in all cases endeavor in the first place, to obtain a good breed of horses; and, particularly, you should aim to get that kind which is full made, and full of action. For breeding mares, choose such as will breed after the horse, and then you will find no difficulty in obtaining a good stake of horses.

As soon as your mares have colts, you should commence handling them, and so continue on until three or four years old. Great care should be taken of them. Too much grain should not be given them while young, but plenty of good hay, and salt once a week, if you do not live near the salt marshes. When you commence breaking the colts, you should be very gentle with them, and never suffer them to be stormed at or abused. Put the bridle on them, let them stand two or three hours at a time, and then lead them about the yard several times in a day. In the next place, the saddle should be put on and girted rather tight; again be led about; after which a light boy should ride it, while you mount a horse and ride along side. Thus proceed up and down the road together; then put your carriage harness on, and let the colt stand about an hour every day. Be sure to girt your harness on well, and never suffer the colt to become entangled in them. Lead it about, once a day, with the

harness on; and then put one of your horses in the shafts of the carriage, whilst you hitch the colt along side, with the harness on. Drive them in this way several times, then put the colt in the shafts and drive them several times, with the old horse at his side. While you are on the road, you should have the old horse ridden ahead of the young one, and then drive the latter by himself. By this process, you will have a first rate family horse, gentle and docile.

That peculiar people,—the Turks,—at Constantinople, give the following account of the Turkish horse. Our own wise people may learn a lesson of humanity from their words. "There is no creature so gentle and respectful to his master, as the Turkish horse. The reason is, they treat their horses with great lenity; they make them lovers of mankind, and they are so far from kicking, wincing or growing untractable by this gentle usage, that you will hardly find a vicious horse among them." Alas! "our christian grooms go on another rate. They never think them rightly curried until they thunder at them with their voices, and let their clubs or horsewhips dwell on their sides. This makes some horses tremble when their keeper comes into the stable, so that they hate and fear them too. But the Turks love to have their horses so gentle, that at the word of command they may fall on their knees, and in that position receive their riders. They will take up a staff or club on the road which their rider has let fall, and hold it up to

him again. I have seen some horses when their master was falling from the saddle stand still, without moving a foot, until he got up again. Once I saw some horses when their masters were at dinner, prick up their ears to hear their voices; and when they did so, neighed for joy."

DISEASES OF HORSES.

I shall add to this work, a short treatise on the most frequent diseases to which this noble animal is subject. Of all the creatures which an All Wise Providence has given to man, the horse is without controversy the noblest, the most valuable and useful. How necessary, then, that the diseases of so useful a creature should be understood! Yet how melancholy the fact, that in all the Medical Schools of America, there has never been established a veterinary chair, notwithstanding the warmth with which the celebrated Dr. Rush urged the necessity, and the advantage. A veterinary chair in the schools of Europe is common. Farriery, as well as physic, should be taught and studied as a profession. The horse should be known from his anatomy to his diseases; for, next to mankind, he ranks in the scale of usefulness. Such a knowledge would save thousands of these indispensable creatures from destruction prematurely, and save thousands of dollars to the ignorant owners of them.

In the following short treatise, I shall speak only of

the more prominent diseases to which the horse is subject; such as colic, botts, distemper, blind staggers, scratches, &c.

COLIC.

This disease attacks the horse very suddenly, and carries off many noble animals; and, yet, if taken in its early stages, it is easily cured. The causes of colic in horses are numerous, among which I shall enumerate the following. I have known bad food, such as improperly cured hay, to produce it. Horses that are warmly clothed and well housed, are attacked with it from drinking very cold water. Sometimes it is brought on by a draught of cold water, after having travelled rapidly. Again there can be no cause apparently assigned, save a sudden loss of tone in the stomach or bowels, causing a spasmodic stricture of the intestine, and a consequent retention of air. Confined air is very frequently the cause of this disease.

The symptoms of this painful disease, are as follows: In the beginning, the horse appears uneasy, paws the ground, and vainly attempts to evacuate. After a while his agony increases, he throws his head from side to side, and groans, as if he would tell his misery. At length he tumbles down, and rolls over, while a profuse sweat breaks out upon him. At intervals he appears to get better; he gets up; but the spasm returns, and he suffers still greater agony. The pulse remains nearly the same, and no fever is

observable. Though sometimes the disease will gradually abate, without the application of any remedy; yet frequently the air continues to accumulate in the intestine, until inflammation takes place, or perhaps rupture, when the unhappy horse immediately sinks and dies.

A very good remedy in this disease, is a quart of gin, in which a small portion of tobacco has been boiled. Hold the horse's head back, and drench him with it. If the pulse becomes quick, three quarts of blood should be taken, in order to relieve the spasm and prevent inflammation of the intestine. The first draught will generally relieve, in the early stage of the disease; but should the misery continue an hour or two, repeat the draught of gin and tobacco. If this should not be found to answer the purpose, administer a pint of castor oil, with an ounce and a half of laudanum. The horse, after he gets up, should be well rubbed and clothed with blankets.

The best manner in which a draught can be administered, is by means of a bottle with a long neck. The bottle is introduced into the horse's mouth, as far as possible, so that the liquid will run down his throat. His head should be elevated high enough to prevent him from throwing out the liquid. His tongue must be at liberty, in order that he may swallow, that organ being absolutely necessary to that operation.

BOTTS.

According to zoology, botts are nothing more or less than a kind of worms, hatched and nourished in the alimentary canal of a horse. There are three kinds of worms to which horses are liable. These are truncheons, mawworms and botts.

The truncheons are considered most dangerous. They derive their name from being short and thick, with dark heads. They are found in the stomach or maw, through which they eat, and destroy the horse.

The maw-worm is found in the maw, somewhat like an earth worm, and of a reddish color. They are about three inches in length.

The bott is found in the great gut. Though a small worm, they have a large head. Botts and the nitts, may be found in the excrement of the horse, as well as in the fundament.

It is a species of fly which lays the egg of the bott. Some authors contend, that the female fly enters the anus of the horse and there lays her eggs; that they are hatched by the heat of the parts, and ascend into the intestines and stomach. Other authors contend that the fly lays her eggs on the hair and legs of the horse, and that from the itching, he carries his mouth to the spot, gathers them in the saliva, and finally sucks them into the mouth, from whence they descend into the stomach. These flies are seldom found in cities,

and the horses, if kept in stables, are seldom affected.

I have seen these botts, which are large maggots, put into strong Nitric Acid, (Aqua Fortis,) through which they waded apparently as if it had been water. The Sulphuric Acid, (Oil of Vitriol,) was then poured upon them, which completely cooked them.

The bott is of a singular construction. Around them are circular rings, and they have prickly feet, which enable them to hold on to the part where they breed. The rough muscular coats of the stomach are well suited to them, for there they cling and suck like leeches, until the part looks like a honeycomb. They cause convulsions, and often throw the horse into great agonies, painful indeed to witness.

It may be easily discovered, whether a horse is troubled with any of these worms, by the following: He will strike at his belly with his hind legs, and paw the ground with his fore legs. He will turn his head to look behind, as if trying to discover the cause of his agony. He will also groan like one in misery, and roll his restless eyes.

Botts are not often discovered to be in the stomach of the horse, until they have acquired considerable size; and hence they are very dangerous. They are not so dangerous in the beginning of summer, in the straight gut, for they often come away in the dung. The worst effect is, that they render the horse rest-

less. The horse suffers most from them in May and June, for they seldom disturb him longer than from fifteen to twenty-five days at a time.

From the following symptoms, it may be known when the horse is suffering from the truncheon or maw-worm. His hair stands out the wrong way, and he strikes his hind feet against his belly. He looks jaded, becomes lean, and has spasms in the belly. He will occasionally after being griped, stretch himself on his belly, and then get up to his food. But above all, the presence of the worms in the excrement.

Now to the cure. Calomel, repeated in large doses, is an excellent remedy for botts in the stomach. After the calomel, an active purge.

For botts in the straight gut, give the following: *Savin*, a spoonful; cut into small pieces, twice a day, in moistened *meal*, to which add four or five cloves of *garlic*.

Perhaps there is no better treatment than the following: Let the horse be kept from food during one day, and at night give him a mixture of molasses and milk. This, it is said, will cause the botts to lose their hold, and pass off by the bowels. Or bran and warm water, in small quantities, may be given. As soon as possible, after this, give him a ball made of bread and honey; mix with one scruple of turbith mineral and the same quantity of calomel. The next evening give him one pint of castor, and half a pint of linseed oil. It is supposed that the worms, in their

eagerness for food, will eat the mercurial mixture, which will destroy them, and that the oils will throw them off.

APOPLEXY, OR BLIND STAGGERS.

This disease, in the brain of the horse, is caused by too great an accumulation of blood in that part. The symptoms are a want of appetite; drowsiness; inflamed and watery eyes, and a staggering movement of the animal, from which the disease takes its name. The head of the suffering creature leans on the manger; the urine is discharged in small quantities, and fever prevails in the system. Sometimes, in the advanced stages, he reels about as if blind, and unable to keep his feet or see his way. Sometimes he beats his head against the wall, and is struck forcibly to the earth, as if by some invisible power.

The causes, besides too great fulness of blood in the brain, are as follows: Colds, caught by being turned out into the field too early, after violent exertion; high feeding; want of exercise, and by moist *cobwebs*, either taken in through the nose or mouth.

If the first, or too much blood in the brain, be the cause, copious bleeding must be resorted to; two quarts of blood from the neck, and a pint from the thigh; after which administer half a pint of linseed oil, the same of castor, forty grains of calomel, sixty of jalop, and two ounces tincture of aloes. Give the above every morning and evening, and be par-

ticular to avoid all cold water, as it is very injurious.

If the animal being turned too suddenly to grass after great exertion be the cause, it will be proper to bleed freely, and with straw to support the head. Also a clyster of senna and salt should be given, morning and evening. The fumes of burning tar passed up his nose will be found excellent, inasmuch as the disease proceeds from cold. Equal parts of antimony, cinnabar and guiacum, made into doses of one ounce, should be given every day for a month.

If fulness of blood, want of exercise, or high feeding be the cause, small quantities of blood must be frequently taken, and a diet given which will have a tendency to open the bowels.

With respect to cobwebs as a cause of this disease very little is known; and it is useless to say any thing further here.

SCRATCHES OR GREASE.

This disease is said to be very prevalent among the horses of England, owing to the carelessness and bad management observed. It arises from excessive labor, a miry stable, and from suffering the hair to grow long on the fetlocks without being cleansed from the dung and dirt which collect there. The dirt collects, becomes hard and heats the foot, even so as to disease the sole. Owing to this, the foot and leg swell, from which a matter is thrown out much resembling grease,

from which the disease derives in part its name. The joints become stiff and swollen, and the horse entirely lame.

Let it be forever remembered that, instead of suffering the hair to grow, as many people believe to be an advantage, in preserving the foot from injuries on hard roads, it should be kept trimmed and clean. If the hair that grows on the part, is the only defence against injury from stones or frozen earth, it is a poor one, and not worthy the attention of the farrier. Such injury bears no comparison to that inflicted by the disease. Another thing should be remembered. A horse should never be rowelled for this disease, as all experience demonstrates the fact, that instead of proving a cure, it too often leads to consumption.

The best remedy for this disease, with which I am acquainted, is the following: Clean the part with a corn cob, and wash it well with strong soap suds; after which apply a plaster of boiled tar. According to my experience, this remedy never fails. The following is very good in the incipient stages of the disease: Four ounces of Venice turpentine, one ounce of quicksilver, and grind them until the quicksilver disappears; then add mutton suet and honey, each two ounces. Anoint the part once or twice a day, with this composition.

But if the horse is of full habit, and the hair turns the wrong way, then a more extensive practice must be pursued. He must be bled, purged, and altera-

tives used, to correct the vitiated state of the blood.

Sometimes deep seated sores and cavities are formed in the horse's heels. In this case, the knife must be resorted to; the parts laid open, and one of the preparations, above spoken of, applied; for the application must be made to the bottom, or a cure cannot be effected.

The following is an excellent purge in this disease: Two ounces *Aloes*, three drachms *Rhubarb*, two drachms *Calomel*, and oil of aniseed enough to make a mass. Divide this into two *pills*, or balls.

A pint and a half of Castor oil may be given for a purge.

FOUNDERED.

This is a disease in the feet of horses, and arises from the following causes: *First*, severe labour; *second*, too great a quantity of new grain; *third*, hard riding; *fourth*, sudden colds; *fifth*, great heats. These inflame the blood, and as farriers say, *melt the grease*, which settles into the feet, causing the disease above named. Thomas Cooper declares this disease to be a species of gout, "produced by permitting the animal to eat or drink heartily while hot; or by violent exercise on a full stomach."

The general mode of treating this disease is to bleed first, and if not entirely effectual, cooling salts, clysters, and an opening diet to be administered, to

lessen the rapid circulation. Emollient poultices are applied around the hoof, to soften and restore an equal perspiration. I have found hot brine bathed over the parts to be an excellent external application. The horse should be led about immediately after.

The hard part of the sole should be cleared away, in order that the poultice may be applied for the opening the pores. No greasy application should be made under any pretence whatever, as they are all injurious. Exercise, as the horse can bear it, is very beneficial.

LOSS OF APPETITE.

It is often the case, as every farmer will readily acknowledge, that the horse from bad management, or ill treatment, will lose his appetite and refuse the choicest food. The causes are cold, a long journey, too great labor, and an exess of food. When this is the case, he looks hollow eyed, lean, and his hair dry and frizzy. He appears dull, and has little disposition to move.

Egg shells are an excellent remedy. They should be dried before the fire until they are very dry, but not scorched; and then powdered in a mortar. Then scald some bran and sift the egg shells into it. Give the horse a small draught of this two or three times a day, and the effect will be very soon visible. It will loosen him, and act as a tonic in restoring the lost tone of the stomach. Also, wrap a piece of Assa-

fœtida around the bit of the bridle, and keep the sick horse from the society of other horses. I have seen wonderful effects produced, in restoring decayed appetite, by simply tying a small piece of this substance round the bit of the bridle, and keeping it in the horse's mouth. In a short time he became more lively and active, and soon showed symptoms of returning appetite.

In obstinate cases, it is recommended to take a quart of blood from the neck vein, and afterwards to administer a purge. Where there is a foulness of stomach, it is recommended to diet the horse a few days, or one or two days, before giving the purge. Let him be one or two hours before, and the same time after taking the medicine, without food.

An excellent purge is the following; *Jalop*, one drachm; *Aloes*, one ounce; *Rhubarb*, one drachm; with *Castor Oil* sufficient to make it into a mass. A while after he has taken this, give him gentle exercise in the open air.

SPAVIN.

There are two grades of this disease, the one called the *blood spavin*, and the other the *bone spavin*.

The blood spavin is a soft swelling, which appears on the inside of the hock, some suppose the master vein; but it is erroneous. A horse afflicted with this

disease, raises his leg from the ground with a stiff jerk, and he appears to have a lame movement.

The first thing to be done towards a cure, is to cut off the hair from the part swollen, and after rubbing, with a piece of soap, round the outside of the spavin, apply a blister composed as follows: *Hogs lard*, half an ounce; *Beeswax*, three drachms; *Sublimate*, half a drachm; and *Cantharides*, two drachms. This generally effects a cure; if not, repeat the blister. Let the blister be spread upon a piece of soft white leather.

BONE SPAVIN.

The second form of spavin is called *bone spavin*, which consists of a bony excrescence, or hard swelling on the inside of the hock, a little under the joint, somewhat lower than a blood spavin. It often causes lameness just before it makes its appearance, which may be discovered by feeling the part, which is hot and tender. The same treatment as in blood spavin.

A blister should be applied, and repeated as often as necessary. But when the disease is of long standing, the cure often becomes difficult. Should this be the case, the skin should be irritated with caustic, and the day after, the application of a strong blister will be necessary. After this, the horse should rest several months.

I have said thus much on the most common diseases

of the horse, because there are so few who know how to treat this noble animal when he lies stretched and groaning at their feet. If owners of horses would but study *superficially* these diseases, how many fine beasts might be saved from incurable malady, or a sudden death!

ON THE

IMPROVEMENT OF MILCH COWS.

So soon as you find your heifer becomes very forward with calf, you should commence feeding her with slops or some kind of grain ground, so as to make slops; and that will cause the heifer to spring her bag. About two or three weeks before she has her calf, and the same time after, you should give her some short corn; say half a gallon of ears each day, which will strengthen her, and she will soon recover from calving. She should then be fed high, and that will make her one of the first rate milch cows, and you must continue on to feed with plenty of hay and slops during the whole time your cows are giving milk.

When your cow has had her second calf, and it has broken and made the bag soft, they should be seperated. The cow should have but very little slops or hay to-day, as to-morrow I would have her spaid. After

this operation is performed, and while she is getting well, you should suffer the calf to suck her occasionally; but never suffer it to hunch. Your milkmaid should, in milking her, strip every drop that she can get, as a neglect of this practice has often caused cows to go dry. The milkmaid should be very gentle. The milk may be taken from the cow and given to the calf, which should by all means be weaned so soon as the cow gets well.

After the calf is weaned, the cow should be fed very high on slops, grass, and hay, which course will insure the cow to give abundance of milk for ten or fifteen years, and generally as much as cows give four weeks after having a calf.

One thing I wish particularly to mention. All cows should be housed as carefully as horses are. They should have their stables, and their beds made in wet and cold weather. A cow kept in a good, warm and dry stable, will become fat more easily, and her milk will be as rich as yearling's. Another thing to be observed is, your cow should be curried and rubbed down as regularly and as often as your horse; morning and night will be sufficient. This course will render your cow gentle and docile as a dog, and two cows thus used will furnish a large family in the country with milk and butter. If your cows are good, they will give from two to three gallons at a milking; which will be ten or twelve gallons per day. The more pains you take with your stock, the finer and larger they will be.

ON RAISING BEEF CATTLE.

Calves which you wish to grow large, should be taken when about two weeks old. Their feed should be as follows: Take a small quantity of Indian mush made thin, and put into it an egg, which has been well beaten in a bowl. The egg should be stirred in the mush while boiling, and afterward some milk must be stirred in the same. This should be given to the calf with a spoon, until it learns to drink the mush and milk. It should be regularly fed three or four times a day, and keep it in or under a dry shed, never suffering it to run out until it is a year old, when it should be transferred to a small clover lot, and should be curried and carded two or three times a day.

By pursuing this course, you can have your beeves at eight years old, to weigh from five to six thousand pounds; which will bring you from two to three thousand dollars for each beef.

To prove what I am going to relate, concerning a calf of mine treated in this manner, I shall refer you to the inhabitants of Talbot County, Eastern Shore of Maryland, at the last cattle show in Maryland in 1826. I took a small runt of a calf, and commenced feeding it in the above manner. At the time the cattle show came on, my calf was eighteen months old, and weighed twelve hundred pounds alive; and if I had continued on until it had been eight years old, what

would it not have been in the same ratio? I say it would have weighed six thousand four hundred pounds.

There were two beeves passed through Baltimore for Washington city, about the middle of March, 1838, which were said to weigh four thousand each; and both of them sold for three thousand five hundred dollars.

Well, then, my gentle readers, suppose you had been keeping twenty head of cattle during the same time, in the manner graziers keep them; and you carry them to market on the same day, and sell them. They will not bring more than twelve or fifteen hundred dollars.

Now, my dear reader, is it not better to keep less stock and take more pains with them, which will bring you double and treble the amount of money? I should say so; but many have such old fashioned habits that they will not retract. Take my advice, and depend on it you will not rue it; for if you will count the cost between raising twenty head and two head for eight years, I think you will be ready to agree that I am right.

ON THE RAISING OF HOGS.

You should take the best breed you can obtain for your own interest, which will be those that will fatten

young; say from ten to fifteen months old. Be sure never to keep your hogs over one winter, as they become expensive when kept longer. Breeding sows should be kept in fine order; and as soon as your sow has pigs, and even before, you should commence giving her slops, and never suffer your pigs to become poor; for a diminution in size is invariably the consequence. Put them in a pen, so soon as the sow weans them. A large pot should be kept to boil potatoes, pusley, lambs quarter, cabbages, &c. Pumpkins, simblens, and all kinds of vegetable matter when boiled, will give far more nutritious matter than when unboiled. One bushel of potatoes boiled, is equal in nutriment to a bushel and a half raw. The above substances boiled, should be put into a hogshead, together with some small quantity of bran, and all the meat liquor and dish water. Let it stand until fermentation takes place, and it becomes sour; for it is then better for hogs than when perfectly sweet.

Keep but few sows that you intend to breed from, and as soon as one has pigs, or the next day after, she should not have much to eat, for the course of twenty-four or thirty-six hours; and then take three pints of meal, and one pint of hogs lard, or the skimmings of the pot; to which add one pint of salt; work them well up together, and spread it upon a board and bake it, as you would bake bread, until nearly done. Give it to your sow as hot as she can take it. In one day from the time she eats it, she will take the boar; and

in due time will prove with pig. Hogs that are intended for bacon, should never run at large; for the best pork and easiest fattened, is that which is kept up in pens. They are fat, while those which run out are lean on the same food; and another advantage is, that when kept in the stye they are out of the corn field, and out of mischief.

My opinion is, that any man who has from two to five hundred acres under cultivation, can kill from six to ten thousand pounds of pork annually. This too may be done from the offal of the farm, for instance: small Irish potatoes, lambs quarter, pusley, pumpkins, &c. As soon as your clover is old enough to cut, give your hogs a portion every day, and your pork will be of the very best kind.

Your pigs should be trained to go in the pen with the sows to eat slops, so soon as they are large enough; and when your sows are about to wean her progeny, the pigs should be taught to go into the pen, where they should be kept about half their time at first. As soon as they become accustomed to confinement, they should be put up in a clean pen for good, which pen you should be careful to keep clean, particularly in warm weather; for I have seen large hogs, of three hundred weight, fall victims to a filthy sty. Besides the loss, filthy pens are injurious to health, producing fevers and malignant diseases. During the period the Cholera raged, the disease was traced in a town, in a neighboring State, to a number of filthy pens contiguous to each other.

Filthy pens cause the holes in the legs of the hogs to be stopped, their throats become affected, and they fall helpless to the ground and soon die. The only remedy is to wash their legs in a tub full of warm soap suds, with a stiff brush, and run a knitting needle five or six inches up those holes, until they are perfectly cleansed. The throat should also be scrubbed with the brush; after which, grease the legs and throat with tallow, and the hogs will very probably recover.

BEST MODE OF CURING BACON.

Hogs should never be killed unless in a thriving condition; and if the weather should prove cold, you should, when salting your meat for bacon, have all your salt heated tolerably hot in a pan. With this hot mixture, rub your meat until you bring the grease out of it. Pack your hams in a hogshead at the bottom; and for every hundred pounds of your shoulders and jaws, take one bushel of alum salt ground, or boiled salt. Let your pork remain for seven or eight days, and then make your pickle to bear an egg. For every 1000 pounds put two pounds of saltpetre, and one gallon of molasses. Put these in the pickle, and then pour it down the side of the cask into the meat, and let it remain seven weeks, when you should rinse your meat in the pickle, and hang it up in the smoke house. The smoke house should be rendered as dark as possible, to keep out the flies; for it is from

the eggs which they lay in the meat, that the worms originate.

The smoke should be regularly kept up until the meat stops dripping; when it should be slackened. This process of curing bacon, I know to be good; for I have tried it many years, and never knew it to fail; while my neighbors were complaining every year of spoiled bacon.

ON THE

MANAGEMENT OF SHEEP.

You should endeavor, in purchasing a flock of sheep, to get them in good health and sound; for one bad sheep injures the whole flock. Pasture your sheep in the dryest pasture you can obtain, which should be changed for another of the same kind, whenever practicable; and have the sheep penned every night in a dry pound well littered, and give them some salt once or twice a week. Give them about a gill of beans, or corn; one quart of potatoes, turnips or some kind of vegetable matter that will be of much nutriment, and that will cause your sheep to improve in flesh and wool. This treatment will render them gentle and docile; and in the summer you should pasture your sheep in the woods, if not too thick with undergrowth. Be sure to have some

shades round your sheep pen, so that they can retreat in wet weather, which will prevent them from taking cold, which brings on many disorders among them.

Be particular when you shear your sheep, to put them under these shades; for that is the time when they are most injured by taking cold. You should pay strict attention when they are about to have lambs, and feed the ewes with grain. Sheep should be fed in winter with clover hay, which has been salted; and while feeding on this hay you need not give your sheep any salt.

I am of the opinion that you can improve a flock of sheep as much in proportion as you can your stock of cattle, and we have all seen to what extent cattle have been improved. Our common steer will only weigh from five to eight hundred pounds, while an improved breed passed through Baltimore to Washington, one of which weighed four thousand pounds. Two of them which passed through in March, 1838, weighed four thousand each. Here then, my dear readers, you see what improvement can do for cattle; and by the same judicious mode of treatment, your sheep may be improved likewise.

ON THE

MANAGEMENT OF BEES.

My plan for the management of the honey bee is as follows: In winter, the gums should stand in the warmest place that can be found; and in summer, the coolest. The gums should be set about three feet from the ground, and a sort of house or shed should be erected over them; so as to shade them from the sun in summer, and shield them from the blasts of winter. The gums should hold about a bushel, and when it is necessary to take the honey from them, they should be raised up and a cloth spread under them. Then turn up the cloth, and tie a cord round the gum to prevent the bees from coming out at the bottom. The next step is to take off the head of the gum, and with a pipe of tobacco blow in the smoke at the top, and the bees will settle to the bottom and remain there, while you are blowing in the smoke. So soon as you take what honey you think proper, you should nail on the top again, and the next morning take off the cord and the cloth. The bees will cheerfully resume their work again, and fill up the hive.

Two or three empty and unoccupied gums should always be kept on hand; and you should watch your bees vigilantly, for you may generally tell when they are about to swarm. When this takes place, you

should have an iron pan or some sounding body, and with an iron bar beat on it, which will cause them to pitch. Then take one of the spare gums and rub it inside with a mixture of sweet fennel, salt and water, or a decoction of hickory leaves, with salt and water; after which set your gum on a clean table, covered with a cloth. The whole should be placed under the limb on which the bees have pitched. Shake the limb and they will settle, and run into the gum and soon go to work.

When your gum becomes old, you should kill the bees, as they are good for nothing. Should your bees fail, on account of the severe and protracted winter, or of being robbed too close, they should be fed with molasses and water. Never suffer any person to disturb the gums by thumping against them; for when disturbed, they are very apt to commence eating their honey. In England, they destroy the bees in robbing them, but this is cruel, besides being useless and a considerable loss.

In a bee hive we behold a representation of a republic, containing from ten to twenty thousand inhabitants. In this republican city, industry is the order of the day, and order and equality are every where observed. Their houses, or cells in the comb, are made of virgin wax, and these not only serve as the homes of the young bees, but as receptacles for their stores of honey. Between these combs there are streets wide enough for two bees to march, and there are also transverse passages or streets.

The working bees compose the most numerous part of the republic. To them is entrusted the defence of the city; they bring in the honey; build the cells, and nourish the young. They do all the offices of the hive; they fight against all intruding strangers, and, in short, attend to all the concerns of the State.

Drones are distinguished from the working bees by their larger size, and by their making more noise when on the wing. They die in July, and are carried out of the hive by the working bees.

The bee or apis is a genus of insects, of which the *mellifica*, or common bee, is the most valuable. It is very remarkable in their history, that they will not remain domesticated among a savage people. Several authors mention the circumstance, that the honey bee and the common house fly do not, and will not reside with the North American Indians.

Bees have their superior officers, whom they follow and obey in all cases. When one of these dies, if he be at the head of the government, all working ceases; the bees are no longer on the wing in quest of honey, but the whole city appears to be covered with mourning and confusion. The bees are seen through a glass hive, some standing in groups as if discussing the merits of the deceased, or the order of the funeral procession; while others, like guards, are walking to and fro before the passage. The funeral procession then takes place—the dead dignitary is car-

ried in pomp out of the city; after which, they return more briskly to elect a new officer. When the new officer is elected, they proceed in the Turkish plan, to get rid of all who might attempt to usurp the government. Certain bees are appointed to go round and strangle all the rest of the royal blood in their cells. These curious proceedings have been observed through a glass hive. It has been observed that the bees invariably return to their labors, as soon as their new officer is appointed.

It is something remarkable, that the bee has two stomachs, in one of which is digested the pure honey, and in the other the crude wax.

I shall now speak more fully of the government of bees, and the most approved manner of preserving them after robbing them.

An *apiary* should be situated in a pleasant south direction. A valley is preferable to a hill, as the bees on their return to the hive can descend much more easily than ascend when loaded with honey. The hives should be situated where there are no bad smells, and near a stream of water where they can drink. Water appears to be a necessary ingredient in the production of honey. The hives should be placed in a spot surrounded by, or in the neighborhood of flowers and shrubby trees, from which the bees may obtain honey, and on which they may settle when they swarm.

BEE HIVES.

Of all the substances of which hives are made, and they are many, straw has been most generally preferred. They have been preferred for three reasons. *First*, hives made of straw are cheaper than those made of wood, glass, or any other material. *Second*, they are warmer in cold weather; and *Third*, they are cooler in warm weather, than any other hives.

An ingenious French gentleman recommends the floor of the hive to be made of plaster of Paris, and the hive a basket work, composed of straw bound with bands made of the internal bark of the lime-tree. Over this, he says, should be smeared a full coating made of one part ashes and two parts cow-dung. Cleanliness appears to be essential to these industrious insects, and nothing could better answer this purpose than the smooth white plaster of Paris. The coating of the hive is said to prevent the entrance of noxious insects, while the smell of the straw is peculiarly agreeable to the bees. The cover of this hive is a broad board, nearly eighteen inches in diameter. The entrance has a door, which may be closed in winter, to keep out all intruders. At the bottom of the door are small holes, in the form of a half moon, just large enough to permit two bees to enter abreast. Above these are other holes, only large enough for one bee to enter. The straw wall of the hive should be an inch, and the cement half an

inch in thickness. One great advantage attending the straw hive, is, that the bees, from their comfortable state during winter, swarm much earlier in the spring. There have been many kinds of hives invented, but it is needless to enumerate them. The Egyptian bee hives are made of clay and coal dust, blended together, and formed into a hollow cylinder, from six to ten feet high. When dried in the sun, in the manner of clay bricks, this hive becomes extremely hard, and may be carried from place to place without danger of breaking. It is not uncommon in Egypt, for the natives to carry their bees into different parts of the country to procure honey, when from the overflowing of the Nile, they can get none at home. They start in October and return in February, after the bees have gathered the sweets of flowers through an extent of hundreds of miles, on the banks of the dark and turbid Nile.

Floating bee hives are not uncommon in France. They are carried in boats or barges, one of which will carry from fifty to a hundred hives. The barge is so constructed, that the bees are screened from both sun and rain. They float along the river, while from the flowers on the banks the bees gather their delicious sweets. But bees are not only transported from place to place by water, but by land also. They are carried in a cart, which contains about fifty hives.

It has not yet, I believe, been ascertained how

much cold bees can endure. In extreme northern countries they are found in trees. Even in the coldest parts of Russia, they are found in winter, in hollow trees, alive. The hives in Russia, are made of bark. In Portugal, bee hives are constructed of the rind of the cork tree, in the form of a cylinder, and a little more than two feet high, by twelve or fifteen inches in height. The inside of these hives is divided into three compartments, and the top is covered with an earthen pan inverted.

Bees, as well as the silk worm, have their diseases; one of which is the diarrhæa, brought on by feeding voraciously on certain plants, such as the elm and milk thistle. It is said that pomegranite seed pounded, united with honey and sweet wine, is an effectual remedy. Also raisins and rosemary, boiled in wine. When hives become infested with insects, they should be thoroughly cleansed, and perfumed with the leaves of pomegranite.

Many winged insects are very annoying to bees, among which may be mentioned hornets and butterflies. The best plan to destroy hornets, is to place basins of water round the hive, into which the hornets will fly to drink, and will be drowned. Lighted candles, it is said, will exterminate the butterflies.

It is well known that bees often go to war with one another; one hive battling against another. To prevent this, Dr. Darwin says, a board one inch thick should be laid on the bee bench, and so fixed with

respeet to the hive, that the assailing bees will fight under great disadvantage. This is an interesting subject, and I would refer the reader to larger works on the subject.

AN ESSAY

ON THE

CULTIVATION OF THE MULBERRY,

AND THE

REARING OF SILK WORMS.

There can now be but little doubt that the silk culture is destined, at no distant day, to become one of the grand resources, and silk one of the great staples of the United States. A little antecedent to the American Revolution, the people of the Colonies went heart and hand into the cultivation of silk; and at the instigation of Dr. Franklin, a silk filature was established in Philadelphia. Large trees of the White Mulberry, (Morus Alba,) are still standing in Connecticut and other New England States, which were then used for the propagation of that interesting insect, the silk worm.

The first account, however, that we have of the cultivation of silk in this country, was in the reign of King James, who was a great patron of that elegant employment; and who granted a certain number of acres of land to any settler, or emigrant, who would

plant a certain number of Mulberry trees. It is well known that the silk worm cannot be profitably propagated in England, on account of the humidity of the climate; and it was for this reason that he was desirous of introducing the culture into the Colonies. England, at the present day, manufactures large quantities of the beautiful silk fabrics seen in our markets; but the raw material is not produced at home, being brought from France and Italy.

At the period above mentioned, considerable quantities of silk were cultivated, or produced, in the United Colonies, until the storm of war arose, and burst like a tornado on the devoted head of America. During that period, in which the torch of civil war flashed through our cities, like the flaming sword of the angel at the gates of the garden of Eden, the spirit of individual enterprize was paralyzed; all eyes were turned to, all hands united in, the defence of the country; and hence, it is not to be wondered at, that the silk culture languished, and finally expired; for the few who were exempt from the ranks, were required to furnish subsistence for the army and the people.

At the conclusion of the long war, no more was thought of silk, or the silk worm, with the exception of the inhabitants of a few places in the New England States, who have continued the culture, they and their posterity, up to the present time. They labored too under great disadvantage, having to climb trees from

forty to sixty feet in height. They had not the advantages which the Chinese Mulberry, (Morus Multicaulis) confers, of rapid growth, large leaves, easily gathered, and of a superior quality.

The successful and universal introduction of this species of manufacture, as well as culture, will save the country from sixteen to twenty millions of dollars annually in woven fabrics, to say nothing of the sewings, refuse silk, &c. It will give employment to thousands of children and aged persons, who would otherwise be a burthen to their parents, friends, or the public. Advance this business, and the inmates of alms-houses, particularly, in the country, would so far from being a burthen to the county, pay the expenses of the establishment, and have a surplus. Another great advantage would accrue from the universal establishment of the silk culture. In many of the states, and particularly in Maryland and Delaware, there is a vast number of acres of land worn out and turned out, which might be turned to advantage, by being planted with the Chinese Mulberry trees. Poor land, and particularly a warm sandy soil, is peculiarly adapted to the Mulberry; the leaves are more relished by the worm, and contain more nutriment, as well as more of the resin which forms the silk, than leaves produced from a rich soil; simply because the latter are more crude, and from their rapid growth less compact in their structure. The leaves on a poor soil of course are much smaller; but what

they lack in quantity is recompensed by the quality, and though more tedious to gather, it will require a less number to produce a given quantum of silk. The silk will also be stronger, and of a finer, smoother texture.

Our Legislatures are beginning to awake to the interest of the people and the nation at large, and with a liberal hand, worthy the munificence of the greatest Republic in the world, are offering a bounty or premium for every pound of silk raised or reeled. Confucius, the great philosopher of China, acknowledged and declared, that China was indebted for her great wealth and splendor to the tree called the Morus Multicaulis, or Chinese Mulberry. Every incentive should be used to stimulate and arouse our people to this grand subject; for I religiously believe, that the culture of silk will prove a fountain of wealth to the country. There is no country under Heaven better calculated for the business than the United States, particularly the Middle and Southern states. The climate is adapted to the growth of the Mulberry, and particularly suited to the nature and instinct of the worm. There is every inducement that can possibly be offered, for the people of the Middle States to engage in this healthful, profitable, pleasing employment; and that it is profitable, no one will pretend to deny. The expenses are not great. A cocoonery may be built for, comparatively, a small sum, as there is no finish about it, requiring nothing

but a bare frame covered over with boards, leaving spaces for windows to ventilate the room. These windows should be numerous; with shutters to close in damp or cold weather. On the inside should be shelves put up, and here ends the items of the cocoonery.

The Mulberry (Morus Multicaulis) may be planted, say five feet high, this year; and be fed from the next. The idea, that the cultivator must wait five or six years is erroneous; all that is necessary, is to have a sufficient number of them. Having written thus much by way of introduction, I shall proceed to the Mulberry.

THE MULBERRY.

It is universally conceded by all authors on the subject, that the only natural food for the silkworm is the Mulberry, though there are a variety of substances on which the worm will feed, such as lettuce, blackberry leaves, rose leaves, &c. Some recommend the culturist to sow a bed of Mulberry seed, as the first thing to be done towards the cultivation of silk; but I prefer planting the cuttings, if the Chinese Mulberry is to be cultivated. The cuttings will certainly produce a tree sooner than the seed. The seed of the White Mulberry, however, may be sown.

There are many varieties of the Mulberry, springing from several species. The best varieties of the

tree should be chosen, and the soil most suited to its cultivation.

The varieties of the Mulberry spoken of are as follows: First, the White Italian; second, the Tartarean; third, the Shining Leaved; fourth, the Dandolo; and fifth, the Chinese. The last has three varieties, viz: the Morus Cucullata, the Morus Multicaulis, and the Perrottet Mulberry.

Among the varieties of this tree, not suitable as food for the silk worm, some authors enumerate the Red and Black Mulberry. This is an egregious error, for I have fed worms both on the red and the black; and though the worms did not grow quite so fast, or so large, yet they spun very compact balls; they reeled well, and proved to be fine, soft and glossy silk. Those worms fed on the White, grew somewhat faster, and somewhat larger; yet the silk produced from the red and black was equal, if not superior.

I have not the least doubt but that of all the Mulberry tribe, the Chinese is the best; both as a food, and in the facility of gathering the leaves. Some culturists believe, that the Chinese Mulberry cannot stand the severity of our winters; but I am of the opinion that they can, after the first winter; for I left many out the last winter, and not a single one died, though the experiment was tried under very unfavorable circumstances. In all cases, where the Chinese Mulberry has been killed by the severity of the cli-

mate, the indigenous trees have also fallen victims, which goes to prove that it is not so much the delicacy of the tree, as the intense severity of the weather.

The culturists of the New England States, recommend the White Italian Mulberry as a reserve, in case the Chinese Mulberry should fail. But I do not believe it will fail in the Middle States, and would recommend its cultivation alone, inasmuch as the leaves are so large, and it is so easy of propagation. That it will soon become acclimated in the United States, there can be no doubt; for its tenacity of life is such, that it cannot be otherwise. I have frequently broken off limbs in the middle of summer, the ends of which being covered with rich mould, they have taken root and grown.

Besides the Chinese Mulberry, and the Morus Alba, there are several other varieties, which are richly worth cultivating; especially when the Chinese, or Morus Multicaulis, cannot be had. Among them may be enumerated the Tartarean, the Shining Leaved, and the Dondolo Mulberry; the latter of which was found by Count Dondolo, the great Italian silk culturist, in the woods of Italy. They all have large leaves, are easily propagated, and the worms are excessively fond of them. Large quantities of silk may also be produced from them.

There has been much dispute concerning the soil best adapted to the Mulberry, to insure a proper

growth. Some have contended that the Mulberry requires a dry, warm and sandy soil, while others have strenuously contended, that it should have a low, wet and rich soil. My experience has taught me that the Morus Alba, or White Mulberry, flourishes best in a dry, sandy soil; but I am fully convinced, from ample experiments, that the Morus Multicaulis is most favored by being placed in a damp, rich mould. Judge Comstock is of opinion, that any soil which will produce Indian corn, is suitable to the last mentioned tree. This is no doubt true; but at the same time, the soil above mentioned, I have found from experience, to be the very best soil for the Chinese Mulberry. It is very true, as Judge Comstock observes, that in Italy, Piedmont and France, where the growing of silk is carried to a great pitch of perfection, Indian corn is found growing with great vigor, and is used for bread stuffs by the generality of people. I think, if my memory serves me rightly, that it is in Cambria, in Italy, where the Black Mulberry (Morus Nigra) is universally used as food for the worm; and silk from the leaves of that tree has been declared to be much finer and stronger.

PROPAGATION OF THE MULBERRY.

Culturists enumerate six different methods of propagating the Mulberry. The first is by the seed; the second, by budding or inoculating; the third, by grafting; the fourth, by cuttings; and the fifth, and sixth, by layers and suckers.

To procure the seed, the fruit should be put into a vessel of water, bruised, and the water and pulp should be carefully poured off. The seed that are good will sink to the bottom, while those which are unripe will float, and should be poured off with the pulp. A sheet, or other large cloth, should be spread under the tree, and the tree shaken gently, so as to detach all that are ripe, without disturbing the unripe berries. The berries should be washed as soon as possible after being gathered; for if kept several days, fermentation takes place, and destroys the vegetating property. But when it becomes necessary to keep the seed, they should be spread upon a board and dried in the shade; after which, they should be put into a bottle and sealed hermetrically.

When the time arrives for sowing, and the culturist is under the necessity of buying seed, he should be careful in the selection, as many cheats have been practised by those who vend foreign seed. I would recommend those of our own growth, in preference to foreign seed; as the silk growers and manufacturers of Europe, look with a jealous eye on every attempt at the silk culture in America. Several kinds of seed, such as turnip, have been sold in this country fot the genuine Morus Multicaulis. At first, this conduct would appear strange; but when we recollect the fact, that if you touch a man's purse you touch his soul, we need not be astonished. When the cotton manufacture was in its infancy, swarms of spies

were sent over to discourage and decry the efforts then being made to establish cotton factories of our own. Millions were thus abstracted, or rather detained, from the pocket of John Bull, and he was left to chew his lip with mortification and disappointed hope. The cotton manufacture is now established upon a base firm as adamant, and which can never be shaken by the arrows of envy, or the shafts of malevolence and jealousy.

The proper time for sowing the seed, is about the first of May; but the time may be extended to the beginning of September. A bed should be made, large or small, according to the quantity to be sown. Trenches should be made across the bed, and the seed dropped in about two or three inches apart; for if planted too closely together, they will smother each other and come to naught. When winter approaches, the roots of the young trees should be covered with straw; for there alone lies the danger. The shoot may be killed to the ground, but it will come forth again the next spring, and will grow more vigorously than before. Some culturists recommend the cutting off all the stalks of the first year's growth, and suffer them to come forth anew the next season. I am inclined to think this a very good plan, so far as my experience and judgment extends. When this experiment is tried, they should be cut off about two or three inches from the ground.

In dry situations, and in dry weather, the young

plants should be watered every day; but it should always be done before sunrise, or after sunset. They should also be carefully hoed, and all weeds destroyed.

TRANSPLANTING.

When the trees in the nursery have grown too thick to thrive, they should be transplanted to a lot of ground where it is intended they shall remain. It is unnecessary to describe particularly the mode of transplanting, as the Mulberry is taken up and set into the earth again, precisely in the manner of other trees. Some recommend shortening the tap root; but I do not believe in the doctrine, for if any part of the root is cut away, part of the stalk or branches should be cut away also. If they are transplanted through necessity in midsummer, all the leaves should be stripped off; they should be removed in a wet season, and shaded when clear, from the sun's rays, until the roots take hold, and new leaves put forth.

The trees may be transplanted when one or two years old, and, if intended for standard trees, they should be placed about eight feet asunder, one from another. There will then be left sufficient room for the admission of the plough, and for cultivating the ground in potatoes. Mr. Cobb recommends planting them at the distance that apple trees are planted from one another.

The young trees should be cultivated with great

care for several years, and from the first year, should be annually *pruned.* Mr. Goodrich, President of the Hartford County Silk Society, writing upon this subject, says—.

"I would begin to prune the trees the first year, observing to cut off all *sprouts* which grow near the ground; no leaves ought to be suffered to grow nearer than two or three feet to the ground. The earlier you begin to prune, the easier it will be to form good trees, and the more rapidly they will grow.

"The second year I would begin to make silk of the *twigs* which are trimmed off. If the trees have been properly cultivated from the beginning, I think you may make silk enough the second year to pay all the expense of making the silk, and of cultivating the trees that year. The principal object, however, ought to be, not to make silk the second year, but to cultivate the trees in the most judicious manner."

The same author recommends heading down trees, from year to year, to avoid the necessity of climbing large trees, as at Mansfield, Connecticut, some of which are from thirty to forty feet high. He says—

"I propose to save this labor in a great measure, by trimming and heading down the trees from year to year, so that they shall not grow more than six or eight feet high, and in such a manner that the leaves may always be gathered by a person standing on the ground. In this manner mulberry leaves are gathered in Persia, and in the vicinity of Constantinople."

Cultivating the White Mulberry in hedges, has been highly recommended by some; but I am far from being in favor of them, except they are intended merely as a fence. The trees, or rather bushes, in hedges, are generally very crowded; and, consequently, bear very small leaves, which are tedious to gather; and another inconvenience is, that those trees are apt to become thorny.

There are two methods of making hedges; the first, by sowing the seed; and the second, by transplanting the trees as before stated. Judge Comstock thinks the hedge the best method of cultivating the Mulberry. I shall quote a passage from his work on the subject of transplanting.

"To make a hedge," says the Judge, "by transplanting from the nursery, take plants one or two years old, and set them at the distance of eighteen inches apart, or, if it is intended to make a thickset hedge, at the distance of one foot. Cut off the tops at four or six inches from the ground, leaving two buds opposite each other, and removing all the rest. This causes the stock to have two vigorous branches the first year. The next spring, cut one of these two branches on the same side, at about twelve inches from the ground, in such manner that each plant may have a long one and a short one. Cut horizontally on the same side, also, one after another, all the branches, and fasten them with cords or withes, so that they may form a line parallel with the earth, and leave the

entire branches untouched. At the commencement of the third year, the plants will have branches to form a hedge.

"The height, form, &c. of a hedge, may be regulated according to the taste of the cultivator, by cutting off the branches, when covered with leaves, and feeding the silkworm upon them. Some cultivators are permitting their standard trees to grow up out of their hedges at the distance of ten or twelve feet from each other. This is doubtless an improvement, as by cutting away the hedge, an orchard of standard trees would be left, should it ever be found desirable so to do. Rails might also be inserted into the standards, and a good fence easily made."

CUTTINGS, LAYERS, &c.

Having treated upon seed, as one of the modes of cultivating, or rather of propagating the Mulberry, I shall now proceed to speak of the other methods, without, however, observing any particular order, taking them as they occur to my mind.

In propagating the Chinese Mulberry, I consider the cutting as the best and the surest means of obtaining the genuine Morus Multicaulis. This tree, it is said, cannot be propagated from the seed without producing hybrid varieties; as the *pollen* of the native Mulberry, will mix with its own when in blossom, and hence a mongrel class is produced.

I have some experience in planting the cutting, and

have never failed in producing large and thrifty trees; many of which grew from seven to eight feet high the first season, and put forth limbs of considerable size. These limbs I cut off in the ensuing spring, or rather in February; cut them into pieces, each piece having on it two buds, all of which were placed in a box, covered with dirt, and placed in the cellar until the time for planting, which, in the Middle States, is in April or May. Some cultivators say that they should be cut off in the fall, and kept in sand until Spring. I have tried this experiment, and nearly all of them rotted. They should be taken off the tree in the Spring, for then it is seldom that any of them will rot. They also grow more vigorously.

There is another prevalent error among cultivators, of planting the cutting perpendicularly in the earth, and having an idea that one bud forms the roots and the other the trunk. This is a most egregious mistake. Each bud has within it the elements of a tree, in the same manner that the seed has, and so far from the bud producing the roots, the bud sometimes rots while the roots are shooting out vigorously. The roots are thrown out below, and have no connection with the bud, as may be seen by examining one when growing.

As every bud produces a tree, the cutting should be planted horizontally, and after the ends have been covered with wax of some kind to keep out moisture, they should be covered about two or three inches

deep, and in rows about eighteen inches or two feet, one from another each way. They should always have air and light when they begin to rise above the earth. Some say a shady location is preferable; but it matters not so they are well watered when the season is dry. I would prefer propagating the White Mulberry from the seed.

The second method of propagation which I shall treat of, is by layers; and it is without doubt the easiest, but I have one objection to its being the best, which is, that the buds being so close to each other, the trees spring up in clusters; and those which are most forward, soon overshadow and destroy the growth of the others. I have tried this method to my satisfaction, and what is here related will be found true by others.

The method of making layers, is by bending down the branches of a tree and fastening them to the earth by wooden prongs stuck down; or by planting the tree in a slanting direction, and covering the whole tree, save the ends of the branches, to the depth of three or four inches with rich mould. Many trees are said to have been raised by this method from one in a season. Mr. Kenrick states that a gentleman of New England produced from two trees, in one season, two hundred and two, besides the two original trees. This, however, was a rare instance, and can seldom be accomplished.

After the growth of one season, the trees are

separated by the knife, and transplanted into situations where they will have sufficient room to grow.

Grafting is the third means of propagating the Mulberry, and many cultivators are of opinion, that the Morus Multicaulis, grafted on the stalk of the White Mulberry would stand our winters much better.

The shoulder grafting is, to my judgment, the best mode. It is performed like splicing two pieces of timber together, each piece cut half through from the end down to a shoulder, about an inch or two in length; then lashed together with a soft bandage, and covered with wax. The operator should be very careful to adjust the two pieces, so that the wood and bark of each may come together and admit the ascent of the sap.

In many parts of Europe, and particularly in Italy and France, grafting is practised on all, whether standard, hedge or dwarf trees. They entertain a mistaken idea that grafted trees bear more leaves.

The fourth species of propagation is denominated budding, or inoculating. It is much more easily performed than grafting, and by many is considered far better. The manner of performing this operation, is by taking a bud from a scion of the kind you desire, and putting it into another tree. An incision should be made across the scion about an inch above the bud, into the heart; the knife then turned and run down an inch below the bud. This should be taken off,

and the woody part dexterously cut out from the bark, taking care not to destroy the eye of the bud, as it is then good for nothing. This being absolutely necessary, it is easy to tell when the eye of the bud is destroyed, as a hole will be discovered.

The next thing to be done, is to prepare the stock or limb to receive the bud. This is done by making an incision transversely, and then downwards, about an inch or two long, in the form of a T. The bark is now carefully pealed up with a thin blade of bone or ivory, taking care not to wound the *cambium*. The bud, or rather the bark, to which the bud is attached, is now to be slipped into the opening made in the trunk or limb of the tree, and nicely wrapped with soft bandages, observing to leave the bud out. A little wax over this will complete the process.

The fifth mode of propagation is by suckers, which are shoots which start up from the roots. In the Spring they should be taken up with some roots to them and planted out in a favorable situation. Neglect not to water them.

THE CHINESE MULBERRY.

Morus Multicaulis.
Morus Cucullata.
Perrottet Mulberry.

Universal opinion appears to concede the palm to this Mulberry. It seems to combine in itself all the

excellencies of all the species; the principal of which are its rapid growth, its easy cultivation, and large leaves, by which so much time and labor are saved.

In consequence of the great quantity of resin in the leaves, more silk is made than from a given quantity of leaves from any other Mulberry.

The Morus Multicaulis was brought from Manilla, in 1821, whither it had been carried by the Chinese as a tree of ornament and usefulness. M. Perrottet, who obtained these trees, carried only two to France, and from them have sprung the millions that are in Europe and America. I think, if my memory serves me, that their introduction into the United States was between the years 1830 and 1833.

It is a tree of extremely rapid growth, attaining frequently in a season, a height varying from five to ten feet. It is of a spongy texture, succulent, and of course very susceptible of the influence of cold and frost. Many are still in doubt whether it will endure our climate; but for myself, I have not a doubt but that it will soon become acclimated. Many distinguished culturists in the United States, have given us their experiments upon the best modes of treatment, among whom are Mr. Kenrick, Dr. Stebbins, and Mr. Davenport, who are fully acquainted with all its peculiarities, as well as its excellencies. These gentlemen recommend the following course of treatment.

A poor soil must be chosen for the Morus Multi-

caulis, so that the cultivator may have it in his power to make the tree grow rapidly or slowly as he pleases. In the early part of the season, by the aid of manure, its growth must be forced until the last of July, or the first of August, when every stimulus must be withdrawn, so as almost entirely to stop its growth. By this means, the succulent limbs have time to harden before they are nipped by the autumnal frosts.

From my experience in cultivating the Morus Multicaulis in one of the Middle States, this course appears to me entirely unnecessary, for I have invariably observed that the trees grow very little after the beginning of August.

The Chinese Mulberry, as observed before, is easily propagated by any of the methods described; but I prefer the cutting to any other. The cutting may be calculated upon with certainty, as it puts forth its roots readily, and grows with great luxuriance. Cultivators appear to be at variance, with respect to propagating this tree from the seed; some declaring that the seed will produce the genuine tree, while others contend that they will not. As observed before, it no doubt arises from the mixing of the *pollen* of two varieties, thus producing a *hybrid* variety, that the dispute has sprung.

The Chinese Mulberry is denominated Morus Multicaulis, from the many stalks which annually shoot up from the roots, bearing immense quantities of foliage. In speaking of the delicacy, and the liability

of this tree to be killed by the frosts of winter, Judge Comstock observes—

"We have little doubt of the ultimate acclimation of the Chinese Mulberry in this country, and consider it but of little consequence whether they can or cannot be propagated from the seed; but should it finally be compelled to yield to the severity of our climate, we should still consider it the most valuable variety of the Mulberry for cultivation in this country. It is the opinion of the most skilful and experienced cultivators and culturists, that should the shoots of the Chinese Mulberry be destroyed by the frosts of every winter, so that nothing could be gathered from the plants but the foliage on the annual shoots, they would be far preferable to the White Mulberry, as more silk could be made from them, than from trees of the White eight and ten years old."

It has been declared by many, that worms fed on the leaves of the Morus Multicaulis spin much larger cocoons, and that the silk is much stronger; seldom breaking in reeling. I have never had a fair opportunity to test the truth of this oft-repeated assertion, yet I am inclined not to doubt it, knowing that worms fed on the White Mulberry produce larger cocoons than those fed on the black.

About the last of October, all trees of one season's growth should be taken up, being very particular not to break the roots, and also to preserve as many of the small fibres as possible; for they are the mouths

through which all aliment is taken into the stomach or roots. They should never be drawn up forcibly from the earth, as this detaches the ends of the roots and the fibres; but they should be dug with a small blunt hoe and with the fingers.

When out of the earth, the next process is to place the roots in boxes, and pack dirt around them, so that no spaces are left. Place the boxes in the cellar, and examine them once or twice in the winter, and moisten the roots if dry.

OF THE SILK WORM.

The silk-worm belongs to a great family of insects, *genus phalena; sub genus bombyx; species, mori*, from Morus the Mulberry. It was first found in the woods of China, which consist principally of the Mulberry, and the intelligence reaching the ears of Her Royal Highness, Shi-ling-Shi, queen of China and sister to the moon, she ordered some of the wonderful worms to be brought into the palace, where she reared them with her own hands, and studied their nature, habits, and diseases. The Royal maids, seeing their mistress so pleasantly and amusingly engaged, soon followed her example, and the worm from a tiny insect, grew by the aid of cultivation, to the length of three or more inches.

To imitate royalty, the people soon became engaged in rearing the worm, and experimenting upon the cocoon, until their amusement resulted in the art of reeling silk, and afterwards of weaving it. Beautiful crimson fabrics were produced, which astonished the world; for so secret were they in the matter, that in the time of the Roman Empire, under the Cæsars, the people of Europe knew not from what, or in what manner, silk was procured; some supposing that it was the bark of a tree, others that it was the entrails of an insect, &c.

During many centuries, the silks of China sold at an immense price. None but the vastly rich could afford to buy them; for it is recorded of one of the Roman Emperors, that he refused his queen a rich silk dress on account of the high price, it being worth its weight in gold. Even down to a later period, silk fabrics were extremly costly. History informs us that one of the kings of England borrowed of the Earl of Mar a pair of silk hose, giving as an excuse, these words: "Surely ye would not that your king should appear as a scrub before strangers!" The Royal personage was to attend a party.

For ages China enjoyed the exclusive privilege of cultivating and manufacturing silk. But the day of competition came, and her monopoly was at an end. Two monks, travelling on a pilgrimage from Constantinople, wandered into China; where they were well received on account of their religious cha-

racter. They took advantage of their privilege, and though to carry off any of the silk-worm's eggs they knew was death, if detected, one of them concealed some of the eggs in the hollow head of his cane. Though searched, he escaped with them, and carried them safely to Constantinople. The king was pleased at the recital of the process of rearing the worm: but, unfortunately, the travellers had forgotten to ascertain upon what kind of leaves they were fed; whereupon the king offered him a large reward to go back to China and discover what tree the leaves were taken from, on which the worms were fed. They went, and returned with intelligence that it was the Mulberry.

Thus was the silk worm, and the silk culture, introduced into eastern Europe; and from that thimble full of eggs have sprung the millions, and billions, and trillions of worms, which since have toiled to adorn the angel form of beauty. When we look at the labors of a single worm, how insignificant it appears; yet how magnificent is the product of congregated millions! Who, that did not know, would suppose for a moment, that all the silk in those fabrics which grace the limbs of female loveliness, and which are used for a thousand other purposes, sprung from the labors of a tiny worm?

The limits of this work will not admit of my going into detail, and giving a history of the march of the silk culture over Europe. Suffice it to say, that

it lingered for a long time on the confines of Eastern Europe; in Greece and the Grecian Isles; then spread into Italy, France, Spain, &c. Italy and France have excelled all the countries of Europe in the rearing the worm, and in the beauty of silk fabrics.

REARING THE WORM.

When the silk-worm first comes forth from the egg, it is a small black insect resembling the tiny black ant. Leaves being placed near, they will crawl upon them and commence eating, as fast as they hatch. They should be fed three or four times a day, with fresh leaves, cut up in small pieces, for the first five days, and then oftener as they grow larger.

At the end of five days the first moulting, or shedding of the skin takes place, when the worm is a quarter of an inch in length. It now droops its head, ceases to eat, and appears extremely sick. In twenty-four or thirty-six hours it slips out of its skin, and again commences eating. On the eighth day of its age, the second moulting takes place, when it is again sick and ceases to eat. It is now half an inch in length, and begins to assume a lighter colour. The third moulting takes place on the thirteenth or fourteenth day, and the fourth on the twenty-second or twenty-third. The worm now eats ravenously, and is two inches in length. In ten days more it acquires its full length, ceases to eat, and goes wandering

about, with head erect, and leaving fibres of silk on every thing it touches. Its back is of a yellow color, and the worm is ready to spin. The next thing to be done, is to bring in some oak or hickory branches, which have been previously cut, and withered in the sun, and place them back of the shelves, or over the worms. They will soon climb, and, after finding suitable places, will commence spinning their cocoons. Each worm will require four or five days to complete its cocoon. Five or six days after the last worm has commenced spinning, the cocoons may be gathered from the bushes. A keen sighted person is required to gather the cocoons, or some will be overlooked, which are spun in leaves curled up. The largest and most firm cocoons should be laid aside for seed, and the others should be put into shallow baskets and placed in ovens to bake, taking care not to scorch the silk. When the chrysalis or worm in the cocoon is dead, the cocoons should be taken out and spread in the shade to dry, otherwise the vapor which arises from the dead chrysalis will ruin the silk.

The cocoons saved for seed should be placed in an airy room, where they should remain untouched. In about twelve to fourteen days, according to the state of the weather, the fly will come forth from the cocoon. This is effected by throwing out a fluid, which dissolves the gum of the silk, and the legs of the fly serve to part the strands of silk until the head

projects. So soon as the flies come forth the room should be darkened, and the flies placed upon newspapers spread upon a table. After copulation, the female commences laying her eggs, which vary in number from two to five hundred. All those eggs which do not change their color within a few hours after being laid are unimpregnated, and consequently are good for nothing.

I have given a mere outline of the silk-worm, which will be filled up in future pages. When we contemplate this interesting insect in all its operations and transformations, the mind is irresistibly led up to that sublime Being, who has placed before us in the transformation of the worm, a complete picture of man's redemption. Like man it toils through life and plays the glutton; but more wise than man, it prepares for the tomb; or, in other words, it spins its own tomb, the cocoon. In twelve or fourteen days it bursts the barrier of the grave, and comes forth robed in white, a beautiful butterfly. It labors and toils no more, but all is pleasure, all is enjoyment. The very instruments or organs with which it labored are gone, and a new form is given to enjoy its second existence. But in a few days this beautiful creature dies, and here ends the simile; for man shall live immortal, "unhurt by the wreck of matter and the crush of worlds."

DISEASES OF THE SILK WORM.

The silk-worm is perhaps the most delicate insect in existence. The least injury, wet leaves, or tobacco smoke, is fatal to them. The rest of the caterpillar tribes, which are a mere pest to mankind, have a great tenacity of life; for I have by way of experiment, cut the common catterpillar suddenly in two with a sharp knife, and one-half crawled with the same facility that the whole body did. I have also placed them in close confinement, and smoked them with segar smoke during twenty minutes, without apparently the least effect.

The silkworm is also the most inoffensive creature in the world, Nature having made it entirely for usefulness, without giving it any means for self-defence. Yet almost every creature in the creation appears to be an enemy to it. Among its enemies may be enumerated the cat, rat, mouse, cockroach, ant, spider, and many smaller insects, as bird lice. A gentleman in Pennsylvania had a whole crop of worms destroyed by lice, which fell from pigeons' nests above them. I had a very large silk-worm, which commenced spinning late in the evening, and to my great astonishment next morning, a spider had wound its threads around the worm and hoisted it up an inch or two above its cocoon. I examined it, and found it dead. Mice are extremely fond of the eggs, as well as the worms. I have known a whole crop of worms

destroyed by mice. Wishing to cross the breed of two species of the silk-worm, I placed two flies on a table near a window, which opened on a shed. In a few hours I returned and found them literally eaten up by large black ants. From the delicate texture of the worm, it must be a sweet morsel to those ravenous animals and insects which live by plunder.

The silk-worm is subject to six diseases, which frequently prove fatal to thousands of their race. The first disease I shall treat of is the *Lusette.*

They are generally attacked in the fifth age by this disease. It generally arises from want of attention, and a scanty supply of proper food. When affected by it, the body of the worm has a shining appearance, and the head becomes much enlarged. The stomach on dissection is found full of a transparent fluid. The proper remedy is to seperate the infected from the sound worms, and give them a full supply of fresh leaves. They should, however, not be fed to the full immediately, but the leaves given in small parcels at first; otherwise, a disease precisely the reverse will be the consequence.

The next disease is denominated the *Grasserie,* the reverse of the former. This disease is brought on by feeding the worms too liberally on young and tender leaves. The period at which they are most liable to it is in the third and fourth ages, when they begin to eat voraciously. Affected with this disease, the worm becomes dyspeptic, appears dull, while its

body becomes short and thin. The body swells, turns a green colour, and becomes opaque. The slightest touch will break the skin, which is covered with a greasy humor. The remedy is plainly pointed out, which is a reduction of food, and that which is not so nourishing.

The *Tripes* is another, and the third disease, to which this useful insect is liable. It is caused by the stench which arises from the litter on the shelves, and want of general cleanliness and ventilation. Worms thus afflicted become soft and wrinkled, and look when dead, like the living worm. I have seen them become putrid fifteen or twenty minutes after death, and so rotten that when taken up with a stick they would not hold together, but fall to pieces. Worms in this country are more subject to this disease than any other, though a little precaution would prevent it. Chloride of lime, dissolved in water, and set in the cocoonery, will destroy all noxious exhalations. The floor should be sprinkled with the solution, especially in hot weather, when it is dangerous to sprinkle with water alone, on account of the vapor which arises. Nothing is more injurious to worms than wet leaves and a damp atmosphere. I have seen hundreds die from both these causes. Whenever the worms prove to be sick, they should be immediately conveyed away where the air is pure and dry; for one sick worm will infect hundreds.

The *Yellows* is the fourth disease, and is brought

on by placing the worms in a room too warm, and where the heat is too sudden. It generally attacks the worms in the fifth age, near or about the time they ascend to spin. When attacked by this disease, the body swells and changes to a yellow color, from which circumstance the disease takes its name. The feet of the worm appear drawn up, and the rings become enlarged. The worm refuses to eat, goes wandering about, and stains every thing yellow it touches. After this the body becomes soft and soon bursts, throwing out a fluid which is death to those worms upon which it may fall. It is certainly by far the most fatal disease that the poor worm has to contend against. The diseased worms should be immediately attended to, and conveyed away to another apartment. Change of air and increase of heat are said to relieve some worms, but no remedy is to be depended upon; for there is no disease which proves so deadly as this. The great object is to prevent the spreading of the disease. Judge Comstock mentions a case, where worms were cured of this disease by accidentally eating oak leaves.

The *Muscardine* is known among the worms in the fifth age. It is occasioned by a very hot, dry and close state of the air, and is known by the black spots on different parts of the worm, which turn different colors afterwards, until the whole body becomes colored. A curious mould covers the body finally, and it dies. Ventilation and purification are the remedies.

The *Passis*, the last disease to which the silk-worm is subject, is occasioned by too much heat in the early state. The body in this disease becomes thin, and the appetite destroyed. The only thing necessary, is to remove the diseased worms, ventilate the room, and feed temperately with young leaves.

COCOONERY.

All that is requisite in building a cocoonery, is to have a house capable of being well ventilated, or closed up, so as to exclude moisture, wind and cold. Many persons use barns, sheds and rooms in their dwellings, which being fitted up with shelves, answer the purpose very well. In some parts of Turkey, a room or rooms are always appropriated to this purpose in their dwellings.

In furnishing cocooneries, Mr. Cobb gives the following directions: "I have used three tiers of rough pine boards, fixed upon upright posts, about four feet in width, one above the other, with a space between of two and a half feet, affording room sufficient to pass all around the frame, so that I could reach any part of it. In making the shelves, it is well to have the lowest one six inches broader than the one above it, and to make the same difference in the shelves above, so as to break the fall of such worms as happen to tumble down." Mr. Cobb describes another method as follows:

"It is about two and a half feet wide, by five or six

long, made of thin boards, with a piece two inches wide, nailed flat on the upper edge along the sides and ends, with legs about a foot long in the corners. The legs do not pass through the table, but leave a part of the hole on the upper side for the feet of another table to set in. Thus contrived, five or six of these tables are set one above another, and are taken down, cleansed, and again set up with facility. One of these shelves will accommodate five or six hundred worms." I have always followed the plan of covering the shelves with newspapers, and Mr. Cobb recommends the same.

Having planted the Mulberry, and built the cocoonery, the next process is to hatch the eggs. The Italian process of hatching the eggs is calculated to embarrass the American silk grower, but be it known that it is entirely useless in this country, as Nature generally accomplishes that part about the first of May, in the Middle States. Mr. Rhind describes the Italian process, as follows:

"The temperature of the chamber near the place where the eggs are put, should be 63½ degrees; this is obtained by increasing the fire, should the temperature be less; and by opening the ventilator, and even the door should it be greater. This temperature should be observed two consecutive days. On the third day, the temperature is raised to 66; on the fourth to 68; on the fifth to 70; on the eighth to 77; on the ninth to 79; and on the tenth, eleventh, and twelfth, to 81 degrees."

How different is this from the process in our own country! Here, all that is necessary, is to bring the eggs from the cellar, place them in a south window, taking care that the sun does not shine upon them, and they will hatch in a few days.

The time for hatching is various, as are the climates of our widely extended country. In the Middle States, the first of May is the usual time, though the matter must be governed by the putting forth of the Mulberry leaf. In New England they are not hatched until the latter part of May or first of June, while in the South, April is the usual month. A very good plan for hatching and feeding is to place the eggs on the table, and place over them a paper pierced full of holes, through which the worms can ascend and fix on the small, tender leaves which are placed on top of the paper. Some culturists peal off the eggs from the paper before they hatch, but I do not coincide with this plan. The worms require something to fasten their feet to, and when the eggs are glued fast to the paper, they have the power of drawing themselves from the egg shells.

One thing should be particularly observed. The worms which hatch on the first day, should be placed to themselves; those hatched on the second, to *themselves, &c.* By this means each lot will moult or shed their skins about the same time, and be ready to spin about the same time. You are then not under the necessity of feeding some while others are moulting.

So soon as the worms are hatched and on the leaves, they should be carried to the cocoonery and placed on the shelves. Three or four times a day will be often enough to feed them during the first age. Young and tender leaves chopped, should be given; because the worm almost invariably fixes upon the edge of the leaf. This is owing to the organic structure of the mouth, and when the leaves are chopped, the worms are not under the necessity of eating through the leaf. No wet or wilted leaves must in any case be given, as they are sure to produce disease. The leaves should be kept in a cool cellar or milk-house; I have kept them thus for three, four and five days. Feed not too liberally at first, as the litter increases, covers up some of the worms, and they are apt to be thrown out with it. The leaves from young trees are better than those from older ones, during the first and second ages. Great cleanliness should be observed, particularly in warm weather, and to remove the litter. All that is necessary is to place fresh leaves on one corner of the table, and thus tempt the worms there, when the refuse matter may be swept off.

When the worms arrive at the third age, they may be fed with unchopped leaves from the full grown tree. Frequent cleaning must now be practised, and all diseased worms instantly removed, least they should infect others. If proper attention is paid to cleanliness and to ventilation, very few or no worms

will die from disease. Damp or wilted leaves, want of pure air and space, and want of cleanliness, are the great causes of disease in the silk-worm. All means should be used to prevent insects and mice, ants, cockroaches, &c. from ascending to the shelves, as they will destroy many during one night. Lemon juice on the shelves is said to prevent the approach of ants.

Sufficient room must in all cases be allowed the worms, as much of their growth and product depends upon it. In the first age, they will require comparatively but little; but as they advance in age and size, they will necessarily require more room. Mr. Cobb has laid down the space which is required in every age of the worm. He says, "It is calculated the worms proceeding from an ounce of eggs (40,000) should have space as follows:

	sq. feet.	*inches.*
In the first age,	7	4
In the second age,	14	8
In the third age,	34	10
In the fourth age,	82	6
In the fifth age,	183	4"

No certain rule, however, can be be laid down, and the culturist can alone come at the matter by experience.

The quantity of food eaten by a given number of worms is astonishing and almost incredible; and equally so the quantity of silk which they produce.

Many culturists have attempted to ascertain the weight in each case. M. Bonafous informs us, that 7217 pounds of leaves were required to feed 200,000 worms. Count de Hazzi says that 200,000 worms will destroy 10,000 pounds of leaves, as follows:

	lbs.
In the first age,	50
In the second age,	150
In the third age,	460
In the fourth age,	1390
In the fifth age,	7950

Count Dondolo thinks that twenty-one pounds of leaves will make one pound of cocoons.

Congress published a manual in 1838, respecting the quantity of food required each day of the silk-worm's existence. I shall give a few extracts, though I have not the least faith in such systematic rules. The number of worms is 180,000.

"1st day.—Three pounds and three quarters of chopped leaves, six hours between each of four meals, the smallest quantity at first, and increasing the quantum.

"2d day.—On this day, about six pounds will be needed, chopped very small. This will suffice for the four regular meals, the first of which should be the least, increasing them as they proceed, as was done in the meals of the first day.

"3d day.—This day twelve pounds of soft leaves, chopped very small, will be required for the four meals. The worms will now feed with avidity.

"4th day.—Six pounds twelve ounces of chopped leaves should be given. For the quantity should be diminished as the appetite increases. The first meal should be of about two pounds four ounces, and the other meals should decrease in proportion as the quantity of leaves given before, appears not to have been thoroughly eaten.

"5th day.—This day, one pound and a half of young leaves, chopped small, will be about sufficient. They should be scattered very lightly several times in the day, on the sheets of paper, where there appears still to be worms feeding. Should the worms have left off feeding, it would be unnecessary to distribute any further quantity. Towards the end of the day, the worms are torpid; a few begin to revive.

"6th day.—For this day will be needed nine pounds of tender shoots, and nine pounds of tender leaves of the Mulberry, well picked and chopped small.

"7th day.—Thirty pounds of chopped leaves will be required to-day. This quantity divided into four portions, should be given at intervals of six hours, the two first meals less plentiful than the two remaining.

"8th day.—Thirty-three pounds of fine chopped leaves, well picked, will be necessary, and this time the two first meals should be the largest.

"9th day.—This day only nine pounds of picked

leaves, chopped small, will be required. The worms sink into torpor, and the next day they will have cast their skins.

"10th day.—This day fifteen pounds of the small shoots will be necessary, and equally as much of the picked leaves, chopped rather less than hitherto.

"11th day.—This day ninety pounds of leaves, chopped, will be needed. The two first meals, the least copious, because towards the close of the day, the worms grow voraciously hungry.

"12th day.—This day there should be given ninety-seven pounds of picked leaves, chopped and divided into four meals—the three first meals most plentiful. Towards evening the hunger of the worm decreases; consequently the last should be the least meal.

"13th day.—This day, about fifty-two pounds and a half chopped leaves, will be sufficient. The decrease of food is in consequence of the diminution of appetite. They should have four meals, the largest first; and the last the least meal. Those only that seem to require it should be fed.

"14th day.—Twenty-seven pounds of picked leaves will be required; if not enough, more may be added; if too much, less given.

"15th day.—The worms begin to rouse, and thus accomplish the third age. The general view of this age presents the following result. In six days the

worm goes through its third age. In this age, those worms proceeding from five ounces of eggs, have consumed nearly three hundred pounds of leaves and young shoots.

"16th day.—On this day, thirty-seven and a half pounds of leaves and young shoots will be needed, coarsely chopped with a large blade.

"17th day.—For this day will be wanted one hundred and sixty-five pounds of sorted leaves, a little cut. The two first meals ought to be the lightest.

"18th day.—For this day will be needed two hundred and twenty-five pounds of sorted leaves, a little cut. The two first meals the most plentiful; the last to be about seventy-five pounds.

"19th day.—This day the distribution of the cut leaves should be two hundred and fifty-five pounds; the three first meals of about seventy-five pounds each—the fourth of forty-five pounds only.

"20th day.—No more than one hundred and twenty-eight pounds of picked leaves will be needed this day; because the hunger of the worm diminishes much. The first meal should be most considerable.

"21st day.—Thirty-five pounds of picked leaves, are enough for this day. It is easy to find out when, and in what quantities, the worms need most their food.

"22d day.—The worms rouse on this day, and ac-

complish their fourth age. In about seven days they have accomplished their fourth moulting, and cast their skins. They have consumed in that period, two hundred and seven pounds of leaves for each ounce of eggs, or 40,000 worms.

"23d day.—Since the preceding day, almost all the worms must have accomplished their fourth moulting, and be already roused. The worms proceeding from one ounce of eggs, in the fifth age, consume about one thousand and ninety-eight pounds of sorted, picked leaves, which makes the quantity of leaves requisite for the five ounces, to be five thousand four hundred and ninety pounds weight.

"24th day.—For this day will be wanted two hundred and seventy pounds of sorted leaves, divided into four meals; the first of which should be the least, of about fifty-two pounds; and the last most plentiful, of ninety-seven pounds.

"25th day.—This day the worms will require about four hundred and twenty pounds of sorted leaves. The first feed of seventy-seven pounds; the last should be the largest, and of about one hundred and twenty pounds.

"26th day.—This day the worms will want five hundred and forty pounds of sorted leaves. The first feed should be of one hundred and twenty pounds, and the last of one hundred and fifty.

"27th day.—The worms will require this day eight hundred and ten pounds of sorted leaves. The

first feed of one hundred and fifty pounds, and the last of two hundred and ten pounds.

"28th day.—This day the worms should have nine hundred and seventy-five pounds of picked leaves, divided into five feeds, the last the largest.

"29th day.—The worms will require this day, nine hundred pounds of well sorted leaves. The first meal should be the largest, and those following should diminish. Should there be any intermediate meals wanted, they must be given as before.

"30th day.—The worms this day must have six hundred and sixty pounds of well sorted leaves. The proportion of leaves must diminish, as the appetite of the worms decreases much. The food must, as usual, be divided into four messes. The largest meal given first, and gradually diminishing. The first meal should be two hundred and ten pounds.

"31st day.—The worms this day need four hundred and ninety-five pounds of leaves, which must be distributed as it may be wanted.

"32d day.—This last day they attain perfection, which may be ascertained by the following directions:—

"1st. When on putting some leaves on the wickers, the insects get upon the leaves without eating them, and rear their heads as if in search of something else.

"2d. When, on looking at them horizontally, the

light shines through them, and they appear of a whitish yellow transparent color.

"3d. When numbers of the worms, which were fastened to the inside of the edges of the wickers, and straightened, now get upon the edges, and move slowly along, instinct urging them to seek change of place.

"4th. When numbers of worms leave the centre of the wickers and try to reach the edges, and crawl up upon them.

"5th. When their rings draw in, and their greenish white color changes to a deep golden hue.

"6th. When their skins become wrinkled about the neck, and their bodies have more softness to the touch than heretofore, and feel like soft dough.

"7th. When, in taking a worm in the hand and looking through it, the whole body has assumed the transparency of a ripe yellow plum. When these signs appear in any of the worms, every thing should be prepared for their rising, so that those worms which are ready to rise may not lose their strength and silk in seeking for the support they require."

The above are the rules of European cultivators, but I do not believe in the theory; for however well it may succeed in feeding worms on this plan in Europe, it cannot be observed in America. I have raised as large worms as were ever produced in Europe or America, some of them being from three inches

and a half to three and three quarters in length; they were not the mammoth worm. I am in favor of chopping the leaves, as the worms invariably fix upon the edge; but I do not see any need of sorting, except it be in the first, and perhaps the second age. In the fourth and fifth ages, when the worms are large and vigorous, there is no necessity even for chopping the leaves, as the worms will readily devour them.

ASCENSION OF THE WORM.

Branches of hickory or oak should be procured, and the leaves withered in the sun, that they may be ready when the worms cease to eat, and prepare to ascend. These branches should either be suspended over them, or placed on the back part of the shelves, in such a manner that the worms may crawl upon them without difficulty. When the branches are placed on the shelves green, the leaves contract while the worms are spinning, and interfere with their labors. Some worms will wander about, wasting their silk; these should be placed upon the branches. In three or four days after the last worms have ascended, the cocoons may be gathered from the bushes.

The only thing to be observed in gathering the cocoons is, not to press them too tightly in the hand, but to give them a gentle rolling motion, by which they will be easily and cleanly detached from the leaves. When they are all gathered, they should not

be suffered to remain in the basket, but should be immediately baked in shallow baskets in an oven, stirring them and taking care that they are not scorched. They should then be spread upon tables or shelves in an airy situation, and turned over every day. Every thing depends upon curing the cocoons well; for if they are suffered to lie in piles they mould, and a moisture is thrown out which gives them a bad odor, and they are not worth reeling. A great quantity of cocoons has been ruined by not attending to this necessary and indispensable part of the business. When improperly cured, the cocoons reel with great difficulty.

With respect to stifling the worm, various modes are in use. Some recommend their being placed in the sun two or three hot days; but it appears to me, this is an uncertain method. The next method is the oven, which I have mentioned, and which I think is the best. Mr. Cobb says—"I have used the first method with success. The oven being moderately heated, the cocoons were spread out in oblong baskets, eight inches deep, in box covers, pans, &c. and permitted to remain in the oven half an hour."

Some recommend the steam of boiling water, and others the vapor of hot spirits of wine or alcohol. Many other modes are recommended, but I prefer baking them in an oven.

SEED.

Always choose the largest and firmest cocoons for seed. The floss should be taken off, and the cocoons spread upon a table covered with newspapers. The room should be darkened and cool. In from twelve to fifteen days, according to the warmth of the weather, the flies will come forth. The males and females will commence copulating, and should not be disturbed. The male moth is known from the female by being much smaller; and from the constant motion of its wings, as it sweeps with an airy circle round the female. The female will lay from two to five hundred eggs; and one hundred female moths it is computed, will produce an ounce of eggs, or forty thousand worms. The eggs adhere to the paper, and should be rolled up and put in some place secure from mice and other creatures which are fond of them. It is a mistaken notion that they must be kept where they will not freeze. I have known eggs to remain all winter on a window pane, where they were laid, without the least injury. In the spring, they may be placed in a cellar or ice-house until the Mulberry puts forth its leaves; but generally this is not necessary, as the same warmth that hatches the eggs, will bring forth the leaves. Nature is seldom remiss in her duty, timing all things with beautiful regularity.

OTHER KINDS OF FOOD.

Though it is universally acknowledged that the Mulberry is the food designed by Nature for the worm, attempts have been made to substitute some other kind, which might be produced with more facility than the Mulberry. There are many kinds of leaves upon which the silk-worm will live, among which are lettuce, and the leaves of the hop, hemp, dandelion, rose and fig, and some say the blackberry. The leaves of the currant are also spoken of. But I do not believe these leaves will answer any other purpose than to keep the worms alive until the proper food can be obtained, for there is a resinous matter in the leaf of the Mulberry, which forms the silk. In the Cabinet Cyclopedia will be found a letter from a lady, who says—"In the summer of 1785, I subsisted several thousand worms entirely on lettuce leaves during three weeks, and for the remaining short period of their lives I afforded them their natural food. At the end of a month from their hatching they began to spin, and eleven ounces of silk were procured from four thousand cocoons." This lady believed that they could not be fed longer on lettuce than three weeks, for on trial she found that but very few spun at all.

The same lady informs us, that she fed worms on blackberry leaves, and that they ate the leaves of the elm with great avidity. She also found that they ate

the leaves and flowers of the primrose and cowslip. She afterwards gave them the Mulberry leaves, which as soon as they had tasted, they refused all others. She declares that the worm will not touch any flower of a red color. Mademoiselle Coge tells us, that she fed worms on the viper grass, and that the silk was equal to any produced from the natural food.

I consider lettuce the best substitute for the Mulberry, but I do not believe that worms can be reared on it to any profit. Indeed it is useless to look for a substitute so long as the Mulberry is so easily cultivated.

REPEATED CROPS.

Culturists are fully of the opinion, that two, and even more crops of silk may be raised in a season, and experience seems to go to prove it. In some parts of Italy, two crops are raised from the white worm, called the two crop worm. This worm will finish its cocoon, come forth, lay its eggs, and then those eggs will hatch, thus producing two crops.

There is no doubt but that the two crop system is profitable, and a very good plan would be this: If you wish to raise two hundred thousand in a season, bring up from the cellar fifty thousand, and hatch them. The week after, bring up fifty thousand more; and the next week fifty thousand more, until all are hatched. Now when the last parcel is hatched, the

first will begin to spin; and when the last are a week old, the second lot of worms will ascend; so that there would not be that trouble which would attend cultivating the whole number hatched at one time, because many of them would be small, and the number would be continually decreasing, as they ascended to spin. By having the eggs in an ice-house, they can be kept back at pleasure.

It has been a notion with some culturists, that the silk-worm will degenerate, as Buffon has said of the American people. I am one of those who entertain the belief, that by choosing bad cocoons for seed, and by bad management, the worms will become deteriorated; and, on the contrary, when good seed are chosen, and the worms well attended, the breed may be improved vastly.

I have now treated of the cultivation of the Mulberry, and the rearing of worms; I shall next proceed to treat of the art of reeling silk for the manufacturer. Much of the profit of the silk culture depends upon reeling well; and, therefore, the reeler should apply him or herself to acquiring the art thoroughly. Some persons have an idea that it is an extremely difficult art to learn, but attention and perseverance will soon overcome all obstacles. Practice is all that is requisite. In a few trials the author of this learned to reel, and made some sewing silk which was as even and beautiful as any from the reels of Italy. There could be no more beautiful employment

for our ladies than this, and the day is not far distant when we shall not point to an isolated lady as a good reeler, but when there will be hundreds, and perhaps thousands, who will reap a rich subsistence from it.

SILK.

ART OF REELING SILK.

The first thing to be done towards reeling silk, is to obtain a good reel, and there are a number in use besides the Piedmontese, among which are those of Mr. Smith of Baltimore, Mr. Gay of Lisbon, and Mr. Cobb of Dedham. I have myself used Mr. Cobb's reel, and found it answered the purpose very well. It is made in the following manner: A frame of pine three feet six inches in length, and two feet in width, the height of which is three feet. There is a bar at the front end which traverses with a lateral motion of five inches, and on this bar, which is two feet five inches in length, the eyes are fixed through which the threads pass, and by the transversing of which the silk is scattered on the reel. On the back end of the frame is placed the reel, with a wheel on each end of the axle. On the right side of the front end of the frame, is a large wheel eleven inches in di-

ameter, which is used to set the reel in motion by means of a band, which passes from it round the smaller wheel on one end of the axle. On the other front side of the reel is a horizontal wheel, with a band which passes from it to the wheel on the other end of the axle of the reel. There is a moveable wire attached to the horizontal wheel, and also to the transversing bar, which causes it to traverse every time the wheel turns round.

I have attempted to describe the reel merely for the gratification of the reader, as it will always be cheaper to buy the reel than to make it. They can be had at almost any of the variety stores, or stores where Mulberry seed and cocoons are bought and sold.

Having obtained a good reel, the next thing to be done is to sort the cocoons. Some culturists divide them into five different qualities, though I never found it necessary to make more than two or three parcels, choosing the most firm and fine cocoons to make the best silk. The qualities are as follows: *First*, the *fine* cocoons, are those which have a very smooth, close and fine grain. *Second*, the *chiques* or skins, are soft and easily compressed under the fingers. *Third*, the *demi fine*, which have a large, flimsy grain. *Fourth*, the *double cocoons*, are those which are united; or those in which two or more worms have spun together. These can seldom or never be reeled. *Fifth*, the satin cocoons, which are the worst of all.

The next process is to pick the cocoons, or take off the floss, which is sometimes done by children. Other reelers run the floss off after the cocoons are placed in the water. The water in the basin or pot should be soft, such as rain water, and heated to about 180 degrees Fahrenheit. Experience, however, is necessary to ascertain the temperature required, as different qualities of cocoons require different degrees of heat in the water. Generally, the water should be nearly to boiling heat, and kept so by means of a furnace under the pot or basin. If the water is too cold, the thread will not run freely; but will catch and draw up to the reel; and if too hot, the silk will come off in flakes, which will ruin the even texture of the fabric or sewing silk. A brisker fire or a little cold water will remedy defects.

The water being of the proper temperature, a double hand full of cocoons are thrown into the pot or basin and stirred with a stick split at the ends, or with a broom corn wisp, which will catch the floating fibres; and if the cocoons have been picked before, these fibres may be immediately attached to the reel as fast as found. If the floss has not been previously taken off, it may be run off after catching up the end. When the silk begins to run smoothly and evenly, it may be broken off; the one end fastened to the reel, and the other, which is floss, may be laid aside among the refuse silk. When a sufficient number of the fibres are obtained, they should be united, and passed

through the guides and fastened to an arm of the reel. The ingenious machinest of Lisbon, Connecticut, Mr. Gay, who is now disseminating information on the silk culture through the Middle States, has invented a machine, which takes the silk from the cocoon, and immediately winds it on spools, thus saving the trouble and time of reeling, and then taking the silk from the reel to the spools. His machine has a fly wheel to it, which fans and dries the silk before it reaches the spool.

On Mr. Cobb's reel, two skeins can be reeled at the same time. At the first the reel should be turned with a slow and regular motion, until it is found that the silk runs well, when the reel may be turned rapidly. As fast as the cocoons run off, or the thread breaks, new ones must be attached, which is done simply by placing the fibre smoothly along side of the others, and giving it a gentle twist with the wet fingers. Some recommend crossing the threads, but according to my experience this is not a good plan. The cocoons after being wound off in part, and the chrysalis of those that are entirely unwound should be taken out of the water; otherwise there is a likelihood of the silk being stained. So soon as there is discovered the least tinge in the water, it should be changed.

It would be useless to go any further into a detail of the art of reeling silk. I might write a dozen folios on the subject, and still practice would be neces-

sary to give the reeler an adequate idea of the process. A few hours spent in reeling will teach more than volumes, which only describe it. Let not the person despair, for the art may be acquired in a few days, and even in a few hours.

Silk, when taken from the reel, is called raw silk, because it is not manufactured. There are three qualities, enumerated in proportion to fineness, or by the fibres taken from a certain number of cocoons. This is the reeler's business.

It is not only necessary to be particular in reeling silk, but also in every thing appertaining to the business. Care is necessary in disbanding silk from the reel, as its fibres are subject to different degrees of tension. Hence the necessity of sorting the cocoons well. They should all be of one kind; that is, all that are reeled in one lot. If part are of the *fine* or *demi fine*, all of them should be. There are other causes, however, to which the different degrees of tension is owing. Some of the cocoons are longer in the water than others, and the slender last ends of some are united with the strong first ends of other cocoons. It is, therefore, certain that some of the fibres will stretch much more readily than others.

The skein of silk should in all cases remain on the reel several hours, or even a day when convenient; by which it will become thoroughly dry. I have no doubt but that Mr. Gay's machine is best calculated to take silk from the cocoon, to say nothing of the

saving in time and trouble. As was observed before, it takes the silk immediately from the cocoon to the spools; the fibre is dried before it reaches the spool, and consequently cannot stick to those upon which it is laid. The unequal contraction of the fibres cannot take place on the small circumference of the spool, as is the case on the reel.

When the skein is perfectly dry on the reel, it should be gathered up in a mass with the fingers, loosened from the bars, and after being taken off, it should be tied with shreds of refuse silk in all those places where it rested on the bars of the reel. It should be tied, however, before it is taken from the reel. Double it then and tie it near each end. A piece of folded paper should be fastened to the end of the thread to prevent it from being lost in the skein, which sometimes happens, and gives considerable trouble to find it.

DIFFERENT KINDS OF SILK.

There are different kinds of silk, of which I shall give a description in the language of Mr. D'Homergue, an experienced culturist and reeler. He observes, "In winding off the silk from the cocoons, whether perfect or imperfect, the finest and best threads are not those which are first spun; on the contrary the first threads which come off the cocoons are coarse, uneven, and unfit for use in the silk manufactories, either of the stuffs, twist or sewing silk.

This loose, furzy substance, which is about one-tenth part of the whole silk on the cocoon, is called in French *fleuret*, and in English *floss*, from the Latin *flos*, flower; a name which reminds us of *lucas a non lucendo*. As soon as the threads of the silk in the process of reeling come out fine and regular, this floss is seperated from them and put aside for use, as will be presently mentioned. To it are added all the threads which, either from some defect in the cocoons, or from the awkwardness of the women employed in the different operations of reeling, winding, and doubling, either break off so as not to be easily united to the other threads, or come out uneven, or otherwise unfit for use; these are called the *waste silk*, and added to the *floss*, assume with it the same name. This mass, boiled in soap and water, afterwards carded and spun on the spinning wheel, takes the name in French of *bourre de soi* or filoselle. Boyer, in his dictionary, translates the word *filoselle* into English by *ferret silk* or *flurt silk*. This last name is evidently a corruption, or an English pronunciation of the French word *fleuret, floss silk*.

"This floss, ferret, or flurt silk, by whatever name it may be called, is employed in making silk stockings, mittens, gloves, suspenders, night caps, and in general, all kinds of silk hosiery. I have heard that the women of Connecticut knit silk stockings and mittens out of the silk which they extract from the cocoons.

"Thus nothing is lost of the precious material produced by the silk-worm. I mean by those who understand the art of employing it. Otherwise, all experiments by those who are unskilled in the business, cannot but be attended with consi derable loss.

"There are then, six different kinds of silk, extracted from the cocoons by processes of various kinds, or which vary more or less from each other in the manner of using them, and all which require not only skill and dexterity, but knowledge acquired by long practice. I shall recapitulate them in their order, according to their degrees of fineness.

1. Silk of the first quality, or singles.
2. Silk of the second quality, or organzine.
3. Silk of the third quality, or tram silk.
4. Sewing silk of the first and second quality.
5. Cordonnet, or twist of ditto.
6. Filoselle, or floss silk."

The utmost economy must be practised in reeling silk, if the culturist would reap the full profit of the business. No particle of silk, however small, should be thrown away, but on the contrary all should be saved, and added to the mass of refuse silk. As the culturist who does not reel his silk, but sells the cocoons loses a great part of the profits, so he who reels and does not save all the particles of waste silk, loses in like manner much of the profits.

PREPARING SILK.

Preparatory to being dyed, silk should be cleansed. As spun by the worm, silk contains several substances. First, *colouring matter;* second, *gum;* third, *wax;* and fourth, an oil resembling in its nature the essential oils of vegetables. The gum is of a friable texture, and appears of a reddish yellow color. Silk, when analyzed, is found to contain 23 to 25 per cent. of gum—it is soluble in water. The wax is of a harder texture and very brittle, but is never found in a proportion of more than one per cent; oftentimes less. The proportion of coloring matter is very small.

While these substances are in the silk, it is stiff and unpliable, and the process of extracting them is called *preparing or cleansing silk.* Whenever it is intended to be dyed, the silk is boiled and afterward gummed, the gum having an affinity for the dye. But when the silk is to remain white, it is simply boiled and the gumming omitted.

To ungum silk, many skeins should be united together, so that they may not tangle in the process. These are put into strong suds. From fifteen to twenty pounds of soap (some use thirty) are required for every hundred pounds of silk. The soap should be thoroughly dissolved in water, over a gentle fire, and the temperature raised nearly to boiling heat, but should never boil, as it would injure, if not ruin,

the silk. The silk is now put into the suds, there to remain until the gum is discharged, which may be known by its flexibility and softness to the touch. The silk also becomes very white. When this is the case, the skeins should be wrung, and washed clean.

There is a second process, called "*bagging*;" but I have never found it necessary, and I believe it has seldom or never been used in this country.

When it is intended that silk shall be dyed, it should be *alumned*. Dissolve fifty pounds of alum in hot water, and pour it into a vessel containing fifty gallons or more of cold water, and stir it well, otherwise chrystalization will take place. The washed silk is immersed in this solution during eight or ten hours. Then take it out, wash and wring it, and after rinsing it, beetle it if necessary. Great care should be taken not to put the silk in while the water is hot, as the least warmth will injure the lustre of the silk. The alum should be good. Some alum is combined with iron, and this should always be avoided, as it is good for nothing, and if used would ruin the whole lot of silk.

When it is desired to give silk brilliancy, and render it of a pure azure white, it is subjected to a process called "*sulphuring*;" or, in other words, it is fumigated with brimstone. The silk is hung up on poles in a close room, the poles being suspended above by cords, about seven feet from the floor. If

there is a hundred pounds of silk to be sulphured, two pounds of brimstone should be put into a dish and set on fire. All windows and doors must be shut, and the silk left exposed to the fumes for fifteen or sixteen hours. The doors and windows should then be opened and the room well ventilated, before any person attempts to enter, when the silk may be taken down If it should not be white enough for the purpose intended, it may be subjected to repeated fumigations.

MANUFACTURE OF SEWING SILK.

The great consumption of sewing silk in this country, will ever render the manufacture of it profitable; not only in large factories, but in the cottages of our country. For many years the manufacture of sewing silk has been carried on in Connecticut, and the industrious wives and daughters of that State have rendered themselves profitable to their husbands and fathers. They did this too, with the spinning wheel, having none of the machinery now used, to facilitate the process. The Italians seldom use the best silk in making sewings or twist, whereas in the above State it is always used. So far, however, our people have never rivalled the sewing silk of Italy, for their raw silk commands a higher price than our manufactured article. They use the Piedmontese reel, and all their silk is reeled upon it. There are reckoned three ways of manufacturing silk into sewings and twist.

First, by means of the common reel and spinning wheel. Second, in families, by the aid of Brooks' Spinning Machine. Third, in factories with many complicated machines. The process in factories is as follows: The silk is first reeled on one of the reels in use, and afterwards wound off on bobbins, by a machine called a winding frame. It is useless to describe the machine, as no one can have an adequate idea of it without seeing it. The silk, however, runs from swifts over rods made of glass, and is run upon bobbins by a transverse motion. The inequalities are taken from the silk by a machine of such a structure as to admit the silk through holes in plates of iron, and from them it passes over a rod of glass to other bobbins. Then the silk is spun on a spinning frame, the spindles of which are said to turn eighteen hundred times every minute. This machine can give any number of twists to the inch.

After this, the doubling of the silk commences; sometimes called tramming. There is a machine in use on which the thread may be doubled any number of times, according to the size of the thread intended. The next process is twisting, or technically called throwsted. A machine is used for twisting, and the twist is afterwards set by means of steam. It is steamed as it comes from the twisting machine. After it is steamed it is boiled in soap suds, and is now ready to be dyed.

As the manufacture of silk does not properly belong to an essay on the culture of silk, I shall say

nothing of the process of dyeing the various colors, inasmuch as recipes may be found in all works on the subject.

In speaking of the manufacture of sewing silk in families in Connecticut, Mr. Cobb says—"After it is reeled from the cocoon, it is immersed for a few moments in boiling water, taken out, put on swifts, and spun or twisted on a common woollen wheel, beginning at the large end of the piece, that is the end which was reeled first; and when it becomes small, which is the case when one-half or two-thirds is run off, the small end of another piece is added to it, and thus they are twisted together. It is then spooled directly off the spindle; a sufficient number of spools is put into a small spool frame to make a thread of proper size, which is twisted again while it is moist. It is reeled again, and cleansed by boiling in strong suds for three hours, then dried and colored. Undergoing this process it shrinks about one-half in weight; after this for sewing silk, it is doubled, twisted and reeled on a reel two yards long, and is divided into skeins of twenty threads each, as the statute of the State requires. If it be calculated for twist, it is made three threaded, twisted and done up into sticks with a small hand machine, and is then ready for market."

Brooks' Silk Spinning Machine is highly spoken of, as suitable for families engaged in the art of making sewing silk. This machine takes the silk from

the cocoon, twists, doubles and brings forth the perfect sewing silk. The thread is remarkable for its even texture, for its brilliance and strength. It is considered superior to that which is made in the usual way by reeling. The machine is calculated for a double or single thread, and prepares it for the loom or sewing silk. There is one great advantage in using Brooks' Silk Spinner; which is, that it takes the fibres from the cocoons in a wet gummy state, and unites them in that condition. The consequence is, the thread is united in one solid mass before it has time to dry; and, consequently, must be much stronger and more even. A premium and several medals have been awarded to Mr. Brooks for his invention. In a letter, published in one of the papers devoted to the silk culture, he says—"I do not reel it at all before it is twisted into warp or filling, or doubled and twisted into sewing silk, or for other uses, of any size or twist that may be wanted—perfectly even, firm, smooth, and strong, as any that can be produced from any part of the world."

The period is rapidly hastening on, when our manufactories will rival, and perhaps surpass, in their products the boasted fabrics of Europe. Mr. Gay, from Connecticut, brought into the middle States some samples of silks woven in his native State, which were as beautiful as any I ever saw from the far famed looms of France and Italy.

LABOR, PROFIT AND QUANTITY.

The labor required to attend to a given number of worms is not easily computed, as many circumstances must be taken into the account. If the large leaves of the Chinese Mulberry are used, instead of the small leaves of the White Mulberry, the labor will be vastly lessened. Then the size of the trees, and their distance from the cocoonery must be considered; also the industry of the persons engaged.

To attend to 500,000 worms, one person will answer for the first week; two persons for the second; four for the third; and for the last ten or twelve days, about eight or ten persons will be required. These persons may be women and boys.

As it respects the profit arising from the culture of silk, many estimates have been made; some of which have been entirely too high. It has been reduced to certainty, that one hundred and fifty dollars nett profit may be realized from an acre of full grown trees. A certain writer estimates the product of one million of worms at 500 pounds of silk. I should say 400 lbs. would come nearer to the truth. Five hundred pounds, at three dollars per pound, (after deducting the price of reeling,) would amount to $1500. The expense of labor would be about $300, which would leave $1200 nett profit.

Various estimates have been made with respect to the quantity of silk produced by a given number of

worms. The second year that I cultivated the worm, only a hundred and ninety cocoons of the large speckled Lombardy worm were required to the pound. M. Bonafous says, that two hundred and fifty will make a pound; while Mr. D'Homergue makes three hundred and thirty weigh a pound. From 8000 cocoons Mr. Cobb reeled three pounds of silk. Count de Hazzi informs us, that from eight or ten pounds of cocoons, a pound of reeled silk may be obtained. Eight pounds of cocoons, or about 8000, make a bushel; from which, two to three pounds of reeled silk may be expected. The difference in these calculations is owing to the different kinds of worms, and the manner of feeding. The cocoons of worms of the large species, are three times as large as those of the small species.

In conclusion I must observe, that putting the profits of the silk culture at the lowest estimate, the business is still profitable; and I recommend all who are properly situated to embark in it. I have had the honor of introducing the culture of the Mulberry, and the rearing of worms into a part of the state of Delaware, with fine prospects of success. May they reap the reward, as I have no doubt they will, of their enterprize.

CULTURE OF THE BEET.

That the beet may be cultivated to advantage for the making of sugar, is now reduced to a certainty. The French have carried the cultivation of the beet and the manufacture of sugar to considerable extent. So early as 1812, according to a Paris newspaper, 214 licenses were taken out for the manufacture of sugar. Messrs. Ronaldson and Vaughn, with others, have done much to introduce the culture of the sugar beet into the United States, and richly deserve the thanks of the community as public benefactors. Much interest is excited in England on this subject.

In this essay I shall endeavor to give a concise account of the mode of raising the beet, and of the manner in which sugar is made from it. Sugar is one of the constituents of the beet root, and care should be taken in procuring the sugar, to destroy as little as possible. It is an undeniable fact, that in the present state of the manufacture, much is lost through improper management.

In cultivating the beet and manufacturing sugar, I would recommend the manufacturer to make only the raw sugar, as the process of refining is very difficult and complex, requiring an intimate knowledge, gained

by long experience. Refining commences after the raw sugar is made, and the process lasts six or eight months, making the time long before he can dispose of his product.

The beet is a biennial plant, which bears seed the second year. The height to which the stalk grows, is from two to four or five feet. The beet will grow in any soil where the potato flourishes; but a sandy soil impregnated with vegetable matter, is the best. A very sandy soil, however, should not be chosen. It is said that small beets give a larger proportion of sugar than large ones. Calcareous soils are not adapted to the culture of the beet, neither is a very clayey soil; but marl and clay improve a sandy soil.

The ground to be prepared should be ploughed three times; twice in the winter and once in the spring. Some culturists, however, only plough twice. If the soil is sandy, it should not be ploughed deep; but in a clayey soil the matter is reversed. It is, I believe, agreed that the best manure is that in which putrefaction has just begun, as it by the division of the soil gives the roots room to strike freely into the earth. The ground is harrowed twice, and rolled between each harrowing after the last time it is ploughed, in the spring. By all means the soil should be well pulverized. The soil should be damp at the time of planting the seed.

SEED.

The choice of seed is a very great matter, as on the color of the root depends the color of the sugar, and, consequently, its value. The method of choosing proper seed, is to sow some of them in a pot of vegetable mould, and expose it to a heat of 30 degrees Centigrade, or 86 degrees of Fahrenheit's thermometer, watering the earth in the pot from time to time during the process. Two small leaves will shoot up from each seed in about twelve days, which when fully blown out, should be rubbed gently between two fingers. Should the sap, thus obtained from the leaves by the rubbing, colour an object red, the seed are not good, and should by no means be used. The reason of this is, that sugar made from white roots is not of so high a color as that which comes from the red beet, and is not so troublesome to refine. No seed should be used but those of the Silesian white beet, if they can be had. No other rule to discover good seed, is so certain as the above.

The French people practice four modes of sowing the seed. The *first*, is to sow them in beds, in nursery style. The *second*, broadcast, in the manner of sowing wheat. The *third*, in drills. The *fourth*, by a machine for the purpose. A very small space is required for sowing the seed in beds, for so soon as they grow thick, they are transplanted. This is done about a month or six weeks after germination.

The labor in this mode is great, and is not all the inconvenience; for the beets are injured by being exposed, and the small fibres are torn asunder.

The second mode, also, has some objections. It is very easy to scatter the seed, as in sowing wheat; but the worst of the matter is, that this mode requires a great deal of seed. In some countries the seed sell at an enormous price. Seven pounds are required for an acre when sown broadcast. There is one very great advantage in this mode of sowing, which is, that the cultivator can cull out the worst, and leave the best plants growing, by which he will be certain of an excellent crop.

The third mode of sowing is very good. When the seed are sown in drills, a harrow is used with very fine teeth. Women in France sow the seed, by putting them singly into the furrow, about twelve inches apart. A cross harrow is then used, which is finer. An acre may be sowed in this way, by four women, which is a very great saving.

The machine, for sowing the seed, is considered the most simple and economical of all the modes enumerated. I will endeavor to describe it. The machine is composed of a hopper, to receive the seed; the bottom is shaped like a cylinder of wood, with cavities in the surface to receive the seed, the cavities being sixteen inches asunder. Two wheels support the machine, and in those wheels are teeth, which give motion to the cylinder. The cylinder as

it turns, causes the seed to fall in its cavities, and then drops them into the furrow, at the regular distance of sixteen inches. The furrows are formed by shares, fixed in front of the machine. There are three of them, and they plough but half an inch deep. For the purpose of covering up the seed, there are three rollers fixed behind. This machine, drawn by one horse, will sow several acres in a day, attended by a man or boy, whose only care is to keep the hopper supplied with seed, and the holes open.

The sower should be particular not to put the seed more than half an inch deep in the ground, as when too deep they do not receive the influence of the air, moisture and warmth, which are absolutely necessary to germination. The seed should always, when practicable, be put down immediately after the ground has been broken up.

Cultivators are at variance as to the proper time for sowing the beet seed, but it has been found to be a fact, that they can scarcely be sown too soon in season, for the simple reason, that the sooner they are sown the sooner they arrive at maturity, and the sooner the manufacturer may begin with the process of making sugar. It is declared to be a fact, that sugar made in September is more easily extracted, and is of a lighter and more beautiful texture, than when the process is delayed. It is also declared, that the quantity obtained from the roots will be considerably greater, if sown in March, than if sown in May.

The time for sowing, however, ranges from March until May, and even June.

CARE IN CULTIVATION.

Great care should be taken to remove all grass and noxious weeds, which may obstruct the growth and materially diminish the product. Every cleanliness must be observed, during the whole process of growing the beet. They should be stirred with the hoe three times. The first time when they have three or four leaves; the second, a month after; and the third a month after the second. It is no matter whether there are weeds or not, the hoe should be used to loosen the surface of the soil, and give air to the fine fibres which rise towards the surface. Never use the hoe after a rain, but do the matter judiciously, and a heavy crop is inevitable. One thing should be particularly observed; whenever any of the plants become unhealthy, they should be taken up, and should any show a tendency to go to seed, cut the stalks off. Never tear off any of the leaves of the healthy beet, for every leaf taken away is a certain quantity of sugar lost. The above should be religiously observed by the cultivator.

TAKING UP THE BEET.

The proper time for taking up beets, may be known by the changing of the leaves from a bright green and red colour, to a brownish yellow, and when they

droop and wither. When this is seen, they should immediately be taken up, as the sugar every hour they are suffered to remain in the ground is being lost, and saltpetre replaced instead. A spade is generally the instrument with which the beet is taken up, and the manner of doing it, is to make a deep cut in front of each plant; then to bury the hand under the same and force it from the earth, being careful not to bruise the roots by knocking one against another. The beets are all laid on the ground in one direction, that is their roots, and then with a spade the stalks are seperated from the roots. This must absolutely be done, or the plant will continue to grow, and a great loss of sugar be the consequence. But the plan of cutting off the roots with a spade is condemned by many culturists, and they contend that it should be done with the hand. The danger in bruising them is this; fermentation ensues, and, of course, whenever and wherever this takes place, the sugar is lost. Beets should always be dug in dry weather, as they often *heat*, as it is called, in wet weather, and fermentation ensues.

The next thing in order, is to preserve the beets. Some place them in a cellar, but it is said that a pit is better. The size of the pit of course must be according to the quantity of beets. It is said that the best form and size is twelve feet long, three feet wide at bottom, and thirty-one inches deep. In this pit may be stowed from two to three thousand pounds

of beets. In forming this reservoir, the dirt should be thrown out on both sides, so that when the beets are placed therein the earth may easily be heaped over them. A coat of dirt three inches thick, is sufficient. Be particular that this pit or reservoir be located where the springs cannot rise. Occasionally the beets should be examined, for one rotten one may ruin a large quantity. Some cover the beets with straw, but this practice is condemned, as the roots are more apt to ferment or rot.

When first taken up, be careful not to suffer the beets to lie long exposed on the ground to moisture and air. They are equally injured by both extremes of heat and cold, and even when subjected to a temperature, if damp, of 56 degrees of Fahrenheit, the vinous fermentation will ensue, and a loss of sugar be the consequence. So, on the contrary, the beet freezes very easily, so much so that large quantities have been known to freeze when the thermometer was only two or three degrees below the freezing point. When once frozen, it is entirely useless to attempt to thaw them for the purpose of making sugar, for they are then found to be but a black and rotten mass. So hard are they when frozen, that the instrument is blunted with which it is attempted to cut them.

PRODUCTION OF SEED.

The seed of the beet are only produced the second year, being, as was observed before, a biennial plant.

When beets are gathered, those should be selected which are intended for the production of seed the next year. The following are the appearances by which good beets for seed are chosen:

1st. Choose those which are perfectly healthy.

2d. Of middle size, thickness and length.

3d. Be particular that they are not forked.

4th. They should be perfectly white.

A portion of the stalk and the leaves of the beets you have chosen for seed, should be cut off; but care must be exercised not to cut down to the neck, as that might injure, if not destroy, the germinating power. The next process is to pack them down in sand, and place them in a cellar, or some other proper place. In the beginning of spring, say about the first of March or April, they should be *set out*, or planted up to the neck, and about two feet six inches apart. Give them room and nourishment, and they will put forth luxuriantly, growing four or five feet high, and will need propping. About the fifteenth or twentieth of September the seed will ripen, when the stalks should be cut off, several of them tied together, and hung up where the air will circulate freely through them. When they are perfectly dry, you should strip them, which is done with the hand. The seed should now be spread upon a board and dried by a fire, or in the sun. After this process, the chaff should be extracted, and the clean seed put away in bags, where no mice or insects can injure them. Each

beet, it has been computed, will give from three to six ounces of the best seed. No cultivator should ever sow seed that are more than five years old, as they become shrivelled and rotten, and lose their vegetative power. It is well known that the seed of the white beet will often produce the red or yellow, and it is said that this may be corrected by changing the soil from clay to sand, and *vice versa.*

NOTE.—Beets should never be cultivated on land newly cleared, nor even on land that has been covered with timber within several years; for it has been proven by actual experiment, that such land is entirely unsuited to such cultivation. Neither should beets be grown for any number of years successively, though the land should be ever so well suited to the production. "Many farmers in France pursue the following rotation: the first year wheat, the second beets, the third clover, and so on, wheat, beets and clover in succession. When beets are to follow wheat, the ground should have two deep ploughings, as it must be so hard as to require it. Some plant potatoes the first year, beets the second, oats or wheat the third, and clover the fourth. There is, however, a sugar maker at Arras, who has grown beets on the same ground for fifteen successive years, taking care only every year to change the manure or dressing; this, however, is not a practice to be followed—certain growers have been ruined by it."

ON MAKING BEET ROOT SUGAR.

The second part of the subject treats of making the sugar from the beets, the manner of cultivating which has been shown. The object here is to show how the greatest quantity and the best quality can be produced.

It has been a custom with those in France who make their own raw sugar to refine it; but experience proves that this is a very bad plan, as it requires a long acquaintance with the art, and a considerable knowledge of chymistry. But this is not all: the great length of time required should be a sufficient barrier, for with the production of the raw sugar and the process of refining, fifteen months at least must elapse, before he can realize the reward of his labor.

Sugar, I need not say, for it is well known, is one of the constituents of the beet; and the great art in extracting it from the root, is to choose some process by which the largest quantity can be obtained and the least portion destroyed; for it is conceded on all hands, that a portion *is* lost in the present imperfect state of the art. The time, however, is rapidly approaching, when like that of silk, knowledge will be disseminated on the culture of the beet, and not only the culture, but the manufacture of sugar. When the cultivation and manufacture of silk and sugar

shall have been brought to perfection, millions of money will be saved to the country, and employment given to thousands who are now entirely unproductive. I shall proceed to describe the manufacture in the order in which the manufacturer proceeds. And first,

TO CLEAN THE BEETS.

This work is done by women and children. The beets should be either washed or scraped. The instrument used for scraping, is a knife with a wide blade and nine or ten inches long. The women and children now seat themselves around the pile of beets, and each one taking a single beet in the hand, scrapes every particle of earth and other matter off. The very large beets are cut into two or four pieces, after being scraped, to render them of a proper size to enter the rasp. The incision, however, should always be longitudinally or lengthways. The process of cleaning is very necessary, and should be done neatly. Manufacturers are at variance with respect to the necessity of washing the beets; some contend that it is absolutely necessary, while others declare that a rough brush, after the knife, is sufficient. But it is my opinion drawn from correct premises, that water is necessary to a thorough cleaning, though the quantity necessary for a manufactory is not so great as some imagine. In fact the quantity required is but small, and can readily be obtained in any manufactory.

The process of cleaning should always be carried on in the vicinity of the press and rasping apparatus, and the enclosure where it is carried on, should be sufficient to contain a supply for the establishment for five days. The clean beets should be placed in baskets and conveyed to the rasp, where they are left, and empty baskets taken back. It is said that four women skilled in the business, will clean and carry six or seven tons in twelve hours. The next process is

THE OPERATION OF RASPING.

There have been many mills invented in France, for the purpose of rasping the beet; but universal consent, I believe, has declared in favor of the one invented by Molard. The following is a description of the machine. A cast iron cylinder is set round with rough blades like saws, zigzag and jagged. These tooth-like processes saw, tear and squeeze the juice from the beet. An author, whose name I do not recollect, says that Molard's mill will operate on three or four tons of beets in an hour, with the labor of two men.

The beet is of a very firm and solid consistence, so much so that the juice cannot well be extracted by pressure alone, on account of its being contained in a great many little cells, and hence it is necessary that the rasp should break these in order to obtain the juice. The process of rasping requires more ex-

pedition than any other in the manufacture of sugar from the beet. The quantity rasped at any one time should never exceed that which is required for immediate use, as the pulp is powerfully operated on by the atmospheric air, so much so, that in half an hour a great change is effected. The rasp and the press should go together in their operation, the one but a little in advance of the other. There is another thing which should be particularly mentioned. In all cases the rasp should be kept perfectly clean, as any particles of pulp left sticking to it will ferment, and injury must ensue.

It is expensive to work the rasp mill by human power, and, therefore, oxen are better suited than even horses, because they are kept with less cost than horses, and will eat the pulp, which horses will not. Some manufacturers in France, prefer wind power to either that of water or steam, on account that water cannot always be obtained in level countries, and the expensiveness of steam, when not located in a coal region. But there is one great objection to wind power, which is, that it is very uncertain and irregular.

TO EXTRACT THE SUGAR.

Sugar is extracted from the pulp only by pressure. The greater the pressure the greater the quantity obtained from a certain quantum of pulp, yet it is impossible with the greatest known pressure that the hy-

draulic press can produce, to obtain all, for the pulp will remain moist. It is a question, whether the last portions of juice are worth the trouble of obtaining them. The first juice runs from the bags without pressure, the second with a light pressure, the third with a heavy pressure; and it remains to be proven, whether the juice obtained by a very heavy pressure, is worth the cost of the labor. The last juice obtained cannot be more than eight or ten per cent. This would, of course, in a great measure depend upon the power used; for steam, wind, water, horse, or ox power, are all cheaper than the labor of man, though it is so frequently used. A hydraulic press, of the power of ten tons, will extract seventy per cent. of juice at first; but when the power is doubled, eight per cent. is about the portion extracted, which will not certainly pay for the labor.

The quantity of syrup to be obtained from a given weight of beets, depends more upon the rasp than the press. The finer they are rasped the more juice is obtained, but all beets do not give the same proportion; for it has been found by actual experiment, that those beets which contain the most sugar, yield the smallest portion of juice. It is the quantity of water which makes up the superabundance of juice, and so exactly is this pointed out by the areometer, that manufacturers can ascertain how much sugar can be obtained from a given quantity of roots. The operation of pressing should be carried on as rapidly as possible.

A great many presses have been used for the purpose of obtaining the juice from the beet, as the wedge, the lever, the screw, cylinder and the hydraulic press. Universal consent appears to give the preference to the hydraulic, as it is more powerful, and, consequently, more expeditious; for it extracts all the juice that is worth the labor to obtain, at one operation. There are certain articles which belong to the press. These are

1st. The bags which are to hold the pulp.

2d. A wide reservoir in which the bags are prepared.

3d. Hurdle, made of osier or hemp.

4th. A cistern to hold juice, provided with a pump and pipes.

The pulp bags should be of very strong material, such as canvas, or stout Irish linen. The canvas should be of such a fabric as to suffer the juice to run through it freely, and yet retain the pulp. The bags, when in use, should be changed in about every ten or twelve hours, and then washed in hot water. The size of the bags is governed entirely by the power of the press, and the number is regulated by the number of presses in operation. Twenty-five bags is called in France, *un jeu de sacs*, or a set; which set is sometimes used with one press. Two sets will be sufficient for a press that is kept in operation through the day, and three sets if the press is kept in operation day and night.

The reservoir in which the bags are prepared, should be of the following dimensions, admitting that the hurdles are 2 feet wide, and 2½ in length. The width should be 2½ feet, the length 6½, and the depth 1 foot. The reservoir should be made of strong wood, and lined with metal, such as copper. It should be stationed between the rasp and the press, and the end near the cistern to receive the pulp. A cock should be fixed in one corner of it, and rails should be fixed round it to hang the bags on. The reservoir must be raised a few inches from the floor, for the sake of convenience.

The hurdles are made of very strong osier, and serve to support the bags under the press. The size of them is regulated by the face of the press. The hurdle, in its structure, resembles the hamper, and is easily made by a basket maker. There should be the same number of hurdles that there are of bags, with the exception of one. They should be washed with lime water every twelve hours, in the reservoir mentioned above. There should be more sets than one, that they may be renewed or changed every ten or twelve hours.

The cistern, like the reservoir, should be made of strong wood, and lined with copper. The cistern is intended to contain the juice as it runs forth from the press, from whence it is carried to the clarifying copper. Pipes should lead from the press to the cistern, and a pump is necessary to throw up the juice

into the clarifying copper. The cistern must of course be situated lower down than the press, so that the juice by a common law of gravitation, shall flow from the press into it. It should always be kept perfectly clean. The shape of the cistern is of no moment at all, and the size depends upon the mode of working. If there is one defacation in twelve hours, the cistern should be about half the size of the defacating copper; but if there are two or three defacations in the same time, the cistern should be of the same capacity.

DEFACATION.

The juice, just as it comes from the press, contains all the matter that is soluble in the beet, such as sugar, water, &c., as will be enumerated hereafter. Now it is very plain, that if the juice were composed of nothing but sugar, combined with water, it would be no trouble whatever to evaporate the water and leave the sugar behind; but then there are foreign substances combined with the sugar, which prevent the ready evaporation of the water, and the crystalization of the sugar. From this cause defacation is necessary, and this is nothing more than mixing with the juice certain substances which have an affinity for these foreign substances, and will precipitate them. These substances or agents, should be of such a nature as not to affect the quality of the sugar, but go off with the refuse substances. The substances most

generally used for this purpose are sulphuric acid and lime, great care in the use of which is recommended. Heat is necessary in defacating the juice, and for this purpose boilers are necessary.

The boilers should be made of copper, and of a circular shape. Their size should correspond with that of the establishment, varying from two to five or six hundred gallons. Some manufacturers prefer having a greater number of small ones, ranging in size from 40 to 50 gallons. Every operation, in making sugar from the beet, should be carried on with the utmost despatch. The rasping, as observed before, should go on rapidly, as heat is generated, and, consequently, fermentation takes place in a proportionate degree, by which a corresponding portion of sugar is lost. Heat acts powerfully on all organic substances held in solution by water. Now the longer the time between the rasping and the press, and between the press and the boilers, the greater the fermentation, and, consequently, the greater the loss of sugar. Many times through inattention, or other causes, this is so great that the sugar cannot be seperated at all. Therefore, it is necessary that the boilers should be filled as rapidly as possible, and a number of rasps and presses should be kept in operation, in proportion to the size of the boilers used. If the boiler holds 600 gallons, and it is desired to fill it with juice in two hours, four tons of roots must be rasped and pressed. To perform this in the given time, will require three rasping mills and five presses.

Many are of opinion, that boilers of the middle size are best suited to the purpose; for instance, such as will hold from eighty to ninety gallons. It is believed that two of these would perform the same as one holding 5 or 600 gallons; for while the process of defacation is being carried on in one, the other is undergoing the process of precipitation.

All boilers, intended for the process of defacation, should be in height equal to its diameter. Room should be allowed in the boiler for the operation of boiling, as for instance, if the boiler is to contain 200 gallons of juice, it should be made large enough to hold 240 gallons. The boiler should be stationed at such a height, that the syrup may be easily run off into the boilers for evaporation. The temperature ought never to rise above 212 degrees Fahrenheit. If the boiler is 36 inches both in height and in diameter, the grate should be 23 inches in length, and 15 inches in breadth, and should be made of cast iron, having ten bars. The necessary apparatus belonging to a defacating boiler, are as follows:

1st. An areometer and a thermometer.

2d. A bin and buckets for lime.

3d. A pair of scales with weights for weighing lime.

4th. A copper or lead measure for sulphuric acid.

5th. A spoon plated to examine the juice, and a saucer for experiment.

6th. A wooden spatula to stir the syrup in the boiler.

7th. A funnel and a filter.
8th. A skimming ladle.

OF THE THERMOMETER AND AREOMETER.

The areometer of Beaume should in all cases be used in preference to any other. The thermometer in defacation, is useful in ascertaining the temperature, and thus to know when to put in the agents which produce clarification. It should be frequently put into the liquid while clarification is going on.

The areometer should have a handle of wood, and a case made of tin. When the syrup is to be weighed, it is drawn up in the tin case, holding it by the handle. The syrup should always be at the same temperature when examined, and it should be taken as it exudes from the press, plunged by the aid of the tin case in water, to reduce the temperature to 55 degrees of Fahrenheit. The specific gravity is diminished if weighed while it is boiling, and consequently a difference is found more or less, of 4 degrees. The specific gravity is diminished by the expansion of the fluid by heat.

The lime, which is used in the defacation of the syrup, should be unslacked. It should be weighed while in that state, slacked, and then water enough added to bring it to the consistence of cream. A bin or cistern is used for this purpose, which is of a circular shape, with a cover. The lime should be sifted very fine, and all the lumps should be taken out. M. Du-

brunfaut says, the lime should not be slacked until it is weighed.

The sulphuric acid in its natural state is too strong, and requires five or six times the quantity of water before it can be used. The mixture is made in buckets made of wood, with copper hoops. No metallic vessel save a golden one, and that is too expensive, can be used; as the acid would decompose the metal, and form a sulphate of iron, of copper, &c.

An instrument is necessary to stir the syrup in the boiler, and this should be a round stick, at the end of which should be fastened a round board one foot in diameter, which should be full of holes.

The next things enumerated, are a plated spoon and a saucer, which are for the purpose of examining the syrup. The spoon must always be clean and bright, as the clarifier can more easily tell when the process is complete. The saucer should be white, as it is used for the purpose of ascertaining when the syrup has a superabundance of alkali and acid.

The skimmer should be eight inches in diameter. It is not always necessary to skim the boiling syrup, and especially when precipitation is going on, for then the scum prevents the fluid from cooling too rapidly.

The filtre should be made of coarse cloth or canvas.

I shall now give M. Houdart's method or process of defacation, in a quotation from a work on the man-

ufacture of beet sugar. "Suppose," says the author, "that 114 gallons of juice are to be clarified. The boiler being charged, and the fire burning, the thermometer is placed in it, and should be kept there till it amounts to 60 or 65 degrees (167° or 178° of Fahrenheit.) During this interval, eighty-eight pounds of lime slacked and sifted, are weighed out; four or five bags are then similarly prepared, each bag containing seven pounds of lime. This done, the eighty-eight pounds of lime are put into a wooden vessel, where they are mixed with clear water, till they become like milk. This mixture is poured into the boiler when the temperature is above 60 or 65 degrees of Reaumur. The whole is then briskly stirred for some minutes, in order to incorporate the lime well with the liquor. Before the lime is added, a thick scum will rise on the surface. Lime often destroys this scum, or at any rate, it is suspended in the liquid by agitating it when the lime is added. When thoroughly mixed, some minutes should elapse before the full effect will be produced; then, with a bright spoon, take a little of the liquor, and examine it carefully; if the quantity of lime be sufficient, the juice will exhibit a number of clots, or particles in suspension, which will soon settle to the bottom of the spoon, leaving the upper part of the liquor perfectly clear and transparent, and more or less of an amber color. If, instead of this, the lumps are very much divided, and only swim in the liquor without

settling to the bottom, even for several seconds, and if the juice remains of a thick milky color, it is a proof that more lime is wanted.

"One of the little parcels of seven pounds is then mixed with the water, poured into the boiler, and well stirred as before. The juice is then again examined with a spoon, and if the symptoms are still not so favorable as they might be, another seven pounds are added, and so on, seven pounds at each time till defacation of the whole is complete.

"Eighty-eight pounds of lime to 114 gallons of juice, may always be used with safety. It is in fact the minimum dose which ought to be applied. The quantity varies with the quality of the beet root, and the period of the season when applied. Thus, at the beginning of the season, when the roots are rich and full of sugar, the greater will be the proportion of lime necessary. The object of the lime being to precipitate certain substances which impede the formation of sugar, it should, of course, be added in quantities adequate to the amount of these substances; for, experience seems to show, that as the quantity of sugar increases, so will also these extraneous matters. Thus, a firm, solid beet root requires more than a watery root, and *vice versa*.

"On the whole the safest way is to *begin* with *little* enough of lime, for it is very easy to add more from time to time, as above directed. But it is not to be inferred from hence, that, *on the whole*, a small

quantity is preferable to a larger. So far as is this from being the case, that it is considered better to use too much than too little; for though an excess of this alkali is prejudical to the sugar, it is always less so than an insufficient quantity. The observations of the workmen cannot be too frequently taken during the process of defacating. A clear liquor and a perfect precipitation are the main objects to be accomplished.

"The beet juice, when it comes from the press, is of a milky hue and yet dingy. When heated the scum and froth rise; but as soon as the lime is added, the black dirty color disappears by degrees, and abundance of flakes are seen in the liquor. These flakes are usually of a yellowish grey color; when the proportion of lime is sufficient, they seperate from the liquid and sink to the bottom. When arrived at this stage of the defacation, the fire must be withdrawn, and the boiler left to itself for an hour or two that the whole may settle properly. The cock placed just above the bottom of the boiler should be opened to draw off the liquor clear. The juice is then conveyed to the evaporating pans, of which more hereafter. Care should be taken to watch the liquor as it runs off, lest any part should become thick and turbid, especially towards the end; so soon as this is perceived, the cock should be closed and the lower one opened, that the residuum may pass through the filtre. When this is all drawn off, the boiler is ready for a fresh charge.

"It has been shown that it is better to use too much than too little lime in defacation. Both are stated to be evils, and, yet of the two evils the former is the least. After having operated on the extraneous matter in the sugar, it then begins to act on the sugar itself.

"Defacation by lime alone, then, has this grand inconvenience, that a part of the sugar is destroyed to save the other. In this process, in fact when this syrup is run into moulds, it produces an abundant crystalization; and the molasses which comes from it more rapidly than by any other method, has a very disagreeable taste and smell: it has but little sweetness; and if by any known process a second crystalization be attempted, not an atom of sugar can be obtained from it. Nay, more—the sugar partakes of the bad taste and smell of the molasses, and is thereby rendered unsaleable in the market.

"It is a pity that the defacation by lime presents these inconveniences, for it is the mode of all others the simplest, and best adapted to common farm establishments. It is, indeed, on this account that many manufacturers who have adopted it continue still to use it, notwithstanding the inferiority it presents, both as to quality and quantity of its results as compared with those of other and more complicated methods."

RECAPITULATION;

OR SUGGESTIONS AFTER WRITING THE WORK.

There appears to be in the vegetable, as well as in the animal kingdom, a healing and preservative power, which repairs all breaches, renovates what is worn out, and struggles against decay. Physicians call this power in the human system, the *vis medicatrix et conservatrix naturæ*, or the healing and preservative power of nature. When a bone is broken, nature immediately begins to repair the breach by throwing out a secretion of bony matter, which gradually hardens and unites the ends of the bones. To still plainer show her intention, Nature after having united the ends of the bone, builds up a strong ridge round the part which was seperated, as if to guard against any future violence. This ridge may be felt through the flesh by any person, particularly a young one, who has had a bone broken. In grafting a tree, precisely the same operation is carried on. A secretion of sap is thrown out, which hardens into wood and thus unites the two parts. When the human flesh is cut with a knife, nature also secretes from the blood a fluid, but not bony, which thickens like glue when the wound is kept from the air, and unites the lips of the wound by the first intention—that is, without suppuration. But if the air is suffered to act up-

on the wound by its being uncovered, the oxygen of the atmosphere unites with the secreted fluid, and renders it so thin that it cannot unite the lips of the wound, and hence the necessity of keeping a cut finger or other part wrapped up in bandages. Now this is precisely the case with a tree. If a deep cut is made into it, a fluid is secreted, which will unite the wound if kept covered; but if not, the oxygen of the atmosphere unites with the secreted fluid and renders it too thin to unite the wound. Here we see a great similitude between the animal and vegetable, which it is found will correspond throughout.

We find too, when we open the great volume of nature and pry into her works, that there is a perfect adaptation of every thing to its proper place, use or end. We see it in the golden globes which wheel their courses round the great hall of Heaven—we see it in the glorious sun, without whose light and heat all animal and vegetable life must perish. Without his light the beautiful colors which deck and adorn this world of flowers were extinct, and without the atmosphere which surrounds us, the melodious sounds of music would delight our ears no more; for there is no sound in a vacuum. We see this wonderful adaptation of Nature in the things which are upon our earth and in what concerns man. In level and temperate countries, where swiftness is required, the horse is placed. On the desert we find the camel, an animal capable of enduring long fatigue and of carrying with it a supply of water. It is well known that water is scarce on the great deserts of Asia and Africa, and on this very account Nature has placed a large hollow hump on the back of the camel, in which he may carry his supply of water. He

has also the power of eating a large quantity of food, half chewed, which he can bring up at pleasure and chew as he passes over the desert. Here we see the wisdom of the great Disposer of all things. Had the horse been placed upon the desert as a beast of burthen, instead of the camel, he would have perished for water and food before half his journey were performed. In Lapland and other northern climes, where the earth is covered with eternal snows, the Reindeer is placed. His legs are slender, but they are supported by the snow. He must travel rapidly, or his master would perish in a long journey. There is a skin which he can draw down over his eye, to protect it from the frozen flakes of snow, which would inevitably put his eyes out. In the centre of the skin is a very minute hole, through which he can distinctly see his way without the possibility of injury from the frozen particles. Here again we see a wise provision and adaptation of nature. Were the eyes of the reindeer unprotected, it would be impossible for the animal to travel in those regions of perpetual storm, where the snow flakes are driven before the wind with immense velocity. And again, were the reindeer placed upon the burning sands of the desert, or the camel upon the snow-clad hills of Lapland, how soon would each perish in the performance of the other's task; how ill adapted would they be to those climates. Wonderful are thy works and ways, Oh Lord, God of Heaven!

There is a power in Nature which is ever striving against decay. Nature evidently endeavors to renovate herself. Mark yon field which has been turned out as good for nothing by the injudicious farmer, who has worked it until it can yield no longer. Nature teaches him how

to act. In the first place she causes a small grass to spring up and then a white clover, that the soil may be covered from the burning rays of the sun. The rains and dews fall and moisten the soil, and are prevented from being suddenly evaporated by the covering which is thus provided. *That* water enriches gradually the soil, for we find the farmer tilling *that* field again in a few years. If water alone does not enrich the earth, how is it that all duck puddles, swamps, ditches and marshes become rich? Look at the spot round your *well* which but a few years ago was a mere sand hill, it is now rich, and yet no manure has ever been put there. By what means is it rich? Certainly not from any cause but water.

A plant will not grow in earth alone. Take a portion of the richest earth that ever was seen, divest it of all water, and if you plant a seed in it, it will not grow. But seed will germinate and grow in water without a particle of earth. Take an acorn, attach a string to it, and hang it in a tumbler half full of water, just so as not to touch the water. Even the vapour which will rise by evaporation from the water, will cause the acorn to send forth a stalk and roots, the latter of which will strike into the water and soon fill the bottom space of the tumbler. Wheat will also grow in water, and makes a beautiful appearance, as the process of germination is there visible, and it certainly is one of the most wonderful processes in nature. Mark the acorn before it goes into the earth; it has nothing in its appearance which resembles the oak. A roundish, oblong and pointed surface is all that presents itself to the eye. The shell bursts and a delicate little stem makes its appearance. Is it possible that in that acorn lie the

elements of the future lofty oak, destined to brave the storms of centuries? Yes, though that delicate stem may now be broken with a pin, it may one day become the monarch of the mountain, or the pride of the forest. When we contemplate such things, well may we exclaim, "*multum in parvo.*"

"An undevout astronomer is mad," says a great author, and I will add, that he who reads the book of nature and is not a wiser and a better man, has spent his time to litle purpose. How many pursuits are calculated, if reflected on aright, to elevate the soul to that Sublime Being, who has spread before us the glorious universe for our contemplation. In the cultivation of the silkworm the mind may muse with pleasure and profit. In the life and transmigration of the silkworm, we see an almost perfect picture of the resurrection of man. It comes into the world a tiny insect, and grows with great rapidity. More wise than man, it prepares its own tomb and comes forth a beautiful butterfly, to work no more but to enjoy. Like man it had its infancy, like him grew up to labor, like him found a tomb, and arose from it in a white garb of beauty.

Let the farmer follow nature as his guide; let him observe every and even the most minute operation in her grand field, and she will teach him the true and legitimate mode of procedure. Every vine has a lesson, and every flower a moral; yea, every thing is fraught with wisdom, if man will read it. Believe not the skeptic for a moment. There is a wise God who reared and who rules the universe. I see Him in the grand system of worlds that roll through space, and I hear Him in the midnight blast. His majesty and power is pictured in the stormy ocean, and the beau-

ty of His loving kindness blossoms in the tree and blooms in the rose. Every spire of grass shows forth His goodness, and every insect in earth and air hums His praise. Whether we seek His wisdom in a planet or a plant, in a feather or a fly, we find Him still the same grand, glorious and incomprehensible Being.

My last words to the farmer are, follow nature, husband your resources, and improve your mind as well as soil.

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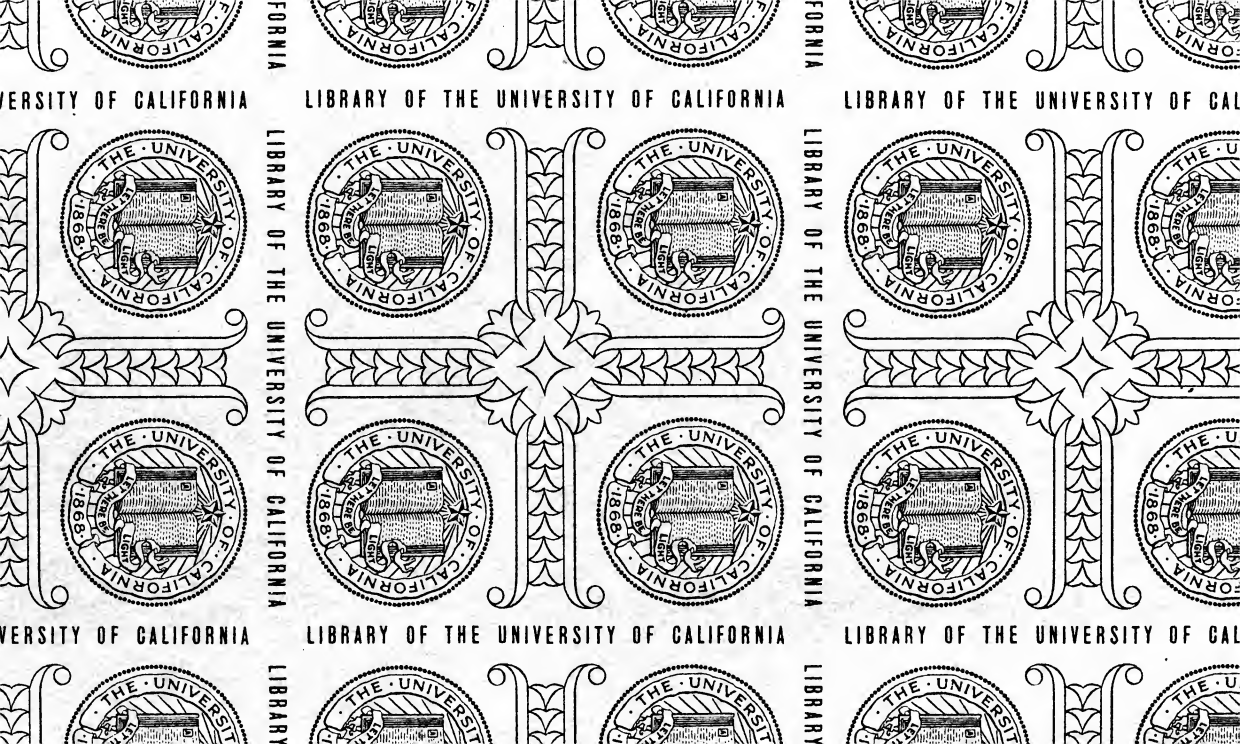
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