ESSAYS

ON

PRACTICAL AGRICULTURE,

INCLUDING HIS

PRIZE ESSAYS,

CAREFULLY REVISED.

BY ADAM BEATTY,

VICE PRESIDENT OF THE KENTUCKY AGRICULTURAL SOCIETY.

MAYSVILLE, KY.,

COLLINS & BROWN.

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DEDICATION.

DEAR SIR:—An intimate acquaintance of more than forty years; and the many evidences of kindness, and friendship experienced, during that long period; together with a knowledge of your devoted attachment to the interests of Agriculture; and of the great benefits you have conferred upon the agriculturists of the United States, by your pre-eminent and successful efforts, in the National Councils, to rear up a home market for agricultural products, emboldened me to ask your permission to dedicate to you this first effort, as far as I know, at a treatise, in book form, on the important subject of agriculture, by a Kentuckian.

I am conscious that the volume, now presented to the public, has defects, which I would have gladly removed. I humbly hope, however, that it will be found to contain some practical information, which will prove beneficial to the farming community; and that it may induce some abler writer to give to the public a more perfect treatise on the most important of all human occupations.

With a deep sense of gratitude, for the many acts of kindness and friendship received, I assure you of my most cordial friendship and esteem.

ADAM BEATTY.

Hon. HENRY CLAY.

PREFACE.

A comparison of the agricultural products of the best cultivated soils of Europe with those of the United States, naturally not less fertile, will satisfy all careful observers, that there must be some radical defect, in our system of husbandry. When we look to the agricultural works of European authors for information, on this important subject, we find so little of *practical* utility, and so much *inapplicable* to our circumstances, as greatly to discourage all efforts to obtain useful information from that source, to aid the American farmer, in his agricultural operations.

The dense population of those countries, in which the greatest improvements, in agriculture, have been made, furnish vast quantities of manure for enriching their land; and the cheapness of labor affords great facilities for manuring and cultivating their soil, in the most perfect manner. The high price of Agricultural products, and a steady home demand, subject to little fluctuation, justifies the great outlay of capital, which their system of agriculture requires.

These circumstances, together with the difference of climate, constitute some of the principle reasons why the European system of agriculture cannot be successfully adopted by the farmers of the United States.

Whilst we look to the agricultural works of European authors for information as to their system of husbandry, and avail ourselves of every thing, which is applicable to our circumstances, we should bear in mind, that the condition of things in the United States is such as to require that we should rear up a *practical system* of our own.

In preparing the premium essays, and other agricultural treatises, contained in this volume, it was the author's design to render them eminently *practical,* and *applicable to our circumstances;* and he flatters himself they will be found highly useful to the practical farmer.

Although the premium essays were written particularly for Kentucky, the author entertains a hope, that they will be found useful in every part of the country, and particularly in the Great West The discussions, upon most of the subjects, will be found applicable to all parts of the Union.

The essays on setting woodland in grass; on grazing and feeding cattle, as practised in Kentucky; and upon the cultivation of the yellow locust, will be found, the author humbly hopes, eminently useful.

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AGRICULTURE OF KENTUCKY,*

Showing what it was, and a comparison with the agriculture of other countries, and especially those most advanced in agricultural improvement. And also, upon the best mode of renovating the soil of Kentucky, where it has been deteriorated by improvident cultivation.

Agriculture may be defined to be, the art of *cultivating* and *improving* the earth, so as to render it *fertile* and *productive*. The term is derived from the Latin words *ager*, a field, and *cultura*, culture, or tillage. The term agriculture, therefore, implies not only the *cultivation* but the *improvement* of the soil.

The cultivation of the earth was, probably, not much attended to whilst it was only sparsely inhabited, and when its inhabitants depended chiefly upon game for a subsistence. At a somewhat later period, when the human race, on some parts of the earth, had become too numerous to depend upon the precarious subsistence furnished by the chase, the pastoral life gradually took the place of the hunter state. The domesticating and feeding of such animals as contributed to the subsistence and comfort of man, would, necessarily, cause him to pay some attention to the providing of pasture for his herds, at least so soon as that which was spontaneously furnished by nature, began to grow scarce. And in proportion as the necessity for artificial aids increased, we may reasonably conclude, that more pains were taken to provide pasture for their herds, during summer; and to lay up a store of such articles as might furnish the most convenient subsistence for them during the winter. In the more southern climates but little

*"For this, and the three following essays, premiums were awarded by the Kentucky Agricultural Society, at their annual meeting in Frankfort, January 1841."

necessity would exist for laying up a supply for winter use. But in northern climates attention to this subject must have sooner become necessary, and that necessity must have gradually increased, with the increase of population.

It is probable that the first efforts to introduce *a system* of agriculture were rude and imperfect; and this science, like most others, must have arisen by very slow and almost imperceptible degrees, and was a long period in arriving at even a moderate degree of advancement.

Hesiod, who is supposed to have been a contemporary of Homer, was the first Grecian, and one of the earliest writers, of whom we have any certain information, who composed a regular treatise on the subject of agriculture. It is remarkable that his poem was entitled "Weeks and Days," because agriculture requires an exact observance of *times* and *seasons*.

Hesiod was succeeded, in Greece, by Democritus, Socraticus, Xenophon, Tarentinus, Architas, Aristotle and Theophrastus. The science of agriculture must have doubtless made considerable advances during the period these distinguished writers flourished.

The celebrated Carthagenian general, Mago, wrote no less than twenty eight books, on the subject of agriculture, which Columella, himself an able writer on the subject, tells us were translated into Latin by virtue of a decree of the Roman Senate. That illustrious general and statesman, Marcus Cato, the censor, at a subsequent period wrote the first *Latin* treatise upon the science of agriculture, which was dedicated to his son, and has come down to the present times. Varro composed a more regular treatise, upon the same subject, which was embellished by the extensive Greek and Latin erudition of its learned author. Virgil, the most distinguished of the Roman poets, wrote a beautiful poem upon this interesting subject. We are told by Servius, that Virgil in writing his Georgics, used the books of Mago, referred to above, and hence we learn, by reading the Georgics, that some discoveries had then been made in the science of agriculture, that even *now* are regarded as very important. I shall mention but one other *ancient* author, Columella, who flourished in the reign of the Emperor Claudius. He wrote twelve books, on the science of agriculture, which contain a great variety of useful facts, and observations.

It would occupy too much space to enumerate the many distinguished writers, on the subject of agriculture, who have flourished in modern times; and I shall name only such as I shall have occasion to refer to in the progress of this essay.

Agriculture has ever been esteemed a science of great importance, and those engaged in its pursuit have always been held in the highest estimation. In Rome, the greatest generals, and the most illustrious Senators and Statesmen applied themselves, most assiduously, to this highly honorable pursuit. Their most distinguished generals, upon their return from the toils and glories of successful war, were eager to re-engage in the cultivation of the soil. They thought it no disgrace, after having triumphed over the enemies of their country, to participate in the daily labors of their farms.

At a period of great and imminent danger, the Roman Senate (believing that its safety could be ensured only by the appointment of a dictator) passed a decree, charging Cincinnatus "to see that no detriment befel the Republic." The effect of this decree was to confer the whole power of the Commonwealth, for the space of six months, upon a single individual. That individual, when notified of the decree, by delegates sent for the purpose, was found following his plough. He accepted the charge which had been conferred upon him; placed himself at the head of the army; triumphed over the enemies of the Republic; and on the *sixteenth day* surrendered up his dictatorial powers, and returned to the cultivation of his little farm. A *second time*, at a more advanced period of his life, this illustrious citizen was called from the labors of his farm, to fill the office of dictator; and a *second time* saved his country from the imminent danger with which it was threatened.

I might refer to other instances of a similar character, if the nature of this essay did not admonish me of the necessity of avoiding details which are not essential to its utility. But I will be pardoned for giving the following beautiful extract from Virgil's second Georgic, by way of illustrating the favorable opinion, entertained by the Romans of an agricultural life, in Virgil's time, as translated in the harmonious verse of Dryden.

"Oh happy, if he knew his happy state!
The swain, who, free from business and debate,
Receives his easy food from nature's hand,
And just returns from cultivated land."
"He boasts no wool, whose native white is dyed
With purple poison of Assyrian pride,
No costly drugs of Araby defile:
With foreign sweets, the sweetness of his oil.
But easy quiet, a secure retreat,
A harmless life that knows not how to cheat,
With home-bred plenty the rich owner bless,
And rural pleasures crown his happiness,
Unvexed with quarrels, undisturbed with noise,
The country king his peaceful realm enjoys."

In a country, in which the profession of an agriculturalist was so highly honored, and which held out such strong inducements to cultivate and improve the soil, the science of agriculture must doubtless have made considerable advances.

It has been said by a modern writer, that a system of *rotation* in crops was not introduced before the eighteenth century. This, though it may be true, in relation to modern agriculture, is not strictly correct. Indications may be found, in ancient writers, that this system was not wholly unknown. Thus Virgil, in his first Georgic:

"Both these unhappy soils the swain forbears,
And keep a Sabbath of *alternate years*.
That the *spent earth* may gather heart again,
And bettered *by cessation*, bear the grain,
At least where *vetches, pulse* and *tares* have stood,
And stalks of lupine grew, (a stubborn wood;)
The *ensuing season*, in return may bear,
The *bearded product* of the golden year.
For flax and oats will burn the tender field
And sleepy poppies harmful harvests yield.
But sweet *vicissitudes* of rest and toil,
Make easy labor, and renew the soil."

But whatever knowledge the ancients had acquired, in relation to a system of *rotation* in crops, was probably lost, when the Roman territories were overrun by the northern barbarians. The skill which had been previously acquired, in agriculture, shared a common fate with all the other sciences; and the whole would have been completely obliterated had not many of the works of the most illustrious authors of Greece and Rome been saved from the barbarian deluge which swept over the whole of the Roman territories. Many years elapsed before agriculture began to revive, and the science might be deemed only in its infancy as late as the sixteenth century. It was about the middle of that century that "Tussers' celebrated five hundred points of husbandry was published in verse." And it was not till 1645 that the culture of *turnips* and *clover* was introduced, articles that now constitute so important a part of English husbandry. It was still later before a regular system of *rotation* of crops was commenced. Among the Romans, "fallowing was a universal practice," and the same system was adopted in England, and pursued until the eighteenth century, when *a rotation of "green and white crops"* was gradually substituted in the place of fallows. This may be considered as a most important era in the science of agriculture. From this period it advanced with rapid strides, towards a state of comparative perfection. And it is only since that period, that agriculture has assumed the rank of an "exact science."

To comprehend fully the benefits of *rotation* in crops, it is necessary to understand the philosophical principles of agriculture, and to have some idea of the food or aliment of plants. "Comparatively speaking, very little was known of the ultimate general principles of agriculture until the splendid discoveries of chemistry had provided means of tracing them out. The laws of vegetation were entirely unknown, and the whole machinery of nature's kingdom was mysterious. The range of the farmer's calculations was limited to certain maxims—wise ones indeed—but few in number. It was known that some soils would produce one species of grain better than another, and that there was a vast difference in the vegetating power of soils. But there was the limit of knowledge; and these few truths only ascertained by simple experiment. Why these things were so, no one knew; and no one thought it possible to know. The want of general principles, of course, was universally felt; and to this want we must attribute many strange and ridiculous rules of farming, common even at this time, which we may well call the superstitions of agriculture; such, for instance as rules for sowing or reaping in a particular age of the moon, or day of the week."

"Chemistry has provided some general principles which will ultimately banish from the farmer's manual all these relics of a barbarous and ignorant age. The celebrated Sir Humphrey Davy has probably accomplished about all for agriculture, which well can be; and his lectures on this subject, should be familiar to every farmer who would know himself and would teach his children the real simple reasons why one system of farming is better than another."* In the application of *science* to agriculture, the first thing to be attended to is the soil. This is the basis of all agricultural pursuits. A thorough acquaintance with its "nature and uses" is essential to the successful operations of the husbandman.

All soils are composed of different species of earths, usually combined, not only with each other, but with sundry other substances, in a great variety of proportions. And upon these proportions depends, in a great degree, the adaptation of different species of agricultural products.

The usual earths, found in our soil, are the following: Silex, Lime and Alumina. These are usually found combined or mingled with each other, in different proportions. Silex, (sand) when uncombined with any other earth, is wholly incapable of sustaining vegetation. If some vegetables are occasionally found growing in pure sand, they are, probably, sustained by food derived from the atmosphere. But sand combined in due proportions, with Alumina, (clay) is found to constitute a very valuable soil. Clay, of itself, though more capable than sand of sustaining vegetation, is known to be but slightly adapted to that purpose. Yet when these two earths are combined, in proper proportions, they form a soil well adapted to many agricultural products. Thus it is shown by the Cultivator for January, 1838, that by the simple process of hauling upon a soil, naturally very sandy, from fifty to one hundred loads of clay per acre, a product of corn was secured, from one hundred and ten to one hundred and eighteen bushels per acre. It is probable, however, that in the soil, thus so greatly fertilized, there was contained a portion of lime and vegetable matter. But the great yield obtained in this instance, is doubtless to be attributed chiefly to the simple addition of clay to the other ingredients in the soil.

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*Farmers' Guide, p. 29. Since the publication of the Farmers' Guide, vast improvements in agricultural Chemistry have been made by Sprengel, Liebig, Johnston, and other eminent chemists.

The other earth (lime) is not what is usually called by that name, the quick lime, obtained by burning limestone. This is a product of art and not of nature. The limestone itself, when disintegrated, is what constitutes this earth. In this state it is combined with a large quantity of carbonic acid and water. These two ingredients constitute about half its original weight. In this state it is the most useful of all the earths, in forming a good soil. It is the abundance of this substance, in the rich limestone region of the west, and particularly in Kentucky, coupled with a large quantity of vegetable matter which renders our lands so extremely fertile.

The earths mentioned above, are usually described as *unorganized* substances. They are always found combined, in greater or lesser proportions, with *organic* or vegetable and animal matter. And it is to these substances that the earths, especially the two former, are chiefly indebted for their fertilizing qualities. One of the principal ingredients in all vegetables, is carbon. And as lime (I use the term in the sense explained above) contains a large quantity of carbon, in a state of combination, it follows that it must afford a considerable quantity of *food* to all vegetables, provided they are capable of extracting it from its state of combination with the earth of which it forms a component part. There is no doubt vegetables do possess this power. It is one of the properties of the *living principle* in all vegetables, to be capable of decompounding compound substances, and absorbing such of the compound parts as are suitable food to accelerate their growth.* It is by this principle vegetables are enabled to evolve carbon and water from calcarious earths; and as lime, when deprived of a portion of its carbon and water, has a powerful affinity for these substances, it will attract them from the atmosphere, and other surrounding substances, and thus be enabled to furnish a constant supply of food to all kinds of vegetables.

But although vegetables have the power to decompose lime, and appropriate one of its components as food for their sustenance, yet this power can be exercised only when other substances are present to aid in carrying out the process. Water

*Conversations on chemistry, p. 279–80.

is the great *solvent* by which vegetables are enabled to absorb the substances which constitute their appropriate food. Hence, during a very dry season, the crops suffer greatly, not because nature has not supplied the appropriate aliment for their sustenance, but because the necessary *solvent* is not present, in sufficient abundance, to enable them to appropriate to their use the food, which nature has provided for them. If the rain is superabundant, the solvent may exist in too large a proportion, and thereby weaken the aliment, and render it less nourishing.

Organic matter, when reduced to its primary elements, exists in a liquid or gaseous state, and will readily combine with water or the atmosphere, and may thus be absorbed by all vegetable substances, by means of their roots and leaves. The earths are of a more solid nature, except the carbon of lime, and seem not susceptible of being absorbed to any considerable extent so as to constitute a part of vegetable growth.*

But though incapable, in themselves, (except lime) of furnishing any considerable aliment to support vegetable growth, they are the principle *media* through which food is furnished; and their greater or less *adaptation* for this purpose assists in constituting what is called *fertility* or *poverty* of soil. I say principle *media*, because it is well known that the atmosphere is also a *medium* through which plants are furnished with aliment by means of the absorbing power of their leaves.

I have been thus particular in showing how carbon constitutes food for vegetables, not because it is the only source of supply, but because the remarks made, on this subject, will serve to illustrate what may be said in relation to other substances, which enter into the sustenance of vegetables.

It was supposed, in the time of Lavoisier, that the elementary principles of all vegetable substances were oxygen, hydrogen and carbon, and that animal substances, in addition to these, contained nitrogen and phosphorus. But more modern chemists have discovered, in both vegetable and animal substances, a variety of compounds, such as lime, potash, phosphorus, sulphur, and the oxides of various metals. It has been

*Some vegetables are found to contain, in combination, a small portion of the silex.—*Farmers' Guide*, p. 31.

supposed, "that the food of plants is, when consumed, either pure carbon or some gaseous compound of carbon."* But this cannot be correct. It is reasonable to infer that the elementary principles of all the substances mentioned above, as found combined with vegetable substances, should constitute a part of their food.† As the black mould of the rich Kentucky soil is composed of vegetable and animal decompositions, it must contribute largely towards the sustenance of vegetation. It is upon this principle, also, that all manures contribute to the fertilization of the soil. They are composed chiefly of ingredients, which constitute the proper food of plants, and consequently must facilitate their luxuriant growth. Some manures, such as "quick lime," are valuable, in consequence of their aiding in the decomposition of vegetable matter. Others, because they assist in extracting from the atmosphere elementary principles, which serve as aliment for plants. Such, perhaps, is plaster of Paris, (sulphate of lime.)‡

The productiveness or unproductiveness of the soil depends upon the elements of its composition. If those elements abound, which afford the *pabulum* or food necessary for the particular crop, which is intended to be grown upon the soil, it may be expected that the crop will flourish and yield abundantly. If there be a scarcity of the elements, which furnish the peculiar or appropriate food for the intended crop, the yield will be proportionably small. But though a particular soil may be deficient in the elements suitable to one crop, it may abound in those which furnish the appropriate *pabulum* for another. Hence it is necessary that there should be a fitness or adaptation of the soil to the particular vegetable or

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*Farmers' Guide, p. 40.

†The investigations of a succession of able chemists, have abundantly proved the truth of this suggestion. Besides the *organic* substances, which furnish appropriate food for vegetables, the following *inorganic* substances have been found in the ash of plants, and consequently constitute a part of their food. Potash, Soda, Lime, Magnesia, Alumina, Silica, Sulphuric acid, Phosphoric acid, Chlorine, Oxide of iron, and Oxide of Manganese. These are not *all* found in *the same plants.*—Johnstone's lectures on the organic elements of plants, part II, p. 318–323.

‡Since this essay was written, Liebig's valuable work on organic chemistry has been received. He explains, in a very satisfactory manner, how plaster of Paris (sulphate of lime) operates as a manure. I have noticed his views, on this subject, in the essay on the system of agriculture, best adapted to Kentucky."

crop which is to be grown upon it. Again, a soil may possess an abundance of those elements, which are suitable for the food of a particular vegetable or other crop, but by growing the same crop, for a succession of years, upon the same ground, the *pabulum* most appropriate for such crop, may become so much exhausted as to furnish only a *stinted* supply to it, and hence its produce will be small. The elements suitable for a different crop may, however, exist in abundance; and hence the advantage, and in some instances, the absolute necessity for a *rotation* in crops. The correctness of these principles will be illustrated by the observations of every intelligent farmer. The same vegetable may be seen to flourish a number of years, and then gradually give way to some other vegetable growth. And again, *that* will be succeeded by another, perhaps the former one again. The same ground will not furnish the appropriate food, and in suitable quantity, to flax, two years in succession,* whilst hemp may be grown on the same ground a number of years, with little or no deterioration. Even timber, of a particular kind, after a long succession of years, will give way to another growth of trees. Thus even our forests are compelled to yield to the great law of nature, that no soil can sustain, in a flourishing condition, any vegetable production when it shall cease to contain, in sufficient abundance, those elementary principles and combinations of matter, which constitute the appropriate food for such vegetable."†

The above extract, coupled with the remarks heretofore made, will, perhaps, be sufficient to show the philosophical principles upon which a *rotation* in crops is founded. But agriculture is a practical science, and the surest test of utility is *actual experiment.* On this subject we have the benefit of many experiments, made in the most accurate and careful manner, which clearly demonstrate the great importance and value of *a good system of rotation in crops.* We are perhaps, indebted more to the celebrated Arthur Young, for experiments on this subject, than to any other man. Although, from climate and other causes, the agriculture of England dif-

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*For flax and oats will burn the tender field,
And sleepy poppies harmful harvests yield.—1 *Georgics.*

†Report of the committee on Education, to the Senate of Kentucky, session 1838–9.

fers very much from ours, yet we may derive much valuable information from experiments made in that country, in relation to *rotation in crops.* The following experiments, made by the distinguished agriculturalist mentioned above, show, in a very striking manner, the great difference in *value* between a *good* and a *bad system* of rotation.

These experiments were made with great accuracy and attention, "upon a soil of the sandy loam kind, incumbent upon a wet clay marl bottom, rendered dry by means of previous hollow draining, and of the annual value of fifteen shillings the acre, broken up from the state of grass under which it had been for a great length of time, and ploughed into ridges in contrary directions, each succeeding year, no manure being applied except in *particular lands or ridges in the fourth year.*"

"The crops, in the whole of the thirty-six courses, were reaped and threshed directly, distinct from each other to obviate the danger of mixing and errors, and are minuted accurately to save the trouble of calculation. In the valuation all the straw is valued at ten shillings per acre, and the crops are likewise estimated—that the fluctuatious of price may not affect the general conclusions—the turnips at 4 s. a ton, carted off; cabbage at 5 s; wheat 5 s. a bushel; barley 2 s. 6d; oats 2 s. 3d.; beans 3 s.; potatoes 6 d." No part of the crops was *consumed on the ground.* Each course ran through six years, yielding a *crop each year.*

1st. COURSE.*		£.	s.	d.
1 Beans	3 qrs. I bushel	4	5	0
2 Turnips	8 tons 6 cwt.	1	13	0
3 Wheat	2 qrs. 5 bushels	5	15	0
4 Potatoes	234 bushels	5	17	0
5 Beans	3 qrs.	4	2	0
6 Wheat	3 qrs. 3 bushels	7	5	0
		28	17	0
Average,		4	16	2

2nd COURSE.		£.	s.	d
1 Beans	3 qrs. 1 peck	4	2	9
2 Cabbages	6½ tons	1	12	6
3 Wheat	2 qrs. 5 bushels	5	15	0
4 Cabbages	7 tons	1	15	0
5 Beans	3 qrs. 7 bushels	5	3	0
6 Wheat	3 qrs. 3 bushels	7	5	0
		25	13	3
Average,		4	5	6½

*There are some slight errors in the *figures*, in some of the courses of experiments, but they exist in the work from which I copy, (Reese's Cyclopædia.) I have corrected such as are evidently typographical, and which do not affect the general results of the calculations. The others, being *unimportant* and not susceptible of correction, without changing *in a slight degree*, the calculations and general results, I have not attempted to correct them. It will be recollected, that eight bushels of 70 lbs. each make a quarter, and that in the valuations of the crops, ten shillings per acre are added for the straw of the wheat, barley, oats and beans.

3d COURSE.

			£.	s.	d.
1	Beans	3 qrs. 1 bush. 1 p'k.	4	5	9
2	Potatoes	150 bushels	3	15	0
3	Wheat	2 qrs. 2½ bushels	5	2	6
4	Cabbages	5½ tons	1	7	6
5	Beans	3 qrs. 5 bushels	4	17	0
6	Wheat	3 qrs. 1 bushel	6	15	0
			26	2	9
	Average,		4	7	1½

4th COURSE.

			£.	s.	d.
1	Beans	3 qrs. 1¼ bushels	4	5	9
2	Beans	4 qrs. 2 bushels	5	12	0
3	Wheat	2 qrs. 3½ bushels	5	7	6
4	Cabbages	6½ tons	1	12	6
5	Beans	4 qrs.	5	6	0
6	Wheat	3 qrs. 1 bushel	6	15	0
			28	18	9
	Average,		4	16	6½

5th COURSE.

			£.	s.	d.
1	Beans	3 qrs. 2 bushels	4	8	0
2	Barley	3 qrs. 1 peck	3	10	7
3	Wheat	2 qrs. 2 bushels	5	0	0
4	Barley	2 qrs. 2 pecks	2	11	5
5	Beans	2 qrs.	2	18	0
6	Wheat	I qr. 7 bushels	4	5	0
			22	13	0
	Average,		3	15	6

6th COURSE.

			£.	s.	d.
1	Beans	3 qrs. 1 bush. 1½ p'k	4	5	5
2	Wheat	2 qrs. 7 bushels	6	3	0
3	Wheat	1 qr. 6 bushels	4	0	0
4	Wheat	2 qrs. 2½ bushels	5	2	6
5	Beans	1 qr. 7 bushels	2	15	0
6	Wheat	1 qr. 4 bushels	3	10	0
			25	15	11
	Average,		4	6	0

7th COURSE.

			£.	s.	d.
1	Beans	3 qrs.	4	2	0
2	Turnips	4 tons	0	16	0
3	Beans	5 qrs. 2 bushels	6	16	0
4	Potat's.	234 bushels	5	17	0
5	Beans	3 qrs.	4	2	0
6	Wheat	3 qrs. 4 bushels	7	10	0
			29	3	0
	Average,		4	17	6

8th COURSE.

			£.	s.	d.
1	Beans	3 qrs. 1 bushel	4	5	0
2	Cabbages	6 tons	1	10	0
3	Wheat	3 qrs.	6	10	0
4	Cabbages	6½ tons	I	12	6
5	Beans	4 qrs. 2 bushels	5	12	0
6	Wheat	3 qrs. 6 bushels	8	0	0
			27	9	6
	Average,		4	11	7

9th COURSE.

			L.	s.	d.
I	Beans,	3 qrs.	4	2	0
2	Potat's	147 bushels	3	13	0
3	Beans	4 qrs.	5	6	0
4	Cabbages	6½ tons	1	12	6
5	Beans	4 qrs. 3 bushels	5	15	0
6	Wheat	3 qrs. 5 bushels	7	15	0
			28	0	6
	Average,		4	13	5

10th COURSE.

			L.	s.	d.
1	Beans	3 qrs.	4	2	0
2	Beans	4 qrs.	5	6	0
3	Beans	4 qrs. 6 bushels	6	4	0
4	Cabbages	8½ tons	2	2	6
5	Beans	4 qrs.	5	6	0
6	Wheat	4 qrs. 1 bushel	8	15	0
			31	15	6
	Average,		5	5	11

11th COURSE,

			L.	s.	d.
1	Beans	3 qrs. 1 peck	4	2	9
2	Barley	4 qrs. 7 bushels	5	7	6
3	Beans	4 qrs.	5	6	0
4	Barley	5 qrs. 4 bushels	6	0	0
5	Beans	4 qrs. 1 bushel	5	9	0
6	Wheat	3 qrs. 1 bushel	6	15	0
			33	0	3
	Average		5	10	0

12th COURSE.

			L.	s.	d.
1	Beans	3 qrs.	4	2	0
2	Wheat	2 qrs. 6 1-2 bushels	6	2	6
3	Beans	3 qrs. 2 1-2 bushels	4	9	6
4	Wheat	3 qrs. 3¾ bushels	7	8	9
5	Beans	3 qrs.	4	2	0
6	Wheat	3 qrs.	6	10	10
			32	14	9
	Average,		5	9	1

13th COORSE.

			L.	s.	d.
1	Turnips	3 tons		12	0
2	Turnips	5 1-2 tons	1	2	0
3	Oats	9 qrs.	8	12	0
4	Potat's.	252 bushels	6	6	0
5	Beans	3 qrs. 1 bushel	4	5	0
6	Wheat	3 qrs. 3 bushels	7	5	0
			28	2	0
	Average,		4	13	8

14th COURSE.

			L.	s.	d.
1	Turnips	3 tons		12	0
2	Cabbage	6 tons	I	I0	0
3	Oats	I0 qrs. 5 I-2 bus.	I0	2	4
4	Cabbage	8 tons	2	0	0
5	Beans	3 qrs. 5 bushels	5	I7	0
6	Wheat	3 qrs.	6	I0	0
			26	II	4
	Average,		4	8	6

I5th COURSE.

			L.	s.	d.
1	Turnips	3 I-2 tons		I4	0
2	Potat's.	I54 bushels	3	I7	0
3	Oats	8 qrs. 5 I-2 bushels	8	I	II
4	Cabbages	8 tons	2	0	0
5	Beans	3 qrs. 5 bushels	4	I7	0
6	Wheat	3 qrs. I bushel	6	I5	0
			26	4	II
	Average,		4	7	6

I6th COURSE.

			L.	s.	d.
I	Turnips	3 tons		12	0
2	Beans	4 qrs.	5	6	0
3	Oats	8 qrs. 7 bushels	8	9	9
4	Cabbages	6 tons	I	I0	0
5	Beans	3 qrs. 6 bushels	5	0	0
6	Wheat	3 qrs. 2 bushels	7	0	0
			27	I7	9
	Average,		4	I2	II

17th COURSE.

		L.	s.	d.
1 Turnips	3 1-2 tons		14	0
2 Barley	5 qrs. 1 peck	5	0	7
3 Oats	5 qrs. 5 bushels	5	11	3
4 Barley	4 qrs.	4	10	0
5 Beans	3 qrs.	4	2	0
6 Wheat	2 qrs.	4	10	0
		24	7	10
Average,		4	1	3

18th COURSE.

		L.	s.	d.
1 Turnips	3 tons		12	0
2 Wheat	2 qrs 7 bushels	6	5	0
3 Oats	4 qrs. 6 1-2 bushels	4	16	1
4 Wheat	2 qrs. 3 bush. ½ peck	5	5	4
5 Beans	2 qrs.	2	18	0
6 Wheat	1 qr. 7 bushels	4	5	0
		24	1	5
Average,		4	0	2

19th COURSE.

		£.	s.	d.
1 Potatoes	106 bushels	2	13	0
2 Turnips	4½ tons		18	0
3 Potatoes	136 bushels	3	8	0
4 Potatoes	198 bushels	3	19	0
5 Beans	2 qrs.	2	18	0
6 Wheat	1 qr. 6 bus.	4	0	0
		18	18	0
Average,		3	2	8

20th COURSE.

		£.	s.	d.
1 Potatoes	105 bushels	2	12	6
2 Cabbages	5 tons	1	15	0
3 Potatoes	110 bushels	2	15	0
4 Cabbages	4 tons	1	0	0
5 Beans	2 qrs. 2 bus.	3	4	0
6 Wheat	2 qrs.	4	10	0
		15	16	6
Average,		2	12	9

21st. COURSE.

		£.	s.	d.
1 Potatoes	104 bushels	2	12	0
2 Ditto	126 bushels	3	3	0
3 Ditto	97 ditto	2	8	6
4 Cabbages	3 tons		15	0
5 Beans	1 qr. 7 bus.	2	15	0
6 Wheat	1 qr. 4 bus.	3	10	0
		15	3	6
Average,		2	10	7

22d. COURSE.

		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Beans	3 qrs.	4	2	0
3 Potatoes	142 bushels	3	11	0
4 Cabbages	5 tons	1	5	0
5 Beans	2 qrs. 4 bus.	3	10	0
6 Wheat	2 qrs. 1 bus.	4	15	0
		19	13	0
Average,		3	5	6

23d. COURSE.

		£.	s.	d.
1 Potatoes	101 bushels	2	10	6
2 Barley	4 qrs. 7 bus.	5	7	6
3 Potatoes	127 bushels	3	3	6
4 Barley	3 qrs. 2 bus.	3	15	0
5 Beans	2 qrs. 7 bus.	3	19	0
6 Wheat	2 qrs. 5 bus.	5	15	0
		24	10	6
Average,		4	1	9

24th. COURSE.

		£.	s,	d.
1 Potatoes	100 bushels	2	10	0
2 Wheat	2 qrs. 1 bus.	4	15	0
3 Potatoes	104 bushels	2	12	0
4 Wheat	2 qrs.	4	10	0
5 Beans	2 qrs. 2 bus.	3	4	0
6 Wheat	1 qr. 6 bus.	4	0	0
		21	11	0
Average,		3	11	10

25th COURSE.

		£.	s.	d.
1 Potatoes	98 bushels	2	9	0
2 Turnips	4 tons	0	16	0
3 Cabbages	5½ tons	1	7	6
4 Potatoes	270 bushels	6	15	0
5 Beans	2 qrs. 2 bus.	3	4	0
6 Wheat	2 qrs. 2 bus.	5	0	0
		19	11	6
Average,		3	5	3

26th COURSE.

		£.	s.	d.
1 Potatoes	101 bushels	2	10	6
2 Cabbages	6 tons	1	10	0
3 Ditto	5½ tons	1	7	6
4 Ditto	3 tons	0	15	0
5 Beans	2 qrs. 6 bus.	3	16	0
6 Wheat	2 qrs. 2 bus.	5	0	0
		14	19	0
Average,		2	9	10

27th COURSE.

		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Ditto	115 bushels	2	17	6
3 Cabbages	3½ tons	0	17	6
4 Ditto	3½ tons	0	17	6
5 Beans	2 qrs. 2 bus.	3	4	0
6 Wheat	2 qrs.	4	10	0
		14	16	6
Average,		2	9	5

28th COURSE.

		£.	s.	d.
1 Potatoes	96 bushels	2	8	0
2 Beans	3 qrs. ½ peck	4	2	4
3 Cabbages	6½ tons	1	12	6
4 Ditto	4 tons	1	0	0

		£.	s.	d.
5 Beans	2 qrs. 2 bus.	3	4	0
6 Wheat	2 qrs. 3 bus.	5	5	0
		17	11	10
Average,		2	18	7

29th COURSE.		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Barley	4 qrs. 7½ bu.	5	8	9
3 Cabbages	4 tons	1	0	0
4 Barley	4 qrs. 1 bus.	4	12	6
5 Beans	3 qrs.	4	2	0
6 Wheat	2 qrs. 6 bus.	6	0	0
		23	13	3
Average,		3	18	10

30th COURSE.		£.	s.	d.
1 Potatoes	99 bushels	2	9	6
2 Wheat	2 qrs. 7 bus.	6	5	0
3 Cabbages	4½ tons	1	2	6
4 Wheat	3 qs. 6 b. 1½ p.	8	1	6
5 Beans	2 qrs. 6 bus.	3	16	0
6 Wheat	2 qrs.	4	10	0
		26	4	6
Average,		4	7	5

31st. COURSE.		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Turnips	4 tons	0	16	0
3 Turnips	5 tons	1	0	0
4 Potatoes	288 bushels	7	4	0
5 Beans	3 qrs.	4	2	0
6 Wheat	2 qrs. 7 bus.	6	5	0
		21	17	0
Average,		3	12	10

32d. COURSE.		£,	s.	d.
1 Potatoes	101 bushels	2	10	6
2 Cabbages	5 tons	1	5	0
3 Turnips	4 tons	0	16	0
4 Cabbages	4 tons	1	0	0
5 Beans	3 qrs.	4	2	0
6 Wheat	2 qrs. 6 bus.	6	0	0
		15	13	6
Average,		2	12	3

33d. COURSE.		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Potatoes	112 bushels	2	16	0
3 Turnips	4 tons	0	16	0
4 Cabbages	4½ tons	1	2	6
5 Beans	2 qrs. 5 bu.	3	13	0
6 Wheat	2 qrs. 3 bu.	5	5	0
		16	2	6
Average,		2	13	9

34th. COURSE.		£.	s.	d.
1 Potatoes	98 bushels	2	9	0
2 Beans	3 qrs. 1 p'k	4	2	9
3 Turnips	4 tons	0	16	0
4 Cabbages	5½ tons	1	7	6
5 Beans	3 qrs.	4	2	0
6 Wheat	2 qrs. 6 bu.	6	0	0
		18	17	3
Average,		3	2	10

35th COURSE.		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Barley	4 qs. 6 b. 3 p.	5	6	10
3 Turnips	4 tons	0	16	0
4 Barley	4 qrs.	4	10	0
5 Beans	3 qrs.	4	2	0
6 Wheat	3 qrs.	6	10	0
		23	14	10
Average,		3	19	1

36th COURSE.		£.	s.	d.
1 Potatoes	100 bushels	2	10	0
2 Wheat	2 qrs. 6 bu.	6	0	0
3 Turnips	4 tons	0	16	0
4 Wheat	2 q. 7 b. 2½ p.	6	8	0
5 Beans	2 qrs. 6 bus.	3	16	0
6 Wheat	2 qrs. 6 bus.	6	0	0
		25	10	0
Average,		4	5	0

The annexed table will show, at a single glance, the general results of the course of experiments detailed above, and will aid the reader in comprehending the remarks I shall make upon them. It must be recollected these experiments were all carried on together and completed in the course of *six years*. Something must be allowed for the more or less favourableness of the season. This may be judged of with some degree of accuracy, by comparing the product of the same crop, (potatoes for instance,) in the different years. Thus their product for the *first year*, (when they could not be affected by any previous crop,) was about 100 bushels per acre. Their product the *second* year, rose to 150 bushels and upwards. This might have been owing, in part, to a better season, and in part to the grass sod having become decomposed. The fourth year, though preceded by three other crops, was larger than any of the preceding. Thus in No. 1, 7, 13, 25, 31 the product in that year was, respectively, 234, 234, 252, 270 and 288 bushels per acre. On the other hand in course 19, the product of potatoes for the same year was only 198 bushels. But this crop was preceded by two other crops of potatoes and one of turnips, which considerably reduced the product. The 19th course clearly shows that the fourth year must have been favorable to the potatoe crop. The first year of that course produced 103 bushels, the second 4½ tons turnips, the third 136 bushels of potatoes, and the fourth, though preceded by three other crops, 193 bushels.

The annexed table shows the average value of each course of crops; and the number of crops respectively of wheat, barley, oats, beans, turnips, potatoes and cabbages, also the average product of wheat in each course.

No.	Average Value.			Wheat crops.	Barley crops.	Oat crops.	Beans.	Turnips	Potatoes	Cabages	Average wheat per acre
1	4	16	2	2			2	1	1		24
2	4	5	6	2			2			2	24
3	4	7	1½	2			2		1	1	22
4	4	16	6¾	2			3			1	22¼
5	3	15	6	2	2		2				16½
6	4	6	0	4			2				16⅓
7	4	17	6	1			3	1	1		28
8	4	11	7	2			2			2	30
9	4	13	5	1			3		1	1	29
10	5	5	11	1			4			1	33
11	5	10	0	1	2		3				25
12	5	9	1	3			3				24⅔
13	4	13	8	1		1	1	2	1		27
14	4	8	6	1		1	1	1		2	24
15	4	7	6	1		1	1	1	1	1	25
16	4	12	11	1		1	2	1		1	26
17	4	1	3	1	2	1	1	1			16
18	4	0	2	3		1	1	1			19
19	3	2	8	1			1	1	3		14
20	2	12	9	1			1		2	2	16
21	2	10	7	1			1		3	1	12
22	3	5	6	1			2		2	1	17
23	4	1	9	1	2		1		2		21
24	3	11	10	3			1		2		15⅔
25	3	5	3	1			1	1	2	1	18
26	2	9	10	1			1		1	3	18
27	2	9	5	1			1		2	2	16
28	2	18	7	1			2		1	2	19
29	3	18	10	1	2		1		1	1	22
30	4	7	5	3			1		1	1	23
31	3	12	10	1			1	2	2		23
32	2	12	3	1			1	1	1	2	22
33	2	13	9	1			1	1	2	1	11
34	3	2	10	1			2	1	1	1	22
35	3	19	1	1	2		1	1	1		24
36	4	5	0	3			1	1	1		22½
				55	12	6	59	18	36	30	768*

*Average wheat crop per acre, 21⅓ bushels.

Some reflections upon the foregoing experiments of Mr. Young, may not be out of place. It will be observed that the "white crops," (wheat, barley and oats,) compared with the "green crops," (beans, turnips, potatoes and cabbages,) as shown by the foregoing table, are as 73 to 143, about one to two; and that the wheat crops average a fraction over one and a half in each course of six years. The average product of wheat per acre, in the entire thirty-six courses, is $21\frac{1}{3}$ bushels. This average, it is obvious, was considerably reduced by too large an introduction of the potatoe crop. Thus from No. 19 to 25 two or more potatoe crops were introduced into each course; and during those seven years the wheat crop averaged only $16\frac{1}{4}$ bushels per acre. If those years be left out the average will be nearly twenty-three bushels. Considering that the soil was inferior, many of the rotations not of the best kind, and that no manure was applied, this is certainly a very good average. The remarkable manner in which the land preserved its fertility in the more favorable *rotations* shows clearly the great advantages resulting from *system* in agricultural pursuits. English writers are of opinion that potatoes are a very exhausting crop. The facts exhibited in Mr. Young's course of experiments fully sustain that opinion. I refer particularly to No. 21, 24, 27, in each of which two or three crops of potatoes were introduced, with decidedly deteriorating effects.

Cabbages are also thought to be somewhat exhausting *when not fed upon the ground*, but not so much so as potatoes. Their influence may perhaps be seen in the 26, 27 and 28 courses, though undoubtedly the smallness of the crop of wheat in those courses should, in some degree, be ascribed to the potatoe crop. No. 2, 8, and 14 would seem to indicate that cabbages are not an exhausting crop. They are certainly not so, when fed upon the ground on which they grew.

Wheat is allowed by all writers, to be a very exhausting crop, and therefore, should not be admitted more than twice in a course of six years, where it is necessary to renovate an exhausted soil, or to keep one of medium fertility in good heart. But if the soil be fresh and naturally very fertile, three crops in six years, may be admitted, if the *residue* of the course be judicious. Wheat was admitted *three times* in five of the above thirty-six courses, and the average per acre in the order of production was as follows: No. 12, 24¾ bushels; No. 30, 23 bushels; No. 36, 22½ bushels; No. 18, 19 bushels; and No. 24, 15⅔ bushels. The average of the whole product of wheat in the five courses was 21 bushels per acre nearly, which is less than the average of the whole 36 courses, though many of them were evidently bad. The *best* of the five courses (No. 12,) was composed of beans and wheat alternately. The product in wheat was an average of 24⅔ bushels in this course, and the aggregate value of all the crops was £5. 9s. 1d., which is greater than the aggregate value of any of the thirty-six courses, except the eleventh, which exceeded it only 11d. The smallest product in the courses having three crops of wheat, was the 24, which averaged only 15⅔ bushels. This course had *two* crops of potatoes and only one of beans, another proof of the exhausting nature of the potatoe crop. The above table suggests another remark in relation to those courses in which three crops of wheat were admitted. It is that the diminution in quantity of the third crop of wheat (unless counteracted by favorable circumstances) shows the exhausting nature of that crop, and that considerable deterioration takes place by repeating it too frequently. No. 12, it is true, shows no diminution; but in this course each of the wheat crops was preceded by a crop of beans, the most favorable of all the crops to precede wheat. In the 36 course the *third* wheat crop was just equal to the *first,* but the latter was preceded by a *potatoe crop,* and the former by *beans.* In the other courses in which three crops of wheat were introduced (No. 24, 18 and 30) the falling off of wheat was very remarkable, producing in those years only 14, 15 and 16 bushels respectively. Upon examining the other crops in those courses it will be seen they were not such as to aid in keeping the soil in heart for a third wheat crop.

An inspection of the preceding courses will show that beans are a remarkably good preparatory crop for wheat. Thus in the following courses in which two or more bean crops were introduced, to wit: No. 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 16, the wheat crops averaged from 22 to 23 bushels. On the other hand No. 5 and 6 having each two bean crops, produced a small yield, which may readily be accounted for from the circumstances of *these courses* each containing *four* grain crops.

It has already been remarked that *alternate* crops of beans and wheat, as exhibited in No. 12, answer remarkably well. The 30th course shows the effects of an *alternation* of potatoes, *cabbages* and beans with wheat. The 36th of potatoes, *turnips* and beans. And the 24th of potatoes, *potatoes* and beans with the same crop. It will be seen upon examination, that these *rotations* become worse and worse, in the order stated, whether regard be had to the value of the *aggregate* crops, the *product* of the wheat, or *deterioration* of soil.

Turnips have a good effect in ameliorating the soil and preparing it for other crops, but the turnip crop itself is of no great value, (see courses No. 13, 14, 15, 31.) It is is but slightly exhausting and if the turnips be fed off on the ground on which they grew, would tend to fertilize the soil. The same remark is true as to cabbages. Some idea of the *comparative* value of cabbages and turnips may be formed from the following facts. In the 36 courses of Mr. Young's experiments, there were 30 crops of cabbages which *averaged* 5 tons 9 cwt. There were 18 crops of turnips which averaged 4 tons 3 cwt. According to the price which Mr. Young puts upon these two articles, the value of the *average* crop of the former would be £1 7s. 3d., of the latter 16s. 7d. The value of the cabbage crop would therefore exceed that of turnips sixty-six per cent. But it must be recollected these experiments were made in a climate very different from ours. To test their relative value here, experiments should be instituted upon our soil and in our climate. In relation to all the experiments, the same fact must be kept constantly in view. Although they will not apply in all their circumstances to our soil and climate, yet they furnish many facts and useful hints that will be of great benefit to the judicious agriculturist. These experiments moreover demonstrate the importance, nay the indispensable *necessity* of a judicious system of *rotation in crops*, in order to preserve the fertility of the soil. The particular *kind of rotation* suitable to our soil, climate and circumstances, will be examined in the progress of this essay.*

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*In the foregoing essay I have spoken of manures losing a part of their valuable ingredients by *evaporation*. This term is not appro-

The following rules have been laid down in relation to a system of rotation of crops, for different soils, which it is important to attend to.

1. "For the best sorts of land, alternate green and white crops."

2. "For those of *full medium* quality, *three* green crops for *two* of the grain or white kind."

3. "For *ordinary* land, two of the green for one of the corn kind."

Besides the green crops introduced into the several rotations adopted by Mr. Young, in his valuable experiments, clover, tares, cole, vetches, peas, rye grass, rye, carrots, beets, parsnips, &c., have also been admitted in the English agricultural system. But it will be unnecessary for me to go farther into the subject at present, as I shall have occasion to revert to it when I come to treat of Kentucky husbandry.

Next to the introduction of the system of *rotation in crops*, the improvement of the cattle and sheep stock of England was the most important step towards the improvement and perfection of her system of agriculture. Without these her green crops could not have been *consumed* nor her lands *manured*. And without improving *her breeds* of cattle and sheep she could scarcely have justified the cost of raising and fattening them for consumption. Hence the system of alternate "white and green crops," and of improving her breeds of cattle and sheep mutually encouraged and sustained each other.

Among the many distinguished Englishmen who entered zealously into the system of improving their breeds of cattle and sheep, there is no one, perhaps, who deserves more credit than the late Mr. Robert Bakewell, of Dishley.

There are a variety of breeds of cattle in England which have obtained considerable repute. I will not attempt to enu-

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priate to convey the idea intended. By the decomposition of animal and vegetable substances, ammonia and other gases are formed, which can exist only in the gaseous state, unless some other substance is present with which they are capable of combining, and forming fixed salts. If no such substance be present, they will escape in the form of gas, and be entirely lost.

The late work of Liebig, on organic chemistry, has thrown much light on the subject of preserving manures from loss by the escape of carbonate of ammonia and other gases. The method of accomplishing this important object is explained, in the essay, on the system of agriculture, best adapted to Kentucky.

merate the whole of them but briefly refer to some of the most distinguished. The following have acquired considerable note. The *long horned* or Lancastershire breed; the *middle horned*, the *short-horned*, the *north Devons*, and the *Alderny*.

"It was from the midland long-horned breed of neat cattle, that the late Mr. Bakewell selected the stock for his great improvement in these animals."

Much attention had been previously paid in procuring and introducing the best cow stock of this sort by others, "and it was by selecting from these that Mr. Webster constituted the noted Canley stock." From cows of this sort and Westmoreland bulls, Mr. Bakewell commenced his improvement, and "by breeding repeatedly from *the best of the same kind*, constantly choosing individuals with the roundest forms and smallest bones, he produced *that variety* which has since acquired so high a character for their fattening property." This variety is what is called the Dishley or New Leicester breed, and is said to be principally calculated for the purpose of the grazier, while the original long-horns have preserved their superiority for the pail."

The middle-horned breed are said, by Mr. Culley, "to be found in the greatest purity and of the best kind in the vicinity of Barnstable. These are of a high red color," and are considered impure if they have any white about them; "they are thin skinned and silky in handling, feed at an early age, or arrive at maturity sooner than most other breeds. They are well fitted for the draft both as to hardiness and quick movement, and their shoulder points are beautifully fitted for the collar." Lord Somerville states that this breed "stands the confessed favorite or among the very first at Smithfield, where prejudice cannot find the way."

The *short-horned* or Holderness breed are supposed to have been originally imported from Holland, and are still called, in some places, the Dutch breed. They were *originally* a coarse breed of cattle, and not estimated so highly as many other breeds. Mr. Donaldson says "they are not so well adapted for the cart or plough as the middle-horned sort, and considering their size and the quantity of food they devour, it is probable, he thinks, that they are inferior to any of the above mentioned." Mr. Donaldson further remarks that "a number of eminent breeders have lately embarked in the laudable undertaking of improving the short-horned breed; and from their knowledge, assiduity and exertions much may be expected." Mr. Lawrence says "we took the coarse, square, Dutch, beefy breed as the basis of this species." That "the extreme coarseness and size of the northern short-horns led, he thinks, to the introduction of Norman or Alderny bulls at some period of the 18th century." He supposes that "there never was a more fortunate cross, as in no other country exists so excellent a breed of cattle, including all the useful properties. In one, perhaps the most important respect, great milking, they are (says he) superior and even without a rival. Their beef is finer than the old short-horned breed, and they fatten much earlier and quicker, carrying still a vast depth of natural flesh, and tallowing within the first degree." He further remarks that "there seems but one respect in which they are, in any considerable degree, inferior to any breed which can be named, which is fineness of flesh. In that particular they, it is obvious, can never equal certain other breeds without the entire overthrow of their Dutch basis, by a repetition of the Norman or some other cross, which would go to destroy the present superior breed."

Mr. Culley observes that "the short-horned breed of cattle differs from the other breeds in the shortness of their horns, in being wider and thicker in their form or mould, consequently feeding to the most weight, in affording by much the greatest weight of tallow when fattened, in having very thin hides and much less hair upon them than any other breed except the Alderny; but that the most essential difference, he thinks, consists in the quantity of milk they give, beyond any other breed, there being instances of cows of this breed giving thirty-six quarts per day, and of forty eight firkins of butter being made from a dairy of twelve cows, but the more general quantity is three firkins per cow, in a season, and twenty-four quarts of milk per day. The great quantity of milk, thinness of their hides and little hair are, he says, probably the reasons why they are tenderer than all the other kinds except the Alderney."

It is remarked by the author of the "Treatise on live stock," that "in comparing the breeds of long and short-horned cattle, he long-horns *excel* in the thickness and firm texture of the hide, in the length and closeness of the hair, in their beef being finer grained, and more mixed and marbled than that of the short-horns, in weighing more in proportion to their size, and giving richer milk. But they are *inferior* to the short horns in giving a less quantity of milk, in weighing less upon the whole, in affording less tallow when killed, in being generally slower feeders, and in being coarser made and more leathery or bullish on the under side of the neck. In a few words, says he, the *long-horns excel* in the hide, hair, and *quality* of the beef, the *short-horns* in the *quantity* of the beef, tallow, and milk."

Mr. Lawrence, in his "treatise on cattle," remarks that "the red cattle of North Devon and Somerset are, without doubt, one of the *original* breeds and one of those which has preserved most of its primitive form. The excellence of this breed for labor is best proved by the fact that the fashionable substitution of horses has made no progress in the district of these cattle, by their high repute as feeders, and for the superior excellence of their beef, which has been acknowledged for ages."

It was remarked by Mr. Bakewell "that the Devonshires could not be improved by any cross with other breeds." But it is suggested by Mr. Lawrence that "by a proper selection from their own stock, they might be bred somewhat more square and substantial, without at all detracting from their delicacy, show of blood or speed. Their laboring powers might be thus increased and their quantity of beef, without either debasing its fine qualities or rendering necessary a larger portion of keep." It is added, that "these cattle have generally, for a a century past, commanded the best price at Smithfield."

"It is stated that the Devonshire variety of this breed are the quickest working oxen in this country, and will trot well in harness, in point of strength they stand in the fourth or fifth class." As milkers they are inferior "to both the long and short-horns, in quantity and quality of milk," and "are certainly no objects for the regular dairy."

The Alderney or French breed of cattle it is stated by the author of the "treatise of live stock," is mostly to be met with about the seats of our nobility and gentry, upon account of their exceedingly rich milk." This breed "are very fine boned in general, light red or yellow in color, and their beef generally yellow or very high colored, though very fine in the grain and well flavored." They are represented to be very tender and not capable of enduring the climate of the northern parts of England.

There are several varieties or mixtures of the foregoing breeds, that have gained considerable celebrity. Among these are the Teeswater, (a variety of the *short-horns*) Suffolk duns, and Herefords. The latter are a variety of the "*middle-horns*." According to Mr. Marshall "they have the *countenance*, pleasant, cheerful, open; the *forehead* broad; *eye* full and lively; *horns* bright, taper and spreading; *head* small; *chap* lean; *neck* long and tapering; *chest* deep; *bosom* broad and projecting forward; *shoulder-bone* thin, flat, no way protuberant in bone, but full and mellow in flesh; *chest* full; *loin* broad; *hips* standing wide and level with the spine; *quarters* long and wide at the neck; *rump* even with the general level of the back, not drooping nor standing high and sharp above the quarters; *tail* slender and neatly haired; *barrel* round and roomy; the carcase throughout deep and well spread." Mr. Lawrence says "of late years considerable coarseness of bone has been observed in the best Hereford cattle, a circumstance which is of trifling importance as they have proved themselves of such superior excellence, that no possible cross could probably improve them." It is further added "that breeders should reflect on the importance of preserving the old blood in a state of as great purity as possible, as they possess for some purposes, the most valuable breed of cattle in the kingdom, and have been very judicious and fortunate in nicely blending the elements of such a variety."

It is proper to remark that the writers on English cattle, from whom I have quoted, are not of very modern date, and that improvements have doubtless been progressing since the period in which they wrote. But it is a matter not only of curiosity but of real utility to learn the progress of improvement and the means by which it has been carried on so successfully. What can be more interesting and *encouraging* to eminent breeders of fine cattle than to learn that our present highly improved and invaluable breed of short-horned Durhams, derived their origin from "the coarse, square, Dutch, beefy breed, which devoured so much food as to render them inferior to most of the improved breeds of cattle in England?" Nothing more clearly shows the great benefits which must continue to result from *care* and a proper exercise of *skill* in the rearing of all kinds of stock.

The great improvements of the breeds of English cattle, next to a selection and judicious crossing of a good stock, is obviously to be ascribed to *good keeping* and *protection from the weather.* And these again are due to the *system* of rotation of *green and grain crops.* While the system of summer fallowing was in use, the best lands produced only one crop in two years. This practice is now wholly abandoned, and green crops are universally substituted in the place of summer fallow, to prepare the ground for a grain crop. And as most of the soils in England require two green to one grain crop, to keep them in a proper state of fertility, it follows that a great quantity of the finest succulent food must be annually raised for their cattle and sheep stock.

Cattle stock should receive the greatest attention and the utmost care during the period when they can have no benefit from the natural pastures, both as regards feeding and protection. The *residue* of the year they wlll need only an abundance of rich pasture and a plentiful supply of salt. Water of course is indispensably necessary.

Mr. Donaldson says that young cattle "during the first winter are almost always housed." And Mr. Marshall informs us that it "is a maxim pretty generally adopted among good farmers, to keep their *young stock* as well as they can the *firs t winter.*"

I have hitherto confined myself to a description of the most noted breeds of English cattle. I must now speak of the introduction of the improved breeds of cattle into Kentucky. It is due to the spirited and enterprising gentlemen by whom this great benefit has been conferred upon our state, and the western country generally, to give as full an account of their efforts as the materials within my reach will enable me to do.

It is stated in the Farmer's Guide, that Mr. Patton, of Virginia, about the year 1782 "purchased an imported bull of the long horned or beef breed, from which, with the common cows of the country, the owner and his neighbors bred. *A few years afterwards,* Mr. Patton obtained a full blooded bull and cow of the *short-horned or milk breed.* Some time after this, Mr. Miller, also of Virginia, imported a bull of the beef breed and a cow of the milk breed, and afterwards purchased an imported bull of the milk breed. The first English cattle brought to Kentucky were from Patton's stock, and were a cross of *the beef and milk breed*, and this cross constitutes the basis of most of the English cattle now in that state."

Mr. Benj. Harrison, a grand-son of Matthew Patton, Sr. gives a more minute and correct account of the introduction of the first English Cattle into Kentucky. He says "that some two or three Mr. Pattons, the sons, and a Mr. Gay, the son-in-law of Matthew Patton, Sr., brought some *half-blooded English Cattle*, (so called,) a bull and some heifers, as early as 1785 or thereabouts." These cattle, he says, "were from the stock of Matthew Patton, Sr." Mr. Patton emigrated to Kentucky about the year 1790, and "brought with him some six or more cows, calves of the long-horned bull before mentioned." This bull Mr. Patton had purchased of a Mr. Gough, of Maryland, an importer of British cattle. Mr. Harrison personally knew the cows mentioned above. "They were large, somewhat coarse and rough, with *very long horns*, wide between the points, turning up considerably, their bags and teats very large, differing widely in appearance from the long horned stock of the importation of 1817." From this description it would seem that the first cattle imported into Kentucky of Mr. Patton's stock, could not have been "a cross of the *beef and milk breed*," as stated in the Farmer's Guide. This work is quite indefinite as to the *time* when Mr. Patton "obtained a full blooded bull and cow of the short-horned or milk breed." It is probable the allusion is to the bull and heifer which Mr. Harrison speaks of as follows: "About the year 1795, Matthew Patton, Sr. procured from the before mentioned *Gough*, through his son William Patton, a bull called *Mars* and a heifer called *Venice*, both of which were sold by Gough as full blooded English cattle, but like the importation of 1817, they had no other pedigree." As Mr. Harrison had the best opportunity of knowing the facts in relation to these cattle, by frequent intercourse and conversation with his grand-father, Matthew Patton, Sr., I must conclude, contrary to the statement of the Farmer's Guide, that the first cattle brought to

Kentucky by the sons and son-in-law, and by Mr. Patton himself, were only *part-blooded* and had *no mixture* of short-horn or milk breed. From Mr. Harrison's description, *Mars* and *Venice* were probably of the short-horned breed, and the first of that description of cattle introduced into Kentucky.* *Venice* produced two bull calves by *Mars*, and then died. One of these was taken to Ohio, near Chillicothe, by William Patton, and was probably the first introduction of the improved breed into that state. The other remained in Jessamine county, in this state, being the property of Roger Patton. *Mars* continued in the possession of Matthew Patton, Sr. till his death, in 1803, and was purchased at the sale of his estate, by a Mr. Peoples, who soon after removed to Montgomery county, where *Mars* shortly after died.

Many bulls, of the half blood, by *Mars*, remained; and served to improve considerably, the native breeds of the neighborhood. Mr. Harrison adds, that the produce of *Mars* by a cross "on the half long-horned cows," brought to Kentucky by Matthew Patton, Sr., "would be considered good even at this day."

Having traced the origin of the *Patton stock*, I will now notice that which is commonly called the *Miller stock*.

In the year 1803, "Daniel Harrison, (the father of Benjamin Harrison,) James Patton and James Gay, purchased of Mr. Miller, of Virginia, who was an importer of English cattle, a two year old bull called *Pluto*, who certified that he was got by an imported bull and came out of an imported cow, but gave no other pedigree. *Pluto* was a dark red or brindle, and when full grown, was the largest bull, (says Mr. Benjamin Harrison,) I have ever seen, with an uncommonly small head and neck, light, short horns, very heavy fleshed, yet not carrying so much on the most desirable points as the fashionable stock of the present day, with small bone for an animal of his weight."† *Pluto* "was bred upon the cows produced by the Patton bull *Mars*, which, (says Mr. Harrison,) produced stock that has been rarely excelled in all the essential qualities of the cow kind. They were unquestionably the best *milkers*

*See Mr. Harrison's account of the introduction of English cattle into Kentucky, Franklin Farmer, Vol. II, No. 25.

†See Mr. Harrison's account before referred to.

that have ever been in Kentucky, taken as a stock, in the general, and but little inferior in point of *form*, to the most approved stock of the present day, and of *greater size*." About the year 1812, Pluto was taken to the state of Ohio, and died shortly afterwards.

About the year 1810, Capt. William Smith, of Fayette county, purchased of the same Mr. Miller the bull called *Buzzard*. He is represented by Mr. Harrison to have been very large, (taller than Pluto but not so heavy,) but coarse. The produce of *Buzzard* was not held in high repute, on account of coarseness, and the disinclination to early maturity." The sire of *Buzzard* was the same as that of Pluto, "but came out of a different cow."

About the year 1813, Mr. Inskep brought with him from Virginia, a large bull of the *Miller and Patton stock*, called *Inskep's brindle*. Mr. Harrison represents him to have been large and coarse, and as a mixture of the long and short-horned breed.

About the year 1814, Messrs. Hutchcraft and Welten procured from Ohio a large bull called *Shaker*. Mr. Harrison says this bull "was a descendant of Mr. Miller's stock, but not by Miller's imported bull."

I have now given as full an accouut of the introduction of the Miller stock, as my information will enable me to do. That and the Patton stock previously introduced, had doubtless a considerable effect in improving the native breeds, in the several neighborhoods to which they were brought, whence they spread to some extent into various other counties. The author of this essay procured a pair of this stock, which were raised by Col. Danialson, of Clarke county, many years ago. They were what were called the *milk breed*. Their horns were of a medium length, and were no doubt a mixture of the long and short-horned breeds, the blood of the latter predominating. They proved to be excellent *milkers*.

Mr. Daniel Harrison, (says Mr. B. Harrison,) about the year 1814, "procured a bull and heifer from a Mr. Ringold, an importer of English cattle, either of Maryland or Virginia." This was probably Mr. Samuel Ringold of Washington county, Maryland. The author of this essay was well acquainted with Mr. Ringold, and knows that he was a breeder of the improved English cattle, but he was too young to have his attention drawn sufficiently to the subject to be able to say what particular variety he cultivated. Mr. Benjamin Harrison says these cattle were called the *Carey Cattle*. "They were pied, red and white, were rather small, light fleshed, raw boned stock, and had no claims to merit, only for milking qualities." The year 1817 is an important era in relation to the introduction of English cattle into the state of Kentucky.

During that year Mr. Lewis Sanders, then of Fayette county, imported, directly from England, "four short-horned bulls, four short-horned cows, two long-horned bulls and two long-horned cows."* These all arrived in the United States, but one of the short-horned cows died in the state of Maryland, the balance safely reached the state of Kentucky. One of the short-horned bulls was sold to Gen. Tho. Fletcher, of Bath county, "another was taken to the southern part of the state by Mr. Tegarden, and sold by him to the Shakers, who took him to the Wabash country, leaving in the neighborhood of Lexington, Tecumseh and San Martin bulls, and Mrs. Moote, the Durham cow, and the Teeswater cow. From these five animals (says Mr. Sanders,) have mainly sprung the stock of 1817. Mr. Sanders continued to breed from this stock for a number of years, and is of opinion that they rather declined, which he attributes to his breeding too long in the same family. In 1831 "he procured a bull and three cows from Col. Powel's celebrated stock; crossing these with the stock of 1817, was highly beneficial, (which says Mr. Sanders) has been continued with singular advantage. The cattle obtained by Mr. Sanders from Col. Powell were accompanied by regular pedigrees, and hence their blood could be traced, in the English herd book. But those imported in 1817 were without pedigrees, and consequently could not be traced back, by record evidence, to the *improved* short-horned breed.

Mr. James Prentice, of Lexington, shortly after Mr. San-

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*See Mr. Sanders' report on cattle, Franklin Farmer extra, April 29, 1840. The Farmer's Guide, page 150, states that these cattle were imported by *Lewis Sanders, William Smith, and William H. Tegarden.* This is an error, occasioned probably from the circumstance of Mr. Smith and Mr. Tegarden having become interested in the cattle after they were imported, or while on their way to the United States.

ders' importation of 1817, imported two short-horned bulls, which were also without regular pedigrees.

Shortly after the return of the Hon. H. Clay from Ghent, where he acted as one of the embassy for treating of peace with Great Britain, he imported from England some beautiful Hereford cattle, then esteemed by many as superior to the short-horned Durhams. This breed is still preferred by some to the short-horns, but the latter, in public estimation, has greatly taken the lead, and is now the fashionable stock of the day.

Subsequent to these importations many enterprising gentlemen entered, with spirit, into the importation of cattle from England, with the view of giving to the west all the advantages of the most perfect breed. Among those who engaged in this highly useful undertaking were the Hon. H. Clay and his son H. Clay, Jr., Walter Dun, and Samuel Smith, of Fayette county; Dr. Martin, of Clarke, Lewis Shirley of Jefferson, Jefferson Scott and Letton and Fisher, of Bourbon; the Lexington and Fayette importing company, and the Ohio importing company. There were other gentlemen engaged in the praiseworthy undertaking of improving our cattle stock, but my information will not enable me to designate them by name. One of the most recent importations was of seven short-horned Durhams by Walt and Beggs, of Louisville, in February, 1840.

The importations made as above, have laid the most ample foundation for an excellent breed of cattle. All that is now requisite to perpetuate their good qualities is *good keeping* and suitable *protection* during the winter months, and the exercise of *due care, skill* and *judgment*, in crossing different breeds, so as to improve and not deteriorate the stock we now have. Much injury may result from injudicious crossing of different races of cattle. In general, it is most safe to cross only with the most perfect in form of the *same race*, and none but the most skilful breeders should attempt to improve a stock already good, by crossing them with a different breed. By breeding only *from the best of the same kind*, constantly selecting those of the most *perfect form*, and that produce the *greatest abundance and richest milk*, the breeder will be sure not to deteriorate his stock.

Next to cattle, sheep are the most important stock, with a view to preserve and improve the fertility of the soil, and to renovate that which has been exhausted by bad husbandry. I deem it necessary, therefore, to appropriate a part of this essay to sheep husbandry. England is quite as celebrated for her breeds of sheep as cattle. They may be divided into the long and short wooled kinds. Of the former, the most noted are the following, and they stand, in point of size, in the order named.

1.	Teeswater—wethers weighing, per quarter, at two years old,		30
2.	Lincoln,	do.	25
3.	Dartmoor or Bampton	do	25
4.	Cotswold,	do	24
5.	New Liecester,	do	22
6.	Romney marsh,	do	22

These bear fleeces from 8 to 11 pounds, in the yolk. The Lincolns bear the heaviest. The Teeswater, Cotswold and Dartmoor wethers average nine pounds each, and the New Liecester and Romney marsh eight pounds. These breeds all bear very coarse wool, which forty years ago, sold in England at 10d sterling (20 cents.) Of the short wooled kinds of native sheep, the most noted are the Ryelands and Southdowns. Southdown wethers average, at two years old, eighteen pounds per quarter, the Ryelands only 14 at 3½ years old. They are a small race of sheep, but bear finer fleeces than any of the native sheep of England. The Southdowns are the next finest. Their wool, at the period above mentioned, was worth two shillings and four pence sterling, (56 cents,) and their fleeces average about three pounds.

The Teeswater are the largest race of sheep in England, and are prevalent also "in the rich, fine, fertile, enclosed lands on the banks of the Tees, in Yorkshire." They are supposed to have sprung from the Lincolns, being an improvement of that stock, as regards size, with little attention to the quality of the wool. They are said to be "a breed only calculated for warm, rich pastures, where they are kept in small lots, in small enclosures, and well supported with food in severe winter seasons."

The Lincolns of the improved breed are said to be "*among* the best, if not *actually* the best long wooled sheep in England." The flavor of the Lincoln mutton is superior to that of Dishley; and is a great favorite at Smithfield. Their wool is from ten to eighteen inches long, but very coarse, being only fit for combing.

The New Leicester or Dishley is an improved breed of sheep, which, according to Mr Culley, "is readily distinguished from the other long wooled sorts, by having fine lively eyes, clean heads, without horns, straight, broad, flat backs, round or barrel shaped bodies, fine small bones, thin pelts, and a disposition to make fat, at an early age." Mr. Culley adds his testimony in favor of the "superiority in the fineness of the grain and flavor of the mutton, to that of the other sheep *of the long wooled kind.*" But upon this point other authors do not concur. The author of the "treatise upon live stock," says the New Leicester mutton is the most *finely grained* of all the large *long wooled species*, but of a flavor *bordering on the insipid.*" Mr. Livingston in his admirable essay on sheep, speaking of Mr. Bakewell's improvement of the Dishley stock, says he was of the opinion "that fat upon the rump and ribs was more important than tallow, and accordingly he produced sheep, on which it is *there found* five or six inches thick." He further remarks that "his sheep are, on that account, less valuable to the epicure than the laborer, with whom they, in some sort, supply the place of pork."

The wool of this breed is "the shortest and finest of the *combing wools*, the length of the staple being six or seven inches."

The late Mr. Robert Bakewell originated this improved variety, and it is supposed the base of the improvement was a cross between the Lincolns and Ryelands, the latter giving fineness to the wool and grain of the mutton. This breed is admitted "to be the most perfectly formed, and consequently more disposed to fatten quickly, and to contain a much larger proportion of meat, on an equal weight of bone." They are said also to be more disposed to fatten "than other breeds of the *same size of carcass*;" but are alleged to be objectionable because of their "fattening too much, and the mutton, in consequence becoming less delicate in its flavor than other breeds that require a greater length of time in the process."

The Cotswold variety are also of the finer species of combing wool, and, like the New Leicesters, are said to have derived this feature from a cross with the Ryelands.

The Romney marsh's are a large breed, carrying wool suitable for combing, of rather a fine quality. They acquire their name from the marsh on which they are chiefly raised, and are said to be well adapted to be "fattened on the rich kinds of marsh pasture, and on those which extend from Hastings to Rye, in Kent." The author of the "synopsis of husbandry," says that "a convincing proof of the great value of this breed of sheep, as well as of the land on which they are fed, is that from six to eight wethers may be fattened per acre.

This breed would be a valuable variety, for the flat and marshy lands which prevail in many parts of the north western states, and which are also found in some places on the borders of the Ohio and other rivers of Kentucky.

The Dartmoor or Bampton variety are prevalent in the districts from which they derive their name. The length of their wool is about the same as of the Romney marsh sort. These breeds have been improved by a cross with the New Liecester, which it is said, "will in some situations bring forward wethers at twenty months old, weighing twenty-two pounds the quarter, with a shear of eight pounds of yolk wool to the fleece." The mutton is said to be of good quality. It should be remarked that in England all the *large breeds of* sheep are raised chiefly *for the mutton*, and that wool is only a *secondary* object. The following statement will give a pretty correct idea of the usual price of mutton in England.

Mr. Dawson, of Berthorp, in the year 1796, sold two hundred *two shear* wethers, (two and a half years old) at three pounds sterling round. And the average of his sales for the six preceding years were as follows: 1790, 35 s.; 1791, 35 s.; 1792, 43 s.; 1793, 38 s ; 1794, 44 s.; 1795, 50 s. These were New Leicesters, which had been twice sheared. If each sharing produced eight pounds, (a large allowance for young sheep) the wool at 10d, would have yielded 13s. 4d. or six and eight pence per annum. But the average of the sales of each wether during the seven years was 43s. 7d. Thus the amount received for mutton was six and a half times as much, *annually*, as was received for wool It will be perceived that the price of mutton gradually rose from 35s. to 60s. At the latter rate, the *mutton* produced *annually*, nine times as much as the annual produce of wool. The contrast between the wool and mutton, of the larger breeds, such as the Teeswater, Lincoln, Bampton and Cotswold, would be still more remarkable. It should also be recollected that since the year 1796, all kinds of meat have risen, whilst coarse wool has remained about stationary,* and consequently that, at this time, the disparity between the price of wool and mutton would be still greater than it was in 1796.

I desire that these circumstances may be borne in mind, when I come to treat of fine wooled sheep and of the sheep husbandry of Kentucky.

Of the various native breeds of *fine wooled sheep* in England, I propose to speak only of the Southdowns and Ryelands. The latter were formerly held in high repute, in consequence of their extreme fineness of wool, but since the introduction of the Spanish merinoes, (1792) which far excel the Ryelands in fineness of staple, they have in some measure, lost their former high reputation. They are, however, considered an excellent stock on which to cross the merino breed. The half bloods from this cross, produce a fleece, it is said, averaging five pounds in the yolk, and worth 3s. sterling, (72 cts.)

The Southdowns are next to the Ryelands, as regards firmness of wool. Mr. Culley describes this variety "as having no horns, grey faces and legs, fine bones, long small necks, and rather low before, high on the shoulders, and light in the fore quarters, sides good, loin tolerably broad, back bone rather high, thigh full, twist good, mutton fine in grain, and well flavored, wool short, very close and fine, in the length of the staple from two to three inches, weight per quarter of wethers, at two years old, eighteen pounds. This breed prevails "on the dry chalky downs, in Sussex, as well as in the hills of Surry and Kent," It is said to have been "much improved, recently, both in carcass and wool, being much enlarged forward." They are considered as an excellent sort for less

*Mr. Livingston, in 1810, sixteen years after the above date, states the price of Teeswater, Lincoln, New Leicester, Cotswold, Bampton, and Romney marsh, at one shilling per pound. Since that period, it is believed it has again fallen, at least to its former price, 10d. See his essay on sheep, p. 100.

fertile and hilly pastures, as feeding close." They are "hardy and disposed to fatten quickly." They come quickly to maturity, the wethers "being seldom kept longer than two years old, and often fed at eighteen months." They are also "capable of travelling well, and of resisting the effects of exposure to cold." The celebrated Mr. Coke, now Lord Leicester, is said to have the best and finest Southdowns in England.

An English writer comparing the Southdowns and Norfolks, (a very noted breed of the fine wooled sort) says "in short, the leading characteristics of the high aud full bred Norfolk and Southdown sheep seem, upon comparison, to be chiefly these, the wool of both is found to be of the first clothing *quality*, but the larger *quantity* is produced by the Southdowns; the mutton of both is equally delicious. But the quiet, gentle Southdowns, in the pasture, must be opposed to the wild, impatient ramblings of the Norfolk, whose constant exercise not only excites continual appetite, but at the same time occasions a considerable waste in the pasture, by treading down and unnecessarily spoiling a great deal of food they do not eat."

It is further remarked that "the hardiness ot the Southdowns, *enduring wet and cold lodging* and a greater degree of *abstinence and fatigue* than the Norfolk, in the fold, is a superiority of much moment, and only to be equalled by another which they possess, in a very superior degree, which is that of doing well upon coarse and sour pastures. It is added "that the Southdowns, compared with the Norfolk, are equally good turnip sheep; and for every possible purpose, whether for their flesh, for their wool, for breeding, for folding, or for the butcher, they demand a *less supply of food* and of an *inferior quality* to that which, in every situation, would appear indispensable to the well doing of the Norfolks."

The foregoing statements and facts present a very favorable view of the Southdown variety of sheep. But their merits are still more strongly sustained by a course of experiments, made by the Earl of Egremont to test the relative value of the New Leicester, Southdown, Romney marsh and some half bloods, being a cross of the New Leicester and Southdowns. It would occupy too much space to give the whole course of his experiments in detail, but the following is the substance of them: In the month of August he put in the same enclosure, wether lambs of the preceding spring, as follows: 17 Southdowns, 19 New Leicester, 12 half bloods, a cross of the New Leicester and Southdown, and 7 Romney marsh. They were all kept alike till June of the following year, when 12 of the Southdowns and all the half bloods were found in marketable condition; and the former were sold at 34s. and the latter at 33s. sterling. None of the New Leicesters or Romney marshes were in marketable condition. This experiment shows the superiority of the Southdowns and half bloods, where it is desirable to sell at an early age.

A part of each kind was kept over for further experiment, and it was found that between June and the 7th of September, (ten weeks,) the Southdowns had gained 13 per cent; the New Leicesters 21 per cent; the half bloods 13 per cent, and the Romney marshes 14 per cent. Here was a gain of 8 per cent. by the New Leicester and 1 per cent by the Romney marshes over the half bloods and Southdowns. This is naturally to be accounted for so far as relates to the Southdowns, from the circumstance of the two sorts, which had gained, being of a larger breed than the Southdowns. It will be recollected that the New Leicester wethers, at two years old, weigh 22 pounds to the quarter; the Romney marshes 25, and the Southdowns only 18. They were now (7th September) about one and a half years old, and consequently it was to have been expected that the *larger breeds*, which had fallen back during the winter, should increase more rapidly during the summer, than the smaller ones, in order to attain their appropriate weight at two years old. They were weighed again the 1st of December following, when the Southdowns had lost 3 per cent., the New Leicesters 2 per cent., the half bloods 4 per cent., and the Romney marshes had gained one third of one per cent. All the sorts, it will be observed, must have continued to gain for some time after the 7th of September, and the larger breeds, for the reasons before stated, must have gained more rapidly than the smaller ones, till winter set in. At this period all would begin to loose, and the loss exhibited above *was not the whole loss.* What had been gained between the 7th September and the period at which they began to fall off, should have been added. If these circumstances be taken into consideration, this experiment would be very favorable to the Southdowns; but the next experiment is still more decisive in their favor. They were weighed again the first of March following, when it was found the Southdowns had lost, between the first of December and first of March, four per cent., the New Leicesters 14 per cent., the half bloods 10 per cent., and the Romney marshes 5 per cent. During the second as well as during the first winter, the Southdowns exhibited a decided advantage over the New Leicesters. The Romney marshes, it will be seen, stand upon almost as good a foundation as the Southdowns, and did much better than the New Leicesters.

The next experiment shows, that from the first of December to June 19th the Southdowns gained 13 per cent.; the New Leicesters 9 per cent; the half bloods 9 per cent., and the Romney marshes 17 per cent. Here again the advantage is decidedly in favor of the Southdowns and Romney marshes.

The experiment was continued through the third summer, when, as might be expected, the New Leicesters again took the lead; and as the result of the whole experiment, it is stated "that the profit for two years and two months feed adding the value of the wool, was 5d and a fraction per week for the Romney marshes, and from 4d to 4½d for the New Leicesters, from the time of their being lambed. The former part of the experiment had shown that the Southdowns and half bloods, at the age of 64 weeks, gave 7d per week profit.

Thus it appears by a course of experiments fully and fairly made, by the Earl of Egremont, that the Southdowns, even for the purpose of mutton, are decidedly more profitable than the New Leicesters. And this result follows without allowing any thing for the *increased quantity of food* consumed by the New Leicesters, or for the *superiority of the mutton* of the Southdowns. It is a well established general principle, that the larger the animal the more food they will require. Here the Southdowns, the smaller animal, upon the same kind of keep, gave 7d profit per week, at the age of 64 weeks, whilst the New Leicesters, at the age of 113 weeks, gave a profit of only 4d to 4½d per week. The wool of the Southdowns is also more valuable. Those of a good quality will average three pounds, worth 2s 6d (60 cents) per pound, whilst the wool of the New Leicesters averaged (ewes and wethers) about seven pounds, is worth only 10d (20 cents.) The annual product of the wool of the Southdowns would be 180 cents, and of the New Leicesters only 140 cents.*

I have been induced to go into these details in relation to the merits of the New Leicester and Southdown sheep, and of the Romney marsh breed, in consequence of a strong impression having been made in this state, that the New Leicesters would be the best stock for us to adopt with a view to mutton and common clothing wool. I am decidedly of opinion that for *both purposes* the Southdown breed of sheep would be greatly preferable. The mutton of the latter, in point of flavor, is greatly superior, the wool is every way better adapted to clothing purposes, the sheep are hardier, thrive better in winter, and would suit admirably the hilly regions, which predominate in the eastern and south-eastern borders of the state of Kentucky. I am also of opinion that the Romney marsh breed would be finely adapted to the flat and marshey lands, which predominate in some of the new states, and which are also found on the borders of some of our rivers.

The New Leicesters will become valuable when we engage in manufacturing worsted, which will require combing wool, but in the meantime the best of our native breeds, improved by the introduction of the Southdowns and Merinoes, will be better adapted to our circumstances and our wants.

I have hitherto treated only of the native sheep of Great Britain. It is wonderful that a people, who paid so much attention to sheep husbandry, and who were so extensively engaged in the manufacture of fine wool, should so long have totally neglected to introduce the merino breed, confessedly the finest wooled sheep that existed any where in Europe. This was owing, perhaps, in part to their prejudices in favor of their own celebrated Ryelands and Southdowns, and in part to an opinion that the merinoes could not exist in the climate of England, or that if they could, they would so degenerate as to be less valuable than their own native sheep. It was imagined Spain "possessed some peculiar advantages of soil and climate, which it would be in vain to seek for elsewhere." And it was believed, says a British writer, "that the superior fineness of the Spanish fleeces was derived *entirely* from some peculiarity of the soil and climate." This opinion was so firmly fixed, says

*These estimates are made in reference to the English market.

the same writer, "that he who asserted the contrary, was regarded by agriculturists and clothiers as a speculative theorist, only deserving pity." Yet long anterior to the period when these *notions* were so strongly predominant in England, the merino breed had been introduced into Sweden. As early as 1739, "the Swedish government, for the promotion of this race, instituted a school of shepherds, under the direction of Mr. Alstrœmer (who first introduced the merino sheep into Sweden in 1723,) and public funds were appointed for granting premiums to those who sold rams of this breed." These premiums were continued up to the year 1792, when being no longer necessary, they were discontinued.

Merinoes were also introduced into Saxony as early as 1765, and they were attended to with such assiduity, skill and judgment, that the flocks of that country, in point of fineness of staple, soon came to excel the best Spanish merinoes.

These examples did not escape the notice of France. In 1776, this celebrated breed of sheep was introduced into that country by Mr. Traudain, intendant of finances, under the direction of the celebrated naturalist, D'Aubenton. This experiment succeeded so well as to convince the government, "that it was easy to introduce and preserve a race of sheep in France, producing superfine wool; and, in the year 1786, a selection of 376 rams and ewes, from the finest flocks in Spain, was made and were conducted, under the care of a mayor, to the farm of Rambouillet." It was not until after all these experiments, that an effort was made to introduce these celebrated sheep into England The first effort was made by individuals, in 1787, but the importation then made, attracted but little attention, and scarcely excited any interest. "The sheep, however, (says an English writer) *lived*, though treated in the English manner, and the wool *had not deteriorated*." These facts having proved that the merino race of sheep could be naturalized in Great Britain, the then reigning monarch, George III, in 1792, "obtained from the marquis of Campoalonjo, five rams and thirty-five ewes, of the Nigrette race."

It might have been supposed, now that the sovereign of the country had taken a personal interest in introducing the merino breed of sheep, that all prejudices against them would have subsided; but such was not the fact. "Although the wool was admitted to be equally fine, with the best wool imported from Spain," yet the manufacturers would not give the same price for it, "fearing that it might not prove equally good when manufactured;" and the king was compelled to have his wool manufactured on his own account, "to demonstrate its fitness for superfine cloth." So slow is the progress of *truth* in overthrowing *prejudice* and *error*.

The merits of the merino breed fully triumphed over all obstacles and are now deservedly held, in Great Britain, in the very highest repute, both as regards the pure breed and the crosses upon the best English stock. It has been ascertained that a cross of the *best* merino rams upon the finest Ryeland ewes, requires *five* crosses to produce as fine wool from the mixed breed as from the pure stock. Thus a cross upon the Ryeland ewes, bearing wool worth 3s. will produce a breed bearing wool worth 3s. 7d and each subsequent cross will add 7d to the value of the wool, so that after the *fifth* cross, the offspring will bear wool worth as much as the Spanish, that is 6s. per pound, provided the *rams and ewes* are of the *finest quality* at the *commencement of the cross*. This shows the error of the opinion, that the New Leicester, or any other of the coarse long wooled sheep, will furnish a good cross for the merino race.

Next to the Ryelands, Southdown ewes, of the finest quality, furnish the best cross of any of the native sheep of Great Britain.

The United States, not having commenced manufacturing fine wool, at the period when the merinoes were introduced into England, had not the same inducement to make an effort to naturalize that valuable race. But not long afterwards, Chancellor Livingston, our ambassador at the court of France, studying to promote the interests of his country, by all the means in his power, turned his attention to this subject, and in the year 1802, selected "two pair of the finest merinoes he could find," from the improved flocks of France, "and sent them over under the care of one of his own servants, intending to follow them by others."* These, says Mr. Livingston, "were the first ever imported into the United States."

*Livingston's essay on sheep, p. 9.

Shortly after this period, Col. Humphreys, of Connecticut, introduced, directly from Spain, a considerable number of this valuable race. These importations laid the foundation of the merino breed of sheep, which are now so numerous in the United States. They were first introduced into Kentucky by Mr. Seth Adams, in the year 1809. A small proportion only, of his flock were of the full bloods, the residue being the produce of a cross of the native sheep of the country. Shortly afterwards, Mr Prentiss, Mr. Lewis Sanders, and other spirited gentlemen, introduced a number of the pure blooded merinoes. In the year 1829, the Hon. Henry Clay imported from the western part of Pennsylvania, a flock of fifty full bloods, being a selection from one of the best flocks in Washington county. These, and other importations, have laid the foundation of the merino flocks in Kentucky, and nothing is now wanting, but sufficient attention and skill, in the management of our sheep husbandry, to secure to us a full participation of the great advantages which must accrue to the United States from the rearing of fine wooled sheep.

The political contests of the day and the selfish views of ambitious aspirants, may, for a time, depress the interests of agriculture and of *sheep husbandry* in particular, but it is impossible that this can continue to be the case for any great length of time. When we look at our present population and take into consideration the well established fact, that it increases in a ratio of thirty-three and a third per cent. every ten years; that our exports, except a single article, (cotton,) instead of increasing in a ratio with our population, is continually diminishing; when we see the results of our present system, (depending upon foreigners to manufacture for us what we could so easily manufacture for ourselves) a system encouraged and promoted by the legislation of the national government, to be periodical revulsions in trade of the most alarming and distressing character, arising, in a great degree, from our too extensive reliance upon foreigners to supply us with *clothing, blankets and other necessaries.* When we take a calm and dispassionate view of these and other kindred facts, it is impossible to come to any other conclusion than that our government will be compelled to abandon the absurd idea of entering into a free competition with nations who are so far in advance of us, in the perfection of their system of manufactures, and who, in consequence of the low price of labor, can alwsys break down and destroy our infant establishments, before they have acquired sufficient stability to enable them to compete with their foreign rivals. When we shall learn wisdom from experience, we shall be compelled (though perhaps not till after long and severe suffering) to do, as all wise nations have done before us, protect our *agricultural interests* by giving protection *to those who manufacture the raw products of our agriculture*. When this period shall arrive, our merino flocks, as well as those of other races, will be found to be of immense value, and of great importance to the general interests of the country. Wool to the amount of two hundred millions of pounds would be produced, (if due encouragement shall be afforded,) before our population shall have reached thirty millions, which will happen within the next twenty years; and in ten years thereafter, it will probably have reached forty millions.* What vast results, then, are to spring from a proper attention to sheep husbandry! How immensely will the wealth and comfort of our citizens be promoted, and the fertility of the soil increased by rearing and feeding 66,000,000 of sheep! But the direct advantages resulting from sheep husbandry, will not be all. Other agricultural pursuits will be greatly promoted first, by diverting a portion of agricultural industry from those branches, which have been pushed to too great an excess; and secondly, by the new

*The Albany Cultivator estimates the "number of sheep, in the wool growing states of the north, at 15,000,000." Supposing them to average three pounds per fleece, the clip of 1830 would be forty-five millions. From this fact it can scarcely be doubted the product of the whole United States, if sheep husbandry should be properly encouraged, would be 200,000,000 of pounds, when our population shall have reached 30,000,000. The following table shows the population of the United States under the different census', from 1790 to 1830, and what it would have been upon a ratio of increase of 33⅓ per cent. for each ten years. The first column shows the actual census, the second the estimated number, according to the above ratio.

1790	3,929,326	Estimated at 33⅓ for 10 years.
1800	5,303,666	5,239,101
1810	7,239,903	6,985,468
1820	9,625,734	9,313,957
1830	12,859,570	12,418,609

The above table shows the actual increase from the yeer 1790 to 1830, to be more than 33⅓ for each ten years. Allowing the increase to progress according to that ratio, we shall have in 1840, 17,146,093; 1850, 22,861,417; 1860, 30,481,903, and in 1870, 40,642,590.

market which will be furnished for agricultural products, by the numerous class of individuals who will be employed in manufacturing the immense quantity of wool, which the United States are capable of growing. Too much attention cannot be given to this important subject. Fine wool, as well as that of medium quality, (such as will be produced by the Southdowns and a merino cross upon that valuable stock,) and the product of our native flocks, will all be objects of much impertance. And when the manufacture of worsted stuff goods shall be extensively introduced, combing wool will also be in great demand.

Sheep husbandry is important for three purposes: 1 Wool; 2 Mutton and tallow; 3 As a means of manuring and fertilizing our soil. I have sufficiently treated of the two first; the third is too important to be passed over in silence. I have heretofore suggested that much manure may be saved by folding sheep of nights. It is doubtful, however, whether the injury to the health of sheep will not be too serious to justify that practice, in warm weather; but in cold frosty weather, folding of sheep of nights may be safely resorted to. But whenever the practice of folding, for a length of time, in the same place, is pursued, the pen should be kept well littered with straw, as well for the comfort of the sheep as with a view of increasing the quantity of manure.

It will be most convenient to have the sheep fold adjoining a shelter, under which the racks and troughs are placed. The shelter should be entirely open on one side, with a south or south-eastern exposure and enclosed on the opposite side, with a suitable building at each end, one for hay and the other for roots, for winter and early spring feeding, till the pastures are sufficiently advanced. It would be most convenient to have the sheep house and fold adjoining a meadow, on which the sheep should be suffered to range during the day. This will be beneficial to the health of the sheep, and their manure will not only be saved but distributed without the expense of hauling. With a view to a like saving of manure, during that part of the year in which the sheep are not folded of nights, they should be suffered to range, as far as circumstances will admit, upon grounds intended for future cultivation.

In England, it is a common practice to feed off their turnip crop to their sheep, upon the ground upon which it grew. This is done by enclosing a small space with hurdles, into which the sheep are put, and continued until they consume all the turnips growing within the enclosure; another space is then enclosed and fed off, and so on in succession till all are consumed. This is found to be a very convenient practice in England, as it saves labor, both in feeding and distributing manure, and might be adopted here with great advantage, if upon experiment, it shall be found, that the rutabaga will succeed well in our soil and climate, and is sufficiently hardy to stand our winters.

A species of cabbage that is sufficiently hardy to stand the winter in England, is frequently fed off to sheep, upon the ground upon which it grew, in the same manner as turnips; and it would be worthy of inquiry and experiment, whether cabbages suitable to our climate and soil could not be raised to advantage, for feeding sheep, during the short period we cannot furnish them with grass, or while the grass is covered with snow.

It is probable the sugar beet will be found to be a more valuable crop in our dry soil than any description of turnips.*

The latter are so subject to be destroyed by insects, when they first come up; and so liable to be injured by drouth, as to render them too uncertain to be relied upon as a crop for winter food for stock. The beet crop is much the less subject to injury from insects, and will probably be found more productive.†

*The rutabaga will not succeed if sowed the usual time we sow the common turnip for table use, (about the first of August,) because it will not have sufficient time to come to maturity. I have, this year, made an experiment to ascertain whether spring sowing or drilling, will not succeed better. In some rich meadow ground, prepared for beets, I planted, in drills, eight rows of rutabaga turnips, 150 feet long. The rows were two feet wide, and the seed dropped just one foot apart. They were planted on the 17th of April, and came up very well, but more than nine tenths of them were destroyed by some kind of insect. I replanted the turnips the same distance apart, on the 17th of June, when the ground was in fine order. They again came up very well, but were a second time destroyed in about the same proportion, as in the first instance. The whole were cultivated with the hoe. The season was favorable for both plantings, except that it was too wet to cultivate them well, but the first succeeded much the best. These averaged in weight, when topped, (in October,) about three and a half pounds. Those planted in June averaged only about one pound. Early planting would, therefore, seem to be best.

†At the same time that I planted eight rows of rutabaga turnips,

I have in a former part of this essay, suggested a plan of a sheep fold. I consider this so important in sheep husbandry, as to justify a more minute description of it. The following plan of a shed and sheep fold is recommended, as regards *economy, saving of manure,* and *shelter and protection* of the sheep. Let a shed be erected upon locust posts set firmly in the ground, fronting to the south or south-east, as nearly as convenient. The posts on the north side should rise about four feet above the ground, and he hewed on the inside so as to admit of being planked up. Those in the front range should be twelve feet above ground. The whole should be tenanted so as to admit of plates the whole length of the shed. The two ranges of posts should be eighteen feet apart, and the length in proportion to the number of sheep it is intended to shelter. The plates upon the two ranges of posts should be connected by rafters, well fastened with wrought iron spikes, or stout seasoned locust pins, and the whole covered as may be deemed most economical. At one end of the shed there should be a frame or log building, eighteen feet square, and about twelve feet to the roof, for holding hay. The gable end of this building should stand towards the shed, and should have a door or space cut out at each end; one for throwing hay to the sheep, should open under the roof of the shed, the other for introducing hay from the meadow or stack, as occasion may require. At the opposite end of the shed there should be a house for containing turnips or beets, of sufficient width so as to cover or

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(17th April,) as mentioned in the preceding note, I planted fifty-eight rows of sugar beets, the same length and distance apart. The ground and cultivation was the same as to both species of roots. The first planting of beets, (owing to their being followed by much cold rain or the seed not being good,) came up very badly, not more than one in fifty. I replanted forty rows on the 16th of May. And of the balance, by way of experiment, I planted a part on the first and a part on the eleventh of June. The season was favorable; (except that there was too much rain to cultivate the beets as they should have been,) and all came up well. Those planted on the 17th of April were the largest, and a row of these, replanted on the 17th of May, taking both plantings together, averaged three and a half pounds each. If none of the beets had been missing, there would have been at the rate of 21,780, (one for each two square feet,) per acre, making 76,230 pounds. Supposing one fourth to be missing, the product per acre would have been at the rate of 62,174 pounds. If the beets had been planted wider in the rows, and cultivated with the plough, I am of opinion the product would have been greater. The beets planted on the first and eleventh of June, were not near so large as the others. Early planting would seem, therefore, to be best.

enclose the end of the shed. This house should be constructed of a *double* pen of logs, with a space of eighteen inches between, and (with a view to economy,) carried up and covered in the usual manner of log cabins. The inside pen should be raised about seven feet, and should have some logs laid across to support some rails or rough plank. The space between the two ranges of logs should be well filled in with materials best calculated to prevent the roots from freezing. Charcoal will answer best, (if that be used, the space between the two ranges of logs might be reduced,) or bark from a tan yard, which has been used for tanning. If neither of these can be obtained conveniently, the interval might be filled with straw, which should be packed in very closely. Straw should also be stowed away, as closely as possible in the roof, so as to form a thick covering between the roof and the room in which the turnips or beets are to be preserved for winter use. This will be necessary to protect them from the extreme cold from above. There should be but one door-way, and that of convenient size for introducing the root crops; which, for convenience of feeding, should open under the shed. This door-way should have an internal and external door, the former a double one, opening against the two sides of the passage and the other opening externally. These doors should be made to fit very closely, and the space between should be lined on the sides with tongued and groved plank. As a greater security against the roots freezing near the door-way, the space between the two doors should be kept well filled with straw, during very cold weather. But in our ordinary winter weather this precaution would not be necessary. And hence the trouble of replacing the straw, after each time of entering the root house, would only be necessary when the weather is very cold. In ordinary weather the only precaution that would be necessary, would be to close the outside door before opening the one within.

It is essentially necessary to the preservation of roots, that they should have some air; and that the effluvia or evaporation, arising from them should have an opportunity of passing off. To accomplish this object, one or more flues should pass from the root house, through the roof, these may be made by nailing four plank together, about a foot in width, so as to form a tube or chimney about a foot in the clear. The lower end should terminate within the root department, and upper end pass through the comb of the roof. By permitting two of the planks of this chimney to rise eight or ten inches above the others, the top may be covered, so as to prevent the rain from descending the chimney. In very cold weather this flue should be closed, which may be done by a sliding door at the lower end, within the root house. In moderate weather the slider may be drawn out, and even in very cold weather the slider may be withdrawn for a few minutes, while engaged in taking roots from the house to feed. This will afford an opportunity for the effluvia to escape. It is injurious to keep roots too warm. To guard against this, the two doors of the entrance way should be kept open, or partly open, so long as the weather is not cold enough to endanger the freezing of the roots, nor will there be any necessity for straw between the two doors, until the weather shows indications of becoming very cold.

If it is desired to keep a great quantity of roots, the house may be enlarged by extending its length, as occasion may require; but in that case the number of flues ought to be proportionably increased.*

*In answer to a letter of inquiry as to the manner of preserving the root crop, during winter, in England, the Hon. Daniel Webster, who, in his late visit, obtained much useful agricultural information, says, "In the greater part of England the turnip is eaten where it grows, by sheep turned on to the land. In the north of England and Scotland, the turnips are often hauled or drawn, and covered with straw, in heaps, and fed to stock. They must not be kept too warm." In another part of his letter he remarks, "they must be covered up slightly in heaps, out of doors. Cellars in barns are too warm. Some, instead of putting them in heaps, lay them down separately, (tops on, roots cut off,) and cover them in that situation." In the plan recommended above, I have endeavored to avoid the inconvenience of saving the root crop by covering them with earth or straw, at a distance from the feeding place; and to preserve them during winter, where they will be easily and conveniently accessible. But care must be taken while securing them from frost, to give them air, and not keep them too warm. We must recollect that the climate of England is very different from ours. Mr. Webster observes, "there is little frost in England, though much wet." Hence a different mode of preserving the root may be necessary, and experience must settle the question as to what is the best mode. I have no doubt, that a house constructed as above directed, will be warm enough to preserve the roots from freezing. And by keeping the doors and flues open, except in freezing weather, and then closing them, and partly or entirely (according to the degree of cold) closing the flues, I am of opinion the danger from the want of air, and from too much warmth, may be guarded against. I would suggest, as another precaution, that the inner folding doors may each have an aperture of convenient size, with a sliding plank, As the shed will be supported by a house at each end, it will require no braces. It should be planked up close in the rear, and on the inside of the posts, to prevent the manure bursting them off. The front should be planked from the plate on the outside of the posts, to within five or six feet of the ground to prevent snow from so readily blowing under. In front of the shed there should be an enclosure sufficient to prevent dogs from entering the fold, and of a size suitable to the number of sheep to be protected. There should be a gateway leading to the meadow or other ranging ground, for the convenient admission, and turning out of the sheep, when about to fill the racks and to place food in the troughs. The ground should be so situated as to carry off the drainage from the back part of the shed, and, if necessary, the floor should be somewhat raised with dirt, so as to keep it dry. At the end next the hay house, there should be two ranges of racks for hay, with a space of eight feet between them, and the inner one so far from the enclosed part of the house as to allow the sheep convenient room for feeding, and passing in the rear of those standing at the racks, say about four feet. My racks are thus constructed. I have timbers hewed out about forty feet in length, three inches thick, and twelve or fourteen inches wide. These are bored, in a straight line, near each edge, entirely through, with an inch and a half auger, the holes being from five to five and a half inches from centre to centre, for the purpose of inserting rounds, shaved out for the purpose. The holes have such an inclination as will make the rounds stand out at the top, so as to be about two and a half feet wide in the clear, while at the bottom they will be about eight inches apart. The rounds may be inserted when perfecly green, but care should be taken to have them so tapering at the end as that they may be driven a little deeper as they become loose by seasoning. They will need nothing more to keep them firmly in place, but occasionally to drive them further in the holes as they become loose by seasoning. The upper end should be left square, and of full size. The rounds should be three feet

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by means of which they may be opened and shut at pleasure. These apertures and the outer door might be left open when the weather is moderately freezing, but not so severe as to endanger the roots. In a word, the root crop cannot be allowed too much air, or kept too cool, so that they do not freeze.

in length, and all should be tapered as nearly alike as possible, so that they may be driven equal distances in the bottom piece of the rack, and thus leave the tops to range even, for the more convenient introduction of hay and fodder. Two or three rounds should be inserted in each end of the rack, in such a position as will prevent the sheep from jumping in. As many of these racks should be arranged along in a line (leaving a few feet between them for the sheep to pass,) as may be necessary. The two sides and ends of each of these racks will conveniently accommodate a hundred sheep. If well filled in the morning and left accessable to the sheep during the day, double that number may be fed from each rack. But to prevent sheep from getting seed in their wool, they should always be turned out of the yard and the gate closed before the hay is thrown from the mow to fill the racks. Once filling will generally answer for twenty-four hours, and even longer, where the sheep can get a bite of grass or are fed with other green food. Each of these racks should be set upon four substantial legs, large at the bottom, to prevent them from sinking in the ground, and set well apart to secure them from being overturned. If necessary, a fifth leg should be placed in the centre to prevent the bottom piece from swagging. The racks should be raised about two feet from the ground.

The troughs may be placed at the end of the hay racks, in a line, so as to be convenient to the root house, or if there be a scarcity of room under cover, they may be placed in the folding pen, in front of the shed. The troughs may be of any convenient length, about a foot wide in the clear, and four inches deep. To prevent the sheep from getting in the troughs, and thus dirtying the food and keeping others from getting their share, each one should have a broad plank placed over it, at the height of twelve or fifteen inches, which will admit of the food being put in and the feeding of the sheep without removing the plank. This may be fixed as follows: let there be an upright pin inserted in each end of the trough, in a two inch auger hole, with a round tenant at the top of the size of an inch auger; then by boring a hole, with an inch auger, in each end of the plank, at the proper points, it may be let down on the tenants, and kept in place by a long nail, inserted in a gimblet hole through the tenant, above the plank. Being thus arranged, the plank may be taken off as occasion may require, for cleaning the trough or any other purpose. If necessary to prevent the plank from swagging down in the middle, it may be supported by a pin or forked stick, the two legs of which may be nailed to the sides of the trough, and the upper end supporting the plank, which is to serve as a cover. With care and attention in keeping up blue grass pastures, for winter feeding, sheep will not require to be fed more than one or two months in the year. But to supply a large flock with winter pasture would, perhaps, require so much ground as to make it less economical than to feed sheep somewhat longer with roots, assisted with hay and corn fodder. Persons engaged in sheep husbandry, will probably find it to their advantage to make provision for feeding their flocks, at least two months in the year. The method of keeping sheep during the ten months they are kept on grass, is extremely simple; nothing is necessary but to furnish them with suitable pasturage, a plentiful supply of salt, and an extensive range; where there are no burs, or frequently shifting them, if confined in small enclosures. They will do well without water, though they would do better if they shall have access to it at will. But during the two months they are to be fed, much care should be taken to prevent them from falling off. If they are kept upon hay and fodder alone, (the latter is best where they have nothing but dry food,) they will fall off very much in flesh. The cause of this is clearly manifested by some experiments made by the celebrated naturalist, D'Aubenton, whose name I have mentioned in connection with the introduction of merino sheep into France. He ascertained, by a course of careful experiments, that medium sized sheep will, upon an average, consume eight pounds of grass per day or two pounds of hay. He also ascertained, that eight pounds of grass, when completely cured, will make two pounds of hay. He next made some experiments to determine how much water each sheep will drink in a day, when fed on hay alone, and found the quantity to be three pounds. From these facts it appears that when fed on grass, a sheep of medium size, will consume eight pounds, (including the evaporable and solid parts,) and when fed on hay, will consume only five pounds including water. With such a difference in the diet of sheep, when fed on green and dry food, there must be a great falling off in flesh. This experiment shows the importance of allowing sheep free access to water, when fed on dry food, and of supplying them with a due proportion of roots or some other succulent food, after their pasture shall have failed. With the advantage of an establishment such as I have described, this could easily be done, at but little expense; whilst it would considerably increase the quantity of wool and manure, and keep the sheep in a thriving condition during the period they cannot be supplied with grass. This plan of feeding would also enable those engaged in sheephusbandry to keep their sheep off their pastures somewhat later in the spring, which would allow the grass to get a good set before the sheep are turned on.

Our climate is well adapted to the rearing of sheep; they are subject, if well kept, to scarcely any disease, and the period during which they require feeding is very short. There is nothing, therefore, to prevent Kentucky from engaging in sheep husbandry to great advantage. She possesses, moreover, in the hilly region of the country, an immense quantity of land that is finely adapted to the rearing of sheep, and is scarcely fit for any other purpose. These regions may, with great advantage, be converted into sheep walks, where an immense number of sheep may be grazed, during the spring, summer and fall months, which will enable those engaged in sheep husbandry, to keep up their home pastures as a reserve for winter grazing. We have, therefore, the strongest inducements to engage extensively in this business, which cannot fail in greatly promoting the prosperity of our state, and the wealth and happiness of our citizens.

Having occupied so much space in treating of the agriculture of England, I can give but little room to that of other countries of Europe. Next to England, France may be regarded as most worthy of attention, in an agricultural point of view. Her soil is said to be better adapted to agricultural purposes than any country in Europe.* It produces most of the useful plants, and is congenial to the rearing of all the most useful domestic animals. In relation to internal and foreign commerce, it is admirably situated, being in a great measure

*Farmers' Guide, 23.

surrounded by the North Sea, British channel, Bay of Biscay and Mediterranean, and intersected in all directions by navigable rivers and canals. Her climate is mild and very favorable to agricultural pursuits. With these advantages and inducements, we may readily suppose the example of England would not be lost to this country; and accordingly she has paid much attention to the science of agriculture. "As early as 1761, there were thirteen agricultural societies, besides nineteen subordinate co-operating ones." Since that period, and especially during the time Bonaparte swayed the destinies of France, "many new ones, together with some professorships, were established." France has adopted the system of *rotation* in crops, and, as in England, the old system of summer fallows has generally given way to the more useful and more profitable practice of introducing some preparatory green crop as the forerunner of grain crops. But it is said, after a succession of crops, the lands are sometimes left "to rest a year or two, during which they produce nothing but grass and weeds, and they are afterwards broken up with a naked fallow."* If this be correct, it is certainly a bad system of husbandry. It would be much better to sow down the field intended to be rested, in red clover, and when sufficiently renovated, ploughed, late in the fall, preparatory to a suitable green crop the ensuing summer, to be succeeded by wheat.

It is said, in the China system of agriculture, great pains are taken not to suffer weeds to go to seed. This is a practice worthy to be followed every where. Its importance cannot be too highly estimated. It is a well settled principle that all plants exhaust a great deal more *at the period of ripening their seed* than at any previous period of their growth. This is owing, in part, to vegetables réquiring much more sustenance, at the time of maturing their seed, than at any previous stage; and in part to the fact of their deriving less food from the atmosphere, at this period, in consequence of their leaves having lost, in a considerable degree, their power of absorption. Hence the importance of not suffering weeds to ripen their seed. Besides, by doing so, a foundation is laid for a crop the succeeding year, which will render the tillage more

*Farmers' Guide, 23.

tedious and expensive. Weeds, moreover, consume a portion of the aliment, which ought to go exclusively to the sustenance of the growing crop.

France has paid much attention to sheep husbandry, and her famous flocks of Rambouillet are said to surpass the best of those in Spain, whence she originally derived them. They were selected with great care and judgment, and the government has held out the strongest inducements to their improvement, by the application of the utmost skill and science. The country is now deriving the full benefit of this wise policy, by the spread of this useful race of animals over all France, which has laid the foundation of her unsurpassed manufacture of fine cloths.

France is also distinguished for the culture of the vine, and for her extensive product of wines and brandies. The rearing of the silk worm has also been extensively introduced and found to be a very productive and profitable agricultural pursuit. The culture of the mulberry took its rise, at the commencement of the seventeenth century, and the honor of introducing the silk culture is due to the Great Henry the fourth. It has already extended itself over the greater part of the kingdom. The raw silk produced in France, has been estimated at four millions of dollars.* This is converted into a variety of beautiful fabricks, which adds greatly to its value, and gives employment to a large number of her citizens.

Nothing can prove more strongly the attention France has paid to husbandry, than the fact, that, notwithstanding she is so largely engaged in the cultivation of the vine and the mulberry, in the production of the raw material for her unsurpassed cloth manufactories, and in rearing the beet for consumption, and to supply her sugar manufactories, yet she not only produces bread stuffs in sufficient abundance for her numerous population, but is an exporter of that article to a considerable extent.

In Holland, agriculture is confined chiefly to pasturage, the management of the dairy and gardening. Madder and tobacco are raised to some extent, as are also the various plants and roots suitable for feeding cattle. Holland is also celebrated

*Farmers' Guide 24.

for her excellent cheese. Her implements of husbandry are said to be better than those of any other part of Europe.*

The German system of Agriculture is said to resemble that of England.† But great improvement has resulted from the recent establishment of schools of agriculture, particularly that of Mogelin, where the principles of agriculture are taught in a practical and scientific manner. It cannot be doubted, that this mode of teaching, and practically illustrating the principles of agriculture, tends greatly to promote its advancement towards perfection.

Flanders has also availed herself of the advantages resulting from schools of agriculture, and has made rapid improvements in the science. By adopting the improved methods of husbandry, she has been enabled greatly to increase her agricultural products, not only without diminishing the fertility of her soil, but has actually greatly improved it.

Judge Buel, in an address to the agricultural society of New Jersey, states that the climate, soil and general make of Flanders "bears a close resemblance to the southern part of New Jersey." That "the surface of the country is flat, and was naturally wet and cold; the soil, generally, sandy and poor, except upon the streams coming from the interior, and at their embouchere into the ocean. And yet with all these disadvantages, there is probably no country in Europe richer in the products of the soil, owing, principally, to her excellent system of husbandry; and no where, apparently, is the condition of the agricultural population better, and the country more exempt from pauperism and crime than in Flanders.‡

The following extract from the address alluded to above, giving an account of the characteristics of Flemish husbandry, conveys in so clear and intelligible a manner, the true principles of a good system of agriculture, and is so applicable in the general, to our own country, that I shall be pardoned for not only giving it entire, but recommending it to the serious consideration of every farmer in Kentucky, and the whole union. "The characteristics which distinguish Flemish husbandry and which have rendered it so uncommonly productive and profitable, are a thorough draining of the land, a

*Farmers' Guide, 24. †Ibid, 25.
‡Franklin Farmer, 1840, p. 182.

perfect pulverization of the soil by frequent and deep ploughings, or by trenching; the subjecting the lands to alternate husbandry, the extensive culture of clover, of root crops, and of tares for soiling and winter feeding their cattle, the careful extirpation of all weeds, a remarkable attention to the saving and judicious application of manures, particularly of liquid manures, a constant occupation of the ground with crops or herbage, and a judicious rotation, differing in almost every district, on account of the difference in soil, and adapted and settled, after long experience, to such as is best suited to the local market, as will best repay the farmer's cost and toil by an abundant return—best cultivate the soil for a succeeding crop—best enrich it for the purpose of increasing fertility, and most effectually prevent, by judicious alternation, that natural disgust, which, even good soils manifest to reiterated crops of the same description; the small size of farms and the keeping them in constant crop; no man attempting to manage more than he can manage well; the cutting of the forage and grinding the grain for the farm stock, thereby lessening greatly this heavy item of expenditure; and, finally, the farmers giving their undivided attention to their farms, and their industrious frugal habits of living—no lumbering; no fishing; no speculation; no hankering after office." The great value of the Flemish system of agriculture is evinced by the uncommon product of a soil which was "naturally wet and cold," and generally "sandy and poor," before the improved methods were adopted. Those products are stated by Mr. Buel to be "in wheat 32 bushels, rye 32½ do., oats 52 do., potatoes 350 do. per acre," a great average truly, and highly creditable to Flemish skill and industry. Having given a sketch of the husbandry of some of the other countries in Europe, in which most attention has been paid to this important subject, it is time I should turn my attention to that of Kentucky, as well in its infancy as in its more advanced state, and in doing so I shall take occasion to compare it with that of foreign countries.

The first settlement of Kentucky may be regarded as the hunter state. Though cattle could easily have been raised by grazing them up on the natural pastures in the summer, and upon the extensive canebrakes in the winter, if the inhabitants had been living in a state of peace, yet such was not their condition. Surrounded by a savage foe, who was ever on the watch to seize upon the property or take the lives of the settlers, if they had raised cattle to any extent, it would only have been for the use of the enemy, and the better to enable him to prolong his predatory incursions, and thereby do them the greater mischief. Thus situated they could rear no more cattle than they could secure within their stockade forts, in time of danger. A few cows for milk and butter, and as many of the young as were necessary to keep up the stock, and to supply the emigrants, was as much as they could aim at, in the early period of our history. But game was plenty, and the same rifle which was necessary for their protection, was amply sufficient to afford an abundant supply of bear, deer and buffalo meat. The whole system of husbandry, at the first settlement of the country, was to raise a little Indian corn for bread or hominy, around the fort, and within the protection of the garrison. But when the population had so far increased as to enable the settlers to act on the offensive, as well as the defensive, they could embody and meet the Indians in their advance, or pursue them in their retreat, and frequently inflict severe retaliation upon them. This had the effect of making the enemy embody in larger parties, and to diminish the frequency of their predatory expeditions. As the settlers began to feel their strength, they enjoyed a greater sense of security, and consequently extended their efforts in raising supplies of agricultural products, for the use of their families and to supply the wants of the emigrants to the country. But a considerable period elapsed before any thing of the grain kind was raised, except Indian corn. The want of mills to grind wheat was an obstacle to the cultivation of that crop. But the great fertility of the soil and the demand for corn, as an article of subsistence for the settler and his stock, as well as to supply the wants of the emigrant, held out a strong inducement for its cultivation. It was not until a commercial communication was opened with the Spaniards, at New Orleans, that wheat and tobacco began to be objects of importance. From this period the culture of those articles began to assume some importance. But there was, as yet, little or no system in the husbandry of the country. A part of the corn ground might be sowed broad cast, among the standing corn in the fall, and reaped in July following, and the balance of the cleared ground cultivated in corn the succeeding year, and that sowed in wheat the following autumn. The wheat stubble the year after the harvesting of the wheat, might be ploughed for corn, and so on in succession. Whilst some new ground cleared for tobacco would serve for that crop. Others again cultivated corn only, in continued succession, without any change. Such was the system (if system it could be called) of cropping that generally prevailed, until a late period of the history of our state. As fertile as our soil naturally is, it began at length, to show the effects of a bad system of husbandry. To remedy this deterioration of soil, something better deserving the name of system began to prevail among the more judicious farmers of the country. Although no very regular system of *rotation* of crops was adopted, yet the practice of occasionally *resting* the land, by putting it down in clover began to prevail. This practice was beneficial in proportion to the length of time the land was permitted to remain in clover, compared with the time it was occupied with grain crops. Some farmers rested it for longer, some for shorter periods, and some not at all. These, by one continued succession of grain crops, at length so exhausted the soil, as to be no longer capable of producing a crop that would pay for its cultivation. It is wonderful that land should be capable, to some extent, of producing grain crops for such a number of years in succession. It shows the almost inexhaustible nature of our incomparable soil, and what might be expected from it if cultivated in a systematic and scientific manner.

In some parts of the state, where grazing cattle has been extensively practised, a system has prevailed of sowing down in blue grass (*Poa*) lands that have been much exhausted by repeated cultivation in corn and wheat crops, and suffering them to lie many years in pasture, and then again to cultivate them several years in corn, whilst other exhausted lands are put down in grass aud suffered to rest. On large farms, where many cattle are grazed, this is doubtless a very convenient and a very good mode of renovating land, provided the corn crop do not occur too frequently.

While the land is in blue grass pasture, it not only receives the manure produced by the cattle grazed upon it, but also from those fattened with the corn and fodder, cut up for winter feeding. It is enriched, not only by having *returned to it all that has been taken from it*; but also by receiving all the manure resulting from the crop of corn, growing on other parts of the plantation. It is a well settled principle, that if every thing which is taken from the soil in the shape of a crop, is returned to it in the form of manure, it will progressively increase in fertility. This may appear strange to some. But when it is recollected that the growing crop receives its aliment, not from the land alone, but, in a considerable degree, from elementary principles, mingled with the atmosphere, the proposition will appear very reasonable. Hence it would seem to follow, that if two fields of fifty acres each, were cultivated in rotation, so as to have each three years alternately in corn and blue grass, and the corn and fodder off of one field should all be fed on the other, there would be a gradual improvement of the soil in both fields. Such would, undoubtedly, be the fact if the feeding of the corn and fodder should be equally distributed over the whole field; and if the ground should be so well covered with grass, and the sod so compact as to prevent injury from washing rains, and summer heat, and treading of stock. The field in corn would gradually deteriorate, during the three years it would be occupied by this grain crop, and, during the three succeeding years, there would be a progressive renovation of the soil. So that it would not only recover all that had been lost, but there would be an actual improvement of its fertility. This principle is very encouraging to agriculturists, but it should never be forgotten, that it will only hold good where the utmost care is taken to prevent injury to the soil by washing rains, or by too great an exposure to the evaporating effects of the sun's rays. If before the commencement of this alternation, the soil had been very much reduced by bad husbandry, the process of renovation by the foregoing rotation, would be too slow to be relied upon, and the crops of grass to those of corn, should be *two* to *one*. The rotation should then be four years in blue grass to two in corn.

Although it is true, as a general principle, that where every thing is restored to the land. in the form of manure, which has been taken from it by growing crops, it will gradually improve in fertility, yet it must be recollected, that where the manure is restored by feeding the crops on the ground, much more will be lost by eveporation than where the feeding is done in small feeding pens, and the manure hauled thence upon the land, and covered with the plough as fast as it is spread. It is obvious this is the most economical way of applying manure, so far as relates to the *manure itself*. But if the cost of hauling all the provender from a large plantation, to one or two feeding pens, and hauling the manure thence to the several fields, to which it properly belongs, the expense will be found to be more than will counterbalance the loss of manure, by suffering cattle to drop it on the ground where it is wanting.

The plan of feeding upon blue grass pastures, which are afterwards to be converted into plough land, is therefore, upon the whole, the most economical, especially in our state, where the ssving of labor is an object of so much importance.

Experience has shown that where lands have been considerably exhausted by constant cultivation in grain crops, they may be renovated by grassing them alone, without applying any manure. This is in strict accordance with the principles laid down above. In this case all is restored to the land which has been drawn from it, and hence it will gradually improve and become more fertile, so long as it is continued in grass. But the renovation cannot, of course, progress so rapidly as where it is assisted by the manure produced by the grain and fodder from the other parts of the plantation.

Where it is intended to improve land by grassing alone, unaided by manure, the product of other parts of the plantation, red clover is to be preferred to any other grass. Clover affords a much thicker covering to the ground during the summer heats, than any other grass, and thus prevents it from injury by evaporation. Its numerous leaves enable it to extract a larger portion of its aliment from the atmosphere, and it leaves upon the ground a much heavier coat of roots, stems and leaves, after having been pastured than any other grasses. If we add to these advantages, that a heavy coat of clover may be ploughed in during the fall of the last year it is intended to keep the land in grass, which will furnish a dressing of manure for the succeeding year, we shall be convinced of the great superiority of clover over other grasses in restoring exhausted lands. For these reasons clover forms a very important crop, and can be introduced with great advantage into almost every good system of rotation.

In some parts of the state a practice prevails of clearing up and thinning out the woodland, and sowing it down in blue grass for pastures.

This mode of husbandry is certainly very judicious, as it renders woodland, otherwise unproductive, almost as valuable as that which has been entirely cleared. But it is sometimes pushed to extremes, especially on plantations where the cleared land bears a small proportion to that in woods. The latter is all cleared up, the small growth and indifferent timber deadened or cut down, and the land sowed in blue grass. The farmer, having now a plentiful supply of pasture, commences the grazing of cattle, partly raising, but chiefly purchasing steers and spayed heifers of a proper age to graze one summer and fall, and then to fatten during the ensuing winter. To feed these the whole of the cleared land is planted in corn, which is fed to the cattle while running in the woodland pastures. Thus the manure produced by the corn and fodder, instead of being restored to the ground which ought to receive it, is scattered upon the woodland pastures, which do not need it. This is very injudicious and is well calculated to deteriorate and exhaust the soil in cultivation, while the woodland, which is naturally sufficiently fertile, receives the manure resulting from the corn ground. It would be a great improvement of this system if the corn and fodder were fed in feeding pens, so situated as to be most convenient for hauling the cut up corn crop to them, and to transfer the manure, when sufficiently decomposed, to the fields on which the corn was raised.

They would thus receive back what had been taken from them. This would be a great advantage, but still a continued succession of corn, for a long time, will cause a deterioration of soil, and a change of crops will be necessary. To guard against this evil the corn ground should occasionally be sown in wheat, in the fall, after a very careful cultivation of corn crops, so as to keeep the field clear of weeds and grass; and in the month of February following, should be thickly sown with red clover. It is of great advantage that the ground should be well covered, and hence it is true economy to sow the clover very thick. A gallon of seed per acre, or at least a bushel to ten acres, is as small a quantity as should be sown. The ground should be rested in clover two or three years, or even longer if necessary to completely renovate the soil. It is very important, when putting in the wheat crop, preparatory to sowing down the land in clover, to leave it as level as practicable, which will not only prevent a loss of soil by washing rains, but will leave it in a condition to be more completely covered with a coat of grass, and less subject to injury by the treading of stock, while in pasture. If the wheat is ploughed in while the ground is in corn, a small harrow should be run across the corn ridges, in the opposite direction, so as to fill up the furrows and level the ground. If a cultivator be used in putting in the wheat, the ground may be laid sufficiently level without harrowing. When the corn is cut and shocked before the wheat is sown, the ground, after being ploughed, should be somewhat levelled by running a harrow over it, if it is intended to sow it down in red clover. With a view to increase the manure in the feeding pen, and to prevent loss from evaporation, as far as practicable, it would be advisable to have the straw hauled to the feeding pen and fed from a rack, so constructed as to furnish, at the same time, a shelter to the stock from the cold winds, and a convenience for feeding the straw. Much manure might also be saved by herding the cattle in the feeding pen every night during the pasturing season, when the stock are grazing on the woodland pastures. This could be done without much trouble, by giving them a little salt, in troughs, every evening, and closing the gate till morning. Being accustomed to get a little salt every evening, they would readily come by calling, and would soon come of their own accord to the feeding pen. With a view to prevent a loss of manure, by evaporation, during the process of decomposition, some writers recommend that the decomposing materials should be covered with earth. This would doubtless be proper, if the cost of hauling the earth or mould, upon the compost and thence to the fields to be manured, did not cost more than the value of the manure saved. And such, it is believed, would be the case, where labor is as high as it now is, and will probably continue to be, if not reduced by an improper interference of the national government. It is believed, however, that if the farmers, who desire to sow down their woodland in blue grass, would have the leaves and trash carefully raked in heaps and hauled to their feeding pens, early in the spring, and cover over thickly the manure and remains of the provender left by the stock, the saving of manure would greatly more than compensate the labor. A considerable advantage would also arise from the ground being left in the best posssible condition for receiving the blue grass seed.

By resorting to these methods of saving and applying manure to corn ground, it would be much benefitted, and would deteriorate less than it would otherwise do; and when it came to its turn to be rested in clover, would be in much better condition for that crop, and much more easily renovated.

Farmers who are not extensively engaged in grazing, and who run more upon corn, wheat, hemp and tobacco, will find the clover crop the most convenient and cheapest method of renovating land which has been much exhausted.* But they should, by no means, neglect the use of every proper means of saving manure, and applying it in the most judicious manner. Wheat, corn and tobacco are all exhausting crops, and will be greatly benefitted by a liberal application of manure. But hemp, though it requires a rich soil, exhausts but little, and may be reared, for a number of years in succession, upon the same ground, without any apparent deterioration, if it be cut instead of pulling, and watered on the same ground on which it grew. But my experience, which does not extend beyond eleven successive crops, will not authorize me to affirm that hemp can be successfully grown on the same ground for any length of time. If experience shall demonstrate that hemp is not an exception to the general rule, which requires a rotation of crops to keep the best of soils in good heart, this crop should be followed by wheat and two or three crops of clover, which would bring it again into fine condition for hemp. Corn, wheat, clover, clover, is a very useful rotation for a rich calcarious soil, that has not been much reduced by bad husbandry. This is a course of two grain and two green crops in four years, and would keep the rich Kentucky lands in good heart, and by proper economy in saving, and judiciously applying manure, the farmer may safely calculate upon a gradual and progress-

*For the rotations suitable for corn, hemp and tobacco, see essays on those subj ects.

ive improvement of his soil. But if the ground has been much exhausted by bad husbandry, or if it be a clay soil, with only a thin covering of vegetable mould, the rotation should be only two grain to four green crops. A clay soil should moreover be aided by the application of plaster of Paris (sulphate of lime) which should be applied to the wheat crop at the time of sowing clover, in the month of February.* And in very thin

*The importance of plaster (sulphate of lime) as a manure upon clay soils, will appear from the following extracts from a letter addressed to the author of this essay, by a very intelligent farmer of Bracken county, Kentucky. His farm is situated upon a lofty oak ridge, dividing the waters, which flow into the Ohio from those which flow into the North Fork of Licking. The natural growth is oak, with no intermixture of the timber peculiar to the rich calcarious soils of Kentucky, which are distinguished by a considerable depth of vegetable mould, except a slight sprinkling of sugar trees at the heads of hollows or ravines, leading towards the Ohio and North Fork. White oak is the predominant growth. The soil is entirely clay, with scarcely any appearance of vegetable mould, even in the best of the land, in its natural state. It is founded upon horizontal limestone rock, lying at the depth of eight or ten feet from the surface. Having been long acquainted with this farm, and knowing that it had been greatly improved by its present owner, (having been much deteriorated by its former occupant,) and that gypsum had been used as one of the means of restoring it to its present degree of fertility, I addressed him a letter of inquiry, as to the use he had made of plaster in renovating his land. The following extracts are from his letter in reply: "I commenced the use of plaster as a manure, in the fall of 1834, purchased one barrel containing four or four and a half bushels, of the blue kind, which I put on 16 or 18 bushels of wheat, at the time of seeding, allowing about one peck of plaster to a bushel of wheat, the wheat being first well wet with water, and plaster sprinkled over and stirred with a stick; and if not sufficiently wet to make the plaster adhere, put still more water, and continued stirring until all the plaster stuck, and the grains separated from each other. The crop of wheat, from that fall's seeding, on the farms in this section of country, was, in the general, much affected with the scab or rot. My wheat, so far as the plaster extended, was scarcely affected in the least, except a small skirt next the woodland, which was not half as much so as that on which there had not been any plaster. The balance of my crop was much injured. About the centre of the field on which I used the plaster, I left a space of about 40 feet across the field, on which I sowed wheat without being plastered. From the first appearance of the wheat, after getting above the surface of the earth, the difference in appearance was considerable, and in favor of that which was plastered. At the time of harvest, the plastered wheat on each side, was about six inches taller, heads longer, free from scab, and the straw of a much more beautiful color. I think the effect of that barrel of plaster, as manure, was worth, to me, at least one hundred dollars."

"I have since used other kinds of plaster, to wit: white and gray, but to say which is the most advantageous for farming purposes, I am not satisfied, as I have not failed in receiving a considerable benefit from each. From the great scarcity of the article and the advance in price, I have not used it to half the extent I am assured it merits. I think that which has the finest and softest texture is the best for far-clay soils it may be necessary to increase the number of clover crops in proportion to those of grain, especially where no manure is applied. The rotation might then be one crop of corn or wheat to three of clover. In very rich land the following rotation is sometimes practised, corn, wheat, clover, and so on, in succession. This is a practice that cannot be recommended, as it would be too exhausting, except where there is a very large application of manure or upon a very rich soil which has not been exhausted. Where but one corn crop and then wheat succeeds clover, it will be unnecessary to sow the wheat in clover, as the seed in the ground will generally be sufficient to set the ground anew in clover

I have found the following rotation to be a very good one, as regards profit, and it will keep a rich calcarious soil, which has not boen much exhausted by bad husbandry, in good heart, and gradually improve its condition; corn, corn, rye, rye, the two last crops *to be fed on the ground.* This is a course of four

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ming purposes, without being particular as to color; when free from an improper mixture." "On the 20th of June last, (by way of experiment) I gave a small portion of corn an upper dressing—about a tea spoon full to the hill—(The reason I did not use it over the greater part of my corn, was, that the season had so far advanced I was fearful it would be entirely lost to the benefit of the present crop of corn. At the time of gathering, it showed its valuable effects as a manure. I am satisfied I gathered, from that which had that small, late, upper dressing, from one fourth to one third more than I did from that which had not, on equal soil." On my land, set in clover or clover and timothy, I spread, by broad cast, one peck per acre, from which, at a reasonable calculation, I cut double, and of a favorable season, three fold. I generally leave a strip without plaster for experiment.

"My short experience with plaster induces me to think, when it is applied by broad cast, either on grass or grain, it should be done early in the spring, after vegetation commences, as it requires much moisture to dissolve it." "From the scarcity of plaster, I have not, in any instance, used more than one peck per acre, either by broad cast or on grain. If it were to be had at a moderate price, I should like to try from half to a bushel per acre."

"Plaster, on such clay as mine, will continue its effects two years if applied to grass."

"The mode I pursue, in the cultivation of my land, differs considerably from that of many more eminent farmers than I claim to be. After my land remains in clover, or clover and timothy two or three years, as circumstances require, I cultivate a crop of corn, then seed in wheat and grass seed the spring following. By properly cultivating the land while in corn, my usual crops of wheat average from 15 to 25 bushels per acre. I have tried fallow, but cannot get more than from my corn land. My crops of corn, of good seasons, yield about 50 bushels per acre." After giving the above extracts, which I consider of great value, it is proper to add, that I have been informed this same farm, before its renovation, yielded less than 10 bushels of wheat and 20 of corn per acre.

grain crops in four years; but rye is not very exhausting when taken from the land, and when the whole product is left on the ground, together with all the manure which is dropped by the stock grazed on it for three seasons, I have found that it not only does not exhaust, but more than restores what the two corn crops have subtracted from the soil. The rye requires but once seeding. The expense of putting it in is only equivalent to the value of the rye which is sown. If the corn have been well cultivated and kept free from weeds, the rye may be sown among the standing corn, early in September, without even ploughing or harrowing, with a full assurance that the first good rain will bring it up. But it will be best to run a harrow or cultivator through the corn, after sowing the rye, if it has not been blown down so much as to forbid this being done.

The rye may be pastured the fall and winter, after sowing, and until the middle of April following. It should then be suffered to seed, and be fed off to mules, hogs, &c. There will be rye enough left, after feeding it off, for seeding the ground the succeeding fall, and it may again be pastured till the middle of the following April, when it should be suffered to grow up and ripen, and be fed off as before. For the third time it may be grazed till the season for ploughing. A second course of the rotation will now be commenced and proceed as before. But if the land has been much exhausted, or if the soil be clay, or clay with a thin covering of vegetable mould, it would be proper to sow the rye in February of the second year, with clover; and that the rye crop should be succeeded by two or three crops of that great restorer of fertility. And where it is desired to renovate a soil, naturally rich, which has been much reduced by bad husbundry, a similar course should be pursued. It is best, when it is intended to sow down a rye field in clover, to plough in the rye the previous fall and harrow the ground, or to put it in with a cultivator. This will leave a level surface for the reception of the clover seed, and free the ground from other grasses and noxious weeds.

If the soil be suitable for plaster, the clover crop should be assisted by a good dressing of this valuable manure.

In speaking of the rotation of crops in Kentucky, I have hitherto confined myself chiefly to the only green crops (clover and blue grass) which have been much in use, in our system of husbandry. But the time is coming when we shall see the necessity of introducing other green crops. Which of them will best suit our *circumstances, climate* and *soil*, must be determined by *experience*. I have endeavored, by the general principles I have laid down, and by presenting very fully, a course of experiments, made by that distinguished writer and agriculturist, Arthur Young, to facilitate the enquiries of the judicious farmer, and to aid him in discovering what rotations will best suit *our circumstances, soil and climate*. According to the English practice, two crops of the same kind ought not to follow each other in any rotation. This is a good general rule, and ought rarely to be departed from. Experience shows that hemp is an exception to the rule. Corn may also be indulged a second time, where it is intended to clean and prepare ground for a crop of wheat, to be succeeded by severul crops of clover. Our circumstances, climate and soil may, perhaps, justify some other exceptions to the rule, but it ought not lightly to be departed from.

It has been seen that the bean crop in England, is one of the best preparatory crops for wheat. This crop would, without doubt, succeed well in our soil and climate. The result of Mr. Young's experiments show that it is a crop of great value; and I can see no reason why it could not be introduced here with great advantage.

The alternate crop of beans and wheat has been found not exhausting, and of great value, in England, in a soil naturally much inferior to ours. Such at least, would seem to be the fact, from the experiments of Arthur Young, heretofore given in this essay. But if upon further experiment it should be found otherwise, or if the soil has been already exhausted by bad husbandry, after two or three courses of beans and wheat, according to circumstances, two crops of clover should follow, when the rotation of beans and wheat might again commence, always remembering that when the soil is suitable, the first crop of clover should have the benefit of a coat of plaster.

Instead of preparing all the ground, which is intended for wheat by a bean crop, some part of it might be appropriated to some other "green crop," such as turnips, carrots, beets, &c. by way of experiment, to ascertain which will suit best for the following crop of wheat. Experience will soon teach the judicious farmer, which will be most suitable to our climate and soil, and the most vuluable for feeding stock. The common turnip, which is usually sowed late in July or early in August, will not, it is believed, answer as a preparatory crop for wheat. It is a very uncertain crop, in consequence of the drouths to which we are subject in the fall months, and the ravaging effects of the fly. Besides the crop will not come to maturity in time for sowing wheat. The rutabaga will probably answer best for stock. These may be sowed in April; or early in May, and may be pulled in time for sowing wheat in September. These, as well as the common turnip, are subject to the ravages of the fly, and experience alone must decide whether they can be cultivated to advantage, as a preparatory crop for wheat. It is best to plant them in drills, and they should be cultivated with the plough and hoe. They should be allowed a space of one foot in the drills, and the rows should be so far apart as to admit of ploughing between with a small shovel plough, say two and a half feet.

Beets and carrots will probably be found the best root crop for stock. These, it is believed, are not subject to so many casualties as the turnip crop. Experiments, in a small way, will soon determine the relative merits of these and other root crops, as a preparation for wheat, and for feeding of stock.*

Potatoes are a very exhausting crop, and so uncertain and unproductive in our climate, as to forbid their general introduction *as food for stock*.

In the cultivation of beets, carrots, rutabaga, &c. the following method is recommended. The ground should be well pulverized by ploughing and harrowing. If done in time to afford the soil the benefit of the frosts of the preceding winter, it will be so much the better. It should then be laid off in furrows two and a half feet from centre to centre, in such a direction as will best prevent the ground from washing, in time of heavy rains. This should be done with a large plough, throwing a wide furrow, and striking as deep in the ground as possible. A well constructed shovel or coulter plough should then be run along the bottom of each furrow, so as to

*See page 75, in relation to beets. To make an experiment on carrots, I planted a few rows, in drills two feet and six inches, on the second day of May. The product was at the rate of 15,125 pounds per acre. They were the long orange colored kind.

loosen the ground to a considerable depth. This should be done early in the spring in order that the ground may have the benefit of the spring frosts, which will aid very much in pulverizing the soil. In this state it should be left till the time of planting. A single horse plough of suitable construction, (one with a double mould board will suit best,) should now be run on each side of the several furrows, so as to form a ridge over their centres. This could be better done by first running a harrow over the ridges, lengthwise, so as to level them down, in some degree. When the ridges are made, a heavy brush or some suitable machine should be dragged over them, lengthwise, with a view of levelling down the tops slightly, so as to give them a proper width for depositing the seed. These should be drilled by a proper machine, along the centre of each ridge, turnips and beets at the distance of one foot and carrots six inches, and other roots according to the size they grow.

There are 43,560 square feet in an acre. Allowing one turnip or beet for each two and a half square feet, the number per acre would be 17,424. But as some may not grow or may be destroyed by some casualty, one fourth may be deducted on this account, which will leave 13,068. If planted in good ground and well cultivated, beets and rutabaga turnips will probably average five pounds each, making 65,340 pounds per acre, equal nearly to thirty tons.*

The saving of manure is so important in the renovation of soil, "where it has been deteriorated by improvident cultivation," that I shall be excused for going somewhat more into detail as to the best means of saving it. I have already suggested the propriety of having feeding pens for feeding all stock which is not housed. The following points should be carefully attended to, in selecting suitable places for feeding pens:

1. The ground should be somewhat elevated, and so near a level as to prevent any drainage through the pen, and the sides inclined to the centre, which should be hollowed out by a scraper.

*The result of an experiment (since the above was written,) shows a product of 3½ pounds for each of these roots. But these were planted too close and from that cause and from excessive rains, could not be cultivated well. The crop was probably injured by too much rain.

2. It should be so situated as to save, as much as possible, the labor of hauling provender to, and manure from the pen to the fields in cultivation.

3. It should, if practicable, adjoin the pasture grounds, so that the cattle may be called up, of nights, during the pasturing season, and salted in the pen, where they should be detained till morning.

4. The pen (if it have none in it,) should be convenient to water, so that the stock may conveniently be let out to it during the winter feeding.

5. It should be as small as will be consistent with the safety of the stock, that the manure may be as little subject to evaporation as possible.

6. It should have a strong rack, (made of rails) running near its centre, and in such a direction as will best protect the cattle from the bleak winds. This should be kept well filled with straw, or, if there be none, then with corn fodder, in order the better to protect the cattle. Fodder should also be scattered over the pen, so as to furnish abundance of room for the weaker stock to feed, without interruption from the stronger.

7. If cut up corn is intended to be fed instead of fodder, there should be two pens adjoining each other, so that the cattle may, every day or two, be shifted, in order that the hogs may follow to pick up whatever grain the cattle may leave or drop. And a separate pen should be provided for feeding fodder. In these pens, (except on the large grazing farms, where from the great number of cattle fed it shall be found to be more economical to haul and feed the corn upon fields intended for future cultivation,) all the feeding should be done, during the feeding season, and the cattle herded of nights, during the spring, summer and fall months, when running on pasture.

If all the corn, on a moderate sized farm, should be cut up and the fodder, or corn and fodder be hauled to the pens, and there fed, it is obvious a large quantity of manure would be saved, and if the cattle, while running on woodland pastures, were to be herded of nights, in the same pens, the quantity would be considerably increased. The manure saved from the woodland pastures will be so much clear gain to the plough land.

The manure of horses may be best saved by stabling them, except when grazing, during the summer, on woodland pastures, when it might be saved in part by calling them up to a feeding pen, and giving them a little corn or salt. Cattle fed on roots, should have shelters, where their manure may be saved and hauled thence over the farm.

Manure loses much by evaporation, to prevent which, some writers recommend that it should be deposited in pits and covered over with a rich mould, and there suffered to decompose before hauling it over the plantation. This would doubtless be a considerable saving of manure; but few farmers find time to bestow the additional labor, which this process requires. Manure, saved in feeding pens, will be very much exposed to the action of the air and the sun's rays, during the summer months, if not protected therefrom. To do this it would be advisable to have it piled in heaps, so soon as the feeding season is over, or nearly so, which might be covered with leaves and other trash, raked up on ground intended to be sown in blue grass. This would be attended with the double advantage of preventing the loss of manure by evaporation, and increasing its quantity by the decomposition of the leaves, &c., This would also leave the woodland in fine condition for receiving grass seed.

The labor of saving and applying manure is very considerable, and as far as it can be avoided without too great a loss, it ought to be done. Thus when stock can be pastured on fields intended for future cultivation, the labor of saving and applying manure, as herein recommended, may be avoided. So also on very large farms, which are applied chiefly to grazing purposes, it may be more convenient to haul the cut up corn to fields intended for future cultivation, and thus suffer the cattle to distribute the manure, where it will be ready for future use. Much labor will, in this way, be saved, though it will be attended with some loss of manure in consequence of the offal, left by the feeding animals, as well as their manure being exposed to the sun and air, and thus losing much by evaporation, which, in feeding pens, might be saved. Yet, under particular circumstances, it may be better to submit to this loss rather than incur the expense of saving and distributing manure, by hauling the provender to feeding pens. The judicious farmer, taking into consideration every circumstance, must decide for himself which course would be best.*

Nothing can more clearly show the importance of saving and applying manure, than a comparison of the products of our naturally fertile lands with those of other countries, which, though originally of very inferior quality, have been rendered, by good husbandry, much more productive than ours.

By good husbandry is meant, first, a judicious system of rotation of green and grain crops; and, secondly, a strict attention to the saving and applying of manure, with a just view to the nature and wants of the soil.

The countries, of whose systems of agriculture I have given a sketch, are greatly in advance of us in these respects. And they have been more than doubly compensated for their labor and expense, by the gradual increase of the fertility of their land, as well as by the more productiveness of their soil. This will be evinced by a few illustrations.

I have before shown that, taking the whole of the thirty-six courses of experiments, made by Arthur Young, good and bad, the average of wheat was $21\frac{1}{2}$ bushels per acre; and that if the courses from 19 to 25, (evidently very bad rotations) had been left out, the average would have been about 23 bushels per acre, and that average would have been considerably increased, if only the best system of rotations had been adopted. Mr. Webster states the average crop in England to be 26 bushels, and this concurs with Loudon, who states the general average of all England to be twenty-six bushels of wheat per acre.

Judge Buel, in an address to the agricultural society of New Jersey states, on the authority of Sir John Sinclair, "the average product of Scotch agriculture *in good soils*, as follows:

*In the foregoing essay I have spoken of manures losing a part of their valuable ingredients by *evaporation*. This term is not appropriate to convey the idea intended. By the decomposition of animal and vegetable substances, ammonia and other gases are formed, which can exist only in the gaseous state, unless some other substance is present with which they are capable of combining, and forming fixed salts. If no such substance be present, they will escape in the form of gas, and be entirely lost.

The late work of Liebig, on organic chemistry, has thrown much light on the subject of preserving manures from loss by the escape of carbonate of ammonia, carbonic and other gasses. The method of accomplishing this important object is explained in the essay, on the system of agriculture, best adapted to Kentucky." [This note is inserted, by mistake on pages 26 and 27.]

wheat, 32 to 40 bushels; barley, 42 to 50 do.; Oats, 52 to 64; turnips 8 to 10 tons. He also states, upon the authority of "the Rev. Mr. Ratcliff, who was sent to Flanders for the purpose of studying its husbandry, the average product of the soil to be: wheat, 32 bushels; rye, 32¼ do.; oats, 52 do.; potatoes 350 do.; per acre." General Washington, in 1790, in a letter to Sir John Sinclair, computes the average crop of Pennsylvania, which he considered the best cultivated state, as follows: wheat, 15 bushels; rye, 20; oats, 30; Indian corn, 25; potatoes, 75.

Mr. Buel says, that when he purchased his farm "it was considered a barren sand," and that he "became the butt of ridicule to some of his acquaintances for attempting to bring it under profitable cultivation," but that "in twenty years it has assumed quite a different appearance. It is now worth $200 per acre for farming purposes; that it netts him more than the interest of $200 per acre," and that the "average acreable product, in corn, is 80 bushels; in grass, nearly or quite three tons, in potatoes, in favorable seasons, 300 bushels, and other crops in proportion."*

Mr Strickland, an eminent British farmer, who resided some time in Maryland, and who travelled much in the United States, forty or fifty years ago, in a communication to the British board of agriculture, stated *our avervge wheat crop* at 12 bushels per acre, except in the county of Duchess, in New York, where he allowed it to be sixteen bushels per acre."†

The average wheat crop in Kentucky, for the last ten years, probably exceeds the estimate of Mr. Strickland for the United States, but certainly falls short of his estimate for Dutchess county, New York. The average corn crop, during the same period, no doubt exceeds the estimate of General Washington, for Pennsylvania, but taking the whole state together, does not exceed thirty-five bushels. Some estimate the average at 40 bushels, but I think it too high, though it is not uncommon for our best managed farms, in good seasons, to produce more than twice that quantity. It is a most extraordinary fact that Mr. Buel should be able to obtain from a soil, "*naturally a barren sand*," an average of 86 bushels of corn per acre, whilst from our rich calcarious soil, having a deep vegetable mould, upon

*See a copious extract from Mr. Buel's address, in the Franklin Farmer, 1st February, 1840. †Ibid.

a sub-soil of clay, we are able to obtain, on an average, only thirty-five or forty bushels.

Our corn crops sometimes suffer severely from drouth, but this happens not very frequently; and, in general, may be guarded against, in a great measure, by early planting and good tillage. We must look then to other causes for the apparent inferiority of our soil to that of Mr. Buel, and to the soils of England, Scotland, Flanders, &c. Those causes are simply *the practice of bad husbandry.*

"Nature," says Mr. Buel, "had been equally bountiful to both continents. But *we* had abused and wasted her bounties while *they* had preserved and improved them. Our *decrease* grew out of a bad system of farming, their *increase* resulted from a more rational and improved system. The prosperity arose from the *science* which *guided labor*, in the one case, and *the want of it* in the other—to that *science* which is still courting our acquaintance and which we must become familiar with and apply, if we would profit largely from those privileges which God has bestowed alike upon us all."

CULTIVATION OF CORN.

Indian corn is a grain so necessary in raising and fattening stock, that it must ever be regarded as very important, in any system of agriculture, suitable for the western country. Though an exhausting crop, it may be raised, for a succession of years, upon the same ground. But although a rotation does not appear so essentially necessary in this, as in some other crops, yet the *fact* of a continued cultivation of this grain, even upon our richest land, for a succession of years, gradually deteriorating the soil, and diminishing the annual product, should admonish the husbandman, that a different system ought to be pursued. It should be a settled principle, with every farmer, so to cultivate his land, as never to *deteriorate* his soil. He should constantly aim at *improvement*, as the best and most certain means of preventing *deterioration*. The first consideration, therefore, with every farmer, should be to adopt such a system, in the cultivation of corn, as will not only prevent his soil from being *reduced*, but will gradually *increase* its fertility, and the product of his crop. The means, by which this may be accomplished, depend very much upon the native qualities of the soil, and the degree of deterioration it has undergone.

To treat this subject in a practical and useful manner, it is necessary that we should distinguish between the white oak lands, of the west, having a clay soil, with little or no vegetable mould on its surface, and the rich calcarious soils, having a deep vegetable mould, with a sub-soil of clay, founded on limestone rock. The latter, in its native state, is extremely fertile, and very productive in corn. But most of the lands of this description, in Kentucky, have been so long, and so unskilfully cultivated, as to have considerably reduced their fertility. Yet experience has shown that they may (when the soil has not been too much washed off,) be restored to their original fertility, by a proper system of cultivation. This *renovation* may be accomplished by a judicious system of *grassing* the land, and restoring to it, in the form of manure, as nearly as practicable, every thing which is taken from it by the growing of crops. Ground which has been much exhausted, should, after a wheat crop, be set in clover, by sowing, about the middle of February or between that and the first of March, among the growing wheat, one tenth of a bushel of clover seed per acre. It should be suffered to remain three summers under pasture, exclusive of the one in which the wheat is harvested. In the third year the clover should be permitted to go *unpastured* from the first of July until about the time the clover ripens,* when it should be turned under, by a well constructed plough, so as to bury every part of it. The better to accomplish this, a harrow, with the teeth reversed, or a heavy brush should be drawn over the clover so as to lay it flat, in the direction the ploughs are to run. A harrow should follow the plough to fill all the interstices, in order the more completely to cover up the clover. During the winter, while the ground is frozen, a dressing of manure (as far as the farm will furnish it,) should be hauled over the ground, but left in heaps till the proper time for ploughing, when it should be spread and *immediately* ploughed in. The field, thus improved, might now grow two crops of corn in succession, and then be again sowed in wheat and clover, and treated as in the first instance.

A second field, in the mean time, might undergo the same system of improvement, and so on in succession, till all the cultivated land shall have been *renovated*. If the soil is natu-

*In a letter addressed to the Rev. H. Colman, agricultural commissioner of Massachusetts, by Professor Samuel L. Dana, and published in the 48th and 49th numbers of the Franklin Farmer, for the year 1840, it is shown, very satisfactorily, that ploughing in green crops are not as beneficial to land, as ploughing them in after they become thoroughly dry. This is a recent and important discovery. The ploughing in of the second crop of clover should, therefore, be delayed until it is not only ripe, but completely cured.

rally rich and has not been much reduced hy cultivation, instead of three crops of clover in succession, two might be adopted, when the rotation would be as follows, clover, clover, corn, corn, wheat. This rotation would require five fields, two of which would be annually in corn, two in clover, and one in wheat, so that in every five years each field would produce two crops of corn, two of clover, and one of wheat.

But if the soil has been much reduced, a shift of six fields would be necessary, and the rotation as recommended above, to wit: three years in clover, two in corn, and one in wheat. which would leave three fields annually in clover, two in corn, and one in wheat. This rotation, with a judicious application of manure, would quickly renovate any of our naturally rich calcarious land, where the soil has not been washed off. When land is naturally rich, and has not been much reduced by bad husbandry, the following rotation will be found very convenient and profitable, particularly for small farms. Corn, wheat, clover, and so on in succession. This will require but three fields, and the farmer will every year have one field in corn, one in wheat, and one in clover, besides the advantage of pasturing the clover after his wheat comes off. But the clover must be suffered to go unpastured after the first of July, and be ploughed in, as herein before directed. This will not only provide a good dressing of manure for the succeeding corn crop, but will cover up such a quantity of clover seed as will furnish an abundant supply for the wheat crop, which is to succeed the corn crop. One great advantage attending this rotation is, that it wholly saves the expense and trouble of sowing clover seed among the growing wheat. It also affords two grain crops in every three years. This, in England, would be considered as too exhausting. But I am persuaded our rich lands of the west, which have not been much reduced by bad husbandry, will bear this course of cropping without deteriorating the soil, especially if an upper dressing of manure is applied, preceding each corn crop, that is to say, every third year.

In clay soils the corn crop should occur less frequently. The rotation, in a shift of four fields, might be clover, clover, corn wheat. Or, where the soil is naturally thin, or has been much reduced by bad husbandry, the rotation might be three crops of clover, and one of corn, and one of wheat. Clover should, in these courses, be the preparatory crop for corn, and ploughed in as herein before directed and a top dressing of manure applied, to the extent the farm will afford. In clay soils the whéat crop should be assisted by a dressing of plaster of Paris, (sulphate of lime,) from a peck to a bushel per acre. If the smaller quantity only is applied, it may be stirred in the wheat, having been previously moistened for that purpose, when about to sow. If the larger quantity is used, (and it is best to do so, if to be had,) it should be sowed broad cast, at the time of sowing the clover seed, in February. The corn crop will also be much improved by applying half a table spoonful to each hill of corn, either at the time of planting or as soon as the corn comes up.*

For farmers who do not desire to raise wheat, the following rotation will be found convenient and profitable. Upon rich lands, which have not been much reduced by bad husbandry, corn, corn, rye, rye, the two latter to be fed off *on the ground.* In this course, the second crop of corn will be followed by rye, sowed in the fall, pastured the next winter and spring, till the 15th of April, and then suffered to go to seed. When ripe it should be fed off to hogs and other stock *on the ground.* About September, or so soon as the fall rains cause the remains of the rye on the ground to sprout, the stock should be taken off. There will be sufficient rye left to seed the ground, and so soon as it shall have attained a sufficient growth, it may again be pastured through the following winter and spring, till the middle of April, when it should, a second time, be suffered to go to seed and fed off as before, until the proper period for removing the stock. It may again be pastured during the following winter. But care should be taken not to leave the stock on after the frost gets out of the ground, as this would cause the soil to break up cloddy and render it less productive. By the time the ground becomes dry enough for ploughing, there will be a thick coat of young rye, which, if well turned under, will afford a light dressing of manure for the succeeding crop of corn.

This rotation will require but two fields, and will be very convenient to hemp growers and graziers, who do not wish to

*See a long note on the benefit of plaster of Paris, in the general essay on agriculture, p. 70.

cultivate wheat crops. In consequence of the rye being fed off upon the ground, the foregoing rotation will rather improve than exhaust the soil. But to restore, speedily, that which has been exhausted, there should be two crops of clover, succeeding the rye crop; or a third crop of rye may be raised to advantage, by ploughing the ground after the second crop is fed off, from the first to the middle of September. Rye will not do well the third year without ploughing the ground, in consequence of white clover and other grasses spreading over the ground, but a single ploughing may suffice for two additional crops of rye.

Where the practice of grazing extensively prevails, large portions of the grazier's farm are kept in blue grass, and pastured for a number of years in succession. These pasture grounds, after having been kept a long period in grass, are occasionally ploughed up and planted in corn. This is certainly a fine preparation for that crop; and if the period, during which the land is kept in grass, in proportion to the time it has been in corn, be considerable, it is well adapted to the improvement of land. But if proper care be not taken in ploughing a stiff blue grass sod, there will be a great difficulty in cultivating the corn crop. If, however, the proper method is adopted, these difficulties may be avoided. There are two modes of converting blue grass sod into arable ground, which may be practised to advantage. One is to put a strong team to a large plough, suitable for turning over a stiff sod. The plough should have a cutter attached to it, for the purpose of cutting the turf, and thus enable the plough to turn it over to the depth of five or six inches, and lay it so smoothly as to have the grass side flat, and the mould alone exposed. The harrow should follow in the same direction with the plough, and by running several times over the ground the interstices will be filled and the turf so completely buried that the grass cannot readily grow. If this operation be performed in the fall or early in the winter, the sod will be so completely rotted, by the time it is necessary to commence ploughing for corn in the spring, as to admit of its being stirred advantageously. But if the sod be turned over in the spring, then it will be proper, by repeated harrowing, to form a sufficient depth of mould to admit of laying off the ground for corn without turning up the sod. By using light ploughs and small harrows, to run between the corn, or the corn cultivator, the crop may be cultivated without turning up the sod, and with very little labor. By the following year the sod will be completely decomposed, and will leave the ground mellow and in fine condition for a crop.*

If the operation of turning the sod be well performed, this mode of cultivating corn will be attended with great advantages. The sod beneath will keep the ground light, and the yield, if the season be favorable, will be very large. If, however, the land do not lie favourable for turning sod (if, for instance, the ground is so situated that the sod must, in part, be thrown up hill,) it may be difficult to turn it over so as to bury the green sward. In that case it will be very troublesome to cultivate.

The other method of managing blue grass sod is more effectual in obviating the difficulties arising from the unfavourableness of the ground for turning sod, and ought to be preferred by all farmers, who have an opportunity of procuring suitable implements.

A properly constructed plough with a *cutter* attached to it, should merely skim off the green sward to the depth of an inch or two, which should be followed by another plough, running in the same furrow, to throw up the mould to the depth of five or six inches. Thus, after the first round, a deep furrow would be formed, into the bottom of which the skimming plough would throw the green sward skimmed off in the second round, which would be covered to the depth of five or six inches by the second plough, and so on in succession, till the whole field is ploughed. In this way the green sward is detached, and buried so deep that it need not be disturbed in the process of cultivating the crop. Being entirely covered, it will serve the double purpose of keeping the ground light and furnishing a dressing of manure.

If the same ground upon which corn has been cultivated the preceding year, is intended to be again cultivated in corn, it is very important that it should be trodden as little as possible by stock, especially when the ground is rendered soft by rains, or by freezing and thawing. Instead of feeding upon the ground

*I would advise the same mode of cultivation, when blue grass sod is ploughed in the fall or winter.

the small remains of fodder which are left, after the corn is pulled, it is much better to cut up the corn, and put it in shocks, *after it is fully ripe.* The fodder may be fed off, either with corn, or after the corn has been *shucked,* according to circumstances. If the corn has been detached from the fodder, the latter ought to be fed in suitable feeding pens, with a view to the saving of manure. And it would always be advisable to haul it off, in large slides, having suitable shelving, when the ground is either frozen, covered with snow, or not too much softened by rains. That there may not be a necessity of hauling fodder when the ground is so soft as to injure it by treading, a suitable time should be selected for hauling and putting in rick, a quantity of fodder, to be kept as a *reserve,* and to be fed from only when the weather is not suitable for hauling from the field. The rick should be made by setting the fodder against poles, and should, of course, be as convenient to the feeding pen as possible.

The cutting up of corn, and removing the fodder to feeding pens, would not only occasion the saving of much manure, but would leave the field in good condition for early ploughing, thus affording the ground the benefit of the spring frosts, which will greatly assist in pulverizing the soil. But a still greater benefit would result from preventing the corn ground being trodden by stock, when in a soft state, during the winter and spring months.

If ground has been sufficiently renovated and properly prepared for a crop of corn, the process of cultivation is very simple. The ploughing should be deep and thorough, and if practicable, early enough to afford the ground the benefit of the spring freezes. If ploughed early in the winter, or late the preceding fall, it would be still better, as the soil would be thereby more completely pulverized, a matter of great importance in the culture of the corn crop. Except where sod is turned over, the ground should be suffered to lie in a rough state till about the time of laying off for planting, and should be then well harrowed, taking care that this operation be performed when the ground is sufficiently dry to pulverize well. The harrowing will destroy any young weeds which may have sprung up, and will level the ground preparatory to checkering it off for planting. It should now be laid off one way at the proper distance for planting, with a large plough, cutting the furrows as deep as can be conveniently done. A second plough, suitable for the purpose (a well constructed shovel or coulter plough will answer) should follow in the same furrow, to loosen the ground as deep as possible. When a field is thus laid off one way, it should, as soon as convenient, be crossed in the other direction for planting, leaving the rows equally distant each way. The laying off for planting should be done with a small, steady running one horse plough, which should not cut a furrow more than two or three inches deep. This method would leave a deep loose soil at the intersection of the two furrows, and would remove the clods from the furrow so as not to be in the way in covering corn. Careful droppers should follow the plough, or ploughs, laying off the second way, who should be particular to drop the corn *precisely* at the *intersection* of the two furrows, and the hands following with the hoes should be careful to cover the corn with fine mould, (cutting the clods from the hill, if any) precisely at the place where it was dropped, except when they discover an error in dropping. Attention to the foregoing directions is important for two purposes, 1. That the corn may be planted where it will have immediately beneath its roots a deep loose soil, which they can penetrate with ease; and, 2. That the rows of corn may be straight, *both ways*, and thus enable the ploughs with very little aid from the hoes to keep the corn clear of weeds and grass. A shallow furrow in laying off the second way is attended with several advantages. 1. The ground is not so apt to *wash* during heavy rains, as when the furrow is broad and deep. 2. The clods will not so readily fall back into the furrow. 3. The corn will not be so liable to be covered by clods rolling on it at the first ploughing, in consequence of there being a greater width between the furrows.

There are various opinions as to the proper distance at which corn should be planted. This must depend upon the nature of the soil, its degree of fertility, and *the number of stalks in a hill*. My own experience inclines me to the opinion that four feet apart, each way, and three stalks in a hill, is the proper medium for the rich calcarious soil of Kentucky, having a deep vegetable mould. This would give 2722 5-10 hills, and 8167 stalks per acre, supposing each hill to have its full compliment. It would be prudent to drop four or five grains in each hill, and thin the corn at the proper period, to three stalks in each hill. If large corn be planted, each hundred good ears, in *ordinary* seasons, will be equivalent to a bushel; and, consequently, if each hill will average three ears (the double ears will usually make up for the missing stalks) the product will be 81⅔ bushels per acre. If the season be favorable, the yield may be still greater.*

But if the ground has been much reduced by bad husbandry, or the corn be planted in a clay soil, it should be thinned to two stalks in a hill. This would give 5445 stalks to the acre, if none be missing, and a product of 54 45-100 bushels, supposing each hundred ears to make a bushel. But it must be recollected, that, if the soil is not good, the ears may be less, and the product consequently diminished.

If oak land be of the poorer kind, it may be necessary to increase the distance. If 4½ feet should be deemed necessary this would give 2150 hills, and 4300 stalks per acre, allowing two for each hill.

Ground may be so very poor as not to be capable of sustaining more than one stalk in a hill. It might then be planted four feet each way, which would give 2722 stalks per acre.

Some farmers are of opinion, that *drilling* is a better method of planting to secure large crops. With extraordinary care in planting and cultivating a small crop, it is probable a larger yield may be obtained. But the advantages of a small increase of product *per acre* will not be equivalent to the increased labor in cultivating the corn, cutting, shocking, hauling of fodder, &c. I would, therefore, by no means recommend the drilling as a general practice.

When planted in squares it can be ploughed both ways, be better cultivated and with much less manuel labor. As soon after the corn is planted as practicable, a single furrow with a

*I have gathered a part of my crop for the present year, planted and cultivated as above directed, and the product is from 95 to 100 bushels per acre. The early part of the season was entirely too wet, but after the 1st of July was very favorable. If the ground, in which corn is planted be very rich, it may be planted 3½ feet each way, and three stalks left in a hill, equal to 10,665 per acre. If the corn is of the largest kind, and the season favorable, eighty good ears will produce a bushel, and the yield will be one hundred and thirty three bushels per acre.

shovel plough should be run between the rows, in a direction opposite to that in which it was planted. This is an effectual security against the corn being washed up by heavy rains, and prepares the ground for the next ploughing, which should be in the direction in which it was planted, unless the ground be very foul. In that case it may be proper to run two additional furrows in the same way, in which the shovel plough had previously run, throwing the dirt from the corn.

If the ground be tolerably level, and have but few stumps in it, a large harrow may be used to advantage, when the corn is about four or five inches high. The horses by which the harrow is drawn should be made to walk between alternate rows, and the harrow dragged over the corn, having previously removed such of the teeth as would come in contact with young plants. This process is deemed very important, by some farmers, in the cultivation of the crop; and, where the ground is very weedy, is well calculated to keep them under till the corn is large enough to hoe. But if the ground in which the corn is planted has been sufficiently freed from weeds, and properly prepared by previous ploughing and harrowing, the after harrowing may be dispensed with.

A small barshare, Dudley, or McCormick plough may be next used, running the bar next to the corn, and throwing the dirt in the middle. The hoes should follow to clear the hills from weeds and grass; or if they be very small, cutting away those adjacent to the young plants, and covering up those standing in the hill, by drawing some light mould around the corn. It is very important in this stage of the crop to destroy the weeds and grass growing among the plants. If the operation be well performed the plough alone will be sufficient afterwards to keep the corn free from weeds and grass.

Various opinions are entertained as to the best kind of plough to be used in the cultivation of the corn crop. After the ploughing, which is accompanied by the hoes, I have used the shovel plough in preference to all others. It is the most economical, being the least expensive, in the first instance, and costs less to keep it in repair. It requires a narrower head land at the end of the rows for turning, and in consequence of the ease with which it can be managed, will break down less corn. It ploughs deeper, throws a wider furrow, leaves the ground in a state less liable to wash, and works the corn better, and does more work than any plough I have tried. It must be remarked, however, that if corn ground is allowed to become foul with grass, especially foxtail, the shovel plough will not answer as well as some others, after the grass has obtained a complete set, and a luxuriant growth. But if taken in time, no plough answers better to keep it under; and corn should be ploughed so frequently as to prevent grass from getting to such a size as not to be easily destroyed by *stirring* the ground. It should be ploughed alternately, each way, and deep enough to *cut the roots* between the rows. This, so far from injuring the corn, will much assist its growth, as young roots will quickly shoot forth, whenever the old ones are broken, and these will furnish nutrition to the growing corn more rapidly than the old ones. In a word, there need be no fear of injuring corn by cultivating it too much, if care be taken to work it only when the ground is in proper condition. My experience is not sufficient to enable me to speak of the *cultivator* as a substitute for the shovel plough. It is well worthy of trial, and where the ground is free from stumps, or nearly so, it might be used to great advantage in preparing corn ground for sowing wheat, and in putting in that crop, as it would leave a more level surface than the shovel plough. But if the plough should be preferred, so far as my experience extends, next to the shovel, I would recommend the Dudley plough. This is somewhat like the McCormack plough, except that it is made of wrought, instead of cast iron, and is in one entire piece, instead of having a detached mould board. In that respect it has the advantage of the McCormack plough, which, at the joining of the share and mould board, cannot make so nice a fit, as where it is all in one piece. It is also lighter and *scours*, or wears smooth, and is kept in order so much easier than cast iron mould boards, the latter being much more liable to rust than wrought iron. Its greatest disadvantage is the difficulty of repairing by unskilful smiths.

The number of times corn should be ploughed, must depend upon the nature of the soil, and other circumstances, of which the judicious farmer will be the best judge. In grass lands, which are generally, in a great degree, free from weeds, three or four ploughings may suffice; in very weedy ground, five or six may be necessary. In general nothing is lost by frequent ploughing, as the crop will be better, and the weeds will be prevented from seeding the ground, for a future crop.

Many farmers cease ploughing their corn at the commencement of harvest. The consequence is that the weeds run to seed, and ripen, which not only injures the crop, but unnecessarily exhausts the ground (for all vegetables exhaust much more at the time of ripening their seed than at any other time,) and moreover furnish a crop of seed, for the ensuing year. Corn should always be ploughed, at least *once*, and if very weedy, *twice* after harvest. The intervals between the ploughing, after the hoeing operation is completed, should not exceed from eight to twelve days. It is particularly important to stir the corn ground *after heavy rains*, to prevent it from baking. If suffered to lie long, after heavy baking rains, when the crop is in an advanced stage, the corn is very apt to *fire*, when again ploughed. This is a great and serious injury to the crop, and one from which it never entirely recovers. It is very important, therefore, that it should be ploughed as soon as practicable, after each heavy rain, taking care not to commence ploughing when the ground is too wet, that is when there is so much moisture in it as to make the soil adhere, like half wet mortar. When it is sufficiently dry to crumble into a fine mould, and not before, should the ploughs commence running after much rain has fallen. To plough ground when very wet, is exceedingly injurious, and should always be avoided. Long continued rains will, occasionally, severely task the *patience* of the farmer, when his corn crop is suffering, but *patience*, on occasions of this kind, is a virtue which will generally be well rewarded, by an increased product of his corn crop, besides preserving his land from injury, by ploughing it when too wet.

Corn is frequently injured by cutting it too green. This is done by many farmers, under the mistaken idea, that the fodder will be better, if the corn is cut while the blades are green. The reverse is true. If cut while the blades are green, and put in shock, the fodder will scarcely be fit for any kind of stock. Thus, by attempting to make superior fodder, the farmer frequently ruins both fodder and corn. The cutting of corn should not be commenced till all the blades below, and nearly all above the ear are dry. When only two or three blades above the ear, show any remains of the green colour; and when such is the general state of the field, the operation of cutting up corn should be commenced, (taking care to begin with that part of the crop which is most advanced,) and should be completed as rapidly as possible, as the blades, after they become dry, are liable to injury from dews and rain. Hemp hooks are the most convenient instruments for cutting. It should be cut about a foot from the ground, as it will stand much better in shocks, when the ear is brought nearer to the ground than it would be if the corn were cut close to the earth. There will also be less weight to handle in shocking, hauling, ricking, feeding, &c., while nothing will be lost, that is fit for fodder. From fourteen to sixteen hills square should be put in each shock. The former will contain 196 hills, and will give nearly fourteen shocks to the acre, supposing the corn to be planted four feet apart each way. The latter will be $10\frac{2}{3}$ shocks nearly per acre. I prefer the former, if the corn be large, and stands well in the hill, that is three stalks in each. But if it does not stand regular in the hill, or if the stalks be of moderate size, then sixteen hills square will make the shocks of a better size.

The saving of corn in the shock, without injury, depends altogether upon the manner in which the shocks are put up. If they are set up so as to stand firmly, there is no danger of the corn injuring: but if the operation is carelessly, or unskilfully performed, they are liable to twist round, and settle down, so as to leave the top open. When this happens, the rain will penetrate the shocks, ruin the fodder, and greatly injure the corn. Shocks should be thus constructed. The stalks of four hills (left standing for the purpose,) should be inclined towards each other, and tied by their tops, so as to form a kind of cone, over the centre between the four hills.* When this is done, while some hands are cutting, those who best understand the process of shocking, should gather the corn by armsful, and set it up around the four hills, thus tied together, setting the first four armsful in the intervals between the bent corn, bringing the buts so near to each other as to make the stalks

*This operation should be performed a week or ten days before the corn is fit to cut up, as thereby the labor of cutting and shocking will be facilitated.

occupy nearly a perpendicular position. In like manner the successive armsful should be set *regularly* all around the four hills of corn, tied as above directed, still keeping the buts well pressed together, at the bottom, so that the pressure at the top, towards the centre, may not be so great as to break down the stalks tied together. This should be further guarded against by placing equal quantities of corn all around, so that the pressure may be equal from all sides towards the centre.

The tops of the corn stalks being smaller than the buts, they will naturally incline inward, so soon as the fodder becomes dampened by rain or dew; but this inclination should not be very great, otherwise the shocks will not so well turn the rain; besides, as the corn may not be equally distributed all around the shocks, the pressure will be unequal towards the centre, and the effect of this inequality will be greater in proportion as the corn varies from a perpendicular position. Care should also be taken to set up the corn, so as not to give it an inclination to the right or left, or *a leaning sideways*. If this be not attended to, the shock, in settling together—as it will when it becomes damp by dews or rain—will be certain to twist round, and cause the top of the shock to open, and thus expose it to great injury from the weather. This point is the most important thing to be attended to, in shocking corn, an operation upon which the complete preservation of the crop depends. That part of the corn which is not intended to be fed away with the fodder, must, of course, be shucked in the field. This should be done while the fodder is damp, otherwise there will be a considerable loss by its crumbling. As fast as the corn is shucked, the fodder should again be put in shock, and this cannot be well done, when it is dry. Hence, after a damp spell, or when the weather is warm and giving, is the best time for shucking corn out of the shocks. If this operation is in progress, during the feeding season, a part of the fodder may be hauled at once, to the feeding pen, and to a rick adjoining it, and so far the trouble of re-shocking may be avoided.

Some farmers do not pursue the practice of cutting up their corn; and among these two different methods, of saving their crops, prevail By some it is contended that shucking the corn upon the stalks, as they stand in the field, and hauling the corn thence, to the crib, is the most economical, or greatest saving of labor. The practice with others is to pull their corn, haul it to a suitable place, and shuck, and then crib it. There can be no doubt that the same number of hands will, by the former method, secure in the crib, a greater quantity of the corn, in the same time, than by the latter.

The plan is, however, subject to two objections. 1st. By this method all the corn, good and bad, must be cribbed together. 2nd. The shucks must either be lost, or stock must be turned in the cornfield to feed upon them. If this be done, the ground will be much injured by the treading of the stock, when rendered soft by rains, or by freezing and thawing. This evil may, in some degree, be avoided by turning the stock into the field *only* when the ground is frozen hard. But our winters are so open, and the changes in the weather so frequent and sudden, as to defeat almost every precaution of this kind. In point of fact we rarely see farmers take the trouble to have their stock removed at every sudden change of the weather, particularly when that change is accompanied by heavy and long continued rains. *Comfort* is most generally consulted, on all occasions of this kind, and the cattle are left to feed themselves, rather than encounter the trouble and inconvenience of removing them to a place where they may be fed. And thus the *ground* is left to suffer rather than expose the *farmer* or his hands to inconvenience.

The other plan is somewhat more tedious, and (if there be no shelter under which to throw the corn as it is hauled, and to shuck it, and save the shucks,) is liable to more serious objections than the first.

If, however, the farmer will provide himself with a cheap and suitable building, under which his corn can be protected while he is gathering, hauling and shucking it; and where he can save, salt, and stow away his shucks till the time for feeding them, the latter plan will, perhaps, be entitled to the preference. Much of the corn, according to this plan, can be shucked during bad weather. It can be assorted, and the different kinds hauled to the appropriate places for feeding. The shucks can be salted, and secured from the weather, and fed away without much inconvenience in bad weather. The stock, fed upon them, will furnish some manure; and above all, this plan will keep the stock from injuring the land, by treading it when rendered soft by rains, and by freezing and thawing. If this plan be adopted, there should be a crib, for holding the *nubbin* corn, and that which is unsound, so situated that this part of the corn may at once be put into it, and thus leave none but the unsound corn to be removed to distant cribs. The process of assorting the corn may thus be performed while shucking it, and the defective parts, by means of baskets, deposited in the adjoining crib; or it may be assorted as the sound corn is thrown into the wagon to haul to the appropriate crib intended for it, while the wagon is unloading.

CULTIVATION OF HEMP.

The first thing to be done, by a person who is about to engage in the culture of hemp, is to rear seed for his future crop. This is not only important, as regards economy, but still more so for other reasons. There is no seed so easily injured and rendered unfit for sowing, as that upon which we depend for producing a hemp crop. If the seed is perfectly sound, has been well ripened, and not injured by heating after it is housed, the hemp cultivator knows how much to sow to the acre, to make it yield to the best advantage. But if the seed has been injured by heating, or, from any other cause, is so defective that only half or two-thirds will come up, the crop will be greatly injured. If too small a quantity of seed be sown, the stalks will grow large and coarse; and, besides producing less, the quality of the hemp will be inferior. If, to insure a sufficient degree of thickness, you sow a double quantity of seed to the acre, and all should come up, there is not only a loss of one half of the seed, but the crop will be injured, in consequence of the hemp being too much crowded.

It is said by some farmers that you cannot easily sow too much seed on the ground, as it will thin itself sufficiently, and only so much seed will grow as it will support; and that by sowing an over quantity of seed, the danger of the hemp growing too coarse will be obviated. This is certainly true, but where a double quantity of seed is sown, that portion of the hemp which will not come to perfection will take from the more thrifty plants a part of the nourishment which they would otherwise have received, up to the period when the *un-*

derling hemp perishes, and consequently will not attain as great a height as it would otherwise have done. Besides, that portion of the hemp which perishes, will be an obstruction in cutting, spreading and breaking, without furnishing any lint. It may, therefore, be laid down as a correct principle, in the culture of hemp, that only so much seed should be sown per acre, as the soil will bring to perfection, or as *near* that quantity as practicable. But as it is impossible to distribute the seed so as to give every foot of ground its due proportion, it is more safe to sow rather an *over* than an *under* quantity of seed.

The foregoing considerations, it is believed, will be sufficient to impress upon the cultivators of hemp the importance of raising their own seed. They will thus have a perfect knowledge of its *quality*, and will therefore know how to regulate the *quantity* to be sown per acre. They will, moreover, be assured that it is free from other seeds, such as fox-tail &c.

The richest ground is the best adapted to raising of hemp seed. And that which has been highly manured is better than newly cleared land, even of the most fertile quality. Land which has been long in grass, and pastured by cattle or sheep, is very suitable for the purpose. To prepare ground for hemp seed, it should be finely pulverized by repeated ploughings: and if grass land is intended to be used, it should be ploughed the preceding fall, so that the ground may be not only more completely pulverized, but that the danger of the hemp being cut by worms may be avoided. Timothy meadow, upon which sheep have been long pastured, during the winter, is finely adapted for hemp seed, but it should be ploughed in the fall, and, if not very rich, should have a dressing of manure.

The seed should be planted as we do corn, either in hills or drills. I prefer the former, because it admits of easier and better cultivation, as the plough can be used both ways. It is usual to plant five feet apart, each way, and suffer four or five stalks to stand in a hill until the blossom hemp is removed, and then reduce the number so as not to exceed two stalks in a hill. Thus there would be two seed plants for each twenty-five square feet. It would be a better practice to make the hills three feet six inches apart, each way, and thin the hemp to three stalks in a hill, till the blossom hemp appears, and at the proper time cut out the blossom or male hemp; and, if necessary, a part of the seed hemp, so as to reduce the latter to one stalk in the hill. If each hill should contain *one stalk*, there would be two seed stalks for each twenty-four and a half square feet. This will give a greater number of *seed stalks* per acre than planting five feet each way, and leaving two in a hill. According to this plan, each seed plant will stand by itself, and, having its appropriate space of ground, can spread its branches without obstruction. According to the other plan, two seed plants, standing together, will obstruct each other. in putting forth lateral branches, and can scarcely be expected to produce *twice* as much as the single stalk.

The ground for hemp seed, having been well prepared by at least two ploughings, and a number of harrowings, sufficient to pulverize the ground, it should be laid off as above directed, and planted in the same manner as corn, except that the seed need not be covered more than an inch or an inch and a half deep. Twelve or fifteen seed should be dropped in each hill, which should be somewhat scattered to prevent them from being too much crowded in the hill. Though good hemp seed is certain to come up, yet it is prudent to plant about the number suggested to guard against casualties. Soon after the hemp seed comes up, a small shovel plough should be run through. both ways, once in a row. If the ground is not foul, the ploughing may be delayed till the hemp is a few inches high, which will enable the ploughman to avoid throwing the dirt on the tender plants. The hoes should follow the second ploughing, and clean away the weeds, if any, in or near the hill, and thin out the hemp to seven or eight stalks. These should be the most thrifty plants, and somewhat separated from each other. The ploughing should be repeated, from time to time, so as to keep the ground light and free from weeds. And when the plants are about a foot or a foot and a half high, the hoes should again go over the ground and carefully cut down any weeds or grass which may have escaped the plough. The plants should be still further thinned out, at this time, leaving but four in a hill, and some fine mould drawn around the plants, so as to cover any small weeds that may have come up around them. After seed hemp has attained the height of a foot and a half, it will soon be too large to plough, but it ought to have one ploughing after the last hoeing. The ground, by this time, will have become so much shaded by the hemp plants as to prevent the weeds from growing, so as to do any injury, and nothing more need to be done but for a boy to follow the plough, and (if three and a half feet be the distance of the hills apart,) reduce the number of plants invariably to *three*, taking care to remove those which the last ploughing may have broken or injured, by the treading of the horse or otherwise.

The next operation will be to cut out the blossom or male hemp. This, according to the opinion of some farmers, should be done as soon as the blossom begins to show, in order to make room for the seed hemp to grow and spread its branches. This opinion must be taken with some allowance. The farina or pollen of the male hemp is necessary to fertilize the seed bearing plants. The seed of the latter would be wholly unproductive, if the *whole* of the male hemp should be cut before its pollen has been thrown out. If those farmers who cut their blossom hemp, at the first moment it can be distinguished from the seed bearing plants, do not entirely destroy their seed, it is because many blossom plants escape, in consequence of their not having shown their sex at the time the blossom hemp is cut, or because adjacent hemp fields may have furnished a sufficient quantity of pollen to fertilize, at least in part, the seed bearing plants. It is important to cut the male hemp so soon as it has performed its office, because much room is thereby afforded to the seed bearing plants to spread their branches.

The following course might be pursued with advantage. When the seed hemp has so far advanced as to enable one readily to distinguish the male from the female plants, let all the blossom hemp be cut out, except one stalk in every other hill, and every other row. This would leave one stalk of male hemp for every four hills. These, together with the stalks which should thereafter blossom, would be sufficient to fertilize all the seed bearing plants, and secure a crop of *perfect* seed. After the blossom plants, thus left, have been permitted to remain until they have pretty well discharged their pollen (which can easily be ascertained by dust ceasing to flow from them when agitated) they, also, should be cut down. Some farmers top the seed plants, when five or six feet high, to make them branch more freely, but this is not necessary where but one or two seed bearing plants are suffered to remain in each hill.

Hemp seed should be planted early in the month of April. Early planting succeeds best. If the ground is in proper condition, it may be planted even as early as the middle of March. Hemp is a hardy plant, and will not, as supposed by some, be injured by frost.* It is also an error to suppose seed hemp should not be cut before it receives a slight frost† If planted early, it will be fit to cut from the first to the fifteenth of September, and there is no necessity to wait for frost. On the contrary, it is better to cut before it receives any frost, because the seeds drop out by handling much more easily after it has received a frost than before, and consequently there will be a greater waste. In cutting the seed plants, care should be taken to agitate them as little as possible, as the seeds drop out very easily when they are ripe. A sharp hemp hook, of a circular form, is the best instrument for cutting seed hemp. The operator should grasp the stalk in one hand, and bend it gently towards him, and with the other should place the blade of the hemp hook against the stalk, about a foot from the ground, and by a gentle pull the stalk will be cut transversely, with but little agitation. The stalks should be laid gently on the ground, so as not to shatter out the seed, four hills in a heap. This operation should be performed in the morning, while the dew is on the hemp, as the seeds will then be less liable to shatter out. There are two modes of managing seed hemp after it is cut. One is to set the stalks up in open shocks until they are sufficiently dry to thresh out the seed, and then, haul them on a sled to a dirt floor, prepared for the purpose, and there thresh out the seed.

The other method is to prepare a large floor on the earth, adjacent to the seed hemp, and by means of forks and poles arranged along the floor, to set up the seed plants in a kind of rick, the butts on the ground, and the tops against the pole on each side.

The former plan is objectionable, upon the ground that all the seed which shatters out before the time of threshing, will be lost; and also, because of the impossibility of removing the seed hemp from the shocks to the slide without a considerable loss of seed. The latter plan requires more labor in preparing the floor, but is much more economical in saving seed,

*Farmer's Guide, 228. †Ibid.

and should be preferred. A sled should be employed to transfer the seed hemp to the floor. If a sheet be spread on the sled, there will be scarcely any loss of seed in hauling, as it can be driven so close to the floor as that all the seed that may shatter off in hauling will either fall on the sheet or on the floor. The seed hemp should be suffered to stand in rick till thoroughly dry. If it should receive some rain, it will be an advantage, as this will cause the seed to seperate more readily from the chaff, and will facilitate the operation of threshing. If the season should be very wet, there may be danger of the seed sprouting in the rick. This must be guarded against, by opening the tops of the hemp, (which will have been pressed together by the rain,) so as to give it air and sun, as soon as the weather clears off. After much rain the seed may be threshed out, even when the tops are quite damp or even wet, and it should be got out without delay, to prevent the seed from sprouting. But if got out when damp, the chaff and hemp seed will become warm in a few hours after it is heaped up. To prevent its injuring, it should be run through a fan, on the same day it is threshed, and taken to the barn or some dry shelter, where it should be spread out, and frequently raked or stirred, until it becomes thoroughly dry and cured, when it should be again run through the fan, and put away in barrels with open heads, in a house which is dry, and to which rats can have no access, as they are very destructive to hemp seed. A house erected upon posts, four feet high, is the best security against these troublesome animals. If the seed hemp get a rain after it is set up in rick, it may be threshed out in a week or ten days, or sooner if it begins to sprout. If it get no rain, it may stand longer in rick. The most convenient mode of threshing is for each hand to have a plank, about twelve or fifteen feet long, and fifteen or eighteen inches wide, set up against the pole, (at an angle of forty-five degrees,) against which the seed hemp was ricked. The operator threshes out the seed by taking one, two, or three plants at a time, (according to their size,) in his hands, and beating them against the plank. As the seed comes out very easily, a few blows are sufficient to knock all the seed out, when the plants are thrown off the floor, in heaps, where they may be burnt, or may be used for covering shelters for hogs, or cattle, &c. They are said to be valuable also for making charcoal for powder manufactories. They are of no value for lint.

It is the safest course, even when the seed hemp is perfectly dry at the time of threshing, to haul the seed, after it has been once run through the fan, to the barn or some dry shelter, and there spread it out thin, and suffer it to become thoroughly cured before it is cleaned and put away. This will be a great security against its heating in the barrels, which would be certain to spoil the seed. If, however, the seed hemp has stood long enough in the rick, for the seed to become perfectly cured, the trouble of hauling it to the barn may be dispensed with, and it may be run a second time through the fan, at the place where it is threshed. But to avoid getting dirt with the seed, it should be run upon a sheet, at the second cleaning, and measured thence into bags.

Old seed will generally not answer for sowing. During the *summer* succeeding the year in which it was reared, it goes through a heat, which destroys its vegetating powers. If, however, it were to be spread out thin, on a dry floor, before the commencement of warm weather and kept thus spread out during the summer, there can be no doubt it would answer for sowing the ensuing year. Yet it is always safest not to trust to old seed without having first tested it by planting a certain number of seeds, and thus ascertaining how many will vegetate.

The floor for getting out seed should be prepared before the time for cutting arrives. It should be as convenient as practicable to save hauling. I usually leave a space along side of my seed hemp, for the purpose. This may be planted in pumpkins, and cultivated with the plough. Shortly before the seed hemp is fit to cut, the pumpkins and vines are removed, the ground is well harrowed and then trod by horses, until it becomes sufficiently solid, and is then scraped with hoes, to make it smooth, swept, &c.

The next step in the process of hemp raising, is to prepare the ground for receiving the seed. This should be done by thoroughly pulverizing the soil. Hemp, more than most other crops, requires that this should be done in as complete and perfect a manner as possible. The hemp grower may always expect his crop to be increased in proportion as this operation is well performed. This can be best accomplished by ploughing the ground, intended for hemp, the preceding fall, or early in the winter, so that it may have the benefit of the winter frosts. It should be ploughed deep, and left in a rough state, without harrowing. Not a hoof should be suffered to go upon it. Shortly before sowing, it should again be ploughed and harrowed. The latter is necessary to level the ground, in order to prevent the seed from rolling into the sinuosities, and thus render the hemp uneven. It should now be sowed and harrowed both ways, or harrowed one way and then rolled or brushed the other way. This is preferable as it will lay the surface of the ground more level, and will facilitate the cutting operation, enabling the workmen to cut closer to the ground and thus save lint. This is the most advisable course for early sowing, when there is always a sufficient quantity of moisture in the ground to bring the seed up. But if there is any doubt about there being a sufficient moisture in the ground to cause all the seed to vegetate, it is more safe to plough the seed in with shovel ploughs. These will cover the seed to such a depth as will insure their coming up, unless the ground should be very dry. In that case there is no alternative but to wait for rain before you sow. Different opinions prevail as to the proper quantity of seed to be sown per acre. My experience, which has been considerable, convinces me that the quantity of *good seed*, upon well prepared ground, and sown when there is moisture enough to bring it *all* up, need not exceed one bushel and an eighth per acre; but as the most skilful sower cannot scatter the seed so as to give every portion of ground its due proportion, it would be advisable to sow a bushel and a peck per acre.*

Manured ground does not answer so well for hemp, the first year, as that which has been laying long in grass. If recently and highly manured, it is apt to make the hemp grow too coarse. Land which has been several years in clover, (if it had not been previously too much reduced by bad husbandry,) is well adapted to hemp, but it is sometimes seriously affected by the cut worm and other insects. To guard against these, clover should always be ploughed the previous fall or early in the winter.

*Experience, since the writing of the above has convinced me that the smaller quantity is best.

A still greater *safeguard* is to sow the clover ground *late* in the month of May.

Hemp may be sowed upon the same ground several years in succession, to great advantage; and as, after the first year, the cut worm is usually not very troublesome, there will be a necessity of taking the precaution of sowing late but one year.

Land which has been long in blue grass, especially if pastured by sheep, is finely adapted to the growth of hemp. But to make it produce well the first year, it is essential that the sod should be well turned over, the preceding fall, so that it may have time to decompose, and become thoroughly pulverized.

Newly cleared land is not so good for hemp as that which has been in cultivation a year or two in corn. But if sowed after corn, the stalks should be cut close to the ground the previous fall, and the roots of the corn turned under with a large plough, so that they may have time to rot. They will be somewhat in the way, in cutting the hemp, the first year, but will be no trouble afterwards.

It is very important for the hemp grower, to have his ground for hemp set apart in fields, in which nothing else grows. These may be kept for hemp a great length of time without any change, and consequently there will be no necessity for suffering any kind of stock to go upon the hemp ground. The soil will thus be kept light and mellow. As soon as the hemp, of the previous crop, is off the ground, it should be ploughed deep, turning all the hemp stubble and roots under. If this can be done in time to have the benefit of the spring frosts, so much the better. It should not be harrowed (if ploughed early enough to have the benefit of the spring frosts,) till the time for sowing. With one harrowing before, and one after, the crop will be pitched. If, in consequence of heavy rains, the ground should have become baked, it would be advisable to plough the seed in with shovel ploughs, so as to render the ground light. And in all cases where there is a doubt whether there is a sufficient quantity of moisture in the ground to bring the seed up by harrowing, the shovel plough should be substituted, as it will cover the seed much deeper, where it will find moisture to make it vegetate. If harrowed in, when the ground is very dry, that which is covered to some depth will sprout and come up, but that portion of the seed which lies near the surface will not vegetate till it rains. If there be only one week between the coming up of the first and last portion of the seed, the latter will be so far behind the other as to be always what is call *underling* hemp, and will be of no value, whilst that which came up first will be too thin, and will consequently grow very coarse. This should be most carefully guarded against.*

Hemp may be sowed at any time between the 10th of April and last of May, *when the ground is in a proper state for sowing*, that is neither *too wet* nor *too dry*. Early sowed hemp generally produces the best crop. It would be best to sow not later than the 20th of May, if it can be avoided, but hemp sowed the 10th of June will make itself before frost, though in general the crop will be light. To give time to cut a large crop of hemp before it becomes too ripe, it should be sowed at different times, so as to allow four or five weeks between the first and last sowing. Some seasons hemp may be sowed as early as the first of April. Frosts will not destroy it, but if sowed too early, its growth may be considerably checked by a succession of cold frosty weather, after the hemp gets up. This will have the effect of preventing it from attaining the height to which it ought to grow, and will considerably reduce the yield per acre. There is, however, not much danger of

*If some time has elapsed, since ground has been prepared for sowing hemp, and especially if much rain has fallen, it is best to put in hemp seed with small ploughs, instead of the harrow. This will not only lighten the soil, and leave it in fine condition for the rapid growth of hemp, but will destroy the volunteer hemp, which shall have come up, from the seed of the previous year. It is important to destroy this, else it will get so far ahead of the newly sowed hemp as to overshadow and injure it to some extent. This can be effectually accomplished only by ploughing the ground. I commonly use shovel ploughs for this purpose. But as these will leave the ground too uneven for cutting the hemp sufficiently low, I would advise brushing the ground, with a heavy brush, in the contrary direction, after ploughing in the seed. This will be better than harrowing as it will leave the ground lighter, an object of much importance in the cultivation of the hemp crop. In laying off ground for sowing hemp seed, it is usual to run furrows with a small plough. Where this practice is pursued, more than a due proportion of hemp seed will fall and be dragged into the furrows, and consequently it will stand too thick to grow to a proper heighth. It is a better practice, and a saving of labor to mark off lands to sow by, by dragging a log chain instead of ploughing. For this purpose I double a log chain, fastening the two ends to a light single tree. The person laying off the ground can ride the horse, and lay it off with great expedition and accuracy, by using stakes of the proper length. This leaves marks plain enough to sow by, and the ground is left level and uniform for the reception of the seed."

this, if not sowed before the 10th of April. If the last sowing be on the 20th of May, there will be a period of forty days between the first and last sowing. This will produce such a difference in the period of ripening, as to give sufficient time for cutting and ricking.

The time for cutting or pulling hemp is indicated by the leaves of the male hemp becoming yellow, and most of them dropping off. Upon a close examination, about this period, it will be found that some of the blossom stalks will have entirely shed their leaves, and begun to turn of a dark colour, having lost their yellow hue. When this discovery is made, no time should be lost in cutting or pulling the hemp. But it may stand a week longer without any very material injury, except that the blossom hemp will not take so good a rot, and will be somewhat worse to break.

There is some difference of opinion as to the best mode of securing hemp after it is ripe. Pulling is still practised by some, and it is probable more lint can be saved in that way than by cutting. It is certain that by cutting some lint will be lost, as with the utmost care, two or three inches next the ground must be lost. On the other hand, many advantages attend the cutting of hemp, which will more than over balance this loss. Cutting is more expeditious than pulling. There is considerably less weight to handle in all the subsequent operations, such as taking up and binding, loading and hauling to the rick or stack, loading and hauling out to spread for rotting, again taking up and shocking, and finally, the trouble and expense of breaking, (the price of breaking pulled hemp being considerably higher.) In all these operations the roots are very much in the way, and particularly so in spreading, and considerably increase the time requisite for going through the various manipulations the hemp must undergo. In a word, when hemp is cut, the grower can manage a much larger crop, which will greatly more than counterbalance the loss by cutting. To this should be added, that cut hemp makes superior lint, and will always have a preference over that which has been pulled, because of the coarse bark which comes off that part of the stalk near the ground forming a part of the lint of the latter. Another advantage in favor of cutting, is that the roots and stubble, when ploughed under, have a tendency to render the soil light, and, when decomposed, forms a slight dressing of manure. These considerations should give a decided preference to cutting over pulling of hemp. With hemp hooks, tolerable hands will cut, on an average, half an acre each; with cradling scythes, (W. L. Larimore's,) an acre may be cut with ease, by good hands, in hemp not exceeding six or seven feet high. If hemp is coarse or taller than seven feet, it cannot be well managed with scythes.* This instrument requires a smooth bottom to do good work.

When hemp is cut or pulled, it should be spread on the ground, keeping the butt ends even, and should be suffered to lie till well cured. This will require a week, or somewhat less, if the weather is clear and warm. If it get a rain, in the meantime, it will be an advantage, as it will cause the leaves more readily to leave the stalks.

There are different modes of treating the hemp crop after it is cut and cured. By some the leaves are beat off, and then, without binding it in sheaves, it is put in shocks, tying two bands round each, one near the top and the other about eighteen inches lower down. In this condition it is suffered to remain till the proper period for spreading it out to rot. By others it is bound in sheaves, (some beating the leaves off and some not,) and put up in shocks, where it is suffered to stand till there is leisure, when it is put in stacks or ricks. A third practice, (and that which I deem the best,) is to take up the hemp as soon as it is sufficiently cured, and bind it in sheaves, without beating off the leaves. The binders throw the sheaves into two rows, with a sufficient space between for a wagon to pass. While the process of taking up and binding is going on, a wagon and three hands, (two to pitch and one to load,) is engaged in hauling the hemp to the rick and ricking it. The rick should be in a central part, so as to require the hemp to be removed as short a distance as possible. Then the process of taking up, binding, hauling, and ricking all progress together. In this way, five or six hands will put up a stout rick in a day and a half and cover it. By having two wagons and ten hands, it may

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*Mr. Larimore has recently made an improvement on his cradle. The improved cradle, I have learned, can be used to advantage in cutting hemp of any height, if not *too coarse stalked*, which should always be guarded against, by sowing enough seed on the ground, when in a proper state.

be accomplished in one day. It is proper to remark, that for making the roof of the rick, it is necessary to have long hemp, from which the leaves should be beat off. In this state only will hemp make a secure roof. *Ricking* is preferable to *stacking*, because the former secures completely *all the hemp* from the weather, except that which composes the roof, while stacking leaves the butts exposed. The first practice, above suggested, is objectionable upon the ground that the outsides of all the shocks are exposed to the weather for several months, before the time for spreading arrives, and is generally much injured by the weather, especially during wet falls. If the fall should be very dry, the outsides of all the shocks will be partially rotted; and as these parts must be spread with the part of the hemp which has had no rain or dew, they will be too much watered before the residue is fit to be taken up, and they will sometimes be entirely ruined.

The second practice, *where the leaves are beat off*, is objectionable, because of the great increase of labor, the process of beating off leaves being very slow and tedious; and when the leaves are *not beat off*, though there is not so much extra labor, if the weather is favorable, yet there is danger of the hemp being seriously injured if there should be much rain. The rain will gradually penetrate the shocks to the very centre, and in consequence of the leaves being packed so closely, the shocks cannot dry without opening them, and loosening the top of each sheaf. And while drying there will be a risk of again getting wet from rain. This plan is, therefore, more objectionable than beating off the leaves before shocking. I am satisfied, from actual experiment, (having tried all these different methods,) that the best way of managing hemp, after it is cut and perfectly cured, is to bind and rick it as herein before described without beating the leaves off, except for the cover.

If the hemp be well cured and ricked, when perfectly dry, many of the leaves will shatter off in the process of ricking. Most of those remaining on the hemp will shake off when it is hauled out and spread. It is an advantage to have the leaves pretty well separated from the stalks, before or at the time of spreading out to rot. But this object will be sufficiently attained by the handling of the hemp, in the different processes of binding, ricking, hauling out, and spreading.

There is a difference of opinion, also, as to the best ground upon which to spread hemp. Some choose meadow ground, in preference to any other place. I formerly pursued that practice, but have abandoned it, from a perfect conviction that the ground upon which hemp grows is the most suitable place to spread it for rotting.

1. This saves much *time* in ricking, as the ricks may always be on the ground on which the hemp grew, and as nearly central as may be to that part of the hemp which is to be put in the rick.

2. All the manure arising from the leaves, half formed seed, &c., will be left on the ground.

3. The hemp *rots* or is watered quicker and more regularly than it does on grass land.

4. If spread on hemp ground, you are sure to guard against stock running there, and the ground is consequently kept in good condition for another crop. Besides the ground is benefitted by being covered with the hemp while rotting.

5. If spread on meadow ground much of the grass will be injured by burning the hemp shives, and if the hemp is not sufficiently watered before the grass springs up among it, it will not obtain a good rot, and may be seriously injured.

The best time for spreading hemp is in the month of December. It then receives what is called "a winter rot," and makes the lint of the hemp a light color, and its quality better than if spread out early. But where a farmer has a large crop, it is desirable to have a part of his hemp ready to take up late in December, so that he may commence breaking in January. To accomplish this object, a part of his crop may be spread out about the middle of October. It would not be prudent to spread earlier, as hemp will not obtain a good rot if spread out when the weather is warm.

The experienced hemp grower is at no loss to tell when hemp is sufficiently watered. A trial of a portion of it on the break will be the best test for those who have not had much experience. When sufficiently watered the stalks of the hemp lose that hard *sticky* appearance or feel which they retain till the process is completed. The lint also begins to separate from the stalk, and the fibers will show themselves somewhat like the strings of a fiddle-bow attached to the stalk at two distant points, and separate in the middle. This is a sure indication that the hemp has a good rot.

The practice of water-rotting has been generally abandoned. The scarcity of water and supposed unwholesomeness of the process have conduced, not a little, to this result. Besides, the circumstance of the manufacturer giving no more for water than dew rotted hemp, has discouraged all attempts to water-rot, to any considerable extent. For rigging of ships, water-rotted hemp is undoubtedly the best, but for bale rope and bagging, dew-rotted answers equally well, and, therefore, it cannot be expected that the manufacturers of these articles should give an additional price for the former.

Some have advised that hemp, after it has been sufficiently water-rotted, should be put under cover.* This is certainly an error. If, after hemp is sufficiently watered, it is put in large masses, it goes through a sweating process, which toughens it, and renders it much more difficult to break. Besides it would cost much labor to haul it from the field, in which it was spread, put it under a shelter, and again remove it to some distance from the shelter to break it out. In these different handlings, the hemp would be a good deal tangled, and much loss of lint would result therefrom. The erection of suitable buildings for the purpose would, moreover, be attended with considerable expense. All this extra labor and expense is wholly unnecessary. When hemp is fit to be taken up, it should be immediately put in shocks, without binding, of suitable size. If it is dry the shocks should be immediately tied, with a hempband, by drawing the tops as closely together as possible, in order to prevent the rain from wetting the inside. If carefully put up, and tied, they will turn rain completely. Each shock should be large enough to produce from fifty to sixty pounds of lint. If the hemp should be considerably damp, when taken up, the shocks should be left untied at the tops until they have time to dry. If shocks are not well put up, they are liable to blow down by a strong wind. To guard against this, it is necessary, when commencing a shock, to tie a band around the first armful or two that may be set up, and then raise up the parcel, so tied, and beat it well against the ground, so as to make it stand firmly, in a perpendicular direction. The res-

*Farmer's Guide 232.

idue of the shock should now be set regularly around the part first set up, as herein directed. If hemp be carefully shocked, it will receive little or no injury till the weather becomes warm. In the mean time it should be broke out as rapidly as possible. If the operation be completed by the middle of April, no material loss will be sustained. If delayed to a later period, more or less loss of lint will be the consequence. Cool frosty weather is much the best for hemp breaking. In that state of the weather, if the hemp is good, first rate hands, on the common brake, will clean two hundred pounds per day, upon an average. Two of my best hands, during the past season, for every day they broke, favorable and unfavorable, averaged 136 pounds. Two others, who are young men, and not full hands, averaged 114 pounds. The ordinary task for hands is 100 pounds. Over work is paid for at the usual price of breaking.

Many efforts have been made to clean hemp by machinery, but hitherto without success. At least no method has yet been discovered, that answers as well as the common hand brake. This is so commonly in use as to render its description unnecessary. A good description of it is given in the Farmer's Guide, page 223, except that the under slats, in the hinder part of the brake, instead of six inches a part, should be from 16 to 18 inches. Those in the upper jaw should, of course, correspond with those in the lower one, that is should be so placed as to play exactly in the centre of the lower slats.

I have now gone through with the process of the hemp culture, from the rearing of the seed to the final completion of the operation, by preparing the lint for market. It has been my endeavor to give the practical results of my own experience, aiming at utility rather than ornament of style.

A few remarks upon the soils, suitable for the hemp culture, will close this essay. It cannot be cultivated to advantage on the white oak lands of Kentucky, but is well adapted to the rich dark, loamy soils, which predominate, in the counties of Mason, Bourbon, Montgomery, Clarke, Fayette, Woodford, Scott, &c. The rich lands, in these counties, are composed of a deep vegetable mould, upon a sub-stratum of clay, which is underlayed by horizontal limestone rock. A considerable portion of the lands, in these counties, are *naturally* extremely well adapted to the growth of hemp; and when they have been reduced, by bad husbandry, they may be restored, by laying them down in clover, three, four or five years, according to the extent of deteriorati on which they have undergone.*

Hemp may doubtless be cultivated to great advantage in a considerable portion of the rich lands, in the neighboring states of the west, where they do not lie so level as to be inclined to be wet. A dry soil is essential to a successful cultivation of this article.

Good hemp land, in Mason county, will upon an average, in ordinary seasons, yield a ton (2240 lbs.) for every three acres. In favorable seasons, and upon first rate ground, I have known over 1200 lbs. to the acre produced. But this is a very uncommon yield. Five acres of my last year's crop, measured and broke out by itself, produced 4911 pounds, equal to 982 lbs. per acre, though my crop was considerably shortened by the dry season.

The success with which hemp can be raised on the same ground, for a number of years, is very remarkable. There is scarcely any other crop, that will not deteriorate the soil, by being grown on the same ground for a succession of years.

The Farmer's Guide states, upon good authority, "that thirteen or fourteen successive crops were taken from the same field, and that the last was the best." I have no doubt of the correctness of this statement, because it conforms to my own experience. A field containing twelve and a half acres, upon which nine or ten successive crops have been grown, produced last season 9809 lbs. of hemp, equal to 789 lbs. per acre, though the season had become very dry sometime before the hemp had attained its growth. This was quite as good a yield, taking into consideration the unfavorableness of the season, as I ever had from the same ground.

I have never discovered the smallest diminution of crop, except what may be fairly ascribed to the unfavorableness of the season. It may, therefore, be laid down as a well settled prin-

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*Clover will not do well for more than two or three years in succession, without ploughing the ground. If, therefore, ground is so much exhausted as to require five or six crops of clover to restore it, after the third crop it should be ploughed in the fall and sowed in wheat, when a new crop of clover will be produced from the seed in the ground, the ensuing spring.

ciple, that hemp is not an exhausting crop. This may be accounted for upon rational principles. 1. Vegetables that have a profusion of leaves, in proportion to their *stalk* and *root*, derive a larger proportion of their aliment from the atmosphere or substances mingled with it, than those differently constructed. 2. Plants exhaust a great deal more while *ripening their seed* than at any previous period of their growth. 3. All other circumstances being equal, those crops which most completely protect the ground from the rays of the sun, and the evaporating effects of the winds, must be most favorable to the preservation of its fertility. In all these respects the hemp crop is very favorable. Even after it is cut it still covers the ground until it is put in rick. And being again spread on the same ground during the winter, it saves the soil from the deteriorating effects of stock running upon it. If we add to all these advantages that it receives from the hemp all the leaves, blossoms, pollen, imperfect seed, &c., which annually serves as a dressing of manure, we shall not be surprised that hemp should have little or no tendency to deteriorate the soil.

CULTIVATION OF TOBACCO.

The first step in the process of tobacco culture is to make provision for an abundant supply of plants. Tobacco seed are very small, and the plants, when they spring from the ground, grow very slowly, and would soon be smothered by weeds if not carefully guarded against. The places selected for plant beds, should be such as would not be likely to produce many weeds. New ground or that which has been long set in grass, would be best for this purpose. To guard still further against weeds, and to ensure a thrifty growth of plants, it is essential that the place in which the seed are to be sown, should be burnt. A light burning with straw or other light material will not be sufficient. A good coat of brush laid upon the ground intended to be used for a plant bed, and arranged so closely as to make it burn readily, serves best for the purpose. Care must be taken also, before laying on the brush, to take all trash from the ground, so that the heat may readily destroy the seeds of any weeds which may have been deposited there. New ground is always to be preferred for plant beds, and brush as the material for burning the ground. But if the tobacco planter have no new ground, then he must substitute grass land in its stead, and this should be well burned by having a range of logs (those which are seasoned are best) laid along one edge of the ground, intended for plant bed, and heaped up sufficiently to make them burn readily. These must be set on fire, and after burning the ground which they cover sufficiently, they must be moved by means of hooks, to the adjacent ground not yet burnt; and so on, in succession, until the entire space, intended for a plant bed is burnt. If one set of logs is not sufficient to burn a space as large as will be necessary, others must be added so as to enlarge the space, or they may be burnt at different places as may be most convenient.

Where sod ground is intended to be used, it would be advantageous to have the sod lightly skinned off with sharp hoes, before the space is burnt over.

After the ground is burnt it must stand sufficiently long to cool, and then the ashes should be carefully removed. The ground should now be dug up with hoes, to the depth of two or three inches, and so as to pulverize it as much as possible, and should be well raked with an iron tooth rake, so as to break up the soil into the most minute parts. It will now be ready for sowing the seed. It is important that this operation should be as regular as possible, and care should be taken to put the proper quantity of seed upon the ground. If sowed too thick, the plants will be so much crowded as to injure their growth. If sowed too thin, a deficiency of plants may be the consequence. A common silver table spoonful of seed will be sufficient for fifty square yards. More than that quantity should not be sowed on that space of ground. But if the ground prepared be abundant, the plants would grow more thrifty by sowing a spoonful of seed on seventy or eighty square yards. The seed allotted for a particular bed should be put into a vessel half filled with fine mould or earth, and stirred so thoroughly as to cause the seed to be equally distributed in all parts. It should now be separated into two equal divisions. And the plant bed having been divided into convenient lands for sowing, one portion should be sowed as equally as possible in one direction, and the other portion in the same bed, in the opposite direction. The plant bed should now be well raked with an iron tooth rake, both ways, and should then be well trodden by the feet of men or boys, so as to render the loose soil firm and compact. The bed should be thinly covered over with brush to keep it moist and to protect the plants from frost. Plant beds should be prepared and sown as early in February as the weather will admit; though it will be in good time if sown any time in that month.

Tobacco requires a rich soil, and that which is new or nearly so, answers best. Next to ground which has been recently cleared, lands which have been long in grass, especially if pastured by sheep, answers best for tobacco. In preparing ground for tobacco, great care should be taken to plough it deep, and pulverize it completely. Grass land intended for tobacco, should always be ploughed the previous fall. And it is better that all kinds of land intended for that purpose, should be ploughed in time to have the benefit of the previous winter frosts. It should be kept light and free from weeds, by repeated ploughings, till near the time of planting. It should then be laid off into ridges, by a single horse plough, (to prevent the ridges from being trodden by the off horse) from three to three and a half feet from centre to centre, according to the kind of tobacco which is intended to be planted. The ground should be crossed at the same distance, by a shovel plough or one with a double mould board. The ground will now be in a condition, requiring nothing more to be done to prepare for the planting, but to cut off the centre of the square or ridge with a broad hoe. This last operation should be performed when the plants are of sufficient size for setting, and should be made only so many at a time as there will be plants to fill the first *season* that happens. Plants can only be set after a rain, and much care should be taken in this operation, for if plants are well set they will grow quickly, but if badly set they will be kept back some time, and many hills will require to be re-planted. This will cause much additional labor and render the crop irregular as to the time of ripening. When the crop is planted its cultivation must be carefully attended to. The first thing to be done is to see that the cut worms do not destroy the young plants. These must be sought after and destroyed. The plants must be kept free from weeds. In this operation both the plough and hoe should be used until the plants become too large to use the former without breaking the leaves. During the last ploughing, tobacco should be ploughed only during the heat of the day, when the leaves will have *wilted* and will not easily break.

Tobacco is very subject to be injured by the horn worm. This insect is very destructive, and if not destroyed will ruin the crop. The utmost care is, therefore, required from an early period of its growth, to save the tobacco crop. From the time the horn worm makes its appearance, the crop should be gone over once a week till it is cut. *Topping* and *priming* are next to be attended to. The latter consists in breaking off the leaves next to the ground, which, to the number of four or five, are of no value. The number of leaves to which tobacco should be topped, varies according to the kind of tobacco raised, and the season of topping. The *first* topping will always admit of a greater number of leaves being left; and, in proportion as the season advances, fewer leaves should be left. The heavier kinds of tobacco are generally topped early in the season, to twelve leaves, then to ten, and still later to eight. The lighter kinds of tobacco are topped to a greater number of leaves. The above rule is only applicable to a rich soil. If the soil is light, the topping should be regulated accordingly, and fewer leaves left.*

Suckering is a much more tedious operation. Every plant requires to be twice suckered before it is ready for cutting. The first suckers are of quick growth, and should be removed before they become large, otherwise they will not only injure the growth of the plants, but will sometimes break off the leaves in removing them.

Tobacco is usually planted from the middle of May to the last of June. And the cutting season commonly commences about the middle of August, and is rarely finished until late in September. Between the planting and cutting of tobacco, the labor of attending to it is light, but very tedious. It requires more hands than any other crop, for the same number of acres; but weak hands and children can assist and do much of the work. When it begins to ripen, stouter hands are required, though children may still aid in the subsequent operations. A little practice will enable the planter to distinguish, very readily, the ripe from the green plants. At the first cutting the former must be selected and cut, leaving the others to become riper. When tobacco is ripe the leaves become spotted, with a greenish yellow color, and the leaves are so thick and ridged that by folding and pressing gently between the thumb and finger, they will break or crack. But a little experience will enable the planter to determine which plants are

*Light tobacco, for segar wrappers, such as Roundleaf, Burleigh, and Summerville, should be planted three by two feet, and topped to sixteen or eighteen leaves.

ripe by *sight* alone. Tobacco must be split while standing; and such hands as can readily distinguish between the ripe and green plants, should be employed in the splitting process The most convenient knife for splitting tobacco is in form somewhat like a broad chisel, except that the blade should be very thin. It should be three and a half inches wide, and of the same length, having attached to it a thin spear or shank, to be inserted in a handle about a foot long, having a cross piece on the top, to be held by the hand. After the spear is inserted in the handle, the latter should be shaved flat on two sides, to prevent the end of the handle next the spear from striking against the top of the tobacco stalk as the knife is run down. With this instrument a skilful operator can split the standing plants with great rapidity. They should not be split nearer to the ground than six inches. The cutter may follow immediately after the splitter, or at any convenient time afterwards. A common hemp hook is the best instrument for cutting tobacco. The cutting season is a critical time for the tobacco crop. It is subject to a variety of casualties; and without particular care, is liable to sustain great and irreparable injury. It is subject to be *bruised* in handling, to be *sun burned*, and to be greatly injured by *heating* if suffered to lie too long in large heaps. Each of these will most materially injure the crop, and they must all be guarded against with the utmost vigilance. The first is the most difficult to be guarded against, when tobacco is cut in very warm weather. After it is cut, it *must* lie long enough to fall or *wilt*, so as to become sufficiently pliant to handle without *breaking* or *bruising* the leaves. The hotter the weather the more difficult it is to accomplish this object without exposing the plants to the deteriorating effects of being *sun burned*. It is surprising how quickly this takes place, when tobacco is exposed to the meridian rays of the sun, in the month of August, or early in September. The parts of the leaves which are *sun burned* turn white and soon become dry and crisp; and when cured, assume a green color. The parts thus affected are completely ruined, having lost all the qualities of good tobacco. To guard against this casualty, when tobacco is cut early in the season, the operation should be performed in the morning or so late in the evening that the sun will not have power enough to injure it. Cutting, both in the morning and evening, may be practised as convenience may dictate, and may be managed as follows. The planter may commence cutting in the morning, taking care to cut only so much as he can secure before the sun has acquired sufficient power to injure it. When the cutting is completed and the plants have fallen sufficiently, he should commence piling it in heaps with the buts towards the sun, taking care to handle the plants gently, holding them by the buts, and avoiding any pressure upon the leaves. By handling them thus, and laying them as lightly as possible in heaps, this process may be performed before the tobacco has completely fallen. The heaping should always commence with the plants first cut, so that they may, as nearly as practicable, be exposed to the sun's rays an equal portion of time, or in equal degree, and should so progress till the whole is heaped. The stems of the tobacco are the last parts that *wilt*. Being large and ridged, these require more sun to make them fall, and hence the necessity of placing the buts towards the sun when heaping tobacco. Being thus placed, the stems continue to be affected by the sun, while the plants are lying in heaps. The heaping of tobacco in some degree protects it from being *sun burned*, but the uncovered leaves are, of course, unprotected. Hence the necessity of hauling the tobacco to the place of hanging it as soon as possible, after it has fallen sufficiently to admit of this being done without bruising or breaking off the leaves. Sleds are the most convenient vehicles for transporting tobacco to the scaffold or house where it is to be hung, if near at hand. These should have smooth plank on the bottom, to prevent the leaves of the tobacco from being torn or bruised. There should be no standards in the sleds, and the tobacco should be laid on in two courses, the tails lapped and buts out on each side. When unloaded, the buts should all lie towards the sun, unless the hanging is performed in the shade of a house or trees. These precautions are all for the purpose of preventing the tobacco from being sun burned. If the cutting take place late in the season, or when the weather is cool, they will not be necessary.

Planters who are largely engaged in the culture of tobacco, will be under the necessity of raising it at a considerable distance from the place of housing it. In that case sleds will not be convenient for transporting it, and it would be a much better plan to have a wagon coupled so as to hold a very long body, and sufficiently high to hang the tobacco, after being put on sticks, across the body. The sticks should be filled with the appropriate number of plants, in the field where it grew, and put at once into the wagon, pressing them as close together as possible without bruising the leaves. This will protect the plants from becoming sun burned, and when the wagon arrives at the place of housing it, the tobacco may, at once, be transferred to the place where it is to be cured It would be most convenient to have two wagons, so that one may be filled in the field while the other is hauling and discharging its load, and returning. So, also, if there be hands enough, the smaller ones may be heaping the tobacco, while others are engaged in putting it on sticks, and conveying it to the place of housing it. If the tobacco house be so constructed as to admit the wagons to pass through the centre, additional facilities will be furnished for transferring the tobacco to the place where it is to be cured.

Tobacco plants may be split, during the heat of the day, without injury. It is only liable to be *sun burned* after it is cut. And hence the splitting process may progress, while part of the hands are engaged in hanging that which was cut in the morning. When the afternoon has so far progressed that tobacco may safely be cut without the risk of sun burning, (which is usually about four o'clock in August, and somewhat earlier in September,) the cutting process should commence, and be completed as soon as possible, so as to give time for the plants to fall sufficiently to be handled the same evening, or the next day, before the sun has attained sufficient power to injure them. The first cutting of the afternoon, in the early part of the season, can usually be hauled and hung the same evening. That part of it which has not fallen sufficiently to be handled without bruising or breaking, should be suffered to lie in the field, without heaping, till the next day.

It is usual, when there is not time to hang all the tobacco, during the same evening it is cut, to let a part of it lie over till morning, to be hung while the dew is drying off that in the field. This may be done to advantage if hauled on sleds, provided care be taken to prevent it from heating during the night. If suffered to lie in large heaps, it will be greatly injured in the course of one night. To guard against this casualty, it should be spread in long rows not more than three or four plants deep, when the weather is very warm. In cool weather the danger of heating is not so great. A little experience will teach the tobacco planter to guard against the casualty of which I have been speaking. It is very important that this should be done, as it is completely ruinous to so much of the tobacco as may become heated to a high degree, as it will be if suffered to lie in large heaps over night.

There are two modes of treating tobacco when it is cut, one is to hang it on scaffolds, exposed to the weather; the other is to hang it at once in suitable houses.

The former method must, of necessity, be resorted to where there is a scarcity of house room. By hanging sometime on a scaffold, the tobacco commences curing and can be stowed much closer in houses than it can be, with safety, when first cut. But it is subject to serious disadvantages. Those parts which are exposed to the sun are liable to be sun burned, and much of it may, therefore, be injured on the scaffold. Another injury, and a most material one, is, that if suffered to remain on the scaffold till the leaves begin to cure, they are liable to be injured by the dews which fall every night; and still more by a rain, if one should happen to fall. If the tobacco is *housed*, from the scaffold, before it begins to cure, not much is gained in point of room, when stowed in the tobacco house. If suffered to hang on the scaffold till partly cured, it may be greatly injured by rains and dews.

The safest way, therefore, is to put it in houses or under sheds, as soon as it is cut. But here again care must be taken to avoid another casualty, that of being *house burned*. It is stated in the Farmer's Guide, page 265, that if it is intended "to cure by fire, the tobacco is carried immediately from the field to the house, hung on sticks, as before described, and these sticks crowded as close together on the tier as they can possibly be, so as to exclude all air from the tobacco. It remains in this situation until the leaves of the plants become yellow, or of the color of hickory leaves just before they fall. This will generally happen in four or five days, when the sticks must be spread and placed at the proper distances in the house." There never was a greater error than that contained in the above extract. Tobacco thus housed, would be completely ruined long before the five days should have elapsed. If intended to be cured without fire, the house should be as open as possible, for the free admission of air. The sticks on which the tobacco is hung should be placed from eight to twelve inches apart, according to the size of the tobacco, so that the air could circulate freely between the ranges of sticks. It should be continued in this open order until the tobacco is partially cured, when it may be re-hung in much closer order, so as to make room for the later cutting. If hung in open sheds, with tight roofs, so much the better, so that the rain is prevented from beating in on the tobacco, which may be done by setting up fence rails or rough plank against the open sides of the shed.

If intended to be cured by fire, the house should be rendered as tight as possible, in all parts, except the roof, through which the smoke must escape. But instead of being crowded together, as recommended in the extract given above, it should have space enough to prevent the plants on the different sticks from *pressing hard* against each other, after the tobacco has completely fallen. Instead of suffering the tobacco to hang four or five days before fire is put under it, the house should be filled *as soon as possible*, and fire put under it *immediately*, to prevent the danger of house burning. For the first few days the fire should be moderate, till the *edges* of the leaves turn of a yellow color. The fires should then be gradually raised and the house kept sufficiently warm to cure the tobacco in a few days. In making kite foot tobacco, the rule is, I believe, that the tobacco, stalk and all, must be cured in forty-eight hours from the time the fires are *raised*, which, as I have already remarked, must be when the leaves *begin* to turn yellow around their edges. After thus commencing to change color the entire leaf very soon assumes a beautiful yellow hue, and the object is to cure it before it turns to a nutmeg brown. If the curing is not *very speedy*, it will, or a great part of it, change to the latter color before the operation is completed.

The next thing to be done, after the tobacco is housed and cured, is *stripping*. This must be delayed till the *stem* as well as the leaf of the tobacco is thoroughly cured. Stripping can only be performed when tobacco is in such high *case* as to render the stems perfectly pliable, or at least such a portion of them as will supply a sufficient quantity of *tying leaves*, that is, leaves to tie the tobacco in *hands*. To perform this operation neatly, the stem of the leaf with which the hand is tied should be soft and pliant. As seasons for stripping are precarious, whenever tobacco, after being sufficiently cured, comes into case, a quantity for future stripping should be taken down, and packed in close bulk, with the tails in the centre and the buts of the stalks out. This bulk should be enclosed by the walls of the house on two or three sides, and plank on the other, and should be well stuffed all around between the enclosure and buts, with straw, so as to exclude the air. Thus packed away, tobacco will remain in *case* for a long time, but care must be taken not to pack it down when in too damp order, otherwise it will go through a heat, and be greatly injured, unless it be stripped out in the course of a few days. If put down in proper order, it may be stripped out at leisure, provided it is not packed in bulk before the weather has become cool, say November or December. When stripped and tied in hands it must be put in bulk, lapping the tails in the middle and leaving the heads all on the outside of the bulk, so that they can become thoroughly dry. If not in too *high order* when put in bulk, as above directed, it may be suffered to remain till February, when it should be hung on sticks, the hands as close as they can be conveniently placed to each other without pressing them together, and hung in the tobacco house, leaving the sticks so far apart as to admit the air to circulate between them. In this situation the tobacco will become thoroughly dry in a few days. It must be left hanging until a rain shall again bring it in *case*. It will be observed that the *leaf*, in contradistinction to the *stem*, will first come *in case*, whilst the stem will be found still dry and brittle. This is precisely the order in which tobacco should be, when it is to be finally bulked down for market or *prising* in hogsheads.

It should now be put down in a very large bulk, which may include the planter's entire crop. The number of courses may be six, eight, or any larger number, and the whole should be enclosed by the walls of the house and plank, and closely surrounded and covered with soft straw, so as perfectly to exclude the air. In this condition it may be kept for any length of time, and will be ready at all times for hauling to market in the *hand* or *prising*. One precaution only will be necessary. When the cover of the bulk is taken off for the purpose of taking out a part of the tobacco for prising or sale, the entire course or courses, on the top, should be taken off smoothly, and the cover carefully replaced. This is necessary to prevent the top of the bulk from becoming too dry. When *prising* in the summer, some elder bushes may be spread over the bulk to keep the tobacco damp. Tobacco prepared as herein directed, may be kept any number of years in bulk, or may be transferred to hogsheads and kept for any length of time, not only without injury, but will constantly improve by age.

It should be remarked, that to make tobacco of a very superior quality, great care should be taken when the stripping process is going on, to separate all the injured or defective leaves from the prime tobacco. To this end every plant should pass through the hands of a good judge of tobacco, who should *cull* out all the injured and defective leaves, which should be kept and sold separately. The balance of the leaves may be stripped and tied by small hands, who are not skilled in the quality of tobacco. As many persons should be employed in *culling* as may be necessary to furnish employment to all the less skillful hands. Sometimes, especially in kite foot tobacco, three different qualities should be made.

I have now gone through the entire process of tobacco culture, in which I have endeavored to include every thing which can be of *practical* use to the tobacco planter; and have gone as much into detail as will enable him, with a little practice and the exercise of a sound judgment, to understand and apply the whole process to the best advantage.

It is usual to plant tobacco, on our rich Kentucky soil, for several years in succession, on the same ground. Tobacco is an exhausting crop, and ought not, too frequently, to be planted on the same ground. Experience will soon show when the crop should be changed. When it becomes necessary to do so, tobacco should be followed by a wheat crop, and the wheat sowed thickly with clover the following spring. The clover crop should be continued for at least two or three years, and then should have a coat of manure in the fall, and be ploughed in, and suffered to lie till spring, when it would again be in good condition for tobacco.

SYSTEM OF AGRICULTURE ADAPTED TO KENTUCKY.*

In adopting a system of agriculture, best suited to the circumstances of our State, regard must be had to its variety of soil and climate. The climate of Kentucky extends from thirty-six and a half to thirty nine degrees of north latitude. So far as regards climate every part of the State is well adapted to the culture of Indian corn; but wheat can be grown to advantage only in the more northern parts. Indeed, even in those parts best adapted to wheat, this useful grain, except for our own immediate supply, is not found to be a very profitable crop. The new States to the north and west, in the cheapness of their lands, and better adaptation to wheat from climate and soil, will always have great advantages over our State, in supplying the New Orleans market. The culture of that article, to any considerable extent in Kentucky, will, in the general, be found not to be useful or advantageous, and ought, except to the extent of supplying our own wants, to be left to such of our farmers as may occupy a soil not adapted to hemp and tobacco. Besides the uncertainty of the wheat crop in the rich vegetable soils of Kentucky,† it is very exhausting, and requires much attention to manuring and grassing of land to prevent its deterioration.

Barley is better adapted to our soil and climate, is not so ex-

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*Premiums were awarded in favor of this essay and the next succeeding, by the Kentucky Agricultural Society, at the annual meeting in Frankfort, January, 1842."

†Liebig says, that soils particularly rich in humus are not favorable to the growth of wheat.—*Organic Chemistry*, 197–8.

hausting, and may, in those parts of the state where there is a demand for it, be cultivated to more advantage than wheat.

In the rich vegetable soils of Kentucky, which are well adapted to the growth of hemp and tobacco, these crops, together with the necessary grains for feeding stock, such as corn, rye and oats, and the appropriate vegetables for the same purpose, should be the principal objects of culture.

Tobacco can be grown to advantage in every part of the state where the soil is suitable, but it is more peculiarly adapted to the Green River country, where the climate is better suited to the production of a first rate article.

A system of agriculture best suited to our circumstances, whilst it should embrace every variety of product, to which our soil and climate is adapted, should be so diversified as to appropriate lands of various qualities and lying in various latitudes, to the production of those articles which are best adaped to the nature of the soil, and most suitable to the surrounding circumstances.

Thus lands lying near a large town or city, where the facilities for obtaining manure are very great, may be advantageously applied to the production of such articles as will serve for the consumption of the place.

By directing our efforts to the production of as great a variety of articles as the nature of our soil and climate and other circumstances will justify, we shall obtain all the advantages resulting from a division of labor, and, at the same time, guard against the consequences of *over production.*

If the whole energies of our State were directed to the culture of tobacco, there would not only be a misapplication of labor, in attempting to produce that article in lands unsuited to the crop, but there would be an *over production*, and, consequently, a considerable diminution of price. If a like effort should be made to extend the culture of hemp, a similar consequence would result; and so in relation to any other agricultural product. Still greater evils would result if we were to direct all our efforts to the raising of live stock. The consequence would not only be the usual result of *a supply exceeding the demand*, but there would be a *surplus* left on hand which would have to be fed and sustained in the hope of a *future demand* at some distant but uncertain period.

But although our agricultural efforts should be directed to as great a variety of products as circumstances will admit of, yet the *same individual* ought not to attempt the culture of too great a number of articles. In general farmers will succeed better by directing their *main efforts* to some one crop as an article for sale, and such others as are necessary to feed their stock and furnish subsistence for their families.

In one particular our system of agriculture should be uniform. Whatever may be the nature of the crops we cultivate, the utmost care should be taken so to cultivate our lands as never to suffer them to become less fertile.

Although there has been considerable improvement in our system of agriculture, within the last twenty years, yet there can be no doubt we are still far behind the improvements of the age, in the highly useful science of agriculture.

The extreme natural fertility of our best lands induced our early settlers to fall into the error, that it would be impossible to exhaust them. The great depth of the vegetable mould and a most excellent subsoil, founded upon limestone rock, very naturally induced the opinion that it was inexhaustible. Experience has shown the fallacy of this idea, but it is difficult, even at this day, to make the generality of farmers sensible of the extent of deterioration, which much of our naturally rich soil has already undergone; and still more difficult to convince them of the great advantages, which would result from such a change of our system of husbandry as will restore our exhausted soil to its original state of fertility.

A *continued* course of deterioration must, ultimately, terminate in such a reduction of soil as will render the product of less value than the labor necessary to bring it to maturity. Such a course of cultivation not only diminishes the profit of the farmer, each succeeding year, until his profit is reduced to nothing, but his capital, vested in land, will be almost entirely sunk.

The least reflection will satisfy any one of the disadvantages of such a system. It requires no more to cultivate an acre of ground, producing sixty bushels of corn, than would be required to cultivate the same acre, after it has been so reduced in fertility as to produce only thirty bushels. Now if the agriculturist, who raises thirty bushels of corn per acre, is barely paid for the labor expended in raising it, it is evident that the additional thirty bushels, which it would have produced if the soil had not been suffered to diminish in fertility, would have been clear gain.

The same would be equally true of hemp, tobacco, and every other crop, except the small additional labor of harvesting the increased crop and preparing it for market, after it has been brought to maturity.

As land can be much more easily *kept* in good heart and fertile condition than it can be *restored* after it has been deteriorated, a discreet farmer will always resort to the *easier* method, especially as it is by far the *most profitable one.*

If we take from land all or nearly all that it produces, and restore nothing, we gradually abstract from it those nourishing principles, which are essential to the growth of plants; and when the work of destruction has been carried to a certain extent, there will no longer remain in the soil a sufficient quantity of nourishing ingredients to produce a crop sufficient to pay for its cultivation. If a beneficent Providence had not made provision for a supply, to a considerable extent, of those elementary principles which constitute, in various states of combination, the appropriate food of plants, over and above what is furnished by the soil, our best lands, under a bad state of cultivation, would long since have been reduced to a state of complete sterility. In a state of nature every thing is restored to the soil, which is drawn from it by the growth of plants, and hence it continually increases in fertility. To preserve the fertility of land, while in a state of *cultivation*, it is only necessary to restore to the soil such a proportion of the fertilizing ingredients as will, together with those furnished from the atmosphere, be equivalent to the sum of those drawn from the soil by the growing crops.

The office of the soil is, "1. To receive and digest the food designed for the growing plant. 2. To serve as a medium for conveying to the spongiolets or mouths of the plants the water holding in solution the different substances, which pass into and nourish them; and, 3. To serve as a basis for fixing the roots of the plants, and maintaining them in an upright position."*

*Farmer's Companion, p. 50.

The following are the most important elementary principles, which, in various states of combination, enter into the composition of vegetable matter, and furnish the appropriate food for growing plants; oxygen, hydrogen, nitrogen and carbon, together with a small portion of the alkalies and oxydes of various metals. So far as these elementary principles are supplied from other sources than the soil, in which crops are grown, the waste, occasioned by their removal, is replenished. Plants possess the power of decomposing water,* and appropriating its elements by assimilation as food; and as water is composed of hydrogen and oxygen, it follows that two of the foregoing elements are derived, in large quantities, from the atmosphere through the medium of rain, snow and dews.

Liebig, in various parts of his able work on organic chemistry, has shown, that plants derive from the atmosphere, by the absorbing power of their leaves, a large and regular supply of carbon in the form of carbonic acid. He adds "that during the heat of summer, a plant derives its carbon exclusively from the atmosphere."†

Here, then, we have the source whence is derived, in large quantities, three of the principal elements, which, in various states of combination, assist in furnishing food for growing crops. Nitrogen is known to be essential to the healthy and vigorous growth of plants. This element exists in large quantities in all animal substances, and also to a considerable extent in decaying vegetable matters, but much of it escapes, in the form of ammonia, during the process of decomposition.— It was difficult, until recently, to account for the manner in which the loss (sustained by soils while in cultivation) of this indispensable ingredient of fertility, is replenished. Liebig has shown, in a very satisfactory manner, that ammonia (composed of three parts, by weight, of hydrogen, and 14 parts nitrogen) is combined with rain water and snow in small quantities, and hence the loss of nitrogen, sustained by the removal of crops from the soil on which they grew, is, in a limited degree, restored by the falling of rain and snow. Thus nitrogen, to some extent, is also supplied by the atmosphere to growing plants; but as this supply is not so abundant as that

*Liebig's Organic Chemistry, 122.

†Liebig's Organic Chemistry, p. 106. See also p. 54 and 55.

of the other elements, the utmost care should be used by the cultivators of the soil to keep their lands well supplied with this indispensable ingredient of fertility, by taking nothing from the land but what is necessary; by restoring, in the form of manure, every thing that can be restored; and by cultivating clover and other ameliorating crops, which take but little from the soil while they add to it all the fertilizing ingredients which they derive from the atmosphere. When these circumstances are duly considered we may readily account for the length of time during which a soil may be cultivated in the worst possible manner, without entirely exhausting it. A continual effort is made by nature to replenish the earth with those fertilizing ingredients, which have been inconsiderately wasted by the improvidence of man, without any effectual effort on his part to restore even the small proportion of those ingredients which would furnish a full supply of food for his future crops.

When a beneficent Providence has done so much towards restoring the elementary principles, constituting the food of plants, which to a certain extent must be consumed by the growing crops, a strong encouragement is held out to the industrious farmer to do his part also. In looking around he beholds every where the evidence that when all is restored to the earth, which grew upon it, a continued increase of fertility results. This is a sure indication that a beneficent Providence intended that the earth should never become sterile by cultivation—it plainly points out to man that he too should restore to the soil that portion of its products for which he has no use. He should continually bear in mind that the aids, provided by a bountiful Creator, were only intended to supply the *unavoidable loss* of nourishing ingredients or food for plants, occasioned by the necessity of taking from the soil a portion of the growing crops for consumption, and which cannot be fully restored. While, therefore, the prudent farmer may confidently rely upon these aids, in preserving the fertility of his soil, he will recollect that he must also do his part. He may take for consumption the fruits of the earth for both man and beast, and yet give back to it enough to keep up its original fertility, by restoring only a reasonable proportion of that part of its product which remains after consuming all that is of any value for food for himself and provender for his stock.

Next to oxygen, hydrogen, carbon and nitrogen; the alkalies, potash and soda, constitute the most important ingredients, in the food of plants. These were formerly considered as simple substances, but were ascertained by Sir Humphrey Davy, to be metallic basis, combined with oxygen. They are, therefore, real oxides. They are capable of combining with a great variety of substances; and, in various states of combination, form an indispensable food for plants of almost every kind.—Hence if these substances were entirely extracted from the earth, it could no longer produce a vigorous growth of those plants, which require a supply of these alkalies as a part of their food.

Liebig has shown, that these alkalies exist in a state of combination with water, in small proportions, and that where they have been extracted from the soil by growing plants, they may be restored by irrigation, and by rain.* Sea-water also contains these alkalies in small quantities, and Liebig informs us that "the roots of plants are constantly engaged in collecting from the rain those alkalies, which formed part of the sea-water, and also those of the water of springs, which penetrates the soil." That, "without alkalies and alkaline bases most plants could not exist."†

The alkaline earths, lime, and magnesia, are necessary to the vigorous growth of some of the most valuable agricultural products. These earths exist in great abundance, in some soils, but in others are very deficient, particularly in lime. This deficiency is, in some degree, supplied from the atmosphere. Liebig informs us, that "by the continual evaporation of the sea, its salts are spread over the whole face of the earth; and being subsequently carried down by the rain, furnish to vegetation those salts necessary to its existence. This is the origin of the salts found in the ashes of plants, *in those cases* where the soil could not have yielded them."‡ Besides a small quantity of *sulphate* of lime, there is contained in sea-water, according to Liebig, 1.12400 of its weight of *carbonate* of lime.

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*Liebig's organic chemistry 159. 160. 167.
†See further on this subject, p. 196 to 200.
‡Liebig's organic chemistry, 166.
According to Marcet, sea-water contains in 1000 parts:
26.660 chloride of sodium. 4.660 sulphate of soda.
1.232 chloride of Potassium. 5.152 chloride of magnesium.
1.5 sulphate of lime.

Thus it is seen we are indebted to the atmosphere not only for oxygen, hydrogen, carbon, and nitrogen, but also for potash, soda, and the alkaline earths—lime and magnesia. The importance of these will be further noticed, when I come to remark upon manures.

The means of preserving the fertility of the soil, and renovating that which has been partially exhausted are,

1. A judicious rotation of crops.
2. The saving and applying of manures.
3. A liberal cultivation of such crops as receive their chief nourishment from the atmosphere.
4. Good tillage.

As a distinct premium has been offered for the best essay on the rotation of crops, best suited to Kentucky, I do not propose, in this essay, to say any thing on that branch of the subject.

The saving and applying of manures is very important to a good system of husbandry. And great care should be taken to preserve so much of the product of the farm, as is left unconsumed by man and beast, in suitable situations, to be used, at the proper time, for that purpose.

The necessity for suitable application of manure, to cultivated lands, is very evident, when we reflect, that some of the most important ingredients, which serve as food for plants, such as nitrogen, potash and soda, are furnished but sparingly from the atmosphere. These ingredients are all found in manures; and by properly saving and applying them, the farmer is enabled to make up the deficiency of the supply from the atmosphere. Manures contain also other useful ingredients, which, perhaps, can be derived from no other source.

A question of great importance, and one which seems not yet to be fully settled, is what is the best manner of preserving manure till the proper period for applying it to the land in cultivation, and in what condition should it be applied, whether after complete decomposition has taken place, or when only partially decomposed, or in the state in which it came from the earth? Liebig, in his able work on organic chemistry, in its application to agriculture and Physiology, has shown that ammonia is a very important ingredient, in the nourishment of all agricultural products.

During the decomposition of manures, a large quantity of ammonia is formed, but being a gaseous substance the whole passes off, and is entirely lost. If, therefore, long manure is exposed in heaps to the effects of heat and moisture, fermentation ensues, and the consequent formation of ammonia, which passes off in the form of gas, and nothing is left, as he informs us, but "a mere carbonacious residue of decayed plants." An idea of the loss sustained by manure, exposed to heat and moisture, may be formed from the fact, stated by Liebig, "that with every pound of ammonia, which escapes, a loss of sixty pounds of corn (wheat) is sustained." To prevent this loss Liebig recommends "that the floors of our stables, from time to time, be strewed with common gypsum, (sulphate of lime,) the ammonia (he says) enters into combination with the sulphuric acid, and the carbonic acid with the lime, forming compounds which are not volatile, and consequently destitute of smell."*

Growing plants receive large supplies of oxygen and hydrogen (the component parts of water) from rains and dews. They are also supplied abundantly with carbon, in the form of carbonic acid, by means of the absorbing power of their leaves But a full supply of nitrogen, and the alkalies is likewise essential to their vigorous growth. These are more sparingly supplied from the atmosphere, and hence the importance of additional supplies. Putrescent manures abound in nitrogen, but this important element of vegetable food, during the process of putrefaction, nearly all escapes (if no measures are taken to fix it) in the form of ammonia.

Liebig has shown, that this may be done by a proper application of gypsum to stable manure, before the fermenting process commences.† A similar application of gypsum to manure, saved in feeding pens, cow yards, &c., would, no doubt, have a most beneficial effect, but it must be remembered, that ammonia is readily absorbed by water, and consequently large portions of it may be lost, where the manure is so exposed as to become saturated with that fluid. Every precaution, consistent with a due regard to economy, should be used to prevent this. Placing the manure under sheds, and intermingling with it a due proportion of gypsum, would be the most effectual way to guard against the loss of ammonia. But

*Liebig's organic chemistry, p. 239.
†Liebig's organic chemistry, 239.

in general this would be attended with too much expense. The next best method is to so place the manure, preparatory to its undergoing fermentation, as not to subject it to the drainage of the adjacent grounds, or the dripping of water from the roofs of stables, cow sheds, &c. The former object can be attained by a judicious selection of suitable ground for feeding yards, and by cutting ditches, where necessary, to carry off the water. The latter may be secured by erecting stables, sheds, &c., so as to have the manure thrown out at the gable end, where there can be no dripping from the roof. Where stables or sheds have been already erected, upon a different plan, the drippings from the roof may be carried off by leading troughs. These precautions would leave the manure subject only to the effects of rain falling immediately upon it. To guard against this, the manure should be kept in compact heaps, so as to expose as little surface as possible to the falling rain; to this end the manure, collected in cow yards, feeding pens, &c. should occasionally be thrown into heaps in the form of a stack, mingling therewith, during the process, a due proportion of gypsum. A still further precaution might be used, by removing the manure, as soon as it is in a fit condition, to the fields for which it is destined, and there spread. This would check any remaining disposition to ferment, and the falling rains would carry the ammonia down into the soil, with which it would combine, and thus all danger of further loss, to any considerable extent, would be avoided. From what has been said, it will be seen that the manure is liable to great loss during the process of fermentation, unless the utmost care is used to prevent the escape of ammonia. If manure is suffered to undergo complete decomposition, there will be a considerable saving of labor in hauling and spreading, and much less difficulty in ploughing the ground on which it is distributed, but there will be more or less loss of some of the most valuable ingredients of the manure. If the proper precautions are used to prevent the escape of ammonia, perhaps, upon the whole, it will be found most advantageous to suffer the manure to undergo at least a partial decomposition, before it is removed to the fields for which it is intended. But, notwithstanding every precaution that can be used in preserving and applying putrescent manures, some loss will be sustained. Ammonia readily enters into combination with carbonic acid, forming a volatile compound, and is itself, while in a gaseous form, with all its volatile compounds, extremely soluble in water.* And hence every particle of water, evaporating from a dung heap, will carry with it ammonia and carbonic acid, unless they shall have been converted into a salt, which is not volatile. Alumina (clay) exercises an indirect influence on vegetation, by its power of attracting and retaining water and ammonia."† Liebig informs us, that "a part only of the carbonate of ammonia, which is conveyed by rain to the soil, is received by plants, because a certain part of it is volatilized with the vapor of water." But if the soil contains a due proportion of gypsum, or when deficient in this respect, if it should be supplied from time to time with gypsum, "the carbonate of ammonia, contained in rain water," (and of course that which is carried down into the soil by rains, falling on putrescent manures) "is decomposed by gypsum, in precisely the same manner as in the manufacture of sal-ammoniac. Soluble sulphate of ammonia, and carbonate of lime are formed; and this salt of ammonia, possessing no volatility, is consequently retained in the soil. All the gypsum gradually disappears, but its action upon the carbonate of ammonia continues as long as a trace of it exits."‡ It will be observed, from the reasoning of Liebig, that the ammonia which the soil receives during the decomposition of long manure, which may be left or spread on the ground, is also liable to sustain a loss by combining with water and passing off in the form of vapor. But as, in this case, the process of fermentation is very slow, the carbonate of ammonia will have more time to combine with the soil, and the roots of plants are constantly engaged in absorbing it. During slow fermentation there is probably but little loss of carbonate of ammonia, even when gypsum is not present, and when present none at all.

So far, therefore, as the products of the soil, which are not useful for the consumption of man or beast, can be left on the ground, that will be the most economical application of manure. In this mode of applying it, the labor of transporting and distributing it will be saved, and much less loss will be sus-

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*Liebig's organic chemistry, page 130. †191. ‡141, 142.

tained by evaporation than where the decomposition is rapid, and no gypsum is used. Thus it will be advantageous to leave upon the ground as much of the stubble of wheat, rye, &c., as can be left consistently with an economical saving of the grain. With the same view corn stalks may be left on the ground and ploughed in. The straw of rye and oats, fed off to stock, and of the second crop of clover, when fully ripe, will also be of great advantage to the soil. All these will undergo slow fermentation, and if not suffered to be washed away by heavy rains from rolling lands, will add much carbonate of ammonia and some potash to the soil. Liebig informs us, that "ammonia, evolved from manure, is imbibed by the soil, either in solution in watér, or in the gaseous form, and plants thus receive a *larger supply of nitrogen* than is afforded them by the atmosphere."* Indian corn, as well as rye and oats, is sometimes fed off by turning stock in the field. In this mode of feeding the whole product of the soil is restored, and the land must necessarily be enriched, in proportion to the quantity of nourishing ingredients, which the growing crop received from the atmosphere, (always a large proportion) with such abatement only as will be equal to the loss of ammonia, sustained by evaporation.

In the remarks I have hitherto made on manures, I have not referred to one species, which Liebig considers of very great value, I allude to human excrements. This subject is treated very much at large, in the work to which I have so often referred, but it would extend this essay to too great a length to go fully into an examination of this very important ingredient. A few extracts will be sufficient to show its importance. At page 242 he remarks, "that if we admit that the liquid and solid excrements of man, amount on an average to 1½ lbs. daily, (5-4 urine and 1-4 lbs. fæces,) and that both taken together contain 3 per cent. of nitrogen, then in one year they will amount to 547 lbs. which contain 16.41 lbs. of nitrogen, a quantity sufficient to yield the nitrogen of 800 lbs. of wheat, rye, oats, or of 900 lbs. of barley."

"This (he observes) is much more than is necessary to add to an acre of land, in order to obtain, with the assistance of nitrogen absorbed from the atmosphere, the richest possible crop

*Liebig's organic chemistry, 141.

every year. Every town and farm might thus supply itself with the manure, which besides containing the most nitrogen, contains also the most *phosphates*; and if an alternation of crops were adopted, they would be most abundant. By using, at the same time, bones and the lixiviated ashes of wood, the excrements of animals might be completely dispensed with." At page 246 he says "that with every pound of urine a pound of wheat might be produced."

At page 241-2 he states that liquid animal excrements, such as the urine with which the solid excrements are impregnated, contain the greatest part of their ammonia in the state of salts, in a form, therefore, in which it has completely lost its volatility; when presented in this condition, not the smallest portion of ammonia is lost to plants, it is all dissolved by water and imbibed by their roots."

I will quote but one more passage which goes to show the great superiority of human manure over that of other animals. "In respect to the quantity of nitrogen contained in excrements, 100 parts of the urine of a healthy man are equal to 1300 parts of the fresh dung of a horse, according to the analysis of *Macair* and *Marcet*, and to 600 parts of those of a cow."

Ashes of wood and vegetable substances from which potash is derived, is also a very important manure. "Most plants, perhaps all of them contain organic acids of very different composition and properties, all of which are in combination with bases, such as potash, soda, lime or magnesia."* Without alkaline basis, Liebig says, "most plants could not exist." And it is a remarkable fact that where there is a want of the usual alkaline base in a soil, suitable to a particular plant, an alkaline base will be substituted.† This fact shows the indispensable necessity of an alkaline base in all plants. If further proof were wanting the fact that all trees and plants contain more or less of the alkaline bases would be perfectly satisfactory. Some trees require much less alkali than others. Thus pines and fur trees require a much smaller quantity of the alkaline bases than other species. And consequently the former thrive well on a soil where the latter could not exist.‡ One

*Liebig's Organic Chemistry 148. †149.
‡Liebig's Organic Chemistry 198.

hundred parts of wheat straw yield 15.5 parts of ashes; the same quantity of the dry stalks of barley 8.54 parts; of oats straw only 4.42. The ashes of all these are of the same composition."* The facts here stated, prove that wheat is much more exhausting of this particular manure than barley or oats.

Of such great value are ashes esteemed in Germany, that they are transported, as Liebig informs us, "from the distance of 18 or 24 miles." They are particularly valuable to meadows, as these are constantly drained of their potash by the annual removal of the crops of hay—a crop containing a large portion of that ingredient.

It is obvious that if a soil contain only a limited quantity of potash, it must be entirely exhausted, if the growing crops are annually removed, and no part of the product is restored, unless a supply is derived from some other source.

The atmosphere furnishes a small quantity, but by no means sufficient to replenish the waste occasioned by the growing crops, and hence the necessity of making up the deficiency by the application of ashes and other manures, containing potash.

Liebig relates an extraordinary instance of the effects of depriving a soil of its potash, which occurred in the vicinity of Gottingen. A proprietor of land, "in order to obtain potash, planted his whole land with wormwood, the ashes of which are well known to contain a large portion of the carbonate of that alkali. The consequence was that he rendered his land quite incapable of bearing grain for many years, in consequence of having entirely deprived the soil of its potash."†

Liebig says, "it is the greatest possible mistake to suppose that the temporary diminution of fertility in soil is owing to the loss of humus; it is the mere consequence of the exhaustion of the alkalies."‡ He states a variety of facts to corroborate this opinion. When we reflect that the principal ingredient, furnished by humus to the growing plants is carbon in the form of carbonic acid, and that plants derive a very abundant supply of this element, *after* the formation of their leaves, from the atmosphere, by means of their absorbing power, we cannot but regard the opinion that the diminution of

*Liebig's Organic Chemistry 199.
†Liebig's Organic Chemistry 161. ‡196.

fertility in soils is more owing to the loss of alkalies than humus, is at least very plausible. Liebig is of opinion that the great diminution in the fertility of the soil, in Virginia, since its first settlement, is owing to the exhaustion of its alkalies. He estimates that "from every acre of this land, there were removed, in the space of one hundred years, 1200 lbs. of alkalies in leaves, grain, and straw; it became unfruitful, therefore, because it was deprived of every particle of alkali which had been reduced to a soluble state; and because that which was rendered soluble again, in the space of one year, was not sufficient to satisfy the demands of the plants.*

Silicate of potash is an ingredient of indispensable necessity to the vigorous growth of the small grains, and of all plants of the grass kind. Ashes is the source whence it is derived, and hence the importance of saving and applying this manure to our cultivated land, and particularly to that which is appropriated to meadows and raising of wheat. Ashes, which have not been lixiviated, are of the greatest value, as a manure, but after having undergone that process, they still contain silicate of potash, and salts of phosphoric acid, and, consequently, are of great importance as a manure to all plants of the grass kind.†

Phosphoric acid is also a very important ingredient, particularly for the small grains. It is found in the ashes of all plants, "and always, in combination with alkalies and alkaline earths." "The seeds of corn (wheat) could not be formed without the phosphate of magnesia, which is one of their invariable constituents."‡

I cannot quit this subject without recommending to every agriculturist, a diligent study of Liebig's very able work on agricultural chemistry, and particularly that part of it which treats of manures, and the means of preserving the fertility of soils.

Although the manuring of lands, if proper care be taken in collecting, preserving and distributing them, will do much towards preserving their fertility, and renovating such as have been deteriorated by bad husbandry, yet other means can be resorted to, with great advantage in hastening the process.

*Liebig's Organic Chemistry 196. †228.
‡Liebig's Organic Chemistry 200. 201.

A judicious system of grassing our lands, which can be accomplished with but little labor, will always be found very useful, aud must enter largely into our system of agriculture-

Red clover, there can be no doubt, is the best adapted to this purpose. In consequence of its thick growth, and its numerous and broad leaves, it is well suited to draw nourishment from the atmosphere; and does so, perhaps, in a greater degree than any other grass, except other species of the trifolium. Red clover is one of the tribe of leguminous plants, which "are remarkable on account of the small quantity of alkalies or salts in general which they contain."* The *medicago sativa*, (lucerne) according to Liebig, contains less than one per cent, (0.83) and red clover probably does not contain more. Hence one great advantage in the cultivation of this crop will be that it requires, to sustain its growth, but a very small portion of alkali, while it will absorb from the atmosphere not only that ingredient, but also nitrogen in the form of ammonia, and will thus add to the soil two very important ingredients that enter into the constituents of the food of plants. When we take into consideration, that nitrogen and the alkalies are indispensably necessary to the growth of plants, and that these substances are very sparingly supplied from the atmosphere, we will perceive the great importance of the clover crop in restoring and preserving the fertility of soils. Besides, this crop will furnish fine pasturage in the early part of the year, when other grasses are too short for that purpose. After being fed off by stock, whose manure is left on the ground, it produces a luxuriant second crop, which may either be fed off in the fall, or left as a coat of manure upon the ground. This may be repeated two or three years in succession, as circumstances may require. The last crop, when fully ripe, should be ploughed under in the fall of the year, and will thus furnish a coat of manure for the succeeding crop. If ploughed under when green, the operation will necessarily have to take place during warm weather, and consequently a rapid decomposition and escape of ammonia would ensue. This should always be avoided.

Blue grass is also valuable in restoring the fertility of land, but the process is more slow, and should only be resorted to in

*Liebig's Organic Chemistry 204.

lands intended for cultivation, where they can be conveniently left in grass some eight or ten years.

Rye is a crop that exhausts but moderately when the grain is reaped; and when fed off by stock, upon the ground on which it grew, is a rapid restorer of soil which has not been much exhausted. It is attended with the advantage of producing two crops from a single sowing, the second always springing from the seed left on the ground by the grazing stock.

The liberal cultivation of grasses and rye—to be fed off by stock—coupled with a judicious rotation of crops, will undoubtedly have a powerful effect in restoring the partially exhausted lands of Kentucky, but a judicious system of manuring, as recommended in this essay, would greatly add to the rapidity of the process, and should by no means be neglected, especially when lands have been considerably deteriorated by bad husbandry.

Little need be said to show the necessity of good tillage in any tolerable system of agriculture. If land be carelessly cultivated, weeds not only draw from the growing crops a portion of the nourishment, which ought to have gone to their sustenance, but they also tend to diminish its fertility. Besides air is essentially necessary to the growth of plants, so much so that Liebig informs us that "without oxygen, neither seeds nor roots can be developed." If the soil be kept light, and finely pulverized, it greatly increases its capacity for absorbing air and moisture. And as "plants, during their life, constantly possess the power of absorbing, by their roots, moisture, and along with it, air and carbonic acid,"* it follows, that "by loosening the soil, which surrounds young plants, we favour the access of air, and the formation of carbonic acid; and, on the other hand, the quantity of their food is diminished by every obstruction which opposes the renewal of air."†

Thus by a careful and diligent cultivation of land, the crop is furnished more abundantly with its appropriate food, is kept free from the contaminating influence of weeds, is furnished with a due quantity of air, and is not obstructed in its growth by the baked earth with which careless cultivation leaves it hampered. And, in addition to the advantages resulting to

*Liebig's Organic Chemistry 83. †106.

land, the diligent husbandman is rewarded with a greatly increased crop, and the prospect of being relieved from much labor in future, by exterminating all noxious weeds from his arable grounds.

Liebig affirms that "the agriculture of China is the most perfect in the world," and *there no weeds are suffered to grow.*

If, by any, it should be thought I have been too minute in describing the elementary principles constituting the food of plants, I rest my justification in the opinion expressed by Liebig, that "any great improvement in that most important of all arts (agriculture) is inconceivable without a deeper and more perfect acquaintance with the substances which nourish plants, and with the sources, whence they are derived."*

The judgment of Liebig will doubtless be a sufficient apology, unless we are content to be still subject to the reproach that "agriculture has hitherto never sought aid from chemical principles, based on the knowledge of those substances which plants extract from the soil on which they grow, and of those restored to the soil by means of manure."†

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*Liebig's Organic Chemistry 62. †207–8.

For further information, in relation to the elementary principles of manures, best suited for agricultural purposes, I refer to a late interesting work of Liebig—"familiar letters on chemistry, in relation to commerce, phisiology and agriculture." In his 15th letter he shows the great and indispensable necessity of the alkalies, alkaline earths, and phosphates, in the growth of crops; that water, as a solvent, is necessary to enable plants to assimilate these substances, and that *they* are indispensable to enable growing crops to absorb carbon from the atmosphere. That inexhaustible quantities of this substance always exist in the atmosphere, but which cannot be obtained by growing crops, in sufficient abundance, unless they are properly supplied with the alkalies, alkaline earths, and phosphates, and enabled, by the presence of a due proportion of moisture, to assimilate these indispensable ingredients. The great object, he observes, is "to enable these plants to assimilate the carbon of the atmosphere, which exist, in its carbonic acid. In furnishing plants, therefore, with mineral elements we give them the power to appropriate carbon from a sources which is inexhaustible; while, in the absence of these elements, the most abundant supply of carbonic acid, or of decaying vegetable matter, would not increase the produce of a field." These views show how extremely important it is to prevent our lands from being exhausted of their alkalies and phosphates, and the absolute necessity of saving and applying to the cultivated fields all the ashes produced by the burning of fuel, brush, logs &c. and human urine which abounds in phosphates.

ROTATION OF CROPS.

To understand fully the advantages, arising from a good system of rotation of crops, and in what order they ought to succeed each other, it is essentially necessary that the principles, upon which the system is founded, should be studied and fully comprehended.

There are two theories, on this subject, both of which Liebig observes, "explain how it happens, that after corn, (wheat) corn cannot be raised with advantage, nor after peas, peas." "Decandolle supposes that the roots of plants imbibe soluble matter of every kind from the soil, and thus necessarily absorb a number of substances, which are not adapted to the purposes of nutrition, and which must subsequently be expelled by the roots, and returned to the soil as excrements.* Now as excrements cannot be assimilated by the plant which ejected them, the more of these matters, which the soil contains, the more unfertile must it be for plants of the same species. These excrementitious matters may, however, still be capable of assimilation by another kind of plants, which would thus remove them from the soil, and render it again fertile for the first. And if the plants, last grown, also expel substances from their roots, which can be appropriated as food by the former, they will improve the soil in two ways."

The other theory, of which *Decandolle's* is a modification, supposes "that the roots of different plants extract different nutritive substances from the soil, each plant selecting that

*By the term "excrements" is meant those substances, absorbed by a plant, which it is incapable of assimilating.

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which was exactly suited for its assimilation. According to this hypothesis, the matters incapable of assimilation are not extracted from the soil, whilst *M. Decandolle* considers, that *they are returned to it* in the form of excrements." The theory of *Decandolle* supposes, that the substances, not assimilated, are returned *in the same form* in which they were absorbed, without having undergone any chemical change. Upon this supposition the results from both theories would be the same. Experiments, made by *Macair-Princep*, prove that the roots of plants expel matters which they are incapable of assimilating, but Liebig is of opinion, that the matters thus expelled, were formed by the plant itself from the food received from some other source, that this matter is of a true excrementitious nature, and must undergo a change before it can serve as food for other plants.* This change is affected, in some soils, during the course of the ensuing fall and winter, by the influence of air and water, "and at the commencement of spring it has become converted, either in whole or in part, into a substance, which supplies the place of humus, by being a constant source of carbonic acid."†

Liebig remarks, that in calcareous soils the change in this excrementitious matter takes place very quickly, "for the power of organic excrements to attract oxygen and to putrefy is increased by contact with the alkaline constituents, and by the general porous nature of such kinds of soils, which freely permit the access of air. But it requires a longer time, in heavy soils, consisting of loam and clay."

And hence, he remarks, the same kind of plants "can be cultivated, with advantage, on one soil after the second year, but in others not until the fifth or ninth, merely on account of the change and decomposition of the excrements, which have an injurious influence on the plants, being completed in one, in the second year; in others, not until the ninth."‡ "It has been found by experience (he continues) that in those districts where the intervals, at which the same plant can be cultivated with advantage, are very long, the time cannot be shortened even by the use of the most powerful manures. The decomposition of the peculiar excrements of one crop, must have taken place before a new crop can be produced."

*Liebig's Organic Chemistry, page 210–213. †213.
‡Liebig's Organic Chemistry' page 213.

Flax, peas, clover, and even potatoes are plants, the excrements of which, in argillaceous soils, require the longest time for their conversion into humus; but it is evident, that the use of alkalies and burnt lime, or even small quantities of ashes, which have not been lixiviated, will enable a soil to permit the cultivation of the same plants in a much shorter time."*

It may strike some with surprise, that clover and potatoes are placed on the list of plants, the excrements of which require the longest time for their conversion into humus; but it must be recollected that ours is *a calcareous soil*, which, as is shown by a previous extract from Liebig, very quickly converts the excrements of plants into humus, and consequently other crops, or even the same may speedily succeed clover, and even potatoes. A just idea, it is believed, may be formed of the true principles upon which a rotation of crops is founded, by duly considering the quotations given above. A productive soil must not only furnish, in sufficient abundance. all the ingredients which are necessary for the food of plants, intended to be grown upon it, but those ingredients must be in such a condition as to allow of their absorption and assimilation. Hence the necessity of cultivating, upon the same field, different kinds of plants "in such an order of succession that each shall extract only certain components of the soil, whilst it leaves behind those which a second or third species of plant may require for its growth and perfect development."†

Liebig informs us that all plants require alkalies—"some in the form of silicates, others in that of tartrates, citrates, acetates, or oxelates."

"A third species of plants require phosphate of lime, another, phosphate of magnesia, and several do not thrive without carbonate of lime."‡

The great variety of substances, constituting the appropriate food for different plants, shows strongly the propriety of so arranging our crops, that all these ingredients may, in succession, be appropriated. "When we grow in the same soil, for several years in succession, different plants, the first of which leaves behind *that* which the second, and the second *that* which the third may require, the soil will be a fruitful one

*Liebig's Organic Chemistry, 214.
†Liebig's Organic Chemistry, 219, ‡215.

for all the three kinds of produce."* If the first crop for instance, be wheat, which consumes much silicate of potash, it may be advantageously followed by any of the leguminous plants (which contain a very small portion of potash,†) such as turnips, beans, clover, &c., or wheat may very advantageously follow any of these crops, because they are well calculated to prepare the ground for that crop, and take from the soil a very small part of the ingredient which is so absolutely indispensable to the production of the wheat crop.

In the adoption of any system of rotation of crops, the *improvement of the soil* ought to be a *primary object.* It is scarcely possible, that the fertility of the soil should remain exactly stationary. If there should be a gradual diminution of fertility, it will be finally exhausted and become worthless, because the product will no longer compensate for the labor bestowed. But if the rotation of crops and mode of treatment be such as to increase the fertility, no matter how slow the progress, there will be a constantly increasing product, which will annually add to the value of the land.

Judge Buel, in his Farmer's Companion, justly remarks, that "the natural quality and condition of soils have not so much influence upon their ultimate products and profits as the *good or bad management* which they receive. Some of the now poor lands in the Atlantic States, were once as rich and productive as the now rich lands of the Ohio and Mississippi valleys; and the latter, under the treatment, which the former have received, will as certainly become poor, as that like causes will produce like effects."‡

He further remarks, that "the tendency of this system of husbandry, at present pursued, and, in the new South and West, (with many highly creditable exceptions) is to wear out the soil, as it has been worn out, in many cases, on the eastern border of our country."§

The same rotation of crops will not suit every variety of soil; and consequently, in making choice of a rotation for each

*Liebig's Organic Chemistry, 216.

†In 100 parts of wheat straw, there are 15.5 parts ashes; in clover, (lucern) only 0.79, consequently eighteen crops of clover would consume less of the alkalies than one of wheat. See Liebig's Organic Chemistry, page 199 and 204.

‡Farmer's Companion, p. 56. §92.

particular farm, the proprietor must exercise his own judgment as to those best adapted, under all circumstances, to the soil he is about to cultivate.

The importance of not making the rotation embrace too great a variety of products will appear from the following considerations: 1. The advantages of a division of labor apply as well to farming as to any other pursuit. If the attention be distracted by too great a variety of pursuits, there is not only much greater difficulty in carrying them on, but much time will unavoidably be lost by shifting from one to another, and some part of the crop will be sure to suffer from the want of due care, and timely application of labor. 2. There will be a necessity for a greater number of subdivisions of the farm, and consequently much more labor will be required to make and keep in repair the fencing, and more ground will be rendered useless than if the fields were large.

In general a farmer will succeeed better, both as relates to *profit*, and the *improvement of his soil* by directing his main effort to the cultivation of some one product *for sale*, and such others as may be necessary for the consumption of his family, and food for his stock, than if he were to embrace a wider range in his agricultural pursuits.

Influenced by these considerations I shall be governed by them in the rotation of crops recommended in this essay.

Wheat is a very exhausting crop, and, for that reason, is not suitable to a rotation in which hemp is included. Rye is less exhausting than wheat, and when fed off on the ground by stock, is a very improving crop. Corn is so necessary, in every system of agriculture, suited to Kentucky, that no rotation can, with propriety, be adopted, in which that crop is not included.

Corn, according to Judge Buel, is embraced in the second class of exhausting crops. It is less exhausting than either wheat or rye, when those crops are removed from the ground. In the rotation exhibited in the following table, it will be seen, that the hemp crop will be preceded by two crops of corn, two of rye, and two of clover, and consequently, if the rye be fed off by stock on the ground, the hemp crop will follow two moderately exhausting, two moderately improving, and two very highly improving crops. If, therefore, the soil be well adapted to hemp, and not much reduced by bad husbandry, at the commencement of the process, it will be in fine condition for hemp, when that crop succeeds the crops of corn, rye and clover.

The table is adapted to a farm of 300 acres, seventy five supposed to be in wood land, and 225 in cultivation. Four fields of fifty acres each are appropriated to the rotation crops, and the other 25 may be considered as intended for meadow, hemp seed, garden, vegetables and orchard.

The principles of rotation may easily be applied to farms of larger or smaller size. It will be seen, by an inspection of the table, that the product of each year will be one crop each of corn, clover, rye and hemp. The clover crop, when sufficiently advanced, may be pastured till the rye is ripe, and then all stock should be removed, and the second crop suffered to grow up and ripen and should be ploughed under late in the fall, or *early* in the winter, running a double furrow so as to cover the clover as deep as possible with soil. The better to accomplish this a brush should be dragged over the clover, in the same direction in which it is to be ploughed. The entire rotation includes a period of twelve years, and will run thus:

	No. 1.	No. 2.	No. 3.	No. 4.
1841	Corn	Clover	Rye	Hemp
1842	Rye	Corn	Clover	Hemp
1843	Clover	Rye	Corn	Hemp
1844	Corn	Clover	Rye	Hemp
1845	Rye	Corn	Clover	Hemp
1846	Clover	Rye	Corn	Hemp
1847	Hemp	Clover	Rye	Corn
1848	Hemp	Corn	Clover	Rye
1849	Hemp	Rye	Corn	Clover
1850	Hemp	Clover	Rye	Corn
1851	Hemp	Corn	Clover	Rye
1852	Hemp	Rye	Corn	Clover

The second crop of clover being ploughed under, as directed above, will form an excellent preparation for the ensuing crop of corn, which should be cultivated either with light ploughs running very shallow, or the corn cultivator, so as not to disturb the clover sod, until late in July or early in August. It should now be ploughed deep with shovel ploughs, so as to throw the clover seed, or a considerable portion of it, near the surface, which will furnish an abundant crop of clover, among the rye of the ensuing year. The rye should be sown the latter part of August, and put in with a harrow or cultivator, so as to leave a tolerably even surface. If some of the clover shall have sprouted before the rye is sowed there need be no apprehension about destroying it, as there will still be an abundance of seed to supply the future crop. If the corn should be so blown down as to render it impracticable to put the rye in with a harrow or cultivator, it may be sowed early in September, among the standing corn, and will succeed nearly as well as if ploughed or harrowed in.

This method of managing the corn crop, after clover, will give the soil the benefit of the clover crop of the preceding year, and will entirely save the expense of sowing the future crop of rye with this valuable grass. The same method of proceeding will produce the like saving as often as the rye crop succeeds the clover and corn.

The cultivation of the corn crop should be such as to prevent the weeds from going to seed, which, upon a clover sod, is by no means difficult. This would prevent an unnecessary exhaustion of the soil, and leave the ground in fine condition for the succeeding rye crop, and for the hemp crop, when that shall come in regular turn.

Plants exhaust much more at the time of ripening their seed than at any previous period. And in perfecting their seed, they require some of the elementary principles, constituting the food of plants, which are but sparingly furnished by the atmosphere, such as nitrogen, and the phosphate of magnesia.* Nitrogen is found to exist in the seeds of all plants. Without this ingredient they cannot be formed. Hence its absolute necessity in all good soils, and no part of it ought to be exhausted in perfecting the seeds of noxious weeds. I approve of deep ploughing generally; but in cultivating corn after clover, as above directed, there will be no necessity for deep ploughing because of the depth to which the soil was turned up the previous fall. The clover sod beneath will keep the ground very light, so that the roots of the corn can easily penetrate to

*Liebig's Organic Chemistry 163, 201.

a sufficient depth, and thus prevent the crop from being injured by drouth.

It is important that the clover crop, of the preceding year, should not be turned under before it is thoroughly ripe, for two reasons. 1, If ploughed under when green, it will necessarily be during warm weather, and consequently the putrefactive fermentation will progress rapidly, and a great part of the most valuable ingredients of the clover will pass off in the form of ammonia, and be entirely lost. And 2, Because in that case, there will be no seed for the succeeding crop of clover. If ploughed in late, both from the coolness of the weather and dryness of the clover, the fermentation will be very slow, and the formation of ammonia will be so gradual, that it will have time to combine with the soil, which has an affinity for it, and will thus all be saved.

In laying off the ground for corn, in the spring after the clover has been turned under, it should be done with light ploughs and so shallow as not to disturb the clover, nor should it be disturbed until the time mentioned above.

If the corn should be cut up, (which would be indispensably necessary if there is much stock to feed,) it would be beneficial to the rye, and the means of making much manure. The corn should not be cut till it is thoroughly ripe. If cut too green the fodder is not so good, and the corn will be greatly injured. With a view to saving manure, the corn should be fed to fattening cattle in feeding pens, so situated as to be best adapted to saving manure, and the convenience of hauling the fodder to the pens, and manure to the proper fields. That part of the fodder from which the corn shall have been shucked, should be fed in the same manner, with a view to the same object.

Judge Buel says that by pursuing the course recommended by him, "ten or twelve loads of manure may readily be obtained every spring from each animal wintered in the yard.*

British writers lay it down as a rule, that in a good system of rotation, two crops of the same kind should not succeed each other. And judge Buel is of opinion that the mere alternation of crops has a tendency to preserve the fertility of the soil."†

*Farmer's Companion, p. 68.
†Farmer's Companion, p. 209.

In the above rotation, I have adhered strictly to the rule, except in relation to the hemp crop. It is due that I should assign the reasons which induce me to depart from it, in relation to that crop. The hemp crop requires a very rich, light soil; and if our naturally fertile soil has been much exhausted by previous cultivation, it requires several highly improving crops to prepare the ground for producing good hemp. But when land is sufficiently rich, and otherwise adapted to hemp, experience has shown that a considerable number of crops of that staple may be raised in succession, without the least exhaustion of the soil, or the smallest diminution of product. Hence, when there is one field on a farm, rich enough to produce hemp, it is best to cultivate that article for a succession of years on that field, whilst the others are being brought into good condition for a similar culture. Thus, in the above rotation, I suppose field No. 4, at the commencement of the rotation, to be sufficiently fertile, and well adapted to the rearing of hemp. In that case, six crops in succession may be raised without any diminution of crop. In the meantime, the rotation of fields Nos. 1, 2, 3, will be greatly improved; and by the application of all the manure for three years upon field No. 1, that will have become extremely fertile, and will be highly adapted to hemp, and consequently six crops in succession may be raised upon it to great advantage. In laying off the farm for this rotation, the land in field No. 1 and 4 should be the best adapted to the hemp crop. The rotation of hemp may be continued in these two fields alternately for an indefinite period. In the meantime the fertility of the other two fields would be constantly progressing both by the favorable rotation of crops, and the application of all the manure, after the first three or four years, as the hemp fields would need none, after having once been brought into a fit condition for that crop. The succession of changes of the hemp crop from 4 to 1 and 1 to 4 may be continued as long as may be deemed expedient. But in progress of time the hemp crop might be transferred to the fields Nos. 2 and 3, and the rotation of these fields may be transferred to No. 1 and 4. The hemp crop may, for example, be transferred in 1859 to field No. 2, following the rye crop, and field No. 4, in that case, may be made to assume the rotation of field No. 2. In like manner hemp may, six years thereafter, be made to take a six years rotation in field No. 3. Or, if deemed expedient, the hemp rotation may be shifted to fields, No. 2 and 3 immediately after the entire course of twelve years is completed.

The manure may be most profitably applied upon the clover, by preceding the corn crop, and it would be best to haul and spread it before the clover is ploughed in, so that it may have time to incorporate itself with the soil, and thus be highly beneficial to the succeeding crop.* It is not advisable to

*It is a prevailing opinion, among farmers, that manure should be spread and ploughed under as soon as possible, after it has been transported to the fields for which it is intended, in order to prevent its losing a very considerable part of its fertilizing ingredients by evaporation. The apprehension of much loss deters many farmers from hauling out their manure, when they have leisure to do so, because they are not sufficiently strong handed *to spread and plough it under immediately*, and thus the manure is suffered to lie in heaps, in situations in which it is *in reality* subject to *very great loss.* The apprehension of *serious loss*, by hauling manure to the field for which it is intended, and thus exposing it to the air and sun, are entirely unfounded.

When manure is suffered to lie in large heaps, fermentation, accompanied with much heat, ensues, and large quantities of ammonia and carbonic gas escape; and the alkalies are dissolved, by the falling rains, and carried down into the earth, and thus the most valuable ingredients of the manure are entirely lost. But if hauled to the field, for which it is intended, and thrown into small heaps, (say six or eight to the wagon load,) fermentation will be checked, and the falling rains will carry down into the soil the dissolved alkalies, and thus further loss will be prevented. Even when exposed to the sun and air by spreading, no loss can be sustained except the very minute quantity of ammonia, which is capable of combining with water and perhaps a still more minute portion of the alkalies. These will necessarily pass off with that fluid, by evaporation, but may, in some degree, be prevented, by ploughing under the manure as fast as it is spread.

But I repeat, that only a very small loss can be sustained by manure becoming dry before it is ploughed under, and no farmer ought to be discouraged from hauling it out, because he has not time to spread and plough it under *immediately*. If he cannot haul out the whole, before it becomes necessary to plough up his clover ley, he may finish the operation, without any material loss, during the ensuing winter, when the ground is frozen, by hauling and spreading on the surface such portion of it as remains. Although it will not have time to incorporate so well with the soil, and consequently so highly benefit the ensuing crop, yet all its virtues, with the exception aforesaid will be given to the soil. Every rain that falls will carry down into the earth a portion of its fertilizing ingredients, whereas if the manure is left at the stables, cow pens, feeding yards, &c., it is continually subject to great loss, and is every day becoming of less and less value.

The following is recommended as the most economical plan for hauling manure to distant fields. Let two wagons be employed, to be drawn by one team. While one is gone with a load, the other may remain at the manure heap, to be loaded. When the wagon returns, the hands can very speedily shift the horses, from the empty to the loaded wagon, when the team may immediately start to the field. In-apply manure to ground shortly before a hemp crop, because it tends to make the stalks too coarse, and hence manure should not be applied to field No. 1 later than 1843 or 4, after which all the manure should be applied to fields No. 2 and 3, as the rotations of the hemp fields will keep them in prime condition for that staple.

Hemp should be cut—not pulled—and (if dew rotted) it should always be upon the ground on which it grew. Thus nearly every fertilizing principle which went to nourish the hemp crop, would be restored to the soil. Nothing would be removed but the *lint*, and even the *extract* from *that* would, in a great degree, be carried down into the soil, by rains, during the process of rotting. As hemp derives a large portion of its food from the atmosphere, it would thus restore fully as much as it extracted for its nourishment. This is the true cause of hemp's not being an exhausting crop. The stubble, roots, leaves, blossoms, imperfect seed, glutinous matter contained in the lint, and the ashes of the herds or shives are all given back to the soil.

No rotation of crops can be desirable, which will not afford a reasonable profit to the husbandman. But in estimating the profits of a farm, the increased value given to land by greatly promoting its fertility, ought to be taken into the account. The least reflection will convince any one that the profits arising from the cultivation of a farm, as proposed in the foregoing rotation, will be very considerable. Fifty acres of hemp upon land improved as it would be, would yield, upon an aver-

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stead of a body, the wagons should have loose plank, of light material, (say pine or poplar,) two inches thick, and 16 or 18 feet long, laid on the bottom, and a broad plank set up on each side. Thus arranged, the driver only (who should be a stout hand,) need go with a team, as the manure may easily and speedily be unloaded, by raising up the side planks—one end at a time—and drawing off the manure, with a properly constructed dunghook. If the distance, to which the manure is to be hauled, is not very short, two hands can load the manure as fast as the third can haul it to the field, unload, and return. In this way from 20 to 25 large loads of manure may be hauled per day, during the months of September and October, if the distance be not very great. But if the average be only twenty loads per day, seven hundred and twenty loads may be hauled in thirty-six days, with one team and three hands. Thus a field, containing sixty acres, may receive twelve large loads of manure per acre, in the short period of thirty-six days. If necessary, extra hands should be employed to perform this very important operation. Its advantages would compensate the expense more than ten fold.

age, seventeen tons, which, at the moderate price of five dollars per hundred cwt., would give $1,700. Supposing the woodland to be set in blue grass, as it should be, there would be annually fifty acres of clover, and fifty acres of rye to be fed off to stock, besides the fall and winter pasture of the rye field; and seventy-five acres of woodland pasture; and there would, besides fodder and eighteen acres of meadow, (allowing seven for hemp seed, garden and orchard,) be fifty acres of corn for winter feed. With such a provision for stock, one thousand dollars per annum might be realized from that source. And if we allow the increased value of the land to be three hundred dollars per annum, (a very moderate allowance,) we shall have three thousand dollars, as the proceeds of sales and the improvement of land from a three hundred acre farm.

If it is desired that the 25 acres reserved for meadow, should also undergo a regular rotation of crops, it may be regulated as follows: Let two acres be fenced off for a garden and orchard, and the remaining 23 acres be included in one field. One third of this field may be annually cultivated in hemp seed, pumpkins, potatoes, beets, &c., shifting the crops annually as may be deemed expedient, for three years; the other two-thirds may be in timothy meadow. In the fall of the third year, after the hemp seed, pumpkins, beets &c., are removed, let this third be sowed with timothy seed, and one-third of the meadow ploughed up and planted for three succeeding years, in the same crops, and then sowed with timothy seed; and the remaining third of the meadow ploughed up. Thus the meadow would be entirely renewed every six years. It would be highly advantageous to give a light dressing of ashes to that portion of the field which, every third year, is appropriated to new meadow.* The part appropriated to hemp seed, say two and a half acres, ought to have a coat of manure, as this will greatly improve tho crop. And if the ground occupied by hemp seed be changed each year, the entire third of the 23 acres

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*Silicate of potash is an essential ingredient for the vigorous growth of timothy. As the hay crop is removed from the ground, the soil would in process of time be entirely deprived of potash, if none were supplied in the place of that removed. Hence, the importance of ashes for meadows. See Liebig's Organic Chemistry. Orchard grass and clover might be substituted in the place of timothy, which require less silicate of potash.

will, in the course of three years, have been manured, which will keep it in fine condition for the ensuing hay crop.

Next to hemp, tobacco is the great staple of Kentucky, and must always be regarded as an important item in our system of agriculture. It has generally been regarded as a very exhausting crop. But it is *only so because the crop is removed from the ground and nothing adequate returned instead.* Judge Buel, who was a most excellent practical farmer, says, "the small grain crops are the greatest exhausters of the fertilty of the soil, on account of their narrow system of leaves, which draw sparingly from the atmosphere, and the large portion of nutriment they extract from it (the soil) to mature their seeds." It has already been remarked, that plants exhaust more at the time of ripening their seeds than at any previous period of their growth. Tobacco is a broad leaved plant, and consequently extracts much of its food from the atmosphere. It is never suffered to ripen its seed, except a few plants for renewing the crop, and consequently is not liable to the objection of exhausting more than usual at the latter period of its growth. From these facts it is fairly to be inferred, that the tobacco crop is not so great an exhauster of soil as has been generally supposed. Judge Buel ranks it in the second class of exhausting crops, and places it with Indian corn. He remarks, that although these crops "have broad leaves, and derive much of their nourishment from the atmosphere, they are nevertheless gross feeders, bulky crops, and leave very little upon the soil to compensate for what they take from it."*

If, then, tobacco is an exhausting crop *only in the second degree,* and is *less so than the small grains,* it is quite apparent that a judicious system of rotation might be adopted, which, with proper applications of manure, would entirely preserve the fertility of our rich Kentucky lands.

If wheat, the greatest exhauster, can be cultivated successfully, without deteriorating the soil, why cannot tobacco? Wheat is cultivated in England, Scotland, France and Belgium to an immense extent; and yet, in all these countries, by a judicious system of husbandry, the farmers have been enabled to make a gradual improvement of their soil, and to obtain a steadily increasing product of that most useful grain. We

*Farmer's Companion, p. 198

ought then no longer to fear that a continued culture of tobacco "will necessarily wear out our soil." If it have that effect, it will result from *bad husbandry*, and not from any inherent deteriorating effect of the crop itself.

There is much difficulty in forming a rotation, in which tobacco shall take its regular course with other crops, suited to the Kentucky system of agriculture. There are several reasons which forbid this. In the first place, tobacco is a crop, which requires a soil richer than that which may be well enough adapted to corn, wheat, barley, &c. 2, the quantity of ground cultivated in tobacco, on any one farm, must necessarily be much less than is appropriated to wheat, barley, &c., because of the much greater quantity of labor, which that crop requires in proportion to the ground occupied by it. 3, the necessity of planting near to the place of hanging tobacco, in consequence of the great weight of this crop, in its green state, which makes its transportation a very heavy and tedious job, unless the tobacco house is near the place where the crop grows.

These considerations are conclusive against bringing tobacco into a regular alternation with the ordinary farm crops But it may be brought into regular rotation with red clover, with very great advantage. The clover crop is exceedingly well adapted to keeping up the fertility of the soil, and at the same time is highly useful and profitable, in any good system of agriculture that may be adopted.

Judge Buel says, "clover is less exhausting to the soil than almost any other crop. It derives much nourishment from the atmosphere, and its tap roots, penetrating to a great depth, break and pulverize it, and fit it admirably for the reception of tillage crops. We consider the use of clover as cattle food, great as it is, but of *secondary* importance to the farmer, its *most profitable use* being to *feed crops*, and furnish seed. No green crop is so serviceable as manure.*

The rotation I would propose for tobacco would be as follows: Let it be supposed that the quantity of tobacco, intended to be cultivated, annually is ten acres. I would recommend that a field, containing *three times* that quantity of ground should be laid off adjacent to the tobacco house, or houses, or so as to include them as nearly in a central situation as circum-

*Farmer's Companion, p. 158.

stances will admit. Let ten acres, on one side or end of the field, be cultivated in tobacco two years in succession, and the other twenty acres be thickly set with red clover, having a smooth bottom for the purpose of mowing. In the fall or winter of the second year, let ten acres of the clover ley be well turned under, with a large plough, and another plough of suitable construction, follow in the same furrow, so as to throw up the mould to the depth of eight or nine inches, preparatory to the ensuing crop of tobacco.

When the second year's crop of tobacco is taken from the ground, all the roots should be dug up, and removed to a compost heap, and the ground lightly ploughed, and well harrowed or brushed, so as to make it as level as possible, upon which a very thin crop of oats should be sowed, early in March following, with five pecks of clover seed for the ten acres. If sowed late in February it would be still better. The ground having been prepared in the fall, will require no ploughing or harrowing. The freezing and thawing will sufficiently cover the oats and clover seed, and thus a new meadow will be set on the ten acres, which were in tobacco the preceding year.

At the end of four years, from the commencement of the rotation, the remaining third of the field should be ploughed as above directed, and prepared for the ensuing crop of tobacco; and the ten acres, which had been occupied with that crop, should be prepared and sowed in oats and clover, in all respects as in the previous case.

To make the rotation more intelligible let the figures 1, 2, 3, in the following table, represent the three portions of the thirty acre field, and the rotation would proceed as follows:

	No. 1.	No. 2.	No. 3.
1841	Tobacco,	Clover,	Clover,
1842	Tobacco,	Clover, ploughed up in fall,	Clover,
1843	Oats & clover,	Tobacco,	Clover,
1844	Clover,	Tobacco,	Clover, ploughed up in fall,
1845	Clover,	Oats & clover,	Tobacco,
1846	Clover, ploughed up in fall,	Clover	Tobacco,

1847	Tobacco,	Clover,	Oats & clover,
1848	Tobacco,	Clover, ploughed up in fall.	Clover,

From the above table it will be seen that each portion of the field will have alternately two crops of tobacco, and four crops of clover, the first accompanied with oats. In the fourth year of the clover crop, the after math, or second crop should be ploughed under, as above directed. If the clover be well turned under, and covered deep with soil, the succeeding crop of tobacco may be cultivated, without disturbing the clover sod. Light ploughs should be used, which will form a sufficient depth of mould for the tobacco crop without disturbing the clover buried beneath.

When the rotation gets into complete operation it may proceed for any length of time.

The object in sowing oats the first year, is merely to prevent the growth of weeds. They must not be sowed thick lest they should smother the young clover. And to prevent the oats from exhausting the ground, a heavy brush might be dragged over them, when in flower, which would prevent them from seeding, and would thus cause an improvement in the fertility of the soil by restoring all that it had produced.

The clover ground should be manured just before it is ploughed up for the tobacco crop of the succeeding year. Thus the tobacco crop will be preceded by three full crops of clover, a crop of young clover and green oats, and a dressing of manure. The soil, thus highly improved in fertility, will be amply sufficient to bear two crops of tobacco in succession. This will be a great convenience in the rotation, and will justify a departure from the general rule of not making two crops of the same kind succeed each other.

Tobacco after tobacco always succeeds well when planted on a very fertile soil. In this rotation, ample provision is made to secure that object, and the inconvenience of too frequently renewing the clover meadow is avoided. According to this plan manuring is only necessary every other year; and the manure arising from *twenty acres* of meadow for *two years* is to be applied to *ten acres of ground*.

There is another matter of importance, which should be strictly attended to by the tobacco planter. The second crop or growth of tobacco exhausts nearly as much as the first, when the tobacco is cut early. The suckers grow very luxuriantly until they are destroyed by a severe frost. This ought not to be suffered. The roots should be dug up, from time to time, soon after the tobacco is cut, and after the tobacco is all housed, these roots (when clover is to succeed the tobacco crop) should be hauled off to compost heaps on the edge of the clover meadow, intermingling with them a small portion of gypsum. When sufficiently decomposed, they would form an excellent dressing for the clover. If the roots were covered with straw or leaves, it would add to the value of the compost.

The principles of the foregoing rotation can easily be applied to a larger or smaller crop than ten acres. Having explained the foregoing rotation for a tobacco crop, it is now proper to enquire what would be a suitable rotation for other crops to be connected with it. Hemp and tobacco interfere too much with each other to be cultivated by the same farmer, and it ought never to be attempted. But the rotation, as heretofore given for hemp, by leaving out that item, will very well answer to accompany the tobacco crop. It would run thus:

	No. 1.	No. 2.	No. 3.
1841	Corn,	Clover,	Rye,
1842	Rye,	Corn,	Clover,
1843	Clover,	Rye,	Corn,

This rotation will give annually a crop of corn, one of clover and one of rye. The main crop, in connection with this rotation, would be tobacco. That would be the product for sale, and the others would be for feeding stock. If the rye crop should be fed off to stock, as it should be, the above rotation would be composed of one moderately exhausting, one moderately improving, and one very highly improving crop each year. And if all the manure derived from these crops, should be applied to the clover crop, in the fall preceding the corn crop, and ploughed in, as directed, when speaking of the hemp rotation, the improvement would be very rapid. In the meantime much stock could be sustained from the product of these crops, and the woodland pastures, which would add to the profits derived from the tobacco crop. The annual increased value of the land, arising from its rapid increase of fertility must also be taken into the account. When the soil shall have been sufficiently renovated by the above rotation, wheat or barley may be substituted in the place of rye, when the rotation may proceed as in the table. But in that case there will be two exhausting crops, and only one improving crop. If by this change the soil should be found to diminish in fertility, the crop of rye should again replace the wheat. Thus rye, wheat, and barley may alternately be introduced into the rotation without the least inconvenience. The above rotation requires but three fields, besides that appropriated to tobacco. After the first sowing of clover seed, that enriching product will always be supplied by the seed left in the ground by the old crop, as herein before explained. No rotation can, therefore, be more simple, or more economical, and at the same time so enriching as the above.

In the above rotation wheat or barley may be substituted in the place of rye at the commencement of the rotation, provided the soil is fertile enough to bear two exhausting to one improving crop, but this should not be done, except when the soil is very fertile, and then should not be long continued.

In soils that are too thin for tobacco, that crop may be omitted, and two or three crops of clover may follow the wheat or rye, as the case may be. In the former case four fields, in the latter five would be necessary. One of these rotations would be proper in clay soils, having but little vegetable mould, and where the main crop for sale, is intended to be wheat or barley. In the poorer kinds of soil three crops of clover should succeed the wheat or barley, and the clover crop should be aided by the application of gypsum, at the rate of half a bushel per acre, in the spring of the second year.

A considerable portion of the Kentucky lands are what are called oak lands. Some of this is well adapted to wheat, and some again are of a less fertile sort, but all are capable of considerable improvement, and great efforts should be made to accomplish that object.

The farmer should recollect, that in proportion as he adds to the fertility of his soil he increases its annual product, and enhances the value of his land, whilst, by a contrary system, the product will annually diminish, until it will no longer compensate for the labor bestowed on its cultivation, and his land will have become of little or no value. He should never forget, that, by a proper system of husbandry, he is constantly drawing from the atmosphere a sufficient portion of fertilizing ingredients to make his land annually increase in fertility, provided he will do his part, by adopting a proper system of rotation of crops, and restoring to the soil, in the form of manure, that portion of the product, which remains after consuming all that is useful for man or beast.

The following rotation, though not strictly in conformity with the English system, I have found to be a very convenient and profitable one, in connection with the hemp crop. Let three fields, of sixty acres each,* be appropriated to corn, rye and hemp, one of which should be well adapted to, and sufficiently fertile for the latter crop. This field may be cultivated in hemp for ten or twelve years in successsion, without the least diminution of crop, or deterioration of soil. The other two fields may be cultivated in corn and rye, two years each, alternately. Thus after cultivating one field in corn, two years in succession, so carefully as not to suffer any weeds to ripen their seeds, let it be sowed down in rye, in the month of September, putting it in with a harrow or cultivator, if the corn stands up well; if not, let the rye be sowed among the corn without ploughing or harrowing. By putting a little more seed than usual, this mode of sowing will answer nearly as well. The rye may be pastured, when the ground is not too wet, through the winter and spring till the 15th of April, when the stock should be removed, and the grain be suffered to ripen. No part of the crop should be reaped. It should all be fed off to stock on the ground, after the grain is fully ripe. About the first of September, or after the first considerable rain, subsequent to that period, the rye, which has not been consumed, (and there will always be enough left for that purpose) will begin to sprout. The stock should now be all removed until the young growth shall have obtained a good state of forwardness for pasturing, which will be in November or December, according to the favorableness of the season. It may be pastured, as in the preceding year, till the 15th of April, when it should again be suffered to grow up and seed, and be fed off as

*If a farm has been already divided into a greater number of fields, two or more may be appropriated to hemp or corn, &c. without deranging the rotation.

before. The volunteer rye will again furnish some pasture, during the ensuing winter, but care should be taken not to suffer stock to remain on it, after the frost is out of the ground, during the winter or spring preceding the corn crop. It is very important to be particular in this respect, for if stock are suffered to remain on the ground when soft, as it always is when it first thaws, it will break up very cloddy, aud will greatly injure the ensuing corn crop, besides considerably increasing the labor of cultivating it. The ground should be ploughed as early in the spring as it may be found in suitable condition for that purpose, preparatory for the ensuing corn crop, but this operation should be performed when it is dry enough to turn up with a fine mould. It should never be ploughed when wet enough to cause the soil to bake.

In the fall and winter after the second crop of rye is fed off, all the manure of the plantation should be hauled and spread on the ground on which this crop had grown.

The alternate rotation of corn and rye, as above, may be continued as may be found convenient. But in process of time it may be advantageous to transfer the corn to the hemp field. This may be accomplished as follows, let the most fertile field, appropriated to rye and corn, be sowed with red clover seed, in the month of February, next after the rye was sowed, and be continued in clover three years, including the year it was sowed, to prepare the ground for hemp. This field would thus be enriched by one crop of rye, fed off to stock, and two full crops of clover, fed off in the same way. In the fall or winter of the third year the second crop of red clover should be ploughed under, as before directed in this essay, prepartory to the ensuing hemp crop, which would leave it in fine condition for that purpose. And as the hemp crop would now occupy the field, thus prepared for it, corn should be planted in the field which had previously been occupied with hemp.

In making this change of rotation it will be necessary to continue the corn crop three years in succession before it is followed by rye. This, hewever, will happen only once in 10 or 12 years. And when it does happen the exhaustion of these successive corn crops should be compensated by a proportionable application of manure.

Under this system of rotation besides the three fields for hemp, corn and rye, there must be separate inclosures for meadows, orchard, garden, pumpkins, potatoes, hemp seed, pastures, feeding lots, &c. so arranged and partitioned off as to be most convenient. Seed rye may either be purchased every second year, or may be raised by sowing a few acres in the field reserved for corn.

The above rotation of corn and rye may be conveniently connected with that for tobacco, before explained.

The rotation exhibited in the following table is very highly recommended in a communication published in the 17th No., Vol. 4 of the Kentucky Farmer. In a soil of good quality and well adapted to wheat and rye it will be found a valuable alternation of crops, where wheat is intended to be the principal one, provided great care be used in saving and applying manure upon the fallow ground, as recommended in the communication. From the table it will be seen that the full course extends through a period of eight years, and that eight fields will be necessary for the rotation. Of the eight fields three will be annually in wheat, two in clover, one each in rye and corn, and one will be appropriated to summer fallow.

A rotation of eight fields of twenty-five acres each, numbered 1 to 8.

	1	2	3	4	5	6	7	8
1841	Fallow	Corn	Rye	Wheat	Clover	Wheat	Clover	Wheat
1842	Wheat	Fallow	Corn	Rye	Wheat	Clover	Wheat	Clover
1843	Clover	Wheat	Fallow	Corn	Rye	Wheat	Clover	Wheat
1844	Wheat	Clover	Wheat	Fallow	Corn	Rye	Wheat	Clover
1845	Clover	Wheat	Clover	Wheat	Fallow	Corn	Rye	Wheat
1846	Wheat	Clover	Wheat	Clover	Wheat	Fallow	Corn	Rye
1847	Rye	Wheat	Clover	Wheat	Clover	Wheat	Fallow	Corn
1848	Corn	Rye	Wheat	Clover	Wheat	Clover	Wheat	Fallow

According to the above rotation a farm of three hundred acres of land will give annually seventy-five acres of wheat, fifty acres of clover, and twenty-five acres each of corn and rye, leaving 125 acres for woodland, orchard, garden, feeding pens, and fallow. Twenty-five acres of the clover may be appropriated to meadow, and the residue to pasture. There is, therefore, abundant provision made for food for work horses and cattle, and a reasonable stock for a small farm. There will be no necessity to sow clover seed more than once during the entire course, that is on the wheat crop following summer fallow;

and as fallow occurs but in one field the same year, seed for twenty five acres only will be required each year. The second crop of clover being ploughed under when ripe, will always afford seed enough for the ensuing crop of wheat.

If not too exhausting to the soil, the above rotation will no doubt be a very profitable one, on land not adapted to hemp or tobacco, but suitable for wheat, rye and corn. The summer fallow is not in conformity with the modern system of farming, but as it occurs but once in eight years, and will afford a very great convenience in applying manure, during the fallow year, I think this can be no objection to the system.

All the manure arising from the whole farm is to be applied to the fallow ground. Only one eighth of the arable land is to be manured each year, and consequently the whole two hundred acres will be manured once in eight years. If manure be carefully saved and applied as required by this system of rotation, and especially if all the ashes that can be annually saved—leached and unleached—be equally distributed over the fallow field, it is probable the fertility of a good soil may be preserved. It would be advantageous to keep a small flock of sheep upon the fallow field to nip the weeds and convert them into manure, but they should not be suffered to run there during wet times, as they would injure the ground by treading it. The manure, if possible, should be hauled and spread before the wheat is sown, but if not completed in time, the residue could be applied as a top dressing during the winter when the ground is frozen so hard as to bear the wagon and team.

If the above rotation should be found too exhausting it may be improved very greatly, so far as regards the preservation of the fertility of the soil, by continuing clover *two* years instead of one, where that crop follows wheat in the above table. The effect of this addition of the clover crop would be to require *ten* instead of eight fields, each containing twenty acres. There would then be in each crop annually sixty acres of wheat, eighty acres of clover, twenty each of rye and corn, and twenty acres in fallow. According to this plan the most exhausting part of the rotation "wheat, rye, corn," would be preceded by two wheat crops and *four* clover crops, instead of two of each. There will also be but twenty acres to manure annually instead of twenty-five, and nearly double the quantity of clover to produce manure.

Leguminous plants, in consequence of the very minute quantity of silicate of potash which they require, are very finely adapted to enter into rotation with wheat, which requires a large portion of that ingredient. Hence, in England, the great advantage arising from an alternation of "beans and wheat," or what is still better, "beans, beans and wheat." I have no doubt beans might be introduced with great advantage into a rotation with wheat or barley in many of our soils, which are not adapted to hemp and tobacco. The rotation might run thus, "clover, beans, wheat." A still more improving rotation would be "clover, clover, beans, wheat." The former would require three, the latter four fields. In these rotations the second crop of clover being ploughed in when ripe, would always furnish seed for the succeeding crop growing with the wheat.

Connected with the above rotation, rye and corn, in separate fields, might be cultivated, but the rye should be fed off on the ground, and manure should be applied on the rye stubble, preceding the corn crop.

In concluding this Essay, I would advise that whatever rotation the intelligent farmer may adopt, it would be advantageous to arrange it in the form of a table, according to the foregoing examples, which would enable him to see at a glance, the regular succession of his crops for as many years in advance as he chooses to introduce into his table.

ADVANTAGES OF MANUFACTURES TO AGRICULTURE.*

That a steady and adequate market for agricultural products tends to render the agricultural interest prosperous, is a proposition so self-evident as to need no illustration. In examining the question how far a *home market* for agricultural products is important to the agricultural interest, it is necessary to consider the state of the *foreign market*, and to ascertain whether it is sufficient for the consumption of our surplus agricultural products; and whether there is a reasonable probability of that market *increasing* in a ratio with the increase of our *population and production*.

If European markets were generally thrown open to our agricultural products, and the products of our forests, mines, and fisheries, subjecting them to duties no higher than those which we impose upon the manufactures and other productions of those countries, their markets would be of great importance in advancing the interests of agriculture and commerce, and would, in a corresponding degree, lessen the importance of a home market. But if, by the commercial regulations of foreign Governments, we are so restricted in our intercourse with them as to leave us a market for only an inconsiderable portion of our products, and, generally, inadequate prices for even that portion, then the importance of a *home market* will be enhanced in a corresponding degree.

During the last session of Congress, Mr. Webster, the

*A premium was awarded in favor of the above essay, at the annual meeting of the Kentucky Agricultural Society, in Frankfort, in January 1843."

Secretary of State, made a very elaborate report upon the tariff of duties, levied upon our products by the different nations of Europe, which, in the general, are extremely burdensome and frequently prohibitory. As a sample of the general legislation affecting our interests, I will give some of the more important items of the British tariff, a nation with whom we have a far more considerable commerce than with any other.

According to Mr. Webster's report, the following articles are wholly prohibited:

Fish—dried, smoked, or pickled.

Pork—corned or slightly salted.

Gunpowder and shot.

Cattle and sheep.

Timber of different kinds, subject to "enormous" duty, generally prohibitory, besides a discrimination in favor of their own Colonies and vessels, from 250 to 1,000 per cent.

The following articles are allowed to be imported, but are subject to such heavy duties as to either operate as an exclusion or so as greatly to limit their consumption:

Tobacco—in the leaf, per pound,		75 cents.
do.	manufactured, do.	$2 16.

Flour, wheat, rye and oats, and other grain—subject to a sliding scale of duty, regulated by weekly reports of the price in the principal grain districts, and so high as to amount to a prohibition, except when, from a failure of crops in England, the prices of grain rise very high.

Bacon hams, $2,72 per cwt.

Pickled pork, $2,88 do.

Pickled beef, same duty.*

Lard, $1,72 per cwt.

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*Whilst the revision of the tariff was under consideration by our Government, the British Parliament, by way of *ruse de guerre*, made some slight reductions on a few of the products of our agriculture; among the rest, are hams, beef, and pork. Flattered into the hope of a new market, and encouraged by the *extreme low* price of these articles, during the last spring, at New Orleans, some shipments were made to Liverpool, where they were thrown into market, after having been extensively advertised. A Liverpool paper, noticing this introduction of provisions from the United States, says: "We question whether the sales have resulted to the satisfaction of the importers generally. Of the United States provisions a large portion was withdrawn. The hams sold, brought 30s. 6d. to 31s. per cwt., *duty paid.* Prime beef, 38s. to 39s. per bbl., *duty paid.*" Poor prices, indeed, after deducting duty, freight, charges, &c.

Potatoes, 48 cents per cwt.

To these duties, except on flour and grain, there was added by statute, 3d Victoria, May 1840, an additional duty of five per cent.

Tallow candles, $15,20 per cwt. Hides—tanned only, 12 cents per lb; tanned and dressed, 18 cents. Hard soap, $21,60 per cwt.; soft soap, $17,04. Beeswax, $14,40 per cwt.; unbleached, $7,20. Window glass, $40 per cwt. Paper, 18 cents per pound. These comprise nearly all our agricultural products except cotton.

This is, as yet, subject to only a moderate duty because it is essential to the support of their own manufacturers that they should be supplied with this raw material at a low rate, to enable them to compete successfully with other nations, in the manufacturing of cotton goods.

Cotton pays a duty of 70 cents per cwt., and with the additional five per cent. under the statute of 3d Queen Victoria, will amount to about 73 cents per 112 lbs. But, if imported in British vessels, it pays a duty of only *eight cents* per cwt.; an evidence of the great care with which Great Britain protects her navigation interests.

How long the cotton-growing interest is to be thus favored will depend upon the success of the effort now making to grow a sufficient supply of cotton in the British East India possessions to supply their own factories. From a report of the chamber of commerce of Bombay, it appears that from the 1st of June, 1840, to the 1st of June, 1841, there was imported, into that harbor alone, 172,212,755 lbs. of cotton, from the different ports of the British possessions in India. This is a larger quantity than was raised in the United States, in any one year, prior to 1825. From the progress already made in the culture of cotton, there is just reason to apprehend that many years cannot elapse before the British East Indies will grow a sufficient quantity of cotton to supply her own factories, except, perhaps, the finer kinds—the Sea Islands—when she will no doubt pursue the policy by which she has always been governed, of giving protection to her own products by levying high duties on those of foreigners competing with them, and thereby cutting off or greatly curtailing our market for raw cotton.

Having given a hasty sketch of the manner in which our products are affected by British legislation, let us now see what effect it has had upon *the amount of our exports of agricultural products.*

If we are to rely upon *a foreign market* for our surplus products, we ought to have a reasonable assurance that *that* market would be *enlarged* in proportion to our increase of population and production. Let us see whether such a hope can be reasonably indulged.

Tobacco is one of our principal staples.

	hhds.
Of this article there was exported, in 1791	101,272
do do. in 1792	112,428
Average for the two years	106,850
During eleven years, from 1816 to 1826, inclusive, the average exports was	75,992
Showing an annual falling off, during these years, of	30,858

During the first period, our population was about four millions, (by the census of 1790, 3,929,326.) During the last period, it averaged about ten millions, (by the census of 1820, 9,625,734.) Consequently, if the exports of tobacco had increased in an equal ratio with our population, they would have averaged, annually, during the last period, 267,125 hhds. Here there is an annual falling off in the market for tobacco, compared with our population, of 160,275 hhds. In other words, if a population of four millions required a market for 106,850 hhds., a population of ten millions required a market for 267,125 hhds. But, if we come down to a later period, we shall find no improvement at all corresponding with our increase of population in the foreign market for tobacco. In the year 1840, our Government sent a special agent (Mr. Dodge) to Europe to endeavor to effect a more favorable disposition among foreign Governments as to the reception of our tobacco, and to obtain fuller information as to the duties levied upon it. In a letter, dated London, 16th November, 1840, Mr. Dodge estimates the consumption of tobacco, annually, by all the powers of Europe, to be 86,396 hhds., and the duty levied thereon to be $35,071,820. He observes in his letter: "One thing is certain, that, on 86,396 hhds. of American tobacco, costing, in the United States, $6,450,820, and legally introduced into Europe, a revenue is derived of about $35,000,000, being nearly *six times more than its original cost.*" Thus the foreign market for tobacco, in 1840, was less than the average of 1791 and 1792 by 20,454 hhds. Our population in 1840 was over seventeen millions; and if the market for tobacco had increased in a ratio with our population, the export for the year 1840 would have been four and a quarter times as much as the average of 1791 and 1792, that is, 480,825 hhds. instead of 86,396.

Flour is another of our great agricultural staples. The average annual export of that product for five years, from 1791 to 1795, inclusive, was 810,433 bbls. For the five years from 1822 to 1826, inclusive, the average annual export was 850,-599 bbls. Here is an increase of less than five per cent. in thirty-one years, whilst our population increased, during the same period, from four to about eleven millions, that is, 175 per cent. But if we come down to a later period we shall find the foreign market for flour diminishing instead of increasing. The average annual export of flour for a period of five years, from 1836 to 1840, inclusive, was only 600,396 bbls., whereas, if the export of this product of agriculture had increased in a ratio with our population since the year 1792, it would have been nearly four times as great as the average of 1791 and 1792, that is, 3,241,740 bbls.

The annual export of beef, on an average of five years, from 1791 to 1795, inclusive, was 106,850 barrels. The annual export of the same article, on an average of five years, from 1822 to 1826, inclusive, was 86,396 barrels, showing an average annual falling off of 20,454 barrels. If the market for beef had increased, in a ratio with our population, the annual export would have been increased about 175 per cent., equal to 293,736 barrels, instead of 86,396.

The annual export of pork, on an average of five years from 1791 to 1795, inclusive, was 48,815 barrels. The annual export of the same article, from 1822 to 1826, averaged 73,205 barrels. Here is an increase of 51 per cent. in 31 years, being greater than any other article yet examined; but, during the same period, our population increased about 175 per cent.

I have not at hand a table of exports of beef and pork for a period later than 1826. If the examination were carried on, down to the present time, the results would probably not be more favorable than the above.

There are no tables showing the exports of the products of the forest prior to the year 1803. For that and the four succeeding years, they averaged annually $5.015,600; and for the five years from 1822 to 1826, inclusive, $4,418,859, showing a falling off of more than half a million of dollars annually. If the foreign market had improved, in a ratio with our population, the value of the exports of the product of the forest would have been about $8,916,521.

I have now gone through with all the important agricultural products, which are exported by the States, that do not grow cotton and rice; and it will be seen, so far from the foreign market keeping pace with our population, that in relation to most of the articles, there has been a considerable decrease of exports, showing an actual falling off, instead of an increase in the foreign demand for our products. And as our population, from the year 1790 to 1840, has more than quadrupled, it is evident that we cannot rely upon a foreign market for the products of those States, which, from climate, cannot engage in the culture of cotton. The exports of cotton, unlike other agricultural products, has constantly increased, greatly beyond the ratio of the increase of population, and hence it appears that hitherto the foreign market for this staple has advanced even more rapidly than the population of the cotton-growing States.

The exports of cotton and rice—products of the cotton growing States—for the year 1841, amounted in value to	$56,340,448
The exports for the same year, of all other agricultural products, not including the products of the forest, amounted to	$27,407,499

Thus the cotton and rice growing States, South Carolina, Georgia, Alabama, Mississippi, Arkansas, and the Territory of Florida, with a population of 2,403,878, say, (including the small portion of North Carolina, Tennessee and Louisiana engaged in raising cotton,) two and a half millions have a foreign market for their two staple products, cotton and rice, equal to $22,50 per head, whilst the residue of our agricultural population, amounting to ten millions seven hundred thousand,* have a foreign market for their agricultural products of all descriptions, including the products of the forest, of less than three dollars and a quarter per head. Our Southern brethren have, moreover, a home market for one-sixth of all the cotton they raise. The home market for the years 1838, 1839 and 1840, averaged 289,500 bales, equal to 115,800,000 lbs., which somewhat exceeds one-sixth of the average exports of those years. I have no correct *data* to ascertain the consumption of rice in the United States, but I have no doubt it is larger, in proportion, than the consumption of cotton, and consequently the home market, for Southern products, is fully equal to one-sixth of all that are raised.

Now, if so extensive a *foreign market*, in addition to the home consumption, is necessary to the wants of the cotton-growing States, it is very evident that *that* portion of our agricultural interest, which is not engaged in the culture of rice and cotton, cannot be in a flourishing condition, but, on the contrary, must be exceedingly distressed, unless they can have *a home market* for their agricultural products sufficient to compensate *the deficiency* of the *foreign market*. The foreign market for cotton and rice is about seven times as great, in proportion to population, as for other agricultural products; and consequently to make good this deficiency a *home market* ought to exist equal to *six times* the present market for these products, to wit: $19,50 per head. This, for a population of 10,-200,000, would requre a *home market* equal in value to $198,-900,000. Even with such a home market as this, the cotton and rice-growing States would still have the advantage arising from the home market for their products, equivalent, as shown above, to one-sixth of their foreign market.

The facts and illustrations above set forth show, most conclusively, not only the importance, but *the absolute necessity*

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*By the returns of the census of 1840, persons engaged in agriculture, 3,717,756, and in all other occupations 1,099,448. This includes only the adult population. If a due allowance be made for females, infants, &c,, the entire population will be nearly as follows:

Engaged in agriculture,	13,200,000
In manufactures, trades, and all other pursuits	3,900,000
	17,100,000

of a home market for the agricultural products of those States not engaged in the cultivation of cotton and rice; and that even for the latter, the home market, though not so absolutely essential, is greatly beneficial, coming as it does in aid of the foreign market, in which the *supply* already presses so closely on the *demand*, as scarcely to allow of a fair remuneration to the growers of cotton for the labor and capital expended in its culture.

I will now present some facts, more in detail, to show how important to the agricultural interests the home market has al-already become, and the great advantages which will result from giving such encouragement to agriculture as will secure a constant and steady increase of that market.

A home market for agricultural products to a large amount arises from the productions of one part of our extensive country being consumed by the cultivators of the soil in another part. Thus, the sugar and molasses of Louisiana, and the cotton and rice of Georgia, South Carolina, &c., and the fruits of all the Southern States, are consumed to a large extent in the States in which these articles are not produced; and the Southern States are supplied in turn with bread-stuffs, meat, horses, mules, beef, cattle, hogs, &c., and the fruits of the Middle and Northern States. Other agricultural products, of various kinds, are consumed by those who are engaged in cultivating the soil, in consequence of their preferring to buy certain agricultural products rather than to raise them, such as wheat, by hemp-growers, cattle-feeders, &c., and numerous other instances of the like nature.

There are no *data* upon which an estimate, even approximating the truth, can be made of the extent of the home market, arising from this cause.

There are two other sources from which a home market, *immediately* affecting the agricultural interest, arises.

1. By the use of the raw materials, which are the product of agriculture, by the mechanic and manufacturing trades. To these materials, additional value is given by mechanical and manufacturing industry, and they find a market chiefly at home, and to some extent, are exported and sold in foreign countries.

2. Agricultural products consumed by those who are engaged in occupations other than agriculture.

Of the former, the following are some of the principal items; wool, cotton, raw hides, hemp, flax, and tobacco. To these, many other small items might be added, such as flaxseed, converted into oil, lard into candles, palma christa bean into castor oil, boards into furniture, &c.

It is estimated that there are at least twenty millions of sheep in the United States. Estimating the fleeces, washed on the sheep's back, at two and a half pounds each, and to be worth, on an average, 30 cents per pound, the value of wool

would be	$15,000,000
11,800,000 lbs. of cotton, average 10 cents	11,580,000
Raw hides, estimating the products to be 75 per head, (a low estimate,)	12,750,000
Other items enumerated, and all others, estimated	10,670,000
	$50,000,000

We have here a home market for the products of agriculture, amounting to fifty millions of dollars, for which we are indebted to mechanical and manufacturing industry.

To form a correct estimate of the consumption of the products of agriculture by those engaged in other occupations, I will take the estimate, which has resulted from experience in England, to wit: that six bushels of wheat for each soul is necessary to feed her population. According to this estimate, 3,900,000 persons would require for food, 23,400,000 bushels of wheat, equal (taking into consideration the offal) to five millions barrels of flour, which at an average of $5 per barrel, would amount to $25,000,000. Meats, vegetables, milk, butter, cheese, poultry, eggs, fruit, &c., would, at a low estimate amount to twice as much as the bread-stuffs, making the agricultural products consumed by those engaged in pursuits other than agriculture, $75,000,000, and 125,000,000, including the raw materials consumed or worked up by the mechanics and manufacturers. This sum, though it may appear large, I have no doubt is less than the real amount, and falls greatly short of what I have shown the home market ought to be, to render it equivalent to the foreign market for Southern products. To the above items, however, should be added the amount of agricultural products of one part of the country consumed by the agricultural population of other parts; and also the amount consumed by the horses, cows, &c., of those not engaged in agriculture. There are no *data* upon which a tolerably correct estimate can be made of the amount of agricultural products consumed in this way. In my judgment, the amount cannot be less than fifty millions of dollars, making the amount or value of the home market $175,000,000.

The difference between the value of the home and foreign markets, for the agricultural products of the States which do not grow cotton, it will be seen, is very great, and consequently, that it is extremely important for the agricultural interest, that the home market should be cherished, and extended as far as possible.

To show the important bearing which mechanics and manufacturers have, in rearing up *a home market*, I need only remark that, by the late census, it appears that they compose considerably more than two-thirds—nearly three-fourths—of the non-agriculturists; and, besides, to them *exclusively* is due the market arising out of the consumption or working up of the raw materials, as herein before explained.

But to form a true estimate of the *full value* of the home market, we must take into consideration the products of our iron, lead, copper, and coal mines, and the *increased value* given to *every description of raw material*, by the industrial labors of our mechanics and manufacturers. Every dollar added to the value of these raw materials, is a dollar added to the general stock of wealth. The amount of wealth thus *created* —the term is not too strong—is greater by far, than is generally supposed; and it is much to be regretted that we have not more accurate materials from which a correct estimate might be formed. Take as a sample, a few articles of which we have sufficient *data* to form a tolerably correct estimate.

There was manufactured, in the United States, in the year 1842, 158,000,000 yards of *printed calico*, estimated to have cost 11 cents per yard, on an average

	$17,338,000
Cotton goods, *not printed*—probably twice the amount	34,676,000
	$53,012,000

Deduct the cost of the raw material	11,580,000
Added to the wealth of the country, by this branch of manufacture alone	$40,434,000
Paper, made out of a material costing but little	16,000,000
Iron, raw material taken from the earth	16,000,000

The increased value given to iron, by working it up and applying it to a thousand useful purposes; these, and hundreds of other articles might be enumerated, which are the results of mechanical and manufacturing skill, if we had the *data* upon which to make correct estimates.

Past experience has shown that our population has steadily increased at the rate of 33⅓ per cent. for each ten years, whilst the *foreign market*, so far from progressing in an equal ratio, is not so good *now*, for the aggregate of our productions, as it was in 1792, *forty years ago*. We have not the slightest ground to hope for such an improvement of that market, as to render it adequate to the wants of our rapidly increasing population. There is no alternative left us, then, but to cultivate our own resources, and to strive to give an impetus to the *home market*, which will carry it forward with a rapidity equal to the ratio with which our population advances. This can be done only by encouraging and invigorating the operations of our iron, lead, copper, and coal mines, and by stimulating the industry of our mechanics and manufacturers, by securing to them the *home market* for the sale of their products, against the undue competition of foreign pauper labor, so that they may speedily dispose of their fabrics, and thus, by quick returns, dispense with the necessity of large and overgrown capitals. There need be no fear of monopolizing. All experience has shown that *home competition* is abundantly sufficient to secure every possible improvement in the art of manufacturing, and to bring down the price of manufactured goods to the lowest possible point at which they can be afforded. The history of the cotton manufacture proves this beyond all question.

To show the immense field we still have for extending *home industry*, and to raise up a *home market for agricultural products*, let the following facts be deeply pondered by every friend of his country:

A report made to the British Parliament, not long since, shows that the following are the amounts of British manufactures, consumed by the nations named, viz:

Prussia, average for each person		7	cents.
Russia,	do	15	do.
Denmark,	do	17	do.
France,	do	20	do.
United States,	do	402	do.

From the above table it appears that the United States consume of British manufactures, more than *twenty times* the amount of any other nation, and nearly thirty times as much as Russia, a nation like ours, which has only recently devoted much attention to home manufactures.

If we had a similar table of the consumption of French goods, by the United States and other nations, we should probably see a no less unfavorable state of things, and the more to be regretted, as most of our imports from that country are wines, brandies, and silks. Now, if we could reduce the consumption of the manufactures of these and all other foreign nations to twenty cents a head, or even fifty cents, by manufacturing for ourselves, instead of suffering those to manufacture for us, *who refuse to take our bread and meat in turn*, who can doubt that an immense increase in the *home market* would immediately result; causing to flourish not only the agricultural interest, and the mining interest; but every other interest in the community.

The agricultural interest would be benefitted in a two-fold manner: First, by the increased consumption of agricultural products, by the additional number of persons engaged in the various operations of mining, and in mechanical and manufacturing pursuits, and the various employments connected therewith, such as the construction of buildings, &c.; and, secondly, by a transfer of a considerable number of those, now engaged in agriculture, to other pursuits, thereby converting them from *producers* into *consumers*, and thus more nearly equalizing *supply* and *demand*; and preventing such a glut in the market as will prove exceedingly injurious to the agricultural interest, by reducing prices below the standard of a fair remuneration for capital and labor expended.

To show the vast amount of the internal trade of the United States, I extract the following table from Niles' Register, October, 1842, page 130. Allowing the trade of two-thirds of New York, one-half of Ohio, the whole of Vermont, Michigan, and Wisconsin, to pass through the New York Canals, they would accommodate the trade of three millions of our population; but it is well known, however, that a considerable portion of the trade of these States and Territory passes into Canada, by way of the lakes and the Welland canal. The trade of the canals will, therefore, probably not embrace more than two and a half millions of our population; yet it will be seen that the trade, passing through these canals, considerably exceeds the exports of the whole of the United States. The following facts are shown, by the table as I have here abridged it, giving, however, the whole substance. The exports are for the year ending 30th September, 1841, and the trade through the canals for the same year, as reported by the New York canal commissioners:

	TONS.
By the United States Treasury tables, the tonnage on American shipping, entering during the year,	1,631,909
Do. passing through New York canals	1,521,661
Exports of the products of the forest	6,264,852
Do. passing through New York canals	11,841,103
Exports of products of animal and vegetable food, including rice	16,737,462
Do. passing through New York canals	20,832,266
Exports of flour alone	7,759,646
Do. passing through New York canals	10,478,416
Total exports of articles of domestic origin exported in American vessels	82,569,389
Value of all articles passing through New York Canals	92,202,929

If we suppose the commerce, passing through New York canals, to be equal to one-sixth of the whole internal commerce of the United States, then that commerce will amount to the sum of $553,217,574, a vast sum, but less, it is believed, than the real amount of the internal commerce of the whole Union.

Household manufactures, though subordinate *in degree*, are *in principle*, entitled to the same consideration as those carried on upon a larger scale, by the use of machinery. Equally, with the latter, do they add to the wealth of the country, precisely as much as is equivalent, to the increased value, which is given to the raw material, by the application of domestic labor. In some respects, even more praise is due to this species of labor than any other, inasmuch as it gives a virtuous employment to the fairest portion of our population, and, without which, a large part of the female sex would be destitute of the means of employing themselves usefully and profitably to the community. The entire value of this species of labor, may truly be considered as so much added to the general stock of wealth, besides the wholesome influence exercised upon the morals of society, which is even more important than the wealth thus created. Household manufactures should, therefore, be encouraged by rendering this species of labor honorable, in the highest degree. Every stimulant, which a wise legislation can apply, should be liberally used for this purpose.

The policy of increasing and enlarging the manufactures of the State, as far as the means are within our power, cannot be doubted. Whatever tends to increase the wealth of the State, will in a proportional degree, increase the wealth of the Union, and, consequently, every argument which has been urged in favor of encouraging the manufactures of the nation, will equally apply to those of the State, so far as by appropriate State legislation, this can be effected. The power of the State, it must be admitted, is, in this respect, very limited, but, in co-operation with the General Government, much good may be done.

In the first place, household manufactures should be encouraged and stimulated, by premiums offered through the medium of the State, and county agricultural societies; and to this end, suitable appropriations should be made, to be applied under such general regulations as the law may prescribe.

In the next place, the erection of the most approriate machinery for manufacturing hemp into cotton bagging, and other raw materials, (the product of agriculture,) such as wool, flax, silk, &c., into suitable fabrics, should be encouraged, by exempting all buildings, erected for this purpose, together with the machinery and appurtenances, from taxation for a considerable period. Similar buildings, and machinery, for manufacturing cotton fabrics of all kinds, should likewise be exempt from taxation for a reasonable length of time. And the like exemption should be extended for the encouragement of such other manufactures as the Legislature, in its wisdom, may, from time to time, deem worthy of encouragement. The time during which the exemption should continue should be liberal, not less than ten years. Nothing can be lost by thus inducing capital, from abroad, to come among us, for permanent investment. For if it were not thus induced to come, we could levy no taxes upon it, and if we can induce its investment, by ten years exemption from taxation, it will be a source of revenue at the expiration of the period of exemption; and, in the meantime, every year these factories are in operation, they will be adding to our wealth, and will, moreover, exercise a wholesome influence upon our agriculture, by the consumption of its products.

Investments of capital, for manufacturing purposes, may be advantageously encouraged, also, by granting long leases of water privileges, upon favorable terms, at the locks and dams, on the rivers now in the course of improvement. The encouragement would be still more efficient, if the erections and machinery were wholly exempt from paying any rent for a period sufficiently long to enable these manufacturing establishments to get fairly under way. Establishments for manufacturing purposes can afford no profit until they get into complete operation; there is, therefore, great propriety in subjecting them to no burdens, on the part of the State, until they begin to yield some remuneration for the capital and labor expended.

In addition to these modes of encouragement, the Legislature ought, from time to time, as circumstances shall require, to press upon the National councils the urgent necessity of encouraging agriculture, by raising up and firmly establishing an adequate home market, for not only the products of agriculture, including those of the forest and the fisheries, but also of our iron, our lead, copper, and coal mines, which can be effectually done only by encouraging and protecting *home industry* against the competition of the pauper labor of Europe. Appeals of this kind, if made in a patriotic spirit, and with that unanimity of sentiment, which, on this subject, prevails among our citizens, could not fail to have a most powerful influence upon the National councils.

The tariff, now in operation, will probably be adequate to the protection and encouragement of the industrial pursuits of all classes of the community. But to render it effectual, in accomplishing the objects proposed, it is essential that *confidence in its permanency* should be inspired, for without proper assurance, that the Government will continue the system which has been adopted, no one will be willing to invest capital, which may be utterly sunk by a change of policy, by our National councils. All that is now necessary is for the State Legislatures, and the people everywhere, to use their utmost efforts *to give firmness and stability* to the system which has been adopted. If this be done, and such a regulation of the *currency* effected as shall give us a circulating medium, co-extensive with the Union, and at all times convertible into gold and silver, and so regulated as to forbid sudden expansions and contractions, and so completely guarded as to prevent even the slightest apprehension of a *suspension of specie payments*, there would ensue a more steady and permanent prosperity than has ever been witnessed in this country.

BREEDING HORSES FOR AGRICULTURAL PURPOSES.*

The No. for June 1st offers premiums for the 1st and 2d best essays "on the subjects of breeding and rearing horses for agricultural purposes." The writers are laid under no res-

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*In the year 1839, Thomas B. Stephenson, Esq. editor of the Kentucky Farmer, a most intelligent and zealous friend of agriculture, offered premiums for the *best* and *second best* essays, on breeding and rearing horses for agricultural purposes. The above essay, and the one next succeeding, competed for the premiums. They were referred, by Mr. Stevenson, to Orlando Brown, Esq. who was requested to associate two gentlemen with himself, to decide on the merits of the essays. The following letter from Mr. Brown shows the result of the reference.

FRANKFORT, Nov. 4th, 1839.

THOMAS B. STEVENSON, Esq,—Sir: The essays, which were submitted to me, in conjunction with two other gentlemen to be selected by me, have been most carefully perused and considered. It was a difficult matter to determine to which the preference should be awarded, when both the essays were so distinguished for their merit, and for their beneficial public tendency. I selected, as my associates, Robert W. Scott, Esq. and John Lewis, Esqr. These gentlemen are well known to the agricultural community, and great confidence is justly reposed in their judgment. I had hoped that their concurrence in opinion would have rendered it unnecessary for me to decide, but even *they* differ, and when they do, I may well distrust my own conclusions. It is also strong evidence of the almost entire equality of merit in the two productions. Mr. Lewis and myself agree in awarding the superiority to the essay written by Mr. W. Williams, of Tennessee. Mr. Scott considers the one written by Mr. Beatty as preferable. We all concur in the opinion that they are both eminently creditable to their authors, and that you confer lasting benefits upon the country in enlisting such able pens in behalf of its most valuable interests.

Yours respectfully

ORLANDO BROWN.

Believing, from the favorable opinion expressed by Mr. Brown, that both essays would be useful, I have solicited and obtained permission from Mr Williams to include his essay, in conjunction with my own, in the volume which is now submitted to the public. The approbation of Mr. Stevenson, who generously offered and paid the premiums for these essays, for their publication, has been also obtained.

trictions as to the mode of discussion, or the breeds they may choose to advocate. An agricultural paper could not be expected to have been more liberal. A dissertation on the blood and proportions, the breeding, rearing and training the turf race-horse; or the stouter built, not much less blood-like roadster, hunter, or war-horse which the advance of modern times has introduced, might not have suited the tastes of a majority of your readers. You are aware, however, that by placing an interdict on the turf, the camp, the field, and the road, you damp the ardour of your writers, and strip the horse of his glory. The plough and cart horse is a mere utilitarian, and ploughing and carting, however the poets may have embellished them in song, are known by the *Workies* to be plain fact matters, and effectually achieved by the due and continued application of bone and sinew. There evidently is no fancy in the affair to the man who holds the handle and guides the team. There is, however, ample room for the exercise of much practical good sense in pointing out the best method of breeding, raising, breaking and working farming horses to the best advantage. The profits of agricultural operations generally are moderate, and managed as they are in many instances loss is incurred. Most breeders of animals, it is apprehended, receive but a very inadequate compensation for their time and attention and money expended. It ought not to be, and that it is does not result necessarily, but from the want of proper care and judgment in breeding and raising. They follow what has been, not inaptly called, the hap-hazard mode, by putting any sort of a female to any sort of a male without regard to qualities; and in raising they are so stinted and starved as to warp and destroy whatever little of good form and constitution, they may have accidently brought into the world with them. These seem to act without object, except that they know a horse is a horse and a steer a steer, and that if the colt was got for a barrel of corn and the calf gratis, they have saved their money.

The business of breeding animals, in modern times, is said to be a science. It has not been, however, and probably never will be reduced to exactness. "Dame nature" in her operations delights to display endless varieties. But certain rules have been laid down by the observance of which we may reasonably expect to approximate certainty. "Like begets like" is the leading rule. It not only has its exceptions, but it must be understood with limitation. Select a horse and mare, such as you want, or as near as you can find, the produce of their conjunction may resemble the sire, or the dam, or neither; but it may have an intermediate form, or may take after some remote ancestor; and if the remote ancestors were indifferent, or positively bad, the chances will be against the rule, in proportion to the number of worthy progenitors. It should be enjoined on beginners, therefore, 1st, To select good animals to start upon, where no better evidence can be had: 2ndly, But where it can, to select them from good families. In England, where more attention has been paid to the breeding and rearing the blood horse, than in any other country, they have arrived at extraordinary size, and power and endurance; and it has been done by combining the Arab, Barb and Turk, and developing the bone and muscle of the new race by generous feed and judicious exercise. There no one thinks of breeding a racer from a mare who has not at least five pure crosses. And many of their most distinguished mares can number double the amount, landing on a royal, or other Arabian or Barb mare. There is something in the blood, that gives family distinction, though the blood may not tell in particular individuals, either from mismanagement, or accident, or from some defect in constitution or form. A third rule requires that they be crossed; in other words, that we avoid the coupling together near relatives. The more remote families, probably the better; but after prohibiting the intercourse of sire and daughter, brother and sister, beyond these we may probably be permitted to use our judgment in selecting the requisite forms. Some of the double Januses were very well proportioned, but they were very small. The double Archys evidently show a falling off. But Wagner by Sir Charles out of a Marion is thought to be among the good ones. And we need not look for a better than Highflyer, his dam by Blank, got by Regulus, both sons of the Godolphin Arabian.

There are some subordinate rules, that in the thorough bred studs, should be well considered. 1. Certain families cross better than others, all being good. 2d. Certain individuals cross better than other individuals. 3rd. And certain individuals breed better than other individuals. Herod and Eclipse were extraordinary racers and stallions, and were of good families, and they crossed well upon good families. But the union of their bloods was rather transcendent, and were we to select from the best of Eclipse's sons, we should take these—Benningbrough, Waxy and Gohanna, all out of Herod mares, and Hamiltonian, out of a Highflyer, a son of Herod. Sir Archy and Eclipse of Long Island are both good stallions, and their blood is thought to cross well, but the blood of Eclipse and Ratler, son of Sir Archy, "nicks." These last rules are to be learned by practice only. Who can assign the reason why Ratler's immediate descendants have not shown his worth? In them it is measurably dormant, but it is shining with resplendant lustre in Mingo and Job, of the second generations. And of Job it was hardly to have been expected as he combines an unsual proportion of Diomede and Sir Archy blood, being bred very much "in and in."

The thorough bred horse, standing evidently and acknowledgedly in the first rank, and the rules for breeding and raising him being "considered and freely understood," a variety suited to a particular purpose is to be produced by considering the proportions wanted, and the families and individuals from which such properties are most likely to be inherited. Were the thorough breds equally numerous and bred and raised at the same or nearly the same cost, I would say without hesitation, and so would every one who understands his interest, put the thorough breds to work. Eclipse, or Ratler, or Tranby, or Mingo, or Job, if put to it in their prime, would have done more work than any inferior bred horses of their size. In June or July, blood will tell as promptly in the corn field as on the race course. My best breds always then take the lead. But the above, and such as the above, are not accessible to farmers generally.—The price forbids. What then is to be done? In this glorious land of liberty, every one, who has the means, does as he pleases, and only wish, I can scarcely hope, that some individuals or companies or agricultural societies would import a bay Turk, a bay Barb and a Cleveland bay, and a bay dray, or draught horse. The Cleveland bays are said to be almost uniformly of bay color and universally gentle in harness. I have seen a few matches from the north, apparently half breds, excellent in harness, of the desired size and shape.

Draught horses, perhaps equal to any, might be had in Virginia or Pennsylvania. The stock should all be selected by a competent judge of horse flesh, and the two coarser kinds should be chosen not only with a view to their own stoutness, but family stoutness and gentleness at work, and with a scrutizing eye to their hoofs and pasterns. Brittle horn, gummy ankles, or tendency to grease in the heals should be an insurmountable objection to a horse however perfect in other respects. We would of course have to choose the temper of the Barbs and Turks, though a man thoroughly conversant with horses can from certain indications form a tolerably correct estimate of their tempers. A person but moderately acquainted would be able to know that Belshazzar was quiet, and that St. Giles was "queer." The mares to be selected, should be well bred, of bay or brown colour and a few greys. They should have long heads, wide between the eyes, and jaws well displayed, with clear placid eyes, and open foreheads; well set ears, and fine muzzles and nostrils; necks of moderate length and muscular, with large detached windpipes; having quarters before and behind with plenty of muscle; large bodies with large ribs, and the short ribs close to the hips; standing even and rather wide on legs, abounding in bone and sinew, and terminated by tough black hoofs. A white pastern and hoof is about as liable to disease as those of black or dark chesnut colour. The Stallions should be of similar shape, but more coarseness is tolerable in them, particularly about the neck. The mares above described of 15½ hands high or upwards should be put to the Barb and Turk, those under, to the Cleveland bay. Those three crosses in the general would produce stock of sufficient size. The best of the colts should be kept for stallions. When a filly was deficient in size she should be put to the dray horse. The crossing and the result of each cross should be regularly recorded. If of very defective form she should not be permitted to breed, or be put to a Jack. If the male inherited the defect, it would not be perpetuated. And all the blind fillies, and those having defective eyes, should be put to a Jack, for a blind mule would be a curiosity. A colt thus bred might be kept as a coverer at about $10 the price of the season of one mare. And where the blood had been diluted with the blood of the dray, at $7,50 or perhaps $5, which should be the minimum price. And I asked why the expense of importing a Barb and Turk should be incurred? It is answered, the Byerley Turk and the Curwen Bay Barb got a colt and filly the sire and dam of Partner, one of the best horses ever bred. He got Tartar, a capital one. He got Herod, the lasting properties of whose stock have probably never been equalled. He got Highflyer, who had no parallel in his day. He got Sir Peter, a good racer, and, as a stallion, without a parallel in his day. He transmitted his excellence to Haphazard; and he to Philho-da-puta; and he got Birmingham, who, but for the inroads made on his constitution by bad management, might have perpetuated the family stoutness. Perhaps it may be done by Philip, who came of Treasurer, a daughter of Camillus, "whose stock were particularly neat and of great strength for their size."

Having chosen the right sorts to cross, and thereby bringing on a new variety, the mode of raising them may be described in a short compass. The mares and horses should be in good health and condition, when put together. During the period of gestation the work to be done by the female should be moderate, and as she approaches the time of delivery the work should be suspended and her condition a little improved. The male should not probably be worked, but plenty of exercise should be given him regularly, and his powers should never be overtaxed. The foals, for the best, should never be dropped except when the grasses are plenty to increase the flow of milk, or, if the mares are to be worked after foaling, generous food should be given them in sufficient quantities. The young will learn to eat at three or four months old, and may be weaned at five or six. They should be sheltered from the inclemencies of winter, and fed to keep them straight and growing, without being forced to precocious maturity, as is done in England, in the racing studs. The object of the forcing system is to attain size and strength to enable them to contend in "their 3 year old form" for the high prizes. The Derby, the Oaks and St. Ledger stakes have great attractions for breeders and sportsmen; and are annually won, not always by the best colts and fillies, but are annually the means of destroying, or greatly impairing the value of many good ones. Nature would indicate that a horse should have attained full age before he is put to his utmost exertions. Foals should be gentled immediately after their birth, and they rarely, perhaps never forget it. Yearlings also should be kept growing uniformly in winter as in summer, and at 2 years old should be halter broke, and used moderately at three, increased in work at 4, and a filly at 5 will do full work, but a gelding not before six, perhaps 7. Very often, however, they are broke down before they are aged by improper management, and thereby several of the most valuable years of their lives are lost or rendered nearly useless.

A few objections may be answered to enable us to come to a close. It is said that the skins of the well breds are fine and liable to chafe and gall. The gear should be made to fit, be of good quality and kept soft and pliant. It is objected against the breds, that they are bad tempered, and restive, and unmanageable. The objection applies not generally, but to a part, and a small part only. The finest, and the best tempered, and altogether the best carriage horse I ever saw, was a Pacolet out of a Spread Eagle. And as to the restive, begin with them young and learn them obedience by times, and keep them obedient. If they are suffered to run wild till four or five years old you should expect trouble, unless you could employ a "whisperer." I had a filly whose sire had a decidedly bad temper, and her dam's sire was equally vicious. She was worked tolerably well at three years old, but was injured so much by another team that she was turned out for the season, and the next year refused. She bred me a filly, sold for the saddle, and a colt, that works kindly, before I sold her, and a better roadster than her is rarely to be seen. I had two fillies full bred. The one was put to work at three years old and worked kindly. The other was a splendid creature, that I used under the saddle; but on one occasion and without requiring her work, but rather to see whether she would work, I put her to the plough. As she did not like it, and fearing she might be injured, I ordered her stripped. I have latterly worked a full bred of the same family; and another thorough bred in the wagon, merely to see that they would work, and they are now both valuable brood mares, the thorough bred a splendid mare, and has a splendid filly.

BREEDING HORSES FOR AGRICULTURAL PURPOSES.

The breeding and rearing of horses, the best adapted to agricultural purposes, is a subject of deep interest to the whole community. Whilst the improvement of *race horses* has attracted great attention, the more important subject of producing those best adapted to farming purposes, has, comparatively, been much neglected. The offering of premiums, to encourage this latter object, affords a strong indication, that a more wholesome practice is about to spring up in the country. Certainly no subject is more worthy the attention of State Agricultural Societies. The United States must always continue to be an eminently agricultural country. It is of the utmost importance, therefore, that we should acquire, and perpetuate, a race of horses the best adapted to farming purposes. And a hope may be indulged, now that the subject has engaged the attention of the State Agricultural Society,* that the great *desideratum*—the most perfect breed of horses, adapted to agricultural purposes—will be attained.

The qualities, necessary to constitute a good farm horse, are the following—a good constitution; gentleness, and evenness of temper; docility; steadiness of movement; capacity to endure steady and constant labor; great muscular power; durability; hardiness, and easy to be kept in order, with moderate feeding.

*At the moment of writing, Judge Beatty was under the impression that the premiums for essays on breeding and rearing horses for agricultural purposes, were offered by the State Agricultural Society; nor did he discover his error till the after manuscript had been forwarded for publication. The premiums were offered by the Franklin Farmer.—Ed. Fr. Farmer.

These qualities, accompanied with a tolerable quick and active walk, will constitute a most valuable animal for agricultural purposes. The agricultural society which shall be instrumental in giving us a breed of horses, possessing these qualities, in an eminent degree, will have rendered the country a most important service, and secured to itself a high standing in the lists of fame. The leading object of this essay is to suggest the probable means of attaining this great *desideratum.*

No country has paid more attention to the improvement of the breed of horses than England. In that country "there are two principal breeds of horses, the *race* or *blood* kind, and the *cart, plough,* or *team sort.*" The latter kind "is chiefly useful in the business of cultivating the soil." There are four principal varieties used for that purpose—"the improved *black cart horse*; the *Suffolk punch horse*; the *Cleaveland bay horse,* and the *Clydesdale horse.*" The first is the *dray breed,* "being, in point of size, larger than any others in the Kingdom." These are said to be "inactive and slow in their movements, besides being clumsy, and not unfrequently badly proportioned." In England they are thought to be "more adapted to heavy drafts upon paved roads or streets than for the purpose of ploughing and harrowing the ground, or any other description of plain labor." And accordingly are mostly used "in drawing of drays, and other sorts of heavy work in large towns." For general farming purposes this breed certainly cannot be recommended.

The *second variety* is the *Suffolk punch horse.* These, when of the genuine kind, are much better adapted to farming purposes than the dray breed. They are said to be "a short plain looking horse, though very compact, and very active and hardy." They are of smaller size than either the *dray breed,* or *Cleaveland bay horse,* and generally about fifteen hands high.

The *third variety* is the *Cleaveland bay horse.* They are said to be "generally clean and well made in most of the parts, being very *strong* and *active,* answering perfectly both for the *team, coach,* and saddle." That "there are few horses capable of *greater,* or *longer continued exertion, in any of these intentions, than these.*"

The *fourth variety,* or *Clydesdale horse,* is said to be "a *strong, active, steady* animal, generally from fifteen to sixteen and a half hands high, and probably, for the purposes of the *cart* and *plough*, inferior to few in this country." (England.)

The Clydesdale horse is described, by a modern writer, "as lighter in the body than the Suffolk punch, and more elegantly formed, in all respects. His limbs are clean and sinewy, his neck longer, his head of a finer form, and his eye more sprightly and animated than in either of the two former kinds. His tread is firm, though tending towards the *nimble*; and he is capable of exerting *a wonderful degree of muscular strength* for a short push, without being hurt by it, which makes him particularly valuable for a hill country, where there is a necessity for calling forth such exertions, on innumerable occasions. He is *hardy*; can live upon any kind of food, and is, perhaps, the *thriftiest* horse for the *cart*, or the *plough* that is to be found in the Island, perhaps on the globe itself. For these purposes he is peculiarly adapted by the *evenness of his temper*, and the *steadiness of his movements.* For the plough he is perhaps *every thing* that could be wished, being, in point of size, neither so large, nor so unwieldy as to render him a burthen to the soil. Two of these horses, in the softest soil, under good management, being perfectly able to draw a full furrow *with ease;* and for horse hoeing, or ploughing a light soil, in good order, *one of the lightest sort* performs the work with alacrity and ease."

The foregoing extracts, from English writers, show that each of the *three last varieties* possesses valuable qualities for farming purposes; but the Clydesdale sort, probably, possesses more of the qualities, necessary to constitute a good farm horse, than either of the others. But to avail ourselves fully of the experience of England, on this subject, we ought to carry out the recommendation of the writer, from whom I have quoted largely above. "What a benefit (says he) would result to the nation were a set of judicious experiments to be conducted, for a sufficient length of time, for the purpose of ascertaining the comparative powers and expense of keeping, of these last three different varieties of horses, so that any one might know, who chose it, with certainty, the profit or the loss that would result to him from employing the one or the other, for any particular purpose that he had in view." Whether this valuable suggestion has ever been carried out, in England, the writer of this essay has not learned, but certain it is, if it could be acted upon, in the United States, by importing several of the best of the *three varieties*, both male and female, and thus ascertain, by actual experiment, which of the varieties possess, *in the highest degree*, the *greatest number of qualities* necessary to form a *complete farm horse*, the agriculturists of the country would derive incalculable benefits from the experiment. Let our State Agricultural Societies then, give an impetus to public sentiment on this subject, by offering separate premiums to any person, who shall first import *a pair* of either of the three varieties. Although the premium may not be large, it will nevertheless have the desired effect. The importer will look to the *profit* he will make by standing the imported animal, to indemnify him for his *outlay and risk* rather than to the *premium.* The very circumstance of the imported horse being *a premium importation* would draw business that would be certain to insure a reasonable profit.

The *three varieties* are all *valuable. Experience* would test which of them is *most so.* And the Agricultural Society, which shall be instrumental in securing to the farmers of the United States the benefits of such experience, will be entitled to their lasting gratitude. In laying the foundation of a good stock of farm horses, it is necessary to attend to, not only the *breed*, but the *form* also. Whatever breed may be selected, the horse should have "the following shapes of the different *parts.* The *head*, as small as the proportions of the animal will admit; the *nostrils* expanded, with a fine muzzle; the *eyes* cheerful and prominent; the *ears* small, upright and placed near together; the *neck*, rising out from between the shoulders, with an easy tapering curve, should join gracefully to the head; the *shoulders*, being well thrown back, should also fall into the neck, at what is termed *the points*, without being perceived, which probably facilitates the going much more than the narrow shoulder; the *arm*, or fore thigh, should be muscular, tapering from the shoulder, so as to meet a fine, straight, sinewy, and long leg; the *hoof*, circular and wide at the heel; the *chest*, deep and full at the girth; the *loin* or fillets, broad and straight; the *body*, round; the *hips*, or hocks by no means wide, but the *quarters* long, and the *tail* set on so as to be nearly on the same right line as the back; the *thighs* strong and muscular; the *legs,* clean and fine boned, the bones of them not round but flat, or what is frequently termed lathy."

The form and qualities of the brood mare should also be attended to. They "should always be well shaped in their different *parts;* be possessed of a large carcase, in proportion to their heights, being pretty full in their bellies, and appearing likely to form good nurses, and have plenty of milk. The *disposition* ought to be *gentle and tractable*; the *constitution* healthy and vigorous, free from blemish of any kind." The horse should be "of a *kindly disposition;* the constitution strong and healthy; the *temper good,* and wholly free from *any sort of vice and contamination,* as upon the *good properties* and *healthy condition* of the parents, in a great measure, depend the future utility and advantage of their offspring. "Since general experience has fully shown, that in what relates to the *form* and other *good qualities* in the progeny, more depends on the *mare* than the *horse,* the usual practice of regarding the horse more than the mare is highly improper." "The *form* and *other properties* of the *horse* should always have as much similarity as possible to those of the *mare;* as in this way their *joint properties* may be more reasonably expected in the young, which they produce, than by violent, unnatural crossing."

The best colts are said to be produced from mares "not above seven years old, or eight at the utmost." They "may be put to the horse when three years old, but it is a better practice to defer it a year or two longer." The principle that what relates to *form* and *other good qualities* in the progeny depends more upon the *mare* than the *horse*, is strongly illustrated in a brood mare, owned by the author of this essay. She possesses, in an eminent degree, all the qualities of *constitution, size, form* and *disposition* necessary to constitute a most valuable farm horse, and her colts partake in a very striking manner of all her good qualities. If the author of this essay could be so fortunate as to meet with a horse possessing the like qualities, he would entertain a sanguine hope of producing a domestic race of farm horses of a most valuable sort.

With proper care and attention, in selecting from our domestic stock mares of good *constitution, size, form* and *dispo-*

sition, and breeding them to large horses, of good constitution, and similar *form* and *disposition,* great improvement would doubtless be made; and in time, by perseverance and strict attention, as perfect a race of farm horses could be produced here as have been reared in England. But we should doubtless expedite the process of improvement by commencing with a stock *already much improved.*

After we shall have obtained a good stock to commence with, the next consideration is how that stock is to be managed so as to *perpetuate,* and, if possible, improve its good qualities. The crossing of different breeds, with a view to improvement, is so much the fashion of the day, that it is necessary to guard against a practice, which, in the general, does much more harm than good. It has been seen, that the *form* and *other properties* of the *horse* should always have as much similarity as possible to those of the *mare.*" Even their dispositions should harmonize. It is thus, only, that we can reasonably expect their offspring to possess the like good qualities. But where there is an *unnatural crossing of breeds,* with little regard to *disposition,* or other *harmonizing good qualities,* can we reasonably expect any thing better than the deterioration of the breed.

I am strongly inclined to believe, that entirely too much stress has been laid upon the necessity of *crossing the breed,* in order to the improvement of stock. "The crossing of different breeds so as to supply the *imperfections* and *defects* of one, by the *merits* and *perfections* of the other," may be practised to advantage when you have a female stock of inferior quality, the offspring of which you desire to improve, by breeding from a male of better quality. But when you have a stock of the improved kind, both males and females, if crossed with a different breed, unless it be done with great judgment, you will be more likely to deteriorate than to improve your breed.

It is generally believed that by breeding *in* and *in,* or in the same line or family, the best stock will deteriorate. The truth of this theory has been greatly shaken by the practice of Mr. Bakewell, one of the most successful breeders in England. His practice was "to unite the *valuable qualities* or perfections of the *same kinds,* by continuing to breed, and selecting *the most perfect* animals *in the same line or family.*" Mr. Bakewell was completely successful in "rearing his *best stock* by the *nearest affinities*, not only without degeneracy in any respect whatever, but with a *continued improvement* and *amelioration.*" It is remarked also that "cattle in the wild state, in particular situations, remain for centuries without the least alteration taking place in their *form*, or change in their *color* or *other properties*. In Spain the owners of Merino flocks "have continued to breed from the same stock, without any attention to consanguinity, for many centuries. Yet it is to this country the world is indebted for the finest race of sheep upon the globe. In Sweden a contrary practice prevails. But in Rees' Encyclopœdia, article Sheep, this is said to arise from a prejudice against breeding "in and in," and that "the practice is useless, when the rams, upon an estate, are already of a good quality; if the contrary were the case, there could not exist a perfect Merino sheep in Spain, as these sheep have continued to breed from the same stock, without any attention to consanguinity, for many centuries.

If Mr. Bakewell's theory shall be found, upon fuller enquiry, to be correct, there will be much less difficulty in propagating, without deterioration, any particular breed of horses, which may be imported from England. But if breeding, by *near affinities*, shall be found to be attended with injurious effects, the evil may be avoided, without going into entirely new families. Distant branches of the same family, or stock may be resorted to rather than *contaminate the blood* by mixing with a strange race.

The value or utility of blood for work horses, is the subject of much contrariety of opinion. *Experience* has shown, in England, that the three varieties, upon which I have remarked, are the best adapted to farming purposes. But we cannot say, that no portion of the *blood* of these varieties is derived from the Arabian, or English blooded horse. There is, in all probability, some mixture of the different races; and from that mixture the good qualities, in part at least, of these varieties may have arisen. We cannot pronounce, therefore, that no advantage is to be derived from a cross with the blooded stock. But if we have already a race of horses, improved by the proper crosses, so as to adapt them admirably to all the purposes of agriculture, is it not the part of *practical wisdom* to adopt that race, and to endeavor to improve thereon, if susceptible of farther improvement, rather than to commence anew? Experience has shown, both in England and America, that horses of the pure and unmixed blood, though very suitable for racing, are not the best adapted to farming purposes. It would be a work of supererogation to undertake to assign the reasons why it is so. *Experience* is the best of all reasons, and we may well be satisfied with *that guide*, without attempting to explore the philosophical causes.

Having presented my views as to the particular variety of horses, best adapted to farming purposes, I will now proceed to make some remarks upon the most suitable method of rearing them. This may be explained in two words, *shelter* and *good feeding*. The protection of any kind of stock from winter rains and snow has been found to conduce very much to their health and thriftiness. Surely it cannot be less so for the horse kind than for other stock. If mares and colts, and the young stock of horses were protected from the falling weather, during the cold months of the winter and spring, it would greatly aid in keeping them in good plight. If thus protected from the *falling weather*, it is no disadvantage, but on the contrary, is beneficial to suffer them to run at large, even in the coldest weather, and when the ground is covered with snow. This affords them wholesome exercise, and tends to render them hardy. All animals attain their growth much more rapidly, and acquire better size, when kept constantly in good plight, and thriving condition, than when *stinted* in their food. Great care should therefore be used in keeping not only the mares, but the young stock of horses, *constantly* in good plight, and thrifty condition. This can best be accomplished by *shelter and good feeding*, during that period of the year, when there is a scarcity of pasturage. Good rich pastures are all important for brood mares, and the young stock of horses. And they should have a full supply of these, during as large a proportion of the year as possible. To this end it is important to keep in reserve a due proportion of blue grass pasture for winter use, for mares and the young stock of horses. These should not be suffered to be grazed after the second growth of grass commences. If the season is favorable, this will happen early in July. But in dry seasons the young grass is later in springing up. The judicious farmer will therefore be governed by circumstances, always taking care to take off his stock *too soon* rather than *too late.* Pastures thus reserved, if the season is favorable, will furnish much winter feeding.

Rye pastures, during the winter and spring months, may also be used to great advantage, in aid of blue grass pastures. If sowed early in September, and the season is reasonably favorable, it will afford much winter pasture, and may also be pastured in the spring till the middle of April, and still produce a good crop of grain to be fed off to stock.

It is not always convenient to furnish *shelter* to young horses, while running on pasture, during the winter months. I would suggest the following as the most convenient and economical method of doing so. Let a shelter of suitable length and about twenty feet wide be framed on stout locust posts, set in the ground, in a permanent blue grass pasture, reserved for horse stock, entirely open at the sides, to the height of six feet, but enclosed at the end with plank. The roof may be made of straw, clapboards, or other cheap material. A situation should be selected which would afford the means of conducting the water off each way; and the dirt or floor, under cover, should be a little raised. A trough or troughs should be extended from end to end, under the middle of the shelter, and so high that stock could not easily jump over them. A crib for holding corn and other food should adjoin one end, with a door opening under the shelter, and one at the opposite end for throwing in corn. A granary for oats, &c. might be made on one side of the door, opening under the shelter. Under this shelter the stock should be plentifully salted, and moderately fed, so as to accustom them to resort to the shelter. If the rye pasture do not adjoin the lot in which the shelter is erected, the stock should be removed there during bad weather and again shifted to the rye when the weather is favorable. If from a scarcity of pasture the young stock should need hay, a rack should be made of rails, convenient to the shelter, and large enough to hold a wagon load, which should be filled as occasion might require. These hints, aided by the experience of the judicious farmer, will be sufficient to secure proper attention and care to young horse stock, during the inclement season of the year. During the milder portion it will only be necessary to furnish the young stock with an abundance of rich pasture, plenty of salt, and a constant supply of water. And even during the winter months, if rye and blue grass pasture is abundant, only light feeding with grain will be necessary.

If the pasture shall not exist in sufficient abundance for all the stock, mares that are suckling colts, should be first supplied, for it is very important that these should be well provided with rich pasture to make them give plenty of milk for their colts. The first season is the most important in rearing horses. During that period the colts should always have a full supply of suitable food. At weaning time the colts should be put on fresh rye or blue grass pasture, and fed with oats, or corn, chopped rye, &c. and to make them feed well, the mares ought to be fed with their colts a short time before weaning. They should have a full supply of rye pasture during the winter succeeding their weaning, besides being fed with oats, &c. Thus they will attain a considerable growth the first year, and will be much easier kept in thrifty condition the succeeding summer and winter, and indeed until they arrive at maturity.

N. B. To save the trouble of frequent references, I have omitted stating the authorities from which the numerous extracts are taken which are quoted in this essay. They will be found in the American edition of Dr. Rees' New Encyclopœdia, articles horse, mare, sheep, breeding, &c.

NATURE OF SOILS AND THE MEANS OF RENDERING THEM FERTILE.

Letter to Thomas B. Stevenson, Esq. corresponding Secretary of the Kentucky Agricultural Society, on the nature of soils, and the means of rendering them fertile, February 1841.*

My Dear Sir: It is time I should make an effort to redeem the pledge I gave you, at your request, to address you on the important subject of agriculture. You were so kind as to limit me to no particular branch of that important science, of course the wide extended field of husbandry is open for my selection. In a correspondence upon so extensive a subject, you must expect me to be somewhat desultory, and not very methodical.

The subject which I have selected for the commencement of our correspondence, is one of great importance. It is in relation to the deteriorated condition of a large portion of the naturally fertile soil of Kentucky. In pointing out the cause of this lamentable state of things, and the appropriate remedy, I do not intend to write a regular treatise on the subject, but to present some general views, which, though not presented in detail, will readily enable you to see the force and bearing, and *importance* of my suggestions.

There are some nine or ten *earths* enumerated by chemists.

*This, and the three following letters, were addressed to Mr. Stevenson, after he had ceased to be the editor of the Kentucky Farmer, and were intended as a part of a private correspondence, on agricultural subjects, but having, shortly afterwards, resumed the editorship of that agricultural journal, he deemed them worthy of being communicated to the public. These letters were written before the author had an opportunity of consulting Liebig's important work, on Organic Chemistry, which has thrown much additional light on this subject, as will be seen by reference to several previous notes.

Of these three only seem to be *essential* to the formation of a good soil. These are lime (*carbonate*) sand and clay. If either of these ingredients are wanting, in a soil, it is defective in its *constitution*, and the foundation of all improvement is to remedy that defect. This must be done by furnishing *a due proportion* of each of the ingredients. Thus if there be too much sand, clay must remedy the evil. If there be too much clay, the remedy is to be sought in the application of sand or calcarious earth, or both. And if the latter ingredient be wanting, it is indispensably necessary that it should be supplied, before we can expect a well *constituted soil.* But as it is believed our naturally fertile lands in Kentucky, have all the necessary ingredients to constitute a good soil, so far as relates to its *constitution*, I need not enlarge on this subject. If then the *constitution* of our soil is good, what is necessary to render it fertile and productive? The answer is, that it must be furnished with those substances which constitute the *food of plants.* Without being furnished with this food the best constituted soils would be perfectly barren. You will, of course, understand me to speak of *a total absence* of all those substances, which properly coustitute the *food of plants.* In general, when we speak of soils, we include not only the *earths* of which they are composed, but also of the animal and vegetable matters combined with them. I wish to be understood, when speaking of the *constitution* of soils, as having reference only to the *earths* of which they are composed. Animal and vegetable substances, which constitute the appropriate food of plants, are the *enriching matters of the soil;* but, unlike the *earths*, they are not of a permanent nature, because the growing crops are constantly extracting them from the soil for their nourishment. The *earths* serve as a support for the growing plants, a place to stand in, and as a *receptacle* for their food, and to assist in assimilating and digesting it to the nature of the growing crops, but it is just as *essential* to furnish *food* to the earth for the use of plants, as it is to furnish *food* to the stomach for the sustenance of animals. The only difference is, that the earth or soil is capable of receiving and laying up a store of food in anticipation for a number of years. But if no new supply be furnished, the growing crop will in time, exhaust the whole store which has been laid up, when the soil will, of course, become unproductive till a new supply shall be furnished. It is true the *entire stock of food* laid up in a good soil can never be entirely consumed, because, before this is done the growing crops will be so feebly supported, and receive so little nourishment as to produce a crop not sufficient to pay for cultivating the ground, and hence it will become necessary to turn it out to *rest*, when it will, by slow degrees, receive a new supply of *food*, and may again, after a number of years, be brought into cultivation. The rich soils of Kentucky had a vast stock of *food* laid up before they were brought into cultivation, and hence it was a long time before this stock of *food* was so far exhausted as to render land too unproductive for profitable cultivation. The vast fertility of our rich virgin soils induced many of our early settlers to believe it would be impossible to exhaust them, and hence the improvidence with which they were cultivated. Experience has, however, shown that they were under a misapprehension on this subject. And it is now easy to perceive, when the true principles of agriculture are better understood, why it is that some of our richest lands produce so much less than they formerly did. There has been no change in the *constitutional ingredients* of our soil, but we have exhausted, to a considerable extent, the *food for plants*, which we originally found in it; and we have now only to replenish it, until the stock of food shall be equal to what it was when our lands were first cleared, in order to restore it to its primitive fertility.

It may not be improper here to show the manner in which soils acquire *a superabundant supply of food for plants.* At first view it might seem as if the growth of vegetable matter upon any soil, would always extract from it as much *food* for its nutriment as it could possibly restore to it, even when left to decompose upon the ground on which it grew. Indeed it might even seem as if *less were restored to the soil* than had been extracted from it, because in the process of decomposition, *a part* of the ingredients, which constitute the food of plants, always escapes in the form of gas; and hence it would seem to follow, that a *continual deterioration of soil* would result from the growing of any plants upon a soil, even when the whole were suffered to remain and decompose on the ground on which they grew. *Experience* shows that such is not the fact, and I will now proceed to state why it is not so. Upon a careful decomposition of vegetable matters, they are found to be composed of oxygen, hydrogen, and carbone, and in most plants of nitrogen also. These together with animal matters, alkalies and a few other ingredients constitute the *appropriate food of plants.* There are some other substances that very slightly enter into the composition of plants, but it is not necessary for my purpose to enumerate them here.* The great source of food for plants is then derived from the following elementary principles; oxygen, hydrogen, carbon and nitrogen. These are all furnished to soils in a greater or less degree, by decaying animal and vegetable matter, and by putrescent manures; but if these were the only sources of supply, I have already shown that they would not restore to the soil as great a quantity of the ingredients, which furnish food for plants, as the growing vegetables extract from it. And hence there is a necessity for a supply from some other source.

I will endeavor, in my next letter, to show that the atmosphere is the great source from which the additional supply of food is to be obtained, and the means by which it is most bountifully furnished, if we will but do our part to obtain it, and apply it to agricultural purposes. I must, however, for the present, close with a request that you will aid me by such judicious reflections, as I know you are capable of making upon the important subject I have taken in hand.

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*Much light has been thrown upon this subject, since the above was written. It is now ascertained, that in addition to the organic substances, named above, the following inorganic substances also furnish appropriate food for plants. Potash, Soda, Sulphuric acid, Phosphoric acid, Chlorine, Oxide of iron, Oxide of Manganese, and that even a small portion of the earth's are consumed by plants, such as lime Allumnia, Silica, and Magnesia.

FOOD FOR PLANTS, AND WHENCE DERIVED.

Letter to same, Dated, February 10th, 1841.

Dear Sir: I stated in my last letter, that oxygen, hydrogen, carbon, and nitrogen were the *elementary principles*, which constituted the *essential* food of plants. Sir H. Davy, (p. 40) states that the three first, "in different proportions, generally alone, but in some few cases combined with azote" (nitrogen) compose the most *essential* ingredients in vegetable matter. But these elementary substances are always found, upon analyzing vegetable matter, in a compound state, forming farina, gluten, sugar, jelly, albumen, &c. all of which are composed, in different proportions, of the above named elements.

It may be proper here to mention, that a very minute quantity of several of the earths enter into the composition of some vegetables. These are doubtless derived from the earths in which they grow, and are probably intended to give firmness to the vegetable fibre; and some of them seem also to contribute to the vigorous growth of plants, either by stimulating them in acquiring their appropriate food, or by suitably preparing it for them. Some other substances also enter into the composition of vegetables, which, in a greater or less degree, contribute to their food. Such are the alkalies, or their compounds, saline compunds, metalic oxides, sulphur, &c. but nevertheless the great source of supply of vegetable food must be referred to the four elementary principles mentioned above, to wit: oxygen, hydrogen, carbon and nitrogen. How far vegetables are capable of drawing these elementary principles from their state of combination in the atmosphere, and assimilating them as appropriate food, has not yet been fully investigated, but that they are capable of doing so, to a considerable extent, has been clearly demonstrated. Jones in his conversations on chemistry, (p. 178–9) says, organized bodies are "distinguished by the possession of that unknown principle called *life*, a principle from which the various organs derive the power of exercising their respective functions. That these organs "*select and arrange* those constituent principles, and *form them* into different kinds of juices and solids, which constitute vegetable and animal substances, in all their varieties."

Sir H. Davy, (p. 12,) says, "The soil is the laboratory in which the food is prepared." A variety of facts are adduced to favor the correctness of these propositions, to some of which I shall have occasion to refer.

Water, it is well known, is essential to the growth of vegetation. I have not mentioned it as a specific food of plants, because it is only a combination of two of the elements, (oxygen and hydrogen,) already mentioned as such. Water is not only important as furnishing two of the elementary ingredients which enter into the food of plants, but there are a variety of other important elements, mingled with it, which are thus also furnished as their appropriate food.

Jones in his conversations on chemistry (p. 134) says, "water is capable of absorbing *all the gasses*, some of them in very minute, and others in very large proportions. Water is a *solvent* of more substances than any other fluid. Hence we rarely or never find it pure in nature, as it dissolves a portion many minerals, over which it passes in the bowels of the earth." He states in another place, that "one pint of water will dissolve thirty-three pints of Sulphurous gas." The same author shows that it will absorb nitrate of lime, carbonate of potash, nitrous oxide, sulphurated hydrogen gas, nitric acid, and a small portion of lime. Sir H. Davy has shown that even *distilled water* contains "saline impregnations;" and that if plants were supplied, in an unlimited manner, with *distilled water*, it would furnish them a number of different substances for their nutriment, (p. 81.) Now if even *distilled water* is capable of furnishing a number of ingredients, as food for plants, besides those composing its own proper elements, it is manifest its capacity, when not distilled, would be much greater.

The atmospheric air is another medium from which food for plants is obtained. It is composed of oxygen and nitrogen, two of the elements appropriate for food of plants. Carbonic acid gas which contributes a large proportion of the food of plants, is mingled with the atmosphere in the proportion of one part in fifty. "Carbonic acid gas is formed in a variety of processes of fermentation and combustion, and in the respiration of animals, and yet (Sir H. Davy remarks) no other process is known in nature, by which it can be consumed, except vegetation." He farther remarks "it is known by various researches, that the constitution of the atmosphere has been always the same since the time that it was first accurately analyzed." Thus it appears, that although large quantities of carbonic acid gas is continually forming, the quantity, mingled with the atmosphere always remains about the same. The cause of this is explained both by Mr. Jones and Sir H. Davy. It is owing to the fact, that vegetables, by means of their leaves, absorb carbonic acid gas, during the day, and perspire oxygen gas. It is true the contrary process takes place at night, when oxygen gas is absorbed and carbonic acid gas is given out. But as this does not take place to near so great an extent, there must be a constant supply of carbon as food to the growing vegetation from the atmosphere. This is a most important fact, and should the more engage our special attention, as the supply of food for plants, from this source, depends very much upon the proper management of the agriculturist.

The foregoing remarks will, perhaps, be sufficient, without going more at large into the subject, to satisfy you that much of the food of plants is derived from the water which falls upon the earth, and which, by its solvent power, carries to the roots of growing vegetables, those ingredients which are suitable for their nourishment. That much is also derived from the carbonic acid gas, mingled with the atmosphere, and from the continued exhalations of this gas from decomposing vegetation; from combustion and the respiration of animals. Sir H. Davy expresses the opinion, that nitrogen, under certain circumstances, is also absorbed by growing plants from the atmosphere.

When we take into consideration the facts herein stated, I think there cannot be a doubt that growing vegetables, of every kind, derive a large proportion of their nutriment from the atmosphere, partly from the water it furnishes, and partly from the elements of which it is composed, and the various foreign ingredients mingled with it.

If I am correct in these views, we may easily see the reason why a soil, in general, will become richer by restoring to it every thing which grows upon it, notwithstanding the loss of the food of plants by various exhalations. This principle is well calculated to encourage the husbandman to exert all his powers to keep up the fertility of his land, which he can easily do by using those means which a bountiful creator has placed within his reach.

In a future letter I will endeavor to show how this is to be accomplished.

P. S. The references to Sir H. Davy are in Mr. Ruffin's edition of his work on agricultural chemistry.

THE MEANS OF RECLAIMING AND PRESERVING THE FERTILITY OF SOILS.

Letter to same, dated February 15th, 1844.

Dear Sir: In my last I promised that I would endeavor to show how the fertility of our rich soil may be preserved; and I will add, how that which has been deteriorated by bad husbandry, may be reclaimed. The cause of fertility in our rich virgin soils must be very apparent, when we apply the principles which I endeavored to establish in my former letters. If a large portion of the food of plants is furnished from the atmosphere, and if *less* is lost by exhalations than is acquired in that way, it follows, as a necessary consequence, that the soil will continually *grow richer*. In opposition to this theory, it may be asked why then, in the course of many ages, have not certain white oak lands become very fertile, which even at this day are found to be very poor. I answer because white oak imber is not only a very exhausting growth, but also because its leaves furnish little or no manure to the soil. It is probable also, that from the peculiar organization of its foliage, it may have but little capacity to absorb carbonic acid gas from the atmosphere. From these and other causes, the nutriment obtained from the atmosphere, and from the very slow decomposition of white oak leaves, may not be more than is barely sufficient to furnish nutriment to the growing timber, and hence there can be no increase in the fertility of the land. What proves this to be the fact is that when oak land is succeeded by a richer growth—sugar tree for instance, as is sometimes the case, the land gradually improves in fertility. I speak here of the poorer kinds of white oak land, which has no other growth of timber mixed with it. Other descriptions of oak land, having a mixture of black oak and hickory are found to furnish a better soil. These lands are growing richer by a very slow and gradual process; and may probably have been formerly entirely a white oak growth.

What is called the *rich land* growth of timber, is of a very different character from white oak. The foliage is very abundant; the leaves probably absorb more of the atmospheric gasses, and when they fall they form a heavy coat of vegetable matter, which undergoes so rapid a decomposition as to form almost a perfect union with the soil, before the heat of the following summer commences. Besides our natural growth of timber, in our richest soils, produces early in the season, a shade almost impervious to the rays of the sun. Hence there is but little loss by the escape of gasses. The dark mould, in our rich virgin soil, has the appearance of being composed almost entirely of animal and vegetable matter. But it is not so in reality. It may be worth while to show how it acquires this appearance. The *capacity* of a soil to *acquire* and *retain* putrescent manure is a quality of great value. Mr. Ruffin, in his very valuable and able treatise on calcareous manures, has clearly shown that calcareous soils have a capacity to fix and retain putrescent manure. The views of Mr. Ruffin are strongly corroborated by Sir H. Davy (p. 54.) "The *extract* from decomposing vegetable matter, when boiled with pipe-clay or chalk, forms a combination by which the *vegetable matter* is rendered more difficult of decomposition and of *solution.* Pure silica and salicious sands have little action of this kind; and the soils which contain the most *alumnia* and *carbonate of lime* are those which act with the greatest chemical energy in *preserving manures.*" These views are sustained by actual experiment and there can be no doubt of their correctness. Let it be supposed then, that a soil composed chiefly of clay (*alumnia*) and calcareous earth, is covered with a species of timber which, in a state of nature, furnishes to the soil a greater quantity of vegetable food annually, than the growing timber extracts from the soil for its nutriment. The result would be an annual gain of vegetable food, and this excess, by reason of the "chemical energy" of alumnious and calcareous soils, would be fixed and united with them. In proportion as the soil thus becomes more fertile, the quantity of vegetable matter would be increased, and consequently each successive year would leave upon the earth a greater excess. Rains falling upon the decaying vegetation draw off from it, what Sir H. Davy calls "vegetable extract," and which by other chemists is called *geine, ulmin,* and *humin.* By whatever name this substance may be called, it forms one of the most nourishing supports of vegetation, and by the solvent power of rain water is carried down into the soil, where, by chemical attraction, it is united with it. The rain water coming first in contact with the surface of the earth, that will naturally acquire the *greatest* share of this vegetable *extract.* But by degrees it will be carried deeper into the soil. This vegetable extract or *humin,* (Sir H. Davy 55.) in proportion to the quantity mingled with the soil, gives it a dark color, and thus it will, in time, assume the appearance of mould. Sir H. Davy shows that the *fibrous parts* of vegetable matter cannot thus be introduced into the soil, but, by a slower process is decomposed, and forms a thin stratum of mould on the surface, which annually accumulates, and which, to some extent, by the freezing and thawing of the earth, and by rains, is mixed with the upper soil. The *humin* contained in this vegetable decomposition, by the solvent power of water, is also, no doubt, carried to some depth in the soil beneath. To these sources of fertility must be added animal decompositions of all kinds. And these are greater than is generally supposed. The number of earth worms and other insect tribes is immense. And these all contribute to increase the fertility of the soil by their death and decomposition. The earths also, if not *already saturated,* will absorb carbonic gas. By these various means the soil, in a natural state, may gradually increase in fertility. But it is probable the increase will not be *indefinite.* When the soil becomes completely *saturated* with vegetable extract or humin, it cannot *permanently* increase the quantity. Sir H. Davy states that water, (the agent by which vegetable extract is introduced into the soil,) will slowly take up or extract from the earths that substance. And hence there seems to be a limit to the increase of fertility. But so long as any portion of the soil, which can be reached by vegetable extract remains *unsaturated,* it would seem that its "chemical energy" would draw it to itself, and fix it there until it should be required for the sustenance of the growing vegetation. The very circumstance of water having an affinity for vegetable extract and being able *slowly* to take it up (when existing in excess) is favorable to vegetable growth. Sir H. Davy, (p. 54,) says "water and the decomposing animal and vegetable matter, existing in a soil, constitute the true nourishment of plants; and as the earthy parts of the soil are useful in retaining water, so as to supply it in proper proportions to the roots of the vegetables, so they are likewise efficacious in producing the proper distribution of the animal and vegetable matter. When equally mixed with it they prevent it from decomposing too rapidly, and by their means the soluble parts are supplied in proper proportions. The application of the facts and principles herein set forth must be postponed to a future letter.

DETERIORATION OF SOIL AND MEANS OF RENOVATION.

Letter to same, dated February 16th, 1841.

DEAR SIR:—I have endeavored to show how soils, in their natural state, may gradually become more fertile; and that they must *necessarily* continue to increase in fertility so long as they receive from the atmosphere, and from vegetable matters, restored to them, *more food* than is consumed by the vegetable growth of the soil. This important fact strongly illustrates the beneficence of a kind Providence. If the fertility of soils could *only* be kept up by restoring to them all the vegetable matter which they produce, it would be impossible to prevent them from *deteriorating*, because, with the utmost care in preserving and applying manures, there would be a considerable waste, and hence all lands brought into cultivation, would, in time, become barren. But as the atmosphere contains an inexhaustible supply of those ingredients which constitute the appropriate food of plants, and will, by the use of due means, furnish *more* than will make up for the *unavoidable loss* in saving and applying putrescent manures, we have the most perfect assurance that a soil will *never deteriorate* if the husbandman will but do his part towards preserving its fertility. This is a most encouraging state of things, and should stimulate every agriculturist to the utmost efforts to prevent his soil from deteriorating; or, if it has already been injured by bad husbandry, to renovate it as soon as possible.

To show the advantage of speedily renovating our naturally fertile soils, which have been much reduced by bad husbandry, let it be supposed that a soil, which, in its virgin state, would produce sixty bushels of corn as *an average crop*, should have been reduced in fertility so much as to make its *average crops* only thirty bushels per acre. Now if this corn is worth twenty-five cents per bushel, in the field, the farmer will have for the *rent of his land*, say two and a half dollars per acre, and five dollars per acre for his labor and superintendence; and the land may be estimated at forty dollars per acre. The same land, when completely renovated, may be estimated as worth eighty dollars per acre, and the *rent* five dollars. Allowing five dollars for labor and superintendence, there would remain for sixty bushels of corn *a clear profit* of five dollars per acre. Thus in the former case, the farmer will be barely compensated for his labor and superintendence, and receive two and a half dollars *rent per acre* for his land. In the latter case, besides being paid for his labor and superintendence, he receives for *rent five dollars per acre*, and besides, five dollars as clear profit. The land, when completely renovated, may be fairly estimated to be worth one hundred and sixty dollars per acre, because it yields a *rent of ten dollars per acre*, being four times as much as the land at forty dollars yielded. Here then we see the intrinsic value of the land *quadrupled* by restoring it to its original fertility. Can there be a greater inducement for making the effort? Every farmer then should immediately set about accomplishing so great an achievement. To enter into an elaborate discussion of the best means of preserving the fertility of our soil, and of renovating that which has been deteriorated by bad husbandry, would hardly be consistent with an epistolary correspondence. I will, however, make a few suggestions on the subject.

1. Restore to the soil, in the form of manure, as far as practicable, all the vegetable matter which has been drawn from it.

2. Cultivate, *in proper alternation*, such crops as derive *much of their nutriment from the atmosphere*, ploughing under a due proportion of them according to the degree of deterioration which the soil has undergone.

3. Occasionally throw up the sub-soil by deep ploughing, after the surface has been considerably exhausted by hard cropping.

4. Carefully exterminate all weeds, and to this end they should never be allowed to ripen their seeds.

I need scarce make any remark on the first point, except to remind you, upon the authority of Sir Humphrey Davy, that putrescent manures ought never to be suffered to undergo a *rapid fermentation* at the manure pile, for the obvious reason, that if allowed to do so, much of the valuable parts of the manure will pass off in the form of gas. It is always best that the process of fermentation or decomposition should be carried on *under the soil*, as by this means the gases would have an opportunity of uniting with the earths of which the soil is composed, and which have a chemical affinity for the gases arising from putrescent matter. On the second point I would remark that in general, broad leaved vegetables and those having the most leaves in proportion to stalk, derive most nourishment from the atmosphere. There is none better than red clover for this purpose. And no crop can be resorted to for renovating our exhausted soils to greater advantage, because it not only *acts powerfully* in restoring lands which have been deteriorated by bad husbandry, but will pay a *good rent* while it is doing so. The number of clover crops, compared with grain crops, must depend upon the degree of exhaustion which the soil has undergone. It is always best to err on the safe side, and make the clover crops come too frequently rather than too seldom. On the third point, I would call your attention to the contents of former letters, in which I showed that the *extract* of decaying vegetables or *humin* will be gradually carried down into the soil by rains, and these, particularly clay and calcareous soils, having a chemical attraction for those substances, will cause them to unite with the soil. As the roots of growing crops are found in greater proportion near the surface, they will take up vegetable *extract* or *humin* more rapidly from thence than from the sub-soil. Hence this vegetable food will be more abundant, deeper in the soil, from whence it should be thrown to the surface that the roots of the growing crops may have an opportunity of taking it up by absorption. By ploughing deep the roots will, moreover, have an opportunity of extending themselves deeper and more widely, and thus collect their food from an enlarged space, and consequently exhaust more slowly. I need scarely make a remark to show the necessity of exterminating weeds. *They* require *food* as well as the growing crop, and all they consume is so much taken from the valuable products of the land. Like all other crops, weeds consume most food while ripening their seeds, and special care should be taken not to suffer them to do so, for the double purpose of saving the land and preventing the ground from being sowed for a future crop. When by these and other methods the soil is *saturated* with vegetable food, its *renovation* will be complete, and the land will have attained its utmost capacity for production.

Letter to Edmund Ruffin, editor and proprietor of the Farmers Register, Petersburg Va., on the relation of the Constitution of Soils to their fertility, dated 17th June. 1841.

Nothing can be more important to the interest of Agriculture, than a correct understanding of the means by which the natural fertility of soils may be preserved, and such as have been deteriorated by injurious husbandry renovated. You have rendered a very important service to the most useful of all sciences, by your Essay on Calcarious Manures. I propose, in this letter, to make some desultory remarks upon the same subject; and shall be much gratified if I shall be able to throw even the smallest light upon a question of so much interest.

Sir H. Davy, in his Agricultural Chemistry, says "the *earths*, and even the *earthy carbonates* have a certain degree of chemical attraction for many of the principles of vegetable and animal substances." That, "in most of the black and brown rich vegetable moulds the *earths* seem to be in combination with a peculiar *extractive matter*, afforded during decomposition of vegetables. In the extract quoted by you at page 30, he seems to place the chemical energy of alumnia and carbonate of lime, in preserving putrescent manures, upon an equality. I concur with you, that the powers of attracting and retaining these manures, possessed by these two earths, differ greatly in force. Taking for granted that carbonate of lime has a very powerful chemical energy, in attracting and retaining those elementary principles, which are the appropriate food of plants, and that the other earths and earthly carbonates possess this power in a slight degree, it will readily appear why soils destitute of lime, in any state of combination, "cannot be improved *durably* or *profitably* by putrescent manures, without previously making them calcareous."—*Essay on Cal. Man.*

In a state of nature, soils are enriched mainly by the decomposition of *vegetable matters* on the surface of the earth. If these were to undergo a rapid decomposition, a considerable proportion of the elements, constituting the appropriate food of plants, would escape in the form of gas, and consequently be entirely lost. And hence, if the growing vegetable had derived its nutriment altogether from the soil, it would *restore much less* than it had *extracted for its nourishment;* and would *exhaust* instead of *increasing its fertility.* But, in general, the decomposition of vegetable matter, on the surface of the earth, is so very slow and gradual, that but little loss occurs from that process. And as vegetables derive much of their nutriment from the atmosphere, the quantity of vegetable food restored to the earth, by their decomposition, commonly greatly exceeds that which has been drawn from the earth for their sustenance. In a state of nature the entire vegetable growth is left upon the soil. When this dies, and falls upon the earth, it becomes subject to the effects of dews and rain. These, before decomposition can take place, draw off from the vegetable matter *an extract,* which is thus carried down into the soil, and only the more fibrous parts remain on the surface to undergo slow decomposition. And this also, when converted into mould, gives out *an exract* to rain-water, and is thus carried down into the soil. Though that part of the vegetable mould, which Berzelius terms *geine,* is, directly, but slightly soluble in water, yet it has been demonstrated by Th. de Saussure that the three constituent principles of vegetable mould "may be converted the one into the other, under the alternately preponderating influence of air and water." Thus *vegetable extract, carbonaceous mould* and *geine* may all, by the influence of air and water, be rendered soluble and carried down into the earth. The *extract* of vegetable matter, mould and geine, which thus mingles with water and descends with it into the soil, is so slightly combined with it, that the earths and earthy carbonates, having a strongnr attraction for it, will draw it off from the water and fix it in the soil. But these earths and earthy carbonates (if there be no lime present) will soon become *saturated*, and consequently can draw no more of these ingredients from the water. The quantity of food for vegetables *laid up in store, in the soil*, would seem to be limited to the amount which it is capable of retaining in a state of combination. This is not great when lime, in some form of combination, is not present, but very considerable when it forms a competent part of the soil.—Hence the great difference in the capability of improving, by vegetable and putrescent manures, soils which have and which have not lime as one of their ingredients, in some form of combination. When soils, destitute of lime in any state of combination, become completely *saturated* with those fertilizing elements which constitute the food of plants, it might be supposed the remainder would continue united with the water, by which they were carried down into the soil. This would be true if there were any chemical attraction in the earths *to fix and retain the water in combination* with them, until the vegetable food could be drawn off by the spongeolets of the growing plants. But such is not the fact. Water will rise to the surface of the earth, whence it will be carried off by evaporation and the absorbing power of the atmosphere. But it cannot carry with it the vegetable extract with which it was combined. The experiments made by Sir H. Davy upon grasses, as detailed in his Agricultural Chemistry, show that the *extractive matter* is always left as a residuum, upon boiling the decoction. Although water may bring back to the surface of the earth such portion of the vegetable extract as may not have been drawn from it by earths, having a stronger attraction for it than the water, yet it cannot be carried off by evaporation and absorption, and consequently it will be left at or near the surface of the soil. This deposite of vegetable extract is one of the causes why vegetable mould is most abundant at and near the surface of soils, and assists in producing "the black and brown rich vegetable mould," in which Davy says "the earths seem to be in combination with a peculiar extractive matter afforded during the decomposition of vegetables." Hence there would seem to be a continual accumulation of geine and other vegetable matters at and near the surface, so long as the quantity of such matters furnished by decaying vegetation exceeds that which was consumed by the growing plants. In the course of time, this accumulation of vegetable matter, at the surface of the earth, would become very great if there were no means of carrying it off. In calcarious soils there is a chemical agency, which exerts great energy in retaining and confining this superabundance of vegetable food, so that the accumulation becomes very considerable. But in soils which are destitute of calcarious earth no such *considerable* accumu lations are found. This is probably owing in part to the nature of the vegetable growth, which may be incapable of drawing much of its food from the atmosphere, and consequently the decaying vegetation may furnish no more vegetable matter to the soil than it drew from it for its own nourishment. But as exhausted lands, even in the poorest soil, when suffered to grow up in timber, are found to increase slowly in fertility, it follows as a necessary consequence, that in the course of time there would be a considerable accumulation of vegetable matter on the surface of the soil, unless some agency is at work to carry off the superabundance. What that agent is, and what are the best means of counteracting its effects, is an important inquiry. From the tenor of your "Essay on Calcareous Manures," it is obvious you suppose the effect is produced by certain vegetable acids, neutralizing any lime which may formerly have composed one of the ingredients of the soil, and then combining with *geine* and other vegetable products, and thereby rendering them unfit for vegetable food for the more useful plants. If your views on this subject are correct, it would seem to follow that there is in fact no loss of vegetable food from the want of a soil to fix and retain it, but that it is only rendered inefficient in consequence of its combination with certain acids in the soil. And it would seem that, if it were all retained in combination with acids, by the application of a due proportion of carbonate of lime the accumulated food of plants would immediately become available, and the soil be restored to the highest degree of fertility of which it was capable. These views are very encouraging and you have sustained them by such proofs and illustrations as to render them extremely probable.*

Note by Mr. Ruffin.

*The opinion expressed in the last passage we consider as sound

The recent discovery of *geine* or *humin*, and the acid formed under certain circumstances by the combination of oxygen with this base, seems to prove that the existence of an acid in a soil is not *always prejudicial* to the growth of useful vegetation. Professor Rennie, as quoted in your essay, says: "humic acid, however, which I may remark is not sour to the taste, readily combines with many of the substances found in soils and manures, and not only renders them, but itself also, easy to be dissolved in water, which in their separate state could not take place. In this way humic acid will combine with *lime, potass* and *ammonia*, in the form of humates, and *the smallest portion of these* will render it soluble in water and fit it to be taken up by the spongeolets of the root fibres."

He further remarks. "It appears to have been from ignorance of the important action of the humic acid in thus helping to dissolve earthy matters, that the older writers were so puzzled to discover how lime and potass got into plants." Professor Rennie says *humin* or (as called by Berzelius) *geine* is composed of carbon and hydrogen, and the addition of oxygen to this base to form *humic* or *geic acid*. This, I apprehend, can no more render it poisonous to plants than the addition of oxygen to carbon, thereby forming carbonic acid, can render

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and true within certain limits—but not to such extent as supposed by our correspondent. Vegetable matters, the remains of plants previously grown there, do, from several causes, greatly accumulate on naturally poor lands. But this accumulation has a limit, which is fixed in each case by the circumstances of the soil; and when that limit is reached we infer that the value of all subsequent additions is lost, as regularly as received. Thus, we suppose that the common poor pine and whortleberry ridges of lower Virginia, which will scarcely produce more than 10 bushels of corn, in their new and best state, actually have at first vegetable manure enough to produce 25 or 30 bushels; and which vegetable manure might have been made useful, be fixed, and become permanent in the soil, simply by adding enough of calcarious manures, at or before clearing the land, and giving time for the two to combine together, and both with the soil. But no more than the supposed maximum of vegetable matter (in its various and progressive states of decomposition,) could remain *uncombined* with the poor soil; and if left for one thousand years without cultivation, we suppose that there would be not only no further increase of fertility, but, also, in our warm and dry climate, no greater accumulation of vegetable matter. The excess would rot, and go off in gasses the final products of decomposition.

But, notwithstanding the exception stated, and others unnecessary to state here, the views presented by Judge Beatty are certainly correct, and such as we meant to maintain within very extensive limits; and so extensive as to afford as much *encouragement* to the improver of soil, as need be desired.—Ed. F. R.

that substance prejudicial to the growth of vegetation. This acid, so far from being prejudicial, is the principal source of the supply of food for vegetables from the atmosphere.

Berzelius says that the "*carbonaceous mould*, which changes a part of the air (atmosphere) into carbonic acid, is itself changed by the air into geine and into the extract of mould; and it is upon this transformation that appears to depend, in part, the advantages derived from the tillage of the soil, which is divided by the action of the plough and exposed to the immediate influence of the air."

Einhof has ascertained that *geine*, in acid soils, is combined with phosphoric and acetic acids;—and De Pontin, it is said, has also found it combined with the malic acid. These authorities are abundantly sufficient to prove that *geine* is found in a state of combination with a variety of acids. Some of these combinations are found not to be prejudicial to vegetation of the most useful kind, but in some of its combinations it may only suit the growth of vegetables of an acid character, as you have shown in your Essay on Calcarious Manures. I have said that the *extract* of vegetable matter, combined with water in the earth will remain behind, when the water is carried off by evaporation and absorption. The question then presents itself, can there be no loss of *vegetable extract*, or *geine*, except that which goes to supply the sustenance of growing vegetation? If there can be none, it would follow that, in a state of nature, where the natural growth is such as to give back to the soil more than is drawn from it for its nourishment, and where the land is sufficiently level to prevent a loss of soil by washing rains, there would be a constantly increasing accumulation of *geine and other vegetable matters*, so that the enriching process would be *ad infinitum*. But I apprehend we cannot rely upon the energy of even our best constituted soils to do thus much for us. There is probably a limit to the capacity of all soils in this respect. When this is supplied, the loss, in a state of nature, in supplying nutriment to the growing vegetation and otherwise, is equal to the gain.

Dr. Peter, of Kentucky, in a very valuable article, published in the Kentucky Farmer of the 17th of April, 1841, speaking of vegetable mould and its solubility, says, "if this mould be washed with water, that fluid will dissolve a portion of it, and if the insoluble residue, after washing, called carbonaceous earth, by Berzelius, be exposed again to the air and moisture, for some time, it will be found again to yield soluble matter to water. This it continues to do until it is entirely washed away; but during the process of this change, it is also continually, although slowly, absorbing oxygen from the air, which combines with its elements, and passes off again in carbonic acid and water. In this manner it gradually disappears in soluble matters and gasses and vapors."

If these views are correct, as I think they are, they strongly corroborate your opinion, that the richest and the poorest soils each exerts strongly a force to retain as much fertility as nature gave them—and that, when worn and reduced, each may easily be restored to its original state, but cannot be raised higher, with either durability or profit, by putrescent manures, whether applied by the bounty of nature, or the industry of man."

There is a point, then, beyond which soils cannot be permanently enriched, without an improvement of their *constitutional organization*, which may be done by supplying those ingredients of a good soil which are deficient, such as clay, where sand is too predominant, and carbonate of lime, where that is defficient, &c.

But without a change in the constitutional organization of the soil, we cannot hope to carry its fertility, *permanently*, beyond what it had acquired in a state of nature. Soils which have been reduced by cultivation, where they have not been injured by washing rains, may be easily renovated. This must be done by again supplying them with those fertilizing ingredients of which they have been deprived by bad husbandry. This may be accomplished, in part, by the application of manures; but it is to the atmosphere we must look as the great storehouse whence we are to draw the necessary supply of vegetable food. To this end, those green crops should be freely cultivated, which derive most of their food from the atmosphere. In soils adapted to it, red clover is the most suitable for this purpose. It is by far the most convenient, and the cheapest method of renovating exhausted soils. It not only supplies a great deal of vegetable matter to soils that have been much reduced, but it is admirably calculated to pulverize, and reduce its component parts to a finely divided state, and thus to produce a condition favorable to a combination with those elementary principles, which are furnished by the atmosphere; and also greatly increases its capacity for absorbing moisture. Care should be taken also to suffer as few weeds to ripen their seeds as possible. These, previous to the time of ripening their seeds, derive nearly the whole of their nutriment from the atmosphere. By destroying them before they seed, nearly their whole product of vegetable matter is a net gain to the soil. Exhausting grain crops should be sparingly cultivated till the soil is completely renovated, and then should bear only such a proportion to the grain crops as the soil will bear without deterioration. It should be a fixed principle never to suffer the soil to *deteriorate*, for as it costs as much to cultivate a soil, producing only half or two-thirds of a crop, as if it produced a full crop, it is perfectly clear that it is the interest of the cultivator to keep his land always in good heart, Besides, it is less difficult to keep land in a state of fertility than to renovate it after it has been exhausted by careless husbandry But it is time to bring my desultory speculations to a close.

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*It is now well known that vegetable matter, while undergoing decomposition, forms a number of acids, termed by chemists humic, ulmic, crenic, apoerenic, malic &c. (See Johnston's lectures part 2d p. 406.) It has also been ascertained, that a number of *inorganic* substances, in addition to those of the *organic* kind, such as potash, soda, lime, magnesia, silica, oxide of iron, oxide of magnesia &c. (all of which substances are contained in the ashes of vegetables) are essential to the growth of plants. The above acids, by combining with these inorganic substances, form humates, ulmates, crenates &c. and thus prepare them for entering into the food of plants, as these salts shall, from time to time, be dissolved, by dews, rain and snow. Oxides are not soluble in pure water, but when this contains acids, in solution, it readily dissolves them, and hence another advantage resulting from the formation of acids, in the process of vegetable decomposition.

Letter to same, on the importance of Alkalies in soils, dated 1st January, 1842.

The following quotation is from Liebig's late work on organic chemistry. "A soil, which has been exposed for centuries to all the influencies which effect the disintegration of rocks, but from which the alkalies have not been removed, will be able to afford the means of nourishment to those vegetables, which require alkalies for their growth, during many years, but it must gradually become exhausted, unless those alkalies, which have been removed, are replaced; a period will therefore arrive, when it will be necessary to expose it, from time to time, to further disintegration, in order to obtain a new supply of soluble alkalies. For small as is the quantity of alkali which plants require, it is nevertheless quite indispensable for their perfect development. But when one or more years have elapsed, without any alkalies having been extracted from the soil, a new harvest may be expected."

"The first colonists of Virginia found a country the soil of which was similar to that mentioned above; harvests of wheat and tobacco were obtained for a century, from one and the same field, without the aid of manure, but now whole districts are converted into unfruitful pasture land, which, without manure, produces neither wheat nor tobacco. From every acre of this land there were removed, in the space of one hundred years, 1200 pounds of alkalies in leaves, grain, and straw; it became unfruitful, therefore, because it was deprived of every particle of alkali; which had been reduoed to a soluble state, and because that which was rendered soluble again, in the space of one year, was not sufficient to satisfy the demands of the plants. Almost all the cultivated land in Europe is in this condition; fallow is the term applied to land left to rest for further disintegration. It is the greatest possible mistake to suppose that the temporary diminution of fertility, in a soil, is owing to the loss of humus: it is the mere consequence of the exhaustion of the Alkalies." —p. 195-6.

Although the facts stated in the latter papagraph of the above quotation may not be entirely correct, yet it is worthy of inquiry whether the diminution in the fertility of the lands of lower Virginia, may not, in a considerable degree, have been caused by the exhaustion of the alkalies, which existed in the soil, at the time it was first brought into cultivation.

According to Liebig, the development of a plant requires the presence, first, of substances containing carbon and nitrogen, and capable of yielding these elements to the growing organism; secondly, of water and its elements; and lastly, of a soil to furnish the inorganic matters, which are likewise essential to vegetable life."—p. 56.

Water is composed of hydrogen and oxygen, and as plants are capable of decomposing, and assimilating its elements, (p. 122 and 125,) there can never be a deficiency in the supply of these to the growing vegetation, except in time of drouth. During the early growth of plants, carbon is furnished by the humus of the soil, in which they grow, but after they have developed their leaves an abundant supply of carbon is obtained from the atmosphere, by means of their absorbing power. This supply is so great, that in the opinion of Liebig, (p. 106.) they no longer acquire any from the soil, and return even that which they had extracted, during the formation of their first leaves. The remaining *organic* substance, essential to the growth of plants, is nitrogen. This, according to Liebig, is furnished, to some extent, from the atmosphere, in the form of carbonate of ammonia. This substance is very soluble in water, and consequently combines with the moisture of the atmosphere, and is brought down to the earth with the dews, rain and snow; and thus furnishes, to some extent, this necessary element for the nourishment of plants. To preserve the fertility and productiveness of soils, *the deficiency of nitrogen* must be supplied by the application of putrescent manures, which abound in this ingredient. According to Liebig, this may be so easily effected, that by the application of human excrements, "using, at the same time, bones and lixiviated ashes of wood, the excrements of animals might be completely dispensed with."—p. 242.

From these views it is quite apparent, that but little effort is necessary to prevent our growing crops from suffering from a deficiency in the principal *organic elements*, which constitute the appropriate food of plants.

But several *inorganic matters* "are likewise essential to vegetable life."* Liebig informs us that "most plants, perhaps

*An opinion formerly prevailed, that *organic substances* formed the *chief* ingredients of vegetable food. But there can no longer be a doubt that *inorganic substances* are as essential to vegetable life as those of the organic kind. Johnston, in his lectures on the application of chemistry and geology to agriculture, part second, p. 263 says: "from the constant presence of inorganic matter in plants, and from its being always found in nearly the same proportion, in the same species of plants, a doubt can hardly remain that it is an essential part of their substance, and that they cannot live and thrive without it. But that it really is so, is placed beyond a doubt, by the further experimental fact, that if a healthy young plant be placed in circumstances where it cannot obtain this inorganic matter, it droops, pines, and dies. But if it be really essential to their growth, this inorganic matter must be considered as a part of the *food* of plants; and we may as correctly speak of feeding or supplying food to plants, when we add earthy and mineral substances to the soil, as when we mix with it a supply of rich compost, or of well fermented farm yard manure." He further remarks that it is almost demonstrated "that plants *do feed* upon dead unorganized mineral matter, and that you are therefore really manuring your soil, and permanently improving it, when you add to it such substances of *a proper kind*.

From these views, the correctness of which I do not doubt, it would be extremely important to ascertain the inorganic matters—and in what proportions, suitable to each of the different crops, we are accustomed to raise. It would be equally important to have the soil of each farm analized, so as to ascertain in what proportions the inorganic elements already exist, so that if any of them are deficient they might be supplied. Johnston shows, that the following are the inorganic elements suitable for the wheat crop. Pot ash, soda, lime, Magnesia, allumnia, with a trace of iron, Silica, Sulphuric acid, Phosphoric acid, Chlorine. Rye and oats require the same inorganic substances, and oxide of iron and magnesia in addition. Rye grass, red clover, white clover, lucern, sainfoin, and the root crops, to wit: turnips, carrots, parsnips and potatoes require the same. It will be seen therefore that crops in general require nearly the same inorganic elements, but they are required in different proportions.

To show the importance of *inorganic* substances to constitute a good soil, Johnston refers to a very fertile soil, containing less than a half per cent. of organized substances, but with a full supply of the proper inorganic substances; and to two other soils, having more than 25 per cent of organized substances, which were barren and unfruitful, because of an almost total deficiency of some of the most important inorganic matters, to wit: lime, magnesia, potash, soda, phosphoric acid, sulphuric acid and chlorine. See p. 418-419.

all of them, contain organic acids of very different composition and properties, all of which are in combination with *bases*, such as *potash*, *soda*, *lime* or *magnesia*. These *bases* evidently *regulate* the formation of the acids, for a diminution of the one is followed by a decrease of the other."–(p. 148.) Here are four of the *inorganic* substances, which are most essential to the growth of vegetables. They are, it is true, combined with *organic* acids, which are necessary to fit them for assimilation, but the quantity of the acid is always regulated by the *base*, so that if the latter be diminished, the former will be decreased in a corresponding degree; and whenever a *base* is present the acid will be supplied. We have then but to furnish the soil with potash, soda, lime and magnesia, (if they do not already exist,) when the necessary acids, to fit them for assimilation by the growing plants, will combine with them.

The inorganic substances, mentioned above, are all important in constituting a good soil, but magnesia is, perhaps, less so than either of the others; yet even this is essential to the vigorous growth of many vegetables, for, as we are told by Liebig "all seeds of the gramineae contain phosphate of magnesia," (p. 93,) and that without this substance, "the seeds of corn (wheat) could not be formed."–(p. 201.)

Many soils are, by nature, abundantly supplied with carbonate of lime. But where it does not exist in soils, it is very important that it should be supplied. Fortunately, the extensive banks of shell marl, in lower Virginia, afford the means of doing so, and no reasonable expense should be spared in accomplishing an object so important in the renovation of exhausted soils.

Vegetables of all kinds contain in their composition, more or less of the alkalies. It is very clear, therefore, that this ingredient is indispensably necessary to their growth. If a soil has been entirely exhausted of the alkalies, it must necessarily be completely barren. If it has been only partially exhausted, it will still be capable of producing a vigorous growth of those trees and plants, which require only a small supply of the alkalies. But the growth of those, which require a large supply, must necessarily be much stinted. Thus forest trees, the leaves of which are renewed annually, require from six to ten times more alkalies than the pine or fir tree, and hence pines will grow vigorously in a soil where other trees cannot attain maturity.–(p. 198.) So 100 parts of wheat straw will yield of ashes 15.5 parts, whilst that of barley yields 8,54, and of oats only 4,42.–(p. 199.)

Plants of the *leguminosæ* family require very small quantities of the alkalies. Buckwheat, beans, lucern clover, and lentils yield less than one per cent of ashes.–p. 204.

These facts are abundantly sufficient to show that the quantity of alkalies, in soils, should be in proportion to the kind of crops intended to be produced. If they exist only sparingly, those crops should be avoided, which require a large supply, unless they should have been furnished by artificial means. Wheat requires not only more of the alkalies than any other crop, but also a considerable quantity of the phosphates, and is therefore a very exhausting crop.–(p. 205.)

The alkalies being so necessary to constitute a good soil, the question arises how this ingredient is to be supplied to those soils from which it has been nearly all exhausted. This is to be accomplished, first, by ceasing to cultivate these crops, which require a large supply of the alkalies; and secondly, by furnishing, by artificial means, those soils which are deficient, with a due proportion of these essential ingredients.

Soils are supplied with alkalies, in the natural way, first, by the disintegration of rocks, (p. 185) and secondly, by water evaporated from the sea, and falling in the form of rain, snow and dew (p. 160, 166, 7.) But the supply from these sources is too slow and gradual to be relied upon exclusively, and therefore great efforts should be made to increase the quantity by the application of ashes. Lixiviated ashes are valuable, as they contain silicate of potash, and salts of phosphoric acid; (p. 228) but those which have not been lixiviated are more so. Both kinds are so highly esteemed as manures, in Germany, that they are transported to the distance of twenty four miles. In situations, which admit of water or railroad transportation, they might be carried to still greater distances, with decided advantage.

It is not very material whether potash or soda is furnished to soils, from which the alkalies have been extracted, for these *bases* are readily substituted for each other, where there is a deficiency of either. (p. 149.) Potash may even be substituted, in many cases, not only by soda, but also by lime and magnesia. (p. 200.) This shows what a powerful effort is made by nature to supply plants with alkalies, by substituting alkaline earths, where they are entirely deficient.

I have heretofore adverted to the high estimate formed by Liebig, as to the value of human excrements as a manure. Of these, urine is by far the most valuable part. Urine contains several ingredients, which are extracted from the ashes of wood, such as the *sulphate* of potash and soda, and *phosphate* of soda. It contains also *phosphates* of ammonia, magnesia and lime, and several other valuable ingredients for the nourishment of plants. Liebig estimates 100 parts of the urine of a healthy man to be equal to 1300 parts of the fresh dung of a horse. (p. 240.) The saving and application of this manure is, therefore, of very great importance. But if not properly taken care of it is subject to great loss. During putrefaction, corbonate of ammonia is formed, which volatilizes, and passes off in form of gas, and the urine becomes alkaline. In this way nearly one half of the urine is lost. (p. 237.) Liebig informs us, that the carbonate of ammonia, formed during the putrefaction, may be converted into a salt, and thus fixed in the soil. This may be effected by strewing a field with gypsum, and then sprinkling it with urine. It may also be neutralized, and converted into a salt, which has no volatility by the chloride of calcium, sulphuric or muriatic acid, or super-sulphate of lime. (p. 238.) As the value of this manure will be so greatly increased, by preventing the ammonia from escaping, which is formed during the putrefactive process, this should never be neglected.*

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*See note at the end of the essay on the system of agriculture best adapted to Kentucky.

Letter to Thomas B. Stephenson, Esq. on the relative value of the most important grasses, dated May 10th, 1841.

Dear Sir: I have noticed in the Kentucky Farmer of the 26th February, a communication from Mr. Lewis Sanders, on the cultivation of the "orchard grass," in which he gives that grass "a preference over all others." Mr. Sanders' communication has suggested to me the idea of an inquiry into the relative value of the most important grasses, cultivated in Kentucky, and whether others *of greater value* might not be introduced. This is a question of much importance, and ought to be tested by rigorous experiments, both as relates to the quantity of grass, hay and nutritive matter, produced by each; and also as to their adaptation to our soil and climate.

Sir H. Davy, in his Agricultural Chemistry, has given the results of a great number of experiments on the grasses, made by Mr. Sinclair, under the direction of the Duke of Bedford, at his garden at Woburn Abbey, which are eminently useful. in this respect, as they will serve as models for conducting similar experiments in our state. The experiments alluded to, embrace near a hundred different species of grasses. I have given, in the following tables, a summary of the most important facts, so far as they relate to orchard grass, (*Dactylis glomerata,*) timothy (*Phleum,*) clover (*Trifolium,*) and blue grass (*Poa*) These facts are derived from Sir H. Davy's work on agricultural chemistry; and include all that are essential to form a correct judgment as to the comparative merits of the different grasses. I have given the results of the experiments of several different species of timothy, clover, and blue grass. These have not all been introduced into the country, but I have thought it would be useful to exhibit their respective merits, with a view to the introduction of the more valuable kinds, if that object has not already been secured.

The following remarks of Sir H. Davy are necessary to show the principles upon which the experiments were conducted, and will enable the reader to understand the annexed tables.

"Spots of ground, each containing four square feet, in the garden at Woburn Abbey, were inclosed by boards, in such a manner that there was no lateral communication between the earth, included by the boards, and that of the garden. The soil was removed, in these enclosures, and new soils supplied, or a mixture of soils was made in them, to furnish, as far as possible, to the different grasses those soils which seemed most favorable to their growth; a few varieties being adopted for the purpose of ascertaining the effect of different soils on the same plants."

"The grasses were either planted or sown, and their produce cut and collected and dried, at the proper season, in summer and autumn, by Mr Sinclair, his Grace's gardener. For the purpose of determining, as far as possible, the nutritive powers of the different species, equal weights of the dry grasses or vegetable substances were acted upon by hot water till all their soluble parts were dissolved.—The solution was then evaporated to dryness by a gentle heat in a proper stove, and the matter obtained carefully weighed. This part of the process was likewise conducted with much address and intelligence by Mr. Sinclair, by whom all the following details and calculations are furnished."

"The dry extracts, supposed to contain the nutritive matter of the grasses, were sent to me for chemical examination. The composition of some of them is stated in a foregoing table; I shall offer a few chemical observations on others, at the end of this appendix. It will be found, from the general conclusions, that the mode of determining the nutritive powers of the grasses, by the quantity of matter they contain, soluble in water, is sufficiently accurate for all the purposes of agricultural investigation."

As some of the grasses contained in the following tables, are most profitable for hay, *when cut while in blossom;* and others, *when the seed is ripe,* the tables show the results in both cases so far as the different results are reported by Sir H. Davy. The letter F indicates that the grass was cut when in flower, and S when the seed was ripe. The better to compare the different species of the same grass, I have framed separate and distinct tables of *timothy, clover* and *blue grass,* and have given the results of the experiment upon *orchard grass,* which will enable the reader to form an opinion as to its comparative merits.

TABLE I.

	80 drachms of grass produce of hay.	64 drachms of grass produce of nutritive matter.	Total grass per acre, lbs.	Do. hay per acre, lbs.	Total nutritive matter per acre.
1. *Phleum pratensis,* called in England meadow cat's tail grass—In Kentucky, timothy, native of Britain, Product at the time of F.	34	2½	40,837	17,355	1,595
Ditto at the time of S.	38	5¾	40,837	19,397	3,668
2. *Phleum pratensis,* a minor variety. Meadow cat's tail. Native of Britain, Product at the time of S.	34	2¾	27,225	11,570	1,169
3. *Phleum nodosum;* bulbous stalked cat's tail grass; native of Britain; product at the time of F.	38	2½	12,251	5,819	478

In giving the above results from Sir H. Davy, I have omitted, in the three last columns, the fractions of pounds, and will do the same in the other tables. One of the most important facts shown by the foregoing table, is the very great difference of nutritive matter in the first species of timothy, when cut at the time the seed is ripe, and at the time of flowering, the total nutritive matter at the former period, being more than two and a quarter to one. This, I apprehend, is the species of timothy which is cultivated in Kentucky for meadow, and every farmer must perceive, by an examination of the table, the great loss which must be sustained in *nutritive matter,* by cutting timothy while in blossom. Sir H. Davy states that "64 drachms of the straws (of this species of timothy) afford of nutritive matter 7 drachms," and that "the nutritive powers of the straws simply, exceed those of the leaves in the proportion as 28 to 8," which is nearly four to one. These facts clearly show the importance of suffering timothy, which is intended for hay, to stand until it is fully ripe.

The other species of *Phleum*, contained in the table, are so obviously inferior to the first as to be wholly unworthy of attention.

TABLE II.

	80 drachms of grass produce of hay.	66 dr. of grass produce of nutritive matter	Total grass per acre, lbs.	Hay per acre, lbs.	Nutritive matter per acre, lbs.
1. *Poa pratensis;* smooth stalk'd meadow grass, native of Britain, product at the time of F.	22½	1¾	10,209	2,871	279
Ditto at the time of S.	32	1½	8,507	3,403	199
2. *Poa trivialis* roughish meadow grass, native of Britain, product at the time of F.	24	2	7,486	2,246	233
Ditto at the time of S.	36	2¾	7,827	3,522	336
3. *Poa angustifolia*, narrow leaved meadow grass, native of Britain, product at the time of F.	34	5	18,376	7,810	1,430
Ditto at the time of S.	32	5¼	9,528	3,811	701
4. *Poa elatior*, tall meadow grass, native of Scotland, product at the time of F.	28	3½	12,251	4,287	669
5. *Poa maratima*, sea meadow grass, native of Britain, product at the time of F.	32	4½	12,251	4,900	861
6. *Poa cristaia*, crested meadow grass, native of Britain, product at the time of F.	36	2	10,890	4,900	340
7. *Poa fertilis*, meadow grass, native of Germany, product at the time of F.	42	4½	14,973	7,861	1,052
8. *Poa fertilis*, fertile meadow grass, native of Germany, product at the time of F.	34	3	15,654	6,653	733
Ditto at the time of S.	44	5	14,978	8,235	1,169

The foregoing table exhibits a number of very interesting facts. Of the eight species of *Poa* enumerated, the product of hay from 80 drachms of grass, varies from 22½ to 44 drachms. The quantity of nutritive matter contained in 64 drachms of grass, varies from one and a half to five and a quarter drachms.

And the quantity of nutritive matter, per acre, varies from 279 pounds (the flower crop) to 1,430 pounds. The quantity of grass varies from 7,486 pounds to 18,376. The difference in the product of hay is equally remarkable. The product of the best crop of No. 1, is 3,403 pounds, whilst the product of No. 8, is 8,235. Equal quantities of grass of No. 3 and 8, contain the like amount of nutritive matter, but the *Poa angustifolia* affords a considerable larger quantity of grass, and 1,430 pounds of nutritive matter per acre, whilst the *Poa fertilis* (second variety No. 8,) affords only 1,169 pounds per acre. The former is, therefore, *apparently* the most valuable, though it does not produce so great a weight of hay. No. 3, 7 and 8 afford the greatest quantity of nutritive matter per acre, and also give a larger product of grass and hay than any of the other species. They would seem, therefore, to be the best varieties of the *Poa genus*, provided our soil and climate will suit them as well as those of England. It is a question of much importance, but which I am unable to solve, whether our famous blue grass belongs to either, and which of the varieties mentioned in the foregoing table. If some skilful botanist would investigate and determine the question, it might be of very great importance; for if it do not belong to the best variety, it would be worthy of inquiry whether we might not be able to introduce a species of *Poa* that would be more valuable than our blue grass.* The *Poa angustifolia* cut when in flower, produces 18,376 pounds of grass; 7,810 pounds of hay, and 1,430 pounds of nutritive mater. This probably exceeds considerably the product of our blue grass. If that be identical with the *Poa pratensis* of England, as I suspect it is, from the description of grass, contained in Rees' Cyclopœdia, then it would seem, from the experiments detailed above, that

*"The famous Kentucky Blue grass is now undoubtedly the *poa pratensis* and in this confident opinion we are sustained by every Kentucky botanist we have consulted on the subject."—Ed. Ky. Far.

several of the species contained in the foregoing table, would be of superior value, provided they are equally adapted to our soil and climate. The flower crop of the *Poa pratensis* yielded only 10,209 pounds of grass, and 279 pounds of nutritive matter per acre. The flower crop of the *Poa angustifolia* produced 14,376 pounds of grass and 1,430 pounds of nutritive matter. Each of the two species of *Poa fertilis*, No. 7 and 8, also greatly excel the *Poa pratensis*, whether we regard the product of grass hay or nutritive matter. These facts clearly point out the propriety of further investigations in relation to this important subject.

We have been in the habit of regarding our blue grass as invaluable, and for pastures it is justly entitled to be ranked very high. But it is possible other grasses may be entitled to still greater praise. It is the part of wisdom to give a fair and full examination to such as may have the appearance of excelling our famous blue grass, and decide upon their respective merits by the test of rigorous experiment.

TABLE III.

	80 drachms of grass, produce of hay.	64 dr. of grass produce of nutritive matter.	Total grass per acre lbs.	Hay per acre lbs.	Nutritive matter per acre lbs.
1. *Trifolium pratensis*, broad leaved cultivated clover, native of Britain, product at the time of S.	20	2½	49,005	12,251	1,914
2. *Trifolium machrorhizum*, long rooted clover, native of Hungary, product at the time of S.	34	2¾	98,010	41,654	4,211
3. *F. Medicago sativa*, lucerne, native of Britain, product at the time of S.	32	1½	70,785	28,314	1,659

By an examination of the table No. 3, it will be seen that the *Trifolium pratensis*, (our common red clover) is less productive of grass and hay than either of the other species. It is also inferior to either of the others as regards the quantity of hay produced by a given quantity of grass. The proportion of hay to grass is only 1 to 4, while, in the other two species, the quantity of hay is considerably over one third of the grass. Taking equal quantities of grass, the lucerne is the least nutritive, and its nutritive matter per acre is also less than either of the others. Although it yields a large quantity of grass and hay, yet from its deficiency of nutritive matter, it would seem to be of less value than either of the other species. But as this species of clover has a very rapid growth, and may be cut more frequently than the others, it may probably, for the purpose of *soiling*, be found to be a valuable grass. The immense quantity of grass and hay produced by the *Trifolium Machrorhizum*, according to the above table, induced me to suspect there was some error in the figures. But by making a calculation, upon the data furnished, I found that there was no error. That species excels either of the others in the quantity of hay and nutritive matter from a given quantity of grass; and also greatly exceeds either of the others in its products per acre, of grass hay and nutritive matter. If the quality of the grass and hay, and their adaptation to the purposes of feeding stock should be equal to our common red clover, and if well adapted to our soil and climate, it may probably be introduced, with great advantage, among our cultivated grasses. Its utility ought, however, to be tested by actual and rigorous experiment.

Dactylis glomerata; called in England, round-headed cock's-foot grass*;* in Kentucky, orchard grass, and by some Salem grass.

In the experiments related by Sir H. Davy, 80 drachms of this grass, at the time of flowering, produced 34 drachms of hay; and 64 drachms of grass produced 2½ drachms of nutritive matter. The quantity of grass, hay and nutriment, per acre, was respectively 27,905; 11,859, and 1,089 pounds. At the time the seed was ripe, 80 drachms of grass produced 40 drachms of hay; 64 drachms of do. produced 3½ drachms of nutritive matter. And the quantity of grass, hay and nutriment was respectively 26,544; 13,272 and 1,441 pounds. These results are quite favorable to this grass, but will not entitle it to a rank above all others, which Mr. Sanders seems to claim for it.

Its merit compared with some other grasses, will appear from the following statement:

	Grass.	Hay.	Nutriment.
Timothy, product per acre,	40,837	19,397	3,668

T. Medicago Sativa,	70,785	28,314	1,659
Trifolium pratensis,	49,005	12,251	1,914
Trifolium Machrorhizum	98,010	41,654	4,211
Orchard Grass,	26,544	13,272	1,451
Poa Angustifolia,	18,376	7,810	1,430

Although the *seed crop* of the orchard grass contains a little more nutritive matter than the *Poa angustifolia,* yet when the comparison is made between the entire quantity of nutritive matter afforded by the *flower* crop of these grasses, it will be seen that the *Poa angustifolia* has greatly the advantage, as an equal quantity of this latter grass affords double the nutriment of the former.

In forming an estimate of the relative value of grasses for pasture, it is very important to take into consideration the quantity of *nutritive matter* afforded by each. This may be illustrated by supposing an ox to eat fifty pounds of grass per day. If pastured on orchard grass he would take into his stomach only one half the quantity of nutritive matter that he would if pastured on *Poa angustifolia.* Now it is manifest that if the grasses are equally palatable, an ox would fatten much more rapidly on the latter than on the former. Several of the species of the *Poa* have greatly the advantage of the orchard grass, as regards nutritive matter. Thus No. 3, 4, 5 and 7, in table second, afford from 3½ to 5 drachms of nutritive matter out of each 64 drachms of grass, while the same quantity of orchard grass affords only 2½ drachms. On the other hand the orchard grass is more nutritive than some of the others. Thus No. 1, which I suppose to be identical with our blue grass, affords only 1¾ drachms of nutriment out of 64 drachms of grass. Here the orchard grass has the advantage of this species of the *Poa.*

The remarks I have made are founded upon data, furnished by experiments made in England. But it would be much more satisfactory if an accurate course of experiments should be instituted upon our own grasses, from the results of which we might determine with greater accuracy the relative value of different grasses, and it is very desirable that some one who is well qualified for the task would undertake it. I have already extended this article to a greater length than I had intended, and must, therefore, refrain from making any further comments, except to say that all the products arising from the experiments made by Mr. Sinclair, appear to be very great. This may in part be accounted for from the excellence of the soil, in which they were made, and the great care with which the different grasses were cultivated. As, however, they all had, probably, equal advantages, the *relative products* may show with sufficient accuracy the relative value of the different grasses.

ON SETTING WOODLAND IN GRASS.

No person, who has seen the beautiful woodland pastures of Kentucky, can help admiring and approving the policy, which converts unsightly and unproductive forests into the most charming and luxuriant pastures. The object of this essay is to describe the manner in which this useful process may be best accomplished.

In the various essays, on this subject, which I have seen, the writers, it seems to me, do not descend sufficiently into the minutia of the process to instruct those who have had no previous information. This is an error into which it is natural they should fall. Residing in a quarter of the country where the whole process is very familiar, and of every day's practice, it is not surprising, that they should not comprehend the necessity of a very minute account of it, in order to instruct others. The object of this essay is to give full and complete information to those who are entire strangers to the process.

The best grasses for setting woodland in pasture are blue grass, (*poa pratensis*) and orchard grass, (*dactylis glomerata.*) The former is generally preferred for the rich Kentucky lands, having a deep vegetable soil; the latter answers best in soils, having a growth of white oak, and hickory; or where there is a considerable mixture of sand. It also succeeds better than blue grass, where the timber has not been much thinned out. But if the soil is well adapted to blue grass, and the timber has been sufficiently cleared away, blue grass is entitled to a decided preference. It forms a more beautiful turf, affords a sweeter pasture, and stands the winter better than orchard grass.

Calcarious soils, having the usual growth of the rich lands of Kentucky, such as ash, sugar tree, black and white walnut, buck eye, box elder, black locust, &c. are well adapted to blue grass. Where white oak and hickory predominate, or where there is a considerable mixture of sand in the soil, orchard grass will do best. If there is a doubt as to which kind is best adapted to the soil, the two grasses may be sown together. By degrees, that which suits best will gain the preponderance, and extirpate the other.

The saving of seed is the first thing, which should be attended to, after the farmer has so far got a start in the business, as to have it in his power to do so. In the commencement of the process he will be compelled to buy, but so soon as it is in his power, he should save his own seed. He will find this more economical, and better, on many accounts. He will be certain to have his seed well ripened, and saved in such a manner as not to heat and spoil, by putting it away when not sufficiently cured and dry. And if saved, as herein directed, it will be in much better condition for sowing than it is, as usually purchased in stores, or commission houses. Besides, when saved by himself the farmer will not be too sparing of his seed, when sowing, as it will have cost him nothing but a little labor.

Various methods of saving blue grass seed are practised, such as stripping, mowing, cradling, and reaping. The first of these methods is too tedious, and besides leaves the seed in bad condition for sowing as it would fall too much in bunches. A well constructed cradle, or a keen sythe, by which the tops of the grass may be cut, and but few of the blades, will be found a convenient way of saving blue grass seed, where the grass stands up well, and there are not many stumps, in the way. If cut with a sythe, it should be thrown into a double swarth, and the scattering tops of the grass raked into the row, so as to be convenient for gathering, and removing, at the proper time. The cradle, if well constructed, will perform both the work of the sythe and rake. When cut the grass should be suffered to lie exposed to the rain and dews, for several weeks, (a longer or shorter time, according to the quantity of rain that falls) until it shall have become so weather-beaten as to cause the seed to seperate readily from the straw, or heads.

If reaped, (which may be found more convenient where there are many stumps, or but little is intended to be saved) each hand full should be spread out thin, and left exposed to the weather, in the same manner as that which has been cradled or mown. After the grass has been exposed to the weather a sufficient length of time it should be removed to a barn floor, (if there be one) or a dirt floor, made for the purpose, where it may be threshed with flails, or tread out with horses, as may be found most convenient. If the quantity to be threshed is not considerable, flails may be used to advantage, but if the quantity is very great, it will be more expeditious to tread it out with horses. If got out with horses, after removing as much of the straw as can be raked off with fine rakes, the seed should be passed through a coarse lime riddle, assisting the operation by rubbing it round the riddle with the hand, and should then be run through a wheat fan, turning so slowly as to blow out only the chaff and fine straw. If threshed with flails, the riddle may be dispensed with, and the rakes and wheat fan will alone be necessary. Orchard grass seed may be conveniently saved by reaping, (leaving the stubble high) and binding in sheaves. These should be set on their butt ends, arranged in long shocks, and left exposed to the weather, until the seed will readily separate, and then, when very dry, should be hauled and threshed, and cleaned by running through a wheat fan.

In removing the grass, cut for seed, to the threshing floor, a sled, with broad shelving, should be used, over the bottom of which a wagon sheet should be spread, in order to save all the seed that may shatter out. When in a proper state to haul to the threshing floor, the seed shatters out very easily, and considerable waste would be unavoidable in loading and unloading from a wagon. But if carefully gathered up with the hands, and laid on a sled, with broad shelving and a sheet thereon, but little loss would occur.

Having described the method of saving seed, I will now proceed to describe the manner in which the ground should be prepared for its reception. This should be done by removing logs, brush, leaves, and rubbish of all kinds, so as to allow the seed, when sown, to come in *contact with the soil.* If it do not do so, *it cannot vegetate.* To sow upon ground, which is coated over with leaves, and rubbish, will be only a waste of seed.

The necessity of cleaning up the ground so completely as to admit such a portion of the seed to come *in contact with the soil* as to give the grass a good set, cannot be too strongly impressed upon all, who desire to convert forests into woodland pastures. No greater portion of the forest should be attempted to be cleared up, in any one year, than can be thoroughly prepared for the reception of the seed; and the portion which is cleared up, should always be sowed late in December or in the months of January or February, after the ground is prepared, in order to prevent nimble-will (a worthless kind of grass) from anticipating the more valuable grasses. (If this grass once gets possession of the ground, it renders the introduction of blue grass much more difficult.)

The following method of preparing ground for the reception of grass seed is recommended. During the summer and fall all the logs, on that portion of the woodland, intended to be sown in grass, the ensuing winter, should be cut, and put in heaps; and all the brush and coarse litter should also be piled. This should be completed before the falling ef the leaves, which, in the rich lands, takes place soon after the first hard frost. After the leaves shall have fallen, and become sufficiently dry to burn, they may be set on fire, during a dry time, when the logs, brush, weeds and leaves will all burn, with only a little attention in putting together the fragments of the logs and brush. If the fall is as dry as that season of the year usually is, this burning will leave the ground sufficiently clean for the reception of grass seed. If the fall should be too wet to burn the leaves, the brush and log heaps should still be burnt (as the fall season is never too wet for this) and an opportunity for burning the leaves, must be sought in February, if the weather will admit, but if the leaves should not become dry enough to burn, in this month, or early in March, the only alternative will be to rake them in heaps, or rows, and sow the spaces between. If the other part of the ground becomes well set, the grass will soon spread over the space, occupied by the leaves, after they shall have rotted.

If the leaves and logs &c. are burnt in the fall the grass seed may be sowed towards the last of December or any time in January, without any danger of its germinating before the warm weather sets in, in the spring. The next thing to be done, after the grass seed is sown, is to clear the ground of a sufficient portion of the *standing timber*, and this work may be commenced immediately after *a part* of the ground is sowed. This process ought generally *to follow the sowing*, if the leaves &c. are burnt in the fall, otherwise the timber, brush &c. will be an obstruction in sowing of the seed. To fit the ground for a vigorous growth of blue grass, about two thirds of the shade of the natural forest should be removed. To accomplish this nearly the whole growth of timber, except that which is suitable for rails, and particularly that which is crooked and unsightly, should either be cut down or deadened. That which is intended to be deadened (including all trees over ten inches in diameter which will die the first season by girdling) should be left standing till the month of May, when they should be deadened. The cutting of the residue should commence as soon as convenient after the seed is sown, and progress during the winter and spring, at all leisure times. It is particularly important, that the sugar trees should be cut, because they are injurious to the growth of blue grass, and cannot be killed, the first season, by girdling them. All the wood cut upon the ground, sowed in grass, should be hauled off for the winters firewood; or if there is a surplus, it may be corded up, on the ground. The brush may be piled and burnt,* or if more convenient, suffered to lie till the ensuing fall, as it will be no material injury to the grass. No injury will result from wagons, teams &c. passing over the ground, after the seed is sowed. On the contrary, the more the ground is tread the better the seed will take.

If it so happens, that the leaves cannot be burnt, in the woods, in consequence of the wet weather, it will become necessary to clear the ground of brush, as well as leaves, before the seed can be sown. This may delay the sowing till late in February, or even till the middle of March. It will be much better to submit to this delay, rather than sow before the ground is properly prepared. Seed sown late in March will succeed very well, if the season is favorable, but there is al-

*When brush or logs are burnt on the ground, the ashes should be carefully scraped up and scattered over the adjacent ground, or hauled to some adjacent field for manure. Grass seed will readily grow upon these burnt spots, after the ashes are removed, but not before.

ways a risk to be encountered, as a very dry spring would prove fatal to grass sowed so late. It is always desirable, therefore, if possible, to have the seed sowed by the first of March. In more northern latitudes it may doubtless be sowed, at a later period, with safety.

For orchard grass the ground should, in all respects, be prepared in the same manner as for blue grass, except that it will do well in a thicker growth of timber; but it will be improved in quality by having the natural forest as well opened as is necessary for blue grass.

The leaves of oak timber do not drop sufficiently early to be burnt the same fall. The crop of the previous year might be burnt in the month of April or May, preceding the time of sowing seed, or, if not too much decayed, (oak leaves are very slow in rotting) they could be more advantageously burnt late in the fall, and the sowing may take place in December following, at which time the few leaves, of the new crop, which will have been shed, after the burning, will not be sufficient to prevent the seed from coming sufficiently in contact with the earth to cause them to vegetate. The only danger would be, that the leaves, falling the ensuing winter and spring, might smother the young grass. I incline to think, that orchard grass would penetrate the leaves, and receive little or no injury, by their falling upon the ground upon which this seed had been sown. But having no practical knowledge, on this subject, I would suggest that it would be safest to test the matter by an experiment, made in a small way, from which little inconvenience would result, if it do not succeed.

A very intelligent and experienced farmer, in the grass growing region of Kentucky, recommends the following plan for setting woodland in blue grass. Burn all the logs, brush, and coarse rubbish, and deaden, or cut off, and haul from the ground a sufficient portion of the less valuable timber, during the summer and fall; sow the ground in January, and turn all the stock on the ground, and feed them there, during the winter and spring, until the seed begins to vegetate, and then turn them off.

According to this plan, it is designed that the stock, by tramping the ground, shall cut the leaves and fine rubbish to pieces, and bring the seed in contact with the earth, and so cover it as to make it vegetate. If the ground is thoroughly tramped over every part of it, the desired object will certainly be obtained. Horned cattle are the best for this purpose; and where the ground is level, and convenient to the place from which the fodder, for feeding them, is to be hauled, the plan will doubtless answer very well. But in many cases it will be wholly impracticable. If, for instance, the fodder be at a great distance from the place, which is intended to be set in grass; or if the land lies very rolling; or is so full of stumps or trees that the vehicle, on which the fodder is transported, cannot conveniently pass among them; or if there be but few cattle to feed. These, and other objections to this plan, which might be mentioned, such as the want of perfect regularity in the distribution of the fodder, over every part of the ground, renders it less eligible, under some circumstances, than the one I have recommended. It is attended with more labor, and will be less effectual, than the other which, if the ground be well freed from rubbish, and sufficiently cleared, will be certain to secure a complete set of grass over every part of it.

Another method of setting land in blue grass, is to feed blue grass, and timothy hay upon the ground, intended to be set. This will be found to be a very effectual plan as to all the woodland, upon which much feeding shall take place. But it is liable to the objections, which have been urged against the other.

The quantity of blue grass seed, usually sowed per acre, is what is commonly called a bushel, that is ten pounds of stripped seed. Seven and a half pounds, cleaned in the way I have recommended, would be more than equal to ten pounds of stripped seed; and is as much as need be sown per acre. But as blue grass is of slow growth, and is sometimes smothered by a luxuriant growth of annual weeds, I would recommend, that, in addition to the blue grass seed, one quart of clean timothy seed, and one quart of clover seed be sown upon each acre. The blue grass seed being much lighter, and of a more chaffy nature than clover and timothy seed, should be sowed by itself. The two latter may be mixed together, and should be sowed *in a contrary direction* from the other. In this way it will be scarcely possible that any spot of ground would be entirely missed. The clover and timothy will come forward much quicker than blue grass, and will have a tendency to keep down the luxuriant growth of annual weeds, which are so common in our rich lands. Besides, if it becomes necessary to pasture the woodland the first year to prevent the young grass from being smothered, cattle will much more readily eat down the weeds, when mixed with clover and timothy, than where they stand alone. Orchard grass seed should be sowed alone, and one bushel of clean seed to the acre.

A difference of opinion prevails as to whether woodland pastures ought to be pastured at all, during the first year. An experienced farmer, to whom I have already referred, recommends that in the month of June all the stock of the plantation, particularly cattle, should be turned on the grass, sowed the previous winter, and suffered to remain until they shall have grazed it close, and then should be taken off, and not again suffered to go on till the following year.

Another farmer, equally intelligent and respectable and also residing in a part of the State, where it is a common practice to put woodland in grass, insists, that no stock should be suffered to run on newly set land the first year, nor until after the grass shall have gone to seed the second year.

The former gentleman says, that about the first of June "the young grass will be up from six to ten inches high, being in appearance quite slender and weakly, and which, if permitted to remain much longer, without being grazed off, will fall with its own weight; will mildew, rot and die, root and branch, *at least in a great measure, especially if the shade covering the ground be considerable.*

My own experience induces me to believe, that there is no danger of the young grass dying for the want of pasturing, except under the circumstances, stated in italics, at the close of the above quotation. If a rank growth of *weeds* do not endanger the young grass, it would certainly be best not to turn any stock upon it the first year. To guard against such a growth of weeds as much as possible, blue grass seed, mixed with clover and timothy, should be sowed early. The blue grass may be sowed in December or January, but as clover is liable to be killed by a severe frost, it should not be sowed before the middle of February; and timothy may be sowed, mixed with clover seed. The two last grasses spring up very quick, after the weather becomes warm, and will tend greatly to keep the weeds in check. I have these grasses now growing, (21st May) among blue grass, sowed early in March, ten inches high, and they have, by their luxuriant growth, kept down the weeds so much as to leave no apprehension of their smothering the blue grass. There is no danger of timothy and clover doing any harm, in this respect, if not more than one quart of each is sowed to the acre, provided the timber is sufficiently thinned out to enable the blue grass to attain a vigorous growth.

But it is proper to remark, that the present season has been an uncommonly forward one, and very seasonable, and clover and timothy have had an unusually rapid growth. The weeds, however, have had an equal advantage in this respect. If my seed had been sowed a month earlier, the grass would have been still more ahead of the weeds.

Yet if there should be any danger of the young grass being smothered, it would be proper to turn on cattle, and pasture it off quickly, about the middle of June, or earlier, if the season has been a forward one. In colder climates the time of pasturing the young grass should of course, be somewhat later. A time should be chosen for this purpose, when the soil has not been rendered soft by rains, lest an injury should be done to the tender roots of the young grass. If the ground is very rolling, the injury to youug grass, by the treading of stock, would be much greater than if the ground were level.

Newly set woodland pastures should be kept perfectly free from stock, during the winter next after it was sowed, and until the blue grass shall have run up to seed. And during the subsequent years, so long as it is intended to be kept in pasture, stock ought to be turned off early in February, and not suffered to go on again till the grass begins to shoot up to head. Thus treated, it will afford much more pasture than if suffered to be grazed, when very young. Blue grass, intended for winter feeding, should not be pastured later than the first of July. If pasture is abundant, it would be still better not to pasture it at all, during the summer or fall, but keep it in reserve for winter feeding. Treated in this way, it becomes exceedingly rank, and covers the ground with a very thick coat of herbage for winter use.

Having now gone through the process of setting woodland in grass, I will conclude with a few remarks, as to the best method of freeing such pastures from various weeds, and shrubbery. Most of the *annuals* will soon give way to the grass, without any effort on the part of the husbandman. If any remain, a single cutting, after the grass is well set, will generally extirpate them. The by-ennials, such as mullins and thistles, &c. should be carefully cut before their seed ripens. As there may be a store of seed in the ground, all will not come up the first year; besides these do not run up to stalk till the second year, and hence many small ones may escape observation at the first cutting. The operation must be repeated as often as any are perceived running up to stalk. The number will lessen every year, and, finally, diligence and perseverance will destroy them all, except the thistles, growing from seed, furnished by *kind* neighbors. These must be remonstrated with, and persuaded to join in the good work of destroying a weed so exceedingly injurious to pastures.

The per-ennials are more difficult to conquer. The Briers, if any, should be cut close to the ground, in August, (the *dark of the moon* need not be waited for,) and burnt clean, so that sheep will not be prevented from going among the stubble to nip the young shoots, when they first come up. These useful animals will be "laborers without hire," and will do their work effectually, in the course of a year or two, after once cutting and burning the old briers.

Elders, iron weeds and some others are more difficult to subdue. These should be cut annually, about the month of August—elders more frequently. Once cutting will not do. Vigilence and perseverance, with the aid of cattle and sheep stock, will finally enable the industrious husbandman to extirpate from his woodland pastures all noxious weeds and shrubbery of every description. Nothing tends so much to prevent weeds from infesting woodland pastures as to keep them well cleaned up. Every winter or early in the spring all the fallen timber, brush &c. should be carefully removed or burnt. Suffering the grass to get a good start, in the spring, before stock is turned on. has also a very useful effect in keeping down weeds, and will moreover greatly increase the amount of food, to be derived from a given quantity of ground.

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After a few years the timothy and clover will have given way to the blue grass, and now, in the spring of the year, one of the most beautiful sights will be presented that ever eye beheld—a rich soil, sparsely set with straight and beautiful timber, covered with a clean and uninterrupted turf of verdant grass. About the latter end of April, a woodland pasture, which is perfectly clean, and free from weeds, presents the most delightful view I have ever beheld. But the richness and exuberance of the scene is increased, when, a little later in the spring, the grass shall have run up to seed. The tall grass, of one uniform heighth, waving in the wind, presents a richness and exuberance of appearance, that cannot fail to charm all that behold it.

But the beauty of the scene is not the only advantage. The annual value of woodland pastures, in their highest state of improvement, per acre, is equal to the interest on fifty dollars, and, therefore, this additional value will have been given to the land.

ON THE CULTIVATION OF THE LOCUST.

The yellow locust is a native of America, and was first introduced into Europe by John Robin, in honor of whom it was called *Robinia*. The rapid growth, and great *durability* and strength of the locust; and the ease with which it may be cultivated; the small space of ground, necessary for this purpose; and its admirable adaptation for fencing, ship building, and many other uses, renders its cultivation an object of the greatest importance. Its cultivation will be peculiarly important to portions of the Great West, in which prairies are so much more extensive than woodlands.

It may be propagated from the seed, or by suckers, springing up from the roots of trees, which have been cut down. The latter mode of cultivation is attended with the least trouble, and has the advantage of bringing them forward somewhat more rapidly than where they are propagated from the seed. Besides there will be a greater certainty of getting a good stand of young locusts, than where reliance shall be had upon the planting of seed. But as the locust can be cultivated from suckers, only where this valuable tree is already growing, the other method must necessarily be resorted to, in those parts of our country, where the locust is not found, in a native state. Both modes of cultivation will, therefore, be explained. In a country in which the locust already exists, the following method may be adopted. Select a convenient piece of ground, or separate and distinct pieces, on various parts of the plantation, where locusts are growing, not too wide asunder, and pretty well distributed over the ground to be set in locusts. Let all other species of timber be cut down, and the land carefully cultivated, during one summer, with such a crop as will leave the land in good condition for sowing grass the succeeding spring. Hemp, tobacco, pumpkins &c. are convenient, and suitable crops, for this purpose. After these crops are removed, in the fall, let the ground be well ploughed and harrowed, or brushed, so as to leave a smooth surface. One object of this preparation of the ground is to break and wound as many of the roots of the locusts, left standing, as possible, so that suckers will more readily spring up, in sufficient numbers. About the middle of February, for latitude 39°, and somewhat later, for more northern, and earlier for more southern climates, the ground, thus prepared, should be sowed with red clover seed, one gallon to the acre. One month after the grass seed is sowed, say from the middle of March to the middle of April, at a time when the ground is well settled, after the frosts are out, all the locust trees should be cut down, and the brush and timber removed. If this last operation is completed before the locusts begin to bud forth, in the spring, it will be in good time; and it should be as recently before this tree begins to vegetate as may be, as this will facilitate the shooting up of suckers.* Nothing more need be done but to enclose the ground, with a good fence, to protect the young shoots from stock. This is indispensable, as all kinds of stock are fond of the leaves and tender sprouts of the young locust, and would utterly destroy them if allowed to get at them.

When ground is prepared as directed, and the locust trees cut down, at the proper time, an immense number of suckers will shoot up among the clover, and will grow off rapidly with tall and straight bodies. The grass, having been sown very thickly, will keep down the weeds, but will be no obstruction to the growth of the suckers; and these, standing so close together, will be prevented from branching, and, consequently, will require no trimming. Locusts require protection from stock, not only when young, but even after they have grown to the heighth of twelve or fifteen feet. Cattle are so fond of browzing on the leaves and tender twigs, in the spring and

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*Locusts, when cut in the fall or winter, will put up but few suckers.

summer, that they will bend them down to get at the tops, even when of considerable size. I cannot, therefore, too strongly urge the necessity of ample protection to a young locust orchard. Indeed when so large as to be too strong to be borne down by stock, it would still be advisable to refrain from pasturing the ground, on which they are growing, because, if the ground is kept light, by leaving it unpastured, locusts will grow so much more rapidly as will more than compensate for the loss of the pasturage.

In two or three years the less thrifty trees will be overtopped by those of more vigorous growth, and will begin to die, showing decay first in their top branches. To prevent these decaying suckers from absorbing from the earth a portion of the nourishment, which would otherwise be given to the more vigorous plants, they should, every spring, be carefully cut down, close to the ground. In this way the locust orchard will be gradually thinned out, and room be afforded for the young trees, still left standing. After these shall have attained a sufficient size for stakes, the less thrifty ones, which are overtopped by those of more vigorous growth, should, every spring, be cut out for stakes; and, if large enough, for riders, and ground rails for the common worm fence. This process must be continued as long as any of the young trees are over topped, and show indications of decay, in their top branches. A locust grove, thus cultivated, will never want trimming except the exterior trees, and they only on the side next to the open ground. From all the residue, the small lateral branches will soon decay and drop off, and a knife need never be applied to them.

Young locusts are very subject, in Kentucky, to be injured by an insect called the borer, which penetrates the bark, and bores out holes of considerable size, in the wood of the tree. All that are much affected by this insect are checked in their growth, in proportion to the extent of the injury. Those most injured soonest decay, and will, of course, be first cut out; and so on in succession. Those that are but slightly affected may attain considerable size, and may be applied to many useful purposes; but among the great number that will spring up, from the roots of the old growth, enough will probably escape serious injury to cover the ground with as many as can grow to advantage. These will flourish, and come to perfection;

and may be suffered to grow to such size as may, under all circumstances, be deemed most expedient, whilst all the defective ones may be cut out for present use.

I have now growing, upon my plantation, between fifteen hundred and two thousand locusts, cultivated in the manner herein directed, from 10 to 25 years old. From those most advanced, I cut out stakes for re-setting my fences, as required from time to time, so that in a few years I shall have all my fencing supplied with locust stakes. When this is accomplished, I will commence cutting out such of the locusts (having now attained a sufficient size) as show indications of decay, in their top branches, for rails; and thus by thinning out my groves, as occasion shall require, will afford room for those that show no marks of decay.

Locusts, cultivated as herein directed, may stand, upon an average, within twelve feet of each other, after having been properly thinned out, and consequently a little over 300 to the acre. At the age of twenty-five years, if they shall have been completely protected from stock, and the ground not pastured, we may safely calculate upon each acre, if all the locusts were cut down, producing five thousand rails. Thus ten acres of land, in twenty-five years, will have produced fifty thousand rails, besides the stakes, which will, in the mean time, have been cut out, being more than sufficient, including the tops of the locusts, cut for rails, to stake five thousand pannels of fence. Here then we have rails and stakes of the most lasting kind of timber, from ten acres of ground, sufficient to make all the fencing on a plantation of considerable size. And the same ten acres, from which these were obtained, will in twenty five years (a term in which no new rails will be required) produce as many more, with no other labor or expense, except keeping the ground well enclosed.

Thus, it will be seen, that only ten acres of ground will be necessary to furnish, in perpetuity, rails and stakes for a plantation, requiring five thousand pannels of fencing.

It may happen that in the place selected for a locust grove the old locusts may not stand so regularly distributed as to fill the entire space with suckers. In that case the vacant places may be reserved for meadow, and thus no ground will lie idle, but where suckers are growing the grass should be left undisturbed. This growing up annually, and falling on the ground, will increase its fertility and keep it light, and thus hasten the growth of the young locusts.

If a plantation shall afford no convenient place, upon which a sufficient number of locusts are growing, in a state of nature, to cultivate them, upon the principles herein explained, then the following plan is recommended. Let a piece of ground be selected, or more than one (if convenient) so situated as to afford the greatest facilities for approaching it, from all parts of the plantation, say ten acres, and let it be prepared, in all respects as recommended above. In the spring, next after the grass has been sowed, which, if convenient, may have been sown the preceding fall, the whole of the ground should be planted with yellow locusts, in straight lines, each way, at the distance of two rods apart. The trees planted should be of thrifty growth, and from two to four years old. The proper time of planting is after the sap begins to rise, which is indicated by the showing of the bud, in such state of forwardness as to be ready to put forth small leaves. The locust is late in budding, and in this climate (latitude 39°) is rarely forward enough to plant till late in April. If planted in a proper manner, and at the proper time, it is so certain, that scarcely one in twenty will fail. But if planted before the sap is in free circulation many of the plants will fail. It is always best to plant when the ground is in a moist condition, and I therefore, prefer planting soon after a rain. In digging up the young locusts, for planting, care should be taken not to bruise the roots. To avoid this, a sharp axe should be used to cut off the large rots, and all that are bruised should be carefully trimmed, by having the bruised parts cut off with a sharp knife. The lateral branches should be trimmed off, leaving only a part of the top, proportioned to the extent of the roots. They should be set firmly in the ground, but not more than an inch or two deeper than they naturally grow. The holes should be dug wide, so as to admit the roots to take their proper position, taking care not to double or to bend them. Planted, at the distance recommended above, will give forty to the acre, and four hundred to ten acres. If any should die, their places must be supplied the next spring, and at that time, I would recommend to put around each tree half a bushel of half rotted chip manure.

This will keep the grass from binding the young trees, and hasten their growth. The ground, thus planted, may be kept for meadow for four years, or somewhat longer, if the trees shall not have grown thriftily. The ground should now be ploughed, in the fall of the year, and cultivated carefully the succeeding year, so as not to destroy the grass sod; and prepared in the fall or early in the winter, for again sowing down in clover in February, as herein before directed. From the middle of March to the first of April, all the locusts should be cut down, and the timber and brush removed.* Nothing now remains to be done but to pursue the directions, herein given, in relation to suckers, springing up from the roots of locusts, which had been cut down.

To carry out this plan of raising locusts will require time, and the exercise of patience. But it must be recollected, that during the time the husbandman is waiting for his young locusts to attain a sufficient age to be cut down, he will be annually deriving profitable crops from his land; and, at the end of the process, he will obtain a sufficient number of stakes and poles for riders or ground rails, to compensate for all his extra labor; and, besides, he will have his ground more regularly set with locusts than could be accomplished in any other way.

The roots of locusts extend out laterally to a considerable distance; and sprouts will spring up sufficiently thick, over the entire ten acres, and stand more regularly, than they would do, in the general, were you to depend upon cutting down locusts, found growing in their natural state.

But neither of the foregoing methods of cultivating locusts will be practicable, in a country where locusts are not natives of the soil; and hence the necessity of raising locusts from the seed, in such situations.

For this purpose new or second years ground, or land which has been lying in clover, will answer best. If there be none

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*In a valuable work, on the cultivation of the *Robinia Pseudo acacia*, by W. Withers, Holt, Norfolk, England, the following method of cultivating the acacia is recommended. "The acacias are planted in a field, in rows which are fifty feet apart. In the following year a furrow is traced with a plough, three feet beyond the rows of trees, of sufficient depth to touch and graze the surface of the roots. Shortly after a great number of young plants start from the wounds made by the plough." (p. 78.) This method is objectionable, because by leaving the old trees standing, they will overshadow the young shoots, and prevent them from attaining a good shape and size.

such, land which has been lying in blue grass for some years may be substituted. It should be prepared by ploughing the preceding fall, and pulverizing the soil as perfectly as possible. In this latitude (39° N.) the seed should be planted from the middle to the last of April. If planted too early there is danger of the young plants being destroyed by severe frosts. They are not as tender as beans, but a pretty severe frost will destroy them. It is better to avoid the risk by not planting till after the 20th of April, in this climate, and later in proportion, if planted farther north. If planted too late they are more subject to be injured by drouth.

Where the ground is properly prepared, and pulverized, it should be laid off five feet each way, and the seed dropped and covered like corn, except that they should not be covered more than an inch deep, and great care should be taken to leave no clods on the hill. Eight or ten seed may be dropped in each hill, to increase the chances of producing at least three plants, but they should be somewhat scattered, to prevent them from being crowded; and, if too many come up, should be thinned out as soon as the danger of frosts is over. To facilitate the dropping of the seed, they should be stirred in ashes or gypsum to dry them, and the surplus ashes or gypsum sifted out.

Seed may be prepared for planting as follows: They should be gathered the preceding fall, and kept dry till spring. I apprehend, though I have no experience, that if kept dry, they will grow as well after being kept a number of years. Three days before the time of planting, they should be put in a tight vessel, and boiling water poured on them which should be suffered to remain twenty four hours; it should then be poured off, and the boiling water renewed, and suffered to remain the same time; boiling water should again be poured on the seed, for the third time, as in the two first instances. Most of the seeds will now have bursted the hard envelope, by which the kernal is surrounded, and they will be in a proper condition to be planted.*

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*I was taught the above method of preparing locust seed for speedy vegetation, by the late Col. William Fitzhugh, of Washington county, State of Maryland, some twenty years since. I made trial of the method recommended, at the time, and found it to succeed very well. But as I have since cultivated locusts altogether from suckers, grow-

The seedlings should be cultivated, the first year, with great care, suffering no weeds to grow, and thinning them out so as not to leave more than two or three in a hill. The ground should be left as level as possible, at the close of the cultivation, in the fall; and for this purpose it would be proper to use a light cultivator, or harrow, in completing the process. In the spring the ground should be sowed with clover seed, as herein before directed. The young locusts should now be fur-

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ing from the roots of trees, which have been cut down, I concluded to make a more accurate experiment, upon the best method of causing locust seed to vegetate, than I had hitherto done.

On the 11th of April 1844, I divided about a quarter of a gill of seed into three equal parts, as nearly as I could, without actual admeasurement. Upon one of these parts I poured boiling water, and let it remain three hours. Upon another part I poured boiling water, and after standing one hour, poured it off, and repeated the boiling water, and suffered it to remain two hours. Upon the third portion of seed, I poured boiling water; and in one hour poured it off; and repeated the boiling water, permitting it to remain an hour; and then repeated the boiling water for the third time, suffering it to remain on the seed one hour. I now planted the three parcels of seed, in seperate rows, in a bed previously prepared, on which a brush heap had been burnt. In three weeks, I found that 97 plants had come up from the seed which had been exposed to boiling water only once; 56 of those which had been twice exposed to boiling water; and 82 of those which had been three times exposed. From this experiment it seemed as if a single exposure to boiling water was all that was necessary. But as more plants came from the seed, which were three times exposed to boiling water than from those which had been only twice exposed, the experiment seemed not to be conclusive. I concluded that the different results might have arisen, in part, from the unequal quantities of seed; and in part from there being more defective seed in the parcels producing the fewest plants. I therefore, made another experiment as follows:

On the 30th of April I selected from a large parcel eighty seeds as perfect as possible, taking none but what would readily sink in cold water. Twenty of these I planted in a row in the same bed, without soaking, or any exposure to boiling water; twenty were put in boiling water, and the water kept boiling for five minutes; twenty were put in boiling water, and suffered to remain one hour; and upon the remaining twenty, boiling water was repeated, at the expiration of an hour, and suffered to stand till it became cold. The whole were then planted. At the end of three weeks, I found that not a plant had grown from either the seed not soaked, or that which had been boiled for five minutes. From the seed, upon which boiling water had been poured once, fourteen plants were produced; from those upon which boiling water had been repeated, a second time, nineteen plants had been produced. I inferred, from this experiment, that the exposure of locust seed to boiling water for five minutes had destroyed its vegetating power. That pouring boiling water on it *once*, would cause it to vegetate pretty well, but that a repetition of the boiling water would make it vegetate better. In every instance I used rain water. A month has now elapsed since I planted the seed above mentioned, and not a plant has yet sprung from the seed not soaked, or from that boiled five minutes.

ther thinned out, so as to leave only one in a hill, which should, of course, be the most thriving, and straightest plant; and, if any of those left should need it, they should be supported by driving down a small stake, and tying them to it. Nothing more will be necessary but to protect them from stock, and thin them out, as directed, where suckers are allowed to spring up from the stumps and roots of trees, cut down as heretofore explained.

An acre of ground will now contain, if none be missing, 1742 plants, but as this quantity of land will ultimately sustain only about 300 trees, if one plant in six should escape being injured, by the borer, or other casuality, there will still be enough left.

If, instead of planting five feet apart, the seed should be planted only four feet each way, there would be 2722 hills to the acre; and if one plant in nine should escape being seriously injured, there would still be a sufficient number left. The only objection to planting, at this nearer distance, is the danger of breaking down the tender plants, during the process of cultivation. With proper care this might be avoided, and the distance of four, instead of five feet be adopted with decided advantage.

When locusts shall have attained a proper size for rails, which will be in about twenty-five or thirty years, and are needed for that purpose, they should *all* be cut down,—large and small—beginning on one side or end of the field, so that the suckers may grow up, without being overshadowed by trees left standing. This should always be done, in the spring of the year, and the timber and brush removed from the ground. A new crop of locusts will spring up, in the place of those cut down, and will be large enough for use before the rails, obtained from the first crop, will have worn out. Thus the same piece of ground will furnish a permanent supply of rails to fence in the farm.

The following estimate will afford some idea of the profits arising from the cultivation of the locust. The value of rails, made of the better kinds of timber, growing on the rich lands of Kentucky, may be estimated at three dollars per hundred. Locust rails will last more than twice as long, and consequently are worth at least six dollars per hundred. Three hundred trees, growing upon one acre of ground, at the expiration of twenty-five years, will produce five thousand rails, and be worth, at a low estimate, three hundred dollars. The rent of an acre of ground, for twenty-five years, at three dollars per annum, will be seventy-five dollars. Allowing the stakes cut from among the growing locusts, and the top branches of those cut down for rails, to be a compensation for the trouble of rearing and protecting them, and there will be a clear profit of two hundred and twenty-five dollars per acre. To this should be added the saving of labor, in making and repairing of fences, with rails of such great durability, compared with that which would be necessary to keep in repair fences made with rails, which would not last half as long.

But this is not the only saving. In the fertile parts of Kentucky, where good rail timber is not very abundant, it is necessary to keep one third of a moderate sized farm in woods, to supply rail timber and fuel. A few acres, planted with locusts, after they shall have attained a suitable age, will supercede the necessity of keeping woodland for rail timber, and only enough for fuel need be reserved. A large portion of what now lies in forest may be converted into arable land, and thus the profits of the farm may be much increased.

In the foregoing estimate, I have supposed locust rails would last only twice as long as those made of the ordinary timber of our rich lands. But from various proofs of the durability of this timber, contained in the work of Mr. Withers, before referred to, I am satisfied I might have safely estimated that one set of locust rails, would outlast three of the ordinary kind. At page 87, Mr. Withers gives a well authenticated account of a locust post, fifteen inches square, which had stood in the ground seventy eight years, and was perfectly sound "with the exception of half an inch at the place where it had stood even with the surface of the ground." Other very decided proofs of the great durability of this timber are afforded by the work of Mr. Withers, to which I do not now deem it necessary to refer.

Estimating, then, that one set of locust rails will last as long as three sets of the ordinary kind, the profits arising from the cultivation of the locust, upon the data furnished above, will be very great, and beyond all comparison with those arising from any other species of farming. I have hitherto spoken of the value of locust timber only for farming purposes. Mr. Withers has shown, that it is of great value for a variety of other purposes, and among others for ship building. And for this purpose, it is not only valuable for its great *durability*, but also on account of its great *strength*. From a series of experiments, made at the harbor of Brest, the great naval port of France, by the proper naval authorities, it was ascertained, that "the *strength* of acacia (locust) to oak is as 1427 to 820—the *elasticity* is as 21 to 9." This shows its great superiority to oak, both as respects *strength* and elasticity. (p. 296.)

The following extract will be found, at page 208, of Mr. Withers' work. It is taken from a treatise of Mr. Cobbett, on the locust. "It (locust timber) is absolutely indestructible by the powers of earth, air, and water. Its strength far surpasses that of the very best of our spine oak. It is to this timber that the American ships owe so great a part of their superiority to ours. The stanchions round the deck are made of locust; and while much smaller than the stanchions of oak, will resist a sea three times as heavy as the oak will. The tiller of the ship is made of locust, because it demands great strength, and is required not to be bulky. For the same reason the martingales of ships are made of locusts; and if a ship had all its ribs, and beams, and knees of locust, it would be worth two common ships. Further, as to ship building, that important article, the *trunnels*, when they consist of locust, make the ship last, probably, twice as long as if the trunnels consisted of oak."

Trunnels are the pins, which are used to fasten the side planks to the timbers of the ship. Mr. Cobbett says, "the hardest of our spine oak is picked out for the purpose, and, with all that, we know that the trunnel is the thing that first rots; for the water, or at least the damp, will get in round the trunnel, and between it and the plank, and if water or damp hang about oak, the oak *will rot*."

The above extracts show the great importance of locust timber for ship building, and the great value of *trunnels*, made of the yellow locust. These, if prepared by splitting them out, of suitable size and length, and perfectly seasoned, would, probably, even at this time, be a profitable article for shipment to the great ports, in which ship building is carried on extensively. And as locust timber, in consequence of the extent to which it is used, for ship building, rail roads, and other purposes, must become more and more scarce, along the Atlantic frontier, that which is grown in the west will soon be in great demand, and its value enhanced in a corresponding degree.

Mr. Withers shows that for the purposes of fuel the locust is also very valuable. "Its wood is found to give out a much greater heat, during combustion, than that of any other tree." (p. 128.) This fact was ascertained by actual experiment. And the author of this essay can state, from experience, that even the smallest part of the brush of locusts, after a seasoning of one summer, makes a most excellent fuel, especially for kindling fires, heating ovens, stoves &c.

Although the climate of England is not so favourable to the growth of the locust as ours, yet its cultivation there is deemed of the utmost consequence, as is shown by various parts of Mr. Withers' interesting work upon the acacia, or yellow locust.

An idea may be formed of the growth of this useful timber, in England, compared with that of the Scotch fir, elm, ash, and birch by the following table, furnished by T. T. Vallence, Esq. and contained in Mr. Withers' work, page 246. The trees were seventeen years old, and the circumference of each was taken six feet from the ground.

	Heighth.	Circumference.
Acacia, or Locust	24 feet	33 inches.
"	34	34
"	33	23
Scotch Fir	32	27½
"	34	23
Elm	32	17
"	33	17¾
Ash	33	19¾
"	34	24
Birch	36	27¾

The average heighth of the locust, Scotch fir, elm, and ash was as follows:

	Heighth.	Circumference.
Locust,	30½ feet	26⅔ inches.
Scotch Fir,	33	25
Elm,	32½	17½
Ash,	33½	22

The locust exceeds either of the others, in circumference, and falls but little below them in heigth.

In the above table it will be seen that the locust compares very favorably with some of the most rapidly growing timber trees, in England. In the United States, it is believed its growth is much more rapid than it is in England.

The annexed table exhibits the growth of five locusts, planted in my yard, in April 1833, and consequently nearly eleven years have elapsed since they were planted. But as these trees were transplanted, when about three years old, they may be considered as of fourteen years growth.

	Heighth.	Circumference.
No. 1.	40 feet	29½ inches.
2.	43	30
3.	41	26½
4.	44	30½
5.	42	27½

Average heigth 42 f., average circumference 28 4-5 inches. When it is considered, that the above trees are three years younger than those mentioned in the table, furnished by Mr. T. T. Valience, and that they probably lost one year by transplanting, it will be perceived, that locusts are of a much more rapid growth in Kentucky than in England.

In every point of view there is the strongest inducement for cultivating this invaluable timber; and the farmers of the United States cannot too soon direct their attention to this subject. It is pre-eminently important to the region of country, in which there is such an extent of rich prairie, a large portion of which is so distant from timbered land as to be almost useless for purposes of cultivation. The great durability of locust rails will justify their transportation, to more than double the distance to which those made of other timber could be hauled. Besides, by enclosing and securing against fire and stock, a small plantation of locust timber, it could be reared in the very midst of the largest prairies. A sod fence would probably be sufficient to secure the young trees from cattle till they should attain a sufficient size to secure them against their depredations.

ON GRAZING AND FEEDING CATTLE IN KENTUCKY.

I cannot better illustrate this subject than by explaining, in detail, the practice of a very distinguished farmer and grazier of Bourbon county. Mr. H. has usually purchased most of the cattle, which he intends to feed, at such an age as will enable him to prepare them for market by the month of November or December, in the year next after he obtains them; but he some times finds it necessary to keep a part of them till the following year. He intends, in future, to raise a considerable number of stock cattle, from his own cows, his method of doing which, and the advantages he expects to derive from that practice, will be explained hereafter.

Cattle, intended for grazing and feeding, may be purchased, at any time, during the year preceding that in which they are to be prepared for market, after the spring grass has grown sufficiently to afford a luxuriant pasture; and the earlier they are purchased, in that year, the better, provided the grazier has an abundance of good pasture. They are to be put upon blue grass (*poa pratensis*) immediately, at the rate of one head for three acres, of well set and cleared up woodland pasture, from which all the small growth, and large timber, not fit for rails, must have been cut down, or deadened.

There is usually on grazing farms, a large portion of cleared land, set in grass, and it is best that the cattle should have the benefit of this, as well as the woodland pasture, to graze upon, but they should not be restricted to less than three acres each, for if more grass grows than they can consume, which is always the case, when the seasons are favourable, it will remain for winter pasture. Cattle should never be removed from the field or fields, allotted them, during the pasturing season, because it is important to keep them as quiet and still as possible, and experience shows, that removing them tends to make them less gentle, and to cause them to wander more in search of their food. If a large number are to be pastured, it is best to separate them into lots, not exceeding one hundred each, the number to be regulated by the size of their pasture ground, always allowing three acres for each head. In dividing them into lots, the largest cattle should be put in one range; the second size, in another, and so on. Being thus arranged they will not be so apt to drive off the weaker cattle from salt, in the summer, or corn in the winter.

The cattle are to be kept on their respective grazing grounds till the 10th day of December, when they are to be put in fields, on which they are to be fed during the winter. These fields should *always* be cleared ground, which is intended for future cultivation, so that they may receive the benefit of the manure, which drops from the cattle and hogs. When the grazing season is at an end, the cattle are to be carefully examined, and all those, which are intended to be butchered, the next year, are to be set apart for *full feeding*, and the residue are to be only *half fed*. Those that are to be *full fed* should be separated into lots, from fifty to one hundred each, according to circumstances. The smaller number will be best, if there are the necessary conveniences for feeding, in small lots. Each lot must have *two fields* to be fed upon, and the process of feeding will be as follows:

Each steer must have daily as much corn, fed with the fodder, as will be equal to half a bushel, shelled. This is what is called *full feeding*. Cattle not intended for market, the ensuing year, are fed half as much, which is called *half feeding*.

Mr. H. in cutting up his corn, puts 14 by 16 hills in a shock, and five of these (if the corn is tolerably good) will feed fifty head one day. But it is always safest to shuck and measure the corn, in several shocks, in different parts of each field, so as to ascertain their average product; and feed so many shocks as will be equivalent to half a bushel of shelled corn, for each steer, for *full feeding*; and half as much to those cattle, which are to be only *half fed*.

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In feeding, a wagon is used, with a long low bed (about 20 feet) so framed as that the fore part will rise above the fore wheels, and with hoops over those behind, to keep the corn from pressing on them. The bed, by means of shelving, extending a little beyond the wheels, so as to afford a good width to hold the fodder. The wagon is drawn by four stout oxen. Two hands accompany the wagon, (some prefer three, two to hand up, and one to load) one stands on the wagon, whilst the other hands up the corn. The hand on the wagon, commences loading on the forepart, laying up the corn as high as he can reach, and moving back, so as not to tread on the corn, but packing it down with his hands, as straight and regular as possible. Thus loaded, more can be put upon the wagon, and the corn can be thrown off with more regularity and speed. The wagon is now driven to the field, in which the cattle are to be fed; and while one hand drives slowly across one side of the field, parallel with the fence, the other commences throwing off the corn, alternately, on each side, about four stalks in a place, and ten feet apart. When the first line is completed, a second is to be commenced, parallel with the first, and ten feet therefrom. This is to be distributed like the first, and so on, in succession, until the corn, at the different feedings, shall have been regularly distributed over the whole field. A similar process is now to be commenced, in a contrary direction, if convenient; or in the same way with the first, if the ground and other circumstances render that most expedient, and so on until the time of feeding with corn shall have expired.

This mode of distributing corn, fed to cattle, is intended to afford them sufficient room, without pressing too much upon each other, and thus wasting the corn and fodder, by treading it in the ground; and for the purpose of giving to every part of the field a due proportion of manure. But if there are parts of the field, which require more manure than the others, a larger proportion of the feeding should be performed, on these, in order to render every part of the field as nearly equal in fertility as possible.

There must be two fields for feeding each separate lot of cattle, and they should be fed alternately, day about, in each of these fields. When commencing in the morning, one load of corn should be hauled and distributed before the cattle are let in, so that they may be engaged in feeding, while the second load is distributing. And as many loads must be hauled as will serve the cattle one day.

When, on the next day, the cattle are removed to the second field for feeding, the hogs, which are to follow the cattle, must be turned into the field, in which the cattle were fed the day before. When cattle are *full fed*, two hogs for each steer is the number that should follow the cattle. On the morning of the *third day*, before any corn is hauled into the field, in which the cattle were fed, on the *first day*, the hogs are to be called into the field with the cattle, that is the field in which the cattle were fed on the *second day*, where they will immediately commence feeding on the offal; and the cattle may be called into the field, from which the hogs shall have been removed, as soon as one load of corn is distributed. The same process is to be observed daily, with both cattle and hogs, in relation to the several lots into which the cattle shall have been divided, but only one hog to each steer should follow cattle which are to be only *half fed*.

On Sunday, instead of hauling out feed for the day, a second feed should be hauled on a *third field*, into which the cattle may be called, on Sunday morning, and the hogs into that in which the cattle were last fed.

If a *third field* should not be convenient for this purpose, the hogs may be called into the field, in which the cattle were fed on Saturday morning, after they are done feeding, and left with them; and the Sunday feed for the cattle may be hauled into the field, from which the hogs have just been removed, and the cattle called in on Sunday morning. A separate field, for Sunday feeding, is to be preferred, if there be one, because this admits of the cattle feeding the whole day, on Saturday, before the hogs are turned in; whereas, upon the other plan, the hogs will consume all the corn, which the cattle shall not have eaten, in the forepart of the day, and they will get nothing more till Sunday morning.

There should always be a gateway or bars between the different feeding fields, and if the latter are adopted, they should be entirely taken out, when the cattle are to be removed from one field to another, so that they may have no obstruction in passing from one field to another.

Spring pigs, that have been well kept, will suit to follow cattle the next winter. Those following *full fed* cattle will gain one pound per day, upon an average, during the feeding season—about one hundred and twenty days. Those following *half fed* cattle will gain not quite as much.

Hogs that are intended to follow cattle, are raised from good breeding sows, and should be sold as stock hogs, after following cattle one winter. When cattle are turned upon grass, the hogs should be put upon clover, and well salted. From the first of June, if not sold, they should have two ears of corn per day, till rye is fit to be turned on, and then upon oats. After these fail they should again be fed with corn, sufficient to keep them improving till the time for commencing fattening them.

They should now be full fed for seven or eight weeks, when they will be fit for market.

Mr. H. is of opinion, that a grazier can, with decided advantage, raise a considerable number of his stock cattle. His plan is as follows. He supplies himself with a good stock of cows, of the short-horned Durham stock. As these would be too costly to purchase of the full blood, a stock may soon be procured by breeding from a full blooded bull, of good quality, upon the best cows of the old stock, many of which are to be had considerably improved, by crossing with the old Patton stock, Mr. Sanders' importation of 1817, the Teeswater, and Herefords. Calves, from these cows, should have as much milk as they will suck till they are six weeks old. In the meantime the males should be altered, and the females spayed, at the age of three or four weeks. After the calves are six weeks old they should be allowed half the milk, be put on good pasture, and fed with a little corn meal.

At six months old, they should be weaned, put in a good fresh pasture, and fed with cut up corn, a shock to 25 or 30 calves. Once a week hogs may be turned in to pick up the offal. As the calves increase in size and age the quantity of corn should be increased; and they should be fully *half fed*, during the second winter.

Calves, of the improved breed, if well kept, may be made to weigh 500 lbs. at the age of twelve or fourteen months. The second year, they will gain 400 lbs; and the third 350 lbs. Thus the gain, each year, will be less than during the one preceding; and hence it is an important consideration with graziers to bring their stock into market as early as possible. This should be done, of the improved breed, the winter after they are three years old; but the common stock and half bloods must be kept six or twelve months longer.

Mr. H. is of opinion, that if cattle have been *full fed*, and are in fat condition in the spring, they will not gain, on the best of pasture, during the summer, enough to pay for their keep, outlay of capital, risk of death, &c., and consequently it would be most profitable to sell, at that season, unless the prospect of obtaining a better price, the ensuing winter, should hold out an inducement to keep them over the summer.

But cattle, which have been only *half fed*, should be pastured during the summer, as they will gain more than the cost of feeding, outlay of capital, and risk of death.

These, in general, should be *full fed* the following winter; but sometimes a favorable state of the market may render it prudent to sell in November or December.

One advantage, arising from the grazier raising his own stock cattle, in part, is that he can prepare them for market, at an earlier age; and can bring them to a greater weight, at the same age, than he can bring such stock cattle as are usually to be had by purchasing. The former can always be prepared for market at three and a half years old; whilst the latter, in general, cannot be properly prepared before they are from four and a half to five years old. Another advantage is that less active capital will be required than when you depend altogether upon purchasing stock cattle.

Mr. H. is of opinion, that a lot of *ordinary good* cattle, weighing, when purchased 500 lbs each, may be made to gain 500 lbs. by grazing and feeding them well, one year. But if of the improved breed, the gain will be more considerable, depending, however, somewhat upon the condition in which they were, when purchased. The gain may be four or five hundred pounds, on each; and, in extraordinary individuals, as much as six hundred pounds.

Cows, whose calves are weaned, should be grazed on winter pasture, and fed on corn fodder, but no corn. Those which give milk, during the winter, should be well fed, but care should be taken not to keep cows, designed for breeding, in too fat condition, as this would defeat the object intended. They may be kept, for this purpose, till they are ten or twelve years old, when they should be fattened and sold, or killed for beef.

Cattle should be regularly salted, at the rate of half a pound each per week, for those which are grown, and proportionably for those of smaller size. This is usually given, twice a week, by throwing it in handsfull, on the grass, at the distance of a few yards from each other. Cattle, when running on good pasture, fill themselves in the fore part of the day, and then lie down to rest, and ruminate their food; and again rise up to feed towards evening. They should never be disturbed, while thus lying down, to salt them, or for any other purpose. They should always be salted when engaged in feeding. Liebig, in his animal chemistry, has shown, very clearly, how important it is to keep all animals, intended to be fatted, in as complete a state of rest as possible. Hence the importance of furnishing cattle with an abundance of luxuriant pasture, so that they may quickly fill themselves, without the necessity of moving about much in search of their food, and of never disturbing them when lying down.

During a visit to several of the most distinguished and celebrated graziers of Bourbon and Clark counties, in the fall of the year 1842, I ascertained that the general practice of grazing and feeding cattle was similar to that described above. The variations were so slight and immaterial as not to require to be specially noticed. Most of these graziers preferred buying their stock cattle, at from two to four years old, and selling them off as quick as they could be prepared for market. Two years old cattle are kept from two to two and a half years. Those of three and four years old, are kept from one to one and a half years.

One grazier, having in his farm 1160 acres, all improved, was grazing 250 head of cattle, all of which would be ready for market in the spring of 1843. Two other gentlemen, with farms somewhat larger, were each grazing about the same number for *full feeding* the ensuing winter, besides a large number of younger cattle, intended to be only *half fed*.

I visited several other farms, of nearly equal extent, on which a due proportion of cattle were grazing, in the most luxuriant blue grass pastures. In one pasture I saw a small lot of cattle, of the improved breed, aged from four to five years, which it was estimated by a very competent judge, would average sixteen hundred pounds each, nett beef.

There was growing, on several of these farms, from two hundred to two hundred and fifty acres of corn. The crops were exceedingly fine, and were estimated to produce from 80 to 100 bushels per ecre. Whilst the same land, in 1838 and 1839—very unfavorable years for corn—yielded, upon an average, not exceeding forty or fifty bushels per acre.

Cutting up, and shocking corn, in the stalk, constitutes so important a part of the grazing system, that an explanation of the process is indispensably necessary to those, who have no practical knowledge on the subject.

In a very rich soil the corn should be planted in squares from three and a half to four feet, each way, leaving three to four stalks in a hill. Most graziers prefer the latter number, where the soil is in a high state of improvement, from having been long grassed and fed upon. If not in a high state of improvement, the larger distance should be allowed, and only three stalks in a hill. The cultivation should be so careful, as to suffer no weeds to grow up to seed among the corn.

When corn is cut up, it is put in shocks, containing from 14 to 16 hills square. The latter is the most usual number, and the following explanation of the process can easily be applied to any smaller number. The corn should not be cut till the husks are generally dry, and all the blades, except a few of those, on that part of the stalk above the ear. This is important to be attended to, for if the corn is in a green state, when cut up, the fodder will mould, and the grain become musty, and both will be greatly injured. When the period is near at hand for cutting up corn, some careful hands should be employed to tye the tops of the corn together, around which the shocks are to be made. This process must be commenced on one side of the field, in the eighth and ninth rows, and beginning at the eighth and ninth hills from the end, tying the tops of four hills together, with the blades; then passing over the next fourteen hills, in each row, and tying again, as in the first instance, and so on till the row is completed. The second row must be tied opposite the first, leaving fourteen untied rows between. Thus the whole field is to be tied in regular squares, and in such manner as to leave sixteen hills, each way, to constitute one shock. This process should be completed before the corn is ready for cutting up, so that all hands may be engaged in cutting and shocking as soon as the corn shall have attained the proper maturity. The weaker and less skilful hands should be employed in cutting the corn, throwing four hills together, with the butts as even as possible, and the other hands should follow, gathering the corn, and setting it up carefully around the hills, previously tied together, as above explained. In setting up the corn, the hands should be careful to set the first four arms full in the angles of the four hills, tied together, setting the butts a little out from the centre, and pressing the tops together. The residue of the corn, which is to constitute the shock, should be set equally around the four hills, giving it a little inclination inwards, towards the centre, and pressing the tops together, but great care should be taken to prevent any of the corn from leaning to the right or left. If this is not carefully attended to the shock will be apt to twist round, and open at the top, which will let in the rain and snow. But if carefully set up so as to have no inclination to the right hand or left, but leaning a little towards the centre, the shock will require no tying, and will preserve both corn and fodder from injuring. When the corn has attained the proper maturity, the process of cutting and shocking should be completed as soon as possible, as the fodder is liable to be much injured by rains and dews, by standing in the field, after it is sufficiently dried. Hence the advantage of tying the hills, a little before the corn is ready to cut up, so that all hands may be engaged in cutting and shocking. I have found the common round hemp hook the most convenient instrument for cutting up corn, though doubtless there are others that may answer nearly as well.

ON MAKING AND PRESERVING TIMOTHY MEADOWS.

Although timothy hay is not so good for feeding cattle and sheep as that made of some other grasses, yet for horse feed, in connection with grain, it is of very great value. By reference to my letter to Mr. Stephenson, upon the relative value of the most important grasses, it will be seen that timothy, (*phleum pratensis*) whether we regard the quantity of hay produced from a given quantity of grass; or the quantity of nutritive matter; or the product of hay, per acre, will compare favorably with any of the grasses, named in the tables accompanying that letter. By examining those tables it will be seen, that although lucern (*medicago sativa*) produces more hay, per acre, yet that the nutritive matter is less than half that of timothy hay, per acre. And that, taking into consideration the quantity of hay and nutritive matter, per acre, it far exceeds all the grasses in the tables, except one species of clover. This is the long rooted clover, (*trifolium machrorhizum*) native of Hungary. The product of this species of clover, both in hay and nutritive matters, (if no mistake has occurred, in the experiments made by Mr. Sinclair, under the directions of the Duke of Bedford) is astonishingly great. I am not aware that this species of clover has been introduced into the United States. The high character given it by Sir Humphrey Davy, as relates to the quantity of hay which it produces, and nutritritive matter contained in it, renders farther inquiry into its valuable properties of much importance. In product of hay, per acre, timothy falls but little short of this species of clover, and only about fifteen per cent., in nutriment.

Timothy has one advantage over all other grasses, with which I am acquainted, that is the little labor required to convert it into hay. If cut, when fully ripe, as it should be, it will cure in the swarth, and by using the horse rake, it will be prepared for cocking with but little manual labor. If the cocks are well made, they will turn rain so completely as to secure the hay from injury, thus affording ample time for stacking, or hauling it to the hay mough. It can be saved in stacks more perfectly than any other hay. To these advantages, it may be added, that it can be mowed with such facility, that a skilful laborer can easily cut two acres per day, when the meadow has a smooth bottom, and is clear of stumps. And it is of no little advantage, in making timothy hay, that the operation take place at the most convenient and leisure season for the farmer, just after he has secured his harvest, and before the busy season for hemp and tobacco has commenced.

These are great and decisive advantages, and strongly recommend timothy meadows to such an extent as will furnish hay, of this description, for all stock for which it is suitable.

For sheep and cattle, hay, composed of a mixture of Salem grass and red clover, would probably be found to be better adapted. But it is not the object of this essay to treat of these valuable grasses.

Timothy meadows are infested with a species of weed, commonly called the white blossom, which greatly injures them; and sometimes these become so numerous as almost to take the place of the timothy, leaving so little as scarcely to indemnify the cost of cutting and saving the hay.

The main object to be aimed at, in making timothy meadows, is to prevent this weed from getting foothold in them; and I will endeavor to point out the best means of doing so.

The white blossom is a biennial plant, and, I believe, never goes to seed the same year that it springs up. It usually comes up in the spring, when there is much moisture in the soil, but it may also vegetate in the fall, if the season is favorable. During the first year, it shows no indication of running up to stalk. In this stage of its growth it stands the winter as well as wheat or rye, and commences growing early in the spring, runs up to stalk, and begins to ripen its seed about the first of July, in latitude 39°. The ripening of the seed, on the same stalk, is very irregular. Those on the centre branch of the stalk will ripen about the first of July, while, on the lateral branches, manv of the flowers will be quite fresh late in that month. And hence, when there is much white blossom among timothy, if it be cut any time in July, the soil will be replenished with the seed of this troublesome weed, which will generally lie on the surface till the succeeding spring, when it will vegetate, and lay the foundation for a crop the following year.

If ground is prepared for meadow, by such careful cultivation, during the summer, as to destroy every plant of white blossom, which shall have put up in the spring, and shall be sowed in timothy, in the fall. this will afford no security against the white blossom, because there may still be seed in the ground, which will thereafter vegetate, and come up among the timothy, either in the fall or spring. That portion of the seed, which may come up in the fall, will run up to stalk and ripen the following year; and such as may not vegetate till spring, will lay the foundation for a crop the succeeding year.

If the ground should be prepared for spring sowing by ploughing so carefully, the preceding fall, as to destroy every plant of white blossom; and the operation should be repeated in the spring, so as to destroy every plant, which shall have come up, after the last ploughing of the previous year, you may expect your timothy meadow to be clear of white blossom during the following summer, that is such of it as shall have run up to seed. But if there was any seed left in the ground, which did not vegetate the previous year, more or less of it, would be sure to vegetate the following spring, after the last ploughing, and produce a seed crop the next year.

To secure timothy meadows, against this troublesome weed, it is necessary that the ground should undergo, during several years, such a careful cultivation as to prevent any white blossom from going to seed. This process must be continued until *all the seed* in the ground shall have vegetated. In the meantime no white blossom should be suffered to go to seed, in the fence rows, or grounds adjacent to the intended meadow, because, without this precaution, the seed of the white blossom, being very light, would be blown to the ground, which you are endeavoring to free from this noxious weed, and thus your efforts would be unavailing.

The length of time, during which ground should be cultivated, to free it completely from white blossom, depends in part upon the quantity of seed, in the ground; and in part upon the nature of the seasons, and mode of cultivation. If the season be dry, a smaller proportion of seed will vegetate. If it be a wet one, and the ground frequently stirred, a much larger proportion will vegetate. But still much of the seed may not have been thrown so near the surface, as to have been sufficiently exposed to the influence of the sun and air to cause it to vegetate. Besides nature seems to have provided, in order to perpetuate the different species of plants, that only a certain proportion of the seed in the ground, can vegetate at the same time, and hence there must be a succession of crops before all the seed in the ground will have vegetated. Hence, even with the most careful cultivation, and favorable seasons, where there is a large store of seed in the ground, several years may be required to cause its complete extermination. And if a farmer desires to have his timothy meadows entirely free from this great pest, he must persevere until he is assured he has exhausted all the seed in the ground.

When this object shall have been accomplished, the ground, for meadow, should be prepared and sowed late in August or during the month of September. It should be well pulverized by ploughing and harrowing, and laid as level as possible; and when sowed, the seed should be covered lightly with a heavy brush, which will leave the ground much smoother than a harrow. If the ground cannot be got ready to sow by the first of October, in latitude 39°, I would advise to have it completely prepared, before the fall rains render it too wet, and sow the seed from the first to the middle of February, without harrowing or brushing. The freezing and thawing of the ground will sufficiently cover the seed, and it will come up as soon as the weather is warm enough to cause it to vegetate. The only disadvantage of postponing sowing till spring is, that no crop will be obtained the first year. If ground, intended for meadow, is sufficiently strong for hemp, it forms a very good preparation for timothy meadow, as it leaves the surface level, and in good condition for the reception of the seed, which may be sowed upon the stubble, and harrowed in, and then brushed in the contrary direction, which will leave the ground very level.

But hemp ground is apt to have more or less white blossom seed in it. In that case it would not be judicious to sow timothy on hemp stubble, without previous cultivation, long enough to exterminate the seed which may have been deposited.

In making timothy meadows, it is all important to have perfectly pure seed. I would, therefore, advise, that every farmer, who intends making a timothy meadow, should commence by saving his own seed, as that which is to be had by purchase is hardly ever pure. It would be utterly unavailing to have the white blossom completely exterminated from the ground, intended for meadow, if he were to sow timothy seed; not perfectly pure; and if he were to bury his seed, the chances would be ten to one that he would have mixed with it a portion of the white blossom.

To guard against this, let every farmer save his own seed. To this end he should mark off, in a timothy meadow, as much ground as will furnish what seed he may want to sow, which is as free as possible from white blossom. This should be done when this weed is in full bloom, and he should then go over the space selected, and carefully cut off, with a knife or sickle, every stalk low enough to remove every blossom. In mowing the meadow, the part, thus selected, should be left to get fully ripe, when it should be reaped, carefully avoiding to cut either dock or white blossom, if perchance any should have been left, and bound in small sheaves. These should be set up in long shocks, and, when in a proper state for threshing, hauled to the barn or a dirt floor, threshed and cleaned. It is very important that timothy should be thickly set, over every part of the ground, and that no vacant places should be left. It is better, therefore, to sow too much seed rather than too little. Six quarts of good, well cleaned seed to the acre is abundantly sufficient, if regularly distributed; and I would not advise sowing less, as thick sowing makes the best meadow, and has a tendency to keep out weeds.

After all the care that can be taken to exterminate the seed of white blossom, it may happen that some few may be found growing up to blossom, among the timothy, the first or second year. If such should be the case, they should be carefully pulled up before any of the seed ripens; or, if so numerous as to render the process of pulling them up too tedious, I would advise to cut the first crop of timothy before any part of the seed of the white blossom shall have ripened, say about the latter part of June. The hay will not be so good as if the timothy were ripe, but it will be the means of making all the subsequent crops better, by extirpating a great pest. If some few of the white blossom should appear the next season, they should be carefully pulled up before they ripen. It is not probable that any seed will now remain in the ground, near enough to the surface to be able to vegetate, and consequently the meadow will be free from white blossom, provided there is none in the adjacent fields, near enough to blow into the meadow.

Timothy meadows are also liable to be infested with dock. This, though far less injurious than the white blossom, ought to be extirpated. Dock may be destroyed by cutting off the top of the root, with broad hoes, towards the latter end of April, when the timothy is about ancle high. If the top of the root is cut off, at this period, to such a depth as to remove the entire spring growth, the timothy will have grown so much, before new shoots will put out from the root, as to very much check and smother them. And if any should still run up to seed, it will not have time to ripen before the timothy is fit to cut. By repeating this operation, should any dock still appear the next year, it will soon be extirpated.

Elders are also, at times, troublesome to timothy meadows. These may be destroyed by repeatedly cutting them, or, if large, they must be grubbed. They should be cut off, just below the ground, with sharp broad hoes, at the time directed for cutting dock. Such as may put up afterwards will be so young and tender, at mowing time, that they can be easily cut off with scythes, and, on no account, should any be left standing, at that period. Such as may put up, afterwards, may be cut with hoes late in the fall, or the ensuing spring, as above directed. This mode of treatment will soon extirpate them.

To keep timothy meadows clear of other weeds, no other care will be necessary, but to cut them clean at each annual mowing time. The practice of leaving these standing in fence corners, around stumps &c., when mowing, is very prejudicial to meadows, and should be carefully avoided.

Having thus carefully guarded against injuries, to which timothy meadows are liable from several injurious pests, it should next be the care of provident farmers to preserve them, in such a state of fertility, as to make them produce abundant crops. By reference to the article on grasses, referred to above, it will be seen, that the product of hay, per acre, from timothy, when properly cultivated, is very great. But to produce very large crops, the ground must be adapted to the growth of this species of grass; must be well set; and free from dock, elders and weeds. But it must be borne in mind, that timothy requires more of the *inorganic* manures than most of the other grasses, such as silica, potash, soda, &c. Now if the hay is every year removed from the meadow, it is evident these ingredients will in time, be so much diminished as no longer to leave in the soil a sufficient quantity to supply *abundantly* the growing crop of timothy, and hence there will be a gradual diminution of crop, unless proper means are resorted to, to restore what shall have been removed in the form of hay. To guard against the loss of these essential ingredients, as much as possible, a second crop of timothy should never be cut, but should be pastured by sheep, calves, &c. which will convert the grass into manure.

If the hay, or a part of it, should be fed upon the ground, on which it grew, it would be advantageous in preserving to the soil those ingredients, which are so essential to the production of luxuriant crops. This may not always be convenient, and hence the importance of supplying to timothy meadows a quantity of silica, potash, soda, &c, equivalent to the quantity removed, by taking off the crops of hay. These ingredients exist abundantly in ashes, and hence these (leached or unleached) are very important. On every farm many of these, in an unleached state (which are far the most valuable) might be collected from places where logs and brush have been burnt, and applied very profitably to timothy meadows. In clearing up woodland for pastures, the logs, brush, &c. might be piled and burnt at a season when it would be convenient to apply the ashes as manure to timothy and other meadows, and if hauled and spread before they shall have become leached by rains, they would be of very great value, for being leached on the meadows the soil would receive the full benefit of the potash and other ingredients, capable of being dissolved by water, as well as those of a fixed nature, whilst the former would be lost, if the ashes were permitted to remain exposed, for any length of time, where the logs and brush were burnt.

Stable manures also contain silica, potash, &c., though not in such abundance as ashes, and hence are very useful to meadows on this account as well as for other valuable manuring ingredients. The application of these to meadows are very beneficial, though they may, in general, be more profitably applied to other parts of the farm.

Harrowing timothy meadows, as early in the spring as the ground shall be dry enough for the purpose, with a heavy harrow, and well sharpened teeth, is of considerable advantage, especially after they shall have been of several years standing. This operation should be performed both ways, and with such a weight on the harrow as to cause the teeth to cut the turf to the depth of an inch or two.

No stock should be suffered to run on timothy meadows, after the month of December, except when the ground is frozen. Thus treated the soil will be lightened by the winter freezing, and will be in proper condition for the application of the harrow. The grass will spring up early and cover the ground so as to protect it, in a great degree, from the effects of an early drouth, and thus secure to the provident farmer a fair crop, even in the most unfavorable season, and a large one in those which are of a medium character.

ON THE CULTIVATION OF WHEAT.

It is not my intention to write a regular essay on the cultivation of this valuable grain, but to make some suggestions as to the probable cause of this crop being so uncertain, in the rich soils of Kentucky, and upon the appropriate remedy for so serious an evil.

These soils are remarkable for their great depth of rich vegetable mould. Liebig says, that soils particularly rich in humus are not favourable to the growth of wheat. He instances many parts of Brazil, "where the soils are particularly rich in this substance." The stalk, he says, "attains no strength, and droops prematurely." "The cause is this—that the strength of the stalk is due to *silicate of potash*, and that the corn (wheat) requires *phosphate of magnesia*, neither of which substances a soil of humus can afford, since it does not contain them." (organic chemistry 198.) According to this highly distinguished writer on agriculture, *silicate of potash* is essential to the formation of the *straw* of wheat, and *phosphate of magnesia* to the formation of the *grain*. Now if there be a deficiency of these ingredients, in our rich soils, in which humus so much abounds, we, at once, perceive the reason why they are not well adapted to wheat. But cannot this defect be remedied, by supplying our soils with a due proportion of *silicate of potash*, and phosphate of magnesia? The former abounds in the ashes of all vegetable substances. The application of ashes, both leached and unleached, to soils, upon which wheat is intended to be grown, would be of great service in supplying an ingredient, which is so essential in the formation of straw. As grasses and straws of all kinds contain silicate of potash, the manure from stock, fed upon them, will contain this substance; and the application of such manure to lands, intended for wheat, will, consequently, be beneficial. In cutting wheat as much of the straw should be left on the ground as can be, consistently with a due economy in saving the grain. Sickles should, therefore, be used in preference to cradles, as the former leaves a much heavier coat of stubble on the ground.

After the wheat is threshed, all the straw, or the manure formed from it, should be given back to the soil. When it is considered that silicate of potash is of such a fixed nature that it cannot escape, in the form of gas, it will be perceived that a little attention will enable the prudent husbandman to keep his land supplied with a due proportion of this ingredient.

For the formation of *grain*, phosphate of magnesia is required. This is found in the bones of all animals, which contain also other substances of great value as manures. Bones of every description ought, therefore, to be carefully collected, pounded fine, and applied to lands, on which wheat is intended to be sown. Manures, formed by the consumption of grain by man and beast, contain phosphate of magnesia, and ought to be carefully saved and applied to soils intended for wheat. Human urine and phosphoric acid, are also of great value for this purpose, as was shown in the essay on the system of agriculture adapted to Kentucky. (p. 137—142.)

A liberal cultivation of clover is highly useful, in this respect, as this crop requires only a very minute proportion of the silicate of potash to sustain its growth; and by feeding it off, on the ground, or suffering it to fall down and rot, it not only restores all that it had extracted from the soil, but also what it had derived from the atmosphere, thus increasing instead of diminishing the quantity of alkali in the soil. (see p. 142.)

The supplying of a soil with a due proportion of the silicate of potash and phosphate of magnesia, is attended with another beneficial effect. Liebig tells us, that in furnishing a soil with mineral elements, "we give them the power to appropriate *carbon* from a source which is inexhaustible; while in the absence of these elements the most abundant supply of carbonic acid, or of decaying vegetable matter, would not increase the produce of a field." The inexhaustible source, here alluded to, is the atmosphere, one of the component parts of which is carbonic acid. He remarks, that by supplying a soil with a due proportion of lime and ashes, the amount of carbonic acid absorbed by a plant, from the atmosphere, in a given time, is limited (only) by the quantity which is brought into contact with its organs of absorption. (Familiar letters on chemistry, p. 46.)

As carbon is a valuable ingredient in all manures, it is obvious that great benefits must result from furnishing soils with mineral elements, which will enable the plants, growing in them, to obtain an inexhaustible supply of so valuable an ingredient.*

The wheat crop in Pennsylvania is found to derive great benefit from the application of lime to soils, upon which it is intended to be sown. One of these benefits is shown above. Another, probably, arises from the fact that lime is one of the alkaline earths; and it has been seen, that where there is a *deficiency of one alkali, another* may be substituted in its stead. (see p. 229, 230.)

Although Liebig, in the quotation above, speaks only of phosphate of magnesia, as being essential to the formation of the grain of wheat, yet in his familiar letters on chemistry, (p. 51) he attributes equal importance to the *phosphate of lime*. He remarks, that "a field, in which phosphate of lime, or the alkaline phosphates, form no part of the soil, is totally incapable of producing grain, peas or beans."

The foregoing suggestions will, perhaps, be sufficient to attract attention to the importance of applying the appropriate remedy for the better adaptation of our rich vegetable soil to the wheat culture, and what that remedy should be.*

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*See letter to Mr. Ruffin on the importance of alkalies in soils, p. 225.

THE MODE OF FEEDING ROOT CROPS TO SHEEP, &c. &c.

Believing that the following letter, addressed to me, by Mr. Lewis Sanders, of Grass Hills, Kentucky, would be eminently useful to the Agricultural interest, I solicited, and obtained leave from him to introducee it into the volume of essays, now presented to the public. Mr. Sanders is doubtless correct, in the opinion expressed in relation to the unsuitableness of timothy hay as food for cattle and sheep. But I am decidedly of opinion, that it is of great value, as food for horses and mules, when cut for hay, in its ripe state. Its great amount of nutritive matter, in its seed state, as shown in the essay on grasses, together with its large product in hay, and the ease with which it can be saved, are certainly strong recommendations.

Red top is an unproductive grass, in dry soils, but is well adapted to marshey and wet lands. In such situations it produces heavy crops. I have not sufficient information, to be able to speak of its suitableness for feeding cattle, sheep, &c.

My views, in relation to the kinds of sheep, most suitable to our circumstances, are given in the general essay on the agriculture of Kentucky. (see p. 38.) Although the manufacturers of coarse fabrics, in Kentucky, such as Janes, &c., make little or no difference between fine and coarse wool, yet there is, within the reach of the grower of fine wool, a much better market for that commodity. No article will bear the cost of transportation better than fine wool; and it can be sent, with but little expense to the east, where it will command from thirty-five to forty-five cents per pound. There is moreover, reason to believe, that the demand for fine wool will be rapidly extended, under the wholesome influence of the tariff of 1842, which has already caused a number of new manufactories of fine wool to spring up; and these will gradually extend themselves into the West. Such already has been the influence upon the demand for fine wool, that a number of purchasers from the East are seeking for the article at the doors of the sheep growers of the West. I have sold my crop of merino wool, of the present year's clip, *at home*, for a price within a fraction of fifty per cent. more than it netted me, last year, *at Philadelphia.* There will be scope enough, therefore, for the growers of fine as well as coarse wool. The latter will doubtless do best in the neighborhood of large cities, where there will be a ready market for mutton. On the other hand, fine wooled sheep will be more suitable for the mountain regions, where mutton will be of minor consideration. It must always be borne in mind too, that animals consume food in proportion to their size. The same pasture that will sustain a dozen Bakewells, will probably keep nearly twice that number of merinoes in good plight. The latter will, therefore, afford something like two fleeces to counterbalance one of the Bakewells.

GRASS HILLS, KY., Nov. 9, 1843.

To Judge Beatty:

SIR: Your letter of the 2d inst., asking me for my views relative to the cultivation of orchard grass, red clover, turnips, and cabbage, was duly received. I will do the best I can in response, as it gives me great pleasure to do any thing I can in that way to oblige you, to whom the whole agricultural community are under so many obligations for your labors to improve their condition.

As to Grasses.—I think it is safest to sow orchard grass seed early in the spring, as soon as the ground can be prepared, after it is freed from the frost. If sowed in the fall, it comes up well, but three years in four is killed by frost the first winter. The better the preparation, the surer of success. The seed is quite light, and care should be taken to give a uniform cast over the ground; this is a windy season of the year, but early in the morning and in the afternoon the wind is often stilled. One bushel of clean sound seed *uniformly* cast over the ground is sufficient for an acre, but if the preparation of the ground is slovenly, or if the quality of the seed is not known to be good, it is best to increase the quantity. Three pints of red clover seed, sown at the same time, (the laying off to sow the orchard grass, will answer to sow the clover,) on the same ground, will be of great advantage, either for hay or for grazing; the seed not to be mixed, but sown separately.

I have succeeded very well in sowing these seeds on wheat ground in February, but have sometimes failed. The same may be said if sown on oat ground.

I recommend to farmers, that are disposed to cultivate the orchard grass, to prepare a few acres with care, early in the spring, ploughed and harrowed to a fine tilth. Sow as above directed with orchard grass and red clover *only;* it should be well put in with harrowing and cross harrowing, or with a brush. Towards the end of the month of June following, pass over the ground regularly with a grass scythe, mowing uniformly as if for hay. This ought not to be omitted; it cripples, if it does not destroy, the weeds, giving the young grass the advantage of them. Thus treated, there will be most superior grazing for young stock the next fall. The second summer yields a good crop of seed, from ten to fifteen bushels per acre and often more. Every farmer ought to raise his own seeds for his main sowings; not having to buy his own seed, he may sow how and when he pleases, and learn from experience.

I have not known any person that has cultivated orchard grass, (except Mr. Berry, of Henry or Oldham county,) but thinks it the best of all the grasses he has tried. Judge Peters, who, in his lifetime, was at the head of all agricultural improvements in Pennsylvania, gave it greatly the preference over all others. Col. John Hare Powel, the spirited promoter of agricultural improvements in Pennsylvania, since the days of Judge Peters, entertains the same favorable opinions of orchard grass as his distinguished predecessor, and has published several valuable essays tending to prove its great utility.

1st. Orchard grass pastures are ready to afford stock a *full bite* in the spring, ten to twelve days sooner than blue grass.

2d. When grazed down in the summer, and the stock taken off, it will be in condition to receive stock again in less than half the time that blue grass would require; on good ground, in warm weather, orchard grass being fresh cut, will grow more than an inch in twenty-four hours.

3d. It stands a long pinching drought much better than any other grass. I attribute all its good properties, its early growth, its powers of reproduction, and its capacity to withstand a drought, to its abundant strong roots.

As soon as the top seed are ripe, which is easily discovered, it should be expeditiously cut; if left to stand, much and the best seed is lost by shattering out. Use a cradle or a sickle, passing over the heads of the clover, nothing is gathered but the seed and stem; tie up in bundles or sheaves, and put into shocks for a few days, to let the moisture dry up; then haul to a treading or threshing floor. As soon as the seed is cut, introduce the scythe for hay, the sooner the better, as a second crop will follow and be better than the first, of the best sort of hay for any kind of stock that eats hay. But if it is not convenient to cut for hay at that time, there is no great loss in letting it go uncut, as nothing perishes but the stump of the seed stem. The blades (unlike timothy) continue to grow on, ready for the scythe at any time, but the yield will be considerably greater by taking off two crops for hay.

I use two wire riddles for cleaning the seed, one coarse, the other finer, and a third one when the seed is put up for sale. The seed should be spread on a plank floor for a few days to cure. It may then be put into barrels, but not into a large bulk for some time.

Blue grass has very fine long roots, drawing nourishment from a distance. Its seed ripen in June, after which it is of very slow growth, but revive with the moist weather in the fall.

White clover is pretty much of the same character, except that it has not the long fibrous roots of the other. They are both very rich succulent grasses, and of great value on every farm. I think both may now be classed as indigenous to Kentucky. Whatever may have been the fact when the country was first settled, as far as my observation has extended, by clearing or deadening the timber so as to let in the sun and the hoof on the soil, these two grasses make their appearance.

Timothy is more extensively cultivated for hay than any other grass in the State. I do not cultivate it, believing that the hay is of little or no utility. It was remarked by old Thomas Gough, that he would prefer giving his cattle dry leaves from the forest, in the latter part of the winter, to giving them timothy hay. I heard Gen. James Shelby say that a feeder might take any number of bullocks, ten to a hundred, commence feeding at the usual time in the fall, and give them daily as much timothy hay as they could eat, until it was time to put them on grass in the spring, and then the cattle would not be worth as much as they were in the fall when the feeding on timothy hay commenced. I am of the same opinion. Old Mr. Gough and Gen. Shelby are good authority to the feeders of Bourbon, Clarke, and other counties. The crop of hay is consumed, the labor in feeding is lost, risk of life of the bullocks, interest of money, and the depreciation in value, altogether are of some magnitude against timothy hay. I know that sheep fare no better on timothy hay than cattle.

Red-top or herds' grass vegetates late in the spring; I look upon it as a poor and very inferior grass, and upon uplands to be but little better than nimble-will. It is said to be appropriate to wet lands, of which I have no experience.

As to Turnips.—New ground well prepared, or old land made rich by manure, will bring turnips; without good ground and good preparation, a good yield may not be expected. New land, owing to the undecomposed vegetable matter mixed with the surface soil, prevents the formation of crust or baking, a much greater drawback on a turnip crop than the fly. Upon inferior lands, after turnip seed are sown and harrowed or brushed in, the first rain causes a crust, or baking, as it is generally termed. If the seed sprout, and the tender plant gets up through this crust and forms two to four leaves, it is held then as if tied around its little stem by a string, until the fly eats it up. In new, or old land made rich, this baking or crust does not so readily form; the young and tender plants, not being so impeded, grow off at once, and as soon as they get six leaves the fly can do them no injury. I have rarely known a crop to fail if sowed in season on new land, well ploughed. I seldom fail in raising a good crop on old land.

Procure carefully saved seed, of the common large fall turnip, such as I have seen growing since the first settlement of the country, and sow in the usual way in the month of July—

the middle of the month I prefer. Harrow with a light harrow, or brush them in. No after culture is necessary, unless weeds appear to injure the crop, and if so, chop them down with the hoe.

Just before winter sets in, (white frosts do no injury, and they can bear a moderate freezing of the earth,) the crop should be gathered and secured for winter feeding. Haul the turnips with the tops, to the side of a fence, or to the middle of a field, pasture ground is best, to be enclosed by a fence, where it is most convenient to feed them out, by throwing them over the fence, on sod land; any other would become too muddy in warm wet weather. Cut off the tops, to be fed at the time or soon after, as they heat and spoil if let lay too long in bulk. Form heaps of the turnips, near the fence, for the convenience of throwing over, of forty bushels, larger or smaller will do just as well; if made on sod-land so much the better. Then cover the heaps of turnips with straw of any sort; a foot thick is sufficient. If straw is not to be had, cut-up corn-fodder will do; no earth is necessary to be put on the heaps. When the grass fails commence feeding turnips. Throw over the fence as many as the stock will eat up clean, morning and evening, no matter what kind of weather; the straw or covering may be parted and access had to the turnips. I know that turnips may be thus kept through the winter; such a winter as the last would freeze some of the outside ones, but in the middle of the heap they would be sound. Eight hundred bushels per acre may be called a good crop. With superior cultivation, and a favorable season, a much larger quantity may be produced. Turnips weigh 72 lbs. to the bushel; giving 57,600 lbs. of good succulent food (besides the tops) for winter feeding per acre.

Cabbage, unlike turnips in one respect, do not head well on new land, but do best in very rich old land. To insure a good crop of cabbage, the ground must be heavily manured and well ploughed, by all means *trench* ploughed, then levelled and smoothed by two or three harrowings. The planting of winter cabbage should be so regulated as to have the crop as near maturity as you can by the middle of November. If ripe earlier, many will rot, and not keep through the winter. Some sorts will mature in less time than others. The true time of setting out the plants can be ascertained only from experience: difference in soils, in preparation and culture, in climate, and in the sorts cultivated, all have their bearing and effect as to the time of maturity. I would rather take them up a little before than after being ripe. Unripe ones will grow and head after being put away, and over-ripe ones will rot. I cultivate the common drumhead in the main, with a small portion of green curled savoy, setting out the plants about the first of June. The ground being well prepared, with a smooth surface, lay it off in rows, three feet apart, with a light one horse plough, the single coulter is the best; lay a garden line across the rows at right angles, and plant by the line, when one row is planted remove the line three feet, and so on till finished. The planting should be carefully and accurately performed, so that the after culture may be easily done with a one-horse plough. The better the cultivation is, the larger and heavier will be the plants. This gives to each plant nine superficial feet, and four thousand eight hundred and forty plants to the acre. If the ground is as good as any farmer may make it, with sufficient cultivation, (little if any more than a corn crop should receive,) the plants will average, stalk, leaves, and head, twelve and a half pounds, and may be made to average fifteen pounds or more. The first named average would yield sixty thousand five hundred pounds. Thirty tons of green succulent food, so highly important for young stock in the winter and spring, before pastures are ready for them; more particularly for cows giving milk, ewes suckling lambs, and for sheep fattening for the butcher.

Towards the end of November secure the crop, pull up by the roots, and haul to the place intended for feeding out, near to a fence row, or to the middle of the field, as suggested to feed turnips. Commence a long *rick* on the sod, within three feet of a fence, by laying two rows of cabbage down, head to head, with the outer leaves well gathered around the head; (make one or more ricks, to suit the size of the crop,) then lay another row on the first, with the heads out, the roots meeting in the middle. Two double rows being thus snugly and compactly laid, fill up with fine earth the spaces between the stalks, covering them evenly, so as to let the earth extend a little on the heads of the last course. Then lay another double row with the heads in, as at first, on this double row lay another with the heads out, as was laid the second double row, then cover the middle with earth as before. Build on in this way five or six feet high. When up to the square, the top or finishing course should be laid with the heads in, and lapped one past the other, drawing the roots a little in from the outer edge; then cover the heads with earth making a ridge the whole length, and the rick is finished. The earth used in filling and levelling up, makes a trench on the sides and ends that serves to draw off any moisture. Protect the rick with a good covering of cut-up corn fodder, on the sides and ends, and a good covering of straw for the top which forms a roof. Feed the outside heads first, which may be done in any sort of weather by putting aside the fodder, cutting off the heads with a spade or other suitable tool, and throwing them over to the stock. When all of the outer heads are fed away, then commence at one end of the rick; begin at the top and come down to the ground, filling up the trenches evenly as you go along. In making the rick, many waste leaves will be in the way which should be thrown over the fence at the time, giving the stock a chance to eat them. If you find the cabbage and turnips keep well, reserve as many as you can for March and April, two of the most trying months on stock.

Every farmer ought to save seed for his own use. I know from long experience the many evils resulting from dependence on *chance* for a supply; it is a mere chance if your expectations are realized in the produce of seeds purchased. At the time of putting away the turnip crop, select a dozen or more good ones for seed, set them out in a row 18 inches apart in ground fresh ploughed or dug for the purpose, the crown about an inch below the surface; cover the row with a good coating of straw, and when the frost is fairly out of the ground in the spring, remove the straw. To raise cabbage seed, do the same; setting out in the fall is much better than to defer it till spring.

As to Sheep.—I have had some experience in this stock, having handled them for forty years. In 1814, I owned a large flock of Merinoes, then selling the cullings of the flock for over a hundred dollars each at public auction; true it was a time of war, and I was paying two dollars per pound cash, for all the Merino wool I could get, in its natural state too. In three years thereafter (1817) I sold (or the sheriff did for me) the selected flock of Merinoes, upwards of three hundred head, for two dollars each. This flock, that brought a little over six hundred dollars, would have produced three years before upwards of thirty thousand. But peace having taken place in the mean time, and the repeal of the double duties (war duties) in 1816, knocked the Merinoes in the *head*, as it did the manufacturers. It is no longer, it seems to me, a question as to which is the best breed; that, I think, is settled by the price now paid for wool. I have seen wool purchased in Louisville, by the Andersons and by James Cromey, at a very low price; paying no more for the *finest* than for the *coarsest* grades. A stapler could select from these purchases *pick-lock* to all grades below, yet all purchased at the same price. When coarse wool is selling from 7*d.* to 8*d.* in England, the finest grades are worth 2*s.* 9*d.* to 3*s.* 6*d.* per pound; and why this great difference in price? Simply because nature does not allow fine wool to grow on a large carcass, and the small carcass pays too litle from the butcher to justify keeping them. Notwithstanding the high price paid for fine wool in England, her agriculturists will not produce it, as the fleece even there will not (alone pay for their keeping. Attempts were made there to grow fine wool; Merinoes were introduced, and Dr. Parry made the trial of crossing them on the famous Southdowns, but at length had to abandon them for larger carcasses.

As we cannot now get more for fine than for coarse wool, that, I think, should settle the question for the present at least. The breed that produces the heaviest fleece and the largest carcass will bring to the farmer the most money, and therefore should be the breed preferred to all others. The name is not of consequence, Bakewells, Cotswolds, or Southdowns, no matter which; a heavy fleece and large carcass should be the aim, but symmetry of form is by no means to be overlooked. Sheep are short-lived animals, arriving at maturity at four years; some breeds sooner; no improvement afterwards. This is the age to sell. At shearing time put all the four year olds to themselves, both ewes and wethers, give to them the best pastures, and when winter sets in, feed, to fatten for the butcher, in the best way that the farm allows. They may be made marketable from January to May, and if well managed will bring double the money they will do in the ordinary way. The four year olds being sold off, their place is filled by the lambs, so that the flock on the farm is always increasing in value. If kept over four years old, they remain stationary for a year or two, then decline every year in fleece and flesh until they die. The last few years the fleece is too poor to pay for the keeping, so in the end there is a total loss in the keeping of old sheep.

The fattening ewes ought to have the buck first of January. If it is the interest of the farm to increase the number of sheep, some of the best of the ewes may be kept till six years old, but not longer.

I have lost more sheep by housing them in the winter, and more lambs by folding the ewes at yeaning time, than from all other causes. Sheep ought to be protected from the sun in summer, not however, by housing them.

Sheep are free from any sort of disease in this State; no rot, (a disease of the foot,) as prevails in England; no scab, as in Spain; if an ill-looking flock is met with, it comes of neglect, but mostly by poverty or old age.

LEWIS SANDERS.

TESTIMONIALS.

AGRICULTURE.—"Essays on Practical Agriculture, including his Prize Essays, carefully revised. By ADAM BEATTY, Vice President of the Kentucky Agricultural Society. Maysville, Ky., Collins & Brown, 1844."

The above is the title of a volume of 293 pages, lying before us. It contains essays on the agriculture of Kentucky; the system of agriculture best adapted to Kentucky; on the cultivation of Corn; of Hemp; of Tobacco; Rotation of Crops; Advantages of Manufactures to Agriculture; Breeding of Horses for Agricultural purposes; on the nature of soils and the means of rendering them fertile; on food for plants and whence derived; on the means of reclaiming and preserving the fertility of soils; on the deterioration of soil and the means of renovation; on the relation of the constitution of soils to their fertility; on the importance of Alkalies in soils; on the relative value of the most important grasses; on setting woodland in grass; on the cultivation of the Locust; on grassing and feeding Cattle in Kentucky; on making and preserving Timothy Meadows; on the cultivation of Wheat in rich vegetable soils; and the mode of feeding root crops to Sheep, &c. &c. These essays embrace nearly every important subject on which a western farmer desires information.

Their author, Judge Beatty, is a gentleman of mature judgment, great common sense, and of deep research, who has devoted his attention almost exclusively, for years, to the cultivation of the soil, and to the elevation of "farming" into a science. He is pre-eminently a *practical* and *money-making* farmer, and the volume before us imparts, (though we have only glanced hastily over it) valuable knowledge upon all the topics of which it treats. We invite the attention of our Agricultural community to the work, feeling confident, that it will prove a valuable *guide*, to all who will follow its suggestions.

Western Citizen, Paris, Ky.

Essays on Agriculture. By Adam Beatty, Vice President of the Kentucky Agricultural Society. Printed by Collins & Brown, Maysville, Kentucky.

This is a work of some 300 pages on Agriculture, embracing the cultivation of Corn, Hemp, Tobacco, Grasses, the Breeding of Horses, &c. &c.

Judge BEATTY has a high reputation among the farmers of Kentucky for the extent of his agricultural information, and his experience, judgment and discrimination, as a practical farmer.

The work contains, also, essays from several other distinguished agriculturists of Kentucky, and cannot fail of being a valuable book to all who are interested in the cultivation of the soil. No subject can possibly be of more importance, more universally interesting, more beneficent, or more improving to man's moral nature, than the innocent and useful study of agriculture. And yet how much is it neglected?—*Cincinnati Daily Atlas.*

Essays on Practical Agriculture, including his Prize Essays, carefully revised. By Adam Beatty, Vice President of the Kentucky Agricultural Society. Maysville, Ky., Collins & Brown. 1844. pp. 293.

We have so often had occasion to commend the Agricultural writings of Judge Beatty, that our readers must be familiar with his name at least, if not the productions of his pen. The readers of the Kentucky Farmer, to the columns of which he was an able, valued and constant contributor, will not need one word from us, or from any one, in commendation of his work. We have no hesitation whatever in expressing the decided opinion that this volume of Judge Beatty's, is far the most practical and intrinsically useful, and especially for the Western farmer, that has ever issued from the American press. Its great and eminent characteristic is practical usefulness. Judge Beatty, in every essay but one, has written from the practical experience of more than thirty years; and on that one (grazing and feeding cattle) we know that he diligently consulted on the spot the experience of the ablest graziers and feeders in Kentucky. We well remember the pleasure and instruction we derived while attending him in a part of his delightful round among the graziers. Judge Beatty is one of those rare characters, combining with scientific learning practical knowledge derived from actual and long experience. Though a man of science, he has subjected his science to practical tests, rejecting as spurious that which did not stand the severest tests. In saying that Judge Beatty is a practical farmer, we do not mean merely that he is the proprietor of a farm; but that he is such from both study and personal labor. There is scarce any operation in practical farming which he has not for many years personally directed and practically performed. And the proof that he is an able, practical farmer, is to be found, not merely in his book, but in the improved condition and productiveness of his farm. There is indubitable proof; and we have been informed, on what we consider unquestionable authority, that his fields, under his system of culture, while they have annually yielded him satisfactory profits, have improved in fertility. It is from the practical example of such men, that others are to be benefitted. The book of Judge

Beatty presents that example in a style the most agreeable, because it is plain, clear, intelligible, practical, easily understood, so that any one may copy it. With this statement of our estimation of Judge Beatty and his book, for which the agricultural public will remain long indebted to him, we need hardly beseech any one to obtain a copy of it; for we feel assured that every one who hears of such a book, from such an author, will think it just as necessary to have it in order to improvement in his farming, as it would be to have a plough for the breaking up of his grounds. To give a further proof of the utility of the book, we copy the table of contents, which shows great practical judgment in the selection of topics. It will be seen that the essays embrace instructions on nearly every leading operation of Western farming:

Frankfort Commonwealth.

In looking over the foregoing pages, I find some typographical errors, which are corrected in the following table:

ERRATA.

Page.	*Line.*	
23	7	For "that" read "each."
26		This note is inserted *here* by mistake. Its proper place is page 78, where it is again inserted.
51	25	The word "the" surplussage.
85	29	For "have" read "leave."
96	5	For "unsound" read "sound."
96	10	For "unloading" read "loading."
111	14	For "water rotted" read "rotted."
112	22	For "223" read "233."
116	5	For "sed" read "sod."
117	2	For "answers" read "answer."
119	25	For "first" read "second."
129	36	The word "labor" after the word "more" wanting.
139	36	For "fur" read "fir."
146	15	For "affected" read "effected."
148	(note)	For "º 79" read "º 83."
162	31	For "this is" read "these are."
189	3	For "and" read "am."
202	39	For "crop" read "crops."
206	4	For "p 178–9" read "p 278–9."
224	12	For "grain" read "grass."
256	6	The word "not" surplussage.
267	19	For "Sunday instead of" read "Saturday, besides."
269	30	For "500" read "300."
274	8	For "mough" read "mow."
274	14	For "take" read "takes."
277	12	For "bury" read "buy."
287	29	For "revive" read "revives."
291	38	For "action" read "auction."

N. B. The number of pages in this vol. is not quite equal to the estimate, in the prospectus, (300) but there is more matter in the vol. than is contained in 300 pages of Johnston's Agricultural Chemistry.