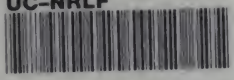

FARMING

WITH

GREEN MANURES,

ON

PLUMGROVE FARM,

BY C. HARLAN. M. D,
WILMINGTON, DELAWARE.

PRICE, 50 CENTS.

WILMINGTON:
GLATTS & ECKEL, BOOK AND JOB PRINTERS,
510 Market Street, up stairs.
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PREFACE.

In publishing these pages, I have two objects in view—the assistance of those who need advice—and the instruction of my foreman on the farm, that he may understand the reason why he is required to do certain things. But how should I know any better than he does, the laws of vegetable life, and the best course to pursue to obtain remunerative crops?

He is supposed to be practically acquainted with the whole Art of Agriculture. Now, the fact must be plain to every one, that no man, in his short life, by his own experience and observation, can become master of this Art, because it takes a whole year to try one experiment. From this fact, his progress in knowledge must be very slow indeed.

Well, then, besides the actual trials on the farm, to improve his mind, the next best thing to do, is to study carefully the recorded experience of other farmers and the writings of the able investigators of the chemistry of plant life. To do this with profit, he should be acquainted, to a certain degree, with every science which has shed any light upon the subject.

Now, the working farmer is generally too much engaged to acquire this knowledge. Well then, if he will please to lay aside all prejudice against me, we will read for him, and report a few of the grand truths, which we find scattered through the vast tome of other times, and the periodicals of our own rushing—busy century.

Whether I shall ever receive any thanks for this, is a very small matter.

The consciousness of having done good to others, will amply repay me for all my trouble.

I sincerely believe, that he who tills the soil, is helping God to feed the world, for without tillage, the earth could not support one-tenth of its present population. Therefore, what I can do, in this good and noble cause, it is my duty to do. And I may as well confess, that to me, it is no tiresome labor, because I love the Art, and ever have loved it, from my boyhood to the present hour.

C. H.

708 Market Street, Wilmington, Del.

November 28th, 1876.

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FARMING WITH GREEN MANURES.

CHAPTER I

NITROGEN, PHOSPHORIC ACID, AND POTASH.

Study the profound works of Professor Johnson, "How Crops Grow," and "How Crops Feed."

Read with close attention the broad and practical wisdom of Joseph Harris, in his "Walks and Talks on the Farm."

Devote long hours of patient thought, to the thirty years of untiring experiments of Lawes and Gilbert, and you will be perfectly convinced, that *Nitrogen* is the most precious, the most important, and the most costly element which the farmer needs to produce a heavy—paying crop.

And next to this in value is Phosphoric Acid, and then Potash.

Other minerals and elements are required, but they generally exist in the soil, in sufficient quantity, or can be added to it, at much less expense.

Then comes the great question, from all civilized countries: How shall we obtain *Nitrogen?* Must we buy it in Nitrate of Soda in Sulphate of Ammonia, or in Guano, at 30 cents a pound? Certainly not, unless we cannot obtain it in any cheaper form.

Four-fifths of the atmosphere is Nitrogen. Does not nature convert a portion of this every day into

Nitric Acid and Ammonia? If not, whence comes that lavish profusion of these compounds discovered by the chemists?

"The Rhine," says Professor Johnson, "daily removes from the country supplying its waters an amount of Nitric Acid equivalent to 220 tons of Saltpeter. The Seine carries daily into the Atlantic 270 tons, and the Nile pours 1,100 tons into the Mediterranean every twenty-four hours."—*How Crops Feed, p.* 270.

Here is a waste of this element, which is incomprehensible, if we have no means to save it. Only *three* rivers carry away as much Nitrogen every year, as there is in 174 million bushels of wheat or Indian corn!

Our farms are in the same condition as the lands drained by those streams.

The annual rains percolate the soil, dissolve the Nitrates, and bear them off to enrich the waters of distant oceans. But all is right. There is a way to save these golden treasures, if we have the wisdom and the will to do it.

Phosphoric Acid, when needed on the farm, can always be obtained from bone, either ground fine, or as super-phosphate of lime.

Potash, according to the researches of Mr. Lawes, "is generally found in sufficient quantities in the soils and the artificial supply is not required."

But notwithstanding this fact, we should use all the wood-ashes we can procure at a reasonable price, particularly on sandy lands, for potash is often greatly needed on that kind of soil.

In 1875, I compiled a table showing the amount

of Nitrogen in a ton of different crops, as compared with some of our standard fertilizers. It was very kindly published, by Mr. Harris, in his "Walks and Talks," No. 141, in the *American Agriculturist.* It is as follows:

	NITROGEN IN ONE TON.
Hungarian Millet, in blossom, . .	20 pounds.
Green Clover, ...	12 "
Green Rye, ...	11 "
Barnyard Manure, ...	10 "
White Mustard, ...	9 "
Green Buckwheat, ...	8 "
Green Corn, ...	6 "
Turnips, ...	4 "
Ground Raw Bones, ...	100 "
Peruvian Guano, ...	280 "
Nitrate of Soda, ...	300 "

I have made *one* alteration in this table. I have ascertained, from a recent analysis, that green corn contains 6 pounds of Nitrogen, instead of 4 pounds, in a ton.

Now, let us examine into the real value of this wonderful element, and also, of the other two, whose merits are not far behind it.

"Professor Johnson, after a very careful consideration of the whole subject, estimates the value of the ingredients of manures as follows:

Potash, ...	7 cents per pound.
Nitrogen, ...	30 " " "
Soluble Phosphoric Acid, . .	16½ " " "
Insoluble " " . .	6 " " "

"Taking Prof. Johnson's figures, the Potash, Phos-

phoric Acid, and Nitrogen in a ton of clover hay would make it worth $17,57 for manure. Bran would be worth $22.10; Peas, $22.84; Malt Dust, $51 30; Linseed Oil Cake, $33.76; and Decorticated Cotton Seed Cake, $47.56 per ton for manure."— *Walks and Talks, No.* 101.

Now if I understand the revelations of chemistry, Nitrogen exists in all of these substances, only in the form of albuminoids. And nothing but the complete decomposition of these protein bodies, and the conversion of their Nitrogen into Nitric Acid or Ammonia, will render them available as plant food. Taking this view of the case, Professor Johnson, most certainly never intended to convey the idea. that Nitrogen in clover hay, &c, is worth 30 cents per pound

If it is worth that much in dry hay, it is worth 25 cents per pound in green corn. Yet Joseph Harris ridiculed this idea, in 1875, with unaccountable severity, considering that he taught the same doctrine in 1872.

The Hon. George Geddes says: "When we read in *Walks and Talks on the Farm*, that the manurial value of a ton of clover hay is $15.82, we are silent out of respect to the high source from which we received the information."

That is decidedly wrong! No man should be silent, if truth must suffer in consequence of that silence.

Is it disrespectful to point out the dark spots in the sun; or must we only notice the dazzling splendor of his golden beams, and forever praise his all-pervading power?

But enough of this. The opinion of another great man, I must criticise, in the interest of truth and science.

When Liebig published his immortal work, "Chemistry applied to Agriculture and Physiology," he taught the true value of Nitrogen in manure. But soon after this, by reasoning upon a subject, which can only be properly examined, by observation and experiment, he jumped to a false conclusion. That "ashes represent the whole nourishment which vegetables receive from the soil."

Hence in using manures he says: "Would not their effect be precisely the same in promoting the fertility of cultivated plants, if we had evaporated the urine, and dried and burned the solid excrement?"

This was his sincere belief. And year after year, in every subsequent work, he would not bend a line from his tangent, but struggled hard, by most ingenious argument, to carry the whole Agriculture of the world with him.

Lawes and Gilbert subjected his theory to a most rigid investigation. The *ashes* of 14 tons of barnyard manure were applied for 30 years in succession, on the same acre, and produced each year, only two bushels of wheat more than the continuously unmanured acre. The artificial mineral manures were also used in the same way, on another plot, and with the same result.

Besides all this, able chemists have demonstrated, by growing plants in distilled water, that to produce a good crop there must be nitrogen in the soil or in the water.

They have dissolved the ashes of plants in pure water, and then, by adding a few grains of nitrogen in the form of a nitrate, have produced a luxuriant

vegetation; but without the nitrogen, only a *very feeble* growth could be obtained *

The fact is, Liebig saw a great light illuminating the heavens of his beloved science, and not having the patient research of less gifted minds, he uttered premature thoughts, grand in their conception, but too deeply colored by his excited imagination. He discovered, what seemed to him, a vast store house of ammonia in the air, and supposing that all plants could absorb, through their leaves, from that source alone, all the nitrogen they needed, he made a positive declaration that there is no necessity of collecting the elements of the atmosphere in the soil.

Now, we regard this question as settled, that the nitrogen of the air, though all-sufficient, must in some way be oxidized and become a constituent of the earth, before plants can receive and assimilate it, and make it a part of their structure.

CHAPTER II.

COVERING THE SOIL.

When green crops are raised to improve the land, it is not indispensable that they should be plowed in to accomplish this object. You need not turn them in, till you are under the necessity of doing it, to prepare the ground for a future crop. But if the greendressing should be Hungarian millet, or white mustard or any thing that might seed the ground at an improper time, you can either plow it in, or cut it

*See a beautiful plate in illustration of this subject, in American Agriculturist, March, 1876.

down when in blossom, and it will improve the soil in proportion to its ability to shelter it.

Cuthbert W. Johnson says:

"An English farmer inadvertently left for some months a door in his fallow field; for several years after, the crops were particularly luxuriant where the door had been lying, so much so that one would have said that some rich manure had been applied to that spot"

Anderson, an eminent Scotch writer, says, in his *Economy of Manures:*

"Every practical farmer knows, or ought to know, for the facts are constantly before his observation, that land can be made exceedingly fertile without manure. He must have noticed that if any portion of the soil has been covered, either accidentally or designedly for sometime, by water, stone. plank, logs, chips, brush, rails, corn stalks, straw, buildings of every description, with hay or straw ricks, leaves or clover, and in fact, that under any and every substance which has covered its surface closely, it (the surface soil) invariably becomes exceedingly fertile, and that the degree of this fertility is totally independent of the covering substance."

After reading these remarkable statements of Johnson and Anderson, both men of extensive observation and intelligence; we can more fully credit the experiments of Gurney in England, upon his fields of grass.

Green grass covered with straw gave him in one month 5,870 pounds per acre. The same kind of grass uncovered produced but 2,207 pounds No rain fell during this experiment. Another plot gave

in one month, when covered, 3,460 pounds per acre. While the rival lot not covered, yielded but 970 pounds. Clover that was covered grew six inches, while that uncovered grew but one inch and a half.

And where a certain quantity of stall dung would double the crop of grass, the mulch spread on top of the manure would increase the crop six times. He used about one ton and a half of straw per acre.

"Boussingault found, upon comparing water obtained by melting two portions of snow, one taken immediately as it fell upon a stone terrace, and the other (from the same fall) after it had lain for 36 hours upon the soil of a contiguous garden, that the second contained ten times as much ammonia as the other. It is well known that snow has a most beneficial effect upon soils, and amongst other causes, Boussingault believes that it may act in preventing ammoniacal emanations from the soil."—*Journal of of the Royal Agricultural Society of England.*

Now we can believe there is much truth in the old proverb, that, "Snow is the poor man's manure."

Not having straw, nor any barn-yard material, to top-dress his wheat, he has often noticed that his crop was much better when kind nature covered it for him.

Does not this investigation of the great chemist reveal to us *one*, if not more, of the deep and far-reaching causes why mulching is so beneficial to the land.

Professor Johnson says:

"The ammonia of the soil is constantly in motion or suffering change, and does not accumulate to any great extent. In summer the soil daily absorbs

ammonia from the air, receives it by rains and dews, or acquires it by the decay of vegetable and animal matter. Daily, too, ammonia wastes from the soil by volatilization, accompanying the vapor of water which almost unceasingly escapes into the atmosphere."—*How Crops Feed, p.* 247.

This is a revelation of scientific truth, which cannot be misunderstood or explained away. Was ever a stern necessity to do anything more clearly demonstrated to the world? We must keep the soil covered, to promote and retain its richness. But how often do we strip the ground naked, and then bake it in the ever-burning sun!

Col. Waring of Ogden Farm, says: "I had read so much about top-dressing that it was determined to try it on this apparently forlorn hope, and the land was well covered before the heavy rains that fell early in May. The result was almost magical, while that portion which had looked so promising as to seem not to need manure, did not yield 1,000 pounds per acre of poor hay, ox eye daisy and red sorrel, this poorer part, solely as an effect of the top-dressing, produced fully 4,000 pounds per acre of very fair hay."

CHAPTER III.

SURFACE MANURING.

Not many years ago it was the universal custom to plow in manure the very day or hour that it was spread upon the field. Farmers became irritable and had but little to say if anything prevented imme-

diate plowing after the precious contents of the barn yard were spread broad cast before their eyes. It was a prevalent opinion that nearly all the richness would dry out, in a few days, if exposed to the weather.

They had often noticed, that manure under cover, was about twice as good as that which lay out of doors all summer, but they did not discover that the great injury which it had received was owing to the leaching rains, which dissolved and carried off its richest elements, and not to the sunlight which occasionally fell upon it.

When manure is spread it soon becomes dry, and then all chemical changes cease, fermentation is arrested, it will decay no more in that condition. And when the dews settle and the rains descend upon it, it will dissolve, day after day, and a peculiar dark rich coffee, will saturate the soil beneath it, so effectually, that Alderman Mechi, could hardly do it better, with his steam-engine, and his pipes and hose in every field.

John Johnston writes to the "Country Gentleman:" "If I only had Col. Pratt here for five or six months I could convince him that surface manuring is the true way, and will, before ten years from this, be the way generally that manure will be used."

And in the "Genesee Farmer," he says to Joseph Harris: "I am not surprised at your correspondent, Buckeye, being opposed to surface manuring. I would have been so myself had not experience taught me better. I have used manure, only as a top dressing, for the last twenty six years, and I do

think one load used that way is worth far more than two plowed under on our stiff land "

Nearly ten years after this was written, he speaks, if possible, with even a stronger faith than ever in defence of his favorite practice.

Harris writes in Walks and Talks, No. 112, that "John Johnston who has a far heavier clay soil than the Deacon, says he has found by actual trial that one load of rotted manure applied as a top-dressing to grass land in the autumn, and the land plowed up and planted to corn in the Spring, is worth as much as three loads of fresh manure plowed under."

Major Dickinson, another able and extensive farmer, declares: "I hold that one load of manure on the surface is worth two loads plowed in."

Charles B. Calvert, a distinguished farmer of Maryland: "Is a strong advocate of the application of stable manures *upon the surface.* instead of plowing them in."—*Cultivator.*

Mr. Bright writes in the *Gardeners' Monthly:* "The practice of top-dressing, or of surface manuring, has long been the favorite method employed by all intelligent gardeners within the circle of my acquaintance. A piece of soil heavily shaded by surface manuring, actually decomposes like a manure heap—that is, it undergoes a sort of putrefaction or chemical change which sets free its chemical constituents, unlocks, as it were, its locked up manurial treasures, and fits its natural elements to become the food of plants. Manure then, I say, chiefly upon the surface. Do not waste your manures by mixing them deeply with the soil. Surface manuring and mulching are the true doctrines. I am sure of it."

In Todd's Young Farmer's Manual, I find the following statement: "James M. Garnet, a Virginia farmer, an excellent writer on agriculture, says: "I began penning my cattle late in the Spring, and continued it until frost, in pens of the same size, moved at regular intervals of time, and containing the same number of cattle during the whole period. These pens were alternately plowed and left unplowed until the following Spring, when all were planted in corn, immediately followed by wheat. The superiority of both crops on all the pens which had remained unplowed for so many months after the cattle had manured them, was just as distinctly marked as if the dividing fences had continued standing, it was too plain even to admit of the slightest doubt.

A near neighbor, a young farmer, had made the same experiment on somewhat different soil the year before, but with results precisely the same. Similar trials I have made and seen made by others with dry straw alternately plowed in as soon as spread, and left on the surface until the next Spring. In every case the last method proved best, as far as the following crop would prove it.

The same experiment has been made by myself and others of my acquaintance, with manure from the horse stables and winter farm pens, consisting of much unrotted corn offal, and without a solitary exception, either seen by me or heard of, the surface application, after the corn was planted, produced most manifestly the best crop.

Upon these numerous concurrent and undeniable facts my opinion has been founded, that *it is best to apply manure on the surface of the land.*"

An able writer, in the *Cultivator*, in 1843, says: "I have seen spots where cattle had been penned at night for a month or two; for *six years* afterwards, the vegetation was double on that spot to any part of the field, although all the manure had been carefully removed and scattered about; now nothing but the liquid could have gone into the earth, and yet the rains of six years never washed away the beneficial effects."

Now, if the valuable material of the barnyard, will not suffer waste when spread upon the open fields, and is better there than anywhere else, then the green crop, whatever it may be, that is raised to improve the land, should be mown down, in Summer, and in Autumn, and should be left upon the surface, as long as possible—to prevent evaporation—to disintegrate the soil, to retain moisture, to be leached by rains and dews, and finally to enrich the ground by its total decomposition.

CHAPTER IV.

WATER AS A SOLVENT.

The mineral constituents of the bones of man and animals are but the *ashes* of our daily food.

Every year, from the rocks and soil these ashes come, decomposed and dissolved by water, carbonic acid and oxygen.

Green manures, by their ability to collect and preserve moisture, on the surface, and in the soil, when cut down or plowed in, render an immense assistance in the growth of the organic world. Water is the

blood of vegetation. It carries nourishment from the ground to the stem, to the leaf, to the seed. In its solvent action rocks become the food of man!

When the soil is *dry*, no mouldering down to a finer dust, no disintegration of minerals, no decay of any kind can be discovered, every atom, apparently stationary, seems fixed and firm as adamant.

Travelers tell us, that in the dry air of Egypt, the old monuments erected thousands of years ago, are just as fresh and smooth in outline as if the chisel had finished them but yesterday. But when some of these relics of the past were transported to Paris, in the moist climate of France, they soon began to change, and atom by atom to crumble away.

Dr. Youmans says: "It has been shown by extensive experiments that no species of rock whatever will resist the solvent action of water impregnated with carbonic acid."—*Atlas of Chemistry, p.* 50.

What an instructive lesson! How valuable to the farmer! Such knowledge, how exceedingly useful. That in our daily effort to convert the earth upon which we tread into a flourishing vegetation we *can* combine and concentrate the forces of nature by covering the ground, that *moisture* and *carbonic acid* may do a great work for man.

Yes, so vastly important is the benefit that may be derived from mulching with green manures that we not only see it in the augmentation of our crops, and the improvement of our tillable soil, but it may be observed in the condition of the forests around us. Those that have a deposit of leaves undisturbed for years, about their roots, make an annual growth much greater than those which have been robbed of

their carpet of dead foliage, by the winds or by the hand of man.

"The fallen leaves," says Liebig, "contain such trifling quantities of potash and phosphoric acid, in comparison to their mass, that it is difficult to account for the injurious consequences arising from the raking up and removal of the fallen leaves in woods."

It *is* difficult only when we forget the conditions existing in the woods. There the protection of the soil, the perpetual moisture, and the carbonic acid constantly forming, work without ceasing beneath the mulch, crumbling and moldering the minerals into an impalpable and soluble state, ready to be absorbed by plants or trees.

Liebig admits that "the injury is, perhaps, rather attributable to the fact that the remains of leaves and plants constitute a lasting source of carbonic acid, which carried by the rain to the deeper layers, must powerfully contribute to disintegrate and decompose the earthy particles."

These substantial truths should establish the advantage, if not the necessity, of shelter and *moisture* to improve the soil, and also to promote the growth of our crops.

Yet there is no scarcity of water in our favored country.

We have a rainfall of 4,000 tons per acre every year. But what becomes of it?

Professor Johnson says: "According to the observations of Dickinson at Abbot's Hill, Hertfordshire, England, and continued through eight years, 90 per cent of the water falling between April 1st and October 1st evaporates from the surface of the soil,

only 10 per cent. finding its way into drains laid three and four feet deep."—*How Crops Feed, p.* 197.

This, we presume, is about the amount of evaporation in the United States. Then, what a magnificent prospect is here presented!

Mighty rivers are pouring, not down the deep valleys, but upwards from our broad fields to the blue sky above us!

Yes, every square mile of territory sends a constant flood, rushing, though invisible, to the vast seas in the viewless air!

Could all the streams from a single State be concentrated into one torrent it would out roar Niagara as it dashed against the clouds!

But what becomes of the poor little 10 per cent. of water that goes sparkling down the ravines to its ocean home? Is it allowed to depart in peace? No. The farmer, at great expense, cuts channels along the hill side to irrigate the sloping plains, and proves that it will pay to do it. And then many calculations are made, and the time predicted when engines will be used to pump back the water again to revive the parched and dusty soil.

All this is done while the 90 per cent. of fluid is passing away without an effort made to save it. We do not need it all. No, not the half of it. We know by covering the land we can retain enough for all the wants of vegetation.

To have a vigorous and uninterrupted growth, we must have moisture in the soil, and we must retain it there from rain to rain, or we will have a partial failure in our crops.

Professor Johnson says: "The great deserts of the world are not sterile because they cannot yield the soil-food required by vegetation, but because they are destitute of water."

He also says: "Poor soils give good crops in seasons of plentiful and well distributed rain or when skillfully irrigated, but insufficient moisture in the soil is an evil that no supplies of plant food can neutralize."

The cause of this will be plain, on a moment's reflection. Plants can only take up their food in a fluid condition.

Mr. Lawes proved that an acre of wheat in five months and eighteen days evaporated through its leaves 355¼ tons of water. Now every drop of this water was more or less instrumental in transporting a little atom of food from the soil to some part of the plant, and when the deposit was made, being no longer needed, the water passed off through the leaves.

Liebig also teaches this doctrine. He says: "Though the soil be ever so rich in the elements of food for plants, still the latter will not grow in hot weather if there be a deficiency of moisture in the soil, for the moisture in the soil is the channel through which mineral food has to reach the interior of plants."

The reader who has not been a careful observer of the changes in nature, and the amount of rainfall, year after year, will be very likely to suppose, that drouth is a plague that very seldom visits our much favored land, and hence he may consider it useless to

spend much time in devising means to remedy the evil. But what are the facts.

The *Cultivator* says: "Seasons of drouth of more or less severity are of frequent occurrence in our climate. Weeks and even months pass with little or no rain; the scorching glare of the sun drinks up our summer brooks and turns the fields to dust or brick-like clods beneath its influence. The growing crops are shrivelled and dwarfed by the heat."

This strong picture received an alarming confirmation of its truth only a few years ago in the new State of Kansas. No rain fell during all the Spring, nor in the first month of Summer, and there was a total failure in the crops of wheat. Dr. Armor, an able farmer in that State, who called on me the same year, said he made no attempt to gather the few grains of wheat which grew on little stems only three inches high, but gave an order, when he left home in July, to plow up the fields for re-seeding in Autumn.

Indeed, water is so indispensable in the process of vegetable nutrition, that only a fortnight of dry weather apparently checks the vigor and freshness of the green world around us.

CHAPTER V.

TILLAGE A MANURE.

In estimating the expense of raising green crops for manure we must not deduct the cost of plowing and harrowing from the value of the green dressing, because tillage is manure, and often the very best manure, which we can apply to many fields, particularly to heavy clays.

Liebig says: "The influence of the mechanical operations of agriculture upon the fertility of a soil, however, imperfectly the earthy particles may be mixed by the process, is remarkable and often borders upon the marvellous."

The truth of this declaration has often been established by the experience of many observing farmers. Here is one case.

"I knew a farmer," says Mechi, "who took a good farm wretchedly out of condition and full of weeds. He fallowed every acre of it, taking care to allow time between each plowing for the vegetation of the seeds. The result was a crop of wheat, averaging 5½ quarters (44 bushels) per acre, and other crops in proportion. He was a wise man."

Now in connection with this good tillage had he put on the field somebody's "nitrogenized superphosphate of lime," it is very likely all the credit would have been given to it, and we might have had his certificate that 44 bushels of wheat per acre were actually obtained by using only 300 pounds on each acre of this wonderful fertilizer.

With such facts before him we are not surprised that Mechi says: "Frequent tillage is our best and cheapest manure."

The farm of Joseph Harris has enough of clay in the soil to require frequent plowing and harrowing to bring out and unlock its highest productive capacity, hence he has discovered the great benefit of thorough pulverization. He says: "That tillage and manure are one and the same thing, is a great truth."

Taking this natural and rational view of the subject it would be very unjust to any green crop which is intended for manure to charge it with anything but the seed. And this will reduce the expense of this mode of improvement to a very low figure.

Harris also says: "On heavy land we have not yet been able to dispense with summer fallowing.

JOHN JOHNSTON, rich as he has made his land, is yet in the habit of Summer fallowing more or less every year.

His practice has been to top-dress his clover land in the Fall, and the next Spring to plow it up, and prepare the land for wheat by plowing it twice more, with repeated harrowings, rolling, &c. In other words, he manures the land in the Fall and then gives it a good old fashioned Summer fallow."

Here, you perceive, are *three plowings*, and enough of harrowing to seed the ground with two green crops, and to turn them in when grown, without any extra expense. And this tillage is never done all at once. It is said that there should always be six or eight weeks between each plowing. This method would be very accommodating to nearly all kinds of green manures.

Observe how careful Johnston is, to neglect nothing that will insure him a large crop of wheat. No wonder he often raises 50 bushels per acre! We see here that the whole of one year is devoted to the preparation of the soil.

He does not confine himself entirely to this mode. Under another heading we will show that he plows in clover in June for wheat. And notwithstanding

he makes from 500 to a 1000 tons of the very best manure every year, he does not compel his fields, to produce a crop, of either grass or grain, to be removed every year. And that is the true philosophy of farming—every other year devoted to the entire restoration of the soil. On light, sandy land much tillage is not required, only to subdue the weeds. And for this purpose, to assist the plow and hoe, there is nothing to be compared to green crops?

The way these act in the destruction of weeds is not as freely acknowledged as it should be, because not clearly understood.

When a quick growing crop is put in the ground all weed seeds that are on or near the surface sprout and make a feeble growth, but do not mature enough to form a blossom or a seed. In this way tens of millions of noxious weeds will germinate and perish beneath the dense shadow of a green crop.

CHAPTER VI.

GREEN MANURES.

Alderman Mechi says: "I have noticed a very money getting farmer in my neighborhood, who never keeps any live stock, except a couple of cows, and who never buys any feeding stuffs or manures.

"*He keeps his land clean and fertile by plowing in green crops*, which require no hoeing or labor, and only one plowing. I know he makes money for he often purchases land. It is the opinion of some knowing hands, that this farmer manages to get

better profits than his neighbors who adopt the ordinary system."

This testimony comes from one who has no superior as an honorable and upright man and able farmer. Therefore his words are worthy of a most careful study. Look at the full weight and meaning of these expressions:

"*A very money-getting farmer! I know he makes money, for he often purchases land.*"

There is not a farmer in the wide world who would not be glad and happy if his good neighbor could say that about him.

Whence comes this undoubted prosperity? Does he keep thousands of sheep or hundreds of milch cows of the purest grades? No! Does he sell Essex pigs or choice calves for almost their weight in silver? No, nothing of the kind.

The whole cause of his *certain success* is told in two words—*Green Manures.*

Well, if one man has accomplished so much in this mode of farming, have we no details of actual experiments on record to confirm such statements? Yes we have. Here is one of great value, because the facts are clearly given and are undeniable.

"In October, 1819," said the late Dr. Browne, of Gorlstone, in Suffolk, "a violent gale of wind drove to this part of the coast an unprecedented quantity of sea weeds. These were eagerly scrambled for, and from my greater vicinity to the beach I collected twenty-seven cart loads,—each as much as four horses could draw,—I spread mine fresh and wet upon little

more than an acre of bean stubble, instantly ploughed it in and dibbled wheat upon it.

"On the 6th of October I then salted the adjoining land with three bushels per acre, manured it with fifteen loads of farm yard dung per acre, and dibbled it with wheat on the 15th of November. The result was that the sea-weeded portion gave three times the produce of any equal part of the field."—*Farmer's Encyclopedia, p.* 582.

How did it happen that this *green* manure produced *three* times as much wheat as the dung from the barnyard. Certainly the nitrogen in this weed was available. It could not be otherwise. And it is very probable it was much more so than that in the yard manure.

Now comes the interesting question—In what condition does nitrogen exist in sea-weed? In the form albuminoids, there is not a shadow of doubt. Just as we find it in clover, in Hungarian grass and in all vegetation. And we have the authority of Boussingault that there is less nitrogen in sea-weed than in clover. And we know there is less phosphoric acid and less potash in the former than in the latter plant.

Then would not the same amount of clover, or Hungarian grass, with salt have brought the same result?

And what a vast difference in the cost of these plants. All the Doctor could get would only cover a little more than an acre. To obtain any more of it, he would have to buy it. What it would cost in England we do not know. In this country it is about the price of good manure.

Col. Waring says that sea weed costs $3 to $4 per cord ,on the beach. While this price continues, of course, it can only be used to advantage, by those living near the coast. We advise every one who can raise a good crop of clover, with bone dust and plaster, to depend on it, unless they can get the weed at a much less figure than $3 per cord.

We feel deeply interested in this experiment of Dr. Browne. We hope it will satisfy all manure makers that green plants can be converted into plant-food, without undergoing the process of digestion in the stomachs of cattle.

And more than this, it should be noticed, that solution and oxidation can take place in full time to furnish all the nourishment required to produce a good crop of wheat.

And that the conversion of vegetable matter, into manure in the barnyard, is not necessary, may be proved by another careful experiment.

"The following I know to be a fact. A person brought up as a farmer in Scotland, was sent to an estate in one of the Windward Islands, to improve the system of tillage.

Not being able to manure a field of six acres that had been much exhausted by frequent cropping, he resolved to give the pigeon pea a fair trial; he accordingly sowed them so thick that in a few months the ground was effectually covered to the heighth of six feet; he then cut down this mass of vegetation, and immediately buried the whole under the large banks that are raised in digging cane holes. His first crop gave him but six hogsheads of sugar; instead of

allowing the canes to shoot up again. as they will, he planted the pigeon pea, and proceeded as before; this second crop yielded twelve hogsheads of sugar, as the benefit of the first decayed bushes was then felt. He tried the peas a third time, and his crop was eighteen hogsheads. Finding the improvement was so wonderful, he resolved on a fourth trial, and the six acres yielded twenty-four hogsheads, which is considered a *first rate crop*, equal to 100 bushels of corn in this country."—(*Cultivator*, 1842.)

We believe that corn will take a high position among green manures when the best way to use it is properly understood. A farmer in Kentucky, sowed corn on a field of 37 acres and the result was so favorable that he says: "Were my only object the rapid improvement of my soil within the shortest space of time, I would not seek further or better means than first sowing down thick with rye, which I would plow under just before the time of ripening, to prevent its seeding the ground, and upon which I would sow one bushel and a half of corn per acre; thus in the same season plowing under a heavy coat of rye and corn, which in the short space of twelve months, will equal if not surpass any benefit which can be derived from clover in two years."—(*Cultivator*, 1843)

One more vote, in favor of corn, I wish to record, from a good writer and practical farmer.

S. E. Todd, says in his Farmer's Manuel: "Some farmers contend that clover plowed under is the cheapest manure that can be made. It is a great fertilizer; but I believe that a soil can be renovated sooner, and at a less expense, with Indian corn than

with clover; because a much larger quantity is turned under yearly of corn than of clover. By being expeditious in business when a crop of wheat, oats or barley is taken off in July, as they are many times, if the soil is plowed immediately and Indian corn sowed it will grow large enough in ordinary seasons, before the autumnal frosts to plow under. But when clover is raised, no other crop can be grown the same season."

These are very high recommendations in favor of green corn. And are they not true? Whatever is undoubtedly beneficial, as food for animals, most certainly will be good manure. Why is clover so much better than wheat straw, for animal food? Because it contains more than four times as much nitrogen as the straw. And that is the very reason why it is so much better for manure.

Without nitrogenous food we can have no flesh upon our bones. Without nitrogen in the soil, we can raise but little food that will make flesh. In other words, nitrogen is an absolute monarch who can never be dethroned, while life exists upon the globe.

CHAPTER VII.

GREEN CORN AS A PROTECTION AND MULCH FOR WHEAT.

One ton of green corn contains 6 pounds of nitrogen, 2½ pounds of phosphoric acid, 9 pounds of potash and 1600 pounds of water I find by years of experience that it is better to plow in two crops of corn in one year, than one great heavy crop, which has grown all the spring and summer.

I have several times turned in from 30 to 45 tons per acre. The great objection to this mode was pointed out to me by the plowman. The surface roots formed such a dense, compact and tough mass, along each furrow, that the plow could not cut them, and it became necessary to run under them; hence the plowing was much deeper than desired.

Two crops in a year, each containing, in tops and roots, about 20 tons per acre, will manure the land well.

Let us compare these with the contents of the barn-yard. At this rate on 20 acres we may have 800 tons of green manure. To equal this dressing, in nitrogen, phosphoric acid and potash, will require about 500 tons of stable manure. And that will cost to buy it, at least five or six hundred dollars even if you could find that much for sale, anywhere within a reasonable distance of the farm.

Having plowed in the first crop of corn about the middle of July, what shall we do next? I will tell you my plan, and if it does not meet your full approval, do not follow it. Or, if doubtful of its value, try it on a small plot, and you will lose but little if it fails.

About the first of August, having the land in good condition, put in the corn in furrows 4 feet apart, and 40 to 50 grains to the foot. Keep the ground mellow and free from weeds, with the cultivator, while the corn is growing. This you ought to do, if there was no crop to work in preparing the land for wheat. Now when the time comes to sow wheat, you will find the sown corn from one to four feet

high, according to the quality of the soil, and the warmth and wetness of the season. Then sow the seed between the rows, and fluke it in, and if the corn is over *three* feet high, roll it down across the furrows. If the corn is below three feet in highth, let it stand.

Now mark the result in both cases.

No blasting winds in winter, nor in the early spring can injure the wheat. The drifting snows will be retained and help to shelter it. The soil, powdered by freezing and drying, into fine dust will not be blown away. No drouths will check its growth. The ground will always be found moist and mellow beneath the mulch. Even the rows of corn, which may only be a foot high, will attract the surface roots of the wheat to banquet in the moist and moldering dust beneath their dense shade. And when it decays in the warm days of spring, the rains will leach out its soluble elements and saturate the soil with them, and do more good to the ripening wheat, than the same amount of green fodder fed to cattle and the residue returned to the field.

To establish these high claims for Indian corn, and the great necessity of shelter for winter wheat, I will quote a few words, from John Johnston, the great Apostle of Agriculture, whom we have already presented, as the powerful advocate of surface manuring.

He says: "Wherever the wheat was exposed to the west and northwest it is greatly damaged, and I fear considerable of it is ruined. I have 18 acres of Soules wheat, about five of which is sheltered by growing timber from the west and northwest—that

five acres looks as promising as any wheat I ever saw; the other part of the field is weak, and I think cannot make a full crop, although much better than much I see around me. The Maryland wheat of which I wrote you, was sown immediately east of the orchard. So far as the shelter of the orchard extended, it looks pretty well; beyond that it is quite feeble. Had my orchard been on as high land as the wheatfield, I have no doubt it would have sheltered all the wheatfield.

I have thought it would pay to plant quick growing timber to shelter fields that are exposed to west or northwest. We have no hard blows from due north, or anywhere easterly, to injure crops, but often from the west. It is only three years ago that half of the wheat in the State that was exposed to the northwest and west was killed by a hard frost and hard blow on the 8th of March. I feel quite sure that it would pay to have plantations for shelter wherever winter wheat is the staple crop. A top dressing of manure, or even straw, would have a tendency to protect it in such seasons as this has been. *This I know.* One inch of straw put on after sowing the wheat, would have saved it, I have no doubt; and fine manure would still be better. Where the wheat is sheltered by our rail fences it is safe as far as that shelter extends, though one would not suppose there was much shelter from a rail fence, but it has been enough to protect the wheat on that severe day, the 17th of February."—(*Country Gentleman, vol.* 23*rd.*)

Probably no man was ever more successful in raising wheat, or ever gave the subject a more patient

investigation than John Johnston; hence these words will be received as instructive truths, by all who know his exalted worth.

The wheat plant has many enemies. The midge, the mildew and the Hessian fly too often nearly ruin it; but according to the authority of Lewis Bollman, of Indiana: "*Freezing out*, is perhaps more destructive to the wheat crop than all other misfortunes to which it is incident."—(*Agricultural Report*, 1862.)

S. E. Todd, says: "In every wheat field may be seen in Spring, plants growing in little hollows, sheltered by lumps or banks from the cold wind, but enjoying the benefit of the sun's rays. The difference between the growth of these plants and others which have not the benefit of shelter, is remarkable.—(*Wheat Culturist, p.* 212.)

Again he says, on page 226: "The more we can protect the wheat plants from piercing winds and intense cold, the better crops of grain we may expect to raise."

In corroboration of these statements, we have seen reports of stumps in the Western States, saving little patches of wheat all over the field.

Sidney Weller of North Carolina, was in the habit of scraping up the pine leaves in the forest and covering his wheat in the fall with much care and trouble. He says: "By four years trial, I have now found it always benefits the wheat; sometimes increasing the product one-half at least, and even guards the clover against the misfortune of burning out in hot, dry summers."—*Cultivator*, 1843.)

What a contrast between the labor of spreading

straw, or pine leaves upon a large field, and the ease and rapidity by which you can roll down a luxuriant growth of green corn where it grew!

This method of raising wheat, will not prevent you from using stable manure as a top dressing.

Any time before sowing the wheat, or afterwards if you wish to do it, you can drive between the rows of corn, and spread the manure from the wagons. You remember that Gurney says, that manure does six times more good under a mulch than when not covered with anything.

CHAPTER VIII.

HUNGARIAN MILLET.

One ton of Hungarian Millet in blossom, contains 20 pounds of nitrogen, 2½ pounds of phosphoric acid, 17 pounds of potash and 1560 pounds of water. When the clover seed which was sown among the wheat has failed to grow, you had better seed the field, in the spring with Hungarian grass. That is if you intend to alternate a green and grain crop in succession.

As soon as all danger is over from frosts, sow one bushel per acre of the Hungarian seed, when the ground is in a good mellow condition, and then roll it in. As soon as this crop comes in blossom, sow over it a half bushel more of seed per acre. Then with your mowing machine, cut it down, and leave it on the ground. Having cut it so early, it will sprout up, and with the last sowing, you will have two crops growing together, and being shaded by the first, will be equal to it in weight and value.

The bushel and a half of seed per acre, will cost about three dollars.

These two crops of green manure will make together 25 tons per acre. And this will amount, on a field of 20 acres to 500 tons. Then, this green dressing will cost 12 cents per ton. The ten thousand pounds of nitrogen in it, will cost less than one cent per pound.

Let us compare this with barn yard manure. It will take 1000 tons to furnish as much nitrogen as we have in the 20 acres of Hungarian grass. If you can buy the manure, and haul it home and spread it, for $1,50 per ton, it will cost you $1500.

Peruvian guano contains 280 pounds of nitrogen per ton, and at the old price of $60, it will cost nearly 2160 dollars to obtain as much nitrogen in that way as we get for $60 in the 20 acres of Hungarian grass.

Nitrate of Soda is another highly concentrated manure, because it contains 300 pounds of nitrogen per ton. But I do not know where you can buy the pure article for less than $90 for 2000 pounds; therefore it will cost you $3000 to get as much nitrogen as we obtain for $60, in 20 acres of green millet.

After looking at the subject through these calculations, does it not seem exceedingly strange, that English and even American farmers will purchase nitrate of soda, and sow from 100 to 250 pounds per acre on their wheat.

Why *will* they do it? Because they want *available* nitrogen. They want it in a condition, that it can be taken up by plants the moment it is sown. Green manures must decay—a complete decomposi-

tion is necessary to convert the nitrogen into nitric acid and ammonia.

But let us have patience, there never was a pile of hay, or grain or grass, that would not rot down, and in reasonable time, make manure.

But how shall we hasten this decay to the best advantage ?

By keeping the material upon the surface. Dr. Vœlcker discovered that hay or new mown grass lost more than half of its richest elements, when left on the field, and exposed to leaching rains for a short time.

Unless the soil is very lose and sandy, vegetable matter will not decay when plowed in, as soon as it will upon the surface.

Combustion is a rapid condition of decay. And the whole process of decay is a slow combustion. In both cases a union of oxygen with carbon and hydrogen. Cover your fire with ashes or earth, and it will not burn as brightly as when uncovered. Bury half rotten manure, or straw, or wood, so deep that air will be *entirely* excluded, and no further decay can take place.

Stirring the soil promotes the slow burning (decay) of the vegetable matter in the ground. A pile of clover hay may lay for years, apparently but little changed by decomposition. But a careful examination will disclose the fact, that nearly all its valuable constituents have been carried into the soil. The shell remains, but the oyster has been extracted.

Minute division favors oxidation. A substance dissolved by water, and deposited on the soil, has its

atoms in a state of great refinement, and will soon be converted by a chemical change into *available* plant food. Hence the unquestionable advantages, of cutting down green crops in mid-summer, and leaving them to cover the ground, as long as possible. At the same time, another green one may be encouraged to grow up through the mulch.

CHAPTER IX.

GREEN CLOVER.

One ton of green clover contains 12 pounds of nitrogen, 2½ pounds of phosphoric acid, 9 pounds of potash and 1600 pounds of water.

We may by good management, have 15 tons by the middle of June, to cut down, or plow in for wheat. If left on the surface as a green dressing, a second crop will grow up, and the two together, will amount. in tops and roots, by the middle of August, to 25 tons per acre. That will be 500 tons on a field of 20 acres. This amount of green manure will contain 6000 pounds of nitrogen.

One peck of seed per acre, at ten dollars a bushel, will make the nitrogen cost less than one cent per pound, and the green clover ten cents per ton! That is $50 for 500 tons of green manure!

Now it will take 600 tons of barnyard manure to furnish as much nitrogen as we get in the 20 acres of clover. If you buy stable manure and haul it home and spread it, at a cost of $1,50 per ton, you pay 900 dollars for a pile, that contains no more nitrogen than what we obtain for $50.

To this you may reply, that when we purchase manure, it is all a clear gain; but that the clover only contains what was already in the soil and air. This would be very plausible reasoning—indeed it would have great weight, were it not an established fact, as we have already shown, that land does not retain its nitric acid, but allows the dissolving waters to carry it off almost constantly.

With this knowledge accepted as a great truth, the careful farmer, will always, employ a trustworthy collector of nature's manurial treasures. Among these he will find, by long experience, that red clover stands in the highest rank.

It will always be profitable, to raise clover in every field on the farm, whenever other crops will permit it. And whenever the crop is not heavy, we should assist the land, by a free use of bone dust and plaster or super-phosphate of lime.

Were all the merits of red clover emblazoned in letters of gold on a large canvass, it would fail to convey to the mind, a full estimate of its true value.

The Hon. George Geddes says: "The agriculture of Onondaga Co., is based on the red clover plant. It is used for pasture, for hay and for *manure*. Strike this plant out of existence and a revolution would follow that would make it necessary for us to learn everything anew in regard to cultivating our lands."

Joseph Harris says: "Raise your own clover seed, and sow it with an unsparing hand. You can not raise too much clover. It is the grand renovating crop of America."

Allen says of clover in his *American Farm Book*:

"*It is as a fertilizer*, however, that it is so decidedly superior to other crops. In addition to the advantages before enumerated, the facility and economy of its cultivation, the great amount yielded; and lastly the convenient form it offers for covering with the plow, contribute to place it far above any other species of vegetation for this purpose. All the grains and roots do well after clover; and wheat especially which follows it, is more generally free from disease than when sown with any other manure. The introduction of clover, and lime in connection, has carried up the price of many extensive tracts of land, from $10 to $50 per acre, and has enabled the occupant to raise large crops of wheat, where he could get only small crops of rye; and it has frequently increased his crop of wheat three fold, where it had been previously an object of attention."

In 1843, *The Cultivator* said: "We know an extensive farmer, and a most successful one, who avers that he can manure his farm cheaper with clover, than he could with manure, could he have it for only the carting from his yard and spreading."

Among experienced farmers, a great diversity of opinion exists, regarding the most profitable way of using clover. Some can hardly be induced to plow it in, or anything else which can be used as forage; among these we may number Joseph Harris; yet even he says: "In certain circumstances it may be better to plow under the clover instead of feeding it to stock on the farm. It is a *quicker* way of enriching the soil."—(*Genesee Farmer*, 1863.)

Now is not this a great concession! He is such an eloquent advocate for feeding every straw, that I

almost thought, if he were to see an ox eating his jacket, he would give him his coat also.

Ten years after this was written, he speaks still more favorably upon this subject, in *Walks and Talks*, No. 116, "We shall have to go back to the old-fashioned plan of plowing under clover, says the Deacon, and, as usual, he is more than half right."

What a great satisfaction it would be to see, the strong and powerful pen of Joseph Harris engaged, in full faith, in defence of green manuring

Here is another example, showing how little it costs to enrich land with clover.

D. D. T. Moore, sowed clover seed with barley, and the next spring on the 8th of June, plowed in the clover for corn. He says: "To ascertain the weight of the crop of clover thus turned under, he cut a square foot of the sod, shook off the soil, and found the weight of clover and its roots to be 2¼ pounds. This would give 49 tons per acre."

Hence he obtained 588 pounds of nitrogen for $1,50—the reported cost of the seed per acre!

Now mark, and remember well, this astounding fact, that we have a green manure, which cost but a trifle over three cents per ton, and which is more valuable, ton for ton, than stable manure! And not a cart, nor horse, nor fork of any kind, was required to spread it evenly over the whole field!

When I first read this account in the *Cultivator*, for June, 1854, I was inclined to suppose that there was some error in the report.

That such a mass of clover could grow in less than fourteen months, and part of that time in the winter

and with barley, seemed beyond all common experience. But after this, most fortunately, I came across the following careful estimate, of the amount of vegetable matter which can grow upon an acre, and that reconciled me entirely, as to the correctness of Mr. Moore's statement.

The Hon. George Geddes says: "Professor Kedzie, of the Michigan Agricultural College, at Lansing, took a square foot of June grass turf and washed away all the soil in running water, and then weighed the roots and surface grass to determine the amount of green manurial matter usually contained in a heavy green sward, and found it to be five pounds to the square foot—or at the rate of more than 100 tons to the acre!"

It certainly is unnecessary to dwell any longer on clover as a means of enriching the soil.

But when, and how to use it, will require some attention.

Will it ferment, and become sour, when turned in, in a green state? Some farmers say it will.

For thirty years, John Johnston, plowed it in about the middle of June. How is it, that we hear nothing from him, about souring the soil?

The Hon. George Geddes says, it is ready to plow in as soon as it comes to full maturity. Now without any exaggeration, we may say that there is not another person in the United States, who has had such a long and large experience, in the use of clover, as a green manure, as this distinguished farmer of New York.

He writes to the *Tribune*: "That he has on his farm, in Central New York, a field which from 1799

to 1873, has had no manure except clover grown on it and plowed under, and that wheat, corn, oats, barley, meadow and pasture have been regularly taken from the land, in five years' rotation—the closing crop being winter wheat with timothy and clover sowed. The clover has been regularly treated with gypsum for fifty years. He has particularly noticed it of late years, and says the land is more fertile now than it was twenty-three years ago."

Yet, we hear nothing from him of any injury to the soil, from this life-long use of clover as a green manure. But such has not been the case everywhere.

Dr. Joseph Henderson, of Mifflin Co., Pennsylvania, says: "Experience here is adverse to turning down green crops as fertilizers, and few I believe, have repeated the experiment. In two instances in my immediate neighborhood wherein heavy crops of clover were plowed in, in full bloom, upon land of excellent quality, the immediate effect, at least, was highly pernicious as evinced in an almost total failure of the succeeding crop of wheat."—(*Agricultural Report*, 1864.)

Here is another case from the same Report.—Joshua S. Keller says: "Clover after growing up a few years, ought to be turned under when fully ripe, with a good plow. Let those who advocate the green state do so to their heart's content. I have the experience of both the dead-ripe and the young green, and would by no means suffer the latter if I could prevent it."

And here is another, from an able writer, whose name I have forgotten: "But powerful as are the effects of green crops plowed in, it is the experience

of some practical men, that one crop allowed to perfect itself and then die where it grew, and then turned in dry, is superior to three turned in green."

What can be the cause of this? The crop that is left to ripen and fall where it grew, shades, protects, and mulches the soil. And it may be, that half its substance is leached out, and enriches the surface, with liquid manure.

If this is the case, certainly no better way could be adopted, to use clover to improve the land. Yet I would modify this treatment, by following the advise of Joseph Harris. That is, to cut down the clover when in full bloom, and let the second crop grow up through it, and also cut the second when ready, and let it decay awhile, before plowing for wheat.

This mode would effectually *head off* all weeds that might be among the clover. But with regard to the crop becoming sour, if turned in green is another matter. If you are careful to plow in the green dressing, very shallow, and the soil is mellow and loamy, there will be no danger of ascetic fermentation. If you are afraid of it, sow lime or salt over it before plowing, and that will prevent it, and be a benefit to the wheat.

Clover has but one fault. In its infancy, it is very tender and feeble, and cannot always stand the atmospheric changes. It may be that we are to blame. We may not know when to sow the seed to insure a perfect germination. One farmer will tell you to sow very early, even on the last fall of snow. Another will say wait till May. And some will declare, that they never fail, when they sow in June. Yet failures will take place.

In 1870, Joseph Harris writes: "Nearly all the spring sown timothy and clover in this section is a comparative failure, and farmers are plowing their wheat stubble and going to sow wheat again."

He sowed about 50 acres, and says: "It is apparently an absolute failure."

In 1872, Mr. Straub, of Maryland, wrote to Harris: "That for the last two years the clover crop has proved almost a total failure."

This is a serious matter, because it is always a double loss. You lose a crop of clover, and all the money invested in the seed.

Have we no remedy? There is but one cause for all this trouble. The want of moisture in the surface soil.

Sidney Weller, of North Carolina, found that when he covered his wheat with pine leaves, even on his sandy soil, the clover never failed, no matter whether he sowed the seed in the fall or in the spring.

When the wheat is protected, with green corn, as recommended in Chapter VII, the clover will find a moist bed to grow in all the year.

If you wish to raise clover independent of any other crop, sow it with buckwheat in the spring, and when the buckwheat is in blossom, cut it down, and it will mulch the clover, and insure a good crop.

CHAPTER X.

GREEN RYE.

One ton of green rye contains 11 pounds of nitrogen, 4½ pounds of phosphoric acid, 12½ pounds of potash, and 1400 pounds of water.

When we compare it with barnyard manure, its great value as a green dressing becomes apparent. I have seen 15 tons per acre, growing on the 8th of May, and this was ascertained by careful measurement. Then on a field of 20 acres, you could have 300 tons of manure, at very little expense, all evenly spread on the ground and ready to plow in.

The most careful analysis is worth nothing, if green rye is not equal, ton for ton, to stable manure, with one small exception. The latter has half a pound of phosphoric acid per ton more than the former.

Now what will it cost you to cover a field of 20 acres, with 300 tons of manure? Can you buy it, haul it, and spread it, for less than $450.

The rye will cost you, for the seed $1,00 per bushel, and two bushels per acre, $40.

That is, it will cost more than twelve times as much to improve with barnyard manure at $1,50 per ton, than to use green rye.

The tillage always pays for itself.

And remember this, the rye grows at a time when you cannot use the ground for any other crop but wheat.

Mr. Root of Illinois, regards this fact of the very highest importance, in using this grain as a green manure.

Besides this great merit, it protects the field from washing during the winter.

It absorbs the soluble minerals, and the ammonia and nitric acid, that might, under other conditions be lost.

For barnyard manure, you can claim no superiority over this plant, but its partial decomposition. It is more available, because a part of it is oxidized.

The rye must undergo this change, before its albuminoids can be of use to growing vegetation. But look at the ample time that it has to decompose, and then you cannot but acknowledge its value.

It may be plowed in for a crop of corn, or may be cut down just as it blossoms, and left as a mulch on the ground. A second crop will then grow up, nearly as large as the first, and may then be plowed in, and Hungarian grass, or white mustard, or buckwheat, or green corn be sown, and make a third crop for turning in for wheat. If corn should be the third crop, I should prefer to use it as a mulch, as already explained in Chapter VII.

J. B. Root, of Rockford, Ill., writes in the *American Agriculturist*, 1875; "The labor of applying evenly forty loads of manure per acre is considerable. All this is done more evenly by the green crop. Seed and labor together cost me but $3,50 per acre. I can not say that it adds as much fertility to the soil as forty loads of manure, but I do say that in our drouthy seasons, it produces as great an increase of crop as do forty two horse loads of good manure. It certainly pays to practice it, and to practice it largely, even on the land well supplied with stable manure."

Every one acquainted with the writings of Joseph Harris, for the last twenty-five years, will suppose of course, that clover is the only green crop which could obtain such a high recommendation from a practical farmer.

But such is not the case. Mr. Root makes but little use of it. He says: "Rye has been my most profitable green manure."

Harris thought it just as useless to plow in cereal crops for manure, as to attempt to carry buttermilk in a basket. He believed they spilt the most of their nitrogen while growing. He has now changed his views. And is conscientious enough to acknowledge, that for twenty-five years he was in error.

He now writes: "I thought then that wheat, barley, oats, corn and other cereals, during their growth gave off nitrogen into the atmosphere, while clover, peas, beans, vetches, and turnips, retained all the nitrogen they got from the soil and from dews and rains.

The theory was simple and plausible, and the practical deduction safe and sound. But more recent investigations failed to sustain this view."

CHAPTER XI.

GREEN BUCKWHEAT.

One ton of green buckwheat contains 8 pounds of nitrogen, 3 pounds of phosphoric acid, and 11 pounds of potash.

It stands very high as a green manure. Two large crops can be raised in one year to plow in for wheat. In 1875, I raised in 51 days 27 tons per acre of green buckwheat. It was sown on the 14th of July, and cut and weighed on the 3rd of September.

Besides it value as a manure, it will make excellent hay. In July, you should make an estimate of the

forage on hand to keep the stock through the winter, and if you need more, instead of cutting a second crop of clover, better sow one or more acres of buckwheat, and top-dress it with plaster and bone dust, or super-phosphate, unless the land is already good; and before the equinoctial storms of September, you may have from the buckwheat, three or four tons of good hay per acre It contains two-thirds as much nitrogen, and more phosphoric acid, and more potash than clover hay.

If wet weather should prevent you from making it into hay, you can plow it in for wheat, and no loss will occur.

Even buckwheat straw, after you have thrashed out the grain, should be saved for hay. It contains four times as much nitrogen, four times as much potash, and three times as much phosphoric acid as wheat straw!

John Johnston once said to Harris: "I should have made more money if I had found out the value of straw for fodder fifteen years earlier."

He alludes, of course, to the straw from his immense crops of wheat.

No wonder farmers can not raise corn after buckwheat, when seed and straw have all been removed. They say, it poisons the land. So does a check on the bank, when it removes all your deposits. But plow the money into the bank, and it will antidote all the poison.

That buckwheat is beneficial as a green dressing. the following may be relied upon.

"We cannot," says the editor of the *Theatre of*

Agriculture, "too much recommend, after our old and constant practice, the employment of this precious plant as a manure. It is certainly the most economical and convenient the farmer can employ."

The *American Agriculturist*, for 1867, page 253, says of buckwheat: "It affords one of the most valuable green manure crops to be used on light leachy lands, for with 100 to 150 pounds of good guano, or 3 to 5 cwt., of bone dust, a heavy crop of manure may be produced on almost any soil."

It also says on page 285: "When this grain is sowed the 1st of August, it will be in condition to plow in for a rye crop the last of September. We have seen rye taken from a field four years in succession, with no other manure than buckwheat turned in at the time of sowing the rye. There was a constant increase in the yield of the grain, showing the benefit of the green crop."

Here we see what a number of green crops may be turned in for wheat every other year. Of one fact we may be certain, that no person ever made money by raising small crops of wheat. Hence every effort should be made to prepare the ground and enrich it, so as to insure a large crop of grain. The cheapest and best way to accomplish this, is to plow in three or four green crops in one year for wheat. And in this way it may be done. Where the clover has failed, as soon as the wheat is off in July, plow and sow rye and buckwheat together. When the latter is in full blossom, cut it down on the rye. Here we have two crops on the field all winter. One acts as a mulch to the other, and both together protect and improve the soil. By the middle of May, the rye

will be in blossom, and should be carefully cut down, and then a second will spring up, and in six or eight weeks, may be as large as the first. Then plow all in together, and by the 1st of August, put in sowed corn, as a mulch for wheat, as directed in Chapter VII.

Take notice to this remarkable fact, that we have four green crops, and the wheat actually put in the ground, with only two plowings!

If your soil should be a heavy clay, and you wish to plow it three times, the rye may be turned in about the middle of May, and Hungarian grass or some other quick growing plant be sown for the third crop.

To conclude this subject, let us examine the relative value of green buckwheat, compared with barnyard manure. In the three crops which you can plow in between two crops of wheat, it will be safe to estimate them all together at 45 tons per acre.

Then on a field of 20 acres, you will have 900 tons, containing 7200 pounds of nitrogen, 2700 pounds of phosphoric acid, and 9900 pounds of potash. Now it will take 720 tons of stable manure to yield as much nitrogen as we get in our triple crop of buckwheat. And nearly as much for the phosphoric acid and potash. If the last crop of buckwheat, should absorb any material from the mouldering ruins of the first, it may be possible, that we only gain from the soil about two-thirds of the amount above given. But that will be amply sufficient for a good crop of wheat.

CHAPTER XII.

WHITE MUSTARD.

One ton of white mustard contains 9 pounds of nitrogen. In two months it will produce 15 tons per acre of green manure. Two crops may be raised from May to September, to be plowed in for wheat. On a field of 20 acres you may have 600 tons at one-tenth the cost of stable manure, and nearly equal to it in value ton for ton.

Joseph Harris says: "On sandy soils, that are not specially enriched by summer fallowing, mustard could undoubtedly be used to advantage as a green manure for winter wheat or for Indian corn the next spring."

Again he writes: "The experience of the heavy-land farmers of Suffolk is in favor of sowing about a peck of white mustard on the long fallows in August or early in September, and plowing in the herbage about six or eight weeks from the time of sowing. The effect upon the barley crop is considered by practical farmers as equal to half a coat of farm-yard dung, obtained at a cost of 2s. 6d for the seed. Upon a clay loam—the mustard being sown after peas, and plowed in for wheat, the difference in the crop was visible to the eye at a considerable distance from the field. At harvest, the wheat where the mustard had been plowed in was six inches higher, and ripened ten days sooner than wheat on adjoining lands where no mustard had been sown, but otherwise treated in a similar manner.—(*Walks and Talks, No.* 100.")

We see by these extracts, that white mustard

may be used to advantage on either sandy on heavy land.

It is also stated by Harris that super-phosphate will greatly stimulate the growth of mustard.

If the seed was cheaper, I would frequently use it, and sow two or three crops for wheat.

I had fifteen tons per acre, of white mustard plowed in early in July, and had the lot seeded down in buckwheat, and when it was in blossom, had it turned in for wheat. The crop was nearly equal, to another field which produced 24 bushels per acre, and which had been dressed with good stable manure and super-phosphate of lime.

CHAPTER XIII.

TURNIPS.

One ton of turnips contains 4 pounds of nitrogen, 1½ pounds of phosphoric acid, 6½ pounds of potash, and 1818 pounds of water. One ton of turnip leaves contains 7 pounds of nitrogen. 20 tons per acre are considered a good crop The tops weigh about eight tons. The two together furnish 136 pounds of nitrogen.

It will require nearly seven tons of Hungarian grass, or 14½ tons of green clover, or 15½ tons of barn-yard manure to yield as much nitrogen as this crop of turnips.

Yet we cannot obtain as much benefit from these manures, as the English farmer gets from his turnips. The reason may be, we do not bestow as much labor and material on our green crops, as he does, to make them available.

Alderman Mechi says: "It seems very ungracious that when you have grown a splendid crop of turnips, at an expense of $35 to $50 the acre, the sheep are to consume it, leaving you nothing but the price of the hay and cake you gave them with it; but it is a system that can't be avoided, until you find some cheaper source of manure."

That is you may sell the fat sheep for enough over their original cost, to pay for the hay and cake you gave them! But how can they afford to give so much for the nitrogen in the turnips? Is it because the turnips are eaten on the ground, and that makes all the nitrogen available. And besides this, the manure from the cake and hay and phosphates are all deposited on the soil. No liquids are lost.

Mechi also writes: "At this moment (March, 1857) you cannot buy lean sheep under 7s. per stone of 8 lbs.. (net dead weight,) whilst the price of fat sheep is only 6s. per stone; so that probably those who purchase lean stock now will have to give away their root and green crops without return, except the manure."

The fact is, it takes so much labor, so much bone dust, or super-phosphate, or other manures, and so much time, to grow a good crop of turnips, and to feed them on the land, so that none of the liquid shall be lost, that we, in our cold climate must look for a cheaper source of nitrogen than by raising turnips to feed to sheep or cattle. We must give more attention and more labor, and more manure to other green crops to secure a heavy yield, and then they will show their power, whether we plow them

in, or leave them on the surface, or feed them to animals, and save all the residue.

The profit from keeping all kinds of stock in England, is very little indeed.

Mechi says: "What the turnips cost to grow is another affair; but the price singularly confirms Mr. Lawes' experiments, that one ton of turnips (without any other food) only produced 5 lbs., nett dead weight of mutton."

This is a positive proof, that all the labor and expense bestowed upon this plant, are directed to one great and grand object—the production of nitrogen. Without it, they know that they cannot raise large crops of wheat.

"Mr. Lawes' experiments furnish correct data on this subject, and show that after paying for purchased food, *nothing* was left for the turnips, although we know they cost 10s. per ton, or more."—(*Mechi.*)

That is $2,50 for a ton of turnips that will make five pounds of mutton, which they sell at 18¾ cents per pound!

A good English farmer once said to Joseph Harris: "Insure me a crop of turnips, and I will insure you every other crop in the rotation." "The rotation is, first, turnips; second, barley, seeded with clover; third, clover; fourth, wheat: and then turnips again and so on. A good crop of turnips, eaten on the land by sheep, means good barley and good clover. Good clover means good wheat. The turnips and the clover may not yield much profit, but the extra yield of barley and wheat more than compensates for the great labor and expense bestowed on the turnip crop."

Here is the whole secret of the great success of the English farmer. A green crop *always* comes in between two grain crops.

With bone dust, or super-phosphate of lime, we can raise turnips as well as they can in England, and we need not feed them to sheep, we can plow them in, and get more manure, than they would yield if eaten by animals. Then what else is needed? We miss the nitrogen from the oil-cake. If more is required, we must make that up some other way. Is not nitrate of soda as cheap as oil-cake? If not, then let us plow in two green crops, or top-dress the wheat with good barnyard manure.

CHAPTER XIV.

BARNYARD MANURE.

One ton of barnyard manure contains 10 pounds of nitrogen, 5 pounds of phosphoric acid, 12½ pounds of potash and 1500 pounds of water.

It may be that you live so near to some town or city, that you can get manure for $1,50 per ton, and can haul it home and spread it for fifty cents a load.

Now, as we have more faith in clover, than in any other green manure, let us compare these two together. You must put on 360 tons of manure upon the 20 acres, to get as much nitrogen as we have in the single crop of clover. That will cost you $540 for the manure. That will be nearly 20 cents per pound for the nitrogen. I say nearly, for we must allow something for the minerals. But how much? Harris says that: "All the *mineral matter* in a ton of barnyard manure could be purchased for 25 cents."

This is too low an estimate for manure that has never been leached by rain ; but may apply very well to all that has been exposed to the weather all summer, and has lost by drainage nearly all its soluble elements.

Great care should be observed in purchasing manure. Its value depends entirely on the kind of material of which it is made, and the care bestowed upon it afterwards. If it has lain in a dry place, and become fire-fanged, and white and mouldy, and so light, that it feels on your fork like a bunch of dry leaves, it is hardly worth hauling home at any price. And if it is made of nothing but straw, although it may look well, do not pay much for it.

But if preserved in a cellar, or covered yard, and has been kept moist with urine or drainage from the yard while rotting, and the animals while making it, have been fed two or three times a day on grain, or bran, or oil-cake and good hay, and the pile is well concentrated by decay, then it is good manure, and worth hauling several miles to your home.

On Plumgrove farm, I have all the liquid which settles in a tank at the lowest corner of the yard pumped up and sprinkled over the manure under cover, and the process of decomposition goes on so regularly, that it could not be made better any other way. Yet with all the care we can bestow upon it, it seems almost impossible to save all the liquid in the stables.

Barns are not properly constructed for this purpose. Stalls should be eight or ten feet high from the floor to the joists above, so that three feet deep of manure may be left under all the animals all the time. And when the stables will hold no more, they may be cleaned out to the bottom, and then refilled with one

foot of sods and turf, and then a light coat of straw or any kind of litter over them. This way is nearly as good, and not so costly, as gutters behind the stalls to carry off the urine.

When in search of manure, in the village or town near you, the most important question, is not, what kind of animals produce it, but how much, and what kind of feed has been given to them. Joseph Harris says that one bushel of Indian corn will make twenty cents worth of manure. And Lawes considers the residue from one ton of clover hay worth over nine dollars.

Now when you find a pile under cover, and a reliable man assures you that it was made by feeding 200 bushels of corn and ten tons of clover hay, with a moderate amount of straw for bedding, then you may safely offer him $2 per ton for it.

It will not do to buy every thing that is called manure. Let me give you an example that is worth remembering.

Col. Waring, of Ogden farm says: "As I drive along the road, I daily meet able-bodied men crawling along beside snail-like ox-teams with loads of stained straw from the private stables in which the summer residents of Newport keep their horses 'up to their knees,' in litter. The cart holds about a cord of the stuff, (128 cubic feet,) for which $5, or more have been paid in town, and to get which, occupies the best part of a day's labor of man and team."

You see he will not even call this manure. What a Conrad-like sneer must have curled his proud lip, as he inspected these loads of "*stuff*" as he calls them.

Is it any wonder that our wisest men declare that the Art of Agriculture is only in its infancy.

CHAPTER XV.

FEEDING GRAIN FOR MANURE.

Many farmers really believe that it is always profitable to raise and fatten cattle; and of course, they continue the business from year to year.

Very valuable manure can be made by it, and this is most fortunate, for it too often happens that they get nothing else for all their trouble and expense.

They are anxious to make the farm very rich, for they are wise enough to know, that in no other condition will it pay, and having full faith in the contents of the stable and barnyard, they purchase thousands of bushels of corn to feed to all kinds of stock. In other words, they want to gather up as much nitrogen in the stable, as we have collected in our 20 acres of clover.

Indian corn contains one pound of nitrogen per bushel. Therefore they must purchase 3600 bushels of corn to get as much nitrogen, as we have in our 20 acres of clover.

At the present time Indian corn brings 60 cents per bushel. Hence they must pay $2160 for 3600 pounds of nitrogen, 230 pounds of phosphoric acid and 140 pounds of potash. That will be paying nearly $2000 for as much nitrogen in corn, as we get for $50 in green clover.

That is provided, they make nothing on the cattle, and all the profit must come from the manure.

Now, how stands the case with experienced farmers?

Alderman Mechi, the most progressive, and one of the most enlightened farmers of all England says: "I have no doubt, this statement will startle many a practical farmer, and will raise a storm of indignation among stock-feeders and stock-breeders; but the naked truth is best told which is, 'that live stock are necessary evils, mere manufacturers of manure, and unattended with any direct profit.'"

This is not his opinion only. Many able men freely endorse it. Here is one whose opinion cannot be misunderstood. "A friend of mine," says Mechi, "a close calculator, who on 1500 acres does not keep a bullock, says: those who keep many bullocks will never want to make a will."

Then why does Alderman Mechi fatten any cattle? Why keep so many sheep? Why does he fatten about 400 hogs every winter?

He says: "I know by long and large experience that pigs pay better for purchased food than any other stock—and even *they* will by no means, 'clear their teeth.'"

His object is manure. He has no other motive. He buys 8000 bushels of Indian corn or barley in a single year to feed to his animals, and looks to his great tank, full of rich manure, for all his profit.

We have many other cases of this kind on record. Here is one: Mr. Burrett, visited the farm of Samuel Jonas, in England, consisting of 3000 acres. He says: "I was surprised at one fact which I learned in connection with his economy. He keeps about 170 bullocks; buying in October and selling in May.

Now, it would occasion an American farmer some wonderment to be told that this great herd of cattle is fed and fatted almost entirely for the manure they make."—(*Genesee Farmer*, 1864.)

Can we do any better in this country?

The Hon. Geo. Geddes, of New York, says: "He would keep no stock of any kind if he could help it. He always lost money by them. You rear a steer till he is a thousand days old, and in ordinary times he is worth $40. You get four cents a day for your time, labor and the food consumed. Will that pay? He keeps sheep to get rid of his straw and tread it into manure."—(*Genesee Farmer, vol.* 25.)

With the highest deference and respect for his opinion, I must say, that this is a very poor excuse for keeping sheep. If he will send out all his straw in the fall, which he does not need for bedding, and have it spread on the field to be plowed for corn the next spring, he will never afterwards complain, that he can not get rid of his straw.

John Johnston says: "Land must have a covering of grass or clover while resting."

How is it possible to have more straw than you can profitably make use of, I cannot see.

Some years ago, I raised 905 bushels of potatoes to the acre, by planting the sets on plowed and mellow ground, a foot apart, and covering them with straw from 12 to 18 inches deep. I would always raise potatoes in that manner, if I could spare the straw to do it.

And when your corn-fodder is hauled in, cover the field where it grew with ten or even five loads of

straw to the acre, and the spring crop that follows it will reward you well for your trouble.

The very day that you spread straw on a bare field, it begins to pay you an interest; it may be of 6 or 10 per cent. on the investment.

But if you expose it in the barnyard to rot, you may lose a part of it by leaching, and get no interest from the balance, from six to nine months to come.

CHAPTER XVI.

FORAGE FOR THE HORSES ON THE FARM.

When we have concluded to use green crops for manure, of course, we should leave all the clover, and all other vegetation stand for this purpose, and cut as little as possible to feed to animals.

It will not do to take the clover, nor the Hungarian grass, nor the sowed corn from the fields intended for wheat.

We should have a clear understanding of the amount of forage which our stock will need and then make ample provision for them.

What is the experience of the best farmers upon this subject?

Colman writes in his *European Agriculture:* "It is estimated by many intelligent farmers in England, that the horse-teams require for their maintenance full one-fourth of the produce of the soil."

Again he says: "Indeed, so far as my observation goes, there is no single source of expense, none which abstracts so much from the profits of farming,

and none of which the farmers in general are so little aware, as that of horse-teams."

Alderman Mechi says: "This brings me to the fearful question: What portion of the acreage of this kingdom do farm horses consume? I answer, nearly one-fourth of all the arable land in the kingdom."

This is a very discouraging picture. That one-fourth of all you raise, will be devoured by the horses, which are required to work the farm!

Is there no way to remedy this? Certainly there is a way. We must raise enormous crops of forage; nothing else can save us from this great expense.

Joseph Harris speaking of John Johnston says: "Last summer he wrote me that he had raised a great crop of timothy, but that the story was too big to tell. I asked him about it yesterday. He top-dressed a piece of timothy grass with a compost of hen droppings, chip manure and cow dung. The timothy was nearly six feet high, and as thick as wheat straw, with heads almost a foot long. He weighed several of the cocks and estimated the crop as five tons to the acre!"

In 1860, a friend of mine, cut and weighed and sold to his neighbors, *nine* tons and a *half* of timothy and clover hay, from a two acre lot, which had been manured from his slaughter-house.

We should learn two useful lessons from these examples.

First, that top-dressing is all that is required to insure a big crop of timothy. And second, that a little land can be made rich enough to furnish us with all the hay needed on the farm. Hay from

Hungarian grass has no superior when well made.

"A correspondent of the *Prairie Farmer*, Mr. Philips, of Butler Co., states that the premium acre at the last fair of that county, yielded eight tons and two hundred pounds of well cured hay."–(*Cultivator.*)

Colman says of millet: "I wish my countrymen were more impressed with the extraordinary value of this plant. I know few plants which make a more abundant return, or which, when it is well cured, give a more nutritious forage, or one more relished by stock."

In 1854, Lawes and Gilbert sowed some clover seed in a rich garden. They say: "The estimated total amount of green clover obtained from this garden soil in six years without further manure is about 126 tons per acre, equal to about 26½ tons of hay."

"Fourteen cuttings have been taken without any re-sowing of seed."

Why was no re-seeding required during the six years? It was either because the soil was so very rich, or because it was cut so often and so early that no seed could mature; and it may be the nature of clover to live on till seeds are developed.

Besides the plants above mentioned, I advise you to have one, two, or three acres of orchard grass. And to use every available means to make the land very rich. It will be ready the first of all to mow in the spring. By top-dressing it in the fall, or very early in the spring it will never fail—never run out.

All the plants above mentioned, have peculiar merits of their own; hence the great advantage of having a patch of each near the barn—for summer soiling, as well as for winter forage.

It is said that the Hungarian is "so deep rocted that severe drouth does not affect it in the least, and it may be sown upon the highest and dryist soils without fear of failure." And that it will yield, when kept for seed, 20 to 30 bushels per acre. Hence the seed need not cost more than fifty cents to a dollar per bushel.

Let me say a few words about making hay. Dr. Vœlcker has discovered that rain will leach out of hay while being made, nearly one half of its best material.

Therefore, how very unwise to cut grass in rainy weather, as many do, to be ready to make hay when it clears up. Far better to mow on a clear morning, and put it up in well made cocks in the evening, should there be any appearance of rain, then it will be comparatively safe. Should even a heavy shower come, all that can fall on each cock, cannot leach through it, and hence no damage will be done.

Another arrangement is worthy of your attention. Have your permanent hay field as near the barn as possible, and then you can haul in three or four loads in less time than you could go to the back field for one load. This is a matter of the highest importance in stormy weather.

One or more acres of sowed corn will make a grand addition to the winter provender, provided you need any.

A brief notice of what others have accomplished with it, I think will be acceptable.

David Miller, of Fayette Co., Pa., writes to the *Cultivator* in 1842: "I have generally had from about 60 to 70 tons of green food to the acre, and

think it decidedly better than grass, for either beef or milk."

H. L. Ellsworth, Esq., says: "I sowed four and a half bushels of common corn per acre broadcast, and harrowed in the same. Having soaked the corn in saltpetre, it took a rapid start, over-topped the weeds, and covered the ground with a forest of stalks. Being anxious to ascertain the quantity, I measured a few square feet of the stoutest. I found I had five pounds of green fodder per square foot—that is 108½ tons per acre. I cut the first crop the early part of July, and plowed and sowed the land again, and took a second crop two-thirds as large."—(*Cultivator*, 1842.)

Here we have 172 tons of green fodder per acre in one year. Of course this large amount of provender could only be obtained on rich land.

Mr. Peters says: "The amount of corn fodder which will grow upon an acre is truly fabulous, and no one will believe it until they have had occular demonstration. It is not a very large thing to grow 200 tons of green fodder to the acre. I think it possible to grow 250 tons with care and a good season."—(*The Genesee Farmer*, 1865.)

"Gustavus Harmoir, President of the Agricultural College of Valencinnes, has been experimenting with Indian corn as a soiling crop. The variety used was the 'Grant Maize of Caraqua.' The seed was drilled May 31st, in rows about three feet apart and 18 inches in the drill. By the 15th of August the stalks were 14 feet high, and the yield was over 450 tons per acre."—(*Genesee Farmer*, 1863.)

We have no higher authority on the value of green corn, as a food for cows, than Col. Waring, of Ogden

Farm, and so perfectly is he satisfied with it, that he exclaims in the *American Agriculturist*: "Corn never —corn-fodder always."

Again he says: "Throughout nearly the whole country there is no crop that can at all compare, when we consider both its value pound for pound, and the enormous yield that may be obtained from an acre, with corn-fodder. Whether the purpose be to make butter, or cheese, or beef, or to keep young stock in thrifty, growing condition, it is at once most profitable and nutritious."

Colman, in estimating the value of different kinds of forage says: "I have some doubts, however, whether, for the purpose of soiling, for milk, or for fattening, any product can be found equal to that of Indian corn cut green."—(*European Agriculture.*)

It is said that if we sow 40 to 50 grains to the foot, in drills three feet apart, we will have one-third more fodder than with 20 grains to the foot. I have raised it for more than ten years on Plumgrove farm, and for winter fodder, I prefer about six stalks to the foot, because it will then grow eight and ten feet high, and can be cut when ready, independent of all weather, and put in shock, and will stand well till November, when it may be put in the barn.

For feeding through the summer to horses, cows, and pigs, I care not how thick it is planted, even fifty grains to the foot will be better than any less amount. But you will find this much more troublesome to save for winter provender, because you will have to cure it in the same way that you make hay, and may be very much annoyed with wet weather.

To conclude, remember this, the *great secret* of

success in Agriculture is the *concentration* of manure and labor. A poor soil, with little labor, little tillage, and no manure will never produce a large crop of green corn, nor any other kind of forage.

CHAPTER XVII.

LOSS OF MANURE.

While making vast piles of manure, by feeding grain and green crops, are you able to save all the residue?

Certainly not. That would be impossible.

How much of it do you lose?

Alderman Mechi declares: "Upon a careful investigation, we safely assert that 20 per cent. of ordinary farmyard manure is wasted. An examination of ten farm homesteads consecutively taken has fully established this supposition."

Manure is the farmer's capital. What business can be carried on with profit, if you are obliged to borrow money at an interest of 20 per cent.?

And if you lose 20 per cent of your capital every year, where is the difference between you and the reckless borrower?

Does Mechi save all the manure? Yes—we may say all of it. It is made over water-tight troughs, and is carefully washed into a great tank, from which it is pumped by a steam engine, through three inch iron pipes, over all the farm. But this is not all he saves by the operation.

It will cost you, at least, fifty cents a ton to haul and spread the contents of the barnyard on any distant field. It costs him but four cents per ton to

spread, in a liquid form, all the manure he makes. Hence his profit as a farmer, on all his great investments, is 15 to 18 per cent. He very truly says: "It is the filling, carting, turning over, refilling, carting and spreading, and wasting, that run away with the farmer's profit."

He has abandoned green manuring, which he once followed extensively. In fact, his great outlay, will not justify it now, even if he wished to do it.

Notwithstanding all this, he says: "If stock is too dear, or you are short of capital, plow in green and root crops, particularly on heavy land."

So much for England's model farmer. Now for the greatest light in our own country.

John Johnston says: "I have suffered an immense loss from the liquids running from my barnyards, but I never could contrive a plan to prevent it."—(*Cultivator*, 1861.")

Probably no man ever estimated manure nearer its true value, or ever had a more striking experience of its power, than John Johnston; and how passing strange it is, that even he, with all his wisdom and ability, could not save the whole of it!

It is an established fact, that the liquid is the most valuable portion of the manure.

Joseph Harris, in alluding to its great waste, say in *Walks and Talks*, No. 49: "As ordinarily managed, however, the liquid either runs away or soaks through the crevices of the planks into the ground and is lost."

The *American Agriculturist*, 1872, says: "The value of liquid manures is not sufficiently realized. It is safe to say that not one thousandth part of this

is ever saved for use, but nearly the whole is allowed to go to waste."

Now, as it is almost an utter impossibility to save all the liquids, unless we adopt Mechi's costly plan, what an over-whelming argument in favor of green manures. For all the liquid of any value, in grain or in manure, originally came from the green stalk.

There is a way of saving the urine which should not be over-looked. Erect a temporary fence around a piece of ground which you can till, and keep your animals on it. Let them remain there till the cold weather obliges you to put them in the barn. You can keep the cattle there all the time, if the lot is large enough to require all their manure, during the warm season, or you may let them pasture in the field by day, and feed them at night in the enclosure with green corn, Hungarian grass, clover, rye, cabbage and everything eatable.

If you will sprinkle over this pen, more or less straw or corn-fodder, it will be an advantage. But do not plow it up, till you want to sow or plant some kind of crop. Better have two or three acres that are very rich, than ten that are very poor. Cows may pasture among rocks and stumps, and on hill-sides, where you never plow, and may return at night, to enrich the pen, and this will pay you well for their night and morning meal. Mechi says: "1500 sheep folded on an acre of land for 24 hours, (or 100 sheep 15 days) would manure that land sufficiently to carry it through a four years' rotation." By this wise arrangement they save all the liquid, as well as the solid residue. This is a matter of vast importance.

CHAPTER XVIII.

JOHN JOHNSTON AND OTHERS ON RAISING WHEAT.

In 1874, one of the editors of the *Country Gentleman*, after a visit to John Johnston said:

"Mr. Johnston showed us a field upon which he had raised wheat for more than thirty years every alternate year, the average yield constantly increasing. His plan was to fallow plow about the middle of June; plow again about September first and top-dress heavily with manure and sow wheat. Early the next spring he sowed on clover seed and plaster. After harvest, if the clover grew large enough to head out, he pastured it more or less; but if no blossoms appeared he put no stock on it. The next spring he pastured the clover lightly until it blossomed when it was turned under as before. He had found this two-crop rotation very successful."

Now, can there be any objection to the addition of one more green crop as a top-dressing to this very successful mode of raising wheat? You recollect how strongly he is in favor of some kind of protection, to save the crop from the blasting winds and other injuries. After plowing in the clover, there would be ample time to raise ten or fifteen tons per acre of green corn, and to cultivate and clean the field as effectually as if nothing was growing on it.

We should notice this fact, that he "top-dressed heavily with manure." Yet even that did not prevent the wheat from being killed when exposed to northwest winds.

If the free use of the very best manure, will always insure a heavy crop of wheat, his crops should never fail. He was in the habit, every winter, of feeding

many tons of oil-cake, and about 1500 bushels of corn, and a large amount of hay. With such a mass of rich material, why should he need, or use anything else. Yet he plowed in clover. And such clover! How rank it must have grown, after the top-dressing such as he gave the wheat. Yet how careful he was, only to pasture the clover lightly, before turning it in! In fact he made use of every means in his power to insure heavy crops of wheat.

Joseph Harris, in his celebrated lecture on "Wheat Culture in Western New York," gives us Johnston's views on the use of salt and lime.

"On rich land," says Harris, "salt has a tendency to check an excessive growth of straw. In some experiments made recently on the farm of the Royal Agricultural Society, the unmanured plot of wheat produced 29 bushels per acre, and the plot dressed with 3 cwt., of common salt 38¾ bushels, or an increase of 9¾ bushels per acre.

"A few years ago I was on the farm of John Johnston, of Seneca County. He had dressed a part of a field of wheat with a barrel of salt per acre, and the effect was most decidedly beneficial. The wheat was heavier, and the straw much brighter and stiffer. It also ripened several days earlier and escaped the midge in consequence. Mr. Johnston is here with us to-day, and he has just informed me that he thinks there is nothing like salt for stiffening the straw on rich lands. He sows a barrel per acre on the fallows just before sowing the wheat. He has sown as much as 75 barrels in a year on his wheat.

Lime is also a splendid manure for producing plump heads of wheat and a stiff straw. There is nothing like it. Mr. Johnston says if he was a young man, he

would lime every acre of his farm. In 1844, he applied 200 bushels of lime on two acres before sowing the wheat, and it was a magnificent crop—over 50 bushels per acre; and he says he can see the effect of that lime on the land to the present day."—*Genesee Farmer*, 1863.

After reading this, shall we be afraid to plow in green manure, lest it should make weak straw, and cause the wheat to fall? Here we have a certain remedy in salt and lime. But we must be careful not to use too much lime. There is an old proverb, the lesson, we presume, of observation and experience:

"That too much lime and no manure,
Will make the farm and farmer poor."

The reason is plain enough. Lime contains very little plant food. A good crop of wheat, of 34 bushels per acre, takes from the soil only one pound of lime, and the straw about seven pounds. Salt and lime act as solvents of the soil, and of the vegetable matter in it. Hence the more green crops, and stable manure we plow in, the longer the land can stand the dissolving action of these minerals.

Alderman Mechi found salt to be indispensable on his rich land. He says: "He salted all his wheats at the rate of four to eight bushels per acre, *and was determined to use much more.* He knew a gentleman in Northamptonshire whose wheat crop could scarcely ever be kept from going down until he used salt, which had effectually kept it standing."

When putting in wheat, it is a matter of great importance to have the land in the right condition to receive the seed. If you plow in a very heavy green crop, and sow at once, you may have almost a total

failure, and raise but a few bushels of wheat. The reason is plain on a moment's reflection. If dry weather should come on, and continue for several weeks, there will be nearly a complete separation between the surface and subsoil. The wheat cannot grow in the dry crust, and as no moisture can arise from capillary attraction to soften this crust, the seed may perish, or make but a feeble growth till the ensuing spring. From a careless disregard of these facts, even large crops of clover plowed in have been, apparently, injurious, and the whole system of green manuring, has been condemned and abandoned.

We find some very excellent advice upon this subject in the Foreign Correspondence of the *Country Gentleman.* The writer says: "We want the ground to settle before sowing. Never sow wheat or rye on new plowed land, if you can help it, but give it the last furrow from six to eight weeks before sowing time. This is of the highest importance. The soil then becomes thoroughly pulverized by the alternate action of rain and sun—it rots; aye, it will rise (puff) like well made dough—I can describe it no other way—the land must look as if yeast had been put into it and had done its work well. Then is the time to sow."

Here you see the ground must *settle.* Now it cannot settle in dry weather, if piled on top of green manure of any kind. In some seasons, there will be so much rain just at the right time, that all seeds will grow no matter when or how carelessly they are put in. That we may never fail to raise a good crop of wheat, I prefer to have Indian corn for the last green dressing, and to keep it on top as a mulch, as directed in Chapter VII.

On spreading lime and other fertilizers, I wish to

say a few words. I have so often noticed the utter impossibility, of spreading anything evenly with the shovel, that I was induced to *invent*, and then take out a *patent* for a machine, which will sow from three bushels to 300 per acre—of material as fine as plaster. or as course as the grains of Indian corn. Its cheapness, simplicity and durability will recommend it to every one. It consists in a hollow cylinder or drum, from 6 to 12 feet in length, and from 2 to 3 feet in diameter. It is formed of long boards or vanes, which have one edge fastened by a hinge at each end to a drum head, and also by a hinge to a drum head in the middle. The free edge of every board over-laps the hinged edge of the vane next to it. By means of movable bolts, the space between the over-lapping edge can be adjusted, to the 32nd of an inch, or to a whole inch if desired. A shaft runs through the drum and has a wheel at each end. One wheel is fastened to the drum to turn it.

CHAPTER XIX.

THE PRESERVATION OF HEALTH ON THE FARM.

The human body is composed of fourteen elements. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, calcium, magnesium, potassium, sodium, chlorine, iron, fluorine and silicon.

All our flesh and bones, the brain and nerves, and blood are made of these elements, in a state of combination.

Perfect health, consists in the *perfect* preservation of the relative proportion of these compounds.

If the mineral matters should predominate for some time in the blood, the capillary system—that is, the

blood vessels which are as fine as hair, will become clogged up, and premature old age will soon appear.

If carbon and hydrogen should be in great excess in the blood, as they are the heat-producers of the world, whether in or out of the system, then there is danger of fevers, boils, abscesses, bilious disorders and eruptive diseases of the skin.

Now the object of this Chapter is to teach you how to prevent all kinds of sickness. We shall say nothing about the medical treatment when you are sick—we leave that to your family physician.

Bread contains more bone—that is, more mineral matter, more *ashes*, than any other kind of food.

Besides this bread and butter, furnish more carbon and hydrogen, to the system than any other kind of diet, except sugar and *fat* meat. Yet, there is nothing more healthy, or more strengthening to the body than bread. It is the *disproportion*, the *excessive use of bread*, when compared with other things, which does all the mischief, and lays a sure foundation for nearly every malady.

In ancient times, when they had no mills that would turn out a 100 barrels of floor a day, and they had to grind their grain by hand, there was very little danger of eating too much bread.

They had to live more upon flesh, fish, fruits and vegetables. And as this kind of diet, did not introduce an *excess* of carbon and hydrogen, nor too much *ashes* into the blood, they lived to be very old, and were clear-headed, and as active, when a hundred years of age, as our young men of twenty-five.

Now let me give you a few well-known illustrations, to establish the truth of these statements.

Plutarch says the Ancient Britons only began to

grow old at 120 years. They lived on acorns, berries, fish, flesh and fowl.

Herodotis tells of a people of Etheopia, who lived on flesh and milk 120 years.

An ancient sect of India lived on fruit and vegetables 150 to 200 years.

The Egyptians live on fruit and vegetables 130 years.

Henry Hastings lived on vegetables 110 years.

A native of Bengal lived 370 years, on a very low diet, principally fruits and vegetables.

Margaret Patton lived 137 years mostly on milk.

Charles Macklem lived 107 years on flesh, fish, fruits and vegetables.

Ann Bannerman lived 105 years on vegetables.

Mrs. Watkins lived 110 years, and the last 30 entirely upon fruits and vegetables.

Owen Carollan lived on potatoes, buttermilk and and cherries 127 years.

Elizabeth Mackpherson lived on buttermilk and greens 117 years.

Mr. Dobson lived on flesh, fruits, milk, cider and vegetables 139 years.

Francis Confit, lived on a very low diet, principally on new laid raw eggs, 150 years.

Philip Loutin, lived on one meal a day, 105 years.

Paul Barrot, lived on vegetables 106 years.

Mary Rogers lived 118 years, and the last 60 entirely upon vegetables.

John Wilson lived 116 years, the last 40 on roasted turnips for supper.

Thomas Parr always proportioned his food to the amount of exercise, and lived 152 years.

John Murphy lived on potatoes and milk 106 years.

Henry Jenkins lived on cold meats and salads 169 years.

On the African Desert, a man was found by Capt. Riley, who lived 400 years on milk alone.

How can we account for these remarkable cases of longevity. There is one cause, and only one. which touches every case. And that is the extreme temperance in the use of bread. They differ in everything else. Climate, age, sex, condition and situation appear to have no effect upon the general result. All come out alike, and reach their Centennial, by observing one rule.

Have we anything in the history of the lower order of animals, to corroborate these deductions? Yes.

The wild hog lives 300 years on acorns, fruits, herbage. roots, and small animals. And it is very probable, never has a full supply of them.

The domestic hog lives on grain from 10 to 20 years.

The eagle lives 500 years on fish and flesh.

The parrot in its wild state lives on fruits 500 or 600 years.

Our common fowls are crammed with grain, and will live only from 10 to 20 years.

Here we may conclude this subject, with a declaration, which cannot easily be refuted. That to enjoy a long life of uninterrupted health with a clear memory, a bright and cheerful heart, and a strong arm, our bread, butter, lard, sugar and fat, must bear a wise *proportion*, to the lean meats, and to the fruits and vegetables in daily use.

During a practice of more than forty years, this subject has engaged my attention Hence it is no sudden conclusion that induces me to say, that our *combustible* diet of carbon and hydrogen, has more influence, in predisposing the system, to disease than all other things combined.