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# THE CANADIAN AGRICULTURAL READER,

DESIGNED PRINCIPALLY

FOR THE USE OF SCHOOLS:

COMPILED FROM THE MOST APPROVED

AND

PRACTICAL AUTHORS,

BY A VICE PRESIDENT

OF THE

NIAGARA DISTRICT AGRICULTURAL SOCIETY,

AND

TOWNSHIP SUPERINTENDENT OF COMMON SCHOOLS.

PUBLISHED FOR THE PROPRIETORS.

NIAGARA:

PRINTED BY JOHN SIMPSON.

1845.

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## PREFACE

### TO THE

# CANADIAN AGRICULTURAL READER.

When the Spartan King was asked, What things he thought most proper for boys to learn? his answer was this:—"Those things they expect to do when men."

The principle involved in that wise answer has called forth this little work. The compiler has seen the youth of this country—seven-eighths of whom become, in the course of time, engaged in the noblest of mere earthly employments, the cultivation of the soil—pass through our schools without receiving the slightest instruction in that profession, to which they hope to devote the remainder of their days. Not one of the books, in which they learn to spell or to read, tells them of things which they can turn to profit in their future avocation; not one of them tells them of the improved modes of agriculture adopted by experienced farmers, or of the changes which the application of science to this art has effected since the time their parents first set out in life.

They are obliged to pick up instruction in these matters as they best can, and, not unfrequently, to envy the more highly favored lot of better instructed agriculturists, who, settling in their neighbourhood, with no better land and no harder labour, invariably secure better crops and raise better animals than they can.

In corroboration of this statement the compiler would refer to the farms of scores of scientific English and Scotch farmers, scattered over the country, compared with the farms of their surrounding neighbours.

The English and the Scotch farmer generally bring to bear upon our lands that improved system of agriculture, without which the farmers of England and Scotland could never live; and if the farmers of this country wish to thrive they must adopt the improved system, for their virgin soil is gone, and all the labour they can put upon their farms, without knowledge and judgment and science, will not enable them to raise the crops their fathers raised.

To give them, whilst at school, a mass of useful information on what is to be the business of their future lives, and at the same time a little insight into the improved system of agriculture, adopted by all scientific farmers, is the object of this work.

And if it begets in the young farmers of this country an anxiety to become better acquainted with what belongs to their noble profession, and induces them to peruse agricultural journals and more scientific works on the subject, the compiler will feel himself well repaid for his labours by the consciousness of being, in some measure, at least, a public benefactor.

The writers from whose works this compilation has been made (to whom the compiler here wishes to express his obligations), and whose names must commend it to every one acquainted with their writings, are men who have carried their science out into practice, viz: the late Judges Buel and Bradly, the late T. G. Fessenden, Willis Gaylord, J. J. Thomas, David Thomas, R. S. Randall, A. B. Allen and John Hare Powell, of the United States; the present enterprising and scientific Editor of the British American Cultivator, W. G. Edmundson, Esq., of Toronto; F. Falkener, Esq., author of "British Husbandry," and Professor James F. W. Johnson, M. A., F. R. S., &c. &c. &c., author of the Applications of Chemistry and Geology to Agriculture, of England.

To those persons who *look only* to immediate results (and such there are and always will be), it may not be amiss to state, that almost every section, whilst it affords excellent lessons to those learning to read, teems also with information, which, if carried out in o practice, would repay ten-fold the price of the work. If any one is dubious on this point, let him carefully examine the work and judge for himself before he purchases it.

Niagara, July 24th, 1845.

THE

# CANADIAN AGRICULTURAL READER.

## CHAPTER I.

### SECTION I.

1. BRIEF HINTS FOR JANUARY.—During winter, cattle are very apt to suffer from a want of water, as running streams are generally frozen, and they are mostly fed on dry fodder.

2. Cattle will drink several times a day, if the water is good and of easy access; proper provision should therefore be made for them.

3. Farmers will save a great deal of hay, especially in wet and muddy weather, if, instead of spreading it upon the ground for them, to be trodden under foot, suitable racks are provided, so that none of it may be wasted.

4. As milk is very valuable in winter, great care should be taken that cows are now milked very clean. But as the operation is apt to be tedious, at this season, in consequence of the slowness with which it is given down, it is best, after having obtained what milk can be done easily at one milking, to pass round all the cows at the conclusion, and give them a second milking, being careful to drain them to the last drop.

5. Cows should not be dried up of their milk too soon before their time of having a calf—this care is especially requisite in case of young cows which are milked for the first season; for when these are dried up too soon it is apt to cause a permanent shortening of their time of giving milk for each successive season. If they are the first season dried early in the fall, it is difficult to obtain much milk after that period in any year afterwards.

6. With careful milking, particularly the first year, and good keeping, cows may be made to give milk for almost any period required, even but a very short time before having a calf.

7. Farmers have differed with regard to the proper time of drying up cows; but this rule we believe to be nearly correct—if they are well fed and in good condition the milking may be continued until nearly the time of having calf; but if they are *not* in good condi-

tion, they should be dried a month or two before that period, in order to allow them to recover their health and strength.

8. During the present month, apple trees may be pruned to great advantage, provided there is mild weather to admit of it being done comfortably to the operator.

9. Trees which are neglected in this particular, become thick and crooked in their branches, produce poor and imperfect fruit, the smaller branches die, and the trees become old before their time.

10. This operation is commonly best performed with a hand-saw. Crooked and stunted side branches should be removed, so that those which remain may have an opportunity to grow freely, and that the light and air may be admitted through all parts. The top of the tree should be left of good shape, and the branches equidistant from each other in every part, as is easily practicable.

11. Too much pruning at a time is apt to check the growth of trees and is therefore not good, but they should be pruned moderately each year.

12. In cutting off large branches, avoid as much as possible broad wounds; which is effected by cutting them off nearly at right angles, and by not cutting them too closely. A stump or projection should, at the same time, be avoided.

13. As the stumps of large branches are apt to crack, admit water and rot, or breed insects, they should be covered with thick paint, or a coat of tar and brick dust.

14. During mild weather in this month, will also be a good time to prune hardy grape vines, if not already done. Many persons, having but few grapes, and those hardy, are apt to neglect them, and let them grow too thick; the quality of the fruit would be greatly improved if they were kept properly pruned, which would be but a few minutes' work.

15. By performing the operation now, the wounds would have time to dry and contract, and the sap-vessels to become closed before spring, and preclude the danger of bleeding.

16. The only care needed in this operation is to cut off all the smaller and least thrifty branches, and the ends of the larger, so that the buds left may be those which are largest and most vigorous, and that they may have sufficient light and air for healthy growth.

17. As fruit trees are apt to be injured by mice whenever there are a few inches of snow to conceal them in their depredations—especially if grass has been suffered to grow round the trees—it will be proper, whenever snow falls, to tread it firmly about them, by which the evil may be prevented.

18. Many other operations may be performed during winter, which

a little observation or reflection will point out—such as procuring and selecting seeds, removing manure to its place of destination, procuring fuel, collecting scions for grafting, making grafting plasters, &c. Great care should be taken to get genuine seeds, and to obtain the best varieties of fruit for grafting—for it is better not to plant a garden than to plant it with spurious seeds, and to omit grafting a tree than to graft it with a poor variety.

### Section II.

1. Brief Hints for February.—Every thing relating to the winter-keeping of cattle must be considered by farmers at the present time as of the first interest. A great deal may be said of the vast benefits derived from cutting straw and hay.

2. These benefits have been satisfactorily determined by direct experiment; they may perhaps be ascribed not only to the operation of cutting, rendering this food more palatable to the animal, and thus inducing it to eat a sufficiency; but also to its causing the more complete mastication of its food, and of course contributing to the more complete extraction of the nutriment it contains.

3. If corn-stalk fodder is cut up about a quarter of an inch in length, cattle will eat it entirely without any thing else being mixed with it. To accomplish this is of great importance, as the centre stalks, which are commonly rejected by cattle, are the sweetest and most nutritious part. If one of the improved cutting machines could be attached to the horse power of a thrashing machine, corn-stalks could be cut cheaply and with great facility.

4. It is a very suitable time during the present month to procure and collect scions for grafting. In some instances, as when the trees from which they are to be taken are ready at hand, cutting them may be deferred till spring; but in most cases, the business should not be put off till then, as the multiplicity of other avocations prevents the attention to it which is requisite; for the greatest care should be taken to procure the best varieties, and the present season of leisure admits of this being done properly. A little additional care may well be taken, when it is remembered that after the scions are once procured, it is as easy to graft and raise good as bad varieties.

5. Early fruit is always exceedingly desirable, coming at a time when, on account of the previous want of fruit, it is so acceptable. We last summer, at the time of wheat harvest, visited the garden of a cultivator of fruit, who had taken considerable pains in this respect, and found fully ripe three varieties of apples, two of the pear, two of plums, three of apricots, and one variety of peach just beginning to be ripe.

6. A succession of fruits is also of the first importance. Scions should be carefully labelled at the time they are cut from the tree, if preserving the names correctly is any object. They may be preserved from drying by burying them in earth neither wet nor dry, in a cellar or other suitable place, taking particular care to protect them from the mice.

7. It is a very proper time now for pruning gooseberries. These are generally allowed to grow without control; the branches become numerous and dense, and a small and inferior fruit is the consequence. To procure good fruit, the branches must be thinned, by cutting off crooked, stunted, and useless ones, and leaving the straightest and most thrifty, and admitting light and air.

8. To prevent too much hurry early in spring, hot bed frames should now be made where they are needed. If proper care is taken of them they may be preserved many years. They should be well painted and kept under shelter when not in actual use.

9. They should be so made that the plank of the frame may be taken apart, to admit of their being easily packed away. This may be effected by nailing them at the ends to corner posts by large wrought nails, clenching them firmly. They are connected together, when used, by iron bolts passing through the corner posts, and keyed on the inside. By withdrawing the keys, they are readily taken apart.

10. During winter a supply of fuel should be procured and cut up sufficient to last through the year. This not only prevents interruption during other business, in summer, but it admits of its becoming *dry*, by which one cord will produce often more than twice as much heat, as one cord of green wood.

11. Wood, dried in a wood house, is found to yield much more heat than that dried in the open air, on account of the process being more effectually performed. Whenever wood is intended for such thorough drying, (as all wood should be,) it should not be split finely, because, if done so, it is consumed too rapidly, and hence has arisen the erroneous belief that dry wood does not always yield so much heat as that which is in a green state.

SECTION III.

1. BRIEF HINTS FOR MARCH.—Before spring opens, the farmer should attend to the performance of whatever can be done *now*, and which may prevent interruption in the busy season of the year. Wood should be drawn, cut and corded; rails split and drawn where needed, corn selected and shelled, and tools repaired.

2. Where there will probably be a deficiency of tools, it may be now conveniently supplied; and in procuring new tools care should be always taken to get the best, even though they may cost a little

more. Where a man can do one third more work by using a good tool, he will soon pay for the additional expense.

3. A common but expensive mode of raising calves, is to suffer them to suck the cow. The practice which not unfrequently occurs, of suffering calves to run constantly with the cow, should be strongly reprobated, as the milk is drawn irregularly, and not often clean, and the cow is consequently soon spoiled. Where the calf sucks regularly, and the milk is drawn completely from the udder, the *expense* should deter from the practice, as the milk will be worth more during the season, than the calf in the autumn. But if the calf is soon weaned to obtain the milk, a good animal cannot be obtained, but poor, stunted, ill-shaped calves will be produced.

4. A good way to raise calves, is to let them suck the cow a few days, then let them suck the finger in a pail of new milk until they learn to drink, then mix a small quantity of water with the milk, at the same time adding meal and mixing it, and then gradually substituting water and meal for milk, until the milk is entirely discontinued. Thus sudden changes are avoided, which are always injurious to calves. Warmed skim milk may be used in place of new milk, after the first few days.

5. Calves, as well as other animals, should have a good supply of clean litter.

6. Milk your cows clean, if you do not wish to spoil them. Sore teats may be prevented by washing them each time before milking with water.

7. Working cattle and horses must be kept in good order, that they may perform labor efficiently in the spring. It is better to give animals extra feeding, if by doing so they can do twice as much work, and consequently enable the man who drives them to do twice as much.

8. Clover seed may be sown any time during this month, and when the season of freezing and thawing the soil arrives, they will be gradually worked into the ground by the operation. This is found by repeated experiment to be better than to defer it till the ground becomes settled in spring.

9. Pruning the raspberry should be performed as soon as the snow is off the ground in the spring. Clear away the old stems, cut away the small shoots, and leave four or five of the largest and strongest of last season's shoots in each bunch, for the next crop. These should be cut off to three or four feet high, and tied to stakes driven into the ground to keep them erect. Early in the spring the ground should be cleared of grass and weeds, and loosened about them.

10. Grafting plasters may be now made, and we have found the

cheapest and by far most convenient material to spread the wax upon, to be brown paper. A sheet may be covered by spreading the wax with a knife, and then cut by scissors into plasters of the required size.

11. Grafting wax may be made by melting together the following substances: two parts tallow, two beeswax, four rosin; or, three rosin, three beeswax, one tallow; or, four parts pitch, four rosin, two beeswax, one hog's lard, one turpentine.

12. Farmers often suffer much at this season from wet feet, we therefore request leave to recommend them to the following India rubber application:—

13. Melt one pound of tallow in an iron kettle, add from four to six ounces of India rubber cut small, and heat the melted tallow until the India rubber in it is dissolved. It will then be fit for greasing boots and shoes, and will render them perfectly impervious to water, though in it all day. During the preparation of this mixture it will boil up in foam, and send off copious pungent fumes, but this does not injure it. One-twentieth part of beeswax improves it. Old worn out India rubber over-shoes may be used in the manufacture.

14. As system and looking ahead is indispensable to success in farming, we would urge upon every farmer a recommendation for making a memorandum book. Provide a small blank book with a flexible leather cover, that it may be conveniently carried in the pocket, and appropriate one page to each week in the season; set down every thing on its proper page, which is to be done at the time denoted.

15. By having this book constantly in the pocket, many things may be noted down the moment they occur to the mind, either during reading or otherwise, which without this would be forgotten and neglected. Further, provide another similar book, and note down in it briefly, during the progress of the season, whatever work is done at the time, with hints of such improvements as may occur. This will form an excellent memorandum book for the next season. Thus the farmer has every thing in black and white before him; he sees his business at one view, and he makes his arrangements accordingly, without unforeseen and unexpected interruptions.

## Section IV.

1. Brief Hints for April.—During the present month, farmers should endeavor as much as possible to get their land into the best condition for planting, for on this will depend in a great measure the success of the crop.

2. No pains should be spared to apply manure copiously to corn and potato crops—the product will abundantly repay the labor.—To the smaller grain crops, as for instance, oats and barley, manure should not commonly be applied, as the benefits in such cases may not overbalance the injury.

3. Wheat, which has been injured by the heaving of the frost, has in some cases been greatly benefitted by passing a roller over it, thus pressing the roots again into the earth.

4. New meadows should be rolled in the spring, to render the surface smooth for mowing.

5. Plaster, to be beneficial to the greatest extent, should be sown on meadows early in spring.

6. Green sward, in order to be turned over neatly, should have the furrow slices one half wider than thick.

7. Seed barley, by being limed and rolled in plaster, has produced crops freer from smut in consequence of this operation, and yielded larger products.

8. The planting of locust trees for timber should be more attended to. The seeds when sown, should be previously scalded by pouring hot water on them and suffering it to stand several hours—the swollen ones should then be sown, and the others re-scalded.

9. Stocks of peach and other fruit trees, should now be cut and trimmed. Every bud should be removed except the one intended to grow.

10. The soil round fruit trees which do not stand in cultivated ground should be spaded for two or three feet on each side. This is absolutely necessary for young trees.

11. The roots of peach trees should be examined for the purpose of removing all the worms which may have eaten into the bark, and all the holes which appear should be searched to their termination that the worm may not escape.

12. We wish again to urge upon farmers, the great benefit to be derived from the culture of root crops—the amount of cattle food thus obtained is too much overlooked. By good culture, many hundred bushels may be safely calculated on, exceeding many times in value a good crop of hay from the same quantity of land. Drilling, instead of sowing the seed, greatly lessens the labor of hoeing.

### Section V.

1. Brief Hints for May.—As regards the application of time with the farmer, there is not a month in the year that demands more attention than the month of May. If the farmer does not plant he will not reap, and if he does plant his grounds before they are

properly prepared, the labor required for their after culture is greatly increased.

2. It is also essential that crops should be put in in season, as well as that the ground should be well prepared. Oats should always be sown before the time for planting Indian corn, otherwise, although there may be a great growth of straw, the grain will be light.

3. Peas, when intended as a preparatory crop for wheat, should be sown as soon as the ground can be prepared, as they are not subject to be injured by the frost, and by sowing early, there is a greater opportunity for preparing the ground after they are off for wheat.

4. Early potatoes may be planted as soon as the frost will admit; and although they may be planted at almost any time from the middle of April to the middle of July, yet, we think, they produce best when planted from the middle of April to the middle of May, or when left until from the middle to the last of June.

5. In the first case, the tubers make their growth before the mid-summer drought; and in the latter, after the fall rains have set in; in either case the potatoes will be better in quality than when grown in the heat of mid-summer, allowing the soil to be sufficiently miost.

6. One mistake universally prevails in selecting soil for potatoes, and we often hear farmers recommending them as fine in quality because they grew on dry, sandy soil. Potatoes growing on a dry, sandy soil are never as good as those which grow upon a deep soil, rather damp than dry, in which there is a large proportion of vegetable matter, which has a tendency to prevent such soils from becoming heated by the sun.

7. We think that our farmers are becoming more and more convinced of the importance of attending to this crop, and of selecting seed with reference to the use for which they are intended.—Those varieties which are considered best for the table are not always found to be the most abundant bearers, and of course could not be raised at the same price per bushel as some of the larger varieties, which may answer equally well for feeding stock.—

8. Until the present season we have known but little difference in the price of potatoes in the market—a bushel of potatoes has been considered a bushel of potatoes, without regard to quality, and all sold at the same price. But this spring we have known some varieties sell at from 2*s.* 6*d.* to 3*s.* 9*d.* by the load, at the same time that others were selling for 1*s.* 3*d.* This difference ought to stimulate farmers to be select in their seed.

9. For the table we have recommended the Mercer, the Pink-eye, and the Sault St. Marie, and we might add the Foxite; for stock the large, round, yellow and flesh colored potatoes, as being valuable for cultivation. In addition to the common farming operations, the gardens and orchards require some attention during the early part of this month. No man ought to be called a good farmer who does not cultivate a good garden and orchard, both of which we have reason to believe have required much attention from the earlier ages.

10. At this season, stock generally requires as much attention as at any season in the year; and perhaps there are as many cattle die in the last half of April and first half of May, as in all the remainder of the year; therefore, much attention is required in this department.

11. This is the month in which economical farmers make additions to their flocks by the purchase of lean animals. There are always to be found these *half-farmers* who will sell their lean cattle in the spring for less money than the hay would be worth which they have consumed; and, as good bargains are not to be overlooked by thorough bred farmers, those who have money to spare, may in most seasons make advantageous purchases.

12. Farm-yards should be thoroughly cleaned this month, so that the manure may be mixed with the soil for summer crops.—No good farmer will allow the straw and other refuse from his barn to lie and waste.

13. Many farming operations during this month depend upon the quantity of team work which is available, therefore the strictest attention should be paid to both oxen and horses. One team well fed, will do more than two starved ones; and farmers should not allow their oxen or horses to run to grass until after spring ploughing is over.

14. It should be considered of first importance to keep the plough moving as preparatory to all kinds of crops, as even good grass is rarely produced from soils that have not been well ploughed.

15. Farmers often become very much elated about procuring new seeds in the spring; but we would caution them against giving up all old practices and plants. Improvements march slowly—better be slow and sure than wild and speculative. He that studies much to find what has been before him, frequently benefits mankind as much as those who study to find that which never was.

## Section VI.

1. Brief Hints for June.—As early in this month as possible, ground should be got ready for Ruta Baga. Any soil will answer well if it is not wet, and is deep, mellow and rich. Too much manure can scarcely be applied, especially if it be fine and well rotted.

2. The most economical method, is to prepare the ground in the very best manner, and plant the seed in drills about 15 inches apart, so that they may be thinned to 8 or 10 inches in the drill. The manure may thus be spread broadcast, and the effect of none of it is lost by lying between remote rows. The cleaning is all done with a hoe, which is quite as economical *for the amount of the crop*, as where a cultivator is used.

3. The only advantage of ridging, is where the soil is not sufficiently deep or fertile, and requires to be accumulated in ridges for this purpose. Where this is the case, it is best to plough the land into ridges and furrows about two and a half feet apart, fill the furrows with manure, split the ridges with a plough and throw them upon the manure, thus forming new drills, on which the seed are planted. This is best adapted to heavy soils suffering from wetness.

4. The seed should be planted an inch deep if the soil is moist, but deeper if inclining to be dry. About one pound to the acre is, in ordinary cases, sufficient. If no drilling machine is at hand, drills may be made with an instrument resembling a large coarse rake with short teeth, each tooth for a drill; the seed may be rapidly and evenly dropped, by means of a tin cup fastened to the lower end of a rod, with a small hole in the bottom, holding the cup by the rod and walking with an even pace and shaking it constantly.

5. The average crop to the acre is about 500 or 600 bushels—900 and 1000 have frequently been obtained, and in one instance they produced at the rate of 2200 bushels to the acre.

6. Crops of Mangel Wurtzel planted last month, should be thinned when the plants are 2 or 3 inches high, leaving them from 6 inches to a foot in the drill, in fertile soil requiring more room than otherwise.

7. Too much pains cannot be taken to have root crops early cleared of weeds; a chief cause of failure is owing to a neglect of this care.

8. In all cases keep *ahead* of weeds. This is cheaper, and saves a part of the crop.

9. It is a good time now to clear grain fields of weeds which may injure the crop or render the seed foul.

10. Plastering corn soon after it is up is often beneficial, and in some instances has increased the crop 25 per cent.

11. Manure should be taken care of to prevent its wasting by fermentation or evaporation. To this end it should be piled in heaps, and covered a few inches with earth or a coating of lime. The quality of lime in retaining the exhalation of fermenting substances, was strikingly proved by covering the carcass of a cow 6 inches with earth containing about one-third lime. No smell was perceived during the putrefaction, and the crop to which the lime was afterwards applied, was far more benefitted than the adjoining crop, where the same quantity of lime was applied. Slacked and old lime is quite as beneficial for manure, as fresh lime.

12. Save your own seed. Farmers are neglectful in this respect, and rely too much on the seed box of the merchant, or a supply from a seed store. when they might, in most cases, produce all they require at home. Begin with the earliest that ripen, and save those of good quality of all the kinds you generally need. It takes but little time, and amounts to a handsome sum in saving expense.

13. The different varieties of turnip ripen their seed early, and the seed should be saved soon. If you have more than you need, distribute your ruta baga among your neighbors; it may confer a great benefit on them, for there are some that would plant will not be at the trouble to procure seed, and he who has raised roots once will generally do so again.

## Section VII.

1. Brief Hints for July.—A subject too much neglected during the middle of summer is the extirpation of weeds. If the nourishment which goes to support the weeds on some farms were applied to the crop, the owners would soon get rich. Weeds are as injurious to the crop as a herd of intruding cattle, and should therefore be removed with as much determination.

2. There is one rule which will apply in destroying all weeds of whatever kinds; that is, that they cannot live if they cannot have access to the air. Hence weeds, the most difficult of extirpation, are soon routed by cutting them off as fast as they appear above ground, or by burying them repeatedly with a plough.

3. Repeated ploughing for destroying weeds is best whenever they have obtained possession of the ground, as in case of Canada Thistles, St Johnswort, and some others; and indeed it is much better to devote the ground a year or two to clearing, where they have spread extensively, than to lose two-thirds of the use of it by them perpetually.

4. Some weeds are easily removed with a common hoe, as, for instance, mulliens, thistles, &c., which infest pastures; cutting them

off at the surface of the ground generally destroys them at once. Docks are very easily removed when the ground is softened with rain, by pulling them up.

5. In order to prevent the trouble of destroying a field of weeds, they should be watched and rooted out at their first appearance, when it will not cost a thousandth part of the labor. Canada thistles, milk weeds, ox-eye daisy, couch grass, charlock or field mustard, and others, whenever they first appear, should be immediately destroyed.

6. Whole fields are frequently seen covered with a luxuriant crop of the large field thistle; if they were cut and raked with a horse rake into large heaps they would make excellent manure.

7. Farmers should use every means practicable to obtain and preserve all the manure that can be done—they should recollect that a good load of manure properly applied, is better than a silver dollar.

8. What most needs attention now, is to preserve the manure which remains unspread during summer, to prevent its wasting by fermenting and evaporating. This is effected by covering it with a coating of earth mixed with about one-quarter *lime*.

9. The advantages of frequent stirring of the earth among crops have been sufficiently proved;—"a rusty hoe in summer is a sign of a poor farmer." But the practice of *hilling* in cultivating hoed crops, is injurious; and it is found by experience that in all common cases, preserving the surface of the ground flat or nearly so is much preferable. For this reason the *cultivator* should be used in preference to the one-horse plough; and if the rows have been planted straight and even, all the weeds may be cut up by it within two or three inches of the plants.

10. Mowing should not be commenced until the stalks of grass begin to change a little to a brown color, or when the seeds are approaching maturity. A greater quantity of nutriment is then contained, the hay is sweeter to the taste and is not so tough as otherwise, and the hay is more easily dried. Grass beaten down by rain, should however be cut before it becomes injured in this way while uncut.

11. A great defect in curing hay, and more especially clover, is drying it too much in the sun. The more improved plan is to dry it partially in the swath and finish by what is termed the *sweating* process, or drying in small cocks, the heat of a very slight fermentation assisting. The labor of spreading is thus saved, t ere is little injury from exposure to dew, and the thin leaves and succulent stalks become equally dried together.

12. Where this plan has been tried, many successive day of

rainy weather have not prevented the making of excellent hay: and indeed while the outside of the cock is wet by the falling rain, the interior has been constantly drying by the slight heat generated. Every farmer should at least try this method; and every one who tries it fairly, adopts it.

13. We still see, in many places, the common hand rake employed to collect the hay on the meadow. This should be no longer tolerated. When it can be raked by a horse with one-fifth the expense, it is surprising that so many adhere to the old practice. If farmers are unwilling to procure a revolving rake, let them at least provide themselves with the common horse rake.

14. The cost is only two dollars, and it will pay for itself in less than half a day, and in half an hour if a shower of rain is coming upon a crop of new hay. Attach the draught ropes to the outer teeth cut to about one-third the length of the others, and no difficulty will be found in managing it.

15. We last year saw a meadow of fifteen acres raked with a common horse rake, in about six hours of time actually employed, a part of which yielded three tons; and the whole of the hay was drawn to the stack, chiefly from the winrow, by the horse and rake, sufficiently fast to keep a strong active man (who had previously laughed at the plan) hard at work all day to pitch it on the stack.

16. By regulating properly, by means of the handles, the pitch of the teeth, loads were collected which were a good load for one horse to draw. One man only (without any rider) was sufficient to manage it. It abridged the labor so much, that cutting the grass was more than two-thirds of the work done on the meadow.

17. On extensive and smooth meadows, we would by all means recommend the revolving rake in preference to any other, and the hay sweep to collect and draw it to the stack or place of deposit. But the common horse rake may be used on any meadow, if not intolerably rough.

18. Mowers should commence work by four o'clock in the morning, when the air is cool and the grass moist, and then they may rest in the heat of the day.

19. In harvesting grain, it is much better to cut it a few days before it is perfectly ripe, than to allow it to stand too long. If cut when not entirely ripe, and bound up *before the stalk becomes dry, it will derive nourishment from the stalk* sufficient to ripen it before the sheaves become thoroughly dry.

20. The great advantages of cutting early are, the grain is not wasted by shelling, the straw is worth more and it enables the

farmer to drive business and prevent losses from bad weather and other delays.

21. Lodged and rusty grain should, in all cases, be cut as soon as admissible, as little is gained by suffering it to stand too long.

22. Whenever it is necessary to leave grain upon the field after it is cut, it should be put so as to withstand any rain without injury. This may be easily effected by placing about six sheaves closely together, pressing their heads to a point, and capping the whole with a seventh. The cap is made by binding a sheaf firmly near the lower end and spreading the straw on all sides by breaking it down over the band.

23. At this busy season of the year, the garden must by no means be neglected—the ground must be kept clear of weeds,—plants which need it watered in dry weather, always in the evening to allow the water to penetrate the soil before evaporating;—herbs, as they come in flower, must be cut and dried for future use; they must be cut in dry warm weather, and always dried in the shade: —fruit trees which bear too thick must have their fruit thinned, if it is wished to have it of any value as to flavor.

24. In the flower garden, seeds must be gathered, labelled, and preserved as they ripen, and the roots of bulbous plants taken up as the tops wither and die; they are best preserved by drying them somewhat, in small heaps, covered with sand or dry soil to protect them from the rays of the sun. As soon as taken up they should be labelled to prevent mixing.

25. Clover hay should never be scattered out of the swath, because in addition to the labor in scattering and again raking up, the hay is thereby greatly injured.

26. Indeed, if the weather be favorable for curing, neither timothy nor any other kind of hay should be scattered, because the less any green grass is exposed to the sun and air in the process of curing, the greater will be the value of the hay, and the less labor required.

27. Let the clover lay in the swath untouched, until about two-thirds of the upper part be sufficiently cured, which in good weather will, if the swath be tolerably heavy, be effected in eight or ten hours; if the swath be light, in a proportionably shorter time.

28. When thus far cured, turn the swath bottom upwards with the fork, an operation speedily performed. Let it then lie exposed to the sun until the under side be cured, which will be, according to the thickness of the swath, in from four to six hours; then throw three swaths together in winrows, and commence

hauling in, the waggon running between two winrows and loading from each.

29. It can hardly be necessary to observe, that all these must be performed after the dew has dried off. It is to be recollected that clover will keep with less drying than almost any other grass. A common test is, to take up a bunch of grass and twist it, if no juice exudes, the hay may be hauled in with safety.

30. We have often hauled in clover cut in the morning in the evening, and always the succeeding day, unless prevented by bad weather. Sprinkling every layer of hay with salt, at the rate of twelve or fifteen pounds to the ton, or interposing a layer of dry straw, from six to twelve inches thick, between every two layers of clover of the same thickness, we found a great preservative; and especially the latter mode will enable the farmer to put up the hay in a greener state than could otherwise be done with safety.

31. Besides this advantage, the straw interposed between the layers of hay, by absorbing its juices, will be rendered much more valuable as provender, and if salt be sprinkled on the hay will be greedily consumed both by cattle and horses.

32. From the great quantity of this grass produced on an acre, its highly nutritive quality, the ease with which it is cut and cured, farmers will find that clover hay is the cheapest food on which they can keep their stock in good order during the winter. If put up in good order in the fall, sheltered from bad weather, and salted, both horses and cattle will keep fat on it alone through the winter, without the aid of grain, unless when worked.

33. The prevalent notion of the difficulty of curing clover hay, is entirely erroneous. In a climate like ours, there will seldom be found any; in a wet and cool climate, like that of England, the difficulty may exist to some extent, as clover when put in cocks will not resist rain as well as timothy and some other grasses; but in the course of fifteen years' experience we have seldom lost any or had it much injured by the weather.

34. Indeed we have found it comparatively easier to save clover hay than corn blades, and as three or four tons of the former, with the aid of plaster, can be made at less expense than one ton of the latter, the farmer must be blind indeed to his own interest, who does not take care to provide himself with at least as much clover as will furnish an abundant supply of provender for his stock.

35. Clover should be cut for hay when about one half of the heads have become of a brown color. If cut earlier, it is believed

the hay will not be so nutritious; if later, the stems will have become harder, and the grass be on the decline.

36. For hogs, however, and young stock, it will be advisable to cut some so soon as it is in full bloom; when cut in this state and salted, hogs are very fond of it, and it is believed might be chiefly wintered on it, if otherwise carefully protected from inclement weather. At all events, by the use of it as food for hogs in part, a great saving of corn may effected.

## Section VIII.

1. Brief Hints for August.—The pressure of work which farmers are obiged to attend to through haying and harvesting, often causes them to neglect the extirpation of weeds at this time, when they are about going to seed. This should be carefully avoided.

2. After the second hoeing of corn, the weeds among the crop, of which there always spring up more or less, are suffered to have undisturbed possession, and the ground becomes completely seeded with them by another year. A little seasonable labor would prevent this evil.

3. We observed a piece of ground which was kept clear of weeds last year, and another which was but imperfectly cleared of them; the consequence was, that the crop this season (field beet) which grew on the latter piece, was literally hid with a dense growth of weeds, while the other was comparatively free.

4. Canada thistles, must, in no instance whatever, be allowed to ripen their seed.

5. Thistles, mulleins, burdocks, &c., in pastures and fence corners must be destroyed without fail.

6. Root crops, as ruta baga, and mangel wurtzel, are liable to be too much neglected after one or two hoeings; they should be kept all the season perfectly clear from weeds, and the benefit they derive from this, and from stirring the earth around them, amply repays the expense of the labor.

7. With a little pains, it is as cheap to raise a good crop, as a crop of noxious weeds; and seed now selected should be therefore as perfectly freed from foul stuff as possible. If clean wheat is always sowed, we may expect, on clean ground, a clean crop; but land will become more and more infested with weeds so long as we sow the seeds with the grain.

8. Chess being almost universally the worst weed among wheat, no pains should be spared to separate it. It may be done by means of brine, first made strong, and then weakened till the wheat will just

sink in it, when the chess, being lighter, floats, and is skimmed from the surface.

9. A basket should be used, to let the brine run off the more freely. The wheat should then be spread on a barn floor, two or three inches thick, and about one-fifteenth part of air slaked lime sifted over it and well stirred. This assists the drying, and destroys the smut.

10. A good fanning mill will clear most of the chess from wheat by passing it through a few times.

11. No seed wheat should be considered clean, until, by repeatedly spreading handfuls of it on a table, no chess can be found.—There is not much of what is termed *very clean* seed that will endure this test.

12. Under draining should be performed during the dry season, and those farmers who have wet spots of ground in cultivated fields should no longer delay this simple mode of rendering such land productive. Open drains should never be made but to carry off surface water.

13. No drain for any other purpose should be much less than three feet deep, but an open one this depth must be nine feet wide to prevent the banks sliding, and this is an enormous waste of land.

14. But a covered drain occupies no ground. The expense of digging, from this cause, is also much greater in case of open drains.

15. Covered drains may be filled with stone or brush. The stone may be laid so as to leave a small open channel at bottom; or if they are quite small, and the quantity of water passing off not large, such channel is not necessary.

16. Brush drains are filled by placing the branches of trees, freshly cut and with the leaves on, in a sloping direction in the ditch, the leaves upwards, and then covering them with earth. The spaces between the branches below allow the water to flow off.—This method of filling is best in sandy ground where stones are scarce.

17. In cutting off under ground channels of water, particularly those which ooze out of the surface of sloping ground, by means of covered drains, the mode of operating should be adapted to circumstances. The common error is to cut in at the wet spot; whereas the proper place is a little *above*, before the current reaches the surface. The judgment and close examination alone can direct the proper course and situation for the drain in such cases.

18. Horses often suffer from slobbering during the latter part of summer, especially when they feed in succulent pastures. The best remedy is drier food.

19. Fruit trees are frequently injured in collecting the fruit, by resting ladders against the branches, and thus bruising the bark. Apricots, plums and peaches, often suffer much in this way.

20. The remedy is to use self-supporting ladders, constructed like a common ladder, with either one or two expanding legs of equal length, which serve to support it without any other prop.

21. Budding or inoculating should be performed while the stocks are growing most rapidly, or while the *cambium* or mucilaginous substance under the bark is in the greatest abundance. This cements the inserted buds and makes them adhere the better to the wood.

22. Cherries and plums should be budded immediately, but peaches may be deferred three or four weeks later, if necessary.—The general rule is, budding may be performed successfully at any time when the bark peels freely.

23. If the stocks are thrifty; if the bark is carefully cut and raised so as not to injure the cambium; if the buds are cut smoothly off the shoot so that they may be applied closely to the wood of the stock;

24. If the bandages are bound so evenly that they may just maintain the close contact between the bud and stock; and if they are carefully removed as soon as they begin to indent the growing stock, there can be little doubt of success in budding.

## Section IX.

1. Brief Hints for September.—Seed wheat should always be selected from the largest and finest part of the field; for as the product always partakes more or less of the nature of the seed, no pains should be spared to procure the best. In this way the variety may be constantly improved.

2. Spare no pains to clean it effectually, so that not a grain of chess or other weed can be found by close searching. There will be weeds enough in all cases, without sowing the seed upon the land.

3. One of the best modes of preventing the ravages of the Hessian fly, and perhaps the only one of much value, is to sow wheat so late that it may come up after the first autumnal frost, where there is reason to apprehend its attacks.

4. All wheat fields, in the least degree liable to surface flooding, should be well supplied with well cleaned furrow drains.

5. In harvesting corn, always cut it up at the surface of the ground in preference to topping it, as the latter method has been found to diminish materially the crop, in some cases several bushels

to the acre, as was proved by measuring. At the same time cutting it up gives a much greater amount of fodder.

6. Where corn is nipped by a premature frost, the best method of securing the crop, is to set all hands at it with scythes before sunrise, so that it may be all prostrate before the heat of the day has melted the frost. The heat gradually emitted from the earth, then slowly thaws it, and as soon as convenient on the same day, it is gathered and properly secured.

7. If the glazing process has commenced on the ear, the nourishment obtained from the slowly drying stalks will ripen it sufficiently, and the fodder will be well preserved.

8. Seed corn should always be carefully selected; if the crop stands long enough in the field, it should be taken from the stalks before they are cut, in order that the selection may be more perfect.

9. Look for those new stalks which support two or more ears, and take the upper one only. This method practised for successive years, has greatly improved the variety and increased its productiveness.

10. As straw is always valuable, either for fodder when cut, or for the manufacture of manure, it should be carefully preserved.

11. When from the thrashing machine, it is most conveniently secured by binding it in large bundles by means of hay ropes, as fast as it is thrown out from the machine. A sufficient number of hay ropes for this purpose may be previously twisted from a stack and placed in readiness.

12. Farmers who have hogs to fatten, will find if they will but try it, that common apples are as good for the purpose as any thing they can obtain, and far cheaper. If the number of hogs be large, it may be advisable to cook them, as this process greatly improves their quality.

13. Whenever grain is fed to hogs, it should always be ground, and not only ground but cooked. The advantages of these two processes combined is indeed great. An excellent way of preparing Indian meal, is to boil about one peck in a five pail kettle of water; this will furnish five pails of most excellent and nutritious feed.

14. Unlike fattening swine, very little advantage is derived from cooking food for cattle,—not sufficient to pay the labour and expense.

15. In all the experiments with feeding and fattening animals, accurate accounts should be constantly kept, the animals should be frequently weighed, and the best and cheapest food thus deter-

mined. The farmer will then know what he is about, instead of working in the dark.

### Section X.

1. Brief Hints for October.—This month will be mostly occupied with the securing of crops, and it is important for their preservation that this be done in the best manner.

2. Root crops especially, should be placed beyond the danger of injury; it is better to take some additional pains than to lose one half the amount by carelessness.

3. Potatoes should be packed away in such a manner that they may keep well, even if the winter should be much severer than common.

4. Their preservation depends on securing them from frost and from moisture. Hence these requisites should be particularly observed, both in placing them in cellars, and in heaps in the open field.

5. The best method of preserving ruta baga in open ground, is the following:—They are to be placed in long heaps, three or four feet wide, and of any desirable length, in a roof-like form, and terminating in a ridge at the top. They are then covered, first with straw, and afterwards with earth. They need not be covered to so great a depth as potatoes require, as they are not so easily injured by frost.

6. But as they are liable without precaution to ferment and rot, in large heaps, holes should be made with a crow-bar through the earth into the heap, at intervals of a few feet, to suffer the warm air which may be caused, to escape; and these holes may be partially closed by straw. Where the soil is such that there is no danger from moisture, these heaps may be placed in broad trenches made for the purpose.

7. Mangel Wurtzel require nearly the same treatment in preserving as the potato—they are more easily injured by frost than ruta baga, and should consequently be sooner secured. As a general rule, they should never be left out later than the latter part of this month.

8. A dry, warm cellar, which will admit of some circulation of air, is the most convenient place for keeping both mangel wurtzel and ruta baga, when they are to be fed out daily during the winter.

9. All ground intended for spring crops next season, should be ploughed before winter without fail. Teams are strong in autumn, the weather is cool and favorable for their labour, and the operation greatly assists in destroying grass and weeds. The diminished

labour in hoeing next season, from this alone, will in many cases compensate for all the expense.

10. In the Garden, seeds are to be gathered as they ripen, carefully labelled, and secured; where they do not ripen simultaneously, and the ripe seed cannot be collected without too much labour, the whole plant should be taken up by the roots and suffered gradually to dry in the house, during which time most of the seeds will become ripe.

11. All hardy perennial aromatic and medicinal herbs may be conveniently transplanted—strawberry plants should be removed early in this month, if not already done, for forming new beds—onions for seed next year should now be set out, selecting the hardest and best shaped roots, and placing them in drills a foot apart and six or eight inches in the drill.

12. Asparagus beds should be cleared when the stocks turn yellow and begin to die.

13. Weeds ripening their seeds are to be removed and carried off the ground to prevent seeding;—and all vacant spaces made so by the removal of crops should be spaded for the action of winter, and for destroying young weeds.

## Section XI.

1. Brief Hints for November.—As the farmer's work is now generally completed, implements should be cleaned, dried and laid aside. Every farmer should have a building for his carts, ploughs, harrows, hoes, rakes, &c.

2. There should be a place for every thing and every thing in its place, in order to prevent looking half a day at a time for lost tools. Tools will last much longer if so used, and now is a good time to do the work.

3. Wherever practicable, plough the ground for spring crops.—Look ahead for next spring, or you will get in your seed too late.

4. Employ leisure time in repairing fences, to prevent hurry next season.

5. Preserve all your refuse apples for feeding hogs and cattle during winter. They are worth more than potatoes, as has been proved by experiment in weighing.

6. To salt pork properly, it is essential only to immerse pieces completely in salt. Place a layer of salt at the bottom, then a layer of pork in the usual manner, filling the interstices, and so on till the barrel is filled. Use plenty of salt, it will not be lost. Saltpetre, when used should be in very small quantities, say a 400th part. Some add a small quantity of sugar.

7. To cure hams, mix a bushel of good salt with a pound of nitre, rub the hams well with the mixture, and put them down. Rub them again in a few days that they may absorb the salt more evenly. In about four weeks, (sooner, if the pieces are small) wash them and hang them up in the smoke house.

8 The following mixture has been recommended as good for ham. One pound salt, one ounce nitre, pulverized and mixed, added to two quarts of molasses; the pieces are to be thoroughly rubbed with this and laid flesh side up, and suffered to remain three weeks.

9. In the Garden, a few vegetables remain to be gathered; cabbages should be taken up on a warm dry day, drained in an inverted position of such water as they contain, and properly protected from water and too great dryness, and from frost. They may be thus protected in various ways. One is to place them in a cellar with the roots buried in a box of earth.

10. Another is to place them in a row in a dry part of the garden, in an upright position, the roots and stems buried, and then covering them with two broad boards or slabs in the form of a roof, and burying these with earth. Another is to separate the loose leaves, and bury them in a conical pile, precisely as turnips and potatoes are treated. When put in the cellar, they should be dry and clean, otherwise in warm weather they will cause unwholesome air.

11. Near the commencement of winter, lay down tender exotic grape vines, first placing a few stones on them to keep them down until two or three inches of earth are thrown on the vines, when the stones are removed and the vacancies supplied with earth.

12. All tender shrubs need protection before winter. Flexible stems may be laid down; stiff upright ones may be protected by incasing them well with the branches of evergreens. All transplanted bulbous roots will also need protection.

13. Asparagus beds when the tops are dead, should be cleared off, and a layer of dung one or two inches thick spread evenly over.

14. Seeds of parsnips, carrots, onions, &c. may be sown in autumn to advantage, if done so late that they will not vegetate before cold weather. Early peas may be sown to great advantage, if there is no danger from mice.

15. A writer on gardening says: "To cultivate parsnips, sow the seed in autumn soon after they are ripe, by which means the seed will come up early the following spring, and let the plants get strong before the weeds will grow to injure them."

16. All vacant ground should be ploughed or spaded, to be sub-

jected to the action of winter frosts, and to be in readiness as early as possible in spring.

## Section XII.

1. Brief Hints for December.—Domestic animals should always commence winter in good condition, and this should be preserved through till spring. To do this, never attempt to winter more than you have abundant means of providing for.

2. All animals should be regularly fed, they should be kept warm and comfortable by sufficient shelter, should have a regular supply of water, and, sheep and cattle especially, should have a portion of roots constantly intermixed with their daily food.

3. Large troughs for feeding with hay, are preferable to racks, as they more effectually prevent waste. Sheep, instead of being left out exposed to the weather all winter, should be properly protected by suitable sheds. If this were attended to, and they have a daily supply of roots with their hay, very few would ever be lost in wintering.

4. Oats, for horses, will afford much more nourishment when ground, than when left unground. Ruta bagas are excellent winter food for horses, fed in moderate quantities, with hay, and a small quantity of oats.

5. All stables for cattle and horses, should be kept constantly ventilated, very clean and well littered with straw.

6. Straw, and poor hay, are readily eaten by cattle if salted by sprinkling brine over them; and they are still better if in addition to this, they are chopped previously.

7. It is a very suitable time during this month, to cart leached ashes on land which may need it. It is particularly valuable on wet meadows; a friend spread eight or nine loads on an acre on his meadow (which was occasionally overflowed by the large creek which passes near it) and the consequence was an increase of one half more grass, although it had produced yearly two or more tons to the acre. This effect continued for several years.

8. Chaptel says, "The action of buck-ashes [leached ashes from asheries] is most powerful upon *moist lands and meadows*, in which they not only facilitate the growth of useful plants, but if employed constantly for several years, they will free the soil from weeds."

9. In the Garden, if the ground continues open, manure may be spread and buried, vacant ground ridged or spaded, sticks for peas, beans, &c. preserved or made, trellises repaired, and vegetables securely covered.

10. To color Green.—Take half a pound of the oil of vitriol,

one ounce of indigo, pulverized; put them in a bottle, shake it repeatedly three or four days; then put it in a hickory bark dye, with two pounds of alum. This mixture will color twelve pounds of yarn. It is to be simmered over the fire several hours, frequently taking it out to air, on a pole over the kettle; you can dye it in iron, copper, or brass; when the yarn is dry, wash it in cold water; the hickory dye is to be taken off the fire when the mixture is put in out of the bottle, or it will run over; for the hickory dye must be boiling hot when it is put in.

11. To color Orange.—Make a strong soap suds, enough to cover your yarn well; put the arronetta in a bag, let it lay all the night in the soap suds; next morning rub it out, then put in as much strong lye as you can without rotting your yarn; put it on the fire and let it nearly come to a simmer; before you put in the yarn, raise it frequently and air it, and add more lye if you wish it deeper; eight ounces will dye twenty cuts.

12. To color Red.—To three pounds of yarn, take one pound of alum, and one pound of madder; dissolve your alum, in a sufficient quantity of water to cover your yarn; scald it well in that water, then rinse it well in pure water; mix wheat bran and water to the consistence of thin gruel, a sufficient quantity to cover the yarn well; mix the madder well in this preparation; put in the yarn and boil two or three hours, stirring and keeping it loose in the vessel.

13. If you do not wish it deep, take it out in a very short time, but let it remain several hours if you wish it deep. Rinse it in cold water after letting in air. The bran must be boiled the night before, and a crock part full taken out and strained, and the madder put in to raise the rest, strained in the morning, and that in the crock mixed with the other, before put on to boil.

14. To color Yellow.—Take three-fourths of hickory bark, with the outside shaved off, and one-fourth of black oak bark done in the same manner, boil them well together in a bell metal kettle until the color is deep, then add alum sufficient to make it foam, when stirred up; then put your yarn in, and let it simmer a little while, take it out and air it two or three times, having a pole over the kettle to hang it on, so that it may drain in the kettle; when dry rinse it in cold water.

# CHAPTER II.

## Section I.

1. The Plough and its Use.—In no one thing has the striking advance of what may be termed the mechanics of agriculture, or the manufacture of farming implements, within the last twenty years, been more fully shown, than in that most important article of husbandry, the plough.

2. When we compare the present beautiful, light, and yet strong ploughs, in general use, with the clumsy, heavy, ill-constructed implements used twenty or thirty years since, it is impossible to deny, that in this respect, at least, a great improvement in the means of good farming has been effected.

3. Some twenty years since, a gentleman of Massachusetts, convinced of the inefficiency of the common plough, ordered from England a new plough, which was highly spoken of, but on its arrival, found it such a huge, clumsy, heavy combination of wood and iron, that after various unsuccessful attempts at use, he was obliged to lay it by, it requiring more team and hands to manage it, than even the ordinary bull plough of New-England, to which he had been accustomed.

4. Wood, about this time, invented the cast iron plough, and this discovery, in the hands of skilful and scientific men and good mechanics, has effected a total revolution in the qualities and construction of that implement.

5. We well remember the first cast iron plough that fell under our notice, (and it was one of Wood's earliest invention,) and so associated with brittleness and fragility were all our ideas of cast iron, that we should not have deemed it worth an hour's purchase in any field, other than the cleanest and best. Experience, however, showed the fallacy of such impressions; patent after patent was taken for what were deemed improvements, and each new plough received a fair share of public favor and patronage.

6. It would be somewhat amusing, and certainly instructive, to trace the history of this implement from the earliest notice it has received, or its earliest delineations on the coins and sculptures of antiquity, down to the present day.

7. The plough of the ancients, and the teams used, were of the simplest kind. The top of a tree, of which one branch constituted

the handle ; an opposite one, shortened and sharpened, was the plough proper ; and the main stem, trimmed of its superfluous branches, and cut off at the proper length, constituted the beam.

8. Asses or heifers formed the teams, when society had so far advanced as to substitute animal for human labor. Before that, men, or more frequently, women, drew as well as held the plough ; and so slow were changes in domestic matters in the east, that Pliny speaks of seeing, in Africa, fields that produced most luxuriantly, worked by an implement like the above, to which was yoked an ass and an old woman.

9. In some parts of the eastern world, the plough, still used, is not much superior to the primitive one, though a piece of iron is sometimes tied to the under branch that penetrates the ground, and bullocks are in some places used to draw it ; the plough used by the Polish peasantry is of this kind, and in Africa, a sharpened stick, or a wooden paddle, constitutes the implement used for stirring the earth preparatory to a crop.

10. We do not intimate that the plough, even the best kind, can be considered as having reached its limits of perfection. With that implement, as with other things, one decided improvement serves only to suggest another.

11. The changes in material point to changes in structure ; and instead of the blunt, wedgelike form of the old plough, a tapering lifting form has been given, which, penetrating the earth easily, and reversing it readily, dispenses with much of the force formerly required to move it, while at the same time the work is done in a manner to which the old plough could make but faint approaches.

12. The effect of early habits is still to be seen in our ploughs, though not to the extent it formerly was. In the early settlement of any wooden country, knolls made by the turning up of the former forest trees, will abound, giving an unevenness to the surface, requiring several ploughings to remove.

13. On such lands, none but ploughs with short beams and nearly upright handles, can be used to advantage ; and such is the character of the plough in all new countries.

14. Ploughs of this description do not run as easy, and require more labour in the holding, than those made with large beams, and a corresponding increase in the length of the share and point.

15. A well constructed plough has its under surface running parallel with the surface of the soil, no matter what may be the depth ploughed; but when constructed in such a way that the plough is continually on its heel, or its point, the ploughman finds hard work, and the work itself must be imperfectly performed.

16. Every one who ploughs, is aware that on the same soils, one plough will run so true and steady as to require scarce an effort to guide it while another demands constant attention and effort; and he also knows that in most cases, the easiest running plough will be the one with the longest exposed surface, and handles of the greatest inclination; and the reasons for this are so evident, as not to require elucidation.

17. Farmers have been considerably divided in opinion on two points connected with ploughs, or rather with ploughing; one of these regarding the manner in which the furrow slice should be turned over; and the other, the depth to which land should be ploughed.

18. Some have contended that the furrow slice should never be laid flat, but always in such an inclined position, that the edge of one slice should just rest on the next one, leaving under the edge so raised, a vacancy nearly as deep as the thickness of the furrow slice.

19. This, it is contended, is advantageous, by hastening decomposition, and by allowing water to pass freely off without injury to young plants.

20. Other farmers maintain as strenuously that the furrow slice should in all cases be laid perfectly flat, or reversed in such a manner that a field after ploughing should be as level as before, the plough simply reversing the surface of the slice.

21. In this, as in a majority of controverted points, our experience and observation lead us to conclude that both sides are partly right, and both partly wrong.

22. We have found that, if on lands strong and with a tenacious or impervious subsoil, which retained for some time what water fell upon it, the furrow slice was slightly lapped, so as to leave a space below, young plants suffered less from a wet season, or an undue accumulation of water, than they would if the furrow slice was fully inverted, and the surface made smooth and even.

23. On the contrary, we have been led to believe that on a light soil, or one inclining to be dry or porous, it was better to invert the surface completely, and by rolling render the surface smooth, and its particles as compact as possible.

24. A surface so treated, will retain its moisture longer than if left in a state more loose and friable, and the conducting power will be increased by the particles being brought more closely in contact.

25. Let the farmer, then, whose subsoil is impermeable to water, lay his furrows as dipping as he pleases; the more space below,

the better for him; but on a light porous soil, lay the surface flat, and make it as dense as it well can be.

26. The benefit which compressing sand soils confers, is well understood in Norfolk, in England, where the treading of sheep in feeding the turnips in the field, is considered not the least beneficial part of the culture required for the production of wheat.

27. Nearly the same remarks may be applied to the other controverted point, viz: that which relates to the depth of ploughing. The propriety or impropriety of deep ploughing must be determined by the soil itself; by its condition, in reference to a supply of vegetable matter in the soil, and the depth to which it has been formerly ploughed.

28. Where the stratum of fertile soil is thin, and the subsoil, no matter from what cause, incapable of promoting vegetation, it is bad policy to bring this infertile subsoil to the surface, as a stratum in which seeds are to germinate.

29. And where the soil is permeable to the depth of twelve or eighteen inches, or as low as the plough can penetrate, and is filled with fertilising materials, deposited by the processes of nature, or by manure applied to the service in cultivation, then the plough may run deep without fear of injury to the present crop, and the certainty of benefit to the future ones.

30. We think the true method of rendering any soil deep and fertile, is to plough no deeper, and bring up no more of the infertile earth at a time to the surface, than can be thoroughly corrected by manures, to be incorporated with it, and thus made friable and productive.

31. At each successive ploughing, if this course be followed, the soil will be gradually deepened and rendered productive to any desired depth.

32. By pursuing this course of manuring and ploughing, Judge Powell rendered his soils fertile to the depth of fourteen inches, and where the roots of plants have this depth of good earth to range in and seek their food, the farmer can hardly fail of securing first rate crops.

33. Every part of a soil so prepared, is fit for the germination of seeds to the lowest depth to which the plough can reach; and the more thorough the ploughing is given, the greater will be the surface exposed to the benefits of æration, or the ameliorating influences of the atmosphere.

34. One of the greatest differences between the old and the new husbandry, depends on this question of ploughing.

35. In the old mode, the plough was used year after year to the

same depth, and the manure applied with reference to the crop solely, while the improvement of the soil was wholly left out of sight.

36. As a natural consequence, "there was no depth of soil," and when manure failed, the fertility of the land was gone, with scarcely a possibility of renovation under such a process.

37. In the new husbandry, the permanent improvement of the soil, by gradual manuring and deepening, is kept steadily in view; and hence the accumulation anduseof manures hasreceived an additional importance.

38. The garden is usually far the most fertile part of the farm, and this is brought about by the gradual incorporation of manures with the subsoil raised at each successive ploughing, until the requisite depth and fertility is gained.

39. On lands long ploughed to a uniform depth, as they were under the old system, the pressure of the plough on the same surface gradually formed an impenetrable strata, thus forming a fatal obstruction to the roots of plants, where it did not naturally exist.

40. In England, on soils inclining to clay, and which have been under the plough occasionally, or almost perpetually for centuries, this impermeable *pan* is common, and one of the most decided advantages found to result from the subsoil plough, is the breaking up and demolition of this artificial obstruction to the spread and depth of the roots of plants.

41. On the old cultivated fields of some parts of this province, the same difficulty exists more or less, and can be removed, and the soil rendered fertile, by the same means so successful abroad.

42. The too frequent ploughing of land is not to be recommended in any case, and unless absolutely required to destroy foul weeds, it should receive no further moving than is requisite to fit it for a crop. The great mistake of Tull, was, that ploughing or pulverization would supersede the use of manuring.

43. But experience shows what indeed philosophy inculcates, that beyond a certain point, ploughing is injurious; and that though essential benefits are derived to the soil from the action of atmospheric agents, manuring in some form is indispensable to successful farming.

44. It may be said that an application of manure should take place every time land is ploughed and cropped. On land that has been brought to a high state of fertility, the decomposition of the rich sward will usually prove a sufficient dressing for a single crop: but for a repetition or rotation of crops, manures cannot be with-

held without a certain deterioration of the soil, and a probable lessening of the crop.

45. Ploughing and manuring must go together, and without this combination, each will be found defective and incapable of producing such results as are certain to ensue when both separate processes are skilfully united.

46. We are therefore disposed to consider every decided improvement in the plough, as a sure indication of progress in agriculture, a proof that another step in the correction and dissipation of ancient error has been gained; and the way opened and the means provided for still farther and more important advances.

## Section II.

1. Ploughing.—Ploughing is justly considered the most important of agricultural operations, as on the manner in which this is performed, depends the facility of executing all succeeding operations on the same piece of land.

2. The manual operation of holding the plough in a proper position, and directing the horses or cattle which draw it at the same time, is only to be acquired by experience; when once attained it is perhaps one of the most agreeable and healthy of agricultural exercises, the body being kept upright, the arms and legs being brought into action, and also the eye and the mind, to keep the furrow straight, and of regular width and depth, and the voice to speak to the horses.

3. *Three different points require particular attention in ploughing;* 1st, The breadth of the slice to be cut; 2nd, its depth; and 3rd, the degree in which it is to be turned over; which last circumstance depends both upon the construction of the plough, particularly the mould-board, and the care of the ploughman.

4. *The breadth and depth of the furrow-slice* are regulated by judiciously placing the draughts on the nozzle or bridle of the plough; setting it so as to go more or less deep, and to take more or less land or breadth of slice, according as may be desired.

5. In general the plough is so regulated that, if left to itself and merely kept from falling over, it would cut a little broader and a little deeper than is required. The coulter is also placed with some inclination towards the left or land side, and the point of the soc or share has a slight tendency downwards.

6. *The degree to which the furrow-slice turns over* is in a great measure determined by the proportion between its breadth and depth, which for general purposes is usually as three is to two, or when the furrow is nine inches broad it ought to be six inches in depth.

7. When the slice is cut in this proprotion it will be nearly half turned over or recline at an angle of forty or forty-five degrees; and a field so ploughed will have its ridges longitudinally ribbed into angular drills or ridglets.

8. But if the slice is much broader in proportion to its depth, it will be almost completely overturned, or left nearly flat, with its original surface downwards; and each successive slice will be somewhat overlapped by that which was turned over immediately before it.

9. And finally, when the depth materially exceeds the width, each furrow-slice will fall over on its side, leaving all the original surface bare, and only laid somewhat obliquely to the horizon.

10. *Ploughing with the breadth and depth nearly in proportion of three to two*, is best adapted for laying up stubble land after harvest, when it is to remain during the winter exposed to the mellowing influence of frost, preparatory to fallow or turnips.

11. *The shallow furrow of considerable width*, as five inches in depth by eight or nine wide, is understood to answer best for breaking up leys, because it covers up the grass turf, and does not bury the manured soil.

12. *Ploughing with the depth of the furrow considerably exceeding the width*, is a most unprofitable and uselessly slow operation, which ought seldom or never to be adopted.

13. *The most generally useful breadth of a furrow-slice* is from eight to ten inches, and the depth ought to be seldom less than four inches, except in soils uncommonly thick and fertile.

14. When it is necessary to go deeper, as for carrots and some other deep rooted plants, a trench ploughing may be given by means of a second plough following in the same furrow.

15. *Shallow ploughing* ought always to be adopted after turnips are eaten on the ground, that the manure may not be buried too deep; and also in covering lime,—especially if the ground be pulverized by fallowing, because it naturally tends to sink in the soil.

16. In ploughing down farm-yard dung, it is commonly necessary to go rather deep, that no part of the manure may be left exposed to the atmosphere.

17. In the first ploughing for fallow or green crops, it is advisable to work as deep as possible; and no great danger is to be apprehended, though a small portion of the sub-soil be at that time brought to the surface.

17. *The furrow-slices are generally distributed into beds* varying in breadth according to circumstances; these are called *ridges* or *lands*, and are divided from one another by guttors or open fur-

rows. The last serve as guides to the hand and eye of the sower, to the reaper and also for the application of manures in a regular manner.

18. In soils of a strong or retentive nature or which have wet, close sub-soils, these furrows serve likewise as drains for carrying off the surface water, and being cleared out, after the land is sowed and harrowed, have the name of *water-furrows.*

19. *Ridges* are not only different in breadth, but are raised more or less in the middle, on different soils. On clay retentive soils, the great point to be attended to is the discharge of superfluous water; but harrow ridges or *stitches* of from three to five feet, are not approved of in the best cultivated countries.

20. In these a breadth of fifteen or eighteen feet, the land raised by two gatherings of the plough, is most commonly adopted for such soils; such ridges being thought more convenient for manuring, sowing, harrowing and reaping, than narrower ones; and the water is drained off quite as effectually.

21. *Ridges on dry porous turnip soils,* may be formed much broader; and were it not for their use in directing the labourers, may be, and sometimes are, dispensed with altogether. They are often thirty or thirty-six feet broad, which in Scotland are called *ban-win* ridges, because reaped by a band of shearers, commonly six served by one binder.

22. If it be wished to obliterate the intermediate furrows, this may be done by casting up a narrow ridglet, or single bout ridge, between the two broad ridges, which is afterwards levelled by the harrows.

23. *The mode of forming ridges straight and of uniform breadth,* is as follows: let us suppose a field perfectly level, that is to be laid off into ridges of any determinable breadth. The best ploughman belonging to the farm performs the operation, with the aid of three or more poles shod with iron, in the following manner: the first thing is to mark off the head ridges, on which the horses turn in ploughing, which should in general be of an equal breadth from the bounding lines of the field, if these lines are not very crooked or irregular.

24. The next operation, assuming one straight side of the field, or a line that has been made straight, as the proper direction of the ridges, is to measure off from it with one of the poles, half the intended breadth of the ridge, if it is to be gathered, or one breadth and a half if to be ploughed flat; and then the ploughman sets up a pole as a direction for the plough to enter.

25. On a line with this, and at some distance, he plants a second

pole, and then in the same manner a third, fourth, &c., as the irregularity of the surface may render necessary, though three must always be employed,—the last of them at the end of the intended ridge, and the whole in one straight line.

26. He then enters the plough at the first pole, keeping the line of poles exactly between the horses, and ploughs down all the poles successively; halting his horses at each, and replacing it at so many feet distant as the ridges are to be broad; so that when he reaches the end of the ridge, all his poles are again set up in a new line parallel to the first. He returns, however, along his former track, correcting any deviations, and throwing a shallow furrow on the oposite side of his former one.

27. This mode has a decided preference over the common practice, of laying the two furrows first towards each other. By first throwing them from each other, and then reserving them, the whole ground is ploughed; and, if the first furrows are shallow, the ridge has but a slight elevation in th centre.

28. These furrows, when reversed, form the crown of the ridge and direct the ploughmen who are to follow. The same operations are carried on until the whole field is marked out.

29. *Direction and length of ridges* are points which must evidently be regulated by the nature of the surface, and the size of the field. Short angular ridges called *butts*, which are often necessary in a field of irregular boundaries, are always attended with a considerable loss of time, and ought to be avoided as much as possible.

30. *In ploughing steep land*, it is advisable to give the ridges an inclination towards the right hand at the top, by which in going up to the acclivity, the furrow falls more readily from the plough, and with less fatigue to the horses.

31. Another advantage in forming ridges in a slanting direction on such land is, that thesoil is not so likely to be washed down from the higher ground, as if the ridge were laid at right angles.

32. Whenever circumstances will permit, however, the best direction is due north and south, by which the grain on both sides of the ridge enjoys nearly equal advantages from the influence of the sun.

33. *In ploughing relatively to season* it is well known that clayey or tenacious soils should never be ploughed when wet; and that it is almost equally improper to let them become too dry, especially if a crop is to be sown without a second ploughing.

34. The state in which such lands should be ploughed is what is commonly indicated by the phrase, "between the wet and the

dry"—while the ground is slightly moist, mellow, and the least cohesive.

SECTION III.

1. FALL PLOUGHING.—The question is sometimes asked, is it best to plough land in the fall ? and if answered in the affirmative, the reasons for such a procedure are demanded.

2. We think that fall ploughing is desirable in most cases, and on most soils, for the following, among other reasons that might be given.

3. It is one of the established principles of philosophical agriculture, that the soil derives much of its productive property from the air, and that chemical changes and combinations are constantly going on, by which fertility is much increased. These alternative effects of the atmosphere, and these changes of the qualities of the soil, are the more active and efficient as new surfaces are exposed to new action.

4. For instance, much greater quantities of carbonic gas will be absorbed by a given surface of earth, if that earth is frequently stirred, than if it was allowed to remain with a single saturated surface.

5. Ploughing, by exposing new surfaces to the action of the atmosphere, must be productive of essential benefit ; and as fall ploughing generally takes place after crops which have partially exhausted the surface of some of its nutritive and absorbent qualities, its service in aid of spring crops is greatly enhanced.

6. There is always on land more or less grass, weeds, stubble, or other vegetable matters convertible into mould by fermentation and decomposition, a process which is greatly aided by being turned under the surface of the earth.

7. Fall ploughing renders such substances much sooner available in advancing the growth of crops, than they would be if left uncovered during the winter ; independent of the great loss necessarily sustained by the washing away of the lighter materials and their dispersion by the winds.

8. Nothing acts more efficiently on moist soils in promoting vegetation, than high pulverization ; and fall ploughing aids this operation most essentially. Lands that if ploughed in the spring only will remain in large cakes or lumps, defying the efforts of the farmer to reduce them suitably, will if ploughed in the fall be found loosened in texture, and fitted for early operations in the spring of the year.

9. Frost is the most efficient disintegrator of the soil with which the agriculturist is acquainted, and he should avail himself of its valuable labors in all practicable cases.

10. The earlier the ground can be prepared for the suitable reception of spring crops, such as corn, spring wheat, and barley, the better it will be found for the cultivator; and in nine cases out of ten, early sown crops are the heaviest, and most productive.

11. Ploughing land acts more effectually in destroying insects than any other mode of treatment, and fall ploughing for this purpose is preferable to any other.

12. Those insects which produce the most mischief to the farmer, such as the fly, cut worm, grub, &c. cannot resist the frost of our winters, if prematurely exposed to its action by a fall ploughing. The cut worm, which accumulates in such numbers in old meadows and pastures, is thus destroyed, and crops planted on them saved.

13. Lastly—Our summers are so limited in duration, that unless the time allotted to vegetation is fully occupied by the growth and ripening of plants, the certain failure of crops may be anticipated. Hence the farmer usually is more hurried by his work in the spring than he ought to be, in order to avoid having his crops caught by the frost and snow.

14. It should be the object of the farmer to have his necessary labour as nearly equalized through the season as possible, and thus avoid all pressures at inconvenient seasons of the year.

15. Experience shows that the farmer in most cases has more leisure hours in the fall of the year than at any other time, and he who would work it right, should employ this time in advancing his next spring's work, for such fall ploughing emphatically is, and thus preventing the pressure of business then usually felt.

16. These reasons we think sufficient to justify the practice of fall ploughing; and unless in cases where the deep silicious or porous nature of the soil seems to forbid its use, we cannot doubt that our farmers will find their account in adopting the practice.

### Section IV.

1. Fallows.—There is no process in agriculture more important to the farmer, or that contributes more to the durability and fertility of the soil, than fallowing, when skilfully performed; and probably there are few processes, the reasons for which are more imperfectly understood, or the principles that render the operation necessary more completely overlooked, than in this case.

2. With most farmers, it is sufficient to know, that by fallowing the ground is made fine, and thus fit for the reception of the seed, while the more important changes the soil undergoes by contact with the atmospheric agents, and which are indispensable to insure fertility, are unheeded.

3. The mechanical part of the process of fallowing is very simple. In our country it usually commences in the fore part of summer, and consists of two or more ploughings and harrowings, as time will admit, or the earth seems to require, until the seed is sown in autumn. This mode, though obviously defective, as not allowing sufficient time for the action of the air and other agents, is still better than simply ploughing up the land and sowing the seed immediately upon it, as is practised by many.

4. In Europe, with the best farmers, the process commences in autumn, and the land thus rendered uneven by the plough is left to the effects of frost, which most materially aids in pulverizing the soil, and rendering it fit to commence operations upon earlier in the spring than would otherwise be practicable.

5. Late in the season, or early in the spring, there is much land that cannot be ploughed with benefit, as it will knead, or smooth over, which will shut out air, and obviate the end in fallowing. Such soils must be drained, or only ploughed while dry. From five to six ploughings, and as many harrowings or dressings by the scarifier, are usually considered proper, before the requisite fineness and aeration of the soil is obtained.

6. Soils naturally good and friable require but a comparatively little labor to bring them into a proper state for the seed, or restore their fertility when partially exhausted by cropping; but those in which the original earths are less favorably blended, and are tough and stubborn, require a longer time for pulverization, and the consequent atmospheric action on the particles.

7. The particles of matter, or the earths, when at rest, gradually assume an equilibrium in their position and affinities, unfavorable to the action of fertilizing agents. This balance of affinities is broken up by the plough, the particles are separated and exposed to the action of water and air, fermentation is essentially promoted, and the earth rendered permeable to the tender roots of young plants.

8. As a soil in its quiescent state has formed its chemical changes, and its particles may be considered as filled with the substances of which their position would admit the combination, it is evident that to give greater fertility, new particles must be exposed, and new chemical changes produced, until the whole mass is saturated.

9. To show how the changing the position of the particles of matter promotes fermentation, we have only to look at the manure in a heap or yard, part of which has been so pressed as to exclude air, and part has been moved by the trampling of animals, or otherwise, so as to be exposed to the moisture and the air.

10. It will be found that the fermentation in the last is much more advanced than in the first; and that by moving the hard pressed, by admitting the formation of new chemical changes, is much hastened in its decay. So with soils; when broken up and pulverized, this important end, fermentation, is gained, which in those compact and unmoved is impossible, as the free action of the atmospheric agents, moisture and air, are excluded. Both air and water undergo decomposition when brought in contact with newly turned soils, and act an important part in the fertilization of the earth.

11. In all soils there is always more or less water and air, but in the unmoved soil they are in a state of comparative rest; they have parted with all the valuable gases or salts they contain to the earths with which they have come in contact, and can, of course, contribute no further to chemical changes; now if this soil is disturbed, new surfaces are exposed to the water and air as they are renewed, and a continuation of the beneficial results is certain.

12. The chemical combination of water with soils, is on much the same principles as water with lime, though the adhesion or union is not so strong; still this union or affinity is increased by the frequent moving of the soil.

13. This is proved by the fact, that portions of soil were taken from a cultivated and from an uncultivated field near by, and subjected to examination, and it was found that the fallow retained moisture longer than the exhausted part, and when both were equally dried, the fallow earth acquired moisture from the air much more rapidly than that from the uncultivated field. This fact is interesting, as showing the absurdity of the doctrine which maintains that corn or other vegetables should never be hoed in very dry weather. The contrary is the fact, and the oftener the earth is moved the better.

14. Moving the earth and pulverizing it thoroughly, while it enables it to feel more fully the effects of air and moisture, also gives it a higher temperature, and of course renders it more congenial to vegetation. Thus a thermometer inserted into the earth finely pulverized a few hours before, to the depth of three inches, rose two or three degrees higher than when placed in undisturbed earth close by.

15. This is accounted for by the partial circulation of the warmed atmosphere through the loosened and friable soil. Ploughing or moving earths, however, when they are wet, has the effect of destroying this permeability, by smoothing the exposed superfices, and rendering them hard and solid when dry.

16. That pulverization increases the chemical powers of the soil is evident from the fact, that manure of any kind will produce a more lasting effect on fallows, than when applied to lands not cultivated or moved:—

Mr. Bland says—

"The best remedy, when in the process of fallowing it is necessary to plough lands too wet, is to plough the furrows upon edge as much as possible, that the water may drain away the easier, with a greater suface being thus left for the action of the frosts, sun, air, &c., to operate upon."

17. It is the custom with many farmers when they plough their summer fallows, to have them harrowed down as smooth as may be, between the times of ploughing. This practice is wrong; as the ground should be left in that manner that gives the largest surface to the air. The harrowing, therefore, after the first breaking up, should precede the plough, until by their combined operation the soil is made fine enough for the reception of the seed.

18. There can be no doubt that the æration, and consequent fertilization of soils, goes on more rapidly when the temperature is the highest, or during the summer months, or when vegetation is most vigorous, as the chemical changes dependent on fermentation and combination are then the most active; and one ploughing at that season, for beneficial purposes, may be considered almost equal to two at another; yet ploughing at other times, when the soil is fit for it, cannot be neglected without injury.

## Section V.

1. As decomposition goes on more rapidly and beneficially in most substances when covered, but exposed to moisture and warmth, there is a decided advantage gained by fall ploughing, in covering the weeds, stubble, &c., that may be on the surface, so that a longer period for their decomposition will be secured for the benefit of the next crop, and their mechanical influence will be favorably exerted in keeping the land light, and preventing that compactness in texture so unfavorable to drainage.

2. On lands where injurious weeds are found, such as the thistle, Johnswort, daisy, &c., the roots of which survive the winter, fall ploughing to be followed by a summer fallow has a good effect, as exposing to destruction by freezing many of their roots, and thus facilitating the cleaning of the soil.

3. In commencing the spring tillage, it is indispensable that the earth, whether it was ploughed in the fall, or is now moved for the first time, should be so dry as to remain friable, and show no symp-

toms of kneading, and if the fallow is to be manured, perhaps no time is better for that purpose than the spring.

4. This is certainly the case, where barn-yard manure, containing, as it unfortunately does, foul seeds in abundance, is to be used, as by this early application, the seeds have time to vegetate, and by the repeated ploughings be destroyed before the seed of the grain crop is put in. If the land is clean, and the manure compost, or fully rotted, the application of it may be delayed till the last ploughing, so as to be turned under with the seed sown, merely covering being all that is required of manure.

5. The Canada thistle is the great enemy that the wheat grower in a large part of our country has to contend against, and this pest can be met no other way successfully than by thorough fallowing.

6. Where the thistle, or other pernicious weeds, tenacious of life, exist in lands fallowed, going over them after each ploughing and picking or gathering all that appear, may be advisable, as greatly aiding in freeing soils from their presence; but in any event the ground should be moved as often as any shoots make their appearance, as this is found to check or destroy them more surely than any other method of treatment.

7. To derive the full benefit which soils are intended to receive from the process of fallowing, as long intervals should occur between the ploughings as is consistent with the number required to bring it into the proper state for the seed, or the eradication of the weeds with which it may be infested.

8. Many of our farmers allow so little time to intervene between their ploughings, that the changes produced on soils by the action of light, air, moisture, &c., have no time for their accomplishment, and nothing is gained by the process but the simple pulverization of the soil. This, it is true, on lands as fertile as most of those in newly cultivated countries are, may be sufficient; but experience proves that all lands are exhausted by cropping, and hence every reasonable precaution should be used, not only to arrest the progress of deterioration, but prevent its commencement.

9. It has been found in England on most of their long cultivated lands, in which clay forms a prominent ingredient of the soil, that immediately below the earth usually moved by the plough, a hard strata of some two or three inches in thickness is found to exist, almost impermeable to roots or to water, and has a pernicious effect on the cultivation of crops.

10. This artificial hard-pan, or moorband-pan, as it is called, is attributed to the pressure of the plough on the earth below, and especially to the pressing, smoothing effect of repeated ploughings,

at times when the earth was in that state of wetness that disposed it to knead. The fact of the formation of such a body, to break up which requires the application of the deep subsoil plough, should prevent farmers from always ploughing at the same depth, and effectually banish shallow ploughing from thorough fallowing.

11. After the earths have been converted into soil by deep ploughing, exposure to atmospheric agents, and combination with vegetable matter to the depth of eighteen or twenty inches, the formation of such an obstacle to cultivation can scarcely take place; and that such a depth can be obtained is evident from the experience of Marshall in England, and Powell in the United States. By gradually deepening his ploughing, the latter converted his soils from shallow ones to fine friable earths, of the depth of sixteen inches, and the excellence of his crops bear testimony to the propriety of the method pursued by him.

14. The change produced on soils by their exposure to atmospheric agents in the process of fallowing is denoted by their change of colour; and the effects are an increase of the power of absorption; a strengthening of its affinities for vegetable and animal matter; a greater friability or lightness of the particles, so far as their adhesion is concerned; a greater permeability to the roots of the cultivated plants; and a general restoration of the fertilizing and productive properties of the soil.

14. Tull, the restorer of good farming in England, considered pulverization alone, all that was necessary to preserve or restore fertility to a soil; but though he doubtless erred in excluding from his system the necessity of returning to the earth in the form of manures, the vegetation that has been taken from it in the form of crops; still it must be admitted that the pulverization effected by summer or thorough fallowing is one of the most efficient preparations the earth can receive, to fit it for the reception of seed, and the accomplishment of the great end of good husbandry, the production of crops.

## Section VI.

1. Deep and Shallow Ploughing.—In the autumn of 1843, my field was ploughed by the teams that contested for the premiums of the Canada Agricultural Society. It was laid out in lots of one quarter of an acre each. The land is level, and free from rocks. The soil is gravelly and shallow, and only of middling quality.

2. It had been in grass four years previous, and never had been highly manured. The common burden of grass produced upon it was not more than one ton to the acre. The whole field ploughed

contained two acres and a half, one acre of which was ploughed in the spring of the present year; and on this part was the best crop.

3. That which was ploughed in the preceding autumn at the ploughing match was well harrowed in the spring, and furrowed, eight rows to the lot, two rods wide. Twelve ox loads of manure were put to the acre, in the holes. The manure was a mixture of the droppings of horses and neat cattle, in about equal quantities, taken from the barn yard.

4. The ground was planted with Indian corn, from the 10th to the 12th of May. The eight rowed corn, and that which is commonly cultivated in this vicinity, was the kind planted. It was hoed three times in the usual manner. Every part was managed as nearly similar as possible.

5. Each lot was gathered and accurately measured by itself. Lots No. 2 and 3, were the most gravelly, and most exposed to the drought; and the whole field suffered considerably for want of moisture. I am of the opinion that it would have been highly beneficial to have cross-ploughed the land in the spring.—The following is the product of each of the lots:

6. No. 1, ploughed by 28 furrows, 4½ inches deep, situate on the western side, yielded twenty and a half bushels of ears.

7. No. 2, ploughed by 28 furrows, 6 inches deep, yielded nineteen bushels of ears.

8. No. 3, ploughed by 22 furrows, 8 or 9 inches deep, yielded twenty-three bushels of ears. This ploughing was apparently deeper than the soil; but in the latter part of the season the crop suffered much less by the drought than either of the lots; and had the soil been as good, the crop would have been much superior.

9. No. 4. ploughed by 28 furrows, 6½ inches deep, yielded twenty-two and a half bushels of ears.

10. No. 5, ploughed by 28 furrows, 6 inches deep, yielded twenty-one bushels of ears.

11. No. 6, ploughed by 36 furrows, 6½ inches deep, yielded twenty-two and a half bushels of ears. The soil of this lot was rather better than the other parts of the field.

12. From the result of this experiment, my opinion is decidedly in favor of ploughing our lands much deeper than is usually practised by our farmers. Especially is it beneficial on lands liable to be injured by the drought.

## Section VII.

1. The Roller.—Is constructed of wood, stone or cast iron,

according to convenience or the purposes for which it is used. In Canadian husbandry, we have yet no reason to expect, or perhaps desire, any but those made of wood, and such as any farmer, who has a moderate degree of mechanical skill, and the carpenter's tools which every farmer ought to keep, may readily construct himself.

2. A good sound oak log, with the frame and shafts appended, makes a good roller. They are made of different lengths, and sizes varying from 15 to 30 inches in diameter. The lighter kinds are made in one piece, but the larger and heavier kinds are advantageously made in two pieces, with an iron rod passing through the centre of both, and upon which they revolve.

3. English farmers construct the frame so as to rise above the roller, upon which a box is fixed, either to contain stones to add to the pressure of the roller, or to receive small stones and rubbish, collected on the field while at work, which are to be carried off.

4. Their shafts, when at work, are generally horizontal. We think the roller is more easily drawn when the draft is on a right line from the collar or yoke of the team to the point of resistance. This may be done and the advantages of the box retained.

5. The uses and advantages of the roller are many and important, and no farmer should be without one. They are particularly important in the seeding process, to break down the clods, pulverize and smooth the surface, and to press the earth to the smaller seeds, which otherwise often fail to germinate for lack of moisture.

6. This is particularly the case with oats, barley, and the grass seeds. In autumn the roller is sometimes passed over winter grain with a view to counteract the effects of frost the following winter. In spring it is advantageously passed over winter grain, as soon as the ground is so solid and dry that the feet of the cattle will not poach the surface.

7. It renders light ground more compact; presses the soil to the roots of the grain and thus promotes their growth; and upon all soils closes the innumerable cracks and fissures which abound on the appearance of dry weather in spring, and by partially burying the crown, causes grain to tiller better, that is, send up more seed stalks.

8. Finally, the roller is of great advantage to grass grounds in the spring, by reducing inequalities of surface, and pressing down the plants or earth which have been thrown up by the frost.

9. There are also rollers for other purposes, viz: the *spiked roller*, which is used for pulverizing stiff soils, preparatory for wheat. This is formed by inserting several rows of spikes, or cast or wrought iron darts, in a common hard wood roller. The

*concave* or *scalloped roller* is adapted to the form of ridges, and is often attached to the turnip roller.

10. In sowing or planting on turf land, the roller is indispensable, as by pressing down the turned sward it promotes decomposition, and causes the crop to feel at an early period of its growth the invigorating effect of the manure so produced.

11. A farmer in the New-England Farmer, describing his method of cultivating corn, ascribes much of his success to the use of the roller. Last year, in planting a field of 14 acres, one half was rolled and the other half harrowed. The soil of the harrowed part was the best, the manure the same in both.

12. "On the first day of July the corn where the land was rolled was one quarter heavier than on the harrowed part, and so it continued through the season until the harvest."

13. Numberless instances, where the superiority of rolled crops has been manifested, might be adduced, but the reasons of the benefit are so obvious, that they need only to be mentioned, to commend themselves to the attention of every good farmer, and induce him to provide himself at once with this implement, if it is not already numbered among his tools required for successful farming.

## Section VII.

1. On the effects of stirring the surface of the earth as a relief against drought.—This is a trite subject, and one which we are aware has been long since settled by intelligent cultivators, in all countries. It is very familiar to gardiners, and the cause of the very superior production of gardens over field culture may be attributed in part to the more frequent application of the hoe and spade.

2. Yet it is true, that a very great number of farmers deny the proposition, and disapprove the practice. They think it dangerous to plough and hoe in the time of extreme drought and heat, while our own experience of twenty years has convinced us, that it is much superior as a remedy against drought, than watering in the limited manner in which that must always be applied.

3. There has never been a season in our memory in which there was a greater necessity for the application of all remedies against drought than the *present.* The drought was not only of longer duration, but it took place, when plants were the least able to resist it, not having sent their roots in quest of nourishmnent far, wide and deep.

4. The early foliage, also, is more tender, and more liable to wilt under a scorching sun and a drying wind.

5. In this extraordinary season, I had a small patch of early potatoes planted in a warm and sandy soil purposely to procure an early crop; the soil was, at least three quarters pure sand, mixed with some food for plants among the sand.

6. The severe drought threatened a total loss of the crop The potato stalks were feeble, drawn up, scarcely larger than goose quills, and I expected every day to see them wither; all hopes of a crop were abandoned.

7. I thought that they were the fair subjects of a desperate experiment. On one of the hottest and driest days I gave them a thorough ploughing, passing the plough four times through each row; first ploughing two furrows from the hills, as near the roots as possible, without throwing out the seed potatoes and then returning the loom, or earth, instantly back by two other furrows.

8. No rain intervened for ten days. In three days after, the potatoes changed their color, they started afresh, as if they had received the benefit of ample showers, while not a drop of rain had fallen.

9. The dews, which were abundant, settled upon the new turned earth, while, before the ploughing, no moisture had been apparent.

10. The last fact, though it cannot have escaped the notice of the most careless cultivator, has not as yet been explained. We can easily see, that a soil. rendered porous, would more readily and easily convey its moisture to the roots.

11. It becomes like a sponge, and is readily permeable, or rather readily permits the moisture to pass between its particles.—But it is not yet understood why it attracts the moisture. Perhaps, however, it may be owing to its presenting a much greater surface to the moist air of the night. The fact, however, which is what *most concerns us*, is settled.

12. Perhaps some of the experiments of our distinguished countryman, Dr. Wells, a physician of London, who rendered himself distinguished by his remarks on dew, may tend to explain this fact, though it is not my purpose now to examine the theory.

13. Every man who feels an interest in the question, can satisfy himself at once, by stirring a small piece of earth in a time of severe drought, and if he does not find it in the morning more filled with moisture than the undisturbed ground in its vicinity, let him continue a disbeliever.

14. But there is another mode, and it is one which I have never seen suggested, by which I apprehend the stirring of the surface, and making it light and porous, is beneficial in great droughts. It is this: light porous bodies are bad conductors of heat; perhaps

for the reason that they have more air between their interstices.

15. The facts are familiar to us. Metallic bodies acquire an intense heat under the rays of the sun, so do stones in proportion to their density. The earth, when very compact, will become exceedingly hot, but garden loam, which is very porous, remains cool at noon day, two inches below the surface.

16. I believe, therefore, that moving the surface, keeping it in a light and porous state, enables it to resist the heat of the sun's rays, that the air between the particles of earth communicates the heat more slowly than the particles themselves do, when in close contact.

17. Such is my theory; but I am an enemy of theories. I always distrust them, and look only to facts; and having observed that a slight covering of half an inch of sea weed would preserve my strawberries from drought, which can only arise from its lying so loose on the surface, I have been led to infer, that the undoubted fact, that soil in a loose pulverized state resists drought, is owing to the same cause, to wit, the slowness with which the heat of the solar rays is communicated to the roots.

18. But be the theory sound or unsound, I am persuaded that every farmer will find that the free use of his plough and hoe, in times of severe drought, will be of more value to him than as much manure as that labour would purchase. I have been always convinced from my experience as an horticulturist, that the great secret in cultivation consists in making the soil porous.

19. In raising exotic plants we know it to be true, and our flower pots are always supplied with soil, the most porous which we can obtain. The farmer may borrow light from an occupation which he looks upon with disdain, but which serves to elucidate and explain the secrets of vegetation.

## CHAPTER III.

### Section I.

1. Wheat Culture.—Of all the crops cultivated in our country, *the crop*, par excellence, is unquestionably wheat. Its intrinsic value as an article of food, its importance as an item of export, its influence on trade, and its vast sway in regulating the exchanges and commerce of the world, render it every where a crop of the greatest consequence, and particularly so in this country.

2. To raise good wheat many things must be kept in view; the nature and texture of the soil—its quality, so far as richness or poverty is concerned—the kind of wheat most suitable for cultiva-

tion under the circumstances of the case—the cleanness and preparation of the seed—the time and method of sowing—and in short all the things that go to ameliorate the soil and secure a crop, must be attended to, rendering the growing of wheat one of the most arduous as well as profitable occupations of the farmer.

3. A good wheat soil always contains considerable clay, but it is so balanced and corrected by other ingredients as never to be cold and sour; if such is the character of any soil, good wheat need not be expected. Freedom from superfluous moisture or stagnant water, is an indispensable condition of a good wheat soil; and when such exemption does not naturally exist, it must be produced by draining.

4. A moist cool climate is found not to be unfavorable to wheat, if the roots are preserved from stagnant water, and are allowed to range in a pervious soil; but in any climate wheat will fail where the soil is saturated with water that does not circulate.

5. To give the requisite dryness and depth where they do not exist, draining and deep ploughing may be relied upon, and where these go together, with proper manuring, a soil can scarcely fail to improve, or to be productive.

6. Deep ploughing, on most lands as they naturally are, and on all lands as they should be made, is essential to good wheat crops. The roots of this plant penetrate in a permeable soil to a great depth, and spread to a considerable distance. The single fact of its being provided with two sets of roots, one of which spreads near the surface, and the other strikes deeply, is a sufficient proof of the necessity which exists for deep ploughing in its culture.

7. In a few instances subsoils may be found which will not admit of deep ploughing, being composed of materials injurious to the wheat crop; but great crops of wheat are not to be expected on such soils.

8. The application of manures is a very essential point in growing the wheat crop. Land can be too rich, as well as too poor for wheat, or rather the manure in the soil may be in that condition which renders it unsuitable for wheat. There are some crops on which fresh or unfermented manure exercises a good effect, and to which it can scarcely be applied in too large quantities, corn for instance; while on others they produce the most unfavorable kind.

9. Nearly all the cerealiæ are injured by fresh manures, the stalk growing too vigorous, while the berry is usually imperfect. Compost manures, or such as are made by layers of turf, stable manure, vegetable mould, lime, &c., in which the decomposition is

already effected, can scarcely be applied too abundantly to land otherwise well constituted.

10. The great crops obtained around old barns, or other decayed or removed buildings, is a proof that large quantities of decomposed manure may be safely used, while a much less quantity of fresh or undecomposed would be fatal. One of the greatest evils of direct manuring for the wheat crop arises from the liability of the grain so manured to lodge.

11. The rapid growth of the stem renders it unable to support its own weight, it is soft and flexible, contains much less silex than those grown in a poorer soil; the wheat does not usually perfect its berry, and at all times, from the thinness and weakness of its skin or cuticle, is more liable to mildew or rust. These things render it certainly unadvisable, unless the land is very poor and reduced, to apply unfermented manure to wheat.

12. The rotation of crops has furnished the means of applying fresh manure advantageously to crops, and at the same time retaining its principal value for wheat. The cultivation of corn or roots in alternation with grain crops, clover, &c. gives the farmer the means of greatly increasing his crops, and at the same time constantly improving his soil. It may be considered as a settled maxim in agriculture, that land improves little or none while nothing is growing upon it.

13. It is the general acknowledgment of this truth, that has substituted hoed or green crops for naked fallows, in the preparation of lands for wheat. Peas and clover are among the best green crops to precede wheat, and the latter may be considered inseparable from the successful culture of this grain. Corn would be one of the very best crops to precede wheat, could it in all cases be removed from the land in season to get in the wheat properly.

14. The thorough manuring and tilling required for corn, puts the ground in good condition for wheat; and should experience prove that *very late* sown wheat is more safe from danger in winter, and more productive than that sown a little earlier, a result said to be established in some of the best wheat countries of Europe, the crop of corn would cease to be objectionable, and might be considered as nearly clear gain.

15. There is a practice which has prevailed to a considerable extent in our wheat producing districts, of growing wheat after wheat several times in succession. Such a system of farming deserves the severest reprehension, and will never be adopted, except by those who are in a haste to be rich, and in defiance of acknowledged consequences.

16. Farmers may have succeeded in raising good crops in this way, where the soil was of the fine quality and excellent adaptation to wheat of much of our western land, but nothing short of the most imperious necessity can justify this procedure, or tolerate such a departure from the correct principles of cropping. Land, which has once produced good crops of any kind of grain, may again be made to produce them; and under skilful treatment lands never cease to yield good crops, where their first cultivation proved the adaptation of the soil to that particular one.

17. It is unhappily too true, that on a large portion of our best cultivated wheat lands, the soil has become so infested with a variety of foul and noxious plants, that a course of naked summer fallow, thoroughly performed, has become necessary to counteract them, and prevent their increase and spread. On clean soils this would not be required, but some valuable crop might take its place, and thus add essentially to the profits, while it lessens the labor of the husbandman, so far as the operation of summer ploughing was concerned.

18. The only alternative of such fallows is hoed crops, and these must of necessity for the reasons before given, be too limited to seriously affect the propriety of fallows on weedy land. Spring crops, such as barley, oats, spring wheat, or even peas, do not allow of sufficient cultivation to check the spread of weeds. The sowing of such crops on land where the Canada thistle for instance abounds, is precisely the treatment to make it spread and flourish. The thistle, stein krout, charlock, &c. will succumb only to ploughings and hoeings so oft repeated that the mutilated plant has no time to recover from one blow before another is given.

19. The preparation of seed, and the quality of that sown, are objects of the greatest consequence. In the most favored sections of our country there are but few fields of wheat in which smut cannot be detected, and in a country so favorable to the perfection and purity of this grain, as the best wheat districts in Canada are, none at all should be suffered.

20. In Europe, continual care is requisite to keep their wheat free, and in the best wheat countries the crop is almost wholly exempt from smut; here but a trifling attention is requisite, and the consequence is, it is found almost every where, and in some places to the serious injury of the crop.

21. Now it is well understood, that soaking or washing wheat in brine, and drying it with *caustic* slaked lime, will effectually prevent smut, as well as benefit the crop in other respects; to sow wheat therefore, without such preparation, is voluntarily to incur

the risk of smutted wheat, and the inevitable consequent loss.

22. There are some other substances that used as a wash for wheat appear to possess the power of destroying smut, such as copperas, vitriol, arsenic, &c., but as none are more certain in their operation, or can be used with less trouble or danger than lime, the application of that substance is undoubtedly to be preferred to any other.

SECTION II.

1. The kind of seed used, and its quality, are things of too much consequence in the culture of wheat to be left to chance. There are many varieties of wheat cultivated, some very productive, and some very hardy; some ripening later and some earlier; and these kinds in sowing should be chosen with reference to the soil and location.

2. Varieties which ripen at the same period, may sometimes be advantageously mixed, for sowing in the same field; but those that ripen unequally should be carefully kept separate. Some varieties of wheat may stand in the field longer than others before cutting, without danger of the seed shelling or wasting.

3. Thus of the two kinds of flint wheat, the white and the Canadian (the latter a comparatively new variety), if the last should be allowed to stand after at maturity as long as the first can be permitted with impunity to do, the loss by shelling would amount to no small portion of the crop. The first may stand almost to suit the convenience of the husbandman, while the last must be cut as soon as its maturity will admit, or certain loss will be incurred; and nearly the same remarks will apply to some other kinds.

4. There are some farmers who seem to think that any thing that is in the shape of wheat, however imperfect or defective the berry, if it will only grow, may be used as seed. This is very mistaken policy. It is impossible that the young plant should be as vigorous and as perfect, when springing from defective and shrunken seed, as when growing from that in which the peculiar principles of the plant are fully developed, and the germination commences without check or hindrance. The seed that ripens first in the ear, and is separated with the greatest ease, is the most proper for seed, as these circumstances show it is the most mature.

5. A farmer in one of our Districts, a few years since, was in the habit of selling large quantities of seed wheat annually and at high prices, as his wheat was of a superior quality, very heavy and productive, and supposed to be a new variety. It appeared, however, that he had brought his wheat to that degree of perfection, by selecting some of the finest ears from a field in the first place, and

then instead of threshing the whole crop grown and using the seed promiscuously, he gently beat the sheaves over a barrel, by which only the best and most perfect grains were separated, and by repeated sowings had rendered the qualities so desirable permanent.

6. The quantity of seed sown differs much in different parts of this country and in Europe. Perhaps the English use a greater amount of seed than any other people, and their crops are certainly not often excelled. From two and a half to four bushels per acre are there used; while here the quantity varies from one to two and a half bushels per acre. The general quantity is about a bushel and a half.

7. Where wheat is sown late, more seed is required, as the wheat does not tiller or spread as much as when sown early; and when the berry is unusually plump and full, more is required than when the kernel is lighter. As on soils, too, that are not rich, a single plant will not throw out as many stalks as where the land is very rich and fertile, it would seem that on such lands more seeds would be necessary to seed it properly; as it is clear that where but one or two stalks shoot from a root, these must be more numerous than when a root produces half a dozen.

8. Opinions among farmers have been somewhat varied on the subject of changing seed; but we think unless more pains are taken to originate and preserve good seed on a farm, than now usually are, there is essential benefit derived from such changes. Wheat is certain to succeed better on lands not naturally adapted to its production, when the seed is brought from a good wheat soil or district.

9. For many years the farmers of large sections of the western district of New-York, where the wheat crop at that time was apt to fail or smut, found a profit in sending some twenty or forty miles to procure seed from the best grain districts, and the crop from such wheat rarely failed in producing grain of good quality.

10. There is also a decided advantage secured in bringing seed from lower land and a milder climate, to elevated lands, or a cold moist climate. Such a change of seed renders the mountain crop earlier and better than it would be if seed from the same neighborhood was used.

11. Professor Brown has on this subject the following remarks, which are undoubtedly correct, as they are founded on the experience of husbandmen in the high and low lands of Scotland:—

12. "We are convinced that the cultivator of a mountainous district, if he always used seed from his own crops, would reap later and later harvests, so that at last they would with difficulty

be brought to maturity; a circumstance easily explained by the comparative shortness of summers in mountain districts. If, on the other hand, the cultivator of a flat country, the climate of which is mild, and the soil dry and light, continually made use of his own seed, it would head every year sooner, the stalks would become shorter, and the heads and grain smaller and smaller, and in time there would result but a poor produce. In this last case, the cultivator brings his seed with advantage from a country or district more cold, the soil of which is good and substantial."

13. The instances in which benefit has been derived, on what are called beech and maple lands, by using seed from oak lands, are so numerous that almost every one must be familiar with them. The advantages in this case, however we may choose to explain them, cannot with propriety be disputed.

14. As to the time of sowing wheat, it may be remarked, that very early sown wheat gets more firmly rooted, than later sown, and in consequence is less liable to injury from freezing out. Wheat may be sown so late as not to germinate until the severity of the winter is past, or the greatest danger from frost is gone by; but such late sown wheat is far more liable to the attacks of blight or rust than that which ripens early, or such is so far advanced before the close of showery weather, that marks the advent of blight, commences, as to be safe from injury.

15. On the other hand, late sown wheat is very certain to escape the Hessian fly which in some parts of the country is the greatest enemy wheat has to encounter. It would seem, then, that where wheat is liable to winter-kill or blight, early sowing is to be preferred; and that where the fly is prevalent, sowing should be delayed as long as possible.

16. It may be added, that some experiments would seem to prove, that in districts where the wheat worm has been so fatal in spring wheat, very late sowing, by delaying the earing of the wheat until the period of the worm fly was passed, would preserve the crop.

17. There is more wheat lost to the husbandman from the single cause of winter-killing or freezing out of the ground in the winter or spring, than there is in this country from all other causes put together. The worst period is in the months of February or March, when the ground is bare of snow, and thawing mild days are succeeded by sharp freezing nights.

18. This freezing expands the surface water, lifts the roots from their place a little at each time, and by successive freezing and thawing, leaves the plant without any hold upon the soil, and con-

sequently to perish. Heavy soils are more apt to winterkill grain, than gravelly, or light ones, as these can retain little water.

19. It would seem to be a necessary inference, then, that thorough draining such soils as are apt to winterkill wheat, would prove a remedy, and theory and fact in this case are found to agree.

20. We have lately had the pleasure of seeing beautiful fields of grain growing on lands, from which, a few years since, the production of wheat would have been impossible. Thorough draining had removed the water that formerly saturated the soil, and by freezing the surface, prevented the lifting out process that always accompanies the freezing of wet grounds.

21. It is usually the case that such wet grounds contain a large supply of vegetable matter, and draining renders them so productive, that the profit of a single crop not unfrequently repays all the expense incurred in the improvement, leaving the land which in its former state was nearly worthless, a clear gain to the husbandman.

22. If on common farms the means of trench or thorough draining are not at hand, surface drains made in such a manner as to carry off the water that falls on the lands, should be constructed immediately after sowing is completed. By preventing such water remaining in, and consolidating the land, grain is less liable to be thrown out; and though far less beneficial, or permanent in its effects, than thorough draining, surface drains should not be omitted where there is the least danger from excess of water.

## Section III.

1. Spring Wheat.—One of the earliest objects which demand the attention and labor of the husbandman in the spring of the year, in those sections of the country in which the cultivation of spring wheat has become a matter of importance, is the preparation of the ground for the seed; which should be got in as early as the nature of the soil and the weather will admit. It is but a few years since the cultivation of spring wheat began to attract notice.

2. Though a valuable grain, we do not advise our farmers to attempt making it a substitute for winter wheat, unless in situations where the latter is liable to fail from being winter killed, or in cases where a crop of this wheat as a spring grain, would be better than oats or barley.

3. Spring wheat requires a rich soil, but one not made so by heavy dressings of manure applied to that crop. Pastures on

which sheep have been fed or folded, fields that have been heavily manured for corn or roots, and from which such crops have been taken, are found to be the best for wheat; as manure applied fresh to the wheat crop, is apt to produce too great a growth of straw, and by lodging the grain endanger the filling of the berry.

4. We have known excellent crops of spring wheat raised on sheep pastures, the ground being carefully and completely turned over in the fall, and in the spring the surface earth is loosened by repeated harrowings for the reception of the seed, without disturbing the turf in the least.

5. One of the greatest difficulties attending the cultivation of spring wheat, (and the same remark will apply to barley, which should also be put into the earth in good season) is found in the general wetness of lands suitable for this wheat, early in the spring, and which too frequently causes the rotting of the seed, or if succeeded by dry weather, baking the surface to such a degree that the young plant is unable to force its way through the obstruction, and of course perishes. Thorough draining is the effectual remedy for this evil, and where this is not done, every precaution should be taken to conduct the water from the field and prevent all accumulation on the surface.

6. The kinds of wheat most in estimation at the present time appear to be the Italian, Siberian, and Tea wheats: but there are numberless other varieties, either original in this country or imported from abroad, which have their advocates, and which probably possess their peculiar good qualities.

7. The fact that winter wheats can readily be converted into spring wheats, leads to the hope, that new and superior varieties may thus be introduced to the farming public; kinds which shall combine the excellencies of winter wheat for flouring, with the certainty of growth which belongs to spring wheat, in a greater degree than any kind now known.

8. In those districts of our country in which the worm has proved destructive to the crops, it has been found that late sowing, by retarding the appearance of the ear until the season of the fly, which fortunately seems short, is over, has exempted the crop from attack.

9. Experiments in the central and northern parts of Canada prove that spring wheat sown from the first of April to the first of May, was almost wholly destroyed; that sown from the first of May to the 20th, escaped with little injury; and that sown after, or at this time, was free from worms. In districts, therefore, where the worm is feared, it would seem to be advisable to delay

as late as may be consistent with the safety of the crop, and its arrival at maturity.

10. Spring wheat may be considered more liable to smut than winter wheat, and it should always be brined and limed previous to sowing. The advantages of this course will be found not only in freedom from smut, but in a more heavy and vigorous growth of the plant, than without such preparation.

## Section IV.

1. Rust on Wheat.—The great bane to successful wheat-growing is rust; and although it is now pretty generally admitted that the disease is caused by the bursting of the sap-vessels of the plants, while the sap is in a state of rapid circulation, being produced from a close, warm, or humid state of the atmosphere; or by showers of rain, followed in close succession by hot sunshiny weather; still the mode of cultivating the land, to prevent the ravages of this enemy to the farmer, is not so generally well understood as it ought to be.

2. In treating upon this, as upon all other Agricultural topics, it is quite impracticable to lay down any set of rules that could be applicably carried out in every instance; but we would wish to be understood to assert, that, in the great majority of cases where rust is most frequent upon the wheat plant, it might almost, if not solely be prevented, by a judicious system of management.

3. The best wheat land in the world is that description of soil where calcareous matter constitutes the principal proportion. On a farm in one of the southern counties of England, where seventy-five per cent. of the soil was composed of carbonate of lime or marl and only a small proportion of the remaining 25 vegetable matter, an average crop of wheat equalling forty bushels per acre has been harvested for the past twenty years, on the four-shift system, without any perceptible deterioration of the fertilizing quality of the soil.

4. It does not necessarily follow, because a soil containing such a large proportion of lime scarcely ever fails of yielding a good return of wheat crops, that a soil containing a less quantity, with skilful and scientific management, might not be equally productive. The exact amount of lime in the soil, to constitute it good wheat land, depends greatly upon circumstances.

5. A soil containing equal parts of carbonate of lime, clay, sand and vegetable matter is probably, when all things are considered, the most productive and profitable land cultivated.

6. Any farmer, when once acquainted with the true science and

practice of husbandry may, in a few years, change the texture of his soil, be its original qualities what they may; and thus, in process of time, convert the most barren into the most productive soils.

7. A soil naturally deep with vegetable matter, to produce a crop of winter wheat, of a superior quality, should be ploughed deep, in order to give a proper consistency to the soil; and, unless the land is previously made very sterile indeed by constant cropping, a dressing of barnyard manure would be likely to be prejudicial to the crop.

8. As evidence of this opinion, the circumstance is worthy of notice, that, on all soils where there is the least vegetable substance, the crops, although comparatively short in the straw, are seldom, if ever injured by rust. It is also a notorious fact, that, on all deep black soils, winter wheat seldom comes to perfection: the rust is almost sure to catch it; and the owner of such a crop is almost sure to calculate largely upon the yield, if only it escape the rust.

9. Much of the land that is sown with autumn wheat is not at all adapted to this crop, inasmuch as it contains too great an amount of vegetable or putrescent, and too small an amount of mineral matters.

10. A soil of the quality just mentioned, averaging the depth of six inches, would, if sown with fall wheat, in nine cases out of ten prove to be a failure, if ploughed only to the depth of the surface mould; but if it were practicable to mix about six inches of the sub-soil with the surface soil, the two would become so closely blended together, that it would be most easily managed, and become a part of the most profitable land under cultivation.

11. On soils composed of nearly pure clay, or sand, the application of a liberal dressing of raw unfermented barn-yard manure would be of great advantage to the wheat crop; but when vegetable matter is the principal ingredient, in order to insure a good return, the addition of barn yard manure is not only unnecessary, but the sub-soil should be litterally mixed with the surface soil, as a means of imparting the proper food to the plant, to produce a hard outer coat to the straw, and also to lessen the chance of being removed and destroyed by the freezing and thawing which takes place at the opening of spring.

12. As the bursting of the sap-vessels of the plant is clearly the cause of the rust, any operation that would have for its object the effect of hardening the straw would lessen the chance of the wheat crop being attacked with this direful enemy to the successful and profitable cultivation of wheat.

13. Depositing the seed in rows, either by a drill or ribbing plough,

would have a tendency to impart this result inasmuch as the air would have a free circulation among the plants.

14. Deep ploughing, where the sub-soil contains any considerable amount of lime and potash, would also have a favorable influence upon the crop, as both lime and alkali will dissolve and separate the sand and the soil, even so minutely that the small particles may be conveyed to the stem of the plant, and thus form a harder outer surface to the straw than if putrescent manures alone were used.

15. To sum up the matter, in conclusion, we would say, plough deep; apply the manure to the crop which immediately precedes the wheat crop; drain the land, either by the plough or spade, in such an efficient manner that the plants would not be apt to receive injury from excessively hot weather; sow early, and let it be done deep and in rows, when practicable, and top dress the crop, with ashes or salt, in the spring, to cause the plants to ripen early.

## Section V.

1. Chess on Wheat.—It is wrong to form hasty conclusions upon matters that have either doubt or mystery involved in their solution; and, from this conviction, we made the following experiment, five summers since, which resulted in a clear demonstration, that the laws of nature, in this instance, as in all other, were uniform and stable :—

2. We selected two acres of the best wheat on the farm, from which, after bestowing much time and trouble, we carefully separated every plant other than wheat, at the period whilst the wheat plants were in flower.

3. The produce from these two acres was thoroughly cleaned with a fanning machine, and afterwards passed through a hand sieve, and steeped in brine sufficiently strong to buoy up an egg, the whole of which process thoroughly cleaned the seed, which resulted in a crop the following year equally free from disease and impurity.

4. About three bushels of seed, which had undergone no preparation, were sown, however, for experiment, the produce from which had an abundance of both chess and smut.

5. To repeat what has been elsewhere stated, we have every confidence that both smut and chess may become comparatively unknown, unless it be as a matter of history; and that rust, in a majority of cases, may be obviated by the introduction of a rational system of cultivation. Such a system of cultivation will be found to consist in sowing good and properly prepared seed, so far

as the two former are concerned; and as it regards the latter, the following will be found to have a considerable influence in lessening the chance of its baneful effects:—

6. Manuring for the crop which immediately precedes the wheat crop; deep ploughing; early sowing; liberal seeding, and depositing the seed in rows; and horse hoeing, are, according to our judgment, necessary steps to insure a good wheat crop, upon much of the worn-out wheat lands of the country.

7. The confidence which we express upon these disputed points may, in some instances, beget ridicule from those of our readers who may have been more regardless in examining into causes and effects than we have been; but to such we would say, try for yourselves, and travel no longer the blind road of tradition, but recollect that only slovenly and improvident farmers are above adopting the improved methods that men of science and deep research have pointed out.

## Section VI.

1. Smut on Wheat.—Various opinions are entertained regarding this disease, so common to the wheat crop. Some suppose it to be a fungous production; others, that it is the work of an insect: others, that it is propagated by inoculation, in a similar manner that infectious diseases are communicated to the animal creation; but the real nature, origin, and habits of the disorder have hitherto eluded the researches of the most scientific inquirers of all nations; and, therefore, it would be presumptuous in us to be positive upon a matter in which there appears so much mystery involved.

2. On one point, however, we feel certain, namely, that the remedy is most easy, and if it were generally adopted, a single smut-ball would not be raised where there are bushels grown under the old slovenly system of preparing the seed.

3. In every neighborhood there are more or less careful farmers, who seldom, if ever, have their wheat crops infected with this disease; from such farmers seed should be procured; and independent of its being good, and free from disease, it should be steeped in a solution of salt and water, sufficiently strong to buoy up an egg.

4. The liquid in the tub should be a few inches higher than the grain, so as to allow it to be stirred, in order to bring all the light grains to the surface, from thence they are to be skimmed off, so long as they continue to rise. If baskets with handles were used, to immerse the wheat in the tubs, it could be conveniently taken out and drained.

5. The seed should be left in the steep about two hours, after which it should be drained, and spread thinly on the floor of the granary, which should be well sprinkled with sifted quick-lime, fresh from the kiln, and which had been recently slaked with a small portion of the liquor.

6. About half a peck of lime is sufficient for a bushel of wheat and it should be carefully mixed, in order that every grain may be completely coated. It may sometimes happen that seed entirely free from smut cannot be procured, but when instances of this kind occur, a solution of one pound of blue vitriol to eight quarts of water should be applied, when quite hot, to three bushels of wheat, and the whole should be frequently stirred, and dried with lime.

7. Sulphate of copper, in the proportion of five pounds to three bushels of wheat, is frequently used with good success; it should be dissolved in a sufficient quantity of water to cover the seed.—After being repeatedly stirred, and cleared of light grains, it should be suffered to remain in the liquid about four hours, and then dried in lime, as mentioned above.

8. Various other preparations of vitriol, nitre, sulphur, arsenic, &c., may be used, with a probable certainty of success; but, instead of trying needless preparations, it would be decidedly better to procure seed free from the disease, and steep it in stale urine or brine, and apply lime, as previously directed.

9. By carefully preparing the seed, and by practising almost absolute cleanliness in the operation, the disease of smut, so detrimental to the farmer's profits, may be wholly avoided.

## Section VII.

1. Winter Killed.—This is a term made use of to denote the destruction of plants by the effects of winter; whether they are not sufficiently hardy to withstand the severity of the climate, or whether they are thrown out of the ground by the mechanical action of the frost and are dryed up, or covered so deep and long with snow that they mould or rot, the same term is applied—"they are winter killed."

2. So far as our observations have extended, we find that by far the greatest proportion of agricultural plants are killed by the mechanical operation of the frost in the spring, such as Wheat, Rye, Clover and most kinds of grasses, while they are young.

3. It frequently happens in this latitude that many plants which have remained perfectly green and fresh under the snow, are destroyed by the frosts after snow has disappeared. To prevent this

with field crops, as young grasses, &c., we would recommend the use of the roller, which is an instrument altogether undervalued by many good farmers.

4. Perhaps the reasons why this instrument has not been more generally introduced, is because it cannot be used to so great advantage on new lands where there are stumps and roots; but as soon as these disappear, the roller should be considered as important an instrument as the plough or harrow and should always be an accompaniment.

5. Many grass lands are materially benefited by being rolled as soon as the frost is out of the ground, while they are yet wet and soft. By this operation, the surface is made more even and smooththan it would otherwise be, and the roots of grasses are more closely pressed in the earth, which facilitates their early growth. In some cases, when the grounds have been long in grass, the use of the harrow before the roller will be found very advantageous. Many garden plants require attention as soon as the snow leaves them.

6. Lettuce plants which were sown in the fall, generally appear first when the snow first leaves them, but many of them perish afterwards by night frosts; such plants should be covered up with straw or mats. Strawberry plants which were set in the fall, are often thrown out of ground in the spring.

7. The ground about such plants should be trodden down as soon as thawed, and if some straw or litter is thrown over them, the better. By a little attention to protecting plants in the spring, cabbage plants may be sown in the fall, and allowed to stand out, and will be found equally as good as those raised in a hot bed.

8. Other plants may be preserved from "winter killing," such as tender shrubs, by wrapping them up in straw, whereby they will be prevented from so frequently freezing and thawing as they would otherwise do.

9. We have seen a thick shelled Almond this spring, which stood in a shaded situation, which was perfectly fresh, while some otheri n a sunny situation, in the same garden, were "winter killed," from which it might be inferred that it was not the severe cold which caused their death, but the too frequent freezing and thawing. We have noticed also that European grape vines, which lay upon the ground without being covered with any thing but snow, were in better condition than those which were left upon trellises.

## SECTION VIII.

1. BARLEY.—The soil for barley should be such as will grow good turnips, or other green crops, including clover, and which embrace the varieties of loams and sands that are not wet, or *very* dry and poor. Indeed, I have taken my crops, and they have been pretty good, from my lightest turnip soils. Barley cannot be cultivated to advantage upon stiff, heavy, and wet grounds, or on such as are of a cold tenacious quality.

2. This crop occupies the ground but about three months; and it is only in a dry, light, mellow soil, that its roots can extend with facility, and supply the food necessary to bring the grain to rapid and perfect maturity.

3. *Previous Crop.*—Crops that precede this grain should be such as leave the ground mellow, and free from weeds; and for this reason hoed crops are to be preferred, such as turnips, potatoes, peas, beans, &c.

4. Small grains should not precede it. They impoverish the soil, leave it foul, and besides, it is contravening one of the most salutary maxims of husbandry, to grow two dry crops in succession. It may follow clover; but if the soil is heavy, the ley should be ploughed in autumn.

5. Barley is successfully sown upon the fallows in England, (not summer, but autumn fallows,) and is sown sometimes after wheat; but in the latter case turnips are pulled, and previously fed upon the stubble; a practice which I think is not likely to obtain here. I have generally sown barley after ruta baga, or potatoes, these crops having received a good dressing of long yard, or stable manure.

6. *Manure* should not be applied to the barley, but the preceding crop. The short period that this grain occupies the ground, does not afford time for the manure to decompose and yield its food to the plants; and if applied to excess, it causes a too rank vegetation, and the straw lodges before the grain is matured.—Where a fallow or clover-ley is employed and ploughed in autumn, dung may be previously employed and ploughed under.

7. *Preparation of the ground.*—Where barley follows a root or hoed crop, one ploughing will generally suffice; but in all cases, a complete pulverization of the soil is necessary; and to effect this a roller is of material benefit. If sown upon grass leys, ploughed in autumn, the spring ploughing should be shallow, so as to leave the sod reversed. But the preferable way may be to harrow the fallow, plough in the seed with a light furrow, and smooth off with the harrow.

8. *The seed and sowing.*—Loudon enumerates six species and sub-species of the barley. The kinds uniformly cultivated here are the two, four, and six rowed spring, (*hordeum vulgare* and *h. distichon*). Thin-skinned, pale, plump seed, should be selected. I sow as soon as the ground is sufficiently dry in spring.

9. The young grain is not hurt by the ordinary frosts of the latter part of April and May. I sow from six to eight pecks per acre, according to the richness of the soil, and the forwardness of the season; the poorest ground and the latest sowing requiring the most seed. In England, the common quantity of seed is from eight to sixteen pecks.

10. Our climate being much warmer than that of Great Britain, barley and other grains till better with us, and consequently we require less seed. We uniformly sow broad-cast, generally on the fresh furrow, and harrow in both ways; and those who have a roller use it in the finishing operation. It gives a smooth surface, breaks down the lumps, brings the earth in contact with the seed, and if grass seeds have been sown, its use is doubly beneficial.

11. I steep my seeds twenty-four hours in a weak solution of nitre, the crude kind of which costs me only eight cents per pound by the quantity. From the analysis and observations of Grisenthwaite, there is reason to believe that this salt is peculiarly beneficial to the barley crop, the grain yielding it on analysis.

12. I have made no comparative experiments, but I think this step serviceable. I have applied to this grain, as a top dressing, with singular success, the powdered dung of pigeons and dunghill fowls, at the rate of twenty or thirty bushels to the acre.

13. The crop admits of no after culture when sown broad-cast. Yet the application of the roller, when the plants are two or three inches high, is no doubt salutary, especially if there has been no considerable rains. Rolling gives a salutary compression to the soil, which in the spring is apt to be loose and porous, and full of cracks, by the alternation of freezing and thawing, or of wet and dry weather; it destroys many insects; and above all, it partially buries the crowns of the plants, and introduces a multiplication of the seed stalks.

14. I can recommend the practice from experience. When grass seeds are sown with barley, the luxuriance of the young grass sometimes chokes the grain, robs it of nutriment, and sensibly diminishes the product.

15. To obviate this evil, it has been recommended to sow the grass seed after the barley has come up, and to cover them with a light harrow and a roller; and it is said, and I think with truth,

that this operation will not materially injure the grain. In dry seasons, the crop is sometimes attacked by worms, while young.—In this case, the roller should be applied, and sufficient weight added to require the draught of two or three cattle.

16. *Time and method of harvesting.*—When the soil is rich and the season propitious, this grain is very liable to lodge. If this happens after it has blossomed, no material injury is sustained in the product. If before, the crop is greatly diminished. This shows the danger to be apprehended from making the soil too rich, and of applying fresh manure.

17. Barley is known to be ripe by the disappearance of the red-cast on the ear, or what the English farmers term *red roan;* by the ears begining to droop, and bend themselves round against the stems; and by the stalks becoming brittle, and of yellowish color. This is the particular period for cutting, as, if suffered to stand longer, the heads break off and the grain wastes with the slightest touch.

18. And it may be cut with the cradle, sickle, or scythe, according to the circumstances. If it stands straight and is not too heavy, the cradle is to be preferred; if heavy, or lodged, the sickle or scythe. But, as the grain is yet soft, and the straw contains much moisture, when it ought to be cut, it should be suffered to become well dried in the swath before it is bound in sheaves, or carried to the barn or stack.

19. If cut with the cradle or sickle, it is bound in sheaves; but the more common practice is to cut the crop with the scythe, rake the ground, and load it with the barley fork.

20. Barley improves for malting by lying till October before it is threshed; though it is often threshed immediately from the field. The great difficulty in preparing it for market, is to rid it of the awns. This may be done with flails, after it has passed once through the fanning mill. And where it is in great quantities, it may be spread from four to six inches, on the barn floor, and trodden with horses.

21. *Produce and profits.*—The average product in England is stated by Donaldson at thirty-two bushels per acre. The product in this province varies from fifteen to seventy bushels, according to season and soil; and I think the average is somewhat short of that in Great Britain. Compared with wheat, its product is as two or two and a half to one; compared with oats, about equal, provided the soil is adapted to this grain.

22. It is, however, to be remembered, that neither wheat nor oats are adapted to a barley soil; the first requiring a more stiff

and tenacious, and the latter a more cold and moist location. The average price of barley is at least two-thirds that of wheat—supposing wheat then, to be 5*s*. 7½*d*. the bushel, and the product fifteen bushels per acre, and barley to be 3*s*. 9*d*. and the product of an acre thirty bushels, and the expense of cultivation equal, the profits of the barley will be nearly as three to two, compared with the wheat. Barley, besides, is a less precarious crop, is subject to fewer diseases, and has fewer insect enemies to encounter than wheat.

23. A correspondent of the Bath Agricultural Society writes—"The last spring being remarkably dry, I soaked my seed barley in the black water, taken from a reservoir, which constantly receives the draining of my dung heap and stables. As the light grains floated on the top, I skimmed them off, and let the rest stand twenty-four hours. On taking it from the water, I mixed the grain with a sufficient quantity of sifted wood ashes, to make it spread regularly, and sowed three fields with it. The produce was sixty bushels per acre.

24. I sowed some other fields with the same seed dry, but the crop, like those of my neighbors, was very poor, not more than twenty bushels per acre, and mixed with green corn and weeds when harvested. I also sowed some of my seed dry on one ridge in each of the fields, but the produce was very poor, in comparison of other parts of the field."

## Section IX.

1. Spring crops—Oats.—Oats are usually considered and treated as if of secondary importance on the farm, and as like wheat or corn they cannot readily be converted into bread, perhaps they are so in certain senses: still we believe oats are worthy of much better treatment than they receive, and can be made more profitable than is usually imagined.

2. If a man has a piece of land he cannot manure for another crop he consoles himself with the thought that it will do for oats; if so wet that any thing else would drown, he puts on oats; if so poor that pennyroyal would not grow, he puts on oats: if other crops fail he puts on oats; and if he is hurried with his work in the spring, his oats are the last thing that goes into the ground, and as a matter of course about the last that is secured in the fall.

3. Is it a wonder then that some should think oats are not profitable? It may in general be considered as certain that land in good heart enough to yield twenty-five bushels of wheat to the acre, would give seventy of oats if properly and seasonably put in;

and as oats will in the course of the winter or spring command from 2*s.* 3*d.* to 2*s.* 6*d.* a bushel, the farmer may make his own calculations on the comparative profits.

4. Oats are less delicate in their choice of soils than either wheat or barley, and in many cases will grow where either of these would be a failure, yet oats require a good soil, and perhaps no crop more abundantly repays early and careful getting in.

5. There are several varieties of oats cultivated, such as the white or common oat, the black, the horsemane oat, the potatoe oat, and the skinless oat. All of these do well, and have produced large crops with the exception of the skinless kind, of which we have many doubts whether they will be found adapted to our country and climate.

6. With oats as with most other crops change of seed has proved beneficial, and new varieties are usually heavier than those that have been longer cultivated in any place. Care, however, in the selection of seed, and early sowing, must prevent the deterioration of any plant which has been found as well adapted to our country as the oat; and if farmers wish the best and heaviest qualities they can easily produce them.

7. There was last year a difference in weight and consequently in value, in many cases, of fifteen or twenty per cent, between early and late sown oats; a decisive proof that care will benefit this crop as well as others. Oats require two and a half or three bushels of seed to the acre; and it may in general be remarked that the man who is covetous of his seed when putting in his spring crops, be they wheat, barley, or oats, will find a verification of the scripture declaration, that he who soweth sparingly shall reap also sparingly.

## Section X.

1. Pease.—The Pea crop is of great importance to the Canadian farmer—the climate of the country being remarkably well adapted for the growth of pease. The soils to which pease are the most appropriate, are sandy loam mixed with calcareous particles, and these soils are abundant throughout all British North America.

2. It is a subject worthy of remark, that some varieties of pease require one description of soil, and others require a soil of a very different character,—for instance, the grey species are best adapted to the strong soils, and the white to the drier and lighter ones. Wherever calcareous earths abound, large crops of the best qualities of pease are grown.

3. A light dressing of shell marl or lime, is ever found to forward a crop. The best preparation for land for this crop, on those

soils suitable for their culture, is thorough deep ploughing in autumn, and without any further labour, the seed should be sown the latter part of April, or first of May, at the rate of three bushels per acre, then harrowed in and rolled.

4. No seed is more difficult to cover than pease ; in all cases where it is doubtful that the seed cannot be completely covered with the harrow and roller alone, we would recommend that they should be ploughed in lightly, and afterwards harrowed singly, and rolled. In most cases, where the land has been ploughed in the autumn, to a much greater depth than usual, that is to say, when two or three inches of the subsoil have been brought up to the surface and exposed to the action of the winter frosts and snows, the ploughing in of the seed will be found to pay 100 per cent. for the labour expended in the operation. On the land we cultivate, we would expect, in an average of cases, from the foregoing management, not less than 40 bushels of pease per acre.

5. If barn yard manure be applied to the soil in the spring of the year, it will occasion the crop to run a haulm, and proportionably lessen the product of grain. We have much confidence in recommending the cultivation of pease on an extensive scale, as it is the best possible food for stock, and is likely to be a profitable article for export. It is almost needless for us to state that pease, like clover, draw their sustenance very largely from the atmosphere, and comparatively, even to a much greater extent, than from the soil.

6. In preparing ground for fall wheat, a much less objectionable plan than making naked summer-fallows, would be found to consist of sowing wheat after pease. This system has been practised from time immemorial, but the manner in which it has been generally performed, is equally as objectionable as the naked fallows.

7. When wheat is intended to be sown after pease, the manure which is usually applied to naked summer-fallows, should be reserved for the pea crop, and should be spread on the ground in autumn, at the rate of about ten tons per acre, and should be ploughed in to the depth of, at least, nine inches,—the land should be made into six yard ridges, and completely cross-furrowed, so that the ground would be dry in the spring, at the earliest possible period.

8. The seed of some short-vined variety should be sown at the rate of *three bushels per acre*, ploughed in very lightly, harrowed and rolled, as recommended in the foregoing remarks. If the crop be large, say to the extent that the cultivator has been in the habit of making his naked summer-fallow, it might be harvested

with a horse and rake, similar to the plan usually practised in collecting hay with a horse.

9. One man will pull four acres per day with all ease; although a portion of the crop might be thus left on the ground, still a provident cultivator would suffer no loss by this means, as his stock of fattening and store swine would gather them off the ground in time for sowing wheat.

10. In ploughing the ground for wheat, it should be done to the full depth that it was previously ploughed in the autumn, and the manure which had been ploughed to such a great depth, will be in a proper state for imparting strength and vigour to the young wheat plants, without entailing the disease of rust, which is generally brought about by the plan usually practised in this country, of heavily dressing naked fallows with unfermented barn-yard manure.

11. If the furrow for wheat be ploughed to the full depth recommended, say nine inches, and the ground immediately harrowed and ribbed, and the seed of an approved variety be sown broadcast, at the rate of *two bushels per acre*, and harrowed in lengthwise singly, and the furrows and cross-furrows be cleaned out with a plough to the full depth,—we would expect from such management a much greater crop, than from a naked fallow. Those of our readers who desire to grow an average crop of *forty bushels per acre*, throughout their entire wheat crop, would do well to try the plan we have recommended, or some other equally as good, and in the spring of the year, top-dress the young plants with fresh house ashes, at the rate of eight or ten bushels per acre, and which should be harrowed in with a pair of light seed harrows.

12. If the harrow teeth be very long, or are likely to injure the plants, fine branches of trees, or brush may be interwoven in the harrow. The object to be gained by harrowing is, the pulverization of the crust that is formed on the surface, and this crust may be as readily broken by harrowing the ground to the depth of two inches as four.

13. We do not wish it to be understood that we would prefer the culture of pease to that of clover, as a preparative crop for wheat, but at the same time we are persuaded, that it requires less care than the latter in the management, and may be on strong clay lands much more efficacious, especially as the clover ley system requires the greatest nicety in the laying down the land with seeds, and also, in the ploughing of the sward, and depositing the seed wheat.

14. It might, however, be observed, that so soon as the ridicu-

lous notion of naked fallows can be exploded, both the sowing of wheat after pease, and on clover ley, may be introduced on the same farm, without interfering with a judicious system of rotation, or a well grounded method of farm management.

15. For fear that it might be thought by some, that we were opposed to the plan of making naked summer-fallows in every instance, we would observe, that there are cases where the practice is absolutely necessary,—those cases, however, are rare.

### Section XI.

1. Culture of the Potatoe.—By common consent the potato has been placed at the head of all the edible roots, wherever it has been introduced, and the climate would admit of its cultivation. Originating from an obscure and worthless root among the Cordilleras of South America, in spite of prejudice and opposition, it has spread with a rapidity unknown to any other vegetable, and is doubtless destined to make the circuit of the globe, adding in an incalculable degree to the means of subsistence.

2. There are few, if any, vegetables grown in the temperate zone that yield so great an amount of food per acre as the potato. Wheat, according to Sir H. Davy, contains 950 parts of nutritious matter in 1000; and the potato 250; but when it is remembered that the yield of the potato, on an average, is from ten to fifteen times as much per acre as wheat, the advantage in favor of the potato is manifest. Besides, such is the human organization that pure nutritive matter is injurious to its healthy functions, and the stomach requires to be more or less distended with other matter before the excitement necessary to nutrition takes place.

3. We are, therefore, justified in supposing that good potatoes used exclusively as an article of food, would be less injurious than pure wheat flour. Be this as it may, the potato in most civilized countries now ranks next as an article of food to the rice of the tropics; and the wheat and maize of the more temperate regions. To Europe is America indebted for the Graminae, and had we returned them nothing more than the potato and maize, the debt must have been considered as cancelled.

4. The potato is usually propagated by the tubers or roots, but new varieties are obtained or old ones that have partially degenerated restored, by cultivating them from seed. There are few plants that show more decisively the improvement that may be made by cultivation than the potato.

5. In 1838, a quantity of the original roots were taken from South America to England, and carefully planted. The result

was a small inferior root, more resembling the ground nut than the potato, and not widely differing in appearance from those of the first year's growth from seeds.

6. There is an idea prevalent among many farmers that potatoes are mixed, or what by the breeder of animals would be called crossed, by having several kinds planted in the vicinity of each other. This is an erroneous opinion. The crossing takes place in the flowers or seeds and not in the roots; and hence there is the same uncertainty that the seeds of any given variety of this root will produce potatoes of the parent kind, that there is that the apple seeds will give apples like those from which they are taken, a thing of very rare occurrence.

7. Every farmer who has paid attention to the manner of growth in the potato, is aware that the tubers are not produced from the roots proper, these being, as in other plants, used solely for the purpose of nutrition, but on shoots thrown out above these, and nearer the surface of the earth.

8. It was the opinion of Decandolle that by repeated coverings of the stem such shoots, and of course potatoes, could be produced the whole length of the stalk, and some experiments that he made seemed to favor such a supposition; still we must be permitted to say, that having in part repeated his experiments, we have found nothing to justify the opinion that such a result would be effected by this treatment of the stem.

9. The propriety of cutting the tubers or planting them whole has been much discussed, and the multitude of experiments on record would seem to show by their conflicting results, that at least as much is depending on other circumstances, as on the root being planted in a whole or cut state.

10. If an acre of ground be planted in hill or drills with whole potatoes, and another acre be planted with sets or cuttings at equal distances with the other, the experiments made by the London Horticultural Society would go to prove that the acre planted with whole potatoes would yield the most, but not much, if any, more than the additional quantity of seed required in planting.

11. If whole potatoes are used, from twenty-five to thirty bushels will be needed; if cut, not more than half that quantity will be required. In both cases, however, much will be depending on the size of the whole potatoes, and the number of eyes in those cut. The distance between the rows must be determined by the length of stem produced by the potato, and the several varieties vary much in this respect.

12. In cultivating the potato a climate rather cool and moist is

found most preferable to any other. Of course the root succeeds much better in the northern states and in these Provinces than in the southern parts of the United States. The potato will succeed well on almost any kind of land provided it is rich, and is not wet and clayey ; but for this, as for most other crops, a friable loam of sufficient consistence to prevent drought will be found superior to any other.

13. Swamps containing large quanties of vegetable matter, when sufficiently drained, have produced great crops, and what in new countries is termed muck land, is also favorable to their growth. Two things in a potato soil seem to be indispensable ; it must be rich, or a crop cannot be expected ; and it must be sufficiently loose to allow the shoots that form the tubers to spread and enlarge freely.

14. In Europe the British islands are justly famed for their root culture, and the introduction of the potato into Ireland has enabled that country to double its population ; if it has not banished want and distress, these evils are not of as frequent recurrence now as formerly, notwithstanding the increase of consumers. Cobbett, indeed, charged upon the potato all the evils of Ireland ; and Dr. Tissot has demonstrated to his own satisfaction, that no potato eating nation has ever produced a great man.

15. The greatest crop of potatoes on record are those grown by General Barnum of Vermont, which reached from 1,500 to 1,800 bushels per acre ; and he gives it as his opinion, that in a good soil, and with his mode of culture, from 800 to 1000 bushels per acre may be safely calculated upon.

16. The reports of the agricultural societies of the United States show that from 500 to 700 bushels per acre are not uncommon. Mr. Bache, of Wellsborough, Pa., in 1839, raised 600 bushels to the acre, and the crop of Mr. Morris, of Cattaraugus, N. Y.. fell but little short. The average crop in this country cannot, we think, be estimated at more than from 175 to 250 bushels, the influence of the seasons being more felt on this crop than many others.

17. The methods of planting are various. General Barnum's mode, after a careful and thorough preparation of his land, is to plant in drills 22 inches apart, and the sets in the drills 10 inches from each other. The drills are kept clean, but the earth is hilled around the plants only once in the season ; as he considers there is much danger of disturbing the young tubers by removing the earth, or causing the formation of new shoots for tubers by repeated hoeings or hillings.

18. The secret of his great crops appears to consist, in his bring-

ing rich fresh earths, the scraping of the ditches or streets, or earth from the barn-yard, or the mould deposited in swamps, and giving each hill a shovel full, as a top dressing. He does this with the aid of a horse and cart, the horse and the wheels passing between the rows.

19. We have seen very good potatoes grown by simply dropping the seed on a clean turf, and spreading over them a covering of straw six or eight inches in thickness. The straw must be evenly placed, and if moved by the wind before it gets settled together, which it will soon do, it must be carefully replaced.

20. This covering of straw keeps the surface moist, the grass cannot spring up through it, and in the fall the potatoes are found on the surface of the turf, and perfectly clean when the straw is removed. The danger in this mode of planting would seem to lie in a dry season which is frequently fatal to the crop; and *a heavy* crop is rarely in this way produced.

21. In the Monthly Visitor, for February, 1840, is an account of an experiment with potatoes, which was eminently successful, and deserving of notice. In the spring of 1839, Mr. Whitney, of Craftsbury, Vt., "broke up a piece of green sward, harrowed it thoroughly, carted upon it manure from the yard at the rate of 32 loads to the acre, cross ploughed it, harrowed it again, and planted it in the usual manner in hills.

22. "At the proper ploughing between the rows, the piece was well hoed, and at the proper time was repeated. In the fall he dug from this piece at the rate of 300 bushels to the acre, which for this year, on account of the rust, was considered a good yield.

23. "By the side of this piece, on precisely the same quality of soil, manure was carted and spread at the rate of 32 loads to the acre; the sward was then carefully turned over, and the furrows laid flat with a roller. Between every other furrow, where they came together, (that is between the first and second, and between the third and fourth, and so on) holes two feet apart were made with a sharpened stick, about three inches deep, large enough to receive the seed.

24. "Into each hole one piece of potatoe was put, and the holes filled up with mellow soil, even with the general surface of the field. There was no further labour bestowed upon the crop till the digging, when the quantity produced was a little over 400 bushels per acre. Although never hoed not a weed was seen in it. Before digging, the field had the appearance of having been well hoed, the potatoes having raised up the ground above them."

25. In all cases the value of the early potatoes is great; and

particularly so in the vicinity of cities, where a constant demand and ready market for such vegetables always exist. Experience has taught the growers of potatoes for the London market that ripe potatoes can be found from ten to fourteen days earlier in hills and drills planted with sets from the top end (the one that has the most eyes) than in those planted from the root end of the tuber.

26. The Lancashire gardeners therefore assort their sets, so as to have them ripen at the same time, and thus obtain roots for market sooner than they otherwise could do. It is probable that quite an improvement might in this country be effected in the same way.

### Section XII.

1. Culture of Indian Corn.—Corn requires a rich soil; of good depth, as the roots penetrate to considerable distances; dry, or at least free from all standing moisture; and kept clean and free from weeds by frequent stirring with the hoe, or still better with the cultivator. Corn will not grow on wet land, or on soils where the sub-soil is so retentive as to retain stagnant water within reach of the roots.

2. Such soils are of necessity cold, and corn, the native of a warm climate, is more retarded by cold and moisture in our country than by all other causes combined. In England corn cannot be grown; the low temperature of their summers compared with ours, though excellent for the wheat crop, is fatal to corn, which, though sometimes attempted there, rarely or never reaches perfect maturity.

3. Land, on which corn is to be grown, must be drained if too wet, and without this preparatory process, in ordinary seasons, corn must prove a failure. Some of the best crops of corn we have ever known, were grown on turf or clover leys, well manured in the spring with stable manure, and then carefully and completely turned under a few days previous to planting.

4. If coarse common barn-yard manure is used, we have known it advantageously applied in the fall, the turf turned over and allowed to remain through the winter. In the spring it is rolled down, a light harrow applied, and a loose surface of earth is readily prepared for the corn, while the decomposed manure below is ready to afford the nourishment required by the young plant.

5. Where fine manure is at hand, manuring in the hill may be advantageously adopted, and some of the great crops of the few past years have been produced in this way. For this purpose we have found the manure from the piggery far superior to any other,

the difference in a hot dry season in favor of this manure being equal to 20 or 30 per cent. Sheep manure is the next best, and for wheat crops, particularly spring wheats, we think it unrivalled.

6. Several kinds of corn have been introduced to the notice of the public within a few years, some of which are doubtless great acquisitions to the farming public, while others require to be more fully tested before their adaptation to our latitude can be decided. As a general rule it may be remarked that corn is always improved by bringing the seed from the north, and that it deteriorates by introducing southern varieties.

7. The reason of this is perfectly obvious, and exists in the nature of the plant itself. No species of the Dent, or gourd seed corn, will be found to succeed well, north of the 40th degree of latitude, unless in some favored situation, while in a suitable climate those varieties are indispensable. Thus the Baden corn, though an excellent variety in a proper climate, must in all the northern, and most of the middle states, give place to the earlier kinds, such as the Dutton, red blaze, white flint, or early Canada corn.

8. In selecting a corn for seed in a district where it is sometimes liable to failure from early or late frosts, several things should be taken into consideration as desirable requisites. The first is, it should be early, have a rapid growth, and arrive at maturity with the least delay. Another requisite is that the cob should be small, and the ear of good length ; since if the cob is too large, it does not become so completely dried as not to endanger the corn by moulding when cribbed, and if the cob is small and not long enough, there will not be a good crop, however mature it may be.

9. The Dutton corn is somewhat liable to the first objection, the small early varieties, some of them at least, to the last. To have a corn yield well, the kernels should be large, close set, and the cob small. Some ears of corn have been noticed, from which the corn shelled and poured into a paper envelope of the ear, would precisely fill it. Such corn, when grown, cannot be otherwise than productive.

10. It is a good plan to submit seed corn to some preparation that will give it vigor and quickness of growth at the outset, and aid as far as possible, in preventing the attacks of those insect enemies beneath, and the winged enemies above the surface, to which experience shows it is exposed. A solution of saltpetre is good, and some propose that the solution be made in chamber lye, this producing, it is contended, as favorable an effect on corn, as it is well known to do on wheat.

11. Where there is any danger that the corn will be assailed by crows, tarring it is necessary, and it is perhaps productive of injury in no case. It is effected by wetting the corn in warm water and letting it drain, then turning a small quantity of corn, and stirring it until every kernel is coated with the tar. It is then dried with plaster for planting, and the addition of this latter article cannot but be beneficial.

12. There should always be as many as five or six kernels of corn put in a hill, and they should not be thrown in a cluster, but spread so as to allow room for growth without the stems crowding each other. When the corn is three or four inches high, it should be hoed, and all the stalks over four in number pulled out, leaving of course those having the best and most vigorous growth.

13. Some prefer only three stalks in a hill, and where the soil is not of the best quality, that number is sufficient. There is not seed enough generally used in planting and it is better to pull two or three from each hill, than to have a deficiency of stems in the field.

14. Corn should always receive two thorough dressings; the ground well loosened and pulverized should be moderately raised around the hills, and if the cultivator is a third time run through the rows before the corn is so large as to endanger its breaking down, it would be well.

15. In ordinary cases, where the soil is equal, the crop of corn will always be in proportion to the completeness of the after culture. Every slight that it receives in the spring, every weed that is allowed to remain to choke the corn, will be felt in the fall when the corn is placed in the half bushel.

16. Well conducted experiments have shown beyond contradiction, that the common practice of topping corn has a direct tendency to decrease the quantity of the crop. Allowing the ear to ripen without molestation produced as might be expected from the well understood law of nature in this respect, the best and heaviest grain.

17. Cutting up by the bottom, and allowing the ears to ripen in stocks gives the next best grain for quality and quantity, and besides gives the best fodder, which, where corn is grown, is of no small consequence. If topped very early, the weight of the corn, and of course the quantity, is greatly diminished; if left till a later period the injury is less, but in all cases where experiments have been tried, the loss is sensible, and good policy demands that the practice should be abandoned.

## Section XIII.

1. Broomcorn.—Of the genus sorghum (broom grass) there are four or five species. *Sorghum saccharatum* is the broomcorn, abundantly cultivated in this country, both for the seed and for its large panicles, which are made into the brooms. The whole plant is saccharine. Attempts have been made in France to extract sugar from it, but with little success.

2. The other species are the following: *Sorghum dora*, (or holcus dora,) common Indian millet, a native of the East Indies, but cultivated in the south of Europe, *s. bicolor*, or two-colored Indian millet, *s. caffrorum*, caffres Indian millet, and *s. nigrum*, coal-black Indian millet.

3. *Method of Planting.*—The broomcorn is planted in rows, about 2½ or 3 feet apart, so that a horse may pass between them with a plough, or cultivator, or harrow. The hills in each row are from 18 inches to 2 feet apart, or farther, according to the quality of the soil. The quantity of seed to be planted is estimated very differently by different farmers—some say that half a peck is enough per acre, while others plant half a bushel, and some a bushel, in order to make it sure that the land shall be well stocked. The rule with some is to cast a tea spoonful, or 30 or 40 seeds, in a hill; the manure at the time of planting should be put into the hill, and old manure or compost is preferred, as being most free from worms.

4. *Cultivation*—The broomcorn should be ploughed and hoed three times—the last time when about three feet high, though some hoe it when it is six feet high, and when they are concealed by it as they are toiling in the field. The number of stalks in a hill should be from seven to ten. If there are only five or six stalks, they will be larger and coarser; if there are about eight, the brush will be finer and more valuable. In the first hoeing, the supernumerary stalks should be pulled up.

5. *Harvesting.*—As the frost kills the seed, the broomcorn is harvested at the commencement of the first frost. The long stalks are bent down at two or two and a half feet from the ground; and by laying those of two rows across each other obliquely, a kind of table is made by every two rows, with a passage between each table, for the convenience of harvesting.

6. After drying for a few days, the brush is cut, leaving of the stalks from six to twelve inches. The longer it is cut, of course, the more it will weigh; and, if the purchaser does not object, the benefit will accrue to the farmer. However, the dry stalks weigh

but little ; if its weight is excessive, the purchaser sometimes requires a deduction from the weight.

7. As it is cut, it is spread on the *tables*, still farther to dry. As it is carried into the barn, some bind it in sheaves : and this is a great convenience for the further operation of extracting the seed. Others throw the brush into the cart or waggon, unbound.

8. *Scraping.*—The process of extracting the seed is called "scraping the brush." Two iron horizontal scrapers are prepared—one moveable, to be elevated a little, so that a handful of brush may be introduced between them. The upper scraper is then pressed down with one hand, and the brush drawn through with the other, the seed being scraped off.

9. This is the old method. A newly invented scraper is superseding the old one. It is an upright instrument, of elastic wood or steel, inserted in a bench of a convenient height for the operator. It is composed of a middle piece, immoveable, with two side pieces of the same height, with the ends turning out a little, and made closer or further from the middle one by wedges.

10. A quantity of brush is taken in the hand, and brought down upon the top of this instrument. As it is forced down, and drawn towards the body, it separates the elastic sticks from the central piece, but their elasticity presses sufficiently on the brush, so that the seed is scraped off.

11. The advantage of this scraper is, that both hands may be applied to the brush, instead of only one hand, as in the other kind, and the elastic power of nature is substituted for the pressure of one of the hands. The instrument also seems to double the scraping surface. It was invented at Hartford.

12. *Product.*—A common crop is 700 to 800 pounds per acre. There have been raised 1,000 and 1,100 pounds per acre, with 80 to 100 bushels of seed. The large kind grows eleven feet high.

13. *Manufacture of brooms.*—Individuals tie up brooms with wire or twine. The expense is greater for materials and labor when wire is used.

14. *Miscellaneous.*—If the stalks are cut before the seed is ripe, they are better, stronger, and more durable, than if cut after the seed is ripe. In this case, the farmer would lose the value of the seed. He of course will not submit to this loss, unless it is made up to him by the increased price of the brush.

15. The seed is used for feeding horses, cattle, and swine. It is ground and mixed with Indian meal, and is regarded as excellent food—it weighs forty pounds a bushel.

16. The brush, when it is put in the barn, should be placed on

a scaffold, so as to be exposed to a circulation of the air, that it may dry, and not mould. For all the purposes of use, a broom made with twine is equal to one made with wire ; and a man can make several more of them in a day.

## Section XIV.

1. Selection and Change of Seed.—It is an opinion held by many, that in cultivating farm crops, every thing depends on a change of seed ; and that seed continually raised on the same farm or in the same region of country, will constantly deteriorate, and that it is this which renders a change necessary.

2. Others, on the contrary, consider a change as of no advantage whatever, and maintain that by always selecting the best seeds from among the best crops, the seed, instead of deteriorating, will actually become improved in quality, even though these crops be always raised on the same farm. Both of these opinions, without qualifications, are erroneous ; but under proper limitations, they are both to a certain degree strictly correct.

3. A change of seed, however, as it is most commonly practised, is of little advantage, and frequently of none whatever. When the place from which the seed is procured, resembles very nearly in soil and climate that where it is sown, little benefit is derived from the change. Hence changes of short distances are unimportant. They should therefore on the contrary be made from different countries, or from places so remote that the difference in climate and season is considerable.

4. But a change merely, even from different countries, is as likely to prove prejudicial as otherwise, unless it is performed with judgment and discretion. Hence, in obtaining seed from other places, the farmer should understand the *rationale* of the effect produced by such a change, in order that he may be able to judge whether he is likely to gain or lose by it. This we shall endeavor to explain.

5. As a general rule, when plants are removed from one climate to another, they naturally tend to adapt themselves to the climate to which they are removed. Thus when plantsare removed from a cool climate to a warm one, they become larger and more luxuriant in growth ; they do not so quickly advance to maturity, but continue growing longer through the season, as the seasons there are longer ; they produce a greater amount of leaves and stalks and less of seed.

6. On the other hand, when plants are removed from a warm climate to a cool one, the reverse takes place ; they diminish in

luxuriance of growth, their season of growing becomes shorter, and they produce a greater amount of seed. Hence, generally, when *seed* is the principal object of a crop, it is more advantageous to obtain the variety from a cooler climate. Indian corn, although supposed to be a tropical plant, produces the heaviest crops in the northern states.

7. Farmers, therefore, in the middle and southern states would probably find a great advantage in procuring occasionally their seed corn from the north. There must however be a limit to this, as varieties from cold countries may be so diminished in the growth of stalk, as not to produce even so great a quantity of seed as might result from the cultivation of larger plants.

8. But when the growth of *leaves* and *stalks* is the principal object, as in fodder, it will often be of use to procure the seed from warmer climates, provided the plants are sufficiently hardy, and advance to proper maturity before the season is over.

9. The effect of climate is strikingly exemplified in the case of Indian corn. In the West Indies the stalk sometimes rises to the height of *thirty feet*, but it produces only a few grains at the bottom of a spongy cob, and is considered as rough provender. In the southern parts of the United States, it rises *fifteen feet* high, and produces about *thirty bushels* to the acre. In the rich lands of Kentucky and the middle states, it produces *fifty or sixty bushels* to the acre.

10. But it is only in New York and New England, where the stalks are but *seven feet* high, that *one hundred and fifty bushels* to the acre have been obtained. Wheat does better in the northern and middle states, and in the Baltic regions of Europe, than in either the southern parts of Europe or of America.

11. Where crops will not deteriorate in desirable qualities by becoming adapted to the climate where they are growing, a continued selection of the best seed will always produce certain improvement. Even this deterioration may be frequently prevented by judicious selection. Thus, if we wish to preserve the quality of early maturity in corn, the seed of which has been obtained from the north, we should always select for seed those ears which ripen first; or if we would preserve the *productiveness* of the variety, we should select from those stalks which bear the greatest number of ears.

12. A want of selection of seed, has often led to the supposition that changes of seed from short distances, even in the same neighborhood, are of great use. Thus, a farmer who never takes any pains to get his seed wheat from the best part of the field, and who

never frees it from chess and cockle, finds a great advantage in obtaining fresh seed every year from a farmer five miles distant, who always keeps good and clean seed. He ascribes the advantage to *change*, while in reality it is only to be attributed to *selection.*—Many farmers always sell their best potatoes and plant the worst, and from this practice has arisen the opinion that the varieties degenerate and run out. An opposite course would lead to a different conclusion.

## Section XV.

1. On the Cultivation of the Sugar Beet.—Of the different species of roots for the support and sustenance of stock, the sugar beet seems destined to become the most extensively cultivated throughout North America. It is finer grained, sweeter, more delicate and agreeable to the taste than mangel wurtzel, at the same time it is more nutritious, and gives as large a yield, and is equally thrifty, hardy, and as susceptible of an extended cultivation in the various latitudes.

2. Fed raw, it is preferred alike by the horse, the ox, the cow, the sheep, and the hog, to every other root, with perhaps the exception of the parsnep; and cooked, it is only inferior to the most farinaceous kinds of the potato. It makes the finest of wool, the most juicy and delicate of meat, the largest quantities and richest of milk and butter in winter, not inferior to that produced from the sweetest pastures in summer.

3. When not grown too large, it also ranks high among the table edibles; and is perhaps the most luscious and palatable of roots to the taste of man. Being then the largest of yielders, the most certain of crops, the easiest handled, secured, and fed, and, above all, a great ameliorator of the soil on which it is grown, we think we are not over sanguine when we assert, that in a very few years its cultivation will become so extended, as to make it the largest and most valuable of our root productions, and that it will work out for Canada, even greater wealth and independence to the agriculturist than the growing of turnips has to England.

4. *Soil and its Preparations.*—The best soil for the production of the sugar beet, is a deep, light, and moderately rich loam, resting on a clay subsoil, but very large crops have been taken from thin gravels and sands, and the hardest clay, but in these cases they had undergone a potato cropping, thereby manuring the preceding year, and a slight covering of compost, ashes, plaster or lime, the spring they were planted in beets. A very rich soil, such as the deep alluvial bottoms of the west, is not so proper: the roots grow too large and rank in it, and are consequently coarser and

less nutritious, and do not abound with near the saccharine matter that is found with those on poorer ground.

5. Plough deep and roll and harrow fine, and have the ground in lands of about one rod wide, with the furrows between them well hoed out, so as to drain the falling water off especially if the sub-soil be at all tenacious, as most of the western lands usually are.

6. *The Seed and its Preparation.*—The white Silesian sugar beet is the best variety, as sweetest, finest grained and growing largest. Soak the seed at least two days previous to planting, in soft tepid water, and then roll it in plaster or ashes so as to prevent its sticking together, and facilitate the sowing. It is indispensable that the seed be well soaked, otherwise, owing to its outward coating, the pericarp being very hard, it may not vegetate at all, or so late as to make a fair crop out of the question.

7. I have frequently had it in soak a whole week, and sowed the seeds already well sprouted, and though followed by long heavy rains, they were the quickest up, and gave the largest produce.—The first and second weeks in May are the most proper times to plant in this latitude; further north or south, of course later or earlier, according to climate.

8. *Planting.*—It can be sown broadcast like the turnip, but as weeds are likely to spring up in most soils and prevent its growth, and the labor of exterminating them much greater in this way, it is preferable to sow in drills. For this purpose, the drill-barrow may be used the same as in planting the ruta baga, but the beet seed is much more difficult to deliver evenly through a small aperturet han the turnip is, and though I have used a great variety of barrows for this purpose, I have never yet had one that worked well and could be depended upon, especially in tenacious or heavy loamy soils.

9. It is preferable, therefore, to take a piece of plank four inches square, or a round stick of the same diameter half or just as long as the lands are wide, fill this with iron or wooden teeth in wedge shape, as far apart as you wish to have the rows, put a pair of tills to this, and hitch on a stout man or steady horse, and once or twice going through the land completely drills it from one to two inches deep. Then follow immediately with the seed, dropping it by hand, or from a long necked bottle, or tin cup with a hole in the bottom, and a stick handle attached to it, shaking the cup or bottle as you walk along, and following sharp with the eye to see that the seeds are evenly dropped.

10. Faithful children of ten years old can do this with more ease and facility than grown persons. As fast as dropped cover

with the hoe ; in heavy soils about half to three-fourths of an inch deep, in sand or light gravel twice this depth. The rows may be from one to three feet apart for a field crop—two and a half to three feet is the best. This distance enables one to use the cultivator for weeding, without danger of cutting or covering the plants by the dirt being thrown up as it passes through the rows. The product is not so great per acre from wide rows, but land being cheap and labor dear in Canada, we must study to facilitate manual operations, at the same time that we have some calculation for a good yield.

11. Four pounds of seed per acre is generally considered enough, but it is better to have a dozen extra plants to thin out, than to be obliged to transplant one. Those transplanted do not thrive half as well as those that remain where they vegetate ; besides, the labor of so doing is more expensive than extra seed and time of thinning. I therefore mean in sowing to have a good seed dropped as near as every two or three inches in the drills

12. *After Culture.*—As soon as the weeds begin to appear, run the cultivator through the row and follow with the hoe. It is very essential that the ground be kept clear of weeds, especially for the two first months, and three hoeings with the use of the cultivator is generally sufficient for the season. As the plants attain a height of about three inches they should be thinned to a distance of about four inches, leaving the strongest and healthiest; then, during the season as they grow, gradually thin out the remainder, leaving the roots in the rows at least about nine or ten inches apart.

13. If left too thick, they shade and choke each other in growth, and the product is not so great as when well thinned. These thinnings are valuable to feed to stock during the summer, and are frequently considered equal to half the expense of cultivation of the whole crop.

14. *Harvesting.*—Chaptal decides that when the leaves begin to decay and turn yellow, it is the best time to gather the beets, for if longer than this in the ground the roots grow hard and strong, and do not yield so great a per cent of saccharine. This of course will take place earlier or later in different climates, and is undoubtedly as good a rule as can be given, it being adopted after a strict chemical analysis of the beet in its growth by that eminent agriculturist.

15. If the soil be light, as the roots generally grow so much out of the ground, they can be pulled up by taking hold of the tops wit' hand—but if more tenacious, the dung-fork is the best instrument that I know of for digging them up. Let part of the hands be at this operation and the other part follow with large knives or bill

hooks; taking up the root with one hand, top off the leaves with the other, and toss the roots into small heaps to dry through the day, and if left out over night and there be danger of frost, let them be lightly covered over with leaves or straw; a hard frost injures the roots and makes them more liable to decay. They may then be taken to a well ventilated cellar, or be pitted in heaps of 100 to 200 bushels.

16. The beet is rather apt to heat and commence sprouting if thrown into large heaps, or packed away in the cellar. If put in the latter place, any other roots except the turnip may be placed at the bottom, and the beets on the top, and if in pits the same roots or straw in the centre. All the beets then have a good ventilation, and an opportunity of throwing off the impure air; and to facilitate this, after covering the heaps with dirt, holes should be made every few feet on the top of them, and wisps of straw be placed in such holes.

17. *Feeding.*—Throw them on to the ground floor, and take a hay knife or spade, and a man will slice up a bushel a minute sufficiently fine to prevent cattle choaking on them. The best way to cook them for stock is by steaming, but they cannot be kept so over two days in warm weather and a week in cold, without undergoing a fermentation, and losing the saccharine matter so grateful to the taste and so essential to nutriment.

18. Either raw or cooked, cattle frequently prefer them to meal or corn. Raw, I think them as nutritious as any root whatever, and as far as my limited experience extends, three bushels of beets with neat stock is equal to one of Indian meal. Hogs demand less bulk to fill themselves than cattle, and perhaps their value to them would be about as four to one.

19. *Product.*—Four hundred bushels is a fair yield in field culture, but six and eight hundred per acre is about as common. The writer grew at the rate of 1,150 bushels to the acre the past year on a hard clay soil, and his average field product was about 600 bushels on the same soil. He has heard of 3,000 bushels being produced to the acre on rich loams. Several of his roots the past season weighed 16 lbs each, and 10 lbs. is not unfrequent; now admitting this last weight to each root, and that seven rows stood in the width of a rod, which would make them about two feet apart and the roots one foot apart in the rows, and allow 60 lbs to the bushel, we should have the enormous product of 3,000 bushels to the acre.

20. But roots so large are coarse, stringy and not unfrequently hollow and have much less saccharine in proportion to their bulk,

than smaller ones. Those of about 5 lbs. weight are far superior; and these standing one foot apart in the rows and five rows in the width of a rod, making them about three feet apart, gives the large yield of 1,100 bushels per acre, which is quite as great as it is desirable to strive for, and upon the whole perhaps the most profitable.

21. I see by most writers on beet cultivation, that the leaves are considered highly nutritious, and are recommended to be cut and fed to stock. I suspect that persons thus writing had more theory than experience upon the subject, when they made such recommendations. I have universally found that they badly scoured all kinds of animals, even when taken up from green pasture to feed on them, and if persisted in, created disease. I have tried all sorts of ways to prevent their scouring, by salting the leaves and mixing them with other food, but the result was the same.

22. They have a sweetish bitter pungent taste, and I found upon chewing the leaves, that the effect on man was the same as on beasts. I know of no better use for them than to be left on the ground to fertilize and assist in giving it heart for another crop. But it will be seen that the roots alone make it a very valuable crop, far more so than corn, or any of the smaller grains. The estimated cost of producing it ranges from three to eight cents per bushel, the average is probably five to six cents.

23. *Raising the Seed.*—There is as much in choosing proper roots for this purpose, as in selecting animals to breed from, and the same general rule holds good in both cases—a medium size and fine true form. Roots weighing four to six pounds and of four to six inches diameter at the top and nine to thirteen inches long, and smoothly and evenly tapering to a point without struggling branches, and of a creamy white color and smooth grain, are the most desirable.

24. "Like produces like," and with such selections followed up, the crop will soon run evenly of the same shape and size as the roots from which the seed was grown. Plant the seed roots, and in this latitude about the 1st of May, three feet apart, and as the stalks grow, stake round them in a circle and tie a small cord from stake to stake, for their support. When the seed shells easily, which, if planted in May, will be in September, is the time to gather it.

25. Two or three dozen roots will grow seed enough for acres, and at one-tenth the cost usually asked for it at the seed stores. When grown at home one knows what he gets, and as it comes to him abundantly and cheap, he can without grudging give to his

neighbours, and thereby greatly promote the culture of this most valuable of roots.

## Section XVI.

1. Ruta Baga, or Swedish Turnip.—Bushel for bushel, we do not think the turnip is as valuable as the carrot, and it is besides liable to the objection of giving an unpleasant flavour to the milk and butter of cows fed upon it extensively, or mostly to the exclusion of other things: but the comparative ease with which it can be cultivated; the certainty with which it is grown, when ordinary steps to ensure success are taken; the great product per acre; and the undoubted value the root possesses as a food for almost any, or indeed every kind of stock, give it a value, which entitles it to the confidence and the cultivation of every farmer.

2. The best soil for the turnip is a rich deep loam inclining to sand. A heavy clay soil is unsuitable for this, or any of the tap-rooted plants, and in such soils the turnip should never be sown. A clover ley is a good preparation for the ruta baga, and if rich, needs no manuring before turning over; but if not in good heart, a dressing of stable manure before ploughing will be useful. Well turned over and rolled down, the turf should not be disturbed by any farther ploughings, but a light harrow used until the surface is rendered perfectly fine, loose, and friable for the reception of the seeds.

3. Where the land is not in turf, and requires manuring for such a crop, the best way is to lay it out in furrows of the proper distance from each other, say 28 or 30 inches, and into these place the manure intended for the crop. By splitting the ridges between these furrows with the plough, new ones will be formed over the manure, on the tops of which, when slightly smoothed and levelled, the seeds are to be sown.

4. A drill is certainly the most expeditious and best way of sowing the turnip, and drills are to be had at most of the seed stores for the trifling sum of three dollars, which will sow them in the best manner. But where a drill is not to be had, an active man will sow and cover half an acre in a day, by hand only. More seed is used by the hand than the drill; and as it is not equally distributed, the plants are not always found at precisely the distances wanted, an evil that may be remedied by transplanting.

5. They should be hoed and thinned as soon as their size will admit, and this hoeing should be repeated once, if not twice, before the leaves spread so as to be injured by the operation. Like other crops, the turnip requires the soil to be kept loose and clean, and the size of the roots is in a great measure determined by the treatment of the plant.

6. The ruta baga may be sown from the first of June to the middle of July ; but in our latitude, and with our climate, we are convinced by experience, that early is better than late sowing, and from the first to the fifteenth of June is better than a later period. Our summers, unlike those of England, are hot and dry, and the young plant, if sown here as late as there, is dried and parched before it gets root sufficient to enable it to withstand the heat. Besides, the turnip continues its growth longer than most plants, and hence a lengthened period is rather favorable to the crop than otherwise.

7. There is no cultivated root that can be gathered with as much rapidity, or preserved with more ease and certainty, than the ruta baga. Cellars are the best for keeping them, but they may be pitted in heaps of from twenty to fifty bushels each, as potatoes frequently are, and they are less liable to injury when so stored, than that root. For a number of years, we have annually pitted more or less, sometimes to the amount of several hundred bushels, and have never experienced any loss worth mentioning.

8. Though adding a little to the labour, at the time of gathering, it is better to strike off the tap root as well as the top, since its hard fibrous texture renders it of little value, and the turnips pack more closely when freed from it. If pitted early, we have found it necessary to make a small opening at the crown of the heap, that the warm air generated may escape readily.

9. When the severe frosts ensue, the opening may be closed, though if neglected, the turnips are rarely injured in consequence. When taken out in the spring, as wanted, they are fresh and solid, and like the potato so kept, better than if deposited uncovered in the cellar.

10. All animals are fond of the turnip, or if disposed to reject it when first offered, soon learn to feed on it readily. Horses, cattle, sheep and swine, have been fed on them ; and so far as our own experience has gone, they have been equally acceptable and beneficial to each. We have repeatedly seen pigs accustomed to them, reject good sound corn for the turnip, when both were given at a time, and horses seem as much pleased with them as with oats.

11. No better apparatus for cutting them is required than a smooth floor, a good shovel, and a willing arm ; but for cattle, there is little necessity for cutting at all, as they will find their way into the interior of a plump ruta baga with as much certainty and as little difficulty as a Kentucky horse into a pumpkin. When fed to animals, it is a good plan to sprinkle salt over the pieces occasionally, or otherwise see that a supply is provided for the stock ;

and for horses, cattle, or sheep, a small quantity of dry food, such as hay or cut straw, should be given with them, or placed within reach of the animals.

12. Last summer the drought was unfavorable to root crops generally; not more perhaps to the turnip than the potato, and we hope those who attempted the culture and failed then, will not be discouraged from a renewal of the effort this season. Considerable experience has convinced us that we have few crops, as a whole, more certain or more valuable.

13. Since writing the above, we have had a letter from a gentleman in Pennsylvania, a most successful farmer, and who has grown larger crops of turnips than almost any other person in this country, in which he says—"I have kept through this winter fifty-six head of grown cattle on the turnips I raised last season, with the addition of about twenty tons of hay."

14. The turnips alluded to were grown on three acres; and though a most extraordinary crop, (nearly 1200 bushels to the acre,) yet the fact of so many cattle being fed, and well fed from so small a quantity of land, is most conclusive evidence of the ability to greatly increase the number of cattle kept by our farmers, by the introduction of the root culture. An ox or cow will consume in five months not less than two tons of common hay, fed upon it exclusively. But allowing that the twenty tons would have kept fifteen head, there remains forty-one head of grown cattle, kept through the winter, on the product of three acres of land.

15. Every farmer can calculate for himself the number of acres of grass he must have mown, to have furnished hay for this forty head; not less than thirty or thirty-five certainly; as we think there are more acres mown that do not come up to two tons per acre than there is that exceed that amount. Our wheat growers, who would like to keep more stock, without lessening their main crop, should consider this subject well.

## Section XVII.

1. Carrot.—*Daucus.*—This plant is said to be a native of Great Britain, where it is still found growing wild. There are many varieties of the carrot; and the following are the finest sorts:—

| | |
|---|---|
| Altringham, (a superior sort,) | Lemon, |
| Early horn, | Long Orange, |
| Cremer, (fine for the table,) | Blood red. |

2. *Soil.*—The carrot requires a light, mellow soil, mixed with sand, and should be dug or trenched one or two spades deep, breaking well all the lumpy parts, so as to form a porous bed, and an

even surface. The orange and red sorts, on account of their longer roots, require a soil proportionably deeper than the horn.

3. *Seed estimate and Sowing.*—The seeds have numerous forked hairs on their borders, by which they adhere together, and therefore should, previously to sowing, be rubbed between the hands, and mixed with dry sand, in order to separate them as much as possible. They are also very light, and therefore a calm day must be chosen for sowing; and the seeds should be disseminated equally, and trodden in before raking.

4. Previously to sowing, if convenient, the seed should be proven, by sowing a few in a pot, and placing it in a hot-bed or hot-house, as it is more frequently bad than most seeds. For a bed 1½ feet by 30, one ounce will be requisite, and the same for 130 feet of drill row. Dr. Deane advises to sow carrots in drills from 9 to 12 inches apart, across beds 4 feet wide. M'Mahon directs to sow thin in drills, distant from each other from 8 to 10 inches, and to thin them to 3 inches apart from plant, in the rows.

5. *To save seed.*—Plant some largest, best roots early in the spring, two feet apart: insert them a few inches over the crowns. They will yield ripe seed in autumn, of which gather only from the principal umbel, which is likely not only to afford the ripest and largest seed, but the most vigorous plants.

6. *Field Culture.*—The only sort of carrot adapted to field culture, says Loudon, is the long red, or field carrot. New seed is most essential, as it will not vegetate the second year. The best soil for the carrot is a deep rich sandy loam; such a soil ought to be at least a foot deep, and all equally good from top to bottom.—On any other soil the field culture of the carrot will not answer.

7. The usual preparation of the seed for sowing is the mixing it with earth or sand, to cause it to separate more freely; but Burrows [illegible], turns over the mixture of seeds and moist earth several times, and thus brings it to the point of vegetating before he sows it. Having weighed the quantity of seed to be sown, and collected sand or fine mould, in the proportion of about two bushels to an acre, I mix the seed with the sand or mould, eight or ten pounds to every two bushels, and this is done about a fortnight or three weeks before the time I intend sowing; taking care to have the heaps turned every day, sprinkling the outside of them with water each time of turning over, that every part of the sand heaps may be equally moist, and that vegetation may take place alike throughout.

8. I have great advantage in preparing the seed so long before hand; it is by this means in a state of forward vegetation, there-

fore lies but a short time in the ground, and by quickly appearing above ground, is more able to contend with those numerous tribes of weeds in the soil, whose seeds are of quicker vegetation.

9. The quantity of seed when carrots are sown in rows, is two pounds per acre; and, for broad-cast sowing, five pounds. The rows for the larger or proper field carrots, should be from 14 to 16 or 18 inches apart; and the carrots thinned in hoeing, to 3 or 4 inches apart in the rows. The seed will be best when sown by hand, as their shape does not well admit of their being sown by machines.

10. Loudon says, it has been advised, by an intelligent cultivator, to deposit the seed to the depth of one inch in the rows, leaving the spaces of fourteen inches between them as intervals; the seed, in these cases, being previously steeped in rain water for twenty-four hours, and left to sprout, [illegible] which it is mixed with saw-dust and dry mould, in the proportion of [illegible] peck and a half of each to a pound of seed. The land [illegible] lightly harrowed over once in a place. Two pounds of seed, in this mode, is found, as has been observed, sufficient for an acre of land.

11. *After culture.*—The first hoeing of carrots must be by hand; an operation which requires a great deal of attention, as it is difficult to distinguish and separate the weeds from the young carrots. Loudon says, from eight to fifteen or eighteen inches each way, is the common distance at which they are allowed to stand; and it has been proved from many years experience in districts where they are most cultivated, that carrots which grow at such distances always produce more abundant crop than when the plants are allowed to stand closer together. [illegible] observed, it is [illegible] if they grow large and rank, when they are chiefly designed as food for cattle, [illegible] distances are preferred for the table.

12. The following is a statement of the mode of cultivating carrots by some, in preference to all others:—Plough as deep in the fall or spring as the state of the land will permit. Cross-plough in the spring, and harrow level. Put on fifteen, twenty, or twenty-five buck-loads of the most rotten compost to the acre, as the heart of the land may be. Spread and harrow it fine; then, with a horse-plough, strike it into two-bout ridges, as near together as four back furrows will make them, and if the two first back furrows are narrow, the other two being deep, the ridge will be nearly to a point, and should be eighteen or twenty inches from the bottom of the furrow, if it be well cleared out.

13. To do which, make another bout in the furrow, if necessary. Then, with the head of a rake, strike off the crown of the ridge,

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till it is three or four inches wide, and with it or a hoe, open a drill in the usual manner. Sow the seed pretty thick, cover and press down a little with a hoe or shovel. When the weeds appear, run a small plougn through the furrows. Hand weed the crop, and hoe the weeds from the sides of the ridge. The orange carrot is best.

**14.** In harvesting, a plough should be run near the side of the range of carrots, and as deep as possible. This loosens the dirt, and clears one side of the carrots almost entirely from the earth. The labourers then, with great facility, take them by their tops out of the beds, and throw them into carts, with only an occasional use of the hoe to plants which the plough has not loosened.

**15.** I have no question that, conducted in this mode, a carrot crop may be made more productive, and less expensive than the potato crop usually is. In sowing, I use a small hand-drill, which lays the seed with great regularity—a circumstance very important both to facilitate weeding and harvesting ; since, if the carrots stand straggling, and not in a line, the plough, when harvesting, leaves the more to be loosened by the hoe or fork.

**16.** Horses are remarkably fond of carrots, and it is even said, that when oats and carrots are given together, the horses leave the oats, and eat the carrots. The ordinary allowance is about forty or fifty pounds a day to each horse. Carrots, when mixed with chaff, that is, cut straw, and a little hay, without corn, keep horses in excellent condition for performing all kinds of ordinary labour.

**17.** In comparing the carrot with the potato, an additional circumstance greatly in favor of the former is, that it does not require to be steamed or boiled, and it is not more difficult to wash than the potato. These and other circumstances considered, it appears to be the most valuable of all roots for working horses.

**18.** The use of the carrot in domestic economy is well known. Their produce of nutritive matter, as ascertained by Sir H. Davy, is ninety-eight parts in one thousand, of which three are starch, and ninety-five sugar. They are used in the dairy in winter and spring to give colour and flavour to butter. In the distillery, owing to the great proportion of sugar in their composition, they yield more spirit than the potato ; the usual quantity is twelve gallons per ton.—They are excellent in soups, stews, and haricots, and boiled whole with salt beef.

**19.** The diseases of carrots are only such as are common to most plants, such as mildew, insects, &c. The mildew and worms at the root frequently injure crops, and are to be guarded against, as far as practicable, by proper choice, soil, season of sowing, and after-culture.

## SECTION XVIII.

1. HEMPS.—The best soil for Hemp is a rich vegetable mould, with a clay substratum, either fresh, or which has been long in pasture. Any stable or ordinary manure is good, if it be necessary to use any, which depends upon the degree of the fertility of the soil. Hemp exhausts very little, and I have known it cultivated for successive years in the same field without any diminution of the crop

2. The ground should be prepared exactly as you would make the best preparation for wheat. A bushel and a peck of seed, or, if the land s uncommonly rich, a bushel and a half, to the acre, should be sowed, broad cast, from the first to the 20th of May. All the plants, male and female, are gathered, by pulling or cutting close to the ground by a cutting knife resembling a reap hook, but shorter. The plants intended to produce seed are sowed by themselves in drills, and cultivated with the plough and hoe, so as to keep them clean.

3. The Crop Hemp is pulled or cut (for there is not much difference between the two methods, although I prefer cutting) about the 20th or 25th of August; and the proper time is indicated by the Hemp leaves turning a little yellow, and the farina escaping when the stalks are agitated. When cut or pulled, the stalks are suffered to remain on the ground a few days until they are cured, and if a rain falls on them so much the better, as it will render the separation of the leaves from the stalks easier.

4. After being cured, the hemp is tied up with a hemp stalk in small bundles, convenient to handle, and shocked in the field. The best farmers, in a week or two afterwards, stack them on the field, throwing the tops inside and the roots outside. Late in November or in December the stacks are broken, and the Hemp spread down on the field, or on the sod, to ret. The length of time it should remain depends upon whether the season is wet or dry, but it will not be less than seven or eight weeks, and may be longer. It is spread as you would spread flax regularly, and avoiding its being tangled.

5. You cannot judge whether it is sufficiently retted or not but by taking up a handful and ascertaining if the lint will separate easily. When sufficiently thus retted it is taken up, and again shocked, and broken out, in the months of February, March, April, &c., as convenient, by a large hand brake. I task my hands 80 lbs. per day, and allow them a cent per lb. for every pound beyond that. I have known, in some instances, as much as 250 pounds per day broken out. As each handful is broken out, the shoes,

that is the little particles of the stalk which adhere to the lint, are carefully beaten off, so as to make it clean, and the hemp is laid away, and at night tied up in a bale or bales, and carried to the Hemp house. All attempts to substitute horse, water or steam power for the hand brake, and there have been many, have hitherto failed.

6. The above method is what we call dew retting. I have never tried water retting. This is effected by immersing the hemp stalks in bundles, in water, and keeping them under with weights. September is the best period, and standing better than running water. The length of time may be a few days or more, according to the temperature of the water. You judge, as in the other mode, when it is sufficiently retted. The Hemp intended to produce seed is suffered to remain in the ground until the first light frost, is then cut, and after a few days the seed are threshed out.

7. Flax.—We hope our farmers will not neglect to sow flax, although cotton is cheap, for there are many uses to which flax is applied where cotton will not answer as a substitute. In the division of labor in this country, there should always be provision made for employing the female part of every family. If we abandon household manufactures, we place our females in a dangerous situation. Every person out of useful employment is strictly dangerous to the community.

8. Many of the *follies* and most of the *crimes* of the present day are the offspring of idleness, even the monster, *intemperance*, is generally supposed to be a branch of that family. As long as the present custom of our country prevails with regard to the division of labor, or so long as the males do all the out-door work, the task of the females cannot be considered over-burdensome, if they continue the good old custom of household manufactures. We always believed the music of a spinning-wheel to be better adapted to a farmer's hou— than a piano, and the sound of a loom indicates more economy th— hat of a guitar.

## Section XIX.

1. Cultivation of Grasses.—In the modern and improved system of husbandry, the cultivation of a farm may be considered under two heads; the *grass* and the *arable* land. The convertible system of husbandry, is where land is converted from tillage to grass, and then again from grass to tillage, and so on, alternately. The advantages to be derived from this practice, says a writer of authority (Sinclair,) cannot be too much dwelt on. By the grain crops, a sufficient quantity of straw is provided, partly to be used

as food, but principally to be employed as litter for cattle, while at the same time, a fair profit is to be derived from the grain.

2. By the grass and green crops, a number of domesticated animals are maintained both in summer and winter; and when they are abundantly littered, as well as fed, a regular and sufficient supply of valuable manure is secured. Hence it is that alternate crops for the food of man, and of the inferior animals, is in general indispensable for the profitable production of both corn, and of animal food, on all soils susceptible of cultivation

3. On the subject of cultivating the grasses, we shall take for our guide an authority we have before acknowledged. Judge Buel has given a classification of the grasses, the seeds of which can be procured in this country, and pointed out the soils on which they respectively thrive. He divides them as follows:—1. Grasses best suited to arable lands, and designed to alternate with grain and roots. 2. Those best adapted for hay or meadows; and 3. Grasses which are most profitably sown for perennial pastures.

4. There are several descriptions of land, which are much more profitably employed in tillage than in grass, particularly those that are dry or light, and which have little tendency to produce good herbage. Yet constant cropping with grain would soon exhaust them of fertility, without an expense for manure which few can afford. The system of introducing artificial or sown grasses after two, three, or four years' tillage is happily calculated to avert the evil, and constitute the basis of most of the late improvements in arable husbandry, as well as farm stock.

5. The grasses best calculated for this purpose, are red and white clovers, lucern, sanfoin and the orchard, tall oat, timothy, and rye grasses. Clover is the primary dependence on all soils which will grow it, and particularly where gypsum can exercise its powers. As vegetables are said to exhaust the soil, in proportion to the smallness of their leaves, clovers are entitled to the high commendation they have obtained among Canadian farmers. But as these plants are liable to premature destruction by the frosts of winter, it is prudent and wise to intermix with their seeds, those of some other grass more to be depended on.

6. On *sands*, *light loams*, and *gravels*, (and these constitute the soils usually employed in convertible husbandry,) the orchard grass, or tall meadow oat grass, appear best calculated for this purpose. They grow early, delight in a clover soil, and are fit for the scythe when clover is in bloom, the period at which it ought to be made into hay. The hay from this mixture, may be made before the

harvest commences ; and if the soil is good, a second crop may be cut almost equal to the first.

7. If intended for pasture the second or third year, either of these grasses will afford more abundant herbage than timothy. Lucern may be sown on deep sand loams ; and sanfoin on dry soils, naturally calcareous, or on those which have been rendered so by marl or lime. On *clays*, and *heavy loams*, timothy may be sown alone, or those grasses named in the preceding paragraph, separate or mixed.

8. On *wet soils*, and reclaimed swamps, as the only object of tillage *ought to be* to prepare the ground to be laid down in grass, the kinds indicated in the preceding remarks as suitable for such soils, and intended for meadow grasses, should be selected ; yet so scanty is our assortment that we can only name timothy and herdsgrass.

9. *Meadows.*—These may be classed under three heads, viz :—low, or alluvial lands, on the banks of rivers, creeks, and brooks ; upland, naturally moist, or of clay, or heavy loam ; and reclaimed bogs and swamps. These soils, to adopt a common term, are *natural to grasses*, while the expense of tillage, and the uncertainty of a crop, render it most proper to appropriate them to grass. The objects in stocking meadows, are, to select those grasses which *yield the greatest burthen of hay, and afford the most nutriment for cattle.*

10. When mixed seeds are employed, care should be taken to select those which can be most profitably cut at the same time ; the impropriety of mixing timothy and orchard grass, for instance, will be apparent, from observing that the last should be cut in the latter end of June, while the former continues to improve till the last of July. Timothy is undoubtedly the best grass which can be employed for meadows on moist or tenacious soils. Herdsgrass and rough stalked meadow grass, often come in spontaneously. And if the timothy is left standing until it is ripe, seeds enough fall to supply new plants.

11. For *light loams*, *sands*, and *gravels*, the tall oat and orchard grasses are probably the best, and to these may be added, red and white clover. The great dfficulty is, to prevent the deterioration of meadows. This takes place from the better grasses running out, and giving place to coarser kinds, to moss, and to useless and noxious plants, aided often by a neglect to keep them well drained. The finer and most nutritious kinds thrive well in *moist*, though but few will live in *wet* soils.

12. It is therefore of the first importance, to keep the surface soil free from standing water, by good and sufficient drains ; and

it often becomes necessary to lay the land in narrow ridges, at right angles with the ditches. Another precaution to be observed is, not to depasture them with heavy cattle when the ground is wet and poachy.

13. Harrowing in the Fall, has been found beneficial to meadows. In Europe, top dressings of lime, marl, compost, ashes, and yard manure, are repeated at intervals of two or three years. With us, the annual application of a bushel of plaster of Paris, is found beneficial on most lands not absolutely wet. Stable manure should be applied only when it can be spared from the more profitable uses of tillage, and is far more beneficial mixed with the soil, than spread upon its surface.

14. Its most economical application is in the form of compost, made by mixing it with bog earth, river sand, the wash from the highways, or other rich earth, at the rate of one load of dung to five or six of earth. If turned and mixed well, this constitutes a valuable top-dressing for grass grounds, and is best applied in the autumn. When these means fail to insure a good crop of hay, it is time to resort to the plough, a course of crops, and reseeding.

15. The number of grasses is very great. It is said that 215 properly so called, are capable of being cultivated in Great Britain. Judge Buel has given an account of twenty-five, foreign and domestic, and exhibited in a tabular view their comparative value, as indicated by their product, and the quantity of nutritive matter which they severally afford, together with the time of their flowering and seeding.

16. Another paper in the Memoirs, by S. DeWitt, Esq , says : In laying down grounds for pasture lands, the English select the seeds of such grasses as will come to maturity in succession ; but I think they carry this scheme to excess, and that there is no necessity for a mixture of such a variety of seeds to be used for these purposes. In our country, the most esteemed grasses are, white and red clover, timothy, or herdsgrass, the red top, and foul meadow.

17. With these some other indigenous grasses intermix, the merits of which deserve to be investigated. Our best grasses for meadows, are unquestionably the timothy, the red top, and the foul meadow. The merits of this last are not generally known. There can be no better hay than that which is made from it. On a rich, moist soil, it will grow uncommonly dense, and I should think, would yield as much from an acre, as any other of the best cultivated grasses.

## SECTION XIX.

1. SOWING OF GRASS SEEDS.—Such Farmers and planters as may not put in their grass seeds in autumn should do so as soon as the frost is out of the ground. For *clover*, there is but one opinion as to the superiority of spring sowing, and although many give the preference to sowing timothy seed in August, still there are those whose opinions are worthy of consideration, that advocate the practice of setting it in spring on the growing wheat or rye: so also, indeed, with respect to almost every other of the artificial grasses.

2. If you intend to sow *clover* seed alone on your grain fields, you should not think of seeding less than from twelve to sixteen pounds to the acre. *Timothy*, if sown alone, should be in the proportion of from two to two and a half gallons of seed to the acre. *Rye Grass*, alone, two bushels to the acre. If *Clover* and *Timothy* be sown together, from ten to twelve pounds of the former seed and a peck of the latter would not be found too much.

3. If you purpose carrying your mixture still further, sow ten pounds of clover seed, six quarts of timothy, and half a bushel of herds grass to the acre,—or, of *clover* eight pounds, *orchard grass* one bushel, *tall medow oat* one bushel, and *herdsgrass* half a bushel. In Europe the following is in many districts a popular mixture, two bushels of *rye grass* seed, and from twelve to twenty pounds of *clover* seed to the acre. It is usual to sow the orchard and tall meadow oat in early autumn, but there is no question that they would succeed in spring. The orchard grass should be moistened with water and permitted to remain so for a day before sowing.

4. Whatever grass seeds you sow on your winter grain, be sure to pass a light harrow, and roller over them. You need not apprehend any injury to your grain, for although some roots may be dragged out, you will be more than remunerated by the addition you will receive from the tillering of the branches of the plants which will be imbedded in the soil during the process. That the grass seed will derive advantage from being thus securely placed beneath the soil, common sense and reason both concur in affirming.

5. They will be much more likely to escape destruction from birds than if left upon the surface; they will vegetate with greater certainty, and with being well fixed in the earth, their roots will be much better able to withstand the droughts of summer and the frosts of winter. We need not say that the operations of harrowing and rolling should be performed when the ground is in a state to bear the treading of the horses without injury, as it will strike the intelligent reader that if done when the ground is *wet*, much injury will result to the grain.

6. *Lucerne.*—Those who may feel disposed to try their fortune with this valuable grass, can do so as soon as the ground is relieved from the frost and dampness. It should be sown on a dry rich soil, which had been previously well cleaned. From sixteen to twenty quarts of seed should be sown. It may be put in with the spring barley and oats. In England and Scotland it is frequently cut four times in a season.

7. He who sows *scantily* must expect to reap in a proportionate degree, or to gather more weeds than hay. In every soil there are ample supplies of the seed of every variety of wild and noxious herbage, and if these are not supplanted by a wholesome covering of artificial grasses, they will inevitably germinate, and show their pestilent fronts to the annoyance of proprietors, and the discomfort of their stock: for the earth will be busy in despite of all the maltreatment it receives at human hands.

## Section XXI.

1. Mowing.—They who have not been in their youth accustomed to do this work, are seldom found to be able to do it with ease or expedition. But when the art is once learnt, it will not be lost. As this is one of the most laborious parts of the husbandman's calling, and the more fatiguing as it must be performed in the hottest season of the year, every precaution ought to be used which tends to lighten the labor.

2. To this it will conduce not a little, for the mower to rise very early, and be at his work before the rising of the sun. He may easily perform half the usual day's work before nine in the morning. His work will not only be made easier by the coolness of the morning air, but also by the dew on the grass, which is cut the more easily for being wet.

3. By this means he may lie still and rest himself during all the hottest of the day, while others who began late are sweating themselves excessively, and hurting their health, probably, by taking down large draughts of cold drink to slake their raging thirst. The other half of his work may be performed after three or four o'clock, and at night he will find himself free from fatigue. If the mower would husband his strength to advantage, he should take care to have his scythe, and all the apparatus for mowing, in the best order.

4. His scythe ought to be adapted to the surface on which he mows. If the surface be level and free from obstacles, the scythe may be long and almost straight and he will perform his work with less labor, and greater expedition. But if the surface be uneven,

cradley, or chequered with stones, or stumps of trees, his scythe must be short and crooked. Otherwise he will be obliged to leave much of the grass uncut, or use more labor in cutting it.

5. A long and straight scythe will only cut off the tops of the grass in hollows. A mower should not have a snead that is too slender; for this will keep the scythe in a continual tremor, and do much to hinder its cutting. He must see that it keeps perfectly fast on the snead; for the least degree of looseness will oblige him to use the more violence at every stroke. Many worry themselves needlessly by not attending to this circumstance.

6. Mowing with a company ought to be avoided by those who are not very strong, or who are little used to the business, or who have not their tools in the best order. Young lads, who are ambitious to be thought good mowers, often find themselves much hurt by mowing in company. Mowers should not follow too closely after each other, for this has been the occasion of fatal wounds. And when the dangerous tool is carried from place to place, it should be bound up with a rope of grass, or otherwise carefully secured.

7. *Hay-Making.*—The first thing to be considered about hay-making is the time of cutting the grass. It should not be cut too early, or before it has got its growth, for this will cause it to shrink too much in drying On the contrary, it should not stand too late, or till the seed be quite ripe. It is not only harder to cut, but the ripeness of the seed will cause it to shatter out while drying, which will be a considerable loss, as the seed is the most rich and nourishing part; and the soil will be the more exhausted by nourishing the seed till it comes to maturity, and the next succeeding crop will be the poorer.

8. There never can be any advantage in mowing late unless it be thickening the grass roots by scattering some of the seed where they were before too thin. He that mows early has the advantage of longer days for drying his hay; and of shorter nights, when the dews are less detrimental to hay-making. But the farmer who has many acres of the same kind of grass, cannot always expect to cut the whole of it in exactly the right season. That he may approach as near to right as possible, he should cut the thickest grass first of all; especially if it be in danger of lodging, or so thick that the lowest leaves perish, or the bottoms of the stalks turn yellow.

9. The thinnest of his grass should be cut next, which is apt to be ripe soonest; and last of all, the middling sized grass, or that which is on a medium between thick and thin. Where a second

crop is expected the same year, thick grass should be cut a little earlier, that the roots may not be injured so much as to prevent their speedy recovery, by being covered too long by the first crop. Some regard should be had to the weather, when the time of cutting is in contemplation. Those, especially, should regard it, who are able to call in as much assistance as they please in hay-making.

10. Grass, which has not been washed by rain for several days, has a kind of gum on it, which is known to be a benefit to the hay; and the farmers are fond of mowing their grass when this gum appears, rather than just after the grass has been washed by rain. As to the drying of hay, or the manner of making it, I know there are a variety of opinions. The right way is to do it in such a manner that as much of the sap as possible may be retained, and in the best state that is possible. In this I should think all would agree.

11. All persons will allow that too much drying is hurtful. It is certainly a loss to rake it, or stir it at all, when it is so dry that the leaves will crumble. And, doubtless, as much of the sap should be retained as is consistent with its being kept in good order for fodder, and for long keeping. Some grasses will keep well with less drying than is needful for others. The Rhode-Island bent, as it is called, or red-top grass, will do with less drying than some other grasses. It has been much practiced to put it up with so little drying that it heats in the mow to so great a degree, as to make it turn brown like tobacco; and it is known that cattle will eat it well, and thrive on it.

12. But the mow will certainly send out part of the virtue of the hay in steams. I cannot but think that all grasses should be so much dried, that the mows and stacks, though they have a degree of heat, should not emit any sensible steam; and I would not wish to have hay made brown by mow burning. It surely does not appear to so good advantage at market. Were it not for the labor and cost, a good way of hay-making would be, for the haymakers to follow at the heels of the mowers, at least as soon as the dew is off, and spread the swaths evenly.

13. Turn the grass about the middle of the same day, make it up into cocks before night; open the hay and turn it the next day; and so on till it be sufficiently dried, doubling the cocks if signs of rain appear. It will not commonly take more than two or three days to dry it unless it be very green, or uncommonly thick and rank. A person who has but little hay to make, need not be much blamed, if he do it in this way; especially if the weather do not appear to be settled.

14. The practice of the best English, Flemish, and French farmers, is to expose the hay as little as possible to the sun. It is carried in dry, but it preserves its green color; and you see hay two or three years old in their market, of so bright a green color, that we should scarcely conceive it to be cured,—yet they are in the practice of preserving it for years and value it more for its age. If such a course be best in climates so cool and cloudy, how much more important would it be under our scorching Summer suns.

15. But if the weather be unsettled, or if showers be frequent, it may be better to spread grass well, as soon as it is mowed, stir it often, cock it the same day it is mowed, open it in the next fair day when the dew is off, let it sweat a little in cock, and house it as soon as it is dry enough. It will bear to be laid greener on a scaffold, than in a ground mow; and in a narrow mow greener than in a broad one. And that which is the least of all made, should be put on a scaffold.

## Section XXI.

1. Pasture.—It is an injury to pastures to turn in cattle too early in the spring; and most hurtful to those lots in which the grass springs earliest, as in those which are low and wet, in which the grass comes forward soonest. The feet of the cattle early in the spring destroy the young grass, and cut up the sward in such a manner as to produce a great amount of injury, without any benefit to the cattle, as the little food they can obtain from the grass just sprouting, serves scarcely any other purpose than to cause them to scour.

2. The grass in pastures should be so far grown before cattle are admitted, that they can fill themselves without rambling over the whole ground. The 20th of May is quite early enough in common seasons to turn cattle into almost any of the Canadian pastures. Out of some, they should be kept still later. The driest pastures should be used first, though in them the grass is shortest, that the breaking of the sward by the cattle's feet may not take place to any great extent.

3. It is recommended not to turn all sorts of cattle into pastures at once. Milch cows, working oxen and fatting beasts should be indulged with the first feeding of a pasture; afterwards, sheep and horses may take their turn. When a lot is thus fed off, it should be shut up, and the dung which has been dropped should be beaten to pieces and well scattered. Afterwards a second lot may be opened and treated in the same manner, and so on in rotation, from one inclosure to another, giving each inclosure some time

to recruit; taking care, so far as possible, to feed the driest pastures first, so that the sward may be the less injured by the treading of the cattle.

4. Something considerable is saved by letting different sorts of grazing animals take their turn in a pasture. By this means nearly all the herbage will be eaten, much of which would otherwise be lost. Horses will eat the leavings of horned cattle; and sheep will eat some things which both the others leave.

5. If swine are turned into a pasture, they should have rings on their noses, unless it is an object to employ those animals in rooting out brakes and other weeds which they consume for food. If they are allowed the first of the feed, they will defile the grass, so that the horses and cattle will reject it.

6. Let the stock of a farmer be greater or less, he should have at least four inclosures of pasture land. One inclosure may feed two weeks, and being then shut up to grow, open another. Each one will recruit well in six weeks, and each will have that time to recruit. But in the latter part of October, the cattle may range through all the lots, unless some one may become too wet and soft. In this case it ought to be shut up, and kept till feeding time the next year.

7. So different is the appetite of different animals, that there is scarcely any plant which is not eaten by some, and rejected by others. The following are said to be facts, which have been ascertained in Holland:—When eight cows have been in a pasture and can no longer obtain nourishment, two horses will do very well there for some days, and when nothing is left for the horses, four sheep will live upon it; this not only proceeds from their differing in the choice of plants, but from the formation of their mouths, which are not equally adapted to lay hold of the grass.

8. Although small pastures are recommended for pasturing neat cattle and horses, yet Mr. Loudon observes that "Large inclosures are in general best adapted for sheep. These animals are not only impatient of heat, and liable to be much injured by flies, in small pastures, often surrounded by trees and high hedges, but they are naturally, with the exception, perhaps, of the Leicester variety, much more restless and easily disturbed, than any other species of live stock."

9. 'Sheep,' says Lord Kaimes, 'love a wider range, and ought to have it, because they delight in short grass; give them eighty or ninety acres, and any fence will keep them in; confine them to a field of seven or eight acres, and it must be a very strong fence that keeps them in.' Though fields so large as 80 or 90 acres, can

be advisable only in hilly districts, yet the general rule is nevertheless consistent with experience.

## Section XXII.

1. Raising Seeds.—Acting on the principle, that every farm should produce as far as possible all that is required for use upon it, we advise farmers to pay more attention to raising seeds. There will always be some which it will be necessary perhaps to purchase, and there are many of which exchanges will produce a good effect, but far the greater part of the seeds wanted by the common farmer may be as well produced by himself, as by another. Some little care and attention is, however, necessary; else, however good the seeds may be, so far as germination is concerned, the plants produced may not be of the kind desired or expected.

2. Nearly all are aware that when plants are so situated, that the pollen or fecundating dust of the blossom of one variety is conveyed to the flower of another variety of the same species, a cross will be the result, and the new vegetable or plant will be a hybrid, having a mixture of the qualities of both, perhaps, but unlike either. It is owing to this easily understood cause, that the seeds of the apple, peach, cherry, potato, and other fruits and plants so rarely produce trees or plants like the original ones.

3. It is this disposition to mix which is to be guarded against, and a few simple rules will enable any farmer to do so effectually. Beets are a plant frequently injured by planting different kinds for seed near each other. Thus, the red and white will produce plants neither red nor white, and frequently of an inferior quality. Radishes of different kinds should never be planted near each other, when intended for seed. Nothing shows the effect of 'amalgamation' quicker, than the planting of squashes and pumpkins near each other.

4. The squashes will be mis-shapen and watery, and the pumpkins warty and hard-skinned, and destitute of the sweetness belonging to the pure article. Nearly the same deteriorating results ensue from planting gourds in the vicinity of squashes. The shell of the gourd is injured, and the squashes are rendered bitter and unpalatable. Corn of the several kinds cannot be preserved in purity, if planted where the dust of the blossoms of one kind come in contact readily with the silks of another.

5. Cabbages of different varieties are very sure to cross with each other when planted together, producing plants like neither of the original kinds. One of the most serious injuries resulting from this tendency, is found to arise when cabbages and turnips intended

for seed are planted near each other. The cabbages produced from such seed will not head well; and the turnips, instead of fine round bulbs with small tufts of leaves, will be surmounted with a cabbage-like stem, an immense quantity of leaves, and the roots themselves will be more or less tough and woody in their structure.

7. Potatoes of several kinds may be planted with impunity near each other, as they are not usually grown from the seeds, but almost always from the tubers, and these are not affected by the fecundating process. We not unfrequently hear complaints from farmers and others about their seed changing into a different and a worse kind. By a little attention to the above suggestions, this difficulty might be avoided, and good seeds grown by every one. The most perfect plants should always be selected for planting out for seed; and where this is done, and a mixture with other kinds is avoided, a change for the worse need not be feared.

## CHAPTER IV.

### Section I.

1. Horses.—By the general consent of mankind it seems to be agreed that the horse is the most noble, useful, and beautiful of animals. Kind docile, and even affectionate in their dispositions, there is no animal, the dog perhaps excepted, that is so closely attached to his master, and appears so well to understand even his wishes, as the horse. We never felt disposed to blame or ridicule the expressions of fondness an Arab will bestow upon his favorite mare; one that has been an inmate of his tent, as it were, for perhaps twenty or thirty years; one that has carried him safe through all his exploits of thieving and robbing without faltering or stumbling; one that knows his voice among a thousand, and in any situation will come at his bidding, always meeting gracefully his caresses, or bearing him off in flight proudly and safely.

2. A man who loves a good horse, and who does not? has his feelings sadly tried by the droves of "villainous, spavined, foundered, narraganset pacers" or trotters, that he is compelled to meet, let him go where he will; animals utterly worthless, except perhaps to drag a plough or a waggon about the farm for a few days in a year, and the remainder of the time a dead weight upon the hands of the owner. A good horse will always sell well. Perhaps there is no species of property less liable to fluctuation or depreciation in value, than a good horse.

3. But what in this respect are horses in general? Take one hundred of the first horses you meet on our farms, old and young

and what think you they would bring a head, if sold under the hammer for cash? and they will bring cash in no other way. Ten, fifteen, or twenty dollars on an average, perhaps; and yet those scape-goats have cost their owners, in rearing, nearly as much as horses that would average one hundred dollars each.

4. The plain truth is, we have too many horses by one-third, and those we have are too poor by one-half; and when we undertake to make sales of them we find such to be the fact. Such horses run the farmer in debt; they do not pay the expense of raising, or any thing near it, and the sooner this truth is realized, the better for all. Now let no farmer who is burdened with old or worthless horses say to himself on reading this—"It is true I have more horses than I want, or than is profitable to keep over the winter, and I must get rid of two or three of the oldest.

5. There are neighbors A and B, they have no horses, and they sometimes come to me for one; to prevent lending them one fit for service I will give old Spitfire to A and Herod to B." If a man has a particle of honor in his constitution, or carries such a thing as a conscience in his bosom, he will go to his neighbor and steal from him his last ten dollars, his only bushel of wheat, or his children's loaf of bread, before he will inflict upon him such a curse as the gift of an old horse.

6. We know there are multitudes of poor men, who can with great difficulty provide bread, who have a great penchant for a horse, and will accept of one as old and helpless as their grandfather, to keep the breath of life in it through the winter, when they should be better employed, and finally before spring comes be obliged to consign the animal to the crows. If you have an old horse who is past service, the good he has done you deserves a better recompense than the tender mercies of a drunken raggamuffin, or the starvation of a man's lot.

6. Kill him, but do not give him away to be abused or starved. Kill him and make a mound over him of lime, vegetable matter and earth, which will prevent all offensive smell, and furnish a few loads of the very best manure; or cut him into small pieces and bury him in the ground where most wanted, certain that his flesh will produce an immediate, and his bones a lasting benefit to the soil. A pig is worth more to a poor man than a horse; and a good cow is worth a dozen. Let every man who is tempted to obtain or keep superannuated horse flesh, remember this.

## Section II.

1. Treatment of the Horse.—Horses in their natural state

are by no means ferocious; they are only wild and fiery; and it may be added with equal truth, that they are not naturally vicious; for their ill tempers, as well as manners, originate generally from defective education, and rough handling. Harsh usage and punishment are of no avail as corrections; for, under cruel discipline the horse becomes more obstinate, morose, and irritable, and is very soon rendered dangerous of approach.

2. If, on the contrary, you use him kindly, and he finds that instead of a tyrant, he has a friend about him, he will be under your hands as tractable as a lamb; in fact so subservient that you may do any thing with him—for it is well known to those acquainted with the nature of the horse, that no animal is more susceptible of soothing, nor more docile and grateful for gentle usage, as he invariably evinces cheerfulness on the approach of the person from whom he receives kind treatment.

3. An occupation for which I have always felt a peculiar partiality, has been, the study of the temper and disposition of the horse; and, from the observations I have in consequence made, am convinced, that a multiplicity of errors are committed from ignorance of his true character in the rearing and tuition of that noble animal, which afterwards fall heavily and very unjustly on him.

4. Many horses have been intrusted to my care for correction, under the supposition that they were bad tempered, or viciously disposed, which, in other hands, would, without doubt, have been acted upon accordingly, i. e. rendered more faulty by harsh proceeding. On acquaintance with them, I generally found the poor animals to be only nervous and irritable from ill treatment, rather than vicious by nature; in short, 'more sinned against than sinning;' for no sooner had I gained their confidence, than the tremulous awe and timidity they evinced on being approached disappeared.

5. After a short trial, I have returned them to their owners, divested of the alledged complaints, with this simple injunction, or something tantamount to it, 'Use him kindly, for vicious conduct makes vicious horses;' at the same time urging them to bear in mind, 'that the horse is naturally of a gentle disposition, and much disposed to associate with man.'

6. This may be exemplified by any gentleman recollecting the pleasure a horse seems to feel when noticed and caressed by himself; yet, on scrutiny, the same demonstrations of joy will not take place on the approach of the attendant. Education generally imparts humanity and feeling to its possessor; and a gentleman enjoying these qualities more eminently than his domestics, the

animal's discrimination causes him to recognize a difference in the behavior of each towards him.

7. Grooms are too prone to be harsh and hasty towards the horse; whereas, if they would only study to make a pleasure of their duty, they would considerably abbreviate the routine of their labor. In consequence of erroneous conduct, horses will occasionally acquire a character for viciousness among stable men, which cannot be substantiated on reasonable grounds, the presence of the owner being frequently a complete refutation of the assertion.

8. Horses usually evince attachment towards those who use them kindly. His late majesty, George III., had a favorite charger named Adonis. Whenever the king, on visiting his stables, chanced to pass near enough for Adonis to hear his voice, the animal would commence whining with joy, and his recognition of his master was always accompanied with so much noise, that, to quiet him, his majesty would invariably command him to be saddled and led forth. Having rode him for a few minutes round the premises the gratified animal would return to his quarters; but had the king not humored his wish, the animal would have become uproarious.

9. Till within a very short period, I was not aware any person had publicly treated on the subject of humanity to horses with the same views entertained by myself; but I perceive with pleasure, in a review of a work printed on the continent, that the author justifies my opinion, and corroborates the truth of my remarks. One extract I have preserved, which I cannot do better than quote.

10. It is justly asserted, in the best works of rural economy and the veterinary art, that *no horses are naturally vicious.* When they become vicious, the reason is, because we pay too little attention to the horse. In a word, we know how to make ourselves intelligible to the horse. It seems truly astonishing, that horses in general are not more obstinate; and that, in the consciousness of their strength, they do not strive more to rid themselves of their slavery, when we consider how severely, cruelly, and barbarously these generous beasts are treated.

11. How often are they beaten and ill used, frequently without any cause! and how seldom, on the other hand, are they addressed in terms of commendation and encouragement, and still less rewarded! and yet attentive observers have ascertained, that the horse, like the elephant and dog, possessess a sensibility of nerves which might be termed a sense of honor, and which is equally susceptible of praise and blame.

12. Vicious habits may likewise be ascribed to imperfect training. For instance; a horse is entrusted for that purpose to a per-

son totally unacquainted with the manner of treating him, consequently incapable of judging whether the horse be qualified by nature to fulfil the intentions of the owner. The age and strength of the animal have not been taken into consideration; and his incapacity to undergo the fatigue allotted to him, although proceeding from weakness, has very incorrectly been ascribed to stubbornness and obstinacy. To resistance, as may be expected, harsher usage has followed; the temper of the animal has become soured; and he has really imbibed a vicious character, which at the outset, was only imaginary.

13. The result has been open warfare between him and his rider, in which the latter seldom gained the ascendancy; and the former has never been duly trained for the purpose for which he was destined; indeed he has frequently been rendered quite unserviceable and become afterwards a drug in the market, though nature had intended him to be useful in many capacities; which under judicious management, would doubtless have been realized.

14. For a long series of years I have been in the habit of making observations on the errors committed in the usual treatment and training of horses; and I am convinced, from experience deduced by long study of the nature of horses, and continual intercourse with them, that mild discipline is the *sine qua non* of stable-management, and it is the interest of every proprietor to see it enforced. Horses have very retentive memories, and seldom forget the unruly tricks or habits acquired from improper and hasty management.

## Section III.

1. Colour of the Horse.—As almost every man has some favorite colour for his horses, and tastes are various as individuals, the colour of this animal would be of comparatively little consequence, were it not indicative of the breeding and blood, and of course, in a great measure, of constitution and temper. It has been said that a good horse could not be of a bad colour; and in many respects the position is true; still, for the reasons given, there are some colours which experience shows should be preferred.

2. Fashions, however, are mutable, and in no respect are they less permanent than in the colour of horses. The colour of his hair, and that of the skin, is depending on the mucous tissue or network immediately beneath the cuticle, the outer or scarf skin being colourless, and only serving to protect the true skin and its appendages from friction or injury. The pure white horse is a very rare animal, the majority of those that appear so having once been grey, and growing white after reaching the age of four or five years.

3. Among the Arabians, a pure white mare is considered almost priceless; as in that case the purity of her blood, and her direct descent from the celebrated steed of the prophet cannot be doubted. Those of the best blood, are not large, but beautiful in the extreme, and as gentle and docile as lambs. Introduced into Europe, they have proved of good constitutions, little subject to disease, not of the fleetest kind or the greatest endurance, but excellent for light carriages or the saddle.

4. Grey horses can be found of every shade from the lightest mixture, or silver grey, to the dark iron grey. The lightest greys show the most clearly their blood of the Arab or barb; are rarely heavy horses, but well built, round bodied, and like those from which they orignated, better for the saddle than the harness. The mixture of blood does not, however, appear to have improved their temper, though it certainly has rendered them more hardy. The iron greys have still more endurance than light greys, and more than their general appearance would indicate, as there is in their build usually quite a departure from the round carcass and close knit frame of the preceding ones.

5. The most common defect in the iron grey is found in the liability of the feet to contraction, which sometimes, though not always, renders them subject to lameness. The dappled grey is usually one of the grey horses, being better built than the iron grey, and capable of more endurance than the lighter kinds. For any purpose; for the saddle or the carriage, the farm or the road, there are few better horses than can be found among the dappled greys, and much pains have been taken to improve their blood. A dark dappled grey usually retains his colour in old age; the lighter ones grow lighter as they become older.

6. The grey requires to be thoroughly broken, and will bear less trifling with than most other horses; appearing to have a tinge of viciousness in his disposition, which, unless checked when young, is apt to become troublesome with age. Roan horses are such as have their hair composed of the white, bay or red, and the black; and it, of course, admits of a great variety of shades. In some roan horses the mixture appears to be a natural one, the hairs of the different colours intermixed, while in other cases the bay or the black appears to have been sprinkled over the others.

7. In such roans the individual hairs are frequently of more than one colour. Roans are generally pretty horses, good tempered, but are not remarkable for endurance. The strawberry roan is a mixture of sorrel with white, sometimes handsome, but not calculated for hard labour or severe fatigue. Pied horses are not so

well liked as greys or roans, but when well matched, they sometimes appear well as carriage horses.

8. Their value, of course, depends on their breed. The cream-coloured, or Hanoverian horse, is remarkable for the iris and red pupil of his eye, and is appropriated to the use of the royal family in England. He has a heavy, yet perfectly formed body, and is a superb animal; but there is no experience to show whether he would be valuable for any other than the light service assigned him.

9. The dun horse, especially of the larger size, is much esteemed in England as a good farm or miller's horse, constitution and temper good, feeding well, somewhat of a drone in his movements, of tolerable strength, and on the whole a useful horse. Some duns are shaded or dappled with spots of a darker colour; and these having better blood, and more action and life, are much sought after as ladies' horses, being both beautiful and manageable. The chesnut horses are divided into three varieties; the lightest, or the sorrel, usually having more or less white on their faces or legs, and generally slenderly made.

10. They have, as a whole, little breeding, and are deficient in hardihood. The next variety has less red and more bay or brown, and is preferred to the former; but though pleasant to ride, is in the harness inclined to be fretful, and of slight endurance, compared with some other horses. The dark chesnut, is as different from the foregoing as possible; fine in the leg, round built, powerful in the harness, of an excellent constitution and endurance, little troubled with disease, unless about the feet, but sometimes having a very fiery and intractable temper. This kind of horse is much esteemed as a carriage horse, and when well broken, is one of the best of horses on the farm.

11. Of all colours, however, the bay horse is the most generally and deservedly esteemed, and in their several varieties they include our best horses of every kind, carriage, road, farm, or turf. Of bays, the lightest coloured are considered the least valuable, showing less breeding, and being less hardy. The proper bay horse, with no white about him, black from the knee and the hocks to the feet, the hoofs of a shining black, is the favorite colour, has generally a good constitution, rarely is affected with bad or tender hoofs, and if not faulty in other respects, will turn out a valuable horse for almost every purpose.

12. As the bay approaches the brown, there is usually less show and action, but increased strength and hardiness; and for hard farm work, perhaps more usefulness. This class has usually more

substance than the lighter bays, and were the same pains taken in breeding, might be made as handsome a horse, and for ordinary purposes, more valuable. Brown is not a fashionable colour, and no horses, as a body, have so little breeding as these.

13. Owing to this, they are comparatively coarse animals; and though there are some excellent horses among the browns, as a whole, they are only calculated for slow work. The black brown has been more neglected than the common brown, and in making choice of them they require to be examined closely. Some of them have the constitution and good qualities of the bay brown, and where this blood is found, few horses are to be preferred.

14. The black horse has always been a great favorite, and with him more pains have been taken in breeding than with many others. The heavy black Lincolnshire horse, principally used in London as a dray horse, is a noble animal in the harness, and could he be rendered more active, would be invaluable, where power and endurance are required. With the exception of the best shade of bays, the black horses, next in size to the Lincolnshire breed, constitute the best horses for the farmer, or the ordinary uses of the carriage or road.

15. The good qualities of these horses have been established by breeding; but of the other varieties of the black horse, there are multitudes of worthless ones all over the country. Owing to the common black horse being so often a poor creature, some have asserted that animals of this colour were more vicious, and more subject to disease and blindness than other horses.

16. Every worker, or breeder of horses, must be, however, aware, that all conclusions derived from the colour of a horse, are liable to be overthrown by fact, so far as individuals are concerned; good horses being found in all the classes enumerated; still, as a whole, there can be no doubt that colour forms no inconsiderable criterion by which to judge of the capabilities and value of the horse. With the exception of the pure white, the lighter shades of each variety appear to have less breeding, and be more liable to disease, than the darker ones.

17. They are also more tender, and not so capable of enduring fatigue, or hard labor, or usage. It may be remarked, that white legs and white hoofs are always a suspicious sign, usually indicating a poor constitution, animals that are tender-footed, or very liable to become so. Horses with white feet suffer more scratches or chapped skin, than horses with darker coloured feet or legs; and a white nose will frequently have the white part a mere scab, from feeding among plants having acrid or irritating juices, such as the

Johnswort, while the other parts remain perfectly smooth and healthy.

## Section IV.

1. The Hackney Horse is the horse of all-work, but in England is principally used for the saddle, and is much more difficult to meet with in perfection than even the hunter or courser. There are many faults can be overlooked in the hunter, which the road horse must not have. The hunter may start, may be awkward in his walk, or even in his trot; he may have thrushes or corns, and yet we may prize him; but the hackney, if he be worth having, must have *four* good legs; he must be sound on his feet, even tempered, no starter, quiet in whatever situation he may be placed, not heavy in hand, and never disposed to say his prayers.

2. The hackney should be a hunter in miniature, with these exceptions: His height should rarely exceed fifteen hands and an inch. He will be sufficiently strong and more pleasant for general work below that standard. He should be of a more compact form than the hunter, and more bulk according to height. It is of essential consequence that the bones beneath the knee should be deep and flat, and the tendon not *tied in.* The pastern should be short, and obliquity enough to give pleasant action, but not enough to render the horse incapable of hard work.

3. The foot is a matter of the greatest consequence. It should be of a size corresponding with the bulk of the animal—neither too hollow nor too flat—open at the heels, and free from corns and thrushes. The fore legs should be perfectly straight. The back bone should be straight and short, yet sufficiently long to leave comfortable room for the saddle between the shoulders and the *huck* without pressing either. Some persons prefer a hollow backed horse. It is generally an easy one to ride. It will canter well with a lady, but it will not carry a heavy weight, or stand hard work.

4. The road-horse should be high in the fore-head, round in the barrel, and deep in the chest; the saddle will not then press too forward, but the girths will remain without crupper in their place. A hackney is far more valuable for the pleasantness of his paces and his safety, good temper and endurance, than for his speed. We rarely want to go more than eight or ten miles in an hour, and on a journey not more than six or seven. The fast horses and especially the fast trotters, are not often easy in their paces, and although they may perform great feats, are disabled and worthless when the slower horse is in his prime.

5. If there is one thing more than any other in which the possessor, and, in his own estimation at least, the tolerable judge of the horse, is in error, it is the *action* of the horse. Let him lift his legs well, it is said, and he will never come down. In proportion, however, as he lifts his legs well, will be the force with which he puts them down again—the jar and concussion to the rider, and the battering and wear and tear of the feet. A horse with too great knee action will not always be speedy; he will rarely be pleasant, and he will not in the long run be safer than others.

6. It is a rule not often understood, and sometimes disputed, but which experience will fully confirm, that the safety of the horse depends a great deal more on the manner in which he puts his feet down than on that in which he lifts them up; more on the foot being placed at once flat on the ground or perhaps the heel coming first in contact with it, than on the highest and most splendid action.

7. When the toe touches the ground first, it may be easily supposed that the horse will occasionally topple over. An unexpected obstacle will throw the centre of gravity forward, and down he will come. If the toe dig into the ground before the foot is firmly placed, a little thing will cause a trip and a fall. Let the farmer who has a stumbler, look at the shoes of his horse. The toe of the shoe will become round before the heel is scarcely touched.

8. Every horse is liable to fall, however, and therefore comes the golden rule of riding. "*never trust to your horse*"—always feel his mouth lightly. He also does wrong who constantly pulls might and main; he wil' soon spoil his horse's mouth and give himself the arm-ache. *Always feel the mouth lightly;* you will thus be able to give the animal immediate assistance, and will also induce him to carry his head well, than which, few things are more conducive to the beutiful, safe and easy going of the horse.

## SECTION V.

1. THE FARMER'S HORSE.—The farmer's horse is also a horse of *all work*; to be ridden occasionally to market for pleasure, but to be principally employed for draught. He should be higher than the road-horse; about fifteen hands and two inches, may be taken as the best standard. A horse with a shoulder thicker, lower, and less slanting than would be chosen in a hackney, will better suit the collar, and collar-work will be chiefly required of him.

2. A stout compact horse is preferable, yet not cloddy. Some *blood* will be desirable, but the half-bred horse will generally suit the farmer's purpose best. He shou.d have weight enough to throw

into the collar, and sufficient activity to get over the ground. It has often been said, that a horse used much for draught is neither pleasant nor safe for the saddle. The common farmer does not want for his own use a *showy, complete* hackney.

3. He must, however, be careful that he is well carried: and if he has taken a little care in the choice of his horse; has selected one with sound feet, shoulders not too thick, and legs not too much under him; and if he keeps him in good condition, and does not overwork him, the five days carting or ploughing will not unfit him for the saddle, especially if the rider bear in mind the golden rule of horsemanship, "always to feel the mouth of the horse."

4. Since the introduction of the small one horse waggon, riding on horseback has been almost abandoned by our country people, and indeed by all classes, unless for pleasure a short distance. The gait of a farmer's horse is, therefore, not of so much importance as formerly. As so much of the farmer's work is waggoning, it will be no disadvantage to him to keep the most improved.

5. *Coach or Carriage Horse.*—There is a great deal of deception, however, even in the best of these. Many of them will prance nobly through the streets and present a showy appearance, but have not much endurance. The knee-action, and high lifting of the feet in the carriage-horse is deemed an excellence, because it adds to the grandeur of his appearance; but, as already stated in a former section, it is necessarily accompanied by much wear and tear of the legs and feet.

6. The principal points in the coach-horse are, substance well placed, a deep and well proportioned body, bone under the knee, and sound, open, tough feet. As the coach or carriage-horse is the one principally in use in this country, it is very desirable that *speed* should be with every breeder an especial quality. The rage for rapid travelling is quite as extensive in this country as in Europe, and it is therefore of much importance that our coach-horses should have as much *natural speed* as possible.

7. The following extract will bring to mind the cruel exactions which are made upon the power of coach-horses as well in this country as in England:—"There is no truth so easily proved or so painfully felt by the stage proprietors, as that *it is the pace that kills.* A horse at a dead pull, or at the beginning of his pull, is enabled by the force of his muscles, to throw a certain weight into the collar.

8. "If he walks four miles in the hour, some part of that muscular energy must be expended in the act of walking, and consequently the power of drawing must be proportionally diminished. If he

trot eight miles in the hour, more power is expended in the trot, and less remains for the draught; but the draught continues the same, and to enable him to accomplish his work, he must tax his energies to a degree that is cruel in itself, and that must speedily wear him out.

9. "Let it be supposed, what every horse cannot accomplish, he shall be able, by fair exertion and without distress, to throw, at a dead pull, a weight into his collar, or exert a force equal to two hundred and sixteen pounds; or in other words, let him be able to draw a load which requires a force of two hundred and sixteen pounds to move. Let him next walk at the rate of four miles in an hour, what force will he then be able to employ?

10. "We have taken away some to assist in walking, and we have left him only ninety-six pounds, being not half of that which he could exert when he began his pull. He shall quicken his pace to six miles an hour; more energy must be exerted to carry him over this additional ground. How much has he remaining to apply to the weight behind him? Only fifty-four pounds. We will make the six miles an hour ten; for it seems now to be the fashion for the *fast* coach to attempt this pace. How stands the account with the poor beast? We have left him only a force equal to *thirty-two* pounds to be employed for draught.

11. "The load which a horse can draw is about fifteen times greater than the power exerted, supposing the road to be hard and level, and the carriage to run with little friction; and the horse which at starting can throw into the collar a weight or force equal to two hundred and sixteen pounds, will draw a load of three thousand two hundred.

12. "Let him, however, be urged on at the rate of ten miles in the hour—deduct the power used in swiftness of pace from the sum total of that which he possesses, and what remains? Not a sixth part—not that which is equal to a quarter of a ton; or if it be a stage coach, the energy exerted in draught by four horses will not be equal to a ton.

13. "The coach and its passengers and its luggage weigh more than this, and the whole is still drawn on, and must be so. Whence comes the power? From the overstrained exertion, the injury, the torture, the destruction of the horse. That which is true of the coach-horse is equally true of every other. Let each reader apply it to his own animal, and act as humanity and interest dictates.

14. "Many a horse used on our public roads is unable to throw all his natural power or weight into the collar. He is tender footed lame; but he is bought at a little price, and he is worked on the

brutal and abominable principle, that he may be '*whipped sound.*' At first, he sadly halts; but urged by torture of the lash, he acquires a peculiar habit of going. The faulty limb appears to keep pace with the others, but no stress or labor is thrown upon it, and he gradually contrives to make the sound limbs perform among them all the duties of the unsound one; and thus he is barbarously 'whipped sound.'

15. "After all, what has been done? Three legs are made to do that which was almost too hard for four. Thus they must be most injuriously strained, and soon worn out, and the general power of the animal must be rapidly exhausted, and at no great distance of time, exhaustion and death release him from his merciless persecutors."

## Section VI.

1. The Draught Horse.—It will readily be perceived that the qualifications, structure and movements of a draught-horse, must necessarily differ essentially from those of a race-horse, and indeed from every other. And yet the draught-horse, for some purpose or other, is more constantly in demand than all others, especially in our larger cities and along all our canals and rail-roads. It is therefore of the greatest importance that an improved breed of large draught, as well as dray-horses, should be reared in our country.

2. To exhibit fully the requisites of a first rate draught-horse, would require a more particular examination of the subject of "draught," and of the "anatomy" of the horse, than would be practicable at the present time. I will therefore, barely remark, that a "dray-horse should have a broad breast and thick upright shoulders, (the more upright the collar stands the better,) a low forehead, deep and round barrel, loins broad and high, ample quarters, thick fore arms and thighs, short legs, round hoofs, broad at the heels, and soles not too flat."

3. The horse which can throw the greatest weight into the collar, with sufficient activity to do it effectually, and with hardihood in proportion, will doubtless constitute the best draught-horse. But these are qualities difficult to combine. An approximation to this standard can only be obtained by a judicious selection in the out-set, and then by crossing with the best of such breeds as exhibit the requisite qualities. Generally, the greatest fault with large horses is their slowness, and in such cases it would be essential to cross with the strongest, the largest and most compact blood horses.

4. Or if you have a mare with some blood, and with decided marks of strength and power, let her be covered by a superior

dray-horse, and the result will probably be the animal you want. It is very necessary that dray-horses should be large as well as compact, that weight may be opposed to weight. Otherwise the immense loads they have often behind them, and the shaking and battering of the thills, will so throw them from side to side as to endanger their burdens or injure themselves.

5. And this is the only advantage in size and weight, for doubtless much of his force must be expended in transporting his overgrown mass. In England they have crossed some of their best native breeds with the heavy Flanders horse, and have thereby much improved their draught. These heavy horses are bred in the highest perfection as to size, in the fens of Lincolnshire, and few of them are less than seventeen hands at two and a half years.

6. Neither the soil nor the produce of the soil is better than in other countries; on the contrary, much of the lower part of Lincolnshire is a cold, hungry clay. The true explanation of the matter is, that there are certain situations better suited than others to different kinds of farming, and the breeding of different animals, and that not depending on richness of soil or pasture. The principal art of the farmer is, to find out *what will best suit his soil and the produce of it.*

7. Connected with the subject of draught horses is rail-roads, and I will just relate a fact, showing the immense power gained by the use of rails. The Surrey iron railway being completed, a wager was laid by two gentlemen, that a *common* horse could draw thirty-six tons for six miles along the road,—that he should draw his weight from a dead pull, as well as turn it round the occasional windings of the road. A numerous party of gentlemen assembled near Merstham to see this extraordinary triumph of art.

8. Twelve waggons loaded with stones, each waggon weighing above three tons, were chained together, and a horse taken promiscuously from a timber cart was yoked to the train. He started from Fox public house, near Merstham, and drew the immense chain of waggons, with apparent ease, almost to Crogdon, a distance of six miles, in one hour and forty-one minutes, which is nearly at the rate of four miles and hour. In the course of the journey he stopped four times, to show that it was not by any advantage of descent that this power was acquired, and after such stoppage he again drew off the chain of waggons with great ease.

9. A gentleman, who had wagered on the power of the horse, then desired that four more loaded waggons should be added to the cavalcade, with which the same horse set off again with undiminished pace. Still further to show the effect of the rail-way in fa-

cilitating motion, he directed the attending workmen, to the number of fifty, to mount on the waggons, and the horse proceeded without the least distress; and in truth, there appeared to be scarcely any limitation to the power of his draught. After this trial the waggons were weighed, and it appeared the whole weight was as follows:

| | tons. | cwt. | qr. |
|---|---|---|---|
| 12 waggons first linked together, | 38 | 4 | 2 |
| 4 do afterwards attached, | 13 | 2 | 0 |
| Supposed weight of 50 laborers, | 4 | 0 | 0 |
| | 55 | 6 | 2 |

## Section VII.

1. Points of a Good Horse.—I prefer a lightish head, neatly set to the neck; the neck rising promptly and strong from the shoulders and withers, and somewhat crowing or curving at the top, tapering to the head with a strong crest. Shoulders well laid in, spreading well back, something like a shoulder of mutton. Chest deep and a little projecting. Withers rising moderately high and inclining well into the back. If the withers are low and flat on the top, the horse will be inclined to plunge to the ground, and when fatigued will stumble or fall.

2. Neither must the withers rise too high, as he will then appear as though on stilts; both extremes are serious impediments to fine and safe action. Ribs should be well rounded out. Back straight and short, well coppled, that is, the hips well thrown forward, forming a strong loin, and giving a long lever from the point of the hip to the hock-joint of the hind leg. The horse should be a good length from the point of shoulder to the extreme point of buttock. Dock strong, and well covered with hair. Close and snug immediately under the dock.

3. The muscles on the inner part of the thighs should be full and well shut together. If there is a large cavity under the dock, the horse will be inclined to scour, and is probably only a door-yard horse. The neck, head and body form a lever, resting on the fore legs as a fulcrum, the head being at the end of the lever. If the neck be very long and the head heavy, or if the neck be quite short and the head short and light, either of these extremes very much affects the regular clips and action. The whole machine should be of good proportion.

4. The fore arm is a very important lever, as regards the safety of a roadster. The legs should be clean and free from blemish, and when in motion move true, and free from cutting or wabbling. The feet should be round and steep; heels broad; coronet and

pasterns of medium length. Shank or cannon, broad and flat, showing the tendons or sinews. The knee large and well dropped down ; the arm above the knee long, and the muscles large and full. The top of the shoulder when matched, to the withers, should not be so heavy loaded with muscle as to impede their action.

5. No objections to the fore feet moving pretty close, but not so as to cut. Much depends on the form of the hind leg and the power of that lever, as regards strength and speed. The shank, hock and thigh should be broad and flat, something like that of an ox ; and if so when in motion will operate like a plank sprung edgewise and then let fly. If the hind legs when at good speed open and spread a little, no objection, providing there is a good free action in the hock joint.

6. FEEDING HORSES.—*In feeding horses with grain*, the proper quantity of the respective kinds is regulated by weight, for in this proportion are the different kinds considered nutritious. We give to a horse per day half a bushel of oats, the weight of which is seventeen pounds, and if we wish to change to other grain, as barley, rye, or Indian corn, the same weight will suffice ; and as these grains are much heavier than oats, a proportionate less quantity, by measure, will suffice. Another rule, deemed important, is this, that whenever heavier grain is substituted for oats, a quantity of fine cut straw should be added, as a substitute for the husk of the oats. This induces a more perfect digestion of the grain.

7. The practice of giving dry grain to horses when pastured, or fed with green cut grass, is condemned ; for the grain thus given is never perfectly digested on account of the effect of the watery juices of the grasses upon digestion. When dry grain and green food are given, as much interval should be allowed between the dry and green food as circumstances will permit.

8. Von Thaer considers eight pounds of meadow hay equal in nourishment to three pounds of oats ; that hay improves by age if well kept, and is most nutritious for horses when a year old ; that the second growth is not equally nourishing ; and that hay should not be unnecessarily exposed in making, the freshness of its scent being peculiarly gratifying to horses and cattle.

9. In Holland and Flanders, farm-horses are uniformly soiled during summer. A horse is supposed to consume from eighty-four to one hundred pounds of green food per day with occasional grain. An acre of clover, at two cuttings, will give twelve tons of green food ; and hence half an acre of clover, fed green, will suffice for a horse four months.

10. It is also a general practice in Flanders, and is extensively

adopted in Great Britain, to convert the entire food into *manger-meat*, that is, to mix the cut straw and hay, the grain and the roots, or whatever is to constitute the provender for the day, and to feed altogether in the manger, in regular messes. The value of this mode of feeding is alleged to consist—

11. "1. In its requiring a more thorough mastication of the food than when it is given in the common way, thereby assisting digestion, and consequently promoting the nutrition of the animal; for it is not only true that old horses lose much of the power of mastication, and that young and greedy cattle are apt to devour a considerable part of their corn entire, when it is given alone, which passing through them in the same state affords no kind of nourishment, but all animals are known to derive nourishment from their solid food, in a certain degree, in proportion to the care with which it is chewed.

12. "2. It is consumed in less time. 3. By the mixture of the materials, some portions of which, as damaged hay, or straw, might be refused if given separately, an equal consumption of the whole is secured.

13. "4. By its admitting of being more readily weighed, or measured, than when given separately, it can be more accurately distributed to each horse; on which it may be observed, that more injury is often done to horses by allowing them an unlimited quantity of rack-meat [uncut hay in the rack,] than even by stinting them to a scanty allowance; for they will not only pass whole nights in eating, when rest would do them more service, but, by this extraordinary distention of the stomach, its powers are weakened and their general health is injured. 5. It prevents waste and consequently goes further."

14. Mr. Wiggins, whose daily business extends to the feeding of three hundred horses, estimates the saving by the feeding entirely in this way, in the manger, at one sixth. Rye is considerably employed as horse feed in America, particularly in Pennsylvania. It is generally coarsely ground and mixed with cut straw or chaff, and moistened, by which the mass is incorporated.

15. Barley is extensively used in the South of Europe, in Asia Minor and in Persia, for feeding horses, for the reason, probably, that oats, being indigenous to colder climates, do not grow well in these countries. In the first of these countries it is uniformly fed with straw. Six bushels have been found on trial, to be equal to eight bushels of oats. Barley contains twenty per cent more starch than oats, five per cent more saccharine matter, and twenty seven per cent less husk.

16. British writers have furnished us with estimates of the annual expense of keeping farm horses. One of these before us gives the aggregate expense of a two horse team and driver at about £90 ($400.) This includes the interest on the cost of the team and implements, (£270) and 10 per cent for repairs and deterioration. We state this fact for the purpose of calling the reader's attention to it.

17. It imports, that allowing for the days when the team cannot labor, and assuming 260 working days in a year, that a team and driver should earn more than 7*s.* 6*d.* a day for 260 days in a year to pay cost; and that all they fall short in doing this is absolute loss to the owner. The keep, in Britain, is probably higher however than it is with us. Yet we are persuaded that few among us duly reflect upon the cost of maintaining a horse team in a plight requisite for doing good service. In Britain a team of good horses is considered adequate to the cultivation of forty to sixty acres in tillage crops.

## Section VIII.

1. Diseases of Horses.—*To preserve a Horse from the Botts.*—Take of bees' wax, mutton tallow, and sugar, each 8 ounces, put it into one quart of warm milk, and heat it until it all melts and mixes; then put the whole into a bottle, and just before the wax, &c., begins to harden, give it to the horse. Two or three hours afterwards give him physic.

2. *Another method.*—Give a horse occasionally a half pint of hard wood ashes mixed in his grain and sprinkled, or given in his drink. This is an excellent remedy.

3. *Another.*—Give your horse salt freely—as that will, in nine cases out of ten, preserve him from the botts. If he is attacked by them, give him a quart of warm fish brine: and if the case be a bad one, repeat the dose once an hour. For this purpose, *save your fish brine.*

4. *Physic for a Horse.*—A decoction of the herb called thorowort, which is very common. Let it be mixed with Indian meal, or given through a bottle, if the horse refuse the meal when mixed with this decoction. This is an excellent remedy against worms.

5. *Cure for the spavin.*—Take one pound of angle worms, fry them well in a pound of butter, and after it is cool, add one gill of spirits of turpentine. Take one ounce Origanum Oil, (sold at the druggists',) which mix in one gill of spirits of turpentine. Every morning, rub the spavin with the angle worm mixture, heated in a shovel over the fire.

6. Every evening rub the spavin with Origanum Oil mixture.

By the the time these are used, you will begin to see the horse improve. During the operation, it will often appear to make him worse; but this must not be regarded as injurious. It does not remove the lump, but the disease will be extirpated.

7. *To prevent Horses being teased with flies.*—Take two or three small handfuls of walnut leaves, upon which pour two or three pints of soft and cold water—let it infuse one night, and let it boil a quarter of an hour—when cold it will be fit for use. No more is required than to moisten a sponge, and before the horse goes out of the stable, let those parts which are most irritable be smeared over with the liquor, viz: between and upon the ears, the flank, &c.

8. *To cure the Thrush in Horses' feet.*—Simmer over the fire, till it turns brown, equal parts of honey, vinegar, and verdigris, and apply it with a feather or brush occasionally to the feet. The horse at the same time should stand hard, and all soft dung and straw be removed.

9. *Shoeing Horses in winter.*—The smith fixes a small piece of steel on the fore part of each shoe, not tempered too hard, which turns up about a ¼th of an inch, in the shape of a horses lancet; the same to the hinder part of the shoe, turned up a little higher than the fore-part, tempered in the same manner. In going up a hill, the fore part gives a purchase that assists the horse, and in going down prevents him sliding forwards.

10. *To prevent the feet of Horses from balling with snow.*—If the frog in the hoof of the horses and the fetlock be cleaned, and well rubbed with soft soap, previously to their going out in snowy weather, it will effectually prevent their falling, from what is termed balling with snow. A number of accidents might be prevented by this simple precaution.

11. *Paste to stop bleeding.*—Take of fresh nettles, one handful, bruise them in a mortar; add blue vitriol, in powder, 4 oz., wheaten flour, 2 oz., wine vinegar, ½ oz., oil of vitriol, ½ oz. Beat them all together into a paste, and a proper pledget of tow laid over the mouth, in order to prevent it from falling out, and then bandage it on with a strong roller. This dressing must remain in the wound 10 or 12 hours.

12. *Ointment for scratched heels.*—Take of hogs' lard, 1 pound, white lead, 4 ounces, alum in fine powder, 2 ounces, white vitriol, 1 ounce, sugar of lead, ½ ounce, olive-oil, 3 ounces. Grind all the powders in a marble mortar with the oil, or on a marble slab; then add the lard, and work the whole together till united.

13. This is a neat composition, and very proper to keep in a

stable during the winter; it will not only be found useful for greasy and scratched heels, but also for stubs and treads of every description. A small quantity must be rubbed on the part affected every night and morning in slight cases; but in treads, or wounds upon the heels, it will be best to spread the ointment on pledgets of tow and secure them with bandages.

14. *Ointment for Greasy Heels.*—Take of white ointment, 1 pound, white vitriol, blue vitriol, and sugar of lead, in powder, each ½ ounce. Mix well together. This ointment, when used, must be spread on strong brown paper; and applied over the part that greases, and bandaged on with listing. He may, after dressing, be turned into a dry straw yard, and a few diuretic balls given to him; one may be given every third day. Once dressing is, in general, sufficient to perform a cure; if not, it may be repeated in a week after.

15. *Astringent Embrocation for Strains in different parts.*—Take of camphor 2 drachms, dissolved in ½ an ounce of strong rectified spirits of wine, nitre, 1 ounce, dissolved in half a pint of wine vinegar, spirits of turpentine, 4 ounces, white lead, or bole asmenic, in powder, ½ ounce, aqua fortis, 1 ounce. Mix and shake them all together in a bottle for use.

16. *Mixture for Canker in the Mouth.*—Take of wine vinegar, half a pint, burnt alum, and common salt, each 1 ounce, bole asmenic, ½ ounce. Mix and shake them together in a bottle for use.

17. *To cure Wind Galls.*—On the first appearance of wind galls, their cure should be attempted by restringents and bandage, for which purpose let the swelling be bathed twice a day with vinegar, or verjuice alone, or let the part be fomented with a decoction of oak bark, pomegranate, and alum boiled in verjuice, binding over it, with a roller, a woollen cloth soaked in the same. Some for this purpose use red wine lees, others currier's shavings wetted with the same, bracing them up with a firm bandage.

18. *Spring Halt.*—This is a kind of lameness peculiar to the hind quarters of a horse, which occasions a sudden jerking of the legs upwards in his going. When it seizes the outside muscles the horse straddles and throws his legs outwards. But when the inside muscles are affected his legs are twitched up to his belly. Sometimes it is only one leg, sometimes in both. The cure is difficult and rarely accomplished. Rubbing and fomentations are recommended, with daily moderate exercise: by which the blood and spirits may be equally derived into its disordered muscle and its corresponding one.

10. *Malanders.*—It consists of chops, or cracks, on the inside of the foreleg against the knee, discharging a red sharp humor. To cure this disease, wash the crack with warm soap suds or old urine; then rub them twice a day with an ointment of hogs' lard mixed with two drachms of sublimate of mercury. Or apply a poultice of the roots of marsh mallows flax-seed, softened with linseed oil, tying it on with a roller. Continue that till the seeds fall off and the sores become clean. Afterwards a mixture of turpentine and quicksilver will be a proper application.

## SECTION IX.

### THE WAGGONER.

1

I've often thought, if I were asked,
What lot I envied most—
What one I thought most lightly tasked,
Of man's unnumbered host,—
I'd say I'd be a mountain boy;
And drive a noble team—wo hoy!
Wo hoy! I'd cry;
And lightly fly
Into my saddle seat;
My reign I'd slack,
My whip I'd crack—
What music is so sweet?

2

Six blacks I'd drive of ample chest,
All carrying high the head—
All harness'd tight, and gaily drest,
In winkers tipped with red,
O yes, I'd be a mountain boy,
And such a team I'd drive—wo hoy!
Wo hoy! I'd cry—
The lint would fly—
Wo hoy! Dobbin—Ball!
Their feet should ring—
And I would sing—
I'd sing my fal-de-ral!

3

My bells would tinkle, tingle-ling,

Beneath each bear-skin cap—
And as I saw them swing and swing,
I'd be the merriest chap;
Yes, then I'd be a mountain boy,
And drive a gingling team—wo hoy!
Wo hoy, I'd cry—
My words should fly—
Each horse should prick his ear!
With tightened chain,
My lumbering wain
Would move in its career.

4.

The golden sparks—you'd see them spring
Beneath my horse's tread;
Each tail—I'd braid it up with string
Of blue or flaunting red;
So does, you know, the mountain boy,
Who drives a dashing team—wo hoy!
Wo hoy! I'd cry—
Each horse's eye
With fire would seem to burn,
With lifted head,
And nostrils spread,
They'd seem the earth to spurn.

5.

They'd champ the bit and fling the foam,
As they dragged on my load—
And I would think of that distant home,
And whistle on the road,
Oh, would I were a mountain boy,—
I'd drive a six horse team wo hoy;
Wo hoy! I'd cry,
Now, by yon sky,
I'd sooner drive those steeds,
Than win renown,
Or wear a crown
Won by victorious deeds:
For crowns oft press the languid head,
And health the wearer shuns—
And victory, trampling on the dead,
May do for Goths and Huns!

Seek them who will—they have no joys
For mountain lads and waggon boys.

SECTION X.

1. FARM STOCK.—It is a pitiable sight to go about the country and see the multitudes of poor cattle, which fill almost every farmer's yards in the spring of the year. Farmers almost universally, in this wheat growing district, keep too much stock. Many are the farmers whose whole stock of cattle and young horses would not pay for the hay they have eaten during the last winter. Of this fact very many are now sensible, and are determined to diminish their stock at all hazards, and some are even now selling their cows, the only part which will avail them any thing the coming season, to drovers for \$12 to \$16, a less sum than the cost of their keeping during the winter.

2. Yet many of these farmers who have been so pinched this spring, will most likely, as soon as grass comes, forget their troubles and their resolves, and as their calves are dropped will say, "Well, it is a pity to knock in the head such a pretty calf as that; I can't spare the milk to fat him, but I can bring him up on skim milk,"—and thus he is suffered to live, a skim-milk calf sure enough—and the next, and next, and so on to the last, are suffered to live in the same way.

3. They pass the summer very well, but the first snow squall in November, fetches them up under the windward side of the fence, bleating and moaning most piteously. Then the wants, the trials, and privations of the last winter come up before our farmers in full view. He remembers his determination of reducing his stock; but what is to be done?—it is too late now to sell. His three years old steers might have been sold perhaps two months ago, but no drovers are seen this time of the year.

4. 'Well, I have got a plenty of straw, and I guess they'll do;' and on he goes the same round, annually feeding out more worth of hay, than his whole stock will amount to, and if he sells any it is in the spring, in the very last pinch; when sure enough, twelve dollars is a fair price for the best he has in his yard. This is indeed a sad picture, but is it not a true one of at least half of all the farmers in this wheat-growing section? Hay is high, always high, and so are corn and oats.

5. Good cattle too are high: a prime yoke of oxen, or a first rate cow, that has been stabled through the winter, and fed on ruta baga, mangle wurtzel and meal, morning and night, will fetch a good price. So does young cattle of the improved breed. But

who among us farmers is willing to pay five dollars for the service of an imported improved Durham bull? Scarcely one in fifty will do it.

6. They had rather breed *in-and-in*, as the English breeders term it, that is, from a bull of their own raising, whose only recommendation may be, that he was forgotten at the time he ought to have been castrated, and was too wild and unmanageable to submit to it afterwards. Our farms are many of them overstocked with young horses, very many of us keep more than we keep well. Many farmers have an old mare, and four or five colts, which endure the severity of the winter with no other shelter than the leeward side of a hay-stack, and which in the spring bear a strong resemblance to the Florida cattle, of which it takes three to make a shadow.

7. These of course no one expects to dispose of until they are broken and fit for service. It might seem that the severe lesson of the last winter would have some abiding effect upon farmers, but probably few will profit by it. Those farmers who are too poor to take an agricultural paper, who won't even take a *Monthly*, because forsooth they know more about farming than they can put in practice—these men will probably do as they have always done—complain of our hard winters, and say they must sell out and go farther south, where the *winters will not eat up the summers;* whereas, if they would only buy the *British North American Cultivator*, and read attentively the many excellent articles on cattle, they would give up the raising of cattle at all, and raise only sheep, or they would raise such cattle as would sell at any time, and at a fair price.

## SECTION XI.

1. ON STOCKING A FARM WITH CATTLE.—The first object of attention, is to consider the proportion between the stock and the quantity of feed which will be necessary to support them. The nature, situation, and fertility of the soil that compose his farm are worthy of notice; also the purpose for which he designs more particularly to rear or feed his cattle, whether for the pail, or for beef. In fact, it will be expedient to observe the greatest exactness in this proportion, because, if he should overstock his land, the Farmer will be compelled to resell before the cattle are in a fit state for the market, and, consequently, at certain loss.

2. While, on the other hand, he will incur a loss in his profit, if he should not stock his land with as many cattle as it will bear. Formerly, a great prejudice prevailed in favor of big-boned, large beasts, but it has been ascertained, that this breed is, in point of

profit, much inferior to the middle-sized kinds. By a careful attention to the selection of stock, great progress may be made towards the improvement of the different species. Among the various professional breeders of modern times, few have attained greater celebrity than the late Mr. Bakewell, of England, to whom we are indebted for many new and important improvements in the science of rearing cattle.

3. The principle which he invariably adopted was, to select the best beast, that would weigh most in the valuable joints; so, that, while he gained in point of shape, he also acquired a more hardy breed. By attending to the *kindliness* of their skin, he became possessed of a race which was more easily fed and fattened than any other. For many years, the practice was to judge by the eye only, without regarding the other qualities of the animal. But, in the present improved age, a more rational mode of forming the judgment has been adopted. The sense of touch is now brought in aid of the sight.

4. By repeated practice, the art of judging of the kindliness to fatten has been brought to such perfection, that any well informed breeder will tell almost instantaneously, in what points or parts they will or will not fatten. In the selection, therefore, of live-stock in general, the young farmer will find it necessary attentively to consider the following particulars; *Beauty, or symmetry of shape;* in which the form is so compact, that every part of the animal bears an exact consistency, while the carcass should be deep and broad, and the less valuable parts (such as the head, bones, &c.) ought to be as small as possible.

5. Further, the shoulders ought not only to be light of bone, and rounded off at the lower point, but also broad and well covered with flesh. The back also ought to be wide and level throughout. In *rearing live stock* of any description, it should be an invariable rule to have the increase from small-boned, straight-backed, healthy, clean, kindly-skinned, round bodied, and barrel-shaped animals.—In the *purchasing of cattle*, whether in a lean or fat state, the farmer should on no account buy beasts out of richer or better grounds than those into which he intends to turn them.

6. For, in this case, he must inevitably sustain a very material loss, by the cattle not thriving, particularly if they be old. It will, therefore, be advisable to select them, either from stock feeding in the neighborhood, or from such breeds as are best adapted to the nature and situation of the soil. *Docility of disposition*, without being deficient in spirit, is of equal moment. Independent of the damage committed by cattle of wild tempers on fences, fields, &c.,

it is a fact, that *tame beasts require less food to rear, support, and fatten them*; consequently every attention ought to be paid early to accustom them to be docile and familiar.

7. *Hardiness of constitution*, particularly in bleak and exposed districts, is indeed a most important requisite. In every case it is highly essential to a farmer's interest to have a breed that is liable neither to disease nor to any hereditary distemper. Connected with hardiness of constitution is *early maturity*. This, however, can only be attained by feeding cattle in such a manner as to keep them constantly in a growing state. By an observance of this principle, it has been found that beasts and sheep thrive more in three years, than they usually do in five when they have not sufficient food during the winter. In the common mode of rearing, their growth is checked.

8. *Working*, or an aptitude for labor. Whether kine be purchased for the plough, or for the purpose of fattening, it will be necessary to see that they are young, in perfect health, full-mouthed, and not broken in any part; that the hair stare not, and that they are not hide-bound, or they will not feed kindly. The same remark is true in application to cows intended for the pail.—Their horns should be fair and smooth, the forehead broad, udders white, yet not fleshy, but thin and loose when empty, (to hold the greatest quantity of milk,) but large when full.

9. Besides the rules above stated, there are some particulars with regard to the *age* of cattle and sheep, which merit the farmer's consideration. Neat cattle cast no teeth until turned two years old, when they get two new teeth; at three they get two more; and in every succeeding year get two until five years old, when they are called *full-mouthed*. Though they are not properly full-mouthed until six years old, because the two corner teeth, which are last in renewing, are not perfectly up until they are six.

10. The horns of neat cattle also supply another criterion by which the judgment may be assisted, after the signs afforded by the teeth become uncertain. When three years old, their horns are smooth and handsome; after which period there appears a circle, or wrinkle, which is annually increased as long as the horn remains; so that, according to the number of these circles or rings, the age of a beast may be ascertained with tolerable precision.

11. Sometimes the wrinkles are defaced, or artificially removed, by scraping or filing. This is a fraudulent practice, too frequently adopted, in order to deceive the ignorant or inexperienced purchaser, as to the real age of the animal. These circles, however, must not be confounded with those ringlets which are sometimes

found at the root of the horn, and which are a pretty sure indication that the animal had been ill-fed during its growth.

## SECTION XII.

1. ESSAY ON CATTLE.—The domestic ox, is not, as is well known, indigenous to America; but was introduced by the first colonists in the beginning of the 17th century. An attempt has been made to trace the origin of the common cattle, and especially those of the northern states, exclusively to the English Devon; and it is probable that it did mingle largely in the early importations, from the fact that a large portion of the colonists were from the south of England, or embarked from ports in that di[illegible] where the Devon at that period was the prevailing bree[illegible]

2. The characteristics of this variety also, a[illegible] color, etc., have always been the favorite ones among [illegible] the United States. But at the time of the settlement of America, little attention, comparatively speaking, was paid to breeds, or purity of blood, and it is altogether incredible that the emigrants. to whose number almost every port in England and probably in the United Kingdom, furnished its quota, should have been at the pains to procure the Devons.

3. To say nothing of the preferences which each would naturally have felt for the cattle of his own district, it would argue a degree of care and solicitude on a subject, then deemed of little importance, altogether incompatible with the character and motives of the men who colonized the new world. Many of them probably were scarcely aware that there was such a breed in existence! Besides, the Dutch in New York, and the Swedes on the Delaware, introduced the cattle of their respective countries, which were subsequently incorporated with the common stock.

4. Although, as we have before remarked, the Devon characteristics prevail, the practised eye will readily detect traces of this varied lineage. Few or none of our common stock equal the North Devon in the finish and beauty of their proportions, more generally perhaps resembling the coarser Sussex ox; and our cows are better milkers Our black polled cattle give indications of their Welsh and Galloway extraction, and it is but a few years since, on the Mohawk and Hudson rivers, there existed undoubted remnants of the stock imported by the Dutch settlers from Holland.

5. To speak of the merits of a race so varied, would evidently be proposterous. Selections may be readily made from our common cattle, combining very considerable excellence for the dairy, the yoke, and the shambles; while another and a larger portion are

destitute in a part or the whole of these qualifications. Their value to cross with the improved breeds, will be hereafter adverted to.

6. We shall proceed now to consider the breeds of later introduction, imported with the view of improving the common stock. These are the Devons, Herefords, New Leicesters, Ayrshires, Alderneys, and the Short Horn family, consisting of the "Improved Short Horn," or Durham, the Teeswater, Holderness, and a thick, heavy buttocked variety of Yorkshire cattle, which have provincially obtained the name of "Devonshires."

7. *The Devon.*—In symmetry and proportion, the high bred Devon scarcely acknowledges an equal. His delicate limbs, deep red colour, beautiful tapering horns, high and spirited action, united with docility in the yoke, and a show of blood, falling little short of that of the thorough bred horse, have always rendered him a favorite with breeders of taste, in his native country. Favorable specimens of them were introduced into the United States in 1817, from the herd of the Earl of Leicester (then Mr. Coke).

8. Notwithstanding his many excellencies, it cannot be said that the introduction of the Devon was attended with any striking benefits. Singularly suited, by his rapid gait, for the plough on the light lands of Norfolk, and some other parts of England, his peculiar excellence, his activity, has been found to avail him little on the more generally tenacious soils of this country. In strength the Devon ranks only in the fourth or fifth class of British oxen. The cross with our common cattle produced an animal somewhat improved from the latter in the points, but with no great additional value for the yoke, and decidedly inferior for the dairy.

9. Yet the slight admixture of Devon blood, has been thought advantageous in modifying the coarseness of heavy, bony breeds, like the Holderness, and it has ever been strenuously advocated as a cross with the Improved Short Horn, by distinguished English breeders. But others object that the Durham gains nothing by the admixture in his propensity to take on flesh and fat; while size and milking properties are sensibly diminished.

10. This was decidedly the opinion of Col. Powell, who instituted numerous experiments. The variety thus produced would doubtless be capable of enduring a shortness of keep, incompatible with the superior size of the pure Short Horn, and thus be better adapted to high and less fertile lands; but there are other breeds which as a cross with the Short Horn, would be as well calculated to attain this end, without so great a sacrifice as milking properties.

11. *The Hereford.*—The Hereford ox is supposed to be descended from the same stock with the Devon, but is larger, heavier in

the bone, usually of a darker red or brown color, with a white face, throat and belly. They are shorter legged than the Devon, hardier, and kindlier feeders, but less docile in temper, and even worse milkers. Indeed, a Hereford cow is rarely seen in an English dairy. Their hardihood and great muscular power give them the first rank among working cattle. This, together with their superior grazing qualities, has led to their introduction into the United States, by the Hon. Mr. Clay, of Kentucky, and several other individuals. But it is probable that their deficiency in milking properties will always prevent their very general adoption, either as a cross, or in a pure state.

12. *The New Leicester.*—This breed, spoke into existence as it were, by the commanding genius of Bakewell, were derived from the original Long Horns, of the mid-land and north-western counties. The Lancashire or Craven, as this original variety is generally denominated, were characterized, at least the better portion of them, by their length and roundness of carcass, and by giving peculiarly rich milk, though in moderate quantities. They were large, coarse boned, but possessing a considerable, and sometimes a marked tendency to fatten. A smaller variety of the same breed, generally inhabiting mountain and moor lands, according to Mr. Youatt, gave milk as superior in quantity as quality.

13. Out of these materials Bakewell formed the New Leicesters, which for aptitude to acquire external fat and early maturity, became almost unrivalled. He reduced the size, and especially the bone of the old Long Horns, and under his moulding hand, the new variety reached a finish and beauty unknown in any other breed of the day. Unfortunately, however, milking properties were to a considerable extent sacrificed by him. The Leicesters, or 'Shakspeares,' as they are more usually styled in the United States, were of different colors, more generally red, with finch or 'lined' backs, as they are termed in this country.

14. Long, slim, tapering horns, projecting forward and downward, and turning up at the points—sometimes falling down the sides of the head in a curve, the points nearly meeting in front, is also characteristic of the race. The New Leicesters, owing to that cardinal defect in Bakewell's system, breeding from too close affinities, and to the appearance of a rival in the improved Short Horns, destined to sweep away all opposition, have nearly disappeared; but grades between them and the old Long Horns are still cherished by many of the mid-land dairies of England.

15. A cross between them and the Short Horns are still more common, and answer excellently for the purposes of the butter

dairy. The milk of the Short Horn is improved in quality, though diminished considerably in amount, and the cross bred animals are supposed to be peculiarly hardy and unsubject to disease. Long Horns of various grades between the old Lancashire and the improved Leicester, have at various periods been introduced into the United States, and specimens of them crossed with the Durham, (with no admixture of other blood,) exist in this and one or two other counties.

16. They are a beautiful breed, possessing much of the substance of the Short Horn, with the peculiar fineness in the forend, characteristic of the New Leicester. Some of them are exceedingly delicate handlers, with thick, silky coats, and are rich though not uncommonly deep milkers.

17. *The Ayrshire.*—It is but a little more than fifty years since, according to Mr. Aiton, (the best authority on the subject,) the Ayrshire cows were "of diminutive size, ill-fed, ill-shaped, and they yielded but a scanty return of milk; the chine of their backs stood up high and narrow, their sides were lank and short, their hides thick and adhering to their bones, and their pile coarse and open." In short there can be but little doubt that they would gain nothing by comparison with the most ordinary Canadian cows.

18. We have adverted particularly to their then condition, because in following them up to their present high degree of excellence, we find a lesson fraught with peculiar value to the Canadian farmer. Our breeders have certainly as good, or a better breed on which to commence their improvements, and the ameliorating crosses which made the Ayrshire cow what she is, are equally within our reach.

19. Though from the length of time which has elapsed, and the imperfect record, or rather the absence of all record, which is too generally kept of such transactions, little is known of the progressive steps attending the cross, and there are some who seem disposed to call in question the fact whether it ever took place, it is generally conceded that the present celebrated race were produced by a judicious admixture between the original cow of Cunningham, Kyle, and Ayrshire, (Mr. Aiton's description of which we have already quoted,) and some of the earlier Short Horns, from the banks of the Tees.

20. The benefits attending the cross were accelerated, and no doubt much heightened by the moist, mild climate, and rich herbage of that district of Scotland where the Ayrshires principally prevail; pronounced by Mr. Youatt, 'the finest dairy county in Scotland, and equal perhaps to any in Great Britain." This improved race

is of red and white colour, beautifully mottled, short in the leg, the horns small and fine, the head and neck delicate, the latter thickening properly towards the shoulders, the carcass deep but inclining to be fat, and the loin and hunch, compared with the Short Horn, narrow.

21. Five gallons of milk daily, for two or three months, after calving, three gallons for the next three months, and one gallon and a half for the remaining four months, in which she is milked, is stated as the *average* amount given by the Ayrshire cow. As a milker, she of course yields to the larger Short Horn, nor will she take on an equal amount of flesh and fat, on the richer soils of England; and on the bleak and heathery hills of Scotland, the various breeds of black cattle would thrive and fatten where the Ayrshire would scarcely obtain a subsistence.

22. But on medium soils, there is perhaps no breed, size and the consumption of food being considered, which presents a much better combination of milking and grazing qualities. Of their value as working oxen, our authorities are silent, and we do not know that any experiments have been instituted among the few imported into Canada. If they are good in this repect, such a breed would be a disideratum in many portions of our country. But as before hinted, we believe this desideratum can be supplied more easily and cheaply by materials within reach. This point will be discussed in its proper place.

### Section XIII.

1. *The Alderney.*—This small breed of French cattle, is fashionable in the parks and pleasure grounds of English gentlemen, on account of their diminutive size, and the peculiar richness of their milk. Col. Powell, after fifteen years experience with them, pronounces them, in his somewhat summary way, "an unthrifty, dwarfish, savage breed;" and Parkinson remarks, "they are of as bad a form as can possibly be described." Their appetite is voracious; an Alderney cow consuming nearly as much as a Short Horn, which is three times her size.

2. *The Holderness.*—Sometime during the 18th century Short Horned Cattle were introduced into the north-eastern counties of England, from the adjacent continent. They are indiscriminately termed *Yorkshire or Holderness* cattle, by the earlier writers; the former name is derived from that of the county where they first began extensively to prevail; the latter from a town in the same county, where either they were originally introduced, or where, as tradition runs, certain improvements in the breed were first attempted.

3. They subsequently, as we shall see, attained the name of Teeswater, and finally of Durham, or "Improved Short Horn." Marshall describes the original Holderness as "thin quartered, too light behind and too coarse before, large shoulders, coarse necks and deep dewlaps." Lawrence, after passing a high encomium on a selection which might be made from them, describes the remainder as "long, gaunt, deep carcasses, without adequate substance, placed on high stilts, of the coarsest timber, slow feeders," &c. They were also, by the consent of all the English writers on the subject, thin skinned, inclined to be tender constitutioned, bad provers, their flesh coarse and often dark or "liery."

4. In one particular, however, they were from the first pre-eminent, namely, in the amount of milk given by them, though it was not of so rich a quality as that yielded by some other breeds. In York, Durham, and the adjacent counties, over which this breed rapidly spread itself, early attempts were made to improve the form, without sacrificing their milking properties. Marshall gives a singular account of one of these efforts.

5. After describing the Holderness, as we have already quoted, he says :—"This, from being found disadvantageous to the butcher, * * * the breeder attempted to enlarge the hind quarters; and had he stopped when he got to the happy medium, he would have wrought a good work; but the fashion was set—cloddy bullocks were in estimation. The first variety of this species of cattle, which I can recollect, was a thick, large boned, coarse, clumsy animal; remarkably large behind, with thick, gummy thighs; always fleshy, but never fat, and the flesh being of a bad quality. This, however, was not the worst; the monstrous size of the buttocks of the calf frequently proved fatal to the cow. * * * They were probably the worst breed the vale ever knew."

6. We have here an exact description of a variety existing in many parts of our own country, known popularly in this, and some of the adjacent counties, as "Devonshires," though their horns, to say nothing of their posterial deformity, prove this to be an entire misnomer.

7. *The Teeswater.*—In more judicious hands the Short Horns rapidly improved. Among the spirited breeders, on the banks of the Tees, (which divides York and Durham,) they rapidly assumed a distinctive character; shorter legged, more compact, the milk but slightly diminished, and this more than counterbalanced by its increased good quality,—better feeders, hardier, carrying more fat, and their flesh more marbled and finer in grain.

8. This signal improvement was effected, it is generally suppo-

sed, by a system of judicious crosses. An importation of cows from Holland, is usually referred to as one of these, and Mr. Berry conjectures the wild white breed of England to have furnished another. Hence the strong admixture of white in the Teeswater and the Durham. The improved variety, denominated indiscriminately, Teeswater or Holderness, immediately became the general favorite in the large metropolitan dairies and milk establishments. For milking properties, and when no longer used for that purpose, aptitude to take on flesh, England had never possessed so valuable a breed.

9. *The Durham, or Improved Short Horn.*—At this epoch, and with such materials, Mr. Charles Colling commenced his career as a breeder. His wonderful success has been ascribed by some, to chance ; but the Rev. Henry Berry, the best possible authority on this subject, thinks otherwise. He pronounces it the result of "a deliberate and well considered plan." Mr. Colling found the Teeswater yet possessing some of the faults of the old Short Horns.

10. From their overgrown size, they were too frequently coarsely and loosely formed, and they were yet entirely inferior to what the Durhams became, in aptitude to fatten and early maturity — Mr. Colling was remarkably favored in his efforts to counteract these defects, by the possession of the bull "Hubback," the great ancestor of the improved race. He was smaller than the Teeswater, while "his flesh, hide and hair," Mr. Berry remarks, "were seldom equalled."

11. On account of his remarkable disposition to take on flesh, he soon became useless. The same qualities marked his dam. It is unnecessary for us to follow the progressive steps which marked the onward career of the Improved Short Horns. While it is admitted that in the hands of some breeders whose attention has been turned exclusively to the carcass, their milking properties have deteriorated, it is well known that in other hands, they have fully maintained their equality with the Teeswaters as milkers, while in early maturity, kindly feeding, proof and quality of flesh, they decidedly surpass them.

12. In early maturity they have, confessedly, no rivals, being ready for the butcher from two to four years earlier than the other English breeds. It is not wonderful that a race, presenting such a rare combination of excellencies, should soon become the favorite of the English breeders. The Long Horns have disappeared before them, or been merged in them by repeated crosses in the northern and midland counties, while in the south they are rapidly superseding the Hereford and the Devon. They have been engraf-

ted on the Holderness Short Horns of the city milk establishments almost universally, and with manifest advantage.

13. The produce, with milk very slightly diminished, but of increased richness, yield as profitable return in the dairy, while the value of the carcass for the grazier is nearly double in amount. Short Horns, of every variety, from the gaunt, unsightly animals described by Lawrence, to the most finished specimens of the improved family, have been repeatedly imported into the Province. The miserable, heavy buttocked variety, known here provincially, as "Devonshires," we have already adverted to.

14. There are also among us, large and not unsightly Short Horns, probably a modification of the above, poor milkers and bad provers, which are popularly known as "English cattle,"—though they sometimes borrow the name of Teeswater or Durham, to suit the purposes of the seller. They are usually red or brown, with dark muzzles, their horns short, fine and tipped with black. A Holderness bull from North Allerton, on the Arve, was imported from England a few years since, and finally was driven to Oneida county in the State of New York, where he remained until he died.

15. Though a monster in size, and marked with the characteristic defects of the earlier Short Horns in his form, his get, with the best common cows, were valuable as milkers, and not deficient in symmetry. Animals of various degees of merit, bearing the name of Durhams, but not of pure blood, have also been introduced at various times, on speculation. And finally, pure Improved Short Horns, in considerable numbers, have been imported by spirited breeders in different districts of the Province.

16. *The Most Profitable Breed.*—Having thus given a hasty summary of the principal facts which tend to throw light on the main question before us, viz: *what breed of cattle is most profitable*, we proceed to state our convictions on the subject. That the common cattle of the country do not possess the greatest attainable combination of excellencies, will readily be admitted. A selection of them present very desirable qualities for the dairy and the yoke; but in feeding properties, and especially in early maturity, they are deficient.

17. A full blooded Durham bullock will go profitably to the butcher, at least two years earlier than the American, a decisive consideration to the grazier; and although the former is the greater consumer, the extra food required by him, will weigh but little against the two or even one year's additional keep of the latter.—But notwithstanding all that may be said for or against them, it is to the *best cross* with selected animals of the common race, feasi-

bility and expense being taken into consideration, that the common Canadian farmer must look for the most profitable breed of cattle.

18. In this proposition we wish to be distinctly understood. We do not intend to assert that the produce of any cross we might thus make, wou'd surpass in value breeds already in existence; but the entire substitution of a foreign variety for our own, presupposed an expenditure of time and funds utterly out of the question. The question then is, with what breed is this ameliorating change to be affected?

19. On a careful comparison of the characteristic merits and defects of our own cattle, with the corresponding ones of other varieties, we arrive unhesitatingly at the conclusion, that to the pure improved Durham, we must look for the basis of the desired improvement. A cross with the Devon or Hereford, would sacrifice milking properties; the dwarfish and ill-shaped Alderney, is not to be thought of: the Ayrshire or the Long Horn, possesses no excellencies that the Durham does not possess in a greater degree: and the Holderness, and the Teeswater Short Horns, compared with the improved race, are as the crude ore to the manufactured and polished metal.

20. The first cross between choice native cows and the improved Short Horn, has generally resulted equally favorably; indeed, the very beauty of the produce has tended to prevent further attempts at improvement, by encouraging farmers to breed directly from half and three-quarter bred bulls. They frequently lack little of the beauty of their sires, and their services are to be more cheaply procured.

21. But the characteristics of a variety thus obtained, are not sufficiently stamped upon them in the first, second, or even third or fourth cross, to be perpetuated with any great degree of certainty in their offspring. In the language of the Rev. Henry Berry, "to breed from the produce of a cross *directly among themselves*, will lead to the results which have induced many persons, without due consideration, to believe conclusive against crossing; but to take one cross, and then return and adhere to one breed, will, in the course of a few generations, be found to stamp a variety with sufficient certainty."

22. Repeated experiments have amply demonstrated, that interbreeding between the Durham and our common race, if conducted on the principles advocated by Mr. Berry, viz: by a constant resort to the pure blooded bull, is attended with a decided and manifest improvement of the produce in every successive generation. The bull selected, should be small of his kind; fine in the bone; un-

usually full in the crops and bosom, and wide in the loin and haunch—points in which the common breed are defective. He should be chosen too, from a family of decidedly good milkers.

23. If the bull is large of his kind, the produce are generally coarse, and marked with the defects which attend great disparity in the size of the sire and dam. The dam should be as good in the points indicated in the bull, as our means of selection admit of; short legged, compact, deep in the girth, and a plentiful and steady milker. We have already alluded to the change effected by the farmers of Ayrshire *on a poorer breed*, by a Short Horn cross; and there can be no good reason why the Canadian farmer, with the same skill and perseverance, may not be equally successful.

24. Indeed there are grade Durhams already among us, which, there can be no doubt, equal or excel the Ayrshire in every desirable point. The Durham, as we have before remarked, requires more feed than our small native cattle. This, his superior size, would lead to expect. But though a greater, he is a more promiscuous consumer, the coarsest quality of hay or straw being readily devoured by him. In England, straw, with a very small allowance of turnips, constitutes his exclusive store keep in winter.

25. But to bring this matter to its true test, will the Durham yield as great a return in flesh, fat, or milk, for the amount of food consumed, as any given breed? That he will, repeated experiment, as well as his daily advancing popularity, in a country where there are varieties greatly excelling our own in aptitude to fatten, and at least equalling them in milking properties, fully attest.—The amount of food required by him, therefore, forms no objection to the improved Short Horn, on good soils, either in his pure state, or as a cross with others.

26. The only question now to be considered is, will the recommended cross supply us with working cattle? It is asserted on the best authority, that the pure blooded Durham ox, will "work admirably;" and the reason assigned for his not being oftener used for that purpose in his native country, is, that his early maturity renders him too valuable for the butcher, to be retained with profit until four or five, for the yoke.

27. There can be but little doubt, that united with our smaller, but vigorous and active race, a heavy and powerful variety of working cattle will be produced. Those especially fed on upland and less nutritious pastures, whose labour ought to compensate for their tardier maturity, with size, feeding properties, and docility, increased by the cross, will lose little, and probably nothing of the activity and hardihood of the common race. To what precise ex-

tent interbreeding should be carried, to produce the most valuable breed of working cattle, experience can alone determine.

### Section XIV.

1. Training Oxen.—The frequent abuse of our laboring animals by those who receive the benefits of their labors, and who ought in return to treat them mercifully, has often given me great pain. Indeed, it is a matter to me perfectly surprising, how any *intelligent* being can so wantonly and unthinkingly abuse dumb animals as many are in the daily habit of doing. I venture to say from my own observation, and that has not been limited in this particular, that nine-tenths of the perverseness of laboring animals arises from the mismanagement, at some period or other, of those who train or use them.

2. It appears to me the rules of management, in all these cases, are extremely simple. You have only to study the natural disposition and history of the animals to know how to manage them. By your own feelings, you can easily perceive that they can have little heart or disposition to labor if scantily fed; of course good feeding is the first step in obtaining good labor.

3. The next is to have your teams properly trained so as to know you, and also to be fond of you, and to love the sound of your voice, for animals are capable of much affection. I have known numerous instances of the kind, and in all cases with which I have been familiar, those who treated their cattle or horses with kindness, always obtained from them the most work, and that too in the easiest way.

4. *Breaking of Steers.*—Yoke them carefully, and let them remain quiet until they will eat their food, which generally takes place in the course of one day. Yoke them again the next day, and put them behind a pair of old steady cattle, and let them stand till they become familiar with them. This generally takes but one day. The day following yoke them again, and put them behind the oxen as before, upon the tongue of a cart or sled. They being now accustomed to the oxen before, will readily follow without whipping or beating. They will soon become kind and gentle.

5. I have employed, in the course of my business, a great many men with teams, both of oxen and horses, and I never yet knew a bawling, noisy, whipping teamster who did a great day's work; nor have I scarcely known such an one who kept a fat team. The best man who ever did me any labor was a good substantial farmer. His oxen were always fat, and spry as colts. He would never

hitch them to any thing which he knew they could not draw;—of course they were not discouraged; and he hardly ever spoke louder to his oxen than in a low tone of common conversation.

6. He would frequently speak to them soothingly, and encourage them when he had a hard job on hand, which was often the case. After making a heavy pull he would sometimes pat them on the back; but I rarely ever knew him strike or worry his team. He carried a slender goad with a short lash to guide them with, and a mere swing of the whip was sufficient for his purpose.

7. I have known several such persons in my life, and I do not hesitate to say, that any person who so manages his teams, will get more labor at less expense, and with more ease to himself than by the ordinary bawling, whipping method so much practised in our country. All the difference with these people is, that the one understands and studies the nature and disposition of his animals, and the other does not. "An even temper and a steady hand," ought to be the teamster's motto, the world over.

## Section XV.

1. Treatment of Milch Cows.—There is, perhaps, no part of the husbandry of our country so much neglected as that which relates to the providing of provender for milch cows on our farms. On many estates, even those of magnitude, the chief part of the food, if not the entire, which they get, are the blades, the tops and the husks of the corn, with an occasional gratuity of nubbins by way of a holiday feast.

2. The consequence is, that if the winter be severe and protracted, there is nine chances out of ten, that every cow long before spring arrives, is either dry, or so near it, that the milk she will give is not worth the trouble and cost of stripping, so that many farmers with half a dozen or more cows have neither milk nor butter sufficient for the domestic uses of their tables, during the latter part of each winter, and by the time that the cold and bleak winds of March arrive, many of the cattle are on the *lift*. How is it possible it can be otherwise?

3. There is little or no succulent in the food we have described in its dry state, and consequently cows fed upon it, must, for the want of matter convertible into milk, cease to yield it. In every other country save our own, it forms a part of the business of every farmer or planter, to provide full supplies of nutritious food for his stock of every kind, and for those which comprise the dairy cows, especial pains and care are taken to provide a sufficient quantity of such roots as are heartening and succulent, so that by thus pro-

viding a substitute for the grasses of the pasture, or the soiling stalls or yards, his dairy, even through the dreary and inclement period of the winter, may continue to contribute largely to the comfort of his family, and to the increase of his fortune.

4. No good farmer, then, will keep more cows than he can well keep, and in so keeping them he finds his trouble rewarded, and has besides the satisfaction of knowing, that in thus acting he has fulfilled an obligation imposed on him by every humane consideration, and discharged a duty required by Him, who, in placing the beasts of the field in subjection to man, enjoined that he should extend towards them his kindest protection and care. We frequently hear gentlemen complaining of the difficulty of procuring such cows as will make profitable returns, and of the impossibility of keeping them to their milk during the winter. The reason is obvious.

5. No cow, and we care not what her breed may be, whether she be of improved Durham short horn, the Devon, the Alderney, the common cow of the country, or any other—we say no cow can be kept in the pail, unless you give her something which will both nourish her system and replenish her udder. To make a cow yield a liberal supply of milk through the winter, she should have in addition to full supplies of food, wholesome hay or fodder, at least half a bushel of roots of some kind, or an equivalent of cabbage or kale per day.

6. And if the hay should be fed long, each cow should have, at least two days in the week, messes of chopped rye and cut straw, to be either steamed or mixed up with boiling water, and permitted to remain until it be fermented before feeding. The ambition of procuring fine breeds of animals of all kinds, is one worthy of every praise; but that of taking good care of what we have, is equally if not more laudable.

7. Besides these considerations, the interest of every farmer is always promoted by feeding his cows well. If fed in the niggard manner we have described, their keeping, such as it is, is a dead loss to their owners; they make no manure worth speaking about, and the animals themselves are comparatively valueless; and if kept generously through the winter, and sheltered from the weather, each cow will give her two gallons of milk per day, and make from four to seven pounds of butter per week, which latter should be set down as the profit, as the milk and cream consumed by the family will more than compensate for the feed.

8. In addition to this, animals thus fed make three times the quantity of manure, and are always in condition to command good prices. We have engaged in no speculative theories in what we

have said, but have addressed ourselves to the common sense of the agricultural community in the hope that they will see the propriety of adopting some plan by which our object can be obtained.

## Section XVI.

1. Butter Making.—Every dealer in the article knows that the most decisive test which can be offered of the skill and neatness of the housewise, or the dairy woman, is furnished by the quality of the butter offered by her in the market. If it is firm, rich, marrowy, and of proper consistence throughout; free from all specks and impurities; perfectly divested of the milk, and giving out that peculiar fragrance belonging to sweet and well made butter—the vender may be set down as one that understands her business, and the produce of whose dairy will always command the first price in the market.

2. On the contrary, if the butter should be white, light and porous; full of particles of dirt, flies' legs, cows' hairs, and other nameless abominations; without being freed from the milk, and abounding in particles of the curdled milk from which the cream was taken—then the character of the dairy for neatness may be marked as suspicious, and prices must be arranged accordingly.

3. The color of butter is no infallible test of goodness, although that which is moderately yellow will, other things being equal, be generally preferred; but where the qualities above named are present, be the butter white or yellow, its excellence may be relied upon. The quality of butter is not however entirely depending on the skill or neatness of the maker—much must be allowed for the kind of pasture or other food allotted the cows.

4. For pasture, clean turf which is mostly composed of white clover, and has been laid down for a number of years, will be found sweeter and better than any other; and of the roots, carrots will make the best colored and flavored butter. No cow, however, kept entirely on roots, will produce as good milk and butter, as if fed partly on these, and partly on fresh grass or hay. Every dairy woman is sensible that to produce the greatest quantity and best quality of cream, milk should be kept at a moderate temperature, and that the cream should be taken from the milk before the latter sours, as, if it is allowed to become thick, it is almost impossible to separate the curdled particles thus skimmed off from the pure cream, and these remaining in the butter, seriously detract from its appearance, and render it unfit to keep.

5. After the cream has been taken from the milk, much of the goodness of the butter is depending on the temperature of the cream

while churning. This point in ordinary dairies is not sufficiently attended to, or if noticed at all, only with reference to the speedy formation of the butter. Cream grows warm from churning, the rise being from four to six degrees, according to the time employed, and the state of the cream; consequently, if the temperature of the cream is too high at the commencement of the operation, at the close it will be so much increased as to have a pernicious effect on the quality of the butter.

6. A few years since, by the request of the Highland Agricultural Society of Scotland, a series of experiments was instituted by Mr. Ballantine, the owner of an extensive dairy, as to the proper temperature of cream for making butter, and the effects of different temperatures on the quantity and quality of the butter produced. Mr. Ballantine's Report, which obtained the premium from the Society, may be found in the 'Library of Agricultural and Horticultural Knowledge,' and is probably the best paper on the subject of making butter which has yet appeared.

7. From Mr. Ballantine's experiments, it appears that the thermometrical range at which butter can be obtained, extends from 45 to 75 degrees of Fahrenheit. A great number of experiments gave 60 degrees, as the temperature at which the greatest quantity of butter could be produced from a given quantity of cream; and 55 degrees of temperature in the churn just before the butter comes, as that which affords the best quality, giving a temperature of 51 to the cream at its introduction into the churn.

8. Repeated churning at this degree of heat, gave butter of the finest quality and colour, the milk being completely separated from the butter, which when washed and made up into rolls kept for a fortnight without acquiring either smell or taste. Mr. Ballantine says—"Butter intended to be sent to the market sweet, should be carefully gathered from the milk with the hand, and the milk squeezed out of it. It should then be put into cold spring water, and after being well washed, it should be made up into rolls with wooden flappers, and put into cold water to firm, but should not be allowed to remain longer than is necessary to firm it, as the water will hurt both its colour and flavor."

9. The practice of *washing butter*, as putting the newly churned article into clear cold water is called, has we believe never prevailed to any considerable extent in the dairies of this country, whereas in England the practice is almost universal. The time it should lie in the water must be determined by the season of the year and the state of the butter, an hour being generally considered sufficient; and after being thus by washing and working completely

freed from the particles of milk and of water, it is salted according to the notion of the dairy woman, and carefully put away for use or the market.

10. Judge Buel condemns the use of water in the manufacture of butter, believing that it dissipates much of the fine flavor that gives to good butter its high value; yet in Orange county, which furnishes the best butter dairies in the state, and probably in the United States, it is a common remark among the dairy women, "give us cold *hard* water, and we will not fail in making good butter."

11. We do not think the washing of butter has been properly tested in this country, or at least the result has not been reported; and that dairyman who should institute a series of experiments with regard to the making of butter in this and other methods, and the effect on its qualities for table use and keeping, and should faithfully record and report the same for some of our agricultural journals, would confer a great favour on a large portion of the community. Some experiments made on a small scale by Judge Buel certainly go far to prove the excellence of unwashed butter for keeping; and had he at the same time put down one or two pots of washed butter in the same way, it would have gone far towards determining the course to be preferred in its preservation.

12. For salting butter, experience has shown that in butter intended to be kept any time, one ounce of good fine salt to a pound of butter is the proper proportion; where it is not intended to be kept, less may be used, according to the taste of the maker. Some persons have recommended that to a pound of salt should be added four ounces of pulverized loaf sugar. We have tried this method, and found the butter admirable.

13. Dr. Anderson says—"In Ireland, (and few countries equal some parts of Ireland in the fine qualities of the butter,) the use of salt and saltpetre is recommended in the proportion of one ounce of fine rock salt, and one-fifth of an ounce of saltpetre, to twenty-eight ounces of butter." None but the finest and purest salt should be used for butter, as every extraneous matter found in the salt injures its quality, and produces a corresponding effect on the butter.

14. For preserving butter nothing more seems to be necessary than that the butter should be put down perfectly sweet and solid, in some vessel that is air tight, and then kept at a temperature between fifty-five and sixty or sixty-five degrees. The great secret consists in a low temperature, and the entire exclusion of air.—Where considerable quantities of butter are to be put down, or packed, casks containing from 60 to 100 pounds may be used.

15. These should be made of white oak or ash, the wood to be

boiled for three or four hours before working, and thoroughly soaked in cold hard water before filling with butter. Into this the butter in good order should be well pounded, and if possible the cask or firkin should be filled at a single operation. At any rate butter of different qualities or colours should not be mixed together; in one case the bad will certainly injure the good, and in the other the mixing of different colours produces that mottled appearance so abominable to the lover of good butter.

16. If there is not butter enough to fill the firkin at once, make a strong brine, clear and pure, and covering the butter with this, let it stand until you have more to put down, when the brine may be turned off and the addition made. There should be a small space left between the head of the cask, when filled, and the butter; this space should be filled with strong well boiled brine, introduced through a hole in the head, stopped with a peg, which may be taken out occasionally for a few days, as sometimes the shrinkage of the butter from the cask will require the addition of more brine.

17. When observation shows no more is required, the cask should be placed where the temperature will remain low, and the butter will be found of a good quality. But where the butter is intended for family use, the best way we know of keeping it sweet, is to put it down in stone crocks or jars which will hold from thirty to forty pounds. The butter should be packed close and solid as directed for firkins, leaving a space of one or two inches at the mouth unfilled. Then make a strong brine, carefully boiling and scumming it, and fill the jar with it.

18. Place the jars in a cool sweet cellar; cover them carefully and securely to prevent any dirt getting in; examine them occasionally to see that the butter is covered with brine, and that the brine remains sweet and good. If a scum rises on the brine, turn it off and boil it, putting in salt if necessary, and scumming it until perfectly pure, when it may again be turned on the butter. Butter in this way has been kept nearly two years perfectly sweet and good; indeed, where coolness is desirable, nothing is better adapted to promote it than stone.

19. A few years since a friend of ours, as an experiment, filled a small firkin with butter in June, headed it up solid, and threw it into his well, where it remained till November, and when taken out was as sweet and fresh in taste as when put in. Perhaps where the means existed of forming a vat in the dairy-house, and throwing into it a stream of cold spring water, this method of keeping butter in water might be advantageously adopted, as the water could not touch the butter, while it would keep it cool, and exclude the

air at the same time. The making of butter is daily becoming a matter of more interest in this country; any methods which shall add to the quantity without impairing its quality, or which shall ensure uniform excellence, will be hailed with satisfaction by those who are turning their attention to this branch of domestic economy.

### SECTION XVII.

1. CHEESE MAKING.—The greatly increased demand for the products of the dairy, and the consequent rapid advance in price—the comparatively small amount of capital required for a beginning by the small farmers of the country, and the avoiding the expenditure necessary where several laborers are employed—and the spreading conviction that the profits of the dairyman, if not as great as the profits of the wheat-grower, are far more sure, has induced many of our farmers to turn their attention to this subject, where with proper management they are certain of an abundant reward for their labor.

2. There surely can be no reason why cheese may not be manufactured in Canada equal to any in the world; yet as a whole there can be no doubt that American cheeses are far inferior to those produced in England, and some parts of Holland, Germany and Italy. The causes of this inferiority must be sought in the different and defective modes of making practised in our country. We sometimes meet with a cheese equal in quality to any that can be produced in any quarter of the globe, but that perhaps is the only one the dairy that furnished it can show of a similar quality.

3. Such would not be the result, if the business of the dairy was carried on upon fixed and correct principles; as entire uniformity in the flavor and quality of the cheese, is a marked characteristic of the best foreign dairies. As the result of some observation and experience, we give it as our opinion, that the reason why there is so much ordinary cheese made in this country is, that little or no attention is paid to the quality of the rennet; and the temperature of the milk being left to chance, is constantly varying from day to day, necessarily affecting the qualities of the curds.

4. It is evident the rennet must have a great effect in determining the good or bad qualities of a cheese, yet in many if not the most of our dairies, it is prepared in the most careless, not to say slovenly manner imaginable. Every thing relating to cheese should be kept perfectly clean, yet rennet is sometimes used, the odor of which is any thing but ambrosial, and it is well if a close examination does not show *living* proof, that the invitation sent abroad on the tainted air has not been in vain.

5. Some of our dairy women maintain, that the quality or flavor of the rennet is of no consequence, as it passes off in the whey; but this is a great mistake, as is well understood by those who have paid the necessary attention to the preparation of rennet. At the celebrated dairy farm of Heyward in England, the rennet is prepared by putting two gallons of brine to six calves' stomachs, at least one year old, to which is added two or three sliced lemons, and after standing a few weeks the liquor is bottled for use. It is not used till two months old, and the older it is, the better it is considered.

6. In some dairies, cloves, sage, and other aromatics, are added to the rennet with the lemon. A stone jug that will cork tight is the best for the preservation of rennet, as the air should be carefully excluded after it is once prepared. To produce uniformity in the quality of the cheese of a dairy, the milk at the application of the rennet should be of a uniform temperature. This in most cases is left to chance, the hand of the dairy woman being the only guide, whereas a thermometer ought always to be used, and whatever rate be adopted as the standard, the milk of each day should be made to conform to the rule.

7. At the Heyward farm, and in others where double Gloucester is produced, the standard is 85°. From that it ranges to 93°. which is the highest admissible in the manufacture of cheese, as a greater degree of heat renders the curd too hard and firm.—Should the milk when brought from the cows and placed in a tub or vat for being converted into curd, be found to have sunk below the proper temperature, a quantity must be warmed sufficient to raise the whole to the desired point.

8. To a neglect of these two things, quality of rennet and proper temperature of the milk, we believe most of the defects in our cheese are owing; and if these difficulties were obviated, we have no doubt that many of our dairies would produce cheese of uniform good quality. Now, in purchasing a lot of cheese, the buyer is pretty certain of getting some that will be first rate, some that are middling, and some that would choke a dog, so hard and tough are they.

9. We read not long since, in some of the scientific journals, that the Germans had succeeded in converting a pine board into very palatable six penny loaves; and had they asserted that the same persons had converted a white oak plank into cheese, we should have been equally ready to credit them, as we have ourselves seen some that approximated marvellously near to that same wood in outward appearance and inward quality, so far as hardness and toughness were concerned.

10. There are but two kinds of English cheese, the manufacture of which could be introduced into our dairies with much prospect of success or remuneration ; these are the Gloucester and the Stilton, and in some of our dairies at present cheese nearly approaching these in quality is produced. In making both these kinds of cheese, there are some peculiarities which must have a decided effect on the quality, yet which have been introduced in full in very few if any dairies in this country.

11. The double Gloucester is made from the night and morning milk, the cream taken from the former. Single Gloucester is made entirely from the skimmed milk. In making Gloucester, the milk is set at the temperature of 85°. After the rennet is applied and the curd is hard enough to break up, it is very slowly and gently cut up with a three bladed knife, the blades reaching to the bottom of the tub and one inch apart, both ways, that the whey may come out as clear or greenish as possible.

12. As the curd settles, some of the whey is dipped off, and the curd is again cut up. This operation is repeated until the whey is entirely separated, and no lumps remain in the curd. The curd is now put into the vats or hoops, and pressed down with the hand. The hoops covered with fine cloth are put in the press for half an hour ; when the curd is taken out, cut into thin slices, and put into a wooden mill, which *tears* it into pieces not larger than small peas.

13. This process of grinding is preferable to breaking up by hand, as the butter is not forced out, and the curd unites better than when made fine by chopping as is generally practised in this country. In some instances a second similar breaking up or grinding of the curd is performed, and after being made as fine as possible, the curd is again put into the cloths and hoops, a little hot whey or water being thrown on the cloths, to harden the outside of the cheese and prevent it from cracking.

14. After being in the press two hours, the cheeses are taken out and dry cloths applied, and the same operation of turning and dry cloths is repeated during the day. A striking peculiarity in the Gloucester cheese is the manner of salting. None is used until the cheese has been made and in the press twenty-four hours ; and even then is not begun unless the cheese is all closed, since if there be any crack in the cheese at the time of salting it will never close afterwards. The salting is performed by rubbing the cheese over with finely powdered salt. The cheese is then returned to the press.

15. The salting is repeated three times with the single, and four

times with the double Gloucester, twenty-four hours being allowed to intervene between each salting. The double Gloucester remains in the presses five days, the single four, when they are put on a shelf or floor of the dairy, and turned twice in twenty-four hours. Gloucester cheese is distinguished for its smooth, close, and waxlike texture, and its very rich and mild flavor. If the curd is salted before being put into the hoops, the salt has the effect of giving a skin to each of the particles of the curd it comes in contact with, which prevents them from intimately uniting.

16. It may be pressed together and become good cheese, yet it never becomes a smooth close mass, like that which is salted after it is made, being always liable to crumble when cut, a prevailing fault with American cheese. The cheese called Stilton cheese, is principally made in Leicestershire, near Melton Mowbray, and the adjacent villages. It is a very rich cheese, rarely used for the table until two years old, when by becoming partially decayed, blue and moist, it acquires the particular flavor which causes it to be so highly prized by the dealers.

17. The following is the most simple process of making it. To the new milk of the cheese-making morning, add the cream of the milk of the preceding evening together with the rennet; the separation of the curd must be carefully watched, and when complete, it must be removed from the whey with as little breaking as possible, and placed in a sieve, until of such consistence as to bear being lifted up and placed in a hoop without much pressure.

18. The cheese as it dries will shrink up, and must therefore be placed from time to time in a tighter hoop, and turned daily, until by gradual drying it acquires the proper consistence for making. By this process none of the cream is lost, and the curd not being broken remains more entire and uniform in its texture. It may not be amiss to remark, that notwithstanding the high price of the real Stilton, and the estimation in which it is held, the preference is rather acquired than natural, few preferring it at first to the Gloucester, or any other first rate cheese.

19. Formerly various coloring matters were used to give color to cheese, some of which were decidedly deleterious; but all these have been superseded by arnotta, which is not only perfectly innocent in itself, but produces a better color than any thing else. It is used in various ways; in some dairies it is dissolved in weak lye, and kept bottled for use; in others it is rubbed on a plate in the milk until sufficient is introduced; of course the quantity used will depend on the judgment or taste of the cheese maker.

20. If cheese cracks, the common red pepper added to the butter

used for rubbing them, until it is very strongly impregnated, and applied to the defective places, will have a tendency to prevent flies and bugs from becoming mischievous, and producing injury. Many dairies within a few years have introduced the practice of putting into their cheese a small quantity of saltpetre, which it is imagined renders the cheese more tender, while it does not detract from its flavor. We have doubts, however, whether the addition of any such ingredients has a real tendency to improve the products of the dairy, and in some instances they have proved positively injurious.

### Section XVIII.

1. Rearing Calves.—It is a very general practice in many places, to permit calves to run with, or at least to suck the cows during the first season, and a prevalent opinion is that this is the best way of raising them. The former practice,—that of allowing the calf to run constantly with the cow,—is always injurious to a milker, for unless a cow has the *whole* of her milk regularly drawn from her, which rarely happens where it is left entirely to the will of the calf, unless the udder is completely emptied, the lactic secretions are constantly diminished, and the cow would consequently become eventually dry.

2. But where the calf is turned to the cow only at stated intervals,—at morning and evening,—and pains are taken that all the milk is withdrawn, although this does not injure the cow, yet it is found to be a very expensive practice; for a calculation will readily show that the milk of a cow during the season, if appropriated to dairy use, would bring more than the whole value of the calf in autumn.

3. Giving the calf but a part of the milk of the cow, and weaning it early in summer and turning it to pasture, is no improvement; for unless it has a good supply of nutritious food, and unless this is continued through the season, there can be no hope of raising a valuable animal. The frequent raw-boned, stunted, ill shaped ones, which we see, are a sufficient comment on the truth of this.

4. Experience has shown, both in England and in this country, that the finest animals may be raised in great numbers, without allowing them to suck the cow after the first three or four days.—One of the best practices is the following. The calf is allowed to suck a few days, till it has increased in strength and appetite sufficient to enable it to swallow readily, during which time care should be taken to milk the cow while it is sucking, in order to draw off

the whole of the milk ; it should then be separated from the cow. Some recommend even to remove it when it is not more than twelve hours old.

5. It may be learned to drink by allowing it to suck the finger placed in the vessel. It should at first be fed entirely on new milk. In two or three days, a very small quantity of water, of the same temperature with the milk, is added, and increased very gradually day after day ; at the same time a small quantity of *meal* is to be added with it, and this also is to be gradually increased, and at the same rate, in order to supply the deficiency of nourishment occasioned by the addition of the water.

6. At the same time, skimmed milk may be gradually substituted for new milk. This should at first be boiled, and afterwards cooled to the proper temperature, as otherwise it would be liable to cause purging. The temperature may then be gradually diminished till it is given cold. Thus in a few weeks the calf will have learned gradually, but almost imperceptibly, to subsist entirely on water or old milk mixed with meal.

7. The meal at first should be fine, but coarser may subsequently be substituted ; and finally shorts or bran may be given if necessary. By thus *gradually* accomplishing any change, it may be done without the least difficulty, at the same time there will be no danger of injury to the calf, which would be the case if sudden changes were employed. Sudden changes indeed, should never in any case be adopted, for they are always detrimental and sometimes fatal.

8. Calves for killing may be fattened in this way, and with proper attention be in as good condition at an age of five or six weeks, as when fed exclusively on new milk ; and it may in many instances be of importance to adopt it for fattening calves, especially during the season of the year when milk is valuable. Calves should have at all times plenty of clean litter and a good supply of fresh air. Calves for the butcher sometimes injure themselves by sportiveness ; this may be prevented by keeping them nearly in the dark, as they evince less of a playful disposition than when exposed to full light.

9. But they should never on any account be confined by tying, for this does not abate the restlessness of their disposition, and they are constantly spending themselves in exertions to get loose. It is a very improper but not unfrequent practice to give little attention to calves after the early part of the season, and to suffer them to feed on pasture alone, without any other food. In this way they very commonly become poor, and but little prepared to with-

stand the coming winter. Their future value greatly depends on their treatment during the first year, consequently they should be kept in good condition throughout the season; and through autumn they should be gradually accustomed to the food on which they are to be wintered.

SECTION XIX.

1. APPLES—*as Food for Stock.*—From twenty-five years experience I am more and more convinced of the value of apples as food for hogs and other farm stock. When I began to feed my hogs on apples, in 1815, it was generally said there was no nourishment in an apple; at length it was admitted that there might be some in a *sweet* apple. Now there are some that go to the opposite extreme, and attribute too much to them, and expect too much from them.

2. The object of these remarks is to set the business in its true light. There is scarcely any food, of which hogs are more fond, than apples; but it is obvious that they are not rich food, and it is in vain to think of shutting up a *land shark,* and in six or eight weeks making good pork of him; you must do as you would do in fatting an ox on grass; take a longer time for it, than if you fat him on grain and provender.

3. I have never failed of making my hogs very fat, and my pork of the first quality on apples. I will state how I manage. I lay up in the fall two or three hundred bushels of apples. I store them in a room in my barn with eight or ten inches of chaff under them, and a foot or more of chaff over them. Thus secured, they freeze very little. I feed them to my hogs and milch cows very freely; I give my hogs all they will eat, and keep them in good flesh till spring. Through the summer I feed them so as not to lose flesh.

4. After harvest they are turned into my wheat stubble, where they live very well for a few weeks till the apples begin to fall; by this time I design to have them half fatted. From the first of September to December they run in my orchard, or are full fed with apples in the pen. I prefer their running at large in the orchard unless the apples are so abundant that they will waste and destroy them, for they will then never go hungry; they will lie very quiet and never run so as to waste their flesh.

5. I am aware that most of those who have written upon the subject, recommend picking up the apples and boiling them; but this costs too much in labor and fuel, and I have doubts whether there is much benefit derived from it. The stomach of the hog was made to digest the raw material, and no doubt is adequate to that purpose.

6. I see no more need of boiling the apples for the hog, than the

grass for the ox; I have in a few cases boiled them, but found the animals preferred them uncooked, and I suppose they were the most suitable judges of what was best for them; at any rate, in the way I have recommended, I have made very good pork, with very little trouble; and I am certain that to pick the fruit and boil it for 15 or 20 hogs, for three months, would be a very serious deduction from the profits of the concern.

7. *On the management of Live Stock.*—In order to guard against the evils resulting from having more stock than the means of keeping are sufficient to sustain, much good judgment and prudent forecast should be exercised in apportioning the amount of stock to the means provided for keeping the animals. In the spring, the husbandman who keeps stock should consider and inquire how many acres of grazing ground he has at his disposal, and what number of such animals as he intends to keep that will be likely to supply with pasture.

8. In the fall, he should make similar inquiries relative to the quantity of hay and other fodder which he has provided for wintering his stock. How many tons of hay he has in store. If roots, straw, stalks, and other articles of coarse fodder are to be used, then let him inquire how great is the quantity of these articles, and to what quantity of hay may they be supposed to be equivalent. These should be the first inquiries, and then another should follow: What amount of stock is it likely these provisions will be sufficient to keep through the winter?

9. When these questions are settled, the rule always should be, to keep a smaller number of animals than it is supposed the means of keeping might, under favorable circumstances, be sufficient to sustain. The remark which I am now about to make is, in my view, of more than ordinary importance, and I desire you to regard it accordingly. The remark is, that from being under-stocked injuries rarely result; and if they do, they are generally small and trifling; but to be over-stocked is always disastrous.

10. It is far better to be able to sell half a dozen tons of hay in the spring than to starve your stock through the winter, and after all, be obliged to buy even the smallest quantity. It should be considered too, that close grazing in the summer injures pasture, and scanty feeding, either in summer or winter, ruins the stock.

11. In order to be able to make judicious apportionments, according to the preceding suggestions, it is very necessary to know, as nearly as practicable, how much pasture, and what quantity of hay and other keeping, will be required to keep any given amount of stock through a year. Should it be inquired how much pasture,

and what quantity of hay are usually required to keep a horse, or an ox, or a cow, through a year, it is believed very few farmers would be able to answer the question.

12. It would be well for farmers to accustom themselves, much more than they do, to make accurate observations, in regard to these and many other things. I do not claim to be master of the subject to which I am now calling your attention, nor can I suppose that the idea of infallibility should be attached to the estimates which I am about to submit.

13. From the best lights that have been spread before me, I am led to conclude, that when hay alone is depended on, it usually requires two tons of hay to winter a horse—for one ox about as much—for a cow one and a half tons—for twelve sheep the same as for a cow. It is believed, that for summering either a horse or an ox, at least three acres of good pasture, or an equivalent thereto, will be required. For summering a cow, two and a half acres may suffice—the same for summering twelve sheep.

## Section XX.

1. Fattening Cattle.—The fattening of cattle demands considerable and constant attention, and the great object is to fatten quickly. An animal when in a state of rearing, may be considered as a vessel open at both ends, in which the supply and the waste being nearly equal, it can never be filled; fattening the animal may be considered as an attempt to fill the vessel, and this can only be done by an excess of supply. The waste being the same as before, the excess must be great; if it is not so, the vessel may be filled to a greater height than before, without ever becoming full.

2. An important hint may be taken from this simile, by many farmers, who know little of the difference between feeding and fattening. Cattle, sheep and swine, may be kept for months, and fed with the view to fattening them, without their gaining a pound of meat. The age at which cattle are fattened depends upon the manner in which they have been reared; upon the properties of the breed in regard to the propensity to fatten earlier or later in life, and on the circumstances of their being employed in breeding, in labor, for the dairy, or reared solely for the butcher.

3. In the latter case the most improved breeds are fit for the market when about three years old, and very few of any large breed should be kept more than a year longer. As to the cows and working oxen, the age of fattening must necessarily be very indefinite; in most instances the latter should be put up to feed

after working three years, or in the seventh or eighth year of their age. The food on which cattle are fattened in summer is grass, commonly on pastures, but in some instances cut and consumed in the yard. In winter, hay and roots, and perhaps Indian corn, meal, &c., are used.

4. When cattle are fattened on grass, the best way is to take young cattle, particularly three or four year old steers, in November, to keep them in the yard all winter, fed partly with straw and partly with hay, but so as to have them in good order in the spring: and these cattle should not be of the larger sizes, but rather middling, such as will come to about 600 weight the four quarters when fattened. They must have good pasture for four months. But as we cannot control the seasons, in case a severe drought takes place, the only remedy is a little grain, or rather meal, given daily.

5. Providing they are thus fed, they will be ready for sale by the middle of September, and generally at this time cattle of the above size are in good demand; if kept later the markets are glutted, and the price always lower. Stall-feeding, however, is common, and judiciously conducted, probably the most eligible method; but the practice of stall-feeding with grass and oil-cake is to be condemned, because it is the most expensive method of sustaining animals.

6. Whatever superfluous grain is raised above the quantities necessary for actual domestic consumption and seed, should be sold and the money laid by to defray the charges of husbandry; but feeding up the grain, and purchasing oil cake and salt into the bargain, for a contingency which is altogether speculative, is, we think, very injudicious; for the average price of beef in the spring of the year rarely warrants such an expensive method of keeping it up.

7. With respect to feeding, the first rule is, a little at a time and often; because experience has shown that animals that eat much in a short time, do not fatten so well as those which eat less, but more frequently. The two great points in feeding animals to profit are, regularity, and a particular care of the weaker individuals. On the latter account, there ought always to be plenty of trough or rack room, that too many may not feed together, in which very common case the weaker are not only trampled down by the stronger, but they are worried and become cowed and spiritless, than which there cannot be a more unfavorable state for thriving; besides, these are ever compelled to shift with the worst part of the food.

8. This domineering spirit is so remarkably prevalent among

horned cattle, that the master beasts may often be observed running about and absolutely neglecting their own provender, for the sake of driving the inferior from theirs. This is much oftener than is suspected, the chief reason of that difference so visible in a lot of cattle after a winter's keep. The weaker animals should be withdrawn and fed apart; or the master beasts should be tied up during their meals. With respect to feeding, it is recommended, from good authority, to begin the course with cabbage and turnips, then to employ carrots and potatoes, and lastly, Indian, oat or barley meal.

9. *Cabbages* are said to possess the property of fattening cattle, not only more expeditiously, but in less proportion than turnips; an acre of the former having been found to fatten one in four more than the same extent of the latter crop. A cow will eat from 100 to 150 lbs. of cabbage per day.

10. *Carrots.*—This root is said to have the advantage of turnips not only in its being a richer and more nourishing food, and in yielding a larger produce, but also in never being annoyed by insects and therefore an unfailing crop. Carrots, when fed with mangel wurtzel, in the proportion of one-third of the former to two thirds of the latter, with a little clover or other hay, were found to be as one to five in fattening cattle, when compared with Indian corn, and a proportional quantity of hay.

11. *Turnips.*—Cattle are fed with turnips, either by being tied to upright posts within doors, or they are suffered to go at large in the straw yard This last is greatly the better mode of feeding, the turnips being supplied from troughs or otherwise, and a shed for shelter being always at hand, and open to the cattle to repose in. It is well, however, that too many animals of strength and size be not put together, lest they disturb each other's feeding.

12. When cattle are of value and put up for quick fattening, it is common to cut off the leaves and tails of the turnips, giving the leaves to the younger and less valuable stock, and the bulbs only to those which are to be fed. Young cattle not intended to be immediately fattened, receive only a limited portion of turnips, their principal provender being straw. By receiving a portion of turnips with their drier provender, these animals are kept in a much more healthy condition than if confined to the latter food, and continue to grow throughout the whole season, instead of pining away at the time when green herbage can no longer be found for them.

13. Cattle fatten much faster with clean turnips than with such as are dirty, and therefore they should never be given without being previously washed. Dirty turuips are also apt to scour them.

As turnips are generally topped when laid up, these tops may be fed as long as they last. Cattle fed on turnips are said to make better beef than when fed on oil cake, it being usually rather rancid when made up into this article.

14. Calves are easily taught to eat them, by tempting them with small pieces at first, and soon become fond of them; and if fed abundantly with them will hold their condition and continue to grow the whole winter, which insures the desirable point of early maturity. Animals who have plenty of turnips scarcely ever wish to drink. Cows have been kept a whole winter within doors, on turnips, and never wanted water.

15. The result of feeding two steers twenty-five weeks upon turnips and straw, the turnips half Swedes or ruta baga, is given in the Quarterly Journal of Agriculture. The steers were half and two-thirds short horned blood. One gained 406 pounds and the other 336. The consumption of turnips was about 200 pounds per day to each. Four bullocks fed seventy days upon ruta baga, at the rate of two bushels per day each, eating scarcely any thing else, and refusing oil cake, produced for the turnips thus fed $75. They required no drink.

16. *Potatoes.*—In the application of potatoes as food for live stock, they are often joined with hay, straw, chaff, and other similar matters, and have been found useful in many cases in the latter winter months. They are much more nutritive when boiled than in their raw state. They were formerly cooked in this way, but are now very generally steamed. Washing was formerly a tedious disagreeable business, but it is now rendered an easy matter, whether on a large or small scale, by the use of the washing machine. Every creature appears to relish potatoes, particularly when they are steamed or carefully boiled.

17. It is asserted that a cow may safely eat them when in a raw state, to the extent of perhaps fifty pounds per day, provided the eyes have broken and begin to shoot. Whenever they are given raw, however, they should be chopped into pieces to prevent accidents. The utility of raw potatoes is, however, doubted by many. Perhaps straw, hay, and chaff, might be employed as a very proper adjunct, with a few ounces of salt added to each feed.

## Section XXI.

1. *Mangel Wurtzel.*—"Two oxen were fed abundantly on Swedish turnips and mangel wurtzel, and the result was that they increased in weight, each of them, when upon mangel wurtzel, much more rapidly than when upon Swedish turnips, in proportion to the weight

which they consumed. I next year," says the writer, "tried the same sort of experiment on a single beast, and the result was similar, but rather more favorable to mangel wurtzel.

2. "It is said that giving large quantities of mangel wurtzel to beasts in a low condition, has been found very dangerous, but I have never found any bad effects from it, either to cattle or sheep. It sometimes happens that when oxen are first put to mangel wurtzel, after coming from the pastures, it disagrees with one or two individuals; in this case I cease giving it to these for one or two days, and when put to it again, it has always agreed with them very well."

3. *Indian Corn, Indian, Oat, and Barley Meal*, are all employed in fattening cattle. Indian corn is sometimes sown to be used as fodder in its green state. In this case it is cut and fed out when the ears are in the milk. An acre of ground perfectly managed will, in this way, yield twelve tons of green fodder, probably a richer and more nourishing food than any yet known.

4. Some persons are in the habit of taking the tops from the corn at a proper season. These should be immediately conveyed to a suitable place, and two days' sun will convert them into the best fodder the farm produces. The main body of the stalks, too, with the blades, after the ears are harvested, should be cut close to the ground, cured and taken to the sheds. They should be cut or chaffed with the straw-cutter, and when given alone or with other food, will be a much more nourishing aliment.

5. Besides the ordinary mode of feeding Indian meal, it has been suggested, on the authority of a practice which prevails in France, whether they might not be beneficially fed in a fermented state. A writer asserts that oxen made half fat, or in good plight, on grass or turnips, are then finished in France upon a sour food prepared as follows:

6. *Rye meal*, (for which Indian or buckwheat may be substituted) with water, is made into paste, which in a few days ferments and becomes sour; this is then diluted with water and thickened with *hay*, cut into chaff, which the oxen sometimes refuse the first day; but when dry, they drink and prefer it. All the husbandmen are decidedly of opinion that they fatten much better because of the acidity. They give it three times a day, and a large ox eats 22 lbs. a day.

7. The practice of grinding Indian corn and cobs together, has been successfully adopted in some places, as furnishing a superior provender. This is stated to be the case in the west; and a gentleman in Shrewsbury, Mass., has for seven or eight years used corn

and cobs cracked and ground together, and says it is the best food he has ever used for fattening cattle.

8. A little town near Frankfort in Germany, is noted for its remarkably fine cattle. They are fed in the following manner:—Straw is cut short by means of a straw-cutter; it is then put into a cauldron, with the addition of potatoes and carrots, and boiled till it forms a kind of jelly; this, mixed with a sufficient quantity of water, is served to the beasts.

9. The animals so fed require no water, and so well do they thrive on this mess, that they are, notwithstanding the summer labor, ready for the butcher at the end of the year. All sorts of grain, which is intended to be given to cattle or horses, is best ground. In order to obtain the greatest benefit from it, boil it in water, and while hot add cut straw, stirring it well, and when cool it will be fit to feed out.

10. Mr. London, of Litchfield, Conn., found that by boiling two quarts of flax seed, which was sprinkled on cut straw that had been previously scalded and seasoned with salt, together with oil cake and oatmeal, and these materials worked together in a tub, with a short pronged fork, he produced a mash on which he fattened a heifer and ox, which netted him more than he had cleared before in fattening oxen and cows for fifteen years; and he ascribed it chiefly to the use of the flax seed.

11. A very successful rearer and breeder of neat cattle in Massachusetts (Col Jacques), recommends from actual experience the following:—Take two bushels of Ruta baga cut fine; one bushel of wheat bran; half a bushel of powdered oil cake; English hay, barley straw, and *salt hay* cut, of each seven bushels; water, ten gallons. Let these be *perfectly* mixed. Give a bushel of this mixture to a cow of the common size every night and morning, and proportionably to greater or smaller animals.

12. Hay, straw, corn tops or blades, and even the stalks, afford abundantly more nourishment when cut or chaffed with a straw-cutter. One bushel of chaffed hay at a mess, given in a trough three times in twenty-four hours, is sufficient for a horse, ox, or cow, and is equal nearly to a third more of that quantity given in the ordinary way.

13. Salt your clover and other succulent as well as coarse hay. But over salting diminishes the nutriment. More than a peck to a ton is superfluous. Half that quantity is often sufficient. Feeding your stock by weight and measure of food, will not only save provender by its orderly distribution, but frequently saves the lives of animals, too often starved by neglect, or gorged and destroyed by profusion.

14. *Raw and prepared Food.*—Unless food be thoroughly deprived of its vegetative powers before it enters into the stomach, the whole nourishment which it is capable of affording cannot be derived from it. In the case of the leaves and stalks of vegetables, this is generally effected by mastication; but it requires some care to accomplish it in case of grain.

15. Hence the advantage of mixing corn given to horses or cattle, with chaff or chopped straw, and hence it is supposed by some, that the instinct which fowls have to swallow small stones, is intended by nature for the same object. But the most effectual mode of destroying the living principle, is by the application of heat; and if vegetable food of every kind could be steamed or boiled before it is given to animals (at least in Winter, and in fattening for the market or feeding for milk,) it is rendered probable, by analogy and experiment, that much more nourishment would be derived from it.

16. An apparatus for steaming food for cattle should be considered as a necessary appendage to every arable and dairy farm, of a moderate size. It has been long known that many sorts of roots, and particularly the potato, become much more valuable by undergoing this sort of operation. And it is equally well known that when thus prepared they have been employed alone as a substitute for hay, and with cut straw both for hay and corn, in the feeding of horses as well as other animals.

17. To a farmer who keeps many horses or cattle, or even swine or poultry, the practice of boiling their food in steam is so great a saving and advantage, that it deserves the most particular attention. Though potatoes have often been given raw to both horses and cattle, they are found to be infinitely preferable, when cooked by steam, as they are thereby rendered much drier and more nutritive. Turnips and other roots are also much improved, as food for cattle, by a similar process.

18. A steam boiler is generally made by setting a kettle, holding twelve gallons or more, in a furnace of brick or stone; and over this a hogshead with one head out and the other bored full of holes, is set so close that the steam of the kettle, when boiling, can only rise through the holes, and thence ascend among the articles to be boiled in the hogshead, and pass off at the top. In this way a hogshead, full of potatoes, will be nearly as soon boiled as a small part of them only could have been, if placed in the kettle underneath.

19. As the kettle must be so closed as to prevent any steam passing off, but through the bottom of the hogshead or vat, a pipe or

tube must be set in one side, through which, with the aid of a tunnel, the water is poured into the kettle, as often as occasion may require. When poured in, the tube is to be stopped with a plug for the purpose. Grain of all kinds may be steam-boiled to great advantage, for feeding and fattening cattle; but in that case, it is requisite to have the bottom of the hogshead covered with a cloth to prevent the grain running down through the holes.

20. By experiments which have been accurately made upon Indian corn and potatoes, used for fattening swine, it was found that they increased in weight one-third faster on the boiled than on the unboiled food; or in other words, they gained three pounds when fed on the former, where they only gained two pounds when fed on the latter. We are fully of opinion that steam boiling food, for feeding or fattening all sorts of cattle, generally increases the value of the food as much as forty or fifty per cent.

## CHAPTER V.

### Section I.

1. Rules for Selecting Cattle and Sheep.—Mr. A. Young, in a tour through some of the agricultural counties, visited Mr. Bakewell, and explains the general principles which guided Mr. Bakewell in breeding beasts or sheep for the butcher, and at the same time explains his own stock, which is in the highest perfection, when examined with an eye to these principles. In all his exertions, his aim was to obtain that breed, which with a given amount of food will give the most profitable meat, that in which the proportion of the useful meat to the quantity of offal is the greatest.

2. *Points of the Beast.*—On this plan the points are those where the valuable joints lie, the rump, the hip, the back, the ribs, and after those the flank; but the belly, shoulders, neck, legs and head should be light, for if a beast has a disposition to fatten, and be heavy in these, it will be found a deduction from the more valuable points. A beast's back should be square, flat and straight, or if there is any rising it should be from a disposition to fatten, and *swell about the rump and hip bones*, and the belly should be quite straight, for if it swells it shows weight in a bad point.

3. He prefers to have the carcass well made, and showing a disposition to fatten in the valuable points. So far on *Seeing*. Mr. Bakewell, to judge whether a beast has the right disposition to fatten, examines by *feeling*. His friend, Mr. Culley, who has had an infinite number of beasts go through his hands, agrees entirely with Mr. Bakewell in this circumstance, and when with him

in Norfolk and Suffolk, was surprised to find *lean* bullocks and *sheep* were always bought there by the *eye* only. So *absolutely necessary is the hand in choosing either*, that they both agreed that if they must trust to the *eye in the light*, or to the *hand in the dark*, they would not hesitate a moment in preferring the latter.

4. The form of the bone in *sheep* is quite hidden; it is the hand alone that can tell whether the back is flat and broad, and free from *ridge* in the back bone; or can examine correctly, if the other points are as they should be. *The disposition to fatten is discovered only by feeling.* Speaking of sheep particularly, the points to examine are the same as in the ox. Flatness, breadth of back, a spreading *barrel* carcass, with flat belly, and by no means curved and hanging. The essential is the carcass, and a disposition to fatten in the carcass, and perhaps to have the least tallow on the sides.

5. *Shelter for Sheep*.—Though it is not best to confine sheep to a close shelter even in very cold weather, yet they should, during the cold season, have a shelter where they can go in very severe weather, and where they can find a protection from storms. When sheep lie out in cold storms, their fleeces become wet, cold, and often frozen, and they suffer greatly by such exposure, as frequently taking cold either destroys them or reduces them to a very feeble state, so that they are of little or no profit to the owner; he loses the advantage of an increase in his flock, and frequently loses the fleece.

6. A feeble sheep seldom raises lamb, for while the mother is in poor health, she can barely get support for herself, and of course she cannot sustain her offspring. A poor sheep has a poor fleece, and much of it is often lost off before shearing time. Some farmers pay but little attention to protecting their sheep from storms, supposing that as they have a warm fleece they may be safely exposed to all kinds of weather. And they can endure a great degree of cold while dry, but when wet their fleeces afford but little protection; on the contrary they are frequently an annoyance, being a cold wet mass in contact with their tender skins.

7. It even causes a shudder as we think how much the poor innocent animals suffer from cold storms. Clothe a man in good thick garments, and while dry they will enable him to endure severe cold, but wet them thoroughly and then let him feel the rigorous cold of a northern winter and he will shrink from a touch of these garments which instead of protecting him, produce a deadly chill, and this course would soon destroy the strongest constitution.

8. Every one should consider that poor "Nanny," with a wet

jacket in cold weather, is like a man with wet garments, in a suffering condition, and should be protected. Even when sheep have a shelter to which they can repair in stormy weather, it is necessary that they should be driven under their shelter, and confined there during rain storms or snow storms that will be likely to produce wetness in the fleece.

9. This subject is far more important than it is generally supposed. There is danger of keeping sheep too warm in winter by having a large number sheltered in a small space. They should have a plenty of room and fresh air. Sheep and lambs are much better for going out and taking exercise in the open air.

### Section II.

1. Saxon and Merino Sheep.—We can well remember that a strong prejudice obtained against the Spanish merinos on their first introduction, and it was not until within a few years that their reputation for usefulness became well established among us. This prejudice was in some measure owing to a want of knowledge of the proper mode of treating them, and to their change of climate, which caused the loss of many, and the deterioration of others.

2. The same prejudice has had to be combated in other countries, on the introduction of merino sheep, as in Prussia, Silesia, Hungary and France, and it has required the persevering exertions of distinguished individuals, and the patronage of the governments, to overcome it. But it has been overcome, and the merinos have obtained a footing and a reputation in most of the countries of Europe; and by careful attention to improvement, in several they have been made to excel, in intrinsic value, the parent flocks of Spain.

3. French merinos, at the public sales at Rambouillet, in 1834, sold, rams at about $100 and ewes at $50. They were of course select animals. The writer on sheep in the Farmer's Series, which has just come to hand, speaking of the relative merits of the Saxon and Spanish merinos, says in strong language, "*the Saxony sheep are decidedly superior to those brought immediately from Spain, not only in their wool, but their general form and propensity to fatten.*"

4. Without a particle of interest to influence our opinion, we do not hesitate to say, that we consider the introduction of the Saxon merino as a valuable acquisition to our husbandry, but by no means to the exclusion of the Spanish merinos. And we are also persuaded, that by adopting the Saxon mode of improvement, the Spanish merino may be made to yield as fine a fleece here as they have in Saxony. The Spanish merino has not degenerated in any country, that we have heard of, where he has received proper attention.

5. It is not climate so much as care, that causes the shades of difference. There are good and bad Spanish, and bad Saxon merinos ; and the bad opinion of the latter, we mistrust, has arisen from the fact, that in the fever of speculation, many inferior Saxons were imported, and brought up by men who were not competent judges, and that these inferior animals have tended to bring into disrepute the whole family.

6. The Elector of Saxony ranks among the first who patriotically and wisely devoted himself to the improvement of the inferior breed of sheep which pastured on the neglected plains of Germany. The indigenous Saxon breed resembled that of the neighboring states: it consisted of two distinct varieties, one bearing wool of some value, and the other yielding a fleece applicable only to the coarsest manufactures.

7. In 1765, at the close of the seven years' war, the Elector imported one hundred rams and two hundred ewes from the most improved Spanish flocks, and placed a part of them on one of his own farms in the neighborhood of Dresden ; this portion he kept unmixed. He endeavored to ascertain how far the pure Spanish breed could be naturalized in Saxony. The other part of the flock were distributed on other farms, and devoted to the improvement of the Saxon sheep.

8. It was soon sufficiently evident to the enlightened agriculturist that the merinos did not degenerate in Saxony ; many parcels of their wool were not inferior to the choicest fleeces of Leon.—The best breed of the native Saxons was also materially improved. The prejudice against every innovation, on the practice of their ancestors, was, however, as strong in Saxony as elsewhere, and the majority of sheep-masters were still averse to the improvement, but the Elector was determined to accomplish his object ; he imported an additional number of the Spanish sheep, and then, adopting a measure unworthy of such a cause, he compelled those who occupied land under him, to buy a certain number of the merino sheep.

9. It was not necessary long to pursue this compulsory system : the most prejudiced were soon brought to perceive their true interest. The pure merino breed rapidly increased in Saxony : it became perfectly naturalized; nay, after a considerable lapse of years, the fleece of the Saxon sheep began not only to equal the Spanish, but to exceed it in fineness and manufacturing value. A sample of picklock merino wool is 1,750th of an inch in diameter and exhibits 2,560 serrations in the space of an inch ; while the Saxon wool is only 1,840ths of an inch in diameter, and presents 2,720 serrations in an inch.

10. Corresponding with this, and most satisfactorily illustrative of the account which has been given of the structure of the fibre of wool and its felting property, and manufacturing value as a dependant on that structure, the price—the true test of value—of the Leonese Spanish wool in 1834, varied from 2s. 6d. to 4s., while that of the Saxon was from 4s. 9d. to 5s 3d. per pound.

11. The government of Saxony very materially contributed to this result by the establishment of an agricultural school and other minor schools for shepherds, and by distributing certain publications which plainly and intelligibly explained the value and proper management of the merino sheep. The government may fail to accomplish many capricious or tyrannical objects, but it will receive its best reward in the full accomplishment of its purpose, when it thus identifies itself with the best interests of its subjects.

12. In Saxony, as in Silesia, although the sheep are housed at the beginning of winter, yet they are turned out and compelled to seek, perhaps under the snow, a portion of their food whenever the weather will permit; and the season must be unusually inclement in which they are not driven into the courts at least for two or three hours during the middle of the day. The doors and windows are also frequently opened, that the sheep houses may be sufficiently ventilated.

13. Some sheep masters, whose convenience is promoted by such a system, keep their flock in a house or yard during the whole of the year, and it is not believed that the sheep suffer from this, either in their health, or in the fineness of their fleece. A great quantity of salt is usually given to the Saxon sheep, and principally during the summer, either in their drink or sprinkled among the fodder.

14. Very great care is taken by the Saxon sheep masters in the selection of the lambs which are destined to be saved in order to keep up the flock; there is no part of the globe in which such unremitting attention is paid to the flock. Mr. Charles Howard, in a letter with which he favored the author, says, that, "when the lambs are weaned, each in his turn is placed upon a table that his wool and form may be minutely observed. The finest are selected for breeding and receive a first mark.

15. When they are one year old, and prior to shearing them, another close examination of those previously marked, takes place; those in which no defect can be found, receive a second mark, and the rest are condemned. A few months afterwards, a third and last scrutiny is made, the prime rams and ewes receive a third and final mark, but the slightest blemish is sufficient to cause the re-

jection of the animal. Each breeder of note has a seal or mark secured to the neck of his sheep, to detach or forge which is considered a high crime, and punished severely."

### Section III.

1. Leicester Sheep.—The Leicester and South Down sheep are at the present time deservedly exciting considerable interest among sheep growers in this country, and promise, by crossing with the merino, to give the common farmer a race of animals yielding more wool than the Saxon or Merino, sufficiently fine for ordinary domestic purposes, and yet more hardy, and requiring less attention than the fine wooled sheep in demand in our climate. Neither the Bakewell nor the South Down can ever supersede the Saxon or the Merino for wool required for the finer fabrics, and if crosses with these are found better for the common farmer, the fine wool grower need not fear that the proceeds of his flocks will ever cease to be in demand.

2. We may here remark in passing that the manufacturers of this country do not make the difference in prices between the full blood and grade wools that they should do to encourage its growth, or as we imagine the difference in the price of fine and ordinary cloths would warrant; certainly not as much as is made in France and England, where the qualities and relative value of the article must be understood, at least as well as here. Repeated examinations of wool from healthy sheep, and of good quality, show the fineness of several varieties to be as follows in parts of 1000.

| | | | |
|---|---|---|---|
| Saxon, . . . . . . . | 840 | South Down, . . . | 660 |
| Merino, . . . . . . . | 750 | Leicester, . . . . | 500 |

3. The principal recommendations of the Leicester breed, according to Culley on Live Stock, are "the beauty and fullness of form, comprising in the same dimensions greater weight than any other sheep; an early maturity, and a disposition to fatten, equalled by no other breed; a diminution in the proportion of offal, and the return of the most money for the food consumed."

4. "As a lowland sheep, and destined to live on good pasture," says Mr. Youatt, "the New Leicester is without a rival—in fact, he has improved, if he has not given the principal value to, all the other long wooled sheep." The same accurate observer gives the following as the characteristic of a true Leicester—a sheep that has precisely the form for an animal requiring plenty of good pasture, without any great distance to travel, or exertion to make in gathering it:—

5. "The head should be hornless, long, small, tapering towards

the muzzle, and projecting horizontally forwards. The eyes prominent, but with a quiet expression. The ears thin, rather long, and directed backwards. The neck full and broad at the base, where it proceeds from the chest, but gradually tapering towards the head, and being particularly fine at the junction with the head; the neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the poll.

6. "The breast broad and full; the shoulders also broad and round, and no uneven or angular formation where the shoulders join either the neck or the back, particularly no rising of the withers, or hollow behind the situation of these bones. The arm fleshy through its whole extent, and even down to the knee. The bones of the legs small, standing wide apart, no looseness of skin about them, and comparatively bare of wool.

7. "The chest and barrel at once deep and round; the ribs forming a considerable arch from the spine, so as in some cases, especially when the animal is in good condition, to make the apparent width of the chest even greater than its depth. The barrel well ribbed home; no irregularity of line on the back or the belly, but on the sides the carcass very gradually diminishing towards the rump. The quarters long and full, and as with the forelegs, the muscles extending down to the hock; the thighs also wide and full. The legs of a moderate length, the pelt also moderately thin, but soft and elastic, and covered with a good quantity of white wool, not so long as in some breeds, but considerably finer."

8. This description will be recognized at once as just by any one who has had an opportunity of examining the many beautiful sheep of that breed that have within a few years been introduced into Canada. They mark an animal calculated to attain great weight, with the flesh where it will be of the most value, and if, as some of his rivals asserted, Mr. Bakewell sacrificed the wool to the carcass, he certainly brought the last to the highest state of perfection.

9. This is evident from the many premiums the improved Leicesters have received in England, where more attention is given to weight of carcass than it has as yet received in this country. The object of Mr. Culley's improvements was to do away the objection raised to the coarseness of the Leicester wool, as left by Mr. Bakewell, while the size and tendency to fatten should be retained, and he has in a measure succeeded, though still not so far as to produce wool fit for the finest fabrics.

10. One of the earliest and most successful growers of the Leicester or Bakewell Sheep in America is Mr. Dunn of Albany. He

has at present, however, but few pure Leicesters, having given his flock a cross of the Cotswold, as he thinks to the improvement of the fleece and the constitution. According to a statement in the *Cultivator*, Mr. Dunn's yearling rams produced wool as follows:—

| | | |
|---|---|---|
| 2 yearlings, | - - - - | 22 lbs. |
| 4 " | - - - - | 42 " |
| 4 " | - - - - | 36½ " |

averaging 10 pounds each. Mr. Wilkinson, of Duanesburgh, has a flock of Leicesters which averaged on the whole six pounds per head.

## Section IV.

1. South Down Sheep.—Next to the Leicester sheep the attention of sheep-growers in this country has been directed to the South Down, a variety highly improved by Mr. Ellman, who has done for them what Mr. Bakewell did for the Leicesters—brought them to a high standard of perfection. As a hill sheep, one that can endure occasional 'short keeping, and hard stocking,' that early arrives at maturity, produces flesh of fine quality, and yields a heavy fleece of good wool, the South Down promises much for our farmers. Which of the crosses will eventually be preferable, the Leicester or the South Down, can only be determined by actual experiment.

2. Mr. Youatt, in the work before alluded to, gives in substance the following characteristics of the South Down:—The head small and hornless; the face speckled or grey; the lips thin, and the space between the eyes and nose narrow. The ears well covered with wool and the forehead also, and the space between the ears well protected by it, as a defence against the fly. The eye full and bright but not prominent. The neck of a medium length; the breast wide, deep, and projecting forward between the forelegs, indicating a good constitution, and disposition to thrive. The shoulders on a level with the back, but not too wide above. The ribs coming out horizontally from the spine, and extending far backward.

3. The hips wide; the space between them and the last rib as narrow as possible, and the ribs generally presenting a circular form like a barrel. The back and belly straight. The legs neither too long nor too short; the bones fine, yet giving no appearance of weakness, and the legs having a speckled grey or dark color. The belly well covered with wool, and the wool coming down before and behind the knee, curled, and free from spiry projecting fibres, or coarser hairs.

4. In reply to a number of queries, on the qualities of the sev-

eral varieties of sheep, made to Mr. Rotch of Otsego, one of the best breeders and skilful judges in America, was the following :—"What breed is most hardy and best adapted to our climate?" To this query that gentleman replied, "South Down, *certainly*." Mr. R. says 'they are a medium size, fine in the fleece, which averages 4 lbs. in the ewes, the bucks reach to 7 lbs.

5. In quality the wool is equal to half blood merino. They are excellent nurses and quick feeders.' Owing to some cause the South Down have not as yet become so well known in this country as the Leicester, though it would seem highly deserving of notice from the hardy nature of its constitution and the quality of its wool.

6. This cause may be found in the fact, that the half blood merino is already found on the farms of most small farmers; and where wool of a superior quality is desired, as usually the case where wool is the object of the grower, the pure Merino or Saxon will be preferred to the South Down or any other kind. In England it has been found impossible to introduce the Saxon or even the common Merino with success, and hence the attention of her agriculturists has been directed to the improvement of their best wooled native breeds, among which the South Down stands proeminent.

7. Admitting, of which we think there can be no reasonable doubt, that the South Down is a sheep of more hardy constitution, is a better nurse, yields as much wool, and that of as good quality as the half blood merino, it is clear an advantage would be derived by substituting the first for the last on our farms. The weight of the South Down and the half bloods would probably not vary very essentially, but the mutton of the former is said to be of a quality far superior to the latter; and as the use of mutton is yearly becoming more common, among all classes in this country, it of itself furnishes a sufficient reason why more attention should be paid to the subject.

8. The introduction of improved animals from abroad, by crosses or otherwise, cannot be too highly commended. The result cannot be otherwise than beneficial to the country; as by it the kinds best suited to the climate, and the wants of the inhabitants, will most speedily be obtained. All experience shows that there are so many circumstances of soil, pasture, climate, and attention to breeding, to be taken into consideration in estimating the value of any particular breed of animals, when that breed is to be transplanted to another region, that success must of necesity be uncertain; and the adaptation of the animal to its new abode can only be decided by actual experiments, fairly conducted and continued for some time.

9. In estimating the value of imported animals when compared with the common breeds of the country, it should not be forgotten that they are usually, and always ought to be, picked and choice ones; that they are in the hands of men who are able to give them good keeping and of the kind best suited to their wants; and that in the hands of ordinary farmers they would not reach the standard of excellence they now do. If these things are overlooked, an exaggerated estimate of their value is apt to be entertained, and disappointment will be the lot of the purchaser.

## Section V.

1. Wintering Sheep.—There is no season of the year which exercises so powerful an influence on the sheep as the winter and spring, and no one which so clearly determines the profit or loss which shall arise to the wool grower. Sheep may be kept fat through the summer, and there is a decided advantage in having any animal in fine order at the commencement of winter feeding, but if the proper care, food, and attention be not paid to the flock during the trying months of March and April, in most cases a serious loss will ensue.

2. On the treatment and health of the flock at this time is mainly depending the increase, for if no attention is paid to the ewes, if they are suffered to take their chance with colts and cattle, if no extra food is given them, or shelter provided, the probability of raising lambs is very small indeed. The grand secret of raising lambs is, if early in the season, providing the ewes with a warm shelter, and at any season, providing food that will cause a sufficient and timely supply of milk.

3. It will not do to depend on dry hay and snow, as food and drink for the ewe, and a few spoonfuls of fallow cow's milk for the lamb, if we wish to find the flock in good heart at shearing, or see lambs playing in the green fields on May-day. All sheep require shelter, and to the ewe, it is indispensable. All sheep should be supplied with drink or rather the water should be so situated that they can drink when they please, but to suppose that milk to any extent can be produced from a pound or two of dry hay alone is preposterous, and in the end will prove ruinous to the man who hopes in such a way to rear his lambs.

4. Ewes previous to yeaning should be separated from the flock; they should receive an extra supply of food, and if possible some of it should be green food, such as cut turnips or potatoes, with occasionally a little salt sprinkled over them, and still better if a little tar is put to the bottom of the troughs from which they re-

ceive this food. Where turnips are not to be had, bran, chopped oats, or coarsely ground corn, wet, may be given them. They should have water, and if at yeaning they still seem deficient in milk for the lambs, some of the above kinds of food may be mixed in warm water and given them, care being taken to give a small quantity often rather than too great a supply at once.

5. There is a general impression among farmers, that early lambs cannot be raised. This is a mistaken opinion, and should not be tolerated. It is true more care for three or four days is usually required in January or February, than in April or May, but it is also true that such lambs are worth much more than late ones, that they winter better, and if raised for the market as many lambs now are, the price, by taking advantage of the market, will be nearly doubled.

6. There can be no doubt that a general improvement in the management of sheep has taken place in this country, but when one sees in the spring sheep with the wool dropping from them; the skeletons lying about the barns, picked by dogs, hogs, and crows; and the apple trees decorated with dead lambs, he is compelled to admit that there is still room for improvement and reform, and that this most valuable of domestic animals does not at all times receive the care and attention it deserves.

7. *Washing Sheep.*—In order to have wool command a good price in the market, or be in the best state for manufacture in the family of the farmer, it is indespensable that it be well washed; and we have reason to believe that this process is but very imperfectly performed in proportion to its importance. In the first place, sheep are usually washed too early in the season. The weather should be warm, and the water should have time to be freed from its winter chill, before the washing of sheep is undertaken.—Sheep now rarely lose their wool in the spring; a reason that once was the most successfully urged for early washing, and no loss from this cause rises from waiting.

8. The health of the sheep, and the comfort of the washer, both demand that regard should be had to the temperature of the weather and water, before the process is undertaken. Sufficient attention is not paid to tagging the sheep, or freeing them from hardened and accumulated dirt, before washing. Neglect here will always cause a serious loss, by injuring the quality as well as lessening the quantity fit for market.

9. There is great deficiency in another repect which should be corrected. Sheep are frequently washed or rather wet, as if the process was one intended for a frolic, not for use. Only get them

into the water, and in the opinion of many, the grand object is accomplished. Now sheep should be washed clean; if they are not, they may as well be let alone, and the time and trouble of wetting them saved.

10. Soap should be used when necessary, and the whole business should be conducted with care and attention. No more should be penned at once than can be washed well and thoroughly within a reasonable time; to shut them up and keep them eight or ten hours without food is a needless piece of cruelty. It is the practice of many to drive their sheep some two or three miles to a lake or river for washing, but the practice is a bad one and generally entirely needless.

11. By driving them so far they frequently tire out, and always get more or less dust and dirt fastened to their wet wool. There are but few farms, certainly but few neighborhoods, in which clear running brooks cannot be found, and with these, places for washing are easily made. A tub four or five feet in depth and as many in diameter, such as is frequently used by the farmer for holding rain water, a trough or spout large enough to convey a suitable quantity of water to the tub, and a pen for yarding the sheep are all that is required; and these can in most cases be provided in a few hours.

12 At such a tub two men can wash easily, without being seriously wet themselves, and with an entire command of the sheep at all times. Some prefer vats of a suitable depth; but the fact that vats are as expensive as tubs, that they can be used for nothing else while tubs when not wanted here are always useful elsewhere, would seem to render tubs preferable.

13. This is, however, of little consequence compared with the benefits of washing sheep at home; a system which when once adopted by the farmer will be rarely exchanged for the laborious one of driving abroad. This method of washing requires but little water; just enough to flow off freely, washing away the dirt and other impurities, either over a depressed part of the margin of the tub, or through a suitable sized opening near the bottom. We are also convinced that a majority of our farmers shear their sheep too soon after washing.

14. If sheep are washed as they should be to render the wool clean, much of the natural yolk or oil of the wool, a substance that contributes much to its smoothness and ease of working, is taken away. If sheared too soon after washing, the wool is destitute of this principle, and is apt to be harsh or tender, an evil that the greasing given by the manufacturer, but imperfectly remedies. Sheep should be allowed to run several days after their wool is dry,

always being careful to confine them to clean pastures, and the benefit of the delay will be felt not only in the superior softness and quality of the fleece, but in the greater weight and consequent profits of sale.

## Section VI.

1. Essay on Swine.—Of the hog tribe, (*Sus*) zoologists describe no less than six species, some of which are so entirely distinct in their general habits and appearance as to have prevented their ever breeding, or even associating together. Five of these species, however, can only be regarded as matters of curiosity to us at present; we shall therefore pass them over, and come at once to that known as *Sus scrofa ferus*, the common wild hog of the Eastern Continent, and from which has directly descended the domestic among us, in all its countless varieties.

2. Except with those nations where its flesh was forbidden by their lawgivers, the wild boar has ever been considered a great delicacy, and eagerly sought for, not only to gratify the appetite of the epicure, but as affording a favorite amusement in the chase, that was considered equally noble, dangerous and exciting to those who followed it. Among the earliest feats that Zenophon thinks worthy to record of his favorite hero, Cyrus, is that of hunting and slaying the wild boar with his own hand; and the greatest of modern heroes, Napoleon, thought a chase of the same kind highly indispensable to royal habits, and to assist in qualifying him to assume the imperial purple with the greater dignity and grace.

3. The time of the domestication of the hog, like that of most other animals, is lost in remote antiquity, but that it must have been very early, we infer from the fact, that the Greeks and Romans offered it as a grateful sacrifice to Ceres, the goddess of agriculture, in order to propitiate her smiles upon their labors, previously to commencing their harvests. That distinguished philosopher, Aristotle, also gave hints on the raising and breeding of swine, which are worthy of regard at the present day; and Varro and Columella, if we could substitute soft, thin hair, for "thick, strong and erect bristles," have described the main points of what we may now consider, with all our modern improvements, a very perfect hog.

4. The reasons that were supposed to influence the forbidding of eating swines' flesh, as well as that of several other creatures, under the Levitical law, are, that the children of Israel, at the time of their exodus out of Egypt, were a very debased and gross people; but few grains and vegetables were then cultivated to vary the food of man, and as they were destined to inhabit where a generally

hot and dry climate prevailed, a great indulgence in these meats would tend to thicken the blood, check perspiration, and consequently, especially engender scrofulous, scorbutic and cutaneous diseases.

5. We find among the Egyptians, that some of the same prohibitions of Moses were made sacred by their priests to that singular people, with the intention, undoubtedly, of more certainly preventing their being used as food, and mainly for the reasons spoken of above. Pork, however, as now usually made, and above all eaten in the moderate quantities that it generally is, and accompanied by so great a variety of grain and vegetable food, can no longer be considered objectionable, especially in a cool climate.

6. As it is one of the most palatable and substantial of meats, the cheapest and easiest reared, the longest and most certain to keep, it has at length become the most necessary item of the stronger food of civilized man, and without doubt the most important of the stock grower's products in the Canadian Provinces. Of all the known varieties of the domesticated hog, the Chinese has long been celebrated as decidedly the most perfect in shape and general conformation.

7. How this breed was first produced, it is impossible now to say; there is no doubt, however, in my mind, but that, like the Arabian horse, it was *original*, and that the best specimens to be found on the Eastern Continent, are the identical counterparts of the pair that descended with Noah from the ark, after the subsiding of the deluge, and that all other varieties have deteriorated by running wild, or from carelessness in feeding, and neglect and inattention in properly breeding,—the goodness of the Deity never forming in the beginning the detestable brute that we see roaming in every direction the country round, like a veritable cannibal, seeking whom and what he may devour.

8. But be this as it may, the Chinese, as we find them scattered along the coasts of the Celestial Empire, and on the adjacent islands, vary greatly in size, and somewhat in shape, and are of every shade of color, from pure white up to jet black. The most approved varieties, however, may be thus described:—A fine head and snout, with the face somewhat dished, small upright ears, a somewhat short and very thick deep carcase, large hams and shoulders, short legs, delicate feet, soft thin hair and skin, a tendency to grow and fatten almost upon air alone, and to give when slaughtered very little offal, and the sweetest and most delicate of pork.

9. As now bred by the writer, their live weights full grown, are

generally from 200 to 300 pounds; occasionally they have gone as high as 400 pounds, but this is extremely rare. They are equally hardy, enduring heat and cold as well as any of the native swine; are fair breeders, usually having from six to nine pigs at a litter; mature easily, and can be fattened at any age. Whether in field or pen, they are ever quiet; the loosest boards keep them up, and the poorest fence secures them within their bounds; and like Diogenes in his tub, they seem never so happy as when left alone to sleep, and dream, and cogitate on deep philosophy.

10. Their meat is exceedingly delicate and sweet. In England it bears the highest price, and is called par excellence the "gentleman's pork." The improved Chinese will yield a greater amount of pork for their food than any other breed in existence; and it is in allusion to this circumstance that the able editor of the Maine Farmer, with no less truth than justice, calls them the "poor man's hog." Boars of this breed are highly recommended to cross with the common hog of the country, as they most rapidly improve the quality of the meat of their progeny, fine their points, give breadth and depth to the carcase, quiet their dispositions, and add a greater tendency to mature quickly, and fatten kindly, and at the same time increase their sizes.

11. Many attempts have been made in Europe to improve the breed of the native swine, by selections and otherwise; but so far as the writer has been able to follow them up, there has been little success, and that little very slowly obtained, except only where resort has been had immediately to the Chinese boar. This is particularly the case with England, whose efforts seem to have carried her, in this department, as far beyond her neighbors as in that of the improvement of horses, cattle and sheep.

12. Every county there boasts of its breed of swine, and certainly many are very deserving, having derived their chief excellence from a cross more or less deep with the large white Chinese boar. Of these are the Leicester, the Bedford or Woburn the Sussex and Cheshire. But the most decided improvement, and which by the care and skill of recent breeders has now nearly attained perfection, was that of the black Siamese boar upon the old stock of Berkshire county.

13. This, I understand, began about forty years since. The Berkshires were then mostly a long, large, coarse, lop eared hog, of a sandy or reddish brown, or white, with black spots, and coming up, not unfrequently, to the high weights of 800, and even 1000 pounds. But it was a slow feeder, long attaining to maturity, an enormous consumer, and in common with most of England's other

varieties, an unprofitable beast. Yet possessing rather thicker hams and shoulders than the other kinds, a longer, fuller body, and its meat abounding greatly in lean, the little, short, fat, black, mouse-eared Siamese told well in the cross; and thus produced the dark, splendid Berkshire, that at present occupies the same rank among hogs that the Durhams do among cattle.

14. They mature quickly, and like the Chinese, can be fattened at any age, and still may be selected, when desirable, for great sizes; are prolific breeders and the best of nurses; thrifty, hardy, and of most excellent constitutions. They are fine in their points, possessing remarkable thickness in the ham and shoulder, and show a round, smooth barrel of good length, that gives a large proportion of side pork. They have little offal, thin rind and hair, and few or no bristles. The meat abounds still greatly in muscle, and the hams particularly are highly prized, commanding an extra price in market, being very tender, juicy and lean.

15. As now bred, the Berkshires vary somewhat in size, appearance and maturity. Those with the finest heads, a dished face, and rather upright than forward ears, with a snugger shoulder and ham, and shorter body, most resemble the Siamese ancestor, and therefore are quickest to mature, and probably give the most delicate meat, and to one satisfied with moderate size, are undoubtedly to be preferred.

16. Barrows of this description, if well fed till 18 months old, easily attain 300 to 400 pounds, and weights within these limits are the most eagerly sought for at the Smithfield market, and are probably on the whole the most profitable for both consumer and producer. Others, generally of a straight nose, with a coarser head, and ears protruding well forward over the eye, or slightly lopped, with greater length of body, incline more to the original Berkshires, attain higher weights, and require a longer time to mature. There are individuals, however, occasionally possessing all the fine requisites of the former selections, together with the large size of the latter.

17. We now come to a pair of fatting barrows of the unimproved breeds of swine. They abound throughout the country, under a variety of most euphonious names, but we may suppose those of Alligator and Landpike about as appropriate to them as any others that could well be applied. They are not, however, introduced here for derision, or for the purpose of getting up a caricature, as the originals can easily be found; but to show that there is *something in breed*, and to illustrate the difference between a good animal and a poor one of the same variety.

18. They have long, peaked snouts, coarse heads, thin chest

and narrow shoulders, sharp backs, slab sides, steep rumps, and meagre diminutive hams, big legs, clumped feet, with the hide of a rhinoceros, and the hair and bristles of a porcupine, and as thick and shaggy as a bear's. How can such animals thrive, and above all ever be fattened? To attempt to make them do either, as the writer found to his cost in his first efforts at farming, were time, and money, and produce thrown away. They have no capacity at digestion, and concocting their food in the stomach for nourishment; and if they had, to the formation of what would it all go? Pork?

19. No, indeed—but offal, bones, rind, bristles and hair, with a narrow streak of gristle underneath, and a still narrower line of lean, both as tough and rank as whitleather, and about as incapable of being masticated: and if it were not, must require a vast deal of *larding* to make it sustain human life. I have been obliged to purchase it occasionally for my workmen, and before they could possibly get up a fry for breakfast, twice the weight in lard from other hogs had to be added to it; and as for baking or boiling one might as well undertake to stew an alligator's hide itself.

20. In disposition, they are like the Ishmaelites of old—their *snouts* are against every man, and every man's *hand* is against them. No reasonable fence can stop them, but ever restive and uneasy, they rove about seeking plunder; squalling, grunting, rooting, pawing, always in mischief and always destroying. Enormous gormandizers, yet never satisfied; but like Pharaoh's lean kine, they lick their jowls for more, and show in their miserable carcases no return for the food consumed. In short, the more a man possesses of such stock, the worse he is off, and he had far better sell his produce at any price—yes, even his corn at a dime a bushel, than to put it into such totally worthless brutes.

## Section VII.

1. *The Boar.*—After obtaining as many other good points as possible in choosing a boar, reference should then be had to a strong, masculine appearance in him, even at the risk of getting some little coarseness, as this denotes great vigor and constitution. Both sexes of the improved breeds of swine are, if allowed, precocious in breeding. To prevent this, the boar pig must be separated from the sows, as soon at least as he has attained four months of age, and it is better thenceforward to keep him entirely by himself.

2. For this purpose, a close covered, roomy pen, with a plank floor, and plenty of litter is provided for him to feed and sleep in, and retire to whenever he pleases, and made comfortably warm in

winter and cool in summer. This communicates, by a door that can be opened and shut at pleasure, with a yard for him to root and exercise in, and a strong upright post or two to rub and scratch against, and a slough hole to cool and refresh himself by wallowing at his pleasure during hot weather. If this yard could be extended to a good grass pasture, with clear, sweet water passing through, it would be still better for the boar to have a run there, and more conducive to his health, vigor and longevity.

3. *The Sow.*—When growing pigs or shoats, and kept up in pens, not more than half a dozen sows ought to herd together, yet in large pastures any reasonable number may be suffered to associate. But when full grown, and especially if of a large size, two at most is sufficient together in confinement, and it would be still better that each one had an apartment to itself in the piggery. Unless the pig was lean, and the object was to somewhat fine her, it ought not to be allowed to breed, if a Chinese, till twelve, and if a Berkshire, till eighteen months old; and if something extra large was wanted, defer their coming in still six months longer.

4. There is then no check in youth, and the first litter of pigs is usually as fine and as large as any subsequent ones. The period of their gestation is sixteen weeks, and the time that they are stinted to the boar should be set down, and one month at least previous to farrowing, each sow should be taken up and occupy a place alone, either in pasture or in pen, similar to that described for the boar, be kept in good order, and strictly watched when expected to bring forth.

5. As soon as dropped, see that the pigs are cleaned and take the teat, and the dam rid of the placenta, and that carried off and buried. She should then be supplied with short cut litter in a moderate quantity, so that her young will not get tangled in it and be smothered. The watching should continue several days, till the pigs are strong and lively, especially if the sow be full grown and heavy, otherwise they are in danger of being lain and trod upon, and killed. One pig more saved than leaving the sow to herself, amply repays all this extra attention.

6. The sows being somewhat feverish at farrowing, should have what water they please to drink about blood warm, but very little food, and that of a light kind, the first twenty-four hours. After this their feed may be gradually strengthened, and when the pigs get a week old, the dam should be fed all it will eat three times a day without cloying. All the whey and milk that can be spared, with a mixture of oat and barley with pea or Indian meal, of one part of either of the latter to three parts of the former, is

highly recommended for nursery, together with an equal quantity of boiled or steamed vegetables.

7. As soon as the pigs will eat, a small open box frame should be placed in the pen, under which they could run and be separate from the sows, a trough set there, and milk with a light mixture of meal and cooked vegetable roots poured out for them. This greatly relieves the sow, and adds much to the growth of the pigs; they wean then without scouring, losing condition in the least, or being checked in their growth.

8. It is generally thought that pigs do as well to be weaned at six weeks old as later, for the little milk that each then gets is obtained by more or less quarrelling, and adds a distaste to their food; besides it is a great consideration to get them off the sow as soon as possible. Eight or ten great pigs tugging at her breast for two or three months, is hard to be borne, and is frequently very pernicious to her teats. In weaning, all but one should be taken off, put the dam on short allowance, and in two days take the remaining pig away, allowing it at first to draw the breast twice a day, and then diminish till once in two or three days during a week.

9. Then turn the sow out to grass and leave off entirely, and commence gradually to put her into condition again. The Berkshires especially are great milkers, and must be well attended to at weaning time, or the breast will fill, become caked and swollen, and finally ulcerate, and be the cause sometimes of the death of the sow. Two litters are allowed per annum, and a preference for farrowing in this climate is given to the months of April and September. Farther south, later and earlier will answer.

10. A pig when first dropped is a very tender animal, and if the weather be too cold it will perish; the dam also is likely to become ravenous and devour her offspring, or refuse to nurse it.—After being weaned, pigs should be fed upon cooked food, at least for a few days; they will then very rarely scour, and if they have a dry warm place to sleep in covered from the weather, will not take cold or be afflicted with swollen head and throat, that too often destroys them. Night air is very pernicious to young pigs, and is the direct cause of most ills that affect them.

11. In order to give them a handsome shape and good growth, some attention must be had to their food and accommodation. To their snug sleeping apartment in the winter, a large dry yard that the sun will shine in when out, should be appended for exercise, and in summer they ought to have the run of a good grass or clover lot, with pure water if possible passing through it. The best food that can then be given them, is as much milk, whey and house swill

as can be had, and a mixture of oat and Indian meal about half and half, with flax-seed ground with it, at the rate of a pint or so to the bushel, or for want of this a quart or two of oat meal may be substituted.

12. All this, and more especially if it can be cooked beforehand, mixed with an equal quantity of steamed roots of any kind, such as potatoes, beets, &c., makes the most palatable, healthful and thriving food for young pigs or old, that I know of. There is a very great saving in cooking food for hogs, and making it pretty thin with water; the liquid alone, in this case, seems to go farther with them than the whole of the food uncooked. Repeated experiments have established the fact, that water, under these circumstances, becomes very nutritious.

13. Shorts and bran, so much given to pigs, is most miserable food alone, and especially if used without being cooked. It almost invariably scours them, and under the most favorable circumstances I could never see much thrift from the feeding. Cold swill, and above all if at all frozen, is very pernicious; it is the cause of several diseases, especially that of casting the inwards, and ought never to be fed. When confined, either as store animals or fattening, all hogs should have a little sulphur and salt occasionally in their food, with pure water to drink at all seasons once or twice a day.

14. Chunks of charcoal or rotten wood should be thrown to them, and they should be allowed now and then to come to the ground a short time for the purpose of rooting and eating dirt. They may not fat, or rather *bloat up*, quite so fast for this, but their flesh will be much superior, and the poor animal will be kept free from the fever that otherwise so much torments it; and indeed, it is believed, except in rare cases, from all other diseases.

## Section VIII.

1. Making Pork.—The business of fattening pork for sale is practised to some extent by most of our farmers, and when performed economically, or when the most is made of the materials given them, is undoubtedly a source of handsome profit. Yet all will admit, that when carried on in the same manner it sometimes is, the process of pork making drains, instead of replenishing the farmer's pocket. To make fattening hogs profitable, it is necessary, first of all, that the breed selected for feeding should be a good one.

2. There is a vast difference in hogs in the respect of easy fattening, proper proportion of bone, weight, &c., and the farmer who thinks to make money by feeding the long snouted, hump-backed slab-sided animals, that are too frequently found among farmers

and disgrace the very name of swine, will find in the end that he has reckoned without his host, and has thrown away both time and money.

3. There are several good breeds of pigs now in the country, mostly produced by crossings of other kinds with the Chinese, and of course having different degrees of aptitude to fatten; and these breeds have been so disseminated over the country, that any farmer who is willing to make the effort, may have some improved animals in his pens. The time has gone by when a hog should be kept four years to weigh four hundred; the business of fattening is little understood where hogs of a year and a half do not reach that amount, and some pigs have even exceeded that weight.

4. Next to selecting good breeds, it is requisite that they should be kept constantly growing. There must be some foundation for fattening when the process commences, or much time will be lost in repairing errors, and much food consumed in making carcase that should be employed in covering it with fat. Hogs should be kept in clover pasture, a field being allotted to them for their exclusive use, so large in proportion to their numbers that the feed may always be fresh, yet not so much so as to run up to seed, or grow coarse or rank.

5. They should have the slops of the kitchen, the whey or buttermilk of the dairy, unless this is required for young pigs, and in general every thing they will eat to advantage, or which will promote their growth. The manner in which the materials intended for fattening pork is prepared and fed, has a decided influence on the rapidity of the process, and of consequence on the aggregate profits. If given out raw much of the value of the article is lost; grain is much improved by grinding, but the full effect of all kinds of feed is only brought out by cooking.

6. Corn is without a peradventure the best article ever produced for making good pork; and though other substances may occasionally be used with advantage, and may produce pork of fair and good quality, yet experience has proved that the real corn fed meat is on the whole superior to all others. Hogs will fatten on corn given to them in any state, yet it is far preferable when soaked, ground, steamed or boiled.

7. A farmer of our acquaintance, and who is celebrated for the weight of his hogs, and the excellence of his pork, is in the habit of mixing oats with his corn before grinding in the proportion of about one fourth, and thinks that if he had not the oats of his own, he should be a gainer in exchanging corn, bushel for bushel, for oats, rather than not have them to mix with his swine feed. He

thinks they eat the mixture better than clear corn meal, are less liable to a surfeit, and of course will fatten much faster with the oats than without them.

8. Peas have generally been ranked next to corn as an article for making good pork, and they are probably the best substitute that has yet been found, hogs feeding well on them, fattening rapidly, and the pork being of good quality. It is almost indispensable that peas should be ground or soaked previous to feeding. Potatoes are more extensively used for fattening hogs than any other of the cultivated roots, and are probably the best of the whole for this purpose. Unless they are boiled, however, they are of little value, comparatively, but when cooked they will give the hogs a fine start in feeding, and they may then be easily finished off with corn or peas.

9. The fattening of hogs on apples may be considered as one of the successful innovations of the age, it being certain that this fruit possesses a value for that purpose which but a few years since was wholly unknown. The success of this experiment has given a new value to orchards, and will probably check their destruction, which in some sections of the country had already commenced to a considerable extent. The various reports from gentlemen of intelligence of the practical results of apple feeding are most gratifying, and we have no doubt the system will be fully approved.

10. Where convenient let the hogs lie in the orchard from the time the fruit begins to fall, till it is time to gather the apples for winter or cider, and they will in most cases be found respectable pork. When it is necessary to put them in the pen, boiled apples mixed with a small quantity of corn, oat, pease, or buckwheat meal, will fill them up rapidly, make them lard well, and fill the farmers' barrels with sound sweet pork of the first quality. If any, however, are doubtful, they can easily finish off their apple fed pork, as is generally done with potatoe fed, with corn or peas, and with similar results.

## Section IX.

1. Profitable Hens.—On the first of January, 1836, I had ten hens and one good crower. In the spring I suffered three of them to go through the process of incubation, which left me seven to make my experiment upon. The three which raised chickens, gave me twenty-four in number, which I sold for 11*d.* each when they were the size of quails. The sooner you sell your chickens the better, for they will bring but a penny or twopence more when full grown than when half grown.

2. When the year was out on the first of last January, I looked over my account and found that my hens had given me ninety-six dozen of eggs, which were sold for £3 19*s*. 6*d*. What we had used in the family made the whole quantity one hundred and ten dozen. The lowest price I sold any for was 8*d*. per dozen—the highest 1*s*. 3*d*. I have asked many farmers to guess the number, but they always came short of it.

3. They ask me what I give them to make them so prolific. I enquire how they treat theirs, what they give them to eat, and where they rest at night. They tell me they let them rest in barns or on apple trees—not giving them much except what they can pick up around the house and barn. They think warm dough will freeze in their crops and kill them in cold weather.

4. Now I'll tell you how I keep the hens. I cause a good house to be made for them on the south side of a hill, and stone it up so warm that an egg will scarcely ever get frozen. During half the time in winter I gave the hens boiled potatoes and bran or meal, mixed together with warm water. I never lost any hens in consequence of this dough freezing in their crops; if they have a good warm house to sit in, dough will not hurt them any more than warm cakes will kill a man. For the remainder of the time, I give them oats instead of corn.

5. I have bought oats for 3*s*. 6*d*. a bushel, while corn was, at the same time, 5*s*. 6*d*., and tried the hens first on the oats and then on the corn. Before feeding the hens I would let the oats soak in warm water for three or four hours, till they got well swelled, and in this way I found that a bushel of oats would go as far as a bushel and a half of corn; thus in using oats instead of corn I saved 4*s*. 9*d*. to every bushel consumed.

6. Hens will dust themselves every day when they can get dry dirt. In the winter, when they cannot, I place a large box of coal-pit dust in their house and keep it dry so that it cannot freeze; this answers every purpose. Hens should never be kept near cattle, for their vermin will escape to the cattle and prevent them from growing fat.

7. I preserve all the pieces of white earthenware that I can find, and when the ground is covered with snow, I pulverize it and give it to them. I find by experience they will eat it in preference to corn. Water is always placed within their reach. Last year, according to the best of my calculation, the cost of keeping my ten hens was £2 5*s*. I sold eggs to the amount of £3 19*s*. 6*d*., and chickens to that of £1—leaving a nett profit in one season of £2 14*s*. 6*d*. Besides this, eleven dozen of eggs, worth ten pence a dozen, were used in the family.

IMAGE EVALUATION
TEST TARGET (MT-3)

6"

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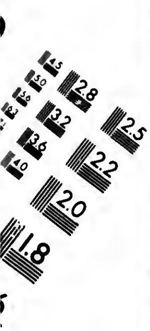
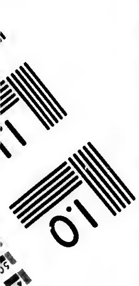

## Section X.

### 1.
### MY COTTAGE HOME.

I've been where pleasure unbedimm'd,
  Hath fill'd my heart with joy—
Where fancy weaves her fairy dreams
  Unmingled with alloy ;—
Where sorrow's bosom heaves no sigh,
  Nor angry passions foam,—
Yet—find no pleasure half so sweet,
  As in my Cottage Home.

2.

I've been where wealth, her flowing robes
  Of gold, hath spread around,—
Where sumpt'ous fare, and sparkling wine,
  In plent'ousness abound ;—
Where Peace—and Love—and Happiness,
  Like sister-spirits roam,—
Yet—find no place, so dear to me,
  As my own Cottage Home.

3.

I've been where England's glory spread
  Her Lion-banner wide—
And with her bleaching canvass hid
  The foam of ocean-tide ;—
Where from her rocky wave-girt base,
  Her sky-ward towers uprise,—
Yet—yet, my Cottage Home appears
  Most lovely in my eyes.

4.

I've been where France, all crown'd with joy,
  Laughs through each vine clad field,—
Where Olive groves and Myrtle-bowers
  Their rich profusion yield ;—
Where Ceylon's sweet perfumes arise,
  And spicy breezes sigh,—
Yet—with my Cottage Home, I find
  No palace that will vie.

5.

I've been where Appenines ascend—
  And where the frowning Alps,
Above the rushing, tempest blast,
  Up-rear their snowy scalps;—
Where high Himmaleh's icy peak
  Stands tow'ring, and alone,—
Yet—find no place in all the world,
  So lovely as my own.

6.

I love my Cottage Home!—I love
  The flowers that round it grow—
The ruffl'd Sunflower—blushing Rose—
  The Hollyhock of snow;—
The graceful Lily—blooming Pink—
  The Marigold so gay,—
The Honeysuckle—Jessamine—
  What sweeter flower than they!

7.

Oh! dearly—dearly do I love
  My grove-environ'd Home,—
And on my heart its smiles shall beam,
  Where'er I chance to roam;—
Its woodbin'd roof—its white-washed wall—
  Its skill wrought, carpet floor,—
Oh! never—never will I leave
  My lovely Cottage more.

## SECTION XI.

1. PLASTER, AND ITS MODE OF ACTION.—Lime is one of the few primitive earths, the one which by its union with sulphuric acid, forms gypsum or sulphate of lime, and has been proved by Sir Humphrey Davy to consist of a metallic base combined with oxygen, though like the base of potash, such is its affinity for the oxygen of the atmosphere, that a complete separation of the two for any length of time was found almost impossible. Lime is soluble in about 450 parts of water. Lime assumes a great variety of appearances, and forms many combinations.

2. With carbonic acid it forms common limestone, the marbles, &c., but all the other combinations are to the farmer of secondary importance, compared with the one which forms the sulphate of

lime, or as it is most generally called "Plaster of Paris." This substance, from the astonishing effect it produces on the grasses, and indeed on most plants, when used under circumstances favorable to its application, has become connected with successful agriculture in such a manner as to justify all the efforts which can be made to explain its mode of action, and more thoroughly investigate its principles.

3. Sulphate of lime, or plaster, is composed, in 100 parts, of lime 34.0, sulphuric acid 44.8, and water 21.2. When crystallized in a pure state, it is called selenite, is partially transparent, and is the substance used by the ancients for the purpose of sculpture, and termed alabaster; but it is generally found impure, or mixed more or less with foreign substances, which renders it, when pulverized or ground, darker in proportion to the extraneous matter it contains.

4. In its natural state, when heated, it parts with its water of crystallization easily, and is then easily reduced to powder, a mode of preparation extensively used when it first came into use as a dressing for soils, but which is now entirely superseded by mills constructed so as to pulverize it without burning. Fortunately, plaster—and we use this term in preference to the more scientific appellation, because it is one which every body understands—is one of the most abundant minerals in nature.

5. The use of plaster as a dressing for plants commenced in Germany, where its value was accidentally discovered by noticing the superior growth and vigor of clover, near a foot-path daily trodden by some peasants who were quarrying this mineral, and from whose clothes it had been dusted over the grass near their pathway. From this beginning its use rapidly spread over Germany and France, and thence into the United States and Canada.

6. It is singular, and shows the cautiousness, if nothing more, of farmers in adopting any innovation on established [illegible]ges, that notwithstanding the length of time it has been used. [illegible] the constantly increasing fertility of those soils where it has been applied the longest, we find there is a lurking prejudice still lingering in the minds of many of our farmers, not to say a serious doubt, as to the propriety of its use.

7. These objectors reason thus—"We do not deny that plaster enables a farmer to procure greater crops of hay or grain than he could otherwise obtain from a given piece of land in the same time; but as the growth is not natural, but forced, and as no additional ingredient of fertility is furnished to the soil by the plaster, it is evident the farm will be exhaused the sooner in exact proportion to the addition made to the crop."

8. The stimulus given to land by plaster it is said, "is precisely analagous in its results to the excitement produced by ardent spirits upon man: while under its influence he is as much above par in his spirits and powers, as he is below when the exciting cause has passed away." We have stated those objections in their strongest form, and in the manner in which, so far as our knowledge extends, they usually exert their influence; as, independent of the fact that such has never yet been the effect of plaster, we hope to be able to show satisfactorily from the nature of the substance itself, and its mode of action on plants, that no such result can take place as is apprehended.

9. We do not maintain that constant cropping of land, without rest, rotation of crops, or returning anything to the soil in the state of manure, would not exhaust it essentially in spite of the application of plaster, but we do maintain, that where plaster is used, even in such an injudicious course of treatment, the exhaustion will not be more rapid, and the profits of cropping will be far greater, than without it.

10. In the first place, these objections to the use of plaster are wholly founded on the mistaken assumption that all the nourishment of plants is furnished by the soil in which they are planted, and of course the exhaustion will be in proportion to the magnitude and the vigor of their growth. This supposition it will not be difficult to show, is a great and fundamental error. The sap or circulating fluid of plants enters the roots by their spongioles or minute fibres, and holding in solution saline, extractive, mucilaginous, saccharine, and other matters, rises upwards through the wood, and is distributed through the fine pores of the stem, and the delicate ramifications of the leaves.

11. These substances are readily soluble, and plants therefore find no difficulty in obtaining their supply from the earth, but the most important ingredient in their growth, and one which enters into their formation in far greater proportion than any other, has not yet been mentioned, and this is carbon or charcoal. Now although carbon or coal exists in the earth in immense quantities, yet as it is perfectly insoluble in water, it cannot, like most of the salts, earths, alkalies, &c., be furnished to plants as they are, that is, by solution and absorption in its natural state. How then is the carbon obtained, the presence of which in abundance is proved whenever wood or the stalks of plants is burned? We answer from the air, and that by two methods.

12. Carbonic gas furnishes the medium through which plants receive their carbon—a substance which in some kinds of wood

and plants, such as box and the straw of wheat, amounts to nearly 50 per cent. of the whole—and is composed of 27.4, parts of carbon, and 72.6, of oxygen. Carbonic gas is the air which so frequently proves fatal in wells, old cisterns, and in close chambers where charcoal is incautiously burned.

13. This gas is by plants absorbed directly from the air, in which it is always found more or less, and under certain circumstances this absorption goes on with rapidity. Experiments conducted by Priestly, Lavosier, Davy, Chaptal, Berzelius, all eminent chemists, prove beyond controversy, that during the day carbonic gas is absorbed, the carbon appropriated to the growth of the plant and the oxygen set free, while during the night directly the reverse of this process is going on, oxygen being absorbed, and carbonic gas evolved.

14. Carbon thus absorbed directly from the air, is one of the methods by which this essential article in their formation is obtained by plants; but it is by another method in which far the greater quantity is procured, and in effecting which plaster becomes so important an auxiliary. Carbonic gas is rapidly absorbed by water at all times, and when recently boiled, water will absorb its own weight of carbonic gas at the common temperature and pressure of the atmosphere.

15. When thus combined with water, and furnished in proper quantities, it is ready for being taken up by the spongioles of the roots, and thus converted into food, or the wood of trees and plants. We say in *proper quantities*, for though indispensable to the growth of plants, too large a proportion of carbonic gas is fatal to them, and when combined with water in its greatest possible quantity, as in the peat bogs of Ireland or Scotland, it is of all substances the least adapted to promote vegetation.

16. We now see how that any substance which will by its chemical action furnish moisture during the heat of summer, and especially on dry sandy or gravelly soils, will, by providing a medium for the supply of carbon at the time it is most required, materially aid the growth of plants; and the supplying the moisture, and thus of course the carbon, is precisely what plaster does when applied to vegetables on such soils as above mentioned. We have shown that plaster is composed of lime and sulphuric acid. Sulphuric acid attracts water, which it takes from the atmosphere so very rapidly, as to imbibe one third of its own weight in twenty-four hours.

17. When plaster is exposed to the air in small quantities, as it is when sown, it slowly undergoes decomposition, or separates into

its constituent parts more or less perfectly. The sulphuric acid thus set free seizes with avidity on the water of the atmosphere, which water is deposited on the leaves of plants, and is thus conducted to the roots of the plants, or on the earth itself, where it is speedily impregnated with the carbonic gas already in the air, or which is rapidly poured from the leaves of plants during that part of the twenty-four hours which forms their period of expiration.

18. Sulphuric acid produces another effect which has a direct tendency to aid in the production of moisture. During its development and combination with the air, it has a tendency to slightly depress the temperature, as all acquainted with the artificial formation of ice will understand, an action directly calculated to effect a greater deposition of dew, and thus add materially to the absorption of carbon. Every one must have remarked, that on those parts of a field where plaster has been sown, the dew is more plentiful, and lies longer, than on the other parts, and that the clover will be more fresh and vigorous. Plaster, operating in the way we have described, produces precisely these effects, and hence on suitable soils the great value of the mineral.

19. Plaster then, if our theory of its action is correct, cannot impoverish land. It is true, that little, if any, of the plaster goes directly to the formation of plants; after the sulphuric acid is separated, a little lime is left, and that, small as may be its quantity, is always of value in a soil by assisting the decomposition of vegetable matter; it is by its chemical action in giving the means of separating from the air a substance necessary to their existence, and offering it ready prepared for the use of plants, that its value is derived.

20. The simple facts of the case seem to be these: Plants must have carbon, or they cannot be healthy and vigorous—as carbon in its pure state is insoluble, it can only be furnished them in the state of carbonic acid or gas—this can only be made available to any considerable extent by combination with water. During the heats of summer, and on sandy ground, this is extremely scarce, and here we find plaster steps in to our aid—the suphuric acid of the plaster attracts this from the atmosphere, and by depositing it in the form of dew, places it in a situation in which this combination with carbonic gas can be effected in the best manner.

21. Thus the chain of cause and effect is complete, and the whole operation bears the marks of most consummate wisdom and design. If this carbon was one of the original earths, and could in its natural state be taken from the soil by plants, instead of being derived from the air, there might be some plausibility in the objections made

against the use of plaster; as it is, they must go for nothing, even were not our view of the subject supported, as it fully is, by long experience of its beneficial effects. We trust, therefore, that no hesitation will be felt by any in purchasing plaster for the purpose of sowing on clover or meadow, or for a top dressing on wheat.

### Section XII.

1. Marl.—In reading a very elaborate report from the pen of a celebrated Geologist, who has been employed in one of the southern States for the past few years, we were astonished to notice that tracts of country equalling some hundreds of square miles, had been increased in value within the past eight years to an extent of upwards of one hundred per cent., and this great advance in the value of property was attributed almost solely to the use of marl.

2. From the moment we read this report, we embraced every opportunity of discovering the location of valuable beds, and have in many cases tested the qualities of the specimens which have come under our observation. The only kind which can be profitably brought into general use in this country, is that which is generally denominated *shelly marl*, which is evidently a deposit of shell fish, in process of time converted into calcareous earth, containing both stimulating and fertilizing properties, which make it so highly prized in Britain that it is classed among the animal manures in point of value.

3. It exists at the bottom of most bogs and morasses, or other pieces of stagnant water, and is usually under layers of a deep black peatty earth. The specimens which we tested were taken from beds covered with about three feet of black vegetable mould, and the timber which grew upon the land was principally a dwarfish growth of black ash. They contained about 50 per cent. of pure lime, and in one instance even a much greater quantity

4. If a substance containing from 40 to 50 per cent. of lime can be had without any cost further than the mere drawing, such farmers as have this substance within their reach would find it to their advantage to apply it to their cultivated land, at the rate of about five tons per acre. We would recommend experiments with marl on a small scale, and by this means its adaptation to the soil on which it is applied may be fairly proved, and the most untutored cultivator would soon be able to form a correct estimate of its value.

5. The principal ingredient in marl that is found to be valuable to the farmers, is the carbonate of lime which it contains, and it is owing to the presence of this earth that marls effervesce on the ad-

dition of acids. The most common test is, to add a small portion of dried marl to a wine glass full of vinegar. A species of violent fermentation will take place if the marl be rich with lime, which will quite astonish a person inexperienced in such matters. This test is so simple and efficient, that it is scarcely necessary for us to mention others.

6. We might, however, mention another: Let the marl be put into a glass, partly filled with water, which will expel a portion of acid contained mechanically in the marl. When the marl is thoroughly penetrated by the water, add a little muriatic acid, or spirit of salt. If a discharge of air should ensue, the marly nature of the earth will be sufficiently established.

7. If a farmer, whose soil is deficient in lime or calcareous earth, can procure, at a convenient distance, a quality of marl, being rich with lime, he will find by such application effects equally as beneficial, as though he had used pure lime from the kiln. When the marl is used, of course the quantity would be required to be greater, but only to an extent equal to the amount of silex and other substances not being carbonate of lime, it contained. The action of marl on the soil will be more slow and lasting than fresh burnt lime, but the benefits in the end will be found to be equally as great.

## Section XIII.

1. Ponds, and Pond Mud.—Pastures that are destitute of water should have artificial ponds made in them, for watering places. Observe where rushes, weeds, flags, and other aquatic plants grow spontaneously: or where frogs are observed to lie squatted down close to the ground, in order to receive its moisture. Or observe where a vapour is frequently seen to rise from the same spot. Some say wherever little swarms of flies are seen constantly flying in the same place and near the ground, in the morning after sun-rise, there is water underneath.

2. If a well is made in a sloping ground, and the declivity is enough to give it a horizontal vent, it will be worth the husbandman's while to dig such a passage, and by means of pipes or any other conveyance, to carry the water across the light soil, through which it might otherwise sink. The greatest quantity of water will be obtained in this manner, because there will be a continual stream. There is no difficulty in making a durable pond in a clayey soil.—Let a large hollow basin be made in such earth, and it will preserve the water that falls in rain. But it is apt to be thick and dirty, if some pains be not taken to prevent it.

3. The declivity by which the cattle enter, should be paved, and

gravel should be spread on the bottom. Or it might be better if the whole were paved. There are many large natural ponds which have outlets in one part, and are supplied by brooks and rivers on the other parts; but a greater number of smaller ponds, which are perfectly stagnant, unless when they are agitated by winds.—Such ponds as the latter, in hot seasons, are apt to become putrid, and contaminate the air about them. For this reason, they should, if possible, be drained.

4. And when the water is not deep, and an outlet can be made without too much cost, they should be drained for the sake of reclaiming the soil. This will be of great value, as it is commonly found to be extremely rich, being made up of the finest particles of soil, wafted into them by winds, and of decayed vegetable substances, besides the mould washed into them by rains.

5. Many farms contain little sunken spots, which are most of the year covered with water, and produce some aquatic bushes and weeds. These are notorious harbors for frogs, and are therefore called frog ponds. They should be drained if it be practicable. It is commonly the case however, that draining them in the common way, by making an outlet, would cost more than they would be worth when drained, because of the height of the land on every side. But in this case, if the banks be not clay, they may be drained in the following manner:

6. Take notice on which side land that is lower than the pond is nearest. On that side, in the bank near the pond, dig a kind of cellar, two or three feet deeper than the surface of the pond; do it in a dry season. If a hard stratum appear, dig through it; and leave digging when the bottom is loose gravel or sand. Then make an open or covered drain from the pond to the cellar. The water will be discharged from the pond, and soak into the earth through the bottom of the cellar, till a scurf is formed on the bottom, that will stop the water from soaking into the earth.

7. This scurf should be broken from time to time, and taken away with a long handled hoe. Or the cellar may be filled up with the refuse stones, and I think it preferable to the other method. If the pond should become sufficiently dry, a small ditch should be drawn around it and discharge itself into the cellar. The land that is thus gained will be rich muck, much of which may be carted away for manure; and common earth or sand may replace it without detriment to the soil.

8. The *mud from ponds*, when they are cleaned out, has always been an object of attention to farmers, so far as regards its collection; but it must be presumed that its different properties, and con-

sequently the most judicious modes of its application to the land, are either but little understood or neglected; for some cart it directly upon the ground and plough it in, either for turnips or corn crops; others spread it upon old leys; and many lay it out in thin heaps to dry, after which they mix it with lime or dung.

9. Upon this it has been remarked, by an eminent agriculturist, that in reasoning with the farmers upon the cause or principle by which they are guided in those different proceedings, the reply is generally 'that it has been their practice to do so—that it has answered very well—and that they know of no better mode of treating it.' It may be observed, that ponds, being usually placed at the bottom of the field, receive, after very hard rain, a part of the soil, as well as of the substances with which they have been manured.

10. If the ponds be large and deep, they may also acquire much decayed vegetable matter, arising from the aquatic plants with which such pools usually abound; and if near the yards at which cattle are commonly wintered, they must likewise receive a portion of their dung; such mud is, therefore, particularly applicable to light soils, both as containing nutritive matter, and adding the staple and consistency of the land. The most common time of mudding ponds, is during the summer months, when it is usual to let the slime lie near the edge of the pond, until the water is drained from it.

11. A spot is then marked, either upon a head land of the field upon which it is to be laid, or as near it as possible, of a size to raise a compost with alternate layers of either lime or dung. If dung can be had, the best mode of preparing this manure, is to lay a foundation of mud, of about a foot and a half in depth, of an oblong form, and not more than eight feet in width, upon which the freshest yard dung is laid to about double that depth; then a thin layer of mud; after which alternate layers of mud and dung, until the heap be raised about five or six feet in height—keeping the sides and end square, and coating the whole with mud, at least twice at different periods.

12. If quick lime be used, and there remains any moisture in the pond scourings, it will be sufficiently fallen for turning, in a few days; but if the compost be made with farm-yard dung, it may require to remain six or eight weeks to ferment and decompose before it is in a proper state for turning. To form them, in the first instance, with both quick lime and manure, is injudicious; the former ought never to be brought in contact with the latter—though manures may be advantageously incorporated with an old compost, in which a little lime has been used. It appears the better mode to

apply it in the latter end of autumn, or early part of winter, and to brush-harrow it well after it has been hardened by frost.

13. *Sea mud* or *Sleech*, has also been used in some places in large quantities, and has been found of so very enriching a nature, as to amply remunerate for carrying it to a considerable distance. It is generally laid upon grass in autumn, and ploughed in without any addition in the following spring. It is also found that its effects remain longer on the land than marl; and although that which is over-marled is spoiled for grass, yet that never happens to sea mud.

## Section XIV.

1. Green Crops as Manure.—An illiterate farmer asked, "Why does not my ten acre field sink down, as I and my ancestors have taken more than a hundred crops from it, without ever adding a particle of manure?" He was not aware that the substance of his crops, instead of being derived from the earth, was principally obtained from *air*, and from the moisture of the soil, so that the quantity of soil itself was little affected.

2. To prove that plants may be produced from no other substances than air and water, let the following experiment be performed: Procure a quantity of pounded glass, wash it clean, put it in a clean glass vessel, and plant in it grass seed or grain; let it be elevated from the ground and kept remote from any thing that can drop into it or come in contact with it. Moisten it frequently with perfectly pure water, so that not a particle of any thing else can come near it.

3. The seeds will vegetate and grow to a height of several inches; and the glass will not be diminished in the least. If the experiment, instead being made of pounded glass were made with silex, alumine, and carbonate of lime, in those proportions in which they exist when they form the most fertile soils, the result would be the same. It is true, that in all good soils there exists animal matter, the quantity of which is affected by the growth of plants; but these substances form but a small proportion of the whole, and vegetable matter in soils is as likely to be increased as diminished by the growth of plants.

4. It will thus be perceived, that the practice of enriching land by green crops, is in fact nothing else than obtaining manure from the *air and rain*;—that plants form a channel through which fertilizing substances are conveyed to the soil, which are taken in by the leaves and pass through the stems to the roots.

5. The roots of grass in good sward ground make a formidable subterranean forest in miniature, and it is asserted on respectable

authority, that more than twelve tons are thus added to the fertilizing properties of every acre of soil. When therefore the leaves and stems as well as the roots, are also thus applied, the whole quantity becomes very large. Crops turned for manure, should always be in a green state, and never ripe and dry. In the former case they ferment and become fit for supporting vegetation; in the latter they continue unrotted often for years.

6. *Clover as a Fallow Crop.*—Clover differs in several respects from the other fallow crops, and on account of its peculiar agencies in preparing ground for other crops, it merits a distinct and particular consideration. Some remarks on the utility of clover as an improver of the soil, and as a kind of grass which, for several reasons, ought to be held in high estimation, have already been made in one of the preceding sections. We will see now what use can be made of it in relation to the culture of wheat.

7. If you have a clover pasture, and desire to apply it to the growth of wheat, it will need no other preparation for that crop, than to be turned over, just at the time, or a little before the time, of sowing. Or if you have a clover meadow, and desire to apply it to the same use, it may be allowed to produce its first, and if you please, its second crop of clover, and after that, be prepared for wheat by simply turning over its tender clover ley. The roots of clover do not form stiff swards, as do those of other grasses. Where clover grows, the ground is always loose, friable, and mellow. It needs only to be turned over, and slightly harrowed, to be put in perfectly good order for any crop.

8. Not only can clover be made to supersede laborious and expensive tillage, but it can be rendered highly beneficial both to the soil and to the crop. It is supposed that the roots of clover, as they rot and undergo decomposition, make the very best of manure.—It is supposed too, that the roots of clover act mechanically upon the soil in loosening its texture, and thus rendering it accessible to many known and unknown contributions from the atmosphere.

9. But it is not by its roots alone that clover is capable of being rendered tributary to the soil. To singular advantage its tops can be applied to the same use. If your clover field, which is intended to be prepared for a wheat crop, is supposed to be deficient in the strength of its soil, and to need recruiting, then, if a pasture, let no stock graze upon it for several weeks next preceding the time when it is to be ploughed. Let the clover grow and have time to produce a good green crop. Then, at the proper time, turn this crop under, and, as an improver both of the soil and of the crop, it will be an equivalent to a good dressing of manure.

# CHAPTER VI.

## SECTION I.

1. FARMING CAPITAL.—The success and profits of farming depend very much upon the command of farming capital, and upon its judicious application. We have not now reference to that system of exhausting husbandry,—which has so seriously impoverished the old cultivated districts of our country, and which is fast impoverishing those more recently brought under culture—but to the *new* system, which not only aims at the largest profits upon the outlay, but keeps in view the *augmentation*, or at least the *preservation* of the natural fertility of the soil.

2. It is easier to *preserve* fertility, than to *restore* it to a soil which has become exhausted by injudicious cropping There are two prominent faults in Canadian farming—we cultivate *too much land*, for the capital employed—and in the second place, we do not take the right method of preserving fertility, by alternating crops, and by blending cattle with tillage husbandry. The consequence of the first is, that none of the land is so *well* or *profitably* cultivated as it ought to be.

3. By keeping a portion of our land under the plough, and almost wholly in grain crops—and another portion in 'natural' meadow, the profits of culture are constantly diminishing, and the land is ultimately '*worn out*,' while the deterioration is accelerated by the want of farm stock to convert the forage into manure, and the want of economy and judgment in saving and applying the little manure that is made.

4. To *keep* land in good heart, or to *augment* fertility, it is essential, among other things, to consume the main products upon the farm, in order that the dung, which the farm stock makes, shall *keep the land rich;* that the land be *well drained*, that it may develope all its resources, which it can never do if water reposes either upon, or within eighteen inches of the surface ;—and that it be kept clean. All these matters, as farm stock, draining, and clear tillage, require labour and capital.

5. Instead, however, of laying out the profits of a farm to keep it good, or improve its condition, these profits are generally applied to the enlargement of its size, to speculation, or to some purpose foreign to the preservation of fertility, or to the improvement of the soil. The capital required for the profitable management of a farm, depends much upon the quality of the soil, the nature of the husbandry which is adopted upon it, and the state of the market.

6. It is a well established fact, that farm stock can be purchased

cheaper, and labour and every thing else had upon better terms—for *cash*, than on *credit*. And it is equally a self evident proposition, that he who is *obliged* to sell the products of his farm, to meet current expenses, seldom obtains so fair a price, as he who can choose his time and his market for the sale of his produce. The farmer, therefore, who keeps the *ready means* in reserve, that he may buy and sell when it best suits his interest, has a manifest advantage over him who buys upon a credit, and sells from necessity.

7. But it is principally in reference to the *improvement of the farm*, and the consequent increase of the profits of the labour which is bestowed upon it, that farming capital is particularly desirable. If, by a moderate expenditure in making land rich, and dry, and clean, we can double its products, we effect a saving of one-half of our labour; or, in other words, we obtain as much from the fifty *improved* acres, as we do from one hundred acres in the old way, and with half the labour.

8. As pertinent to this subject, we subjoin some extracts from British Husbandry, persuaded that the remarks they contain apply to Canadian with almost as great force as they do to British Husbandry. 'There is no mistake more common,' says our authority, 'than that of supposing that the more land a man holds, the greater must be his profits; for the profit does not arise from the land itself, but from the manner of using it; the best soil may be made unproductive by bad management, while the worst may be rendered profitable by the opposite course; *but without sufficient capital no land can be properly cultivated.*

9. 'There is nothing to which capital can be applied with greater certainty of a fair return for its liberal expenditure, when correctly employed, than land; but on the other hand, there is nothing more ruinous when the capital is either insufficient, or injudiciously laid out. In fact—assuming always that the expenditure be directed with judgment—it will be found that the profit upon the outlay increases in more than a proportionate degree to its amount; thus, supposing five pounds to be the lowest, and ten the highest sum that can be employed in the common culture of the same acre of land, it is more than probable that, if the five pounds return at the rate of ten per cent, the ten will yield twenty, or any intermediate sum, at the same progressive ratio.

10. 'Now, admitting that to be true,—and it is presumed that no experienced agriculturist will doubt it—it follows *that* 1000*l*. *expended in the cultivation of* 200 *acres, will only yield a profit of* 100*l*. *while, if applied to no more than* 100 *acres, it would produce* 200*l*.; wherefore, although a farmer of limited capital may not be

driven to the extremity we have supposed, (distress, duns and final ruin consequent upon deficiency of stock, imperfect tillage and scanty crops,) and although he may be able to carry on his business with a certain degree of advantage, it is yet evident that *his profit would be increased by diminishing the quantity of land.*

11. 'Many a one has been ruined by a large farm, who might have acquired a competency with one of half the size. It therefore behoves a man to weigh well the charges with his means, and not allow himself to be seduced by any ideal prospect of gain into the imprudence of entering upon a larger farm than his property will enable him to manage with the spirit necessary to ensure success.

12. 'Much larger capital than was formerly requisite has become indispensable since the general adoption of the alternate system of husbandry; for the foundation of that system, and of all good farming, is the support of more live stock than was possible when the land was brought round to the reproduction of grain by means of repeated fallows, instead of green crops. The charges being thus confined to those incidental to mere tillage, were comparatively light; whereas, now, there are arable farms without an acre of pasture except perhaps a paddock for cows, on which live stock is kept to an amount far beyond the sum required for cultivation.

13. 'But the produce is proportionably large; and more corn and meat are obtained from inferior soils in Norfolk, and other counties where the same plan is pursued, than from some of the best land in the kingdom under less spirited management. It is quite manifest that the more cattle and sheep are well maintained upon any given space of ground, the better it will be manured; and therefore, of two farmers, each possessing the same quantity of land, and devoting the same portion of it to grain, he who can support the most live stock, will not only realize the customary profits of that stock, but will also grow the most corn.

14. 'Except in situations where extraneous manure can be procured, it is only by the union of feeding and tillage, that land can be retained in a high degree of fertility. Were the system, therefore, more generally adopted—especially on poor soils—of laying down a considerble part to grass, there can be no doubt that, if again broken up, its productive powers would be found improved, through the meliorating effects of pasturage and rest; and while the gross produce would be thereby ultimately increased, it would so far diminish the expenses of labor, as in many cases to counterbalance the cost of the stock.

15. 'The farmer who has the means, as well as the discernment, to make some of the various branches of grazing, or the dairy, an

essential part of his business, and thus nurses a portion of his land, preserves the tillage in constant heart with the additional manure; and although the gross amount of corn produced may be less than if more ground were under the plough, yet the acreable produce will certainly be greater, and the deficiency will more than be made up by the supply of cheese and butter, and of flesh.

16. 'He also divides his risk, so that, in the event of an unfavorable harvest, the loss upon his crops will probably be reimbursed by the profit on his cattle. It is a common observation that graziers and dairymen are the most regular rent payers; to which it may be added, that the bane of all necessitous farmers, and the ruin of land, are under-stocking and over-cropping.

17. 'The multitude of circumstances to be considered,—each in some degree varying upon every farm, and with every farmer,—preclude the possibility of forming any calculation that would be precisely applicable to every case; but presuming the land to be of medium quality, and under an ordinary course of cultivation, the live stock to be of a good description, and the implements new, the requisite amount cannot be computed at less than from 7*l.* to 10*l.* per acre

18. 'Less perhaps might *do*, and in many cases no doubt is *made to do*. An active, intelligent man who watches opportunities for picking up bargains of stock and implements, who is in tolerable credit, and is ingenious in devising expedients to supply the want of cash, may contrive to get through, where one of less acuteness would fail.'

## Section II.

1. Fat Animals and Large Crops.—The profits of crops, as well as of cattle, depend mainly upon the return they make for the food and labor bestowed upon them. The man who grows a hundred bushels of corn, or makes a hundred pounds of meat, with the same means and labor that his neighbor expends to obtain fifty bushels, or fifty pounds, has a manifest advantage; and while the latter merely lives, the former, if prudent, must grow rich. He gains the entire value of the extra fifty bushels, or fifty pounds.

2. This disparity in the profits of agricultural labor and expenditure is not a visionary speculation--it is matter of fact, which is seen verified in almost every town. We see one farmer raise 80 bushels of corn on an acre of land, with the same labor, but with more foresight in keeping his land in good tilth, and feeding better his crop, that his neighbor employs upon an acre, and who does not get 40 or even 30 bushels. This difference results from the manner of feeding and tending the crop.

3. If the farmer for the convenience of transportation to market wishes to convert his grain, and his forage, and his roots, and his apples into beef and pork, what is his judicious course of proceeding? Does he dole these out to his cattle and his hogs in stinted parcels, just sufficient to sustain life or to keep them in ordinary plight? No. He knows that a given quantity of food is necessary to keep them as they are, and that the more, beyond this given quantity, which they can transform into meat, and the sooner they do it, the greater the profit.

4. To illustrate our remark: suppose a hog requires twenty bushels of grain to keep him in plight for two years, and that he can manufacture fifteen bushels of this grain into pork in six months, if duly prepared and fed to him. In the one case, the owner has his lean hog at the end of the two years, for his twenty bushels of grain; in the other, he has converted fifteen bushels of this grain into pork—into money—at the end of six months, saved the keep of the hog for eighteen months, and twice or thrice turned his capital to profit. Time is money, in these as in all other things appertaining to the farm.

5. The proposition may be thus stated—that which will barely *keep* a hog two years, will *fatten* him well in six months. Therefore, the sooner we can convert our grain and forage into meat, with due regard to the health of the animal, and the true economy of food, the greater will be the profits which accrue. The remark applies to milk as well as to meat. These facts teach us, to *keep no more stock than we can keep well*; and that *one animal, kept well is more profit than two animals that are but half fed.*

6. If we apply these rules to our crops, they instruct us to *till no more land than we can till well* and to *plant and sow no more than we can feed well*; for the fact must not be lost sight of, that our crops, like our cattle, live and fatten upon vegetable matters. One hundred bushels of corn, or four hundred bushels of potatoes, may be grown upon four acres of land badly tended; and this is probably about a fair average of these crops; while the same amount of corn or potatoes may be grown on *one* acre, if the crop is well fed and tended.

7. The product being the same from the one acre as from the four acres, and the expense but a trifle, if any, more than one quarter as much, it results, that if the crop on the four acres pays for labor and charges, three-fourths of the crop on the one acre is nett gain to the cultivator. Estimating the charges at $25 the acre, the price of corn at $1, and potatoes at 35 cts. the well cultivated acre affords a profit, over and above the charges, of $75—

while the crop on the four acres gives not a cent of profit, but merely pays the charges upon it.

8. Though not in this degree, the same disparity exists in all the operations of husbandry ; and the primary cause of difference consists in feeding well, or feeding ill, the crops, as well as the cattle which are the source of the farmer's profit. Let us continue the analogy a little farther. Every one knows, that to have good cattle it is necessary not only to have an abundance of food, but that much, in the economy of the fattening process, depends upon having it of suitable quality, and properly fed out. The grasses should be sweet and nutritious, the hay well cured, and the grain and roots broken or cooked.

9. The man who should leave his cattle food exposed to waste till it had lost half of its value, would hardly merit the name of farmer. Every one would say, *that man is going down hill.* Cattle say they, must eat, and if we dont feed them, they will give us neither meat, milk nor wool. And so must plants eat—they have mouths, and elaborating processes, and transform dung into grain, roots and herbage, with as much certainty and profit, as cattle convert grain into meat, milk, &c. Hence the farmer who disregards dung, or suffers it to waste in his yards, is as reckless of his true interest as he would be to neglect or waste his grain, hay and roots.

10. Dung is the basis of all good husbandry. *Dung feeds the crops ; crops feed the cattle ; cattle make dung.* This is truly the farmer's endless chain. Not a link of it should be broken, or be suffered to corrode, by indolence or want of use. Once broken and the power it imparts is lost. Preserved, and kept bright by use, it becomes changed into gold. It is to the farmer the true philosopher's stone. The man who wastes the means of perpetuating fertility in his soil, may be likened to the unfortunate sons of opulence who waste, in habits of indolence and dissipation, the hard-earned patrimony of their fathers.

## Section III.

1. Arrangement of Agricultural Labor.—To conduct an extensive farm well, is not a matter of trivial moment, or to the management of which every one is competent. Much may be effected by capital, skill, and industry ; but even these will not always insure success, without judicious management. With it, a farm furnishes an uninterrupted succession of useful labor, during all the seasons of the year ; and the most is made that circumstances will admit of, by regularly employing the laboring persons and

cattle at such kinds of work as are likely to be most profitable. Under such a system, it is hardly to be credited how little time is lost either of the men or horses, in the course of a whole year. This is a great object.

2. As the foundation of a proper arrangement, it is necessary to have a plan of a farm, or at least a list of the fields or parcels of land into which it is divided, describing their productive extent, the quality of the soil, the preceding crops, the cultivation given to each, and the species and quantity of manure they have severally received. The future treatment of each field for a succession of years may then be resolved on, with more probability of success.

3. With the assistance of such a statement every autumn, an arrangement of crops for the ensuing year ought to be made out, classing the fields or pieces of land according to the purposes for which they are respectively intended. The number of acres allotted for arable land, meadow, or pasture, will then be ascertained. It will not then be difficult to anticipate, what number of horses and laborers will be required during the season for the fields in culture, nor the live stock that will be necessary for the pasture land. The works of summer and harvest will likewise be foreseen, and proper hands engaged in due time to perform them.

4. As nothing contributes more to facility and satisfaction in business, than to prepare for what must be done, a farmer should have constantly in view a judicious rotation of crops, according to the nature and quality of his soil, and should arrange the quantity and succession of labor accordingly. Team labor, when frost and bad weather do not intervene, should be arranged for some months, and hand labor for some weeks, according to the season of the year. "A general memorandum list of business to be done," is therefore essential, that nothing may escape the memory, and the most requisite work may be brought forward first, if suitable to the state of the weather.

5. The following rules, connected with the arrangement and successful management of a farm, are particularly to be recommended :—*Firstly*, The farmer ought to rise early, and see that others do so. In the winter season, breakfast should be taken by candle light, for by this means an hour is gained, which many farmers indolently lose, though six hours in a week is nearly equal to the working part of a winter day. This is a material object, where a number of persons are employed. It is also particularly necessary for farmers to insist on the punctual performance of their orders.

6. *Secondly*, The whole farm should be regularly inspected; and not only every field examined, but every beast seen, at least

once a day, either by the occupier or some intelligent person.—*Thirdly*, In a considerable farm, it is of the utmost consequence to have laborers specially appropriated for each of the most important departments of labor; for there is often a great loss of time where persons are frequently changing their employments. Besides, where the division of labor is introduced, work is executed not only more expeditiously, but also much better, in consequence of the same hands being constantly employed in one particular department. For that purpose, the ploughmen ought never to be employed in manual labor, but regularly kept at work with horses, when the weather will admit of it.

7. *Fourthly*, To arrange the operation of ploughing according to the soils cultivated, is an object of essential importance. On many farms there are fields which are soon rendered unfit to be ploughed, either by much rain or by severe drought. The season between seed time and winter, may be well occupied in ploughing heavy soils, intended to be laid down with oats, barley, and other spring crops, by means of the scarifier. On farms where this rule is attended to, there is always some land in a proper condition to be ploughed; and there is never any necessity, either for delaying the work, or performing it improperly.

8. *Fifthly*, Every means should be thought of to diminish labor, or to increase its power. For instance: by proper arrangement, five horses may do as much labor as six perform according to the usual mode of employing them. When driving dung from the farm yard, three carts may be used, one always filling in the yard, another going to the yard, and a third returning; the leading horse of the empty cart ought then to be unyoked, and put to the full one. In the same manner, while one pair of horses are preparing the land for sowing turnips, the other three horses may be employed in carrying dung to the land, either with two or three carts, as the situation of the ground may happen to require. By extending the same management to other farm operations, a considerable saving of labor may be effected.

9. *Sixthly*, A farmer ought never to engage in a work, whether of ordinary practice or intended improvement, without previously giving it the best consideration of which he is capable, and being satisfied that it is advisable for him to attempt it; but when begun, he ought to proceed with it with much attention and perseverance, until he has given it a fair trial. *Seventhly*, It is a main object in carrying on improvements, not to attempt too much at once; and never to begin a work without a probability of being able to finish it in due season.

10. *Lastly*, Every farmer should have a book for inserting all those useful hints which are so frequently occurring in conversation, in books, or in the practical management of a farm. Loose pieces of paper are apt to be mislaid or lost; and when a man wishes to avail himself of these for examining a subject previously investigated and discussed, he loses more time in searching for the memorandum, than would be sufficient for making half a dozen new ones. But if such matters are entered in a book, and if that book has a table of contents, or an index, he can always find what he wants, and his knowledge will be in a progressive state of improvement, and he will thus be enabled to derive advantage from his former ideas and experience.

11. By the adoption of these rules, any farmer will be master of his time, so that every thing required to be done will be performed at the proper moment, and not delayed till the season and opportunity have been lost. The impediments arising from bad weather, sick men, or occasional or necessary absence, will in that case be of little consequence, nor embarrass the operations to be carried on; and the occasion will not prevent due attention to even the smallest concerns connected with his business, on the aggregate of which his prosperity depends.

## Section IV.

1. Farm Implements and Labor-saving Machines.—As farmers generally have more leisure at the present season (February) than at any other time of the year, we would recommend to their attention procuring and repairing such farming implements as they may need for use during the ensuing season. Ploughs, harrows, rakes, hoes, shovels, forks, carts, hay racks, scythes, cradles, and many other things, should be examined and put in order; and if there is a probability of there not being a sufficient number for performing conveniently the required work, it will be proper to procure additional ones to supply the deficiency.

2. We do not wish to advocate a lavish waste of money in buying what would be unnecessary, but to direct the attention of farmers to the importance of always having at hand a sufficient number of tools. It is no evidence of economy to save a few shillings by refraining from the purchase of a rake or a hoe, and afterwards lose a day's work or more, in a hurrying season, in consequence of the deficiency thus occasioned. Neither is it a proof of economy to purchase the cheapest implements only.

3. The cheapest are generally the worst made, and are either weak or clumsy. We have known active men to waste nearly half their strength in using such—in performing, day after day, not

more than two-thirds of the labor they might have done, had they used strong, neat, and well made tools. As it is impossible to work *without* tools, so it is impossible to do work well and expeditiously, without *good* tools.

4. Another important subject, is that of labor-saving implements and machines. There is one great advantage in these, which is generally overlooked. By enabling the farmer to despatch his business, his work is more completely under his control; and he is enabled to guard against loss or damage which might be the consequence of more protracted operations.

5. Thus, for instance, in using the horse rake, he is not only enabled to accomplish the same work with one quarter of the expense he would otherwise have to employ; but by enabling him to perform it so much more expeditiously, he can take advantage of the weather, and have many acres of hay upon the ground without the danger of having it spoiled by rain; as the speed with which he may collect it with a horse rake, enables him to anticipate wet weather.

6. Thus, independently of the *immediate* amount of labor it saves, it prevents the troublesome operation of drying wet hay, after it has once before become fit for the mow or stack. Again, by the use of the planting or drilling machine, one man is enabled to do the work of several; this is one item of saving; but in addition to this, it very often happens that a crop may be planted with it during a favorable season, and while the ground is in the best possible condition; while, without it, the work might be protracted till the ground is rendered unfit by heavy rains; and a loss of many bushels to the acre sometimes arises from crops being planted out of season.

7. A vast amount of labor might be saved by employing a moderate share of thought and contrivance in constructing or procuring, and arranging, some of the simpler and more common kinds of labor-saving machinery. Thrashing machines have become very common, and many are connected with a portable horse power, which may be separated from the machine and applied to other purposes This may be easily, and it sometimes is, attached to a circular saw, (the cost of which is comparatively small,) and the expensive and laborious operation of sawing wood by hand, is rendered expeditious and easy.

8. It may also with a little contrivance, be made to work a straw-cutting machine, a turnip and potato slicer, a corn sheller and other similar machines, which are commonly worked by hand; and this may be frequently done while it is driving a thrashing machine, or

performing other work. We have known a fanning mill to be connected with it, and worked by it, the thrashing machine being situated on a floor above, so that the wheat fell directly from it into the hopper of the fanning mill, and passed out ready for market.

9. We have also heard of a pair of buhr-stones placed in a barn, which could be driven by the horse power of a thrashing machine, and used for grinding food for domestic animals. By a little attention and thinking, numberless similar conveniences may be devised. Improvements of this kind should not however be adopted, until calculation has proved that from the amount of labour they will be required to perform, the ultimate saving will more than counterbalance the immediate cost.

## Section V.

1. Impolicy of Burning Green Wood.—Few things show the tenacity with which we cling, even after the clearest demonstration that such is the truth, to antiquated error, than the fact that there are many individuals at the present day who religiously believe, and what is worse, so far as regards the comfort of themselves and families, practise the doctrine, that green wood for fuel is better, and of course more economical than dry.

2. We think the present season one most admirably adapted to cure such an error as we conceive this opinion to be ; and now while the farmer is suffering with cold fingers from his green wood fire, and he is in good earnest lamenting the leanness of his wood yard, we would request him candidly to review the whole subject, and ask himself whether he had not better desert a position which both sound theory and daily experience show is no longer tenable.

3. The direct experiments of Dr. Black on fuel, and the later ones of Count Rumford on the best mode of producing and economising heat, have, in conjunction with the labors of others demonstrated the very great loss those sustain who use unseasoned wood for the purpose of fuel. Making an estimate of the various kinds of green wood, hard and soft together, and of the same wood when thoroughly seasoned by exposure to the air, the difference is found to be equal to at least one third of the whole ; and if dried at a temperature of 100, the difference will exceed this proportion.

4. Green wood, therefore, contains at least one third its weight of water, and allowing a cord of such wood to weigh three thousand pounds, there will be one ton of wood and a half a ton of water in every cord. That the wood will not burn so long as this water is

present in the wood, all will admit ; it must therefore be evaporated or driven off in the form of steam ; or in other words caloric or heat enough from other sources must be combined with the water to boil away half a ton, or about 120 gallons ; and as this heat must passes off in a latent state, no possible benefit is derived from so great a waste.

5. The amount of dry fuel necessary to perform this operation of boiling away half a ton of water, every farmer can estimate for himself; and we think no one can avoid seeing that whatever this may be, it is a total loss to himself. It is true, as many argue that the consumption of a green stick of wood is less rapid than that of a dry one ; but such forget, it seems, that a much larger quantity must be constantly kept on the fire to produce the same degree of heat ; and that until the green wood has absorbed from other sources sufficient heat to expel the water with which it is charged, the fire is dull and the heat feeble ; there is abundance of smoke, but combustion goes on slowly or not at all.

6. Since the fact of the difference between the weight of dry and green wood as stated above is indisputable, we think that those who have considerable quantities of wood to move would do well to bear it in mind, as by attending to this circumstance, a very great diminution in the amount of labor required may be made ; and the striking off the transportation of thirty-three tons in one hundred, all will agree is no trifling affair. To labor is honorable ; but it is time our farmers should learn that to expend it needlessly is not profitable.

## Section VI.

1. Canada Thistles.—Salt will destroy Canada thistles. It will do this by its own direct agency, and also by an agency that is indirect. It is, I believe, generally known, that salt applied in considerable quantities to the roots of vegetables will destroy their life. I have never known it to fail in doing this except in a case of horse radish in my garden, when I attempted, but without success, to kill it, by the application of strong brine.

2. When Canada thistles exist only in small patches, this will be an easy and expeditious way of getting rid of them. The process is very simple ; first to cut off the thistles a little below the surface of the ground and then apply to the stem of each root a small quantity of salt. A quantity less than a table spoon full will, I think, be sufficient. Strong brine will answer the same purpose. No matter by what philosophical principles of action it is done, the fact is ascertained that salt applied in the manner here suggested, will inflict upon the root a mortal distemper.

3. I have frequently destroyed thistles by salt and by brine, applied in this way, the results in both cases being the same. Care, however, must be taken when salt is used for this purpose, that no stock of any kind run in the field at the time. I salted in one day, and with entire uniformity, three patches of Canada thistles, two of which were in one field, the other in a field adjacent. The experiment, as to the two first mentioned patches, was completely successful, as to the other, it was an entire failure.

4. At first this seemed to involve something of mystery; but the mystery was soon solved, by the consideration that sheep were running in the field where the experiment failed, while there was no stock in the other. The sheep had found the salt and licked it up before there had been time for it to perform its intended functions.

5. Salt, when used to destroy thistles by its indirect agency, is applied to them in small quantities, to induce sheep, cattle and other stock to feed upon them. It may be used to advantage on a scale much larger than when its direct agency is relied upon. In many cases, this is an easy and expeditious method of conquering thistles, there being no difficulty in achieving the conquest in the course of a season. The process is as follows, viz: if the thistles have acquired a considerable growth, they should be cut close with a scythe some days before the salting process is to commence.

6. The object of this is to give an opportunity of sending out young shoots, and clothing themselves with tender or fresh foliage. Salt is then to be strewed on, in quantities sufficient only to render the thistles palatable to the animals that are to feed upon them.—The process of salting is to be frequently repeated, special care being taken not to apply salt so freely as to glut with that article the appetites of the animals. Whatever stock may be put to this use, it must be kept all the while in a condition to be hankering for salt.

7. This being the case, the animals will feed upon the thistles daily, and sufficiently to keep them entirely deprived of their foliage. The thistles, pressed in this manner, will in a little time be under the necessity of capitulating. It is, I believe, generally known, that but few vegetables if any can retain life for any considerable time, if, during the season of vegetation, they are kept continually deprived of their foliage.

8. Several experiments tried by myself to destroy Canada thistles by the means now suggested, have produced the most satisfactory results. In no case have I experienced failure. Here, then, is presented to the farmer, who may have the misfortune to possess

parcels of the Canada thistles, a cheap and expeditious method of getting rid of them. This process need not, as when the direct agency of salt is relied upon, be confined to small patches; but it may be applied to considerable establishments.

9. The farmer who keeps a large stock, say two or three hundred sheep, and other stock in proportion, might by the method now proposed, destroy in one season the thistles of an extensive field, although it were over-run with them. The field to be thus operated upon, might for the season be set apart as the salting place for all the stock on the farm, and the whole stock from time to time be gathered into it to receive their portion of salt, and to graze in the field.

10. This is the vision of my own mind. I have not done it, nor seen it done, neither have I heard of its having been done, yet, I have no doubt that by the use of such means, havock might be made among Canada thistles. From the lights of my own experience, I judge that from the middle of June to October is the best time to operate for the destruction of thistles. In the manner last prescribed, I have commenced operations against them on mowing ground, some weeks after the grass had been taken off, the results of which were their entire conquest the same season.

11. It has been repeatedly announced that thistles may be destroyed by cutting them at the time when they are in blossom, just before a shower. I have never availed myself of an opportunity to test this by experiment. Yet I think considerable confidence may be placed in the utility of such a process. In one instance, having a small patch of Canada thistles near a stream of water, I cut them when they were in blossom, and then gave them an artificial shower by sprinkling water upon them from a water pot. It killed the most of them, and the few that remained exhibited a sickly aspect.

12. In general, Canada thistles, if detected while they are young, can readily be destroyed by the simple act of pulling them up. I have destroyed many in this way. I choose a time for the purpose, when the ground is wet and loose, and have in my hand a pointed stick which, if necessary, I run down, to assist in extracting the root.

13. In July last, I commenced on a patch of Canada thistles which had recently appeared on my premises, an experiment not before tried by myself, nor by others within my knowledge. It was cutting them off with a long bladed grubbing hoe several inches below the surface of the ground, and then settling the ground in a compact form about them, by giving a few blows with

the heel of the hoe. But few, perhaps none, that were so treated have re-appeared. The prospect is that the experiment will result favorably. I think it quite likely that, when Canada thistles grow on stiff ground, or ground that is clayey, they may be destroyed in this way very expeditiously.

## Section VII.

1. Farmer A. who works it wrong.—The world is a world of contrasts, and in no part of it are more striking ones exhibited than exist among farmers. Some seem to be mere cumberers of the earth, and impart their dull, half animated aspect to every thing around them; there are others who seem to impart gladness and freshness wherever they move. One belonging to the first class lately fell under my notice, and his portrait may be given as the representative of much too large a class of men among us. I shall call him farmer A. Travelling is to me a kind of penance; but it frequently places one in situations, and among people, favorable for observation; and a farmer myself, and deeply interested in every thing that relates to their prosperity, their business and their prosperity naturally engross my first attention.

2. I had been directed to Mr. A. as an individual who wished to dispose of his farm, and circumstances rendered it necessary to remain with him through the night. The first aspect of the premises was gloomy and forbidding enough. The "shingled palace," as foreigners delight to call our extravagant two-story wooden houses, had been put up three years before, yet it exhibited few indications that it would ever be finished. The windows were "glazed with boards," one or two excepted, in which a single sash contained a few panes of glass.

3. There were in the rear of the house a few scattering, sorry looking, scrubby trees standing, the remains of an orchard planted by a former proprietor; and I observed some dozen or so of coarse woolled, wild looking sheep, gently browsing on a row of currant bushes, that from their diminutive size and stunted appearance, looked as though they were accustomed to a similar operation, while a straggler or two had commenced pruning the only plum tree visible on the premises.

4. There was what was called a barn and sheds on the farm, but a horse was standing with his head poked through an opening made by a fallen off board, and which board lay half covered and rotting in the dung, the sharp nails sticking up ready to pierce the foot of man or beast; and half the roof of one of the sheds had fallen in from sheer neglect in securing the rafters properly. Not an orna-

mental tree of any kind was near the house; not a fence was discernible except the ghosts of some rail fences; and a dreary community of desolation seemed equally to pervade every part.

5. Farmer A. came originally from "down east," but his long absence from that part of the country, added to the circumstances in which he had placed himself, and his acquired habits, had left in him but few traces of the character that usually marks the provident and intelligent New-Englander. Five times since his marriage had he moved, and though he had lived longer where he then was than in any other place, it being nearly ten years, he was then anxious and preparing to pull up stakes and depart to Michigan or Illinois. His farm was naturally an excellent one, well watered and timbered, and precisely that kind of soil that makes the heart of the wheat grower rejoice, but its whole surface bore sad marks of neglect and improvident husbandry.

6. Farmer A. was not at home when I arrived, but his wife was present. She was undoubtedly once a good looking, amiable woman, but care and neglect had made serious inroads upon her constitution, and, as is too often the case, somewhat tried and deranged the equanimity of her temper. Every one knows, however, that there are men with whom no woman, unless possessed of more than the patience of Job, could live with any degree of peace or comfort; and it is no more than fair to infer that Mr. A. was precisely one of these men. Two or three large awkward girls, and some half a dozen boys, none of them looking remarkably neat or intelligent, made up the family.

7. Soon after the family had taken supper, farmer A. came home, and a single glance at him showed, what indeed his farm had sufficiently indicated before, that he was a devout and not unfrequent worshipper at the shrine of Bacchus, and that great as the triumphs of temperance have been, they had not as yet reached him. Mr. A. had hardly finished his supper, when he began to complain of the hardness of the times, and the great difficulty he found in supporting his numerous family; adding, he believed he must sell out and go to the west, where he could get more land, and live without so much hard work; a reason, by the by, very frequently used, yet but little understood.

8. Wishing to draw him into a little detail of his farming management, I inquired how much land he then owned. He replied, "a little more than two hundred acres." "And how much have you cleared?" "Perhaps two-thirds of the whole," he said. "Your land has every indication of fine wheat land, and with so much in cultivation, your wheat crop this year must have been

heavy, and with such prices as wheat commands, farmers should not complain of hard times."

9. "My land is good enough," he answered, "but this year I was unlucky in my wheat. I did not sow it till quite late; my seed had some chess in it; the fence around the fields was rather low; my cattle and horses would get into them in spite of me; where they nibbled it off the wheat turned to chess, and at harvest I had but little more than enough to supply my family." "But part of your farm is first rate corn land; perhaps your loss in wheat was made up in your corn, and that you know is worth seventy-five cents a bushel."

10. "No, there again my dish was bottom upwards,"—"I think it always is," said his wife in a *sotto voce* tone, calculated to reach me however distinctly, but he did not notice the interruption,—"I had a dozen pigs, and after my corn had been up a week and looked well, that lazy lout," pointing to his eldest son, "whom I had ordered to watch the field, let the pigs lie in it a week, and they destroyed it, root and branch. It was too late to replant, and if I had done that, the frost would have prevented my having more than half a crop; so you see I have not a bushel of corn this year."

11. "But your potatoes?" "My potatoes, with the exception of a few that were injured by the pigs, were passable; but after they were dug and placed in heaps, and while I was waiting to get time to cover them, the boys let the cows get to them, where they eat till one of them was choked to death, and she must stroll off and die where we did not find her till the hogs had torn her, skin and all, to pieces."

12. "Do you have much of a dairy?" I inquired. "No—there is but little profit in making butter and cheese, though some of my neighbors think differently. My boys and girls don't love to milk, so you see the cows, if I had them, would quickly dry up, and the whole concern be good for nothing. I am convinced, as I told you before, that this is no place for me; I must go to the west."

13. While I was conversing with their father, the girls sat staring at us, and doing nothing, while I perceived that two or three of the boys had got into a corner, and were amusing themselves with a greasy and evidently much used pack of cards. As the evening was quite cool, one of the boys was ordered by the father to get some wood. "There aint a single stick," answered the boy, without turning his head from his play. "Where's that load of rails you got yesterday morning?" "Every stick is burnt, and mother picked up wood this afternoon for a fire," responded the urchin.

"Well, you young dog, give us none of your jaw; but go and back a rail, and cut it up quick, and let us have some fire."

14. The rail was brought, cut up, and before ten o'clock we had seen the last of it; nor was it longer a mystery how the house came to stand in an unenclosed common. He had burnt the rails, because he had rather be at the tavern than getting wood, and because he was going to Michigan. The want of rails had made his creatures unruly, and caused the destruction of his wheat and corn, while his children, kept from school to watch his fields, had become as idle and worthless as their parent.

15. While he should have been attending to affairs at home, covering his potatoes and saving his cow, he was swallowing "wet damnation," and his property was in the predicament of a candle lighted at both ends. Farmer A. will go to the west, but unless he effects a prompt and thorough reformation, he will carry with him habits which will ever prevent the accumulation of property; and a family in which idleness and ignorance have already sown the seeds of a plentiful harvest of misery, crime and wretchedness.

## Section VIII.

1. Farmer B. who works it Right.—It was during the same tour in which I met with farmer A. whose system and its results I have given in the preceding section, that I made an acquaintance with another individual whom I shall call farmer B., and if I could convey to my readers but a small degree of the pleasure, which a sight of what industry and good order can accomplish has afforded me in the remembrance of the incidents, I should feel myself amply rewarded.

2. Mr. B. took care to secure a farm containing as many natural advantages as possible, though in this respect I think his farm was inferior to that of farmer A. When he had made his choice, however, he considered it as made for life, and immediately set himself at work to effect a thorough and permanent arrangement of his premises, previous to the course of improvement he intended to adopt. A large farm and great wealth formed no part of his plans—a farm of ordinary size, contentment and competence, were the extent of his ambition, and these things he speedily accomplished.

3. Farmer B.'s house is one of the most perfect specimens of that picture of rural neatness, elegance and comfort, an English cottage, that I have seen in this country. Standing at a little distance from the public highway, unassuming in its altitude and dimensions, embowered in trees, and half hidden in vines and shrubbery, it seems as you approach it the chosen retreat of farming taste

and comfort. The neatly painted pickets of the different enclosures were as firm and perfect as if put on but yesterday.

4. The gates to the different avenues were ready for use without creaking or grating. The avenues themselves were well gravelled, hard and clean—the grass was cut close, and free from all dirt or rubbish, and it was evident the work done here had not been injuriously subtracted from labor required elsewhere; every thing had been done in order and in time, and a glance showed that the whole secret consisted in these two words—good management.—On entering the house, as might have been expected, the same order and neatness was found pervading every spot.

5. Mrs. B. was a middle aged, sensible woman, a good farmer's wife, without the least effort at display or ostentation, but greeting the stranger with a welcome and frankness that gave additional value to whatever obligation she conferred. Two daughters, the one eight, and the other perhaps fifteen, with their mother, constituted the female part of the family. I know of no sight on earth to me more pleasing, or so conducive of delightful emotions, as a beautiful little girl, such as the playful Mary B.

6. They are the rose buds of human nature,—pure themselves, and ignorant of wrong in others, they only delight in seeing others happy,—overflowing with affection which they have not yet learned to hoard for a single favored individual, and unacquainted with those deeper and mysterious influences which startle the young girl, and mantle her cheek with blushes, when she first acknowledges their existence and power; there is a fearlessness and frankness about the innocent creatures, difficult to retain in after life, but which, when combined with purity of heart, form the great charm of female character.

7. Farmer B. was at home when I arrived, and as we walked over his well managed farm, he seemed to feel a rational pleasure in recounting the steps by which he had brought it to such a state of fertility and productiveness, and of which ample proof was found in the fact, that he had that day received six hundred dollars for a crop of wheat grown on twenty acres. Two of his eldest sons were at work in the field, the youngest being at school; Mr. B. remarking, that as he intended his children for farmers, or the wives of farmers, they were kept at school until they were able to aid in the business of the farm, the girls by assisting their mother, and the boys in the field, when the summer schooling was discontinued, but resumed in the winter, or at an academy, as long as was desirable—it being his opinion, that a due regard to health, and an ample acquaintance with the operations of husbandry, demanded that course.

8. Mr. B. said he was a strict utilitarian, and while he submitted as useful to his children, and required in their course of studies, much that others would consider as unnecessary, he would not allow them to consume their time upon courses purely ornamental, and for which in all probability they would find little or no use in their after sphere of active life. Farmer B. was not a visionary or enthusiast in farming; but he loved experiment, and never rejected a proposition because it was new—it was enough that it commended itself to his reason, and was able to bear the close and rigid scrutiny to which he was accustomed to submit all farming speculations.

9. There are few passages in life more delightful than an evening spent in such a family. Intelligent, amiable, and unaffected in their manners, their cheerful courtesy makes one feel at home, and places him at once on one of those green islands that are here and there found in the needlessly broad desert of human life. In the room to which we were introduced for the evening, were a fire, lamps, sofa, carpet, chairs, and what I particularly noticed, a table on which lay one or two of the latest newspapers, a magazine or review, and an agriculural journal of established celebrity.

10. There was an assortment of books, not large, but well selected, consisting of voyages, travels, history, and a number of theological volumes, with one of the popular commentators on the Bible. The family was soon grouped around, and all even to little Mary, were busy, the boys with their books, the girls with their sewing.

11. "You will excuse us," said Mr. B. to me, "but we have in our family long since adopted a practice which we do not like to relinquish: for one hour in the evening, after the usual labors of the day are closed, some one of us, and we intend to do it in rotation, reads aloud for the benefit of the others, and as we have just received a work more than usually interesting, my children would feel deprived of a privilege were this custom omitted this evening."

12. I of course begged I might not be a hindrance to their happiness, and young Mellen, the second son, a lad of sixteen, was called upon to read. The number is but few who enter into the spirit of an author, and understand giving his words and sentiments their proper value and effect. Mellen, however, far exceeded my expectations, and when he named Lamartine's Pilgrimage to the Holy Land, as the work they were reading, I was not surprised they were anxious for its continuation; and when the hour had expired so deeply interested had we all become in the narration of the elo-

quent Frenchman, that by an unanimous vote the book was handed to the eldest daughter, and another hour glided quickly away in listening to her sweet toned voice, and the glowing thoughts of the poetic writer.

13. After what I had seen and heard, I was not surprised to find Mr. B. a man of deep religious feeling, or disposed to wonder at the profound feeling of humility and thankfulness with which he closed the evening by commending us all to the care of a beneficent Creator. After the children had retired, I could not help congratulating Mr. B. on the excellent course he had adopted in his family of accumulating knowledge, and the beautiful effect its influence already exercised.

14. "It is said," he remarked in reply, "that farmers, or their children, do not have as much time to read as the children of professional men or mechanics, and it may be partly true, yet I am convinced the plea which farmers so often urge as an excuse for their ignorance, that they have no time to read, arises more frequently from disinclination to read, than from any other cause.—Few men are sensible how many valuable books are gone through in a year by the reading of one hour a day; and by having them read aloud in the family, all are interested, and all instructed.

15. "As I have accustomed my children to ask questions on what is read and to the correction of errors in the reading, the attention even of the youngest rarely flags during the hour." I went to bed reflecting on the contrast between farmers A. and B., and the different probable results their influence and that of their families would have on their own happiness, and that of the society around them.

16. With farmer A. every thing was at sevens and sixes; nothing in doors or out, in the house or on the farm, as it should be, or as it ought to have been; and this state of things evidently had its effect on the minds of the family, rendering them morose, ill-tempered, I may also say, immoral; as well as continually restless and dissatisfied with every thing around them, without inducing the necessary steps to cure the evils of which they were so ready to complain.

17. On the contrary, at farmer B.'s every thing moved like clock-work, and it was evident his success as a farmer arose from having his work done in season, and from "having a place for every thing, and every thing in its place." Its effects on the family we have seen, and one thing is certain—Mr. B. will not go to the west in search of competence or happiness.

## Section IX.

1. The Story of Uncle Tim and his Son.—Mr. Timothy Treadmill was about the tightest man that ever came from "down east," but although penurious in the last degree he never became very rich. He was a firm believer in the doctrine of "following in the footsteps of his predecessors," and practised it to an iota. The way his father planted corn, he planted it—the same time in the moon that his father sowed peas, he sowed them. The last pair of cart wheels that were seen wearing a streak tire, were Uncle Tim's—and the last of the old wooden ploughs was seen mouldering into its original elements at the back of his wood-house. In short, with the exception of adopting some few improvements in the way of implements, he was precisely as good a farmer the day he left his father's roof, as he was forty years afterwards.

2. That there was any better way of farming than that practised by his father and the rest of the good people down in old Connecticut for so long a time, nothing short of actual demonstration could make him believe. The idea of *improvement* in farming seemed to be as absurd in his mind, as that the bees should set about making an improvement in the construction of their cells, or the birds in building their nests; book farming and *new inventions* were his utter abomination. What! such men as Judge Buel, who never pretended to be a farmer till he was forty years old, undertake to teach *him* how to raise corn and potatoes, who had been a farmer all his days, and his father before him?

3. *He* take a *newspaper* to learn how to farm? no—he knew better than to pay his money for such foolery as that. If any body wanted to read the big stories of *them new fangled farmers* about Albany, about their great crops and their new fashioned kinds of cattle and hogs, he was willing they should, but for his part, he believed he could farm about as well as those that printed newspapers, and raised spotted hogs to sell.

4. His farm was "suitably divided into mowing, pasturing, tillage, and wood-land,"—what was in pasture when he bought the farm remained in pasture still, and what was mowing at that time the ploughshare never disturbed, and what was ploughland then remained still the same. His manure always laid at the barn till fall, because it was so much better for corn after it was nicely rotted, and his barnyard was so situated that the water would run from it in all directions—of course it was always *nice and dry.*

5. When he happened to have a little manure left after planting, be had been known to put a little sprinkling on some spot in his meadow, where he thought daisies and June grass were likely to

run out—but as long as the daisies flourished well he was not alarmed, for he said the farmers down in Connecticut thought they made about the best hay of any thing. In hoeing he was not over anxious about the weeds, for he said they kept the ground light and moist, and that where the quack grass was thickest, he always had the best corn. But as Uncle Tim was not deeply read in natural philosophy, it did not occur to him that the corn and quack both would grow most luxuriantly on the richest spot of ground.

6. But as I said before, Uncle Tim never grew very rich—for, although he saved every thing, the fact was he had *not much to save.* His cattle and his fields being lightly fed, fed lightly in return. It seemed to him that all he gave his cattle beyond what was barely sufficient to keep skin and bone together, was about the same as thrown away, and every hundred of hay he could save to sell in spring, was so much clear gain. And as for laying out any expense to increase his quantity of manure, it was a thing he never dreamed of.

7. But as I said before, starving his cattle and his crops proved to be a bad business, for there seemed to be a fair prospect that it would end in starving himself. He could perceive that the products of his farm gradually diminished from year to year, still he never seemed to suspect that the cause was to be attributed to bad management.

8. There were, however, good things about Uncle Tim. And although errors and prejudices of this kind seemed to be, in a great measure inexcusable, his were entitled to as large a share of charity as those of most other men. There was one thing about which he evinced quite a commendable degree of liberality. He had a son growing up to manhood, and his better feelings induced him to go so far as to say he thought young people now-a-days ought to have a better education than they had 40 or 50 years ago, when he was a young man.

9. In fact, he afforded his son a very tolerable opportunity for acquiring a good common education. And finally young Timothy was becoming quite a reading, and consequently, intelligent young man. This, however, led to consequences entirely unforeseen by the father, and which for a while gave him a good deal of uneasiness.

10. In his intercourse with the more intelligent of their neighbours the young man had occasionally met with agricultural papers, and perused them as far as opportunity permitted, with a good deal of interest. He saw that many of his father's notions about farming were erroneous. The evidences that great and important im-

provements were taking place, were to his mind altogether irresistible. And although he well knew that his father would oppose any innovations, he began occasionally to make known the result of his reading and reflection on the subject, by proposing some little changes in their mode of management, and finally intimated that he should like very well to take the Cultivator.

11. But it was a desperate case, for whatever faith Uncle Tim might have had in more distant things, it was clear that in the matter of *Agricultural improvement*, he had neither faith, nor works. The old gentleman, while he felt disposed to gratify his son in all prudent desires, could not but feel vexed to find him inclined to depart so far from what he considered "the good old paths." Things went on, however, much after this fashion for a considerable time.

12. Timothy would occasionally quote Judge Buel, and speak of the increased profits of the improved methods of husbandry. But to all these representations the old gentleman had always a ready answer. All this, he said, might do very well for *rich men* who lived near a market where all the productions of the farm would sell for ready money, and plenty of manure could be had near by, and for little or nothing. But for small farms, situated as they were away back in the country, to attempt to take those big men for a guide, would be ruinous extravagance. One of Timothy's suggestions, however, rather staggered him.

13. "Well, father," said he one day, as they went out towards the barn, just after a shower, and the streams of water, *as black as your hat*, were running out of the yard, "I think there is one thing we small farmers in the country might do as well as the large ones that live near the cities. If we cannot buy manure, we might take care of what we have; you see that if your barn-yard was *turned bottom up*, it would be just in the shape recommended by Judge Buel, and would hold all this liquid manure that we see running off into the road."

## Section X.

1. Somewhere about these days it came into the heart of Uncle Tim to visit his old friends and relations down in the land of wooden nutmegs, and as his son had never seen much of the world he thought it might be well enough for him to go along too; so after mature deliberation, it was decided that it would be most economical on the whole to go with their own conveyance. Old grey, to be sure, had been worked hard and not *very high fed*, and was a little thinnish, but Uncle Tim guessed he would do to go well enough—he would have a good rest and good keeping down there, and plenty of time

to recruit after he came back. Well, after preparing their box of provisons and their bag of oats, they set off.

2. But Uncle Tim had never foundered a horse in all his life, by giving him too many oats, and he did not mean to begin then—so the bag was not a very big one, and the journey was somewhat longer than they calculated: old grey was a pretty slow horse the latter part of the journey, and if he could have told his mind, would probably have said he was very glad when he reached the end of it. He had then a week or two to rest, but it seemed as if hard times had got to Connecticut before they did, for the granaries were very poorly supplied with oats. The time, however, soon arrived, when they were to set their faces homewards, and the poor old horse, although somewhat rested, was not very much improved in his capacity to perform a journey.

3. Even their small bag was but scantily filled, and to buy oats on the road seemed to Uncle Tim a very improvident way of travelling. So they jogged on with such speed as the circumstances permitted; but before they were within fifty miles of home, old grey gave out, and they were obliged to haul up. The fact was, old grey was a good horse, but he was *used up.* Although he had been a good horse a great while, it was not old age that prostrated him. He had skin and bone and muscle and wind, and four sound legs. The machine was in order, but the *moving power* had been withheld. The poor old horse was as useless as the steam engine without the steam.

4. Well, Uncle Tim and his son were in a bad fix. Their passage home in the stage would cost considerable money, and then to leave old grey there to recruit, and the expense of sending for him, would increase the sum to a pretty important amount—and they could hardly think of selling the old horse for the small sum of ten dollars, which was the most they could get offered for him. The result of their deliberation was, that old grey was left with a farmer near by at a moderate expense, and the father and son took passage home in the stage. It so happened they were the only passengers, so they had plenty of time to think, and occasionally as the spirit moved, to talk a little.

5. "Well, father," said the young man, after a pretty considerable long silence, "I do not know that you think as I do, but it appears to me that our farm and old grey are very nearly in the same situation." "I do not know," said his father, "what there can be about a farm and a horse, that can make them resemble each other so very much." Timothy then undertook to explain.

6. "There is," said he, "what was *once* a good farm, and the

foundation on which to make a good farm now. So there is what was *once* a good horse, and a good frame to make a horse of now. But both have been so overworked and poorly fed that they have become exhausted, and are of but little value. The farm, you know, produces little, if any thing, more than enough to pay for the labor we bestow upon it, and the value of old grey we have had a pretty good opportunity of testing.

7. "Now, it appears to me that I can convince you that under a different course of management, both the farm and the horse would have much more than repaid the extra expense bestowed upon them, and been worth at this day more than double what they are. I am very certain I can as respects the horse, and it is equally clear to my mind with respect to the farm Suppose, then, we had given the horse one peck of oats per day, for the last two months, in addition to what he has had—would not that have enabled him to work considerably harder than he has done, and kept him in good condition?" The old gentleman could not but admit that he thought it would.

8. "Well, now," said Timothy, "do you not think that if old grey was in good working order, he would sell for forty dollars?" "Yes, and more too," was his father's prompt reply. "Now," said the young man, "let us calculate the cost of oats; one peck a day for two months would be nearly sixteen bushels, which, at twenty-five cents per bushel, would amount to four dollars; and as things have turned out, I am sure you will be willing to admit that sixteen bushels of oats disposed of in that way would have been a very judicious expenditure, as, according to our calculation, it would have produced a difference of thirty dollars in the value of the horse." "But," said his father, "old grey is actually worth more than ten dollars, as it will not cost thirty dollars to recruit him up."

9. "Perhaps not," said Timothy; "but whatever it does cost, added to the extra expense of our getting home, and the loss of the work of the old horse after that, would at any rate have been saved by the four dollars worth of oats. And now," said he, "with regard to the farm, you have always told me that it was originally rich and produced great crops; and if it were as good now as it was then, could we not make one hundred dollars more easily than we can fifty now?" "Yes," said his father, "I suppose we could."

10. "Well, now," resumed the young man, "the only question is, whether or not it could have been kept up in its original state of fertility till this day, with the ordinary available means, by a different course of management. I think that it could, and will try to explain as well as I can with my small knowledge of improved

husbandry, what course of management would have been required to effect so desirable a result.

11. "The first great object would have been to increase, by all prudent means, the quantity of manure, and either to use it in a fresh state, or prevent waste by washing or evaporation; and one means of accomplishing this would have been, to *sell no hay*, unless a corresponding amount of manure could have been purchased—but to keep more stock, or, perhaps, to feed what was kept better, so as to consume all the fodder at home.

12. "The next change would have been to divide the farm into smaller lots, so as to pursue what is called a rotation of crops, that is, that the whole may be in turn manured and appropriated to the different kinds of crops; other changes would have been to cultivate the land *better*—to procure more and better implements, and to pay more attention to the breeding of animals of all kinds.

13. "These are the important changes required by what is called "improved husbandry." There are of course many small matters belonging to each that I have not mentioned. And now, although the farm is, as we say, *run out*, a resort to the same measures will raise it to the desired state of fertility; but the improvement must of course be very gradual, unless considerable expense is laid out at the commencement for manure, fencing, &c.

14. "I am aware that this may not appear so plain a case as that of the horse, but I am not able to see how any one can, upon reflection, avoid coming to the conclusion that the two cases are precisely similar. The *fact* is they have both been starved, and for all useful purposes, in their present state, are of very little value. By good food and proper management both may be restored."

15. Uncle Tim kept cool all this time, but it was evident from the way he used up the cuds of tobacco, that he felt a *leetle* uncomfortable. "Well," said he, "I do not think that I shall ever become much of a *book-farmer* myself; but as I am getting old, and as I expect the farm to be eventually yours, and as you are so confident that these new ways are the best, I am willing that you should take the management, and try, and satisfy yourself and *me too*.

16. "I will try and look at your management without prejudice, and at the end of three years, should we both live till that time, if I feel satisfied that the new way is the better way, you shall have a deed at that time." We will only add, that some time before the three years expired, Uncle Tim's deed was made out, "signed and sealed;" and what was still a greater wonder, he had become a constant reader of the *Cultivator*, and said he really did think that Judge Buel had done some good in the world.

## SECTION XI.

### THE FARMERS' FAIR.

Ye husbandmen, both far and near,
  Up, up, stir round, prepare,
With sons, and wives, and daughters too,
  To attend the Farmers' Fair.

Bring wheat and corn of various kinds,
  Bring all that's new and rare,
And barley, oats, rye, buckwheat, millet,
  All to the Farmers' Fair.

Bring pumpkins, squashes, carrots, beets,
  Quince, apple, peach, and pear,
Potatoe, turnip, cabbage, peas,
  And beans to the Farmers' Fair.

Bring "sheep and oxen," large and fine,
  And cows, and horse and mare,
And *pairs* of horses, asses, mules—
  Bring all to the Farmers' Fair.

Bring heifers, steers, and stately calves,
  Let "bulls and goats" be there,
Bring natives, short horns, long horns, no horns,
  All to the Farmers' Fair.

Bring porkers spotted, porkers white,
  Suit every connoisseur—
Let Berkshire, Byfield, China, Leicester,
  Meet at the Farmers' Fair.

Ye wives and daughters bring your best,
  And best with good compare;
Bring *something* that your hands have wrought,
  And come to the Farmers' Fair.

Bring golden butter, melting cheese,
  Bring nick-nacks rich and rare;
Let woollens, cottons, linens, silks—
  Bring praises on THE FAIR.

Mechanics, too, and artists come,
  Bring samples of your ware;
Display the products of your skill,
  And crowd the Farmers' Fair.

Bring cultivators, harrows, ploughs,
  All made for wear and tear;
Corn planters, drills, yokes, shovels, hoes,
  And rakes to the Farmers' Fair.

Machines for thrashing, fanning mills,
  Horse-power and smaller ware,
Straw-cutter, corn-mill, cheese-press, churn—
  Bring all to the Farmers' Fair.

One word to *him* of generous soul,
  Who loves *thus to prepare*—
Oh, let that "Farmers' coat of arms,"
  Be here at the Farmers' Fair.

Ye clergy, teachers, students, come,
  Come taste the bright blue air;
Pale, sallow, sickly, "feeble folk,"
  Turn out to the Farmers' Fair.

Ye Lawyers, Doctors, Merchants too,
  Come gather round—for where
Shall *non*-producers learn *their place !*
  Save at the Farmers' Fair.

Come men and women, old and young—
  Let boys and girls be there;
Come rich, come poor, come mute and blind—
  Come ALL to the Farmers' Fair.

Bring smiling faces, cheerful hearts—
  At home leave gloom and care—
Let a right good hearty shake of the hand,
  Go round at the Farmers' Fair.

The Farmers' Fair—that glorious day—
  May U and I be there;
And friendship, joy, and peace unite,
  To bless the Farmers' Fair.

The Farmers' Fair—oh glorious day,
 Lov'd here and everywhere;
Now all in chorus join and raise
 Three cheers for the FARMERS' FAIR.

## CHAPTER VII.

### SECTION I.

1. GOOD MAXIMS FOR FARMERS IN THE MANAGEMENT OF THEIR BARN-YARDS.—Having submitted to our readers all that occurs to us of importance on the subject of *farm-yard manure*, we shall here recapitulate a summary of the chief points which we deem particularly worthy of their consideration. *Firstly*, to bottom the barn-yard with furze, fern, dry haulm, or any other loose refuse that takes the longest time to dissolve, and over that to bed it deep with straw. *Secondly*, to occasionally remove the cribs of store cattle to different parts of the straw-yard, in order that their dung may be dropped, and their litter trodden equally.

2. *Thirdly*, to spread the dung of other animals, when thrown into the yards, in equal layers on every part. *Fourthly*, to remove the dung from the yard at least once, or oftener, during the winter, to the mixen. *Fifthly*, to turn and mix all dunghills until the woody or fibrous texture of the matter contained in them, and the roots and seeds of weeds, be completely decomposed, and until they emit a foul and putrid smell, by which time they reach their greatest degree of strength, and arrive at the state of spit-dung. *Sixthly*, to keep the dung in an equal state of moisture, so as to prevent any portion of the heap from becoming fire-fanged. If the fermentation be too rapid, heavy watering will abate the heat; but it will afterwards revive with increased force, unless the heap be either trodden firmly down or covered with mould to exclude the air.

3. *Seventhly*, to ferment the dung, if to be laid on arable land during the autumn, in a much less degree than that to be applied before a spring sowing. *Eighthly*, to lay a larger quantity on cold and wet lands than on those of a lighter nature, because the former require to be corrected by the warmth of the dung; while on dry, sandy, and gravelly soils, the application of too much dung is apt to burn up the plants. Stiff land will also be loosened by the undecayed fibres of long dung, which, although its putrefaction will be thus retarded, and its fertilizing power delayed, will yet ultimately afford nourishment.

4. *Ninthly*, to form composts with dung, or other animal and vegetable substances, and earth, for application to light soils.—

*Tenthly*, to spread the manure upon the land, when carried to the field, with the least possible delay ; and if the land be arable, to turn it immediately into the soil. *Eleventhly*, to preserve the drainage from stables, and dunghills in every possible way ; and, if not applicable in a liquid state, to throw it again upon the mixen. *Twelfthly*, to try experiments, during a series of years upon the same soils and crops, with equal quantities of dung, laid on fresh, and afterwards rotted, in order to ascertain the results of their application to the land. The whole quantity to be first weighed or measured, and then divided.

5. The fermentation of farm-yard manure is, in fact, a subject of far greater importance than is generally imagined ; for on a due estimation of its value mainly depends the individual success as well as the national prosperity of our agriculture. The experiments to which we point cannot fail therefore to come home to the interests of every man: they may be made without expense, and without any other trouble than the mere exercise of common observation and intelligence.

6. Leaving aside, however, the discussion concerning the disputed worth of fresh or fermented—of long or short dung—let the farmer sedulously bend his attention to the accumulation of the utmost quantity that it may be in his power to procure. The manner and the time of using it, in either state, must, however, be governed by circumstances which may not always be within his control ; and every judicious husbandman will rather accommodate himself to the exigency of the case, than adhere strictly to his own notions of what he conceives to be the best practice. In fine, whether favoring the one or the other side of the question, let him collect all he can, and apply it carefully to his crops, and then, trusting to events, "*let the land and the muck settle it.*"

## Section II.

1. The Simple Elements in Chemistry.—If it be our desire to obtain the utmost possible benefit which the exercise of our control over the operations of nature is capable of producing, it is indispensable that we should first know the *character of the materials* which she employs, and the laws to which they are subject. Without such information all practice must be merely experimental, and experiments can afford no certain guide to their real effects unless we are acquainted with all the conditions under which they have been made. To understand, therefore, the best method of managing and applying farm-yard manure, it is needful to commence with obtaining some knowledge of the elements or materials of which it is formed.

2. The mass of matter of which the whole surface of the earth is composed, consists of about fifty-five simple substances termed *Elements*, each of which has its distinct character and disposition to combine with other elements, which is called its *affinity for those elements*, and which it manifests in a much stronger degree towards some than towards others. When one element, by virtue of this affinity, unites with another, it is always in a certain fixed and known proportion or weight, and the number expressing that weight is called *its proportional or equivalent number*.

3. To exemplify this, if eight pounds of the gas called oxygen be mixed in a close vessel with one pound of the gas called hydrogen, or inflammable air, and fire be then applied to them, they will unite and form nine pounds of water: therefore, one is called the proportional, or equivalent number of hydrogen, and eight that of oxygen; because they unite in those proportions and form a neutral compound. The latter is called *neutral*, because it resembles neither of the substances from which it has been formed. If, instead of eight pounds of oxygen, twelve pounds had been used, the extra four pounds would have been left in its original state; that is, would not have been neutralized, and only nine pounds of water would have been produced, as in the former instance.

4. But in some instances, an element will unite in *two or more* proportions with one, or with *two or more* proportions of another element, producing substances of very different qualities from each other. The equivalent number of carbon *(charcoal)* is 6, and 6 pounds of that substance will unite with 8 of oxygen, forming a gas called *carbonic oxide*; but if 6 pounds of carbon be burned in a close vessel with 16 pounds, or two equivalents of oxygen, they will form *carbonic acid gas*. It therefore appears that carbon is capable of uniting either with one, or with two, equivalents of oxygen.

5. These resulting compounds have *their* equivalent numbers also, in which proportions they unite with other elements, or compounds, and the numbers which express their equivalents are the sums of their elements. Thus the equivalent of water is 9, the sum of oxygen 8, and hydrogen 1. That of carbonic *oxide* is 14, the sum of carbon 6, and oxygen 8, and that of carbonic *acid* 22; the sum of carbon 6, and *two* equivalents of oxygen 16. Now quick-lime is a compound (as will hereafter be shown) whose equivalent number is 28.

6. If, therefore, 28 grains of lime be dissolved in water, and the solution be agitated in a jar containing 22 grains of carbonic acid gas, the whole of the latter will unite with the former; the lime will lose its burning quality, and subside to the bottom of the jar,

as an insoluble compound called *carbonate of lime*, mild lime, or lime-stone. The equivalent number of this substance is 50—being the sum of 28 and 22; which are the respective equivalents of lime and carbonic acid.

7. It matters not whether we use grains, or pounds, as the equivalent proportions are the same in both cases. Such are the simple and beautiful laws which regulate the combination of elements and their compounds; from a due consideration of which, it will be easy to comprehend how, from a very small number of elements, such an infinite variety of substances as nature presents to our view may be produced.

8. It has been noticed that one element has a stronger affinity for, or disposition to unite with, some other particular element than with the rest; so that, if it were placed among many others, it would select that for which it had the strongest affinity. If, when thus united, another element were presented for which it had a stronger affinity or attraction, it would leave its former companion and unite with the last. This is what is called *elective attraction*, from the element choosing, as it were, its companion; and the same action takes place among compounds.

9. For instance, when carbonate of potash—which is a compound of potash with carbonic acid—is dissolved in water, if a solution of quick-lime be added, the carbonic acid will leave the potash, and unite with the lime to form carbonate of lime, which will sink to the bottom; leaving the pure potash dissolved in water. If this solution be now poured off, and the carbonate of lime washed, dried, and then thrown into vinegar, or any other stronger acid, the lime will unite with the stronger acid, and the carbonic acid will escape as gas.

**10.** In this case the lime had a stronger *affinity* for carbonic acid than the potash had, but had a still stronger affinity for the vinegar, or last acid which was applied to it. It is this action of elements, or their compounds, upon each other, which is the cause of those changes which are called *decay*, or *decomposition*, *fermentation*, and *putrefaction*, in vegetable and animal substances.

**11.** In living plants and animals, the elective attractions of their elements are controlled by the vital principle, and they are thereby combined under a different arrangement than that which they would otherwise have assumed. But when life ceases, the several elements exert their original affinities; each selects that for which it has the strongest attraction, a general dissolution of the animal or plant ensues, and, as the new combinations are mostly volatile, consisting of water and various gases, the bulk rapidly diminishes, and in a short time only a small mass of black mould remains.

12. This is precisely what takes place *when dung is allowed to rot*, as it is called; and such is the waste to which its valuable elements are subjected, all of which are the proper food of plants, and capable of being taken up by the roots at the moment they leave the original mass from which they were separated. The fact of the elements and the compounds they form uniting in certain proportions, has long received such numerous proofs that it is called the *law of their combination.*

13. It has been thought necessary to say thus much of the *general nature of elements*, in order to enable readers who are not acquainted with chemistry, to understand what is meant by certain terms which must be used in speaking of those changes which are continually going on in the works of nature; and over some of which we are daily exercising a control in the management of vegetable and animal substances, of which the farmer's operations in the management of manure present an important instance.

14. Let it be here observed, that as it is not pretended in the following sections to treat of the chemical nature of substances farther than may be conducive to a more judicious management of farm-yard manure, the curious reader must have recourse to professed chemical works for more exact and particular information. He will find the inquiry full of interest, and well deserving of some portion of his hours of leisure.

15. It has been already observed that there are about fifty-five simple substances or elements; of these, however, only fourteen usually enter into the composition of plants, and are therefore all that immediately concern our present subject. They are the following:—*oxygen; hydrogen; carbon; nitrogen; chlorine; sulphur; phosphorus; iron; alumina* or *clay; silica* or *flint; potash; soda; lime;* and *magnesia.*

16. The four last are not, strictly speaking, simple substances, or elements, as they consist of certain bases united with oxygen; but as they are never found in their elementary condition, it will be convenient to consider them as simple bodies. The four first are often called *organic substances*, because of them are formed the organs of plants and animals. The others are called *mineral substances*, merely because they are derived from the earth; they are, however, no less essential to the existence both of plants and animals than the former.

## Section III.

1. Oxygen constitutes one-fifth of the air we breathe, and without its presence in the air animals could not exist a moment; plants

would also soon perish; and it has, on this account, been called *vital air.* Its combining proportion, or equivalent number, is 8, and it exists in water in the proportion of eight parts in nine, hydrogen forming the other part, as has already been shown. It combines with all the other elements, forming in some proportions those substances called *oxides*, and, in other proportions, *acids.* Some of these oxides and acids exist in a gaseous form; but, for the most part, they are either in a fluid or solid condition, and, in the latter state, it constitutes nearly half the solid crust of the earth.

2. When common air is drawn into the lungs, the oxygen which it contains is converted, by its union with carbon, into carbonic acid gas; with hydrogen into water; and, in these states, is expired in the act of breathing, along with the nitrogen, or azote, of the air. The gas, thus expired, being deprived of oxygen in a pure uncombined state, is no longer capable of sustaining life; and it is owing to the consumption of oxygen—that is, its conversion into carbonic acid gas, and water—that animals soon die when confined in close places.

3. The distressing sensation experienced in crowded assemblies, when free access of air cannot be obtained, is owing to the same cause. Oxygen is equally necessary to plants as to animals, as its presence is indispensable to the germination of the seed, and to the subsequent growth of the plant; for if seed be trodden down in wet clay it will not sprout, but will perish for want of the supply of this vital principle. Thus plants often languish for want of a due supply of air to their roots; and, on the contrary, flourish most when it is plentifully admitted by the operation of hoeing, and other modes of opening the soil.

4. It is not only essential to the immediate support of the life of animals and plants, but also the most active agent in producing the decomposition or decay of dead bodies, and their destruction by fire —by uniting slowly in the first instance, and rapidly in the last, with the substances or elements of which they are composed. The action of decay commences as soon as life ceases; and the action of combustion, or burning, as soon as the substance is sufficiently heated.

5. It has been briefly noticed before, that by the union of oxygen with metals and other combustible substances, is formed that numerous class of compounds called *oxides.* These derive their distinctive names from the substance with which the oxygen unites. Thus we have carbonic oxide, oxide of iron, oxide of lead, &c. It is a curious fact, that notwithstanding the perpetual waste in consumption of oxygen by fire, and by the breathing of animals, the quantity in the atmosphere continues the same.

6. The oxygen which is removed from the atmosphere by being united to carbon and hydrogen—in the manner just described to form carbonic acid gas and water—is, by a most beautiful economy of nature, again restored to it by the action of the leaves of plants. These curious little workshops imbibe the carbonic acid from the air, separating the carbon from it, and also a portion of the hydrogen from the water of its own sap. These elements are retained to form the plant, while the oxygen with which they were united by the action of burning and breathing, as explained before, is again restored to the atmosphere.

7. HYDROGEN, or inflammable air, is, as before mentioned, the other element of water, and is the lightest of all gases. Its combining proportion, or equivalent, is *one*, and it exists in most vegetable substances, combined with oxygen, in that proportion; that is, in the proportion of 1 atom whose equivalent is 1 of hydrogen, and 1 atom of oxygen whose equivalent is 8, as before stated. It must be understood that we now speak of the *dry* plant as distinguished from the sap.

8. The oil expressed from the seeds of plants, as well as the oil and fat of animals, owe their greater inflammability to the excess of hydrogen in those substances, above what is necessary to form water with their oxygen. When coal or oil is distilled, the hydrogen which those substances contain dissolves a portion of their carbon, and thus forms the gas of our street lamps. During the putrefaction of animal substances, hydrogen dissolves a portion of their phosphorus, and sulphur, and produces those stinking gases called *phosphuretted* and *sulphuretted* hydrogen.

9. CARBON constitutes about 50 per cent. both of vegetable and animal matter. Its equivalent number, as before noticed, is 6. We are most familiar with it in the state of charcoal and lamp-black. If a piece of charcoal be heated to a certain degree in the open air, oxygen unites with it, and forms carbonic acid gas; and if this action be continued, nothing remains but a few ashes. If it be heated to the same degree in a close vessel containing pure oxygen, the whole of the oxygen will be converted into an *equal bulk or volume* of carbonic acid gas, by its union with the carbon of the charcoal.

10. Carbonic acid gas is constantly found in the atmosphere, and constitutes about one-thousandth part of its weight. It is from this source that plants, either directly or indirectly, derive all their carbon—directly, by means of their leaves, and indirectly, from the decay of vegetable matter in the soil which owed its carbon to the atmosphere.

11. Carbon is a powerful antiseptic; for if meat be kept in powdered charcoal, or in water containing that powder, it will be preserved a very considerable time from putrefaction. It is also a great promoter of vegetation. Plants placed in powdered charcoal, if well supplied with water, grow with great rapidity, and the smallest cuttings, or even portions of leaves, take root. The effect of soot, as a manure, is partly owing to the carbon it contains in a state of minute division. It is dissipated in vast quantities by the fermentation of farm-yard dung, from which it escapes, combined with oxygen as carbonic oxide, carbonic acid, and with hydrogen as carburetted hydrogen.

12. NITROGEN is a gaseous element, indispensable to the existence both of plants and animals. It is found, however, only in small quantities in some of the substances which compose the former, but abounds very much in the latter; and it is this abundance which forms the principal and most striking distinction between them. Its combining proportion, or equivalent number, is 14. When animal substances undergo putrefaction, their nitrogen unites with three equivalents of hydrogen to form ammonia.

13. In this state it is capable of forming nitric acid by the aid of an earthy or alkaline base, and in this change five equivalents of oxygen take the place of three equivalents of hydrogen. The acid thus formed unites with the base and produces a *salt* called *a nitrate*. If the base be potash, it is called a nitrate of potash (*nitre*); if soda, nitrate of soda; and if lime, nitrate of lime. This change takes place most abundantly in warm climates, from whence such salts are commonly obtained. It must, however, occur in all soils under cultivation, which contain animal matter; and the transformation is promoted in the operation of fallowing, by exposing such putrefying substances to the action of the air.

14. Most persons must have observed, that in stables, the mortar between the stones or bricks becomes soft and falls out. This is owing to the putrefaction of the urine first producing ammonia, and then nitric acid; which, uniting with the lime of the mortar, forms nitrate of lime, which is so soluble a salt that it easily washes out. It is the presence of nitrogen, in the form of ammonia, which is the principal cause of the powerful effect of manures of animal origin, and particularly of urine, from which it is abundantly produced.

15. The decay and putrefaction of vegetable and animal substances are continually supplying ammonia to the atmosphere, which is brought down again in every shower of rain, and in this way is supplied both to the leaves and roots of plants. Green crops thus fix and accumulate ammonia in the soil; which, together with the occasional sup-

ply in farm-yard dung, enables it to yield the great quantity of this substance required for the growth of grain.

15. NOTE—It has been observed, that oxygen constitutes about one-fifth of the atmosphere, the other four-fifths is nitrogen, sometimes called azote; but the nitrogen of plants and animal substances is said not to be derived from this source, the latter being always found in a state of combination with other substances. Liebig mentions that there is no natural process or artificial means which can be proved to cause the nitrogen of the atmosphere to enter into combination to form either ammonia or nitric acid. That profound and accurate chemist was the first to detect the presence of nitric acid in rain water, the production of which he attributes to ammonia, which is always contained in the atmosphere.

SECTION IV.

1. The above described four elements—oxygen, hydrogen, carbon, and nitrogen—constitute upon an average about 94 per cent. of plants in a dry state. When plants are burnt in the open air, they undergo a new arrangement, and, with the addition of the oxygen of the air, the three first are resolved into water and carbonic acid gas, leaving behind the remaining 6 per cent. in the form of ashes, consisting of earthy and alkaline salts; which substances act a very important part in the nutrition of plants when they are again returned to the soil. These will be more particularly noticed hereafter.

2. CHLORINE is an elastic fluid, or gas, of a very disagreeable smell, and is not respirable, being exceedingly offensive to the lungs. Its equivalent number is 36, and with one equivalent of hydrogen it forms muriatic acid.

3. SULPHUR is that well known inflammable substance used for making gunpowder and other combustibles. Its equivalent number is 16. United with 3 equivalents of oxygen it forms sulphuric acid or oil of vitriol.

4. PHOSPHORUS is a pale red substance highly inflammable, so much so that it takes fire at the ordinary temperature of the air. Its equivalent number is 12, and it unites with two equivalents of oxygen to form phosphoric acid. This acid united with lime and magnesia forms the earth of bones.

5. IRON is too well known to need a description. Its equivalent number is 28. It unites with one equivalent to form black oxide of iron, that substance which flies off under the smith's hammer in the operation of forging; with another equivalent of oxygen, red oxide, or rust of iron, is produced. This substance is indispensable to the existence of almost all plants, and acts a most important part in the functions of animal life, as it is contained in the blood; and life every moment is dependent upon its presence in the act of res-

piration or breathing. It is the means by which the oxygen, or vital air, when drawn into the lungs, is separated and conveyed by the circulation to every part of the body; and if this action of the iron in the blood be prevented, as it sometimes is by breathing other gases which are therefore called poisonous, life instantly ceases.*

6. Potash, soda, lime, magnesia, silica or flint, and alumina, are all oxides; that is, they consist of bases which have the nature of metals united with oxygen, and are never found separated from it in a natural state. It is indeed only by the most powerful chemical agencies that they are proved to be so compounded—that is, that they can be separated; they may, therefore, be considered as simple substances. They are commonly called *bases* from their tendency to unite with acids.

7. Potash and Soda are called *alkalies*. The former is always found, and the latter very commonly, in the ashes of plants, united with acids. Besides other important purposes which potash serves in the nourishment of plants, it forms, with silica or flint, that hard external covering of all the grasses.

8. Lime and Magnesia are called alkaline earths, and are the bases of the earth of bones, as before noticed.

9. Silica and Alumina are termed earths, though the former is sometimes called an acid, from its tendency to unite with the bases. When a stiff soil is mixed with a considerable portion of water, well stirred, and then allowed to rest, the grosser part, consisting of sand and stones, will quickly subside; if the turbid water be then poured off, the fine particles suspended in it will in a short time settle, or might be more readily separated by passing the water through a filter of paper. The earthy matter thus separated is what is called *clay*, though, in reality, it consists of about equal quantities of silica, or pure flint, and alumina, or pure clay.

10. We have thus briefly described the composition of five different acids: namely—the *carbonic*, *nitric*, *muriatic*, *sulphuric*, and *phosphoric*. These are called *mineral acids*, because they are commonly found united with mineral substances. When these are chemically united with the oxides, or bases, subsequently mentioned, they form what are called *mineral salts;* which have received names signifying at once the particular acid and base of which they are composed. Thus a salt composed of carbonic acid united with a base, is called a carbonate of that base; as carbonate of lime, carbonate of potash, carbonate of soda, &c.

11. If a base is united with nitric acid, the salt is called a ni-

* Professor Liebig, On the Theory of Respiration.

trate; with muriatic acid, a muriate; with sulphuric acid, a sulphate; and with phosphoric acid, a phosphate of that base; making carbonates, nitrates, muriates, sulphates, and phosphates of the several bases, according to the acid with which each is respectively united. Silica, as before noticed, is sometimes called an acid, because it unites with certain bases in the manner of an acid. United with potash it forms a silicate of that base, and is a very important ingredient in manure for corn and grass crops.

## SECTION V.

1. THE GENERAL COMPOSITION OF BARN-YARD MANURE.—In a general view, *Barn-yard Manure* consists of refuse straw, hay, chaff, and grass, and of the dung and urine of animals which are fed in the sheds and stables of the yard.

2. *Straw* consists of carbon, oxygen, and hydrogen; the two latter in the proportions which constitute water, with some portion of nitrogen, and of earthy and alkaline salts. It has been before stated, that the three first elements are abundantly supplied to the growing plants by the atmosphere, and that, therefore, ammonia and the earthy and alkaline salts are the most valuable parts as manure. The value, however, of the combustible part of straw is by no means inconsiderable, as it serves, in the undecayed state, to receive and retain the urine of animals; and, when placed on the ground, attracts moisture from the air, which it supplies to the roots of plants.

3. By its decomposition, it increases the temperature of the soil; and, at the same time, yields carbonic acid gas to the roots of plants, before their leaves are sufficiently expanded to enable them to derive that substance from the atmosphere. Dry straw, when burnt, yields about 5 per cent. of ashes. Professor Johnson gives the following analysis of 100 parts of the *ashes of straw* of different kinds:—

| | Wheat Straw. | Barley Straw. | Oat Straw. |
|---|---|---|---|
| Potash - - | ½ | 3½ | 15 |
| Soda - - | ¾ | 1 | – – |
| Lime - - | 7 | 10½ | 2¾ |
| Magnesia - - | 1 | 1½ | ½ |
| Alumina - - | 2¾ | 3 | – – |
| Oxide of Iron - | – – | ½ | – – |
| Silica or flint - | 81 | 73½ | 80 |
| Sulphuric acid - | 1 | 2 | 1½ |
| Phosphoric acid - | 5 | 3 | ¼ |
| Chlorine - - | 1 | 1½ | – – |
| | 100 | 100 | 100 |

4. The *alkalies and earths* are united with the carbonic and mineral acids as salts, the former of which the Professor has not stated. Some of these salts are soluble, but the larger part are insoluble. The soluble part of the ashes of wheat straw is about 9 per cent. The ashes of the corn of the several kinds consists of the same salts, except that they contain a much larger portion of potash and soda. The Professor observes, that "plants may leave the same weight of ashes when burned, and yet the nature of the ashes be very different: the ash of one may contain much lime; of another much potash; of a third much soda; while in a fourth much silica may be present."

5. Thus 100 pounds weight of the ashes of bean straw contains 53½ pounds of potash, while that of barley straw contains only 3½ pounds in the 100. On the other hand, the same weight of the ashes of the latter contains 73½ pounds of silica, while those of the bean straw produce only 7½ pounds. The different kinds of chaff produce similar ashes to the straw, but always contain a greater portion of silica. It should, however, have been observed, that straw of different kinds yields only a very small quantity of nourishing matter to cattle.

6. *Grass and hay* contain in their combustible substances a very considerable portion of nourishing matter in the shape of sugar, starch, and compounds containing nitrogen, to the presence of which, and particularly the latter, hay owes its superior effect as fodder. The saline and earthy portions correspond nearly with those of straw, but are much more abundant, and produce similar effects as manure.

7. The following *analysis of hay* is given by Professor Liebig:—116 parts of hay dried in the air produced 100 parts when dried at the heat of boiling water. The 100 parts so dried consisted of

| | |
|---|---|
| Carbon | 45.8 |
| Hydrogen | 5.0 |
| Oxygen | 38.7 |
| Nitrogen | 1.5 |
| Ashes | 9.0 |
| | 100.0 |

8. The *salts* which are constantly found in the *ashes of plants* must be essential to their growth; and it may be easily conceived that as they abound in a soil, it will become more fertile. From the different proportions in which we have seen they abound in plants, it may also be readily understood how a soil may be more favourable to the growth of one plant than to another; and also

why a soil which may be favourable to the growth of straw will not produce much grain—owing to the deficiency of potash to supply the demand of the latter. Such is the efficacy of ashes as a manure for meadow-land, that in Germany, according to Professor Liebig, no other kind of dressing is applied, and by their means alone, the most abundant crops of grass are obtained.

9. The extensive foliage of the grasses, and particularly of the trefoils, obtains from the air all the carbon and nitrogen to form, with the elements of water, the nourishing substances they yield. The importance of the earthy parts of plants will be the better appreciated when it is known as a fact, reported by the highest chemical authority, that in certain situations the bones of cattle and horses are very defective in solidity and strength, owing to the deficiency of *bone earth*, one of the principal constituents of ashes. It is highly probable that a similar deficiency in our dairy pastures might, in many situations, have an effect in affecting the quality, if not the quantity, of milk, which always contains phosphate of lime and magnesia in considerable quantity.

SECTION VI.

1. COMBUSTION AND DECAY OF PLANTS.—We have already said that plants in a dry state, such as straw, hay, &c., consist of carbon, hydrogen, and oxygen; a very small portion of nitrogen, and of about six parts in 100 of alkaline and earthy salts; and that the former elements are placed, by the operation of the vital principle, under a different arrangement with regard to each other from that which their chemical affinities give them a tendency to assume.

2. The combustion or burning of vegetable substances is nothing more than a rapid and violent action of those affinities or attractions, in which oxygen plays a principal part. When they are heated to a certain degree, both the oxygen of the air and that already contained in the substance are brought into action, and the result will be easily understood from what has been previously stated of the nature of the elements concerned.

3. The oxygen unites with the carbon to form carbonic acid gas, and with the hydrogen to form water, while a small portion of the hydrogen unites with nitrogen to form ammonia, or (though subject to some doubt) passes off uncombined. Carbonic acid gas is the most abundant of these products, water the next in quantity, and ammonia by far the least. These all escape as gases, and the ashes that remain consist of some or all of the oxides, or bases, before described, united with some or other of the mineral acids—as alkaline and earthy salts, which differ very much, both in kind and quantity, according to the plants from which they are derived.

4. As these salts, or mineral substances, constitute an essential part of all plants, they are themselves capable of acting powerfully as manure. The most valuable, and generally the most plentiful of them, are the salts of potash, and the phosphates of lime and magnesia; not that the other salts contained in ashes are less essential; as, for instance, muriate of soda (*common salt*) and sulphate of lime *(gypsum)*, but because the latter are more liberally supplied to the soil by the hand of nature.

5. If, instead of being burnt, plants are accumulated in heaps exposed to the weather—as in a dung-yard—a similar action to burning, though of slower operation, takes place; which indeed may be called a tardy combustion, in which the elements of the water present take an active part. The greater portion of the carbon, hydrogen, and oxygen, with nitrogen, are thus dissipated; the sulphates and phosphates are decomposed, producing stinking gases; and if in the meantime water be allowed to soak through the mass and drain away, it carries with it the soluble salts, ultimately leaving a black mass, consisting chiefly of carbon, with a small quantity of hydrogen and oxygen, and some insoluble earthy salts.

6. If, therefore, decay be allowed to proceed to its greatest extent, it produces a much worse effect than absolute fire; inasmuch as almost all the soluble salts are lost. Vegetable matter reduced to this state is *humus*, or that black vegetable matter contained in all rich soils, and those of old pasture land. The only difference is in the mode of their production, the one having been produced by the decay of plants on the surface, and the other from the decay of the roots and leaves of plants both above and beneath the soil. They operate in the same way in the nourishment they yield to plants, namely, by the salts they yet retain, by attracting moisture and ammonia from the atmosphere, and by slowly yielding carbonic acid gas to the roots of the growing crop.

7. If the quantity of water which mixes with the heap be limited, it is often evaporated by the heat produced by the fermentation; the chemical action in a great measure ceases; and the heap, when opened, exhibits that appearance which is commonly called "*fire-fanged.*" When in that state, it will be found to have lost more than one-half of its value; but, if due care be taken to regularly mix the layers of dung, without too much intermixture of horse litter, there will be no danger of the dung made by the cattle in the yards being overheated by fermentation, even in the warmest weather. Should that danger, however, be apprehended, an addition of road-scrapings, or earth of any kind, will prevent it; and, in the winter

the cleanings of the cow-house, as being of a cold nature, will answer the purpose.

8. When plants and their seeds are consumed by animals, nearly half their weight in a dry state is given out from the lungs and by perspiration from the skin in a gaseous form, chiefly as carbonic acid gas and water, with some ammonia; the remainder of their substance, together with the effete, or dead matter, of the animal organs, are rejected, as dung and urine, except that portion retained as nourishment by growing and fattening animals. The *solid excrement* contains the woody fibre, the insoluble animal matter and salts, and the *urine* the more soluble salts and substances, rich in nitrogen.

9. If no care be taken of the urine, and it be allowed to run about the yard, it soon putrefies—its nitrogen flies off in the shape of ammonia; its salts are carried away by every shower of rain; and, although a portion of it may be saved by its mixture with the dung of the cattle, yet the greater part of its valuable contents is evaporated by the action of the atmosphere. If it be allowed to drain into a tank or other receptacle, it there also rapidly undergoes putrefaction: and, if this be not checked, a considerable part of the ammonia produced will escape with the sulphur and phosphorus, resulting from the decomposition of the salts containing those substances: occasioning the intolerable stench observed in such cases.

10. Now the ammonia, and the alkaline and earthy salts, are by much the most valuable part of farm yard or stable dung, and the former is always more abundant when cattle are fed with corn, oil cake, and other rich food. Without ammonia no seed could be produced; and without alkaline and earthy salts, neither seed nor plants could exist.

SECTION VII.

1. CAUSES OF STERILITY.—It is the deficiency of some of these substances, where moisture is not wanting, which is the cause of the land producing poor crops: and it is the almost total absence of some, or all of them, which is the cause of complete sterility. Instances may almost everywhere be found of land which, though abounding in humus—such as heathy and peaty soils—are, notwithstanding, incapable of bearing grain. If the valuable substances above mentioned be wasted in the manner described—which is too often the case, to an enormous extent—the crops will be very deficient; and if to this waste be added the carrying away of large portions of the produce—as when hay and straw are sold, and no manure returned—the land will soon cease to bear crops.

2. To increase the quantity of manure raised on the land should, therefore, be the constant aim of every farmer: hay should never be sold, unless two tons of stable litter are returned for every load sent off the farm; and, unless the farm contains a large portion of rough pasture, the horse-teams should be kept in the stable, and soiled during the summer and autumn on green food; every portion of apparently refuse vegetable and animal matter should also be carefully collected and added to the dung-heap; and, in this manner, it is inconceivable what additional quantities of muck may be produced.

3. The manure thus made, and not fermented, is generally applied, either in its fresh state, or only partially turned, to clay land fallows which are to be sown with wheat; as, being of a colder nature than winter-made dung, it will not occasion the crop to be so hastily pushed forward as to occasion straw instead of corn. If attempts be made to supply the place of farm yard dung by *any one salt*, or, in other words, by two or three only of the elements of plants--nitrate of soda, or nitrate of potash, or sulphate of lime *(gypsum)* for instance—it will succeed only where all the others happen to be present on the soil, by the effect of previous manuring; and will inevitably fail where those other needful substances are either absent or very deficient.

4. Now, it is extremely difficult to ascertain in what salt the soil is really deficient; care must, therefore, be taken in the application of artificial manures, that they contain all the elements included in the muck for which they are substituted. These are all usually found, more or less, in the dung-heap: how needful, therefore, is it that the farmer should take good care of that manure produced upon his own land, which certainly contains all the elements of plants, and upon which he knows he can safely rely!

5. It has been stated before, that the most efficient part of farmyard dung is that small portion invisible in the mass, which consists of earthy and alkaline salts and ammonia. The other ingredients which constitute the bulk of manure, consisting of carbon and the elements of water, are abundantly supplied by the atmosphere to the growing plants, and therefore a loss of these by needless fermentation or neglect is of little importance, were it not that their loss is unavoidably accompanied with the waste of the more essential substances in the manner described.

6. It should be the object of the farmer not only to prevent the waste of such precious substances by every means that knowledge and ingenuity can devise, but also to make every addition to them that nature or local circumstances have placed within his reach.

These desirable purposes he will be the better able to carry into effect when he fully understands the nature of the manure he has under his management, and by that means he can exercise a sound discretion in adding to its quantity and effect.

7. Let it not be alleged against any inquiry by the farmer into the constituent nature and chemical properties of his manure, that he has no ideas attached to the several terms used to designate the substances of which it is said to consist. He is obliged to learn the names and uses of the several implements he employs in the cultivation; and, upon what principle, we may ask him, should he refuse to make himself acquainted with the names and general properties of the produce he raises? But little effort is required to obtain a precise knowledge of the several elements, or substances at least, by the employment of which he is enabled to raise and increase his crops, and is it not pleasant to learn, as well as most useful to understand, the reason of their value to him?

8. Nor is this limited degree of chemical knowledge of difficult attainment. Every farmer has seen wood-ashes, and also seen water poured upon them for the purpose of extracting a something: that substance is chiefly potash, which may be seen by evaporating the clear water, which leaves the alkali behind, and the dregs which remain at the bottom consist for the most part of earthy phosphates—a similar substance to the earth of bones.

9. *Soda* is now so commonly used as to be known at sight to most persons; *lime* and *magnesia* are still more familiar; *ammonia* is the common pungent salt of smelling bottles; *sulphuric*, *muriatic*, and *nitric acids*, are extensive articles of commerce, and, with *phosphoric acid*, may be found at any chemist's shop, and these acids, as well as their bases—potash, soda, lime, and magnesia—may be had for a trifle, either separately or combined as salts.

10. When, therefore, the appearance and more obvious qualities of these several substances have become familiar, their efficacy as manure may be proved, by mixing them thoroughly with two or three hundred times their weight of mould, and applying the compost to garden plants. The farmer might in this easy way soon become acquainted with the name, character, and properties of the invaluable substance contained invisibly in the muck of his yards; and would be the better able, and more desirous, to prevent their stealing away from him.

## Section VIII.

1. Excrements of Horses, Horned Cattle, and Pigs.—*The solid excrements of cattle* used in agriculture differ consider-

ably in value according to the age and uses of the animals. Young cattle retain the phosphates contained in their food for the increase of their bones; while dairy cows yield the phosphates in their milk: the dung of both these is consequently deficient in such substances, and produces from this cause a less effect as manure. The value, or virtue, of both the solid and liquid excrements, is most materially affected by the food given to cattle.

2. Grain and oil-cake contain a large quantity of phosphates, as well as starch and substances containing nitrogen, and when these are given as food to cattle, they not only thrive rapidly, but their dung becomes proportionably rich in phosphates and substances producing ammonia. The flesh or muscles of animals, is increased by those parts of plants and seeds which consist of compounds containing nitrogen; and their fat is derived from such as yield starch and sugar.

3. In the case of fattening animals with any given quantity of food, they produce much more both of flesh and fat when kept in a state of repose, and at a moderate temperature, than when exposed to cold and allowed to take exercise. "It is, indeed, known that the vital forces decrease when the body is exposed to a certain degree of cold; and when this is sufficiently intense, that they are either suspended, or altogether annihilated" *

4. Although rather beside our present purpose, we yet cannot refrain from remarking in this place upon that beautiful economy of nature which connects the nutrition and growth of plants with that of animals; by which the inorganic substances essential to the latter are equally so to the former. Thus the phosphates of lime and magnesia, and the sulphate and muriate of soda *(common salt)*, potash, and iron—as required by plants—equally subserve the nourishment of animals.

5. Without the former, the bones of animals could not be formed; while phosphoric, sulphuric, and muriatic acids, soda, potash and iron, are not only necessary to form the substance of animals, but are indispensable to the discharge of the functions of life. In this way, plants may be said to be the caterers of animals, as they collect and concoct the food upon which they subsist. The caseine *(or cheese)*, albumen, and fibrine, which have hitherto been considered the production of animal life, are now ascertained to be previously formed by plants, as well as starch and sugar; and are

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* Professor Playfair on the Application of Physiology to the Rearing and Feeding of Cattle. Journal of the Royal Agricultural Society of England, vol, iv. p. 231.

only assimilated and modified by the animal functions. The three first substances have been by the chemist extracted from plants, and their analysis is precisely similar to those yielded by animals.

6. One thousand parts of the *solid excrement of a cow, or ox,* consists of 750 parts of water, and the remainder of the rejected vegetable matter, and some animal substances derived from the waste which the organs of animals are continually undergoing.—When 1000 of the *dried* excrement is burnt, it yields 60 parts of the following substances :—

| | |
|---|---|
| Silica - - - - - - - - - - | 44 |
| Carbonate and phosphate of lime - - - | 12 |
| Carbonate, sulphate, and muriate of soda - - | 2 |
| Magnesia, alumina, and potash - - - - - | 2 |
| | 60 |

7. The solid excrement of cows and oxen is by itself very little prone to undergo putrefaction or fermentation, which is owing to the very small quantity of nitrogen they contain ; it, therefore, gives out but little ammonia ; but when mixed with urine—which abounds with nitrogen rapid fermentation ensues, and very pungent fumes of ammonia and other offensive gases escape.

8. The *urine of horned cattle* consists of a large portion of water, holding in solution a substance called *urea,* which readily changes by fermentation into ammonia ; it also contains several salts formed from the various elements already described. The following is an abstract of the analysis of 100,000 parts of the urine of cattle by Professor Sprengel :—

| | |
|---|---|
| Water - - - - - - - | 92.624 |
| Urea, with resinous matter - - - - | 4.000 |
| Albumen and mucus, substances containing nitrogen | 200 |
| Salts of potash, soda, and ammonia, with organic acids | 862 |
| Sulphates, phosphates, and muriates of soda, lime, and magnesia - - - - - - | 747 |
| Ammonia - - - - - - | 205 |
| Potash - - - - - - - | 664 |
| Soda - - - - - - - | 554 |
| Lime - - - - - - - | 65 |
| Magnesia - - - - - - | 36 |
| Alumina - - - - - - - | 2 |
| Oxide of iron and manganese - - - - | 5 |
| Silica - - - - - - - | 36 |
| | 100.000 |

9. It is owing to the presence of so much nitrogen in urine that it so rapidly undergoes putrefaction, and promotes that action in vegetable substances in contact with it: as, for instance, in the straw and refuse of the farm-yard. The urea—which abounds in nitrogen—takes an active part in this process, and yields a large quantity of ammonia.

10. The *solid excrement of horses*—as they generally consume a considerable quantity of corn—contains more nitrogen than that of horned cattle; which accounts for the circumstance of its fermenting much faster than the latter. 100 parts of this excrement consist of 70 water, 20 vegetable fibre, and the remaining 10 parts are composed of animalized matter, earthy and alkaline salts. 1000 parts of the dried solid excrement contain, according to Professor Sprengel. 60 parts, by weight, of ashes, of the following composition:

| | |
|---|---|
| Carbonate, sulphate, and muriate of soda | 5 |
| Carbonate and phosphate of lime | 9 |
| Silica | 46 |
| | 60 |

Besides these there must be some other earthy substances.

11. The *urine of horses* is composed of 94 parts in 100 of water; the remaining 6 parts consisting of urea and salts of soda, lime, and potash. Nitrogen is much less abundant in this urine than in that of cows and oxen; which renders the former much less fertilizing than the latter, when applied in a liquid state. Stable dung, however, yields a large quantity of ammonia, most of which is lost to the farmer—as is evident from the strong ammoniacal smell which is constantly emitted in stables; and, more especially, from the heaps generally placed near the door. This escape of ammonia has been alluded to before, in speaking of its principal element—nitrogen; and the injury done to stable walls by the conversion of the mortar into nitrate of lime.

12. The waste of this precious material might be easily prevented by means of strewing the floor of the stable with gypsum powder, by which a sulphate of ammonia would be formed, a substance or salt that is not volatile. The gypsum should be in *fine powder*, or it will fail of producing the desired effect; as some recent experiments have tended to prove. Sulphuric, or muriatic acid, diluted with a large quantity of water, will, however, be much more rapid and effectual.

13. The *dung of pigs* is generally considered to be a "cold manure;" but this can only be said of that of store pigs, for it must form a powerful manure when pigs are fed upon corn and other

food containing much nitrogen. The *urine* contains a large quantity of nitrogen, and becomes exceedingly offensive when allowed to putrefy by itself.

14. The excrements of the pig should, therefore, be constantly carried away along with the litter, and mixed with the other dung of the farm-yard; for if applied by itself to potatoes, or other esculent roots, it is apt to impart to them a most disagreeable flavor; occasioned, probably, by the large quantity of liquid flood which they consume, and to some peculiar volatile substance contained in the urine; which, according to an analysis by Professor Sprengel, contains, in 100,000 parts,—

| | |
|---|---|
| Water - - - - - | 92.600 |
| Urea, with a very little mucus, albumen, and colouring matter - - | 5.640 |
| Salts; as common salt, muriate of potash, gypsum, carbonate of lime, and sulphate of soda - - - - - | 1.760 |
| | 100.000 |

15. From which analysis, it appears, that the urine of the pig contains rather a smaller proportion of water than the urine of horned cattle, and 1½ per cent. more of urea; and this explains the reason of its being more caustic in its fresh state, than that of cattle.

## Section IX.

1. Excrements of Fowls.—The droppings of birds form one of the most powerful of known manures. This arises in part from the circumstance that in the economy of birds there is no final separation between the liquid and solid excretions. Both escape mixed together from the same aperture. *Pigeons' dung* is much prized as a manure wherever it can be obtained in any considerable quantity. In Belgium it is esteemed as a top dressing for the young flax, and the yearly produce of one hundred pigeons is sold for about 20s.

2. Its immediate effect depends upon the quantity of soluble matter it contains, and this varies much according to its age and the circumstances under which it has been preserved. Thus Davy* and Sprengel obtained respectively of

| | Recent. (Davy.) | Six months' old. (Sprengel.) | After fermentation. (Davy.) |
|---|---|---|---|
| Soluble matter in pigeons' dung | 23 per cent. | 16 per cent. | 8 per cent. |

* Davy's *Agricultural Chemistry*, Lecture VI.

3. The soluble matter consists of uric acid in small quantity, of urate, sulphate, and especially of carbonate ammonia, common salt, and sulphate of potash;—the insoluble chiefly of phosphate of lime with a little phosphate of magnesia, and a variable admixture of sand and other earthy matters. When exposed to moisture, the pigeons' dung, especially if recent, undergoes fermentation, loses a portion of its ammoniacal salts, and thus becomes less valuable. When it is intended to be kept it should be mixed with a dry vegetable soil, or made into a compost with earth and saw dust, with a portion of pulverized or charred peat, or with such a disinfecting charcoal as that which is employed in the manufacture of the animalized carbon above described.

4. *Hens' dung* often accumulates, decomposes, and runs to waste in poultry yards, when, with a little care, it might be collected in considerable quantities. *Goose dung* is less rich than that of hens or pigeons, because this bird feeds less upon grain, and derives a considerable portion of its nourishment from the grass which it crops, when allowed to go at liberty over the fields. Its known injurious effects upon the grass upon which it falls arise from its being in too concentrated a state. In moist weather, or when rain soon succeeds, it does no injury, and even when in dry weather it kills the blades on which it drops, it brings up the succeeding shoots with increased luxuriance.

5 *Rooks' dung* unites with the leaves of the trees among which they live. in enriching the pasture beneath them. In old rookeries the soil is observed also to be slowly elevated above the surrounding land. This surface soil I have found to be especially rich in phosphate of lime, which has gradually accumulated and remained in it while the volatile and soluble parts of the droppings of the bird have slowly disappeared. *Guano* is the name given to the accumulated dung chiefly of sea birds, which is found upon the rocky promontories, and on the islands that skirt the coast of South America from the 13th to the 21st degree of south latitude.

6. In that part of America, the climate being very dry, droppings of the birds have decomposed with exceeding slowness, and upon some spots have accumulated for many centuries, forming layers, more or less extensive of 10, 20, and at certain places it is said even 60 (?) feet in thickness. In some places the more ancient of these deposites are covered by layers of drift sand, which tend further to preserve them from decay. In our moist climate the dung of the sea fowl is readily washed away by the rains, so that even where sea birds most abound no considerable quantity of guano can ever be expected to collect.

7. The solid part of the droppings of birds in general, when recent, consists chiefly of uric acid, with a little urate of ammonia, and a variable per-centage of phosphate of lime and other saline compounds. The liquid part, like the urine of other animals, contains much urea, with some phosphates, sulphates, and chlorides. The uric acid and urea, however, gradually undergo decomposition and are changed into carbonate and other salts of ammonia.

8. If applied to the land when this stage of decomposition is attained, they form an active, powerful, and immediately operating manure; but if allowed to remain exposed to the air for a lengthened period of time, the salts of ammonia gradually volatilize, and the efficacy of what remains becomes greatly diminished. Hence, the guano which is imported into this country is very variable in quality, some samples being capable of yielding only 7 per cent. of ammonia, while others are said to give so much as 25 per cent.

### Section X.

1. Dung of Sheep.—Sheep abstract somewhat more nourishment from their food than neat cattle; for if we first weigh the dry food given them, and afterwards the dry excrements, we shall find that these weigh rather less in proportion with sheep than with cattle. It may, indeed, be supposed, that in the digestion of sheep, a greater amount of oxygen and hydrogen unite to form water, which accordingly evaporates with drying.

2. Still the stomach, and other digestive organs of sheep, must have the power of abstracting from the food a larger quantity of nourishment than those of cattle; as sheep, in eating, chew their food more minutely. This is the reason why the same food—especially when consisting of hay, straw, or other dried plants—goes further with sheep than with neat cattle; and this is by no means an unimportant circumstance.

3. The indigestive organs of sheep would seem even in some degree to reduce vegetable fibre; which substance passes undigested through the bodies of most other animals, not excepting the human body. Of what incalculably important consequence would it be, if food could be prepared in some cheap manner, so as to render the whole of the vegetable fibre digestible! And that it is capable by chemical means of being brought into such a state, we know by the fact that sugar may be obtained out of paper, which is very pure vegetable fibre.

4. It is matter of experience that green clover is better food than the hay made from it; the simple reason of which is—that in the process of drying, many of its vegetable particles are so much hard-

ened that the digestive organs have no longer any power to reduce them. By steaming the hay the hardened particles are again softened, and consequently there is always a less portion of such food required than dry.

5. According to Block, the following quantities of excrement arise from different species of fodder given to sheep :—

| | | |
|---|---|---|
| From 100 lbs. of | rye-straw, fluid and solid, . . . | 40 lbs. |
| " | hay, . . . . . . . . . . . | 42 |
| " | potatoes, . . . . . . . . . . | 13 |
| " | green clover, . . . . . . . . | 8½ |
| " | oats, dry excrement, . . . . . | 49 |

6. In this case, therefore, the same thing happens as with cattle; upwards of one-half of the solid food being lost, whether from straw or any other kind of food—for 100 pounds of green clover give 20 pounds of hay, and 100 pounds of potatoes leave 24 or 25 pounds of solid substance. This loss occurs partly in the formation of water; partly in the carbonic acid of respiration; partly in the production of wool and the formation of flesh and fat; and partly also, in the last place, in the evolution of ammonia and other perspirable matter through the skin.

7. The *solid excrements of sheep* has been chemically investigated by Zierl, and this appears to be the only chemical investigation we possess on the subject. 1000 parts, by weight, of the solid excrements of sheep, fed on hay, contained :—

| | |
|---|---|
| Water, . . . . . . . | 679 |
| Sugar of gall and soluble salts, . . . . | 34 |
| Bilious, with extractive matter, . . . . | 19 |
| Humus, with coagulated albumen, and mucus of the intestines | 128 |
| Woody fibre and vegetable remains, . . . | 140 |
| | 1,000 |

1000 parts, by weight, of the dry excrement, give on being burnt, 96 parts of ashes, consisting of—

| | |
|---|---|
| Carbonate, muriate, and sulphate of soda, . . . | 16 |
| Carbonate and phosphate of lime, . . . . | 20 |
| Silica, . . . . . . . . | 60 |
| | 96 |

8. He has undoubtedly overlooked magnesia, potash, alumina, oxide of iron, and oxide of manganese, as all these substances occur in the hay which the sheep had eaten ; but we might take for granted that the whole of the potash of the hay would pass off in the urine. The chemical component parts of the solid excrements of

sheep, as well as of all other excrements of animals, depend naturally on the food the animals eat; and they are so much the better or worse, in their effect as manure, as the food itself is stronger or poorer.

9. *Solid sheep-dung* contains somewhat less water than the solid excrement of cattle; a circumstance which the appearance alone of the sheep dung, being less soft and pulpy, would have led us to expect. It possesses, on the other hand, more of the easily decomposable substances containing nitrogen; for while the solid excrements of cattle in 1000 parts by weight contains only 105 and 112 of this and other substances that are quickly decomposed, that of the sheep contains no less than 180 parts. If, also, we consider that sheep-dung consists of finely divided parts, we shall easily understand how it happens that it comes sooner into action than that of cattle, and whence it arises that on further putrefaction, when lying in heaps, they generate so much heat.

10. The *keeping of sheep in pens* will probably sound strangely in the ears of some. In the north of Germany, however, the severity of the climate during winter requires such protection. In that country the practice is not only necessary for the health of the sheep, but is attended with great economy of food. The views lately developed by that illustrious chemist and physiologist, Professor Liebig, throw great light upon this as well as upon almost every other branch of rural economy, in which he seems, with a master-hand, to "unfold all nature's law;" and has been ably supported by the recent publications of Professor Playfair on the same subject.

11. According to these views the craving for food is much increased by cold; and the increase of food required by animals when exposed to cold, does not go to form fat and increase the growth of the animal, but is expended in keeping up the proper temperature. It is important to be fully aware that clothing and shelter supply, to a great extent, the place of food; at all events, that food will go very much further when aided by reasonable shelter.

12. A very valuable proof of this has been recently given to the agricultural world by Walbanke Childers, Esq., M. P., which is recorded in the second part of the first volume of the Royal English Agricultural Journal. By this experiment it appears that forty sheep, of equal size and weight, were selected: twenty of these were fed in the usual way in the open field, and the other twenty in a rough shed; yet the latter—although they received nearly a fifth less food than those of the open field—showed an increase of twenty stone more in the short space of four months.

13. At Lord Ducie's experimental farm, also—of 100 sheep, kept in the open fields from the 10th October to the 10th March, each eat 24 lbs. daily of Swedes; while another hundred, having a covered shed and a yard to run into at pleasure, only ate 20 lbs. each of the same turnips: thus clearly proving this saving of food to have been occasioned solely by protection from the weather; and that, for fattening sheep, the plan is excellent.

### Section XI.

1. Wood-Ashes and Soot.—Wood-ashes contain, in a greater or less degree, all the more essential elements, or substances, which form the food of plants, except ammonia; or rather all those which are not abundantly supplied by the atmosphere. The most abundant of these are *potash* and *earthly phosphates*. The quantity of these, however, is very variable in the ashes of different plants.—Those produced by beech-wood contain about one fifth part of phosphates, while those of the oak yield scarcely any phosphates.

2. The powerful effect of wood-ashes in promoting the growth of clover of every kind is well known. In Germany, no other manure is used for grass lands, and by these they are kept in the highest state of productiveness. Considering how indispensable they are to keep up the fertility of the soil, it might be well worth trying whether their more extensive use in Canada wold not materially advance the interests of agriculture: wherever made they should be taken as much care of as money, for they are certainly most valuable.

3. The following table contains a statement of the quantity of potash contained in some of the common trees and plants:—

| | | |
|---|---|---|
| 10,000 | parts of Oak, | 15 |
| " | Elm, | 39 |
| " | Beech, | 12 |
| " | Vine, | 55 |
| " | Poplar, | 7 |
| " | Thistle, | 55 |
| " | Fern, | 62 |
| " | Cow-thistle, | 196 |
| " | Wormwood, | 730 |
| " | Vetches, | 275 |
| " | Beans, | 200 |
| " | Fumitory. | 790 |

4. The *ashes produced from the leaves of trees* contain much more potash than those of the twigs and branches. and those of the latter more than those of the trunk of the tree; while the ashes of

the two latter contain the most phosphate and carbonate of lime. The quantity of potash in the leaves varies very much with the season of the year, being greatest in spring and least in autumn.

5. In some parts of England it is the practice to burn the stubble for the sake of the benefit afforded to the succeeding crop by the ashes and it is a very common practice upon the continent. Considering the value of straw for litter, this must be a practice of very doubtful benefit; and where the stubble is not cut for litter, it must, when ploughed down, ultimately afford to the land all that the ashes contain and something more.

6. *Coal-ashes* are not generally available to our farmers, but there are few situations in which they are not beneficial, especially as applied to clover and grass crops; and a consideration of the substances they contain will readily account for the effect they produce. Besides the earthy and imperfectly burnt coaly matter of which they principally consist, they also contain sulphate of lime, with some potash and soda, all of which are known when separately applied to produce a good effect on clover crops, and to favour the production of white clover particularly.

7. *Soot* must have a powerful effect as a manure, from the large quantity of ammonia it contains in the shape of carbonate and sulphate of ammonia: though its quality must differ considerably, according to the matter from which it is derived. The soot produced from Newcastle coals is of the best quality, as the coal contains a larger quantity of bitumen than that which is found in Staffordshire and other parts of England; but it is notorious that London soot is very much adulterated by the sweeps or traders before it goes into the farmer's hands; and, when found to be in that state, the quantity should, of course, be increased.*

8. It is extensively used as a top dressing, spread by hand, at the rate, on seeds and pasture, of twenty to thirty; and on wheat, barley, and turnips from forty to forty-five bushels per acre. It is, however, more generally employed on wheat, and is considered one of the most powerful top-dressings for that crop with which we are acquainted; and experiments have shown its power to be ma-

* If a spoonful of adulterated soot be stirred into a tumbler of water and allowed to subside, a quantity of gritty matter will be found at the bottom of the glass; but, if the soot be in the same state as when swept from the chimneys, the deposit will contain only minute particles of nearly imperceptible earthy substance, which, if rubbed between the fingers, will be soft to the touch.

terially increased by an admixture of one-fourth of common salt; more particularly when laid upon pasture land, the grass of which soon after assumes a growth of increased luxuriance.

9. Though it has almost always been used as a top-dressing, it is probable that it would have a greater effect if used as a compost with other substances by means of the drill; and has, in that manner, been successfully employed in the cultivation of potatoes by an eminent farmer in Gloucestershire. We perceive also, that, in a recent comparative experiment of different manures for the growth of carrots, 54 bushels of soot, and 6 of salt, produced larger crops of both the Alteringham and white Belgian species than 24 tons of stable manure, and 24 bushels of bones; though at one-half the cost.

### Section XII.

1. Knowledge of Farming.—It may be truly said that *every farmer is a practical chemist.* It may, indeed, with equal truth be asserted, that no practitioner would derive more benefit from understanding the principles of his art, and that there is no other art in which the most enlightened practice is of half so much importance to mankind; for (to quote the language of Liebig) "there is no profession which can be compared in importance with that of agriculture: as to it belongs the production of food for man and animals; on it depends the welfare of the whole human species; the riches of states, and all commerce."

2. It is presumed that the preceding explanations of the nature of the several substances which, as manure, fall under the farmer's management, will enable him to form, and to appreciate, more precise notions as to the proper mode of treating them; and that he will the more readily understand the force and meaning of the suggestions offered.

3. When we know that in all good farm-yard dung there is a volatile substance called nitrogen, which, by fermentation, is rapidly converted into ammonia, and in that state escapes into the air and is entirely lost; and when we also know that this substance is the most powerful fertilizer of any in the dung; that neither seeds nor plants can be produced without it; and that certain substances attract this ammonia and prevent its escape, we have made a very profitable discovery.

4. When we have learnt that—besides this invisible but important substance—there are others equally invisible in the mass of dung, and no less necessary to the growth of plants, most of which substances are readily soluble in water, and in that state are easily

carried away (such are the salts of which potash, soda, and ammonia are the bases)—and know how their escape may be effectually prevented; we are then placed in a very advantageous position, from which the greatest benefit might be derived; and it is certain that the farmer's prosperity must be materially influenced by the use he makes of such knowledge in the management of his manure.

5. Most farmers are aware how much more powerful, as a manure, the droppings of sheep are when corn is given them; and the superiority of stable-dung to ordinary farm yard manure is merely owing to the more nourishing food given to horses. Corn consists entirely of the most essential elements of nutrition, both of plants and animals, principally of carbon, nitrogen, potash, soda, lime, and magnesia, with sulphuric, phosphoric, and muriatic acids.

6. These, when taken as food in the corn, are again restored to the land in dung and urine, except such portion as is retained in the bones, flesh, and fat of the animals. By giving crushed corn, therefore, to the sheep and cattle, for the purpose of fattening them, it may be more advantageously disposed of in remote situations than by selling it; and while the stock, so fed, rapidly improve in substance and value, a large portion of the most efficient principles of manure is retained to increase the productive power of the land.

7. Such a practice would, in many instances, form a more profitable method of disposing of a portion of the produce, than by carrying away the utmost quantity of corn that could by possibility be spared, particularly when it would in a great measure remove the necessity, or supply the deficiency of the application of artificial manures.

8. When the true principles of the nutrition of plants and animals become more generally known and appreciated by agriculturists, there can be no doubt that more economical methods of managing and controlling the productive powers of nature will be adopted, and all the various resources which she presents will be eagerly sought and appropriated. Such knowledge is indeed power, and is more precious than fine gold. And though many excellent practical farmers are apt to regard such knowledge as superfluous, the time cannot be far remote when it will be considered a reproach to be ignorant of the leading and more important principles, at least of agricultural chemistry.

9. The knowledge and application of mechanical and chemical principles have raised the manufacturing power of Great Britain above that of all other nations, has extended her commerce and empire to the remotest parts of the earth, and given her the produce of

every clime. In agriculture she is yet in some respects inferior to the Chinese, and in some instances to the Belgians, and it is only by the more general diffusion of knowledge, and the application of principles, that she can hope to take a corresponding leading position in the march of improvement.

10. The light that has been lately thrown upon the operations of agriculture by the profound and laborious researches of Liebig, which has been diffused rather than increased by numerous subsequent writers, the important discoveries of Sprengel, together with the diffusion of both scientific and practical knowledge by the exertions of the Royal Agricultural Society, bid fair to place the agriculture of England on a level with her manufactories.

## Section XIII.

1. Quality of Manure.—The *quality* of the droppings of animals considered as manures is affected by a great variety of circumstances—such as: *Firstly, By the kind of food upon which the animal is fed.*—Thus night soil is more valuable in those countries and districts in which much flesh meat is consumed, than where vegetable food forms the principal diet of the people. It is even said by Sprengel, that in the neighbourhood of Hildesheim the farmers give a higher price for the house manure of the Lutheran than for that of the Roman Catholic families, because of the numerous fasts which the latter are required to observe. Every keeper of stock also knows that the manure in his farm-yard is richer when he is feeding his cattle upon oil-cake, than when he gives them only the ordinary produce of his farm.

2. *Secondly, By the quantity of urine voided by the animal.*—Upon the unlike quantities of urine they produce appears mainly to depend the unlike richness of the dung of the horse and of the cow. The latter animal, when full grown and not in milk, voids nearly 13 times as much urine as the former, and though an equal bulk of this urine is poorer in solid matter, yet the whole quantity contains several times as much as is present in that of the horse. But if the cow discharges more in its urine it must void less in its solid excretions. Hence, supposing the food of a full-grown horse and of a cow to be very nearly the same, the dung of the former—the less urine-giving animal—must be the richer, the warmer, and the more valuable—as it is really known to be.

3. *Thirdly, By the amount of exercise or labour to which the animal is subjected.*—The greater the fatigue to which an animal is subjected the richer the urine is found to be in those compounds (urea chiefly) which yield ammonia by their decomposition.

4. The food of two animals, therefore, being the same—other things also being equal—the solid excretions will be richer and more fertilizing in that which is kept in the stall or fold yard, the urine in that which is worked in the open air or pastured in the field.

5. *Fourthly, By the state of growth to which the animal has arrived.*—A full grown animal has only to *keep up* its weight and condition by the food it eats. Every thing which is not necessary for this purpose, therefore, it rejects either in its solid or in its liquid excretions. A young animal on the other hand *adds to, and increases* its bone and muscle at the expense of its food. It rejects, therefore, a smaller proportion of what it eats Hence the manure in fold-yards, where young cattle are kept, is always less rich than where full-grown animals are fed.

6. *Fifthly, By the purpose for which the animal is fed.*—Is it to be improved in condition? Then the food must supply it with the materials for increasing the size and strength of its muscles—with albumen, or fibrin, or other substances containing nitrogen. In such substances, therefore, or in nitrogen derived from them, the droppings must be poorer, and as a manure, less valuable.

7. Is the animal to be fattened? Then its food must supply fatty matters, or their elements, of which nitrogen forms no part. All the nitrogen of the food, therefore, will pass off in the excretions, and hence the richest manure yielded at any time by the same species of animal is that which is obtained when it is full-grown, and, being largely fed, is rapidly fattening.

8. Is the cow kept for its milk? Then the milk it yields is a daily drain upon the food it eats Whatever passes into the udder is lost to the dung, and hence, *other things being equal*, the dung of a milk cow will be less valuable to the farmer than that of a full-grown animal from which no milk is expected, or than that of the same animal when it is only laying on fat.

9. *Sixthly, By the length of time during which the manure has been kept.*—In 24 hours, as we have seen, the dung of the horse begins to ferment and to lessen in weight. All rich manures in like manner—the dung of all animals especially—decompose more or less rapidly, and part with their volatile constituents. The value we assign to them to-day, therefore, will not apply to them to-morrow, and hence the droppings of the same animal at the same age, and fed in the same way, will be more or less valuable to the farmer according to the length of time during which they have been permitted to ferment.

10. *Lastly, By the way in which the manure has been preserved.*—The mixed dung of the farm-yard must necessarily be less valuable

where the liquid manure is allowed to run off—or where it is permitted to stand in pools and ferment. Twenty cart-loads of such dung may hasten the growth of the turnip crop in a less degree than half the weight will do, where the liquid manure has been carefully collected and returned upon the heaps—to hasten and complete their fermentation, and to saturate them with enriching matter.

## Section XIV.

1. Management of Manure.—In the *Management of farm yard manure* two primary objects present themselves : first to prevent waste of every kind ; and secondly, to increase the quantity of dung by every means in the farmer's power. The waste is effected in the manner before alluded to, by unnecessary and excessive fermentation, by which the organic parts are dissipated in a gaseous form, and by suffering water to run through the dung by which the inorganic substances, the salts, are carried away in solution. No dung should be allowed to ferment until a few weeks before it is put into the soil, and then only in that slight degree as to render it manageable, and to facilitate its decomposition when in the soil.

2. As the farm-yard is the general depôt for dung in the raw state, care should be taken to give it such a form as may best preserve it, as well as bring it to perfection ; and on this there is a little difference of opinion : some theorists recommending them to be made so *concave* as almost to amount to a *well* shape, giving as a reason in support of their opinion,—"that the virtues of dung can only be preserved by its being saturated with urine *or some other moisture* ;" while others assert that dung-yards should be formed *convex*, and assign as their reason, "that farm-yard dung *should be kept dry*." "Practical experience, however, points out," as Blaikie says, "that a medium between these two extremes is best."

3. In this we concur ; and the form which we recommend is to slope the sides towards the centre : making either at the centre or the lower end, as may be found most convenient, a tank (which may be made at much less expense than farmers generally imagine) to receive the soakings of the dung, towards which the entire surface of the yard should have a gentle inclination for discharge.—The bottom should be made of concrete powdered brown lime and gravel, in the proportion of 1 of the former to 6 of the latter, mixed wet, and deposited immediately, or Macadamised stone : or, should the yard be concave, an under-drain should be carried from its centre to communicate with the tank, which should, in that case, be made outside the buildings.

4. The water from surrounding roofs should be conveyed away by shoots, or spouts, from under the eaves, and no water from any source should be allowed to pass through the dung, except the rain-water which falls directly upon it. Indeed, independently of the injury which the manure will sustain by being saturated with water, there is also the very material consideration of keeping the store cattle which are kept in the yards as warm and as free from wet as possible. The *dry-litter* from the horse-stables, shaken from the dung, should, therefore. be spread constantly and regularly over it, as it will add much to their comfort.

5. In order to keep the cattle dry and comfortable. the dung from the stall-fed cattle and pig-sties, and every kind of rough vegetable stuff or animal refuse, together with all the sweepings, soap-suds, and slops from the house, should be carried from the sheds to a compost formed outside the yard, and added in regular layers to the heap, intermixed with the dung of the horse ; for, if this be not done, the manure will be of unequal quality, and the crop, even in the same field, will often display great disparity.

6. We are well aware, that according to the most approved modes of laying out farm-yards, they ought to be surrounded with buildings, which should be raised above the level of the yard, which should also be divided into compartments for cattle of different sorts and age, and every arrangement made in their construction for the saving of labour, and increase of convenience.

7. It is a common custom in England to lay a quantity of loose earth of some kind over the yard, as a foundation for the bedding of the cattle when they are taken for the winter, for the purpose of absorbing their urine, and thus creating, or at least retaining, a valuable portion of manure, which might otherwise be lost ; and this we admit to be a consideration of material importance, though counteracted in some degree by the cold and damp which it occasions to the stock.

8. If peat can be procured within any reasonable distance during the summer time, it should be carted to the neighborhood of the yard, and after laying spread to get tolerably dry, should be thrown up into heaps for occasional use during the winter, the yard being first covered with it as soon as the dung of the previous winter has been removed.

9 The peat so laid up should occasionally be spread upon the surface of the dung ; but in case it cannot be procured, a few hundred weight of gypsum should always be at hand to scatter over the dung from time to time, and also a small quantity of rough sea salt and if that cannot be had, common salt. A little of the gypsum

should be also sprinkled every day upon the floors of the stables where the urine runs, which will be swept out and conveyed with the litter to the general depôt in the yard.

10. Some good farmers improve upon this system, by placing the different species of manure in separate heaps, according to their different qualities and speed of fermentation: thus, for instance, the dung of horse-stables, as being of the richest and hottest nature except that of poultry, that of fatting pigs and stall-fed cattle as well as that of sheep, when kept in fold-yards, and lastly, the stores of the straw-yard; and this certainly affords the great advantage of enabling the husbandman not only to employ these manures at his own discretion, for the use of particular crops at various seasons, but also to either retard or accelerate their fermentation, by an intermixture with each other at the season or purpose for which they are wanted.

11. On small farms, it is, however, inconvenient; but if the plan prescribed above be adopted, the effect of the manure of a farm would be nearly twice as great as when all such means are neglected. The dung-yard should be considered as a manufactory of manure, and corresponding skill and attention should be bestowed upon it, if the farmer be desirous of placing his *first of arts* upon an equal footing with others.

12 When it is found necessary to *cart the manure away*, in order to forward the business of the season, previous to the commencement of the work, a quantity of peat, marl, soil, or road earth should be collected on the spot intended to receive the dung. The *foundation of the heap* should be laid with such material about six to nine inches thick, according to the nature of the dung to be laid upon it, and it should be rather inclined to the centre; so as to retain as much as possible of the soakage of the heap; the sides should be kept upright, and the top level.

13 At the conclusion of the carting the two ends should be brought up to the general level of the heap, and the whole surface, including the top, sides, and ends, should be well coated with the mould, or other material provided for the purpose. About three weeks or a month before the manure is required upon the land, the heap should be turned, the earth thoroughly mixed with the dung, and another layer or coating of earth placed against the sides and over the top of the heap, by which the whole will be kept moist, and the gases, produced by fermentation, prevented from escaping.

## Section XV.

1. Improvement of Manure.—That so little care and well-

directed skill has hitherto been manifested in the management of farm-yard dung in this country, can be no reason for continuing neglect. The success of a father or grandfather is far from being a proof that their practice in many respects cannot be improved upon, though that kind of argument is sometimes advanced. Their success should rather be attributed to their industry and skill, in the exercise of which they availed themselves of the best lights their time afforded them, than to blindly treading in the footsteps of their predecessors.

2. If unreflecting prescription had been the rule, what would agriculture be at this day? In the great majority of instances the vast loss that has hitherto occurred in neglecting the management of manure, must be attributed to the farmer not knowing the nature of the essential substances of which it is composed, and that the most valuable parts could escape as an invisible gas, or flow away dissolved in water. When his liability to loss in this way comes to be fully appreciated, and he becomes aware of the extent to which it is incurred in the ordinary and negligent methods of treating dung, a better system will be adopted, and no pains will be spared to preserve such valuable materials.

3. That even the most enlightened and intelligent of practical farmers have yet very much to learn on the subject of manures, is abundantly testified by the confusion of opinion that generally prevails on the application of certain individual salts, and the wonder often expressed of their success in one instance and their failure in another, in cases where the soil appeared to be the same. Nature is our great guide and instructor in these matters, and if we inquire of her, she will give us true and most valuable answers.

4. Liebig has beautifully observed, "that experiments are questions put to nature, and the results of those experiments are her answers." The chemist has put such questions to nature respecting the composition of plants and their seeds, and she has answered him, "that they are formed of certain bases called by him earths and alkalis, united with certain acids, and of certain gaseous substances, the nature of which earths, alkalis, acids, and gaseous matters, she had previously explained to him."

5. The same question has been put respecting the composition of the dung and urine of the animals which have been fed upon plants and their seeds, and the answer has been, what might have been expected, "that they consist of precisely the same substances, only in an altered form." The chemist naturally inferred that these substances are the food of plants, and that they cannot exist without them; nay more—that if *all* of them are not present the plant

cannot be formed, any more than a house can be formed without timber, though all the other materials are at hand in abundance.—But the farmer has not listened to his lore, and would none of his counsel.

6. Without knowing of what his plants are formed—that many different substances are required for their nourishment, and that the presence of all those substances is requisite to the *fulfilment of the conditions of their growth*—he applies one substance only, an individual salt; and if it *happens* to be the very substance that was wanted to fulfil the conditions of fertility, he gets a crop.

7. Encouraged by this success the same salt is applied to another field, with the full confidence that it will produce a similar effect. In this instance, however, to the great surprise and disappointment of the farmer, it proves an entire failure. Induced by the success of the first application, other persons try the same salt, some with entire success, others with partial benefit; but the greater number generally without any perceptible advantage. Further experience of the kind plainly proves that there is no dependence to be placed upon this particular salt, and it is ultimately abandoned.

8. Such has been the fate of several different salts, in succession, and thus common salt, gypsum, carbonate of soda, nitrate of soda and nitrate of potash have each had their periods of favor and disrepute. A few such successful experiments with a particular salt have led to an extensive application of it, and to consequent great loss and disappointment.

9. Neither plants nor animals can live unless their food contain all the elements of which their substance consists. If a dog be fed upon flesh it will enjoy vigorous health, but if the jelly alone be given it for food, which constitutes only a part of the flesh, it soon dies with all the appearance of starvation. Again, it will live and do well when fed with undressed wheat flour, but rapidly declines if kept upon fine flour, from which all the bran has been taken.

10. When the farmer applies farm-yard dung to his plants, it is like giving flesh to a dog; he administers all the plants want to insure their growth; but when he applies a single salt, it is like giving only jelly or fine flour to the dog: at all events he throws himself upon the chance and uncertainty of all the other salts or substances which plants require for their food being already in the soil. No wonder, therefore, that such empirical practice should so frequently fail.

11. When the farmer stands in need of a substitute for his own proper manure—farmyard dung—as he cannot with certainty tell

what is in the land, he should obtain one that contains, if not all the substances contained in that dung, at least those which are most likely to be deficient; and these in ninety-nine cases in a hundred will be *nitrogen, in the form of salts of ammonia, phosphate of lime, and magnesia* (bone earth), *and potash.*

## Section XVI.

1. Quantity of Barn-yard Manure produced by Crops and Composts.—It has been calculated by an eminent Scotch agriculturist, that the *Barn-yard Manure*, produced per acre by the several crops, is in quantity nearly as follows, from land producing 28 bushels of wheat:

| | *Tons.* |
|---|---|
| By turnips, cabbages, and fallow crops, when applied to the feeding of cattle - - - - | 6 |
| " Clover, grass, or herbage, hay, &c., first year - | 6 |
| " Ditto, if mowed, second year - - - | 5½ |
| " Pulse crops, as beans, &c., part of their seed being used on the farm - - - - | 5 |
| " Pulse crops, when the seed is sold - - | 5 |
| " White or corn crops—wheat, barley, &c., on an average of the whole - - - - | 4 |

2. It is no wonder, therefore, observes this writer, "that green crops should be recommended as sources of fertility, producing proportionally much more manure, besides the other advantages wherewith they are attended." This quantity might, however, be very much increased by supplying the cattle-yards with peat and other rough vegetable substances, which, by care and industry, can be collected.

3. Another method of increasing the quantity of effectual manure in a very great degree is that of forming Compost; by which the farm-yard dung is preserved, and a most valuable addition made to its fertilizing principle: particularly where peat is easily obtainable. The following method of making *peat compost* is given by Mr. Aiton, in his treatise on peat earth, as inserted in Sir John Sinclair's Scotch Husbandry:

4. The peat and dung must be thrown up, in alternate strata, into a heap about four feet and a half high, and in the following proportions: peat, six inches; dung, ten inches—peat, six inches; dung, four inches—peat, six inches, and then a thin bed of dung, and cover the whole with peat. The heap should be put loosely together, and then made smooth on the outside. The compost, after it is made up, gets into a general heat, sooner or later, according to the weather and the condition of the dung: in summer,

in ten days or sooner; in winter, not perhaps for many weeks if the cold is severe.

5. It always, however, has been found to come on at last; and in summer it sometimes rises so high as to be mischievous, by producing what is called *fire-fanging.* In that season a stick should be kept in it in different parts, to pull out and feel now and then; for if it approaches to blood heat, it should be either watered or turned over; and on such occasions advantage may be taken to mix it with a little fresh peat.

6. The heat subsides after a time, and with great variety, according to the weather, the dung, and the perfection of making up the compost, which then may be allowed to remain untouched till within three weeks of using, when it should be turned over, upside down and inside out, and all the lumps broken; then it comes into a second heat, but soon cools and is taken out for use. In this state the whole, except bits of decayed wood, appears a black free mass, and spreads like garden mould. Use it weight for weight, like farm yard dung, and it will be found to stand the comparison.

7. Let it be observed, that the object of making up the compost is to form as large a hot-bed as the quantity of dung employed admits of, and then to surround it on all sides, so as to have the whole benefit of the heat and effluvia. Peat, nearly as dry as garden mould, in seed-time, may be mixed up with the dung, so as to double the volume and more, and nearly triple the weight, and instead of hurting the heat, prolong it.—A correspondent of Sir John Sinclair's states that he has used this compost for seven years, and considers it to be of immense importance. He would rather bring peat for two or three miles than want it for his compost hills.

8. In this process of making compost, a large quantity of almost inert humus is broken down, and rendered fit to yield abundant nourishment to plants, both in the shape of carbonic acid gas and also saline matter; while the ammonia, produced by the fermentation of the dung, is absorbed and retained by the humus. In all cases where peat can be had for the purpose of making compost, experience has shown there can be no question about the propriety and advantage of using it for that purpose. The effects of peat-ashes are well known; and in this case the saline and earthy substances, of which they are composed, are made available as well as the humus, which is retained instead of being dissipated, as in the case of burning.

9. It often happens that all the dung upon a farm cannot be used at the most fitting season, and must be kept for a future occasion; much care is therefore required to prevent its being wasted, either

by fermentation or from the effect of water. The method above noticed of mixing the dung with peat can be practised only in particular situations, but every situation admits of the formation of COMPOST HEAPS by means of mixing earth of some kind or other. It is usual to form compost by mixing the dung with any kind of soil that happens to be most convenient; but it is by no means an unimportant question as to what kind of material is the best for the purpose.

10. The muddy deposit of tideways, the sediment of ponds, and the scouring of ditches, are the first to be recommended; next, calcareous road scrapings, marl, and clay. In making an earthy compost with dung, there is a three-fold object answered: first, to prevent the too rapid decay of the dung; secondly, to present an earthy substance to the slowly decaying matter which is capable of uniting with it, and preserving the ammonia; and thirdly, to afford some addition of saline matter, which most earths contain.

11. The most finely divided earths are, of course, the best adapted for these purposes, and perhaps a rich marly earth should be preferred to any other, from its known fertilizing qualities, while there is considerable uncertainty in that of the other materials mentioned. It is seldom, however, that much choice can be exercised. In forming a compost heap, a bed of the earth should be first laid down, about six inches deep, and then a layer of dung about a foot deep, lightly and regularly laid upon the earth. Let the alternation be repeated until the heap is about five feet high; a thin covering of the earth, both on the top and sides, completing the whole. In about ten weeks the heap should be turned and well mixed, and again covered with a slight coating of the earth.

12. Whenever both peat and lime are available, they form a very good compost for manuring pasture land. The mode of preparing this compost may be performed in the usual way of alternate layers, the peat being used in a double or triple proportion to the lime. The heap should be suffered to remain three or four months, during which time it should be turned and well mixed.—The lime acts very powerfully upon the inert fibre of the peat, and renders a large portion of it soluble in water, and in a fit state for becoming the food of plants.

13. Any refuse animal matter can of course be employed in a similar manner. The carcase of a dead horse, which is often suffered to pollute the air with its noxious effluvia, has been happily employed in decomposing 20 tons of peat earth, and transforming it into the most enriching manure. Night-soil may be composted with peat with great advantage.

14. Many volumes have been writen on the subject of composts, as substitutes for farm-yard dung, and yet the true principle upon which they should be formed does not appear to have been clearly inculcated and insisted upon. Farm-yard dung is certain in its effects because it contains all the elements or substances which plants require for their food; and those composite manures which contain the greatest number of the more essential substances are the most likely to act with corresponding uniformity.

## CHAPTER VIII.

### Section I.

1. The waste of the different constituent Elements of Plants.—If the *entire produce of a farm were to be carried away from it*, and no manure returned to it, the land would, in the great majority of instances, speedily become incapable of bearing crops; or, in the common phrase of farmers, it would be "worn out," owing to the deficiency of ammonia, or of alkaline and earthy salts.

2. If, on the other hand, the *whole of the produce were consumed upon the land*, it would continue to increase in productiveness, until more could not be grown for want of space. This decrease in the former case, and increase in the latter, would be accelerated or retarded by the original nature of the soil, and the maximum quantity would of course be influenced by the same cause.

3. These extreme cases are not merely hypothetical; they may be seen in actual operation in many newly-peopled countries, and particularly in the United States. The forests in that country, which had been growing for many centuries, when cut down and burnt by the settlers, left the land so rich as to be considered inexhaustible; most of the produce was carried away, and the dung left was regarded as an incumbrance.

4. By the repeated cultivation of exhausting crops, however—wheat and tobacco for instance—much of that land in the maritime states, which have been the longest settled, is now reduced to a state of poverty, and requires heavy dressings of manure. Although we mention these as extreme cases, yet the consideration of them is useful, as exhibiting a broad indication of the means by which poor land may become fertile, or very rich land reduced to beggary.

5. The medium case is that of land, in older countries, under a regular course of cultivation, and where corn and green crops succeed each other in due order and proportion, and from whence nothing is carried away but corn, cattle, sheep, and wool. Land,

under these circumstances, is the proper subject for our more particular consideration.

6. If a farm, under such a course of husbandry as that mentioned above, and generally approved as a good and lasting system, be cultivated for a series of years without being supplied with *any manure from foreign sources*, the land must lose, in a course of years, a considerable portion of those inorganic or mineral substances which we have stated above to be indispensable to the growth of plants and which is yearly withdrawn, as we have already stated, in the shape of corn, cattle, sheep, or wool, and the time will necessarily arrive when the crops will become deficient. This will ultimately take place in almost all soils, though upon certain rich spots it may not be perceptible for many years; and, on many, it will of course be felt much sooner than on the generality.

7. It is well known, that land which has "grown sick," as it is called, of clover, will often bear plentiful crops upon being dressed with a seemingly insignificant quantity of gypsum; and when that substance fails, the addition of wood, or even peat-ashes, will produce the desired effect. In the first case gypsum only was wanted in the second both that and potash were deficient. Substances containing much ammonia will generally improve the quality and quantity of wheat; but if phosphates are wanting at the same time in the soil, the ear will still be defective; and if potash, the straw will be weak, and more liable to fall early, and to *suffer blight.*

8. From the foregoing considerations, and what we have previously said upon this important subject, it must be evident that it is trifling with land, and calculated to produce frequent disappointment and loss, to apply any one salt as a substitute for manure.—When the perfect manures (perfect, because they contain all the substances which plants require), such as farm-yard dung, preparations of night-soil, guano, or the dung of other fowls, cannot be obtained, recourse must be had to artificial mixtures. Now the substances the most likely to be exhausted from soils, from the cause above mentioned, are *ammonia, phosphate of lime and magnesia, potash* and *gypsum.*

9. The most generally available sources of these salts are soot, bone-dust, and kelp-ashes (the better if only charred), or the two former with wood or peat-ashes, gypsum or sea salt. If peat-ashes are used, gypsum may be dispensed with. By the application of such partial substances for manure, we do not fulfil all the conditions of fertility, and disappointment consequently ensues.

10. The silent expression of nature has not been rightly understood, because, her interpreter—the chemist—has not been con-

sulted, or has been treated with contempt—as a mere "book learned theorist"—when he has offered his services to explain her meaning.

11. Though nature provides us with ammonia, as well as carbon through the medium of green crops, yet to maintain *a high degree of fertility* in corn crops, and especially in the production of wheat, ammonia must be considered as one of the most important ingredients of an efficient composite manure; and in order to form a manure of unfailing efficacy upon every kind of land, substances containing salts of ammonia must be added to those inorganic or mineral substances that constitute the ashes of the plants and seeds which the land is required to produce.

12. None of these must be omitted except such as we are quite certain already exist in the soil in inexhaustible quantity. There can seldom be any want of silica, and more seldom of oxide of iron. Muriate of soda (common salt) and sulphate of lime (gypsum) are the next substances which are less likely to be deficient in the soil; but very few under constant cultivation contain enough ammonia, phosphates, and potash, and consequently upon which a mixture of soot, wood ashes, and bone-dust, or rape dust, would not produce a most powerful effect.

13. We trust that the above observations, together with what has been previously said, will go far to explain the apparently mysterious nature of manures of this kind and throw light upon a subject which has hitherto been involved in doubt and uncertainty, and the want of which has occasioned much perplexity, as well as frequent disappointment and heavy losses.

## Section II.

1. Rotation of Crops and Drainage.—The rotation of crops is necessarily connected with the subject of manures, and a consideration of the food of plants explains the nature of the advantage which is derived from a varied succession. Green crops replenish the soil with *organic elements*, which they derive from the atmosphere, and some of them—such as sainfoin and lucerne—with *inorganic matter*, which their deep roots extract from the substratum; these they return again to the soil, either in the state of the dung of animals which have fed upon them, or as humus, resulting from the decay of their roots, which entitles them to be called *fertilizing crops*.

2. Unripe weeds of every description, and green crops if ploughed into the ground, have a powerful effect not only on the succeeding crop, but, if repeated, during every regular rotation,

will be found to materially enrich the staple of poor land.—Farmers do indeed sometimes plough in a crop of buckwheat, as a species of summer-fallow, and it is a good preparation for a crop of wheat; but the temptation of feeding it off, or cutting it for fodder, more frequently induces them to rob the land of it.

3. The corn or *exhausting crops*, abstract from the soil both the organic and inorganic substances, much of which, and particularly nitrogen, and the inorganic, or mineral, constituents, are annually carried off by cattle, sheep, and the production of grain; and hence the appellation they have received. These substances are, however, drawn from the soil in very different proportions by different crops; one, as potatoes, requiring more humus; another, as wheat, more phosphates, and nitrogen; and a third, as oats, more silicate of potash; while beans, peas, and vetches require little or no phosphates, and bring a large contribution of carbonic matter in their straw, and nitrogen in their leaves.

4. In this way one kind of plant finds in the soil enough of its appropriate food which the preceding plant did not require, and leaves that which its successor wants. Thus, by a suitable and judicious rotation, each exhausting crop receives in its turn due support, while, by the supply of manures, and the timely interchange of green crops, all the substances are restored to the soil, which would otherwise be exhausted.

5. There is, however, another cause for the necessity of a change of crops besides the exhaustion of the proper food of plants; for it has been found that however plentifully manures may be supplied, land will not sustain an unvarying succession of the same crops. It has been discovered by recent experiments that plants discharge an *excrement* from their roots when placed in water, and that a second of the same kind, placed in the same water, sickens; but if this plant be replaced by a third of a different kind, no such consequence results.

6. This *excrement*, therefore, operates as a *poison* to those plants from which it has been produced, and an accumulation of it in the soil, by a repetition of the same crop, must necessarily prove injurious. Time, therefore, is required for the decomposition of this peculiar excrement, before the land will bear a repetition of that crop. This change takes place much sooner in light and open than in adhesive and heavy soils, and it is accelerated by the operation of fallowing, and the action of lime and alkalis.

7. This is one object answered by repeated dressings of lime in particular localities where the wheat crop is too often repeated. We will here suggest another cause of the advantage of change.—

Each plant is observed to have its peculiar tribe of predatory insects, which would accumulate in a succession of the same crops, but are periodically checked or destroyed by a succession.

8. In conclusion it should be observed that every care and attention which can be paid to the preparation and application of manures will be ineffectual in rendering soils fertile, unless due regard be given to the removal of excess of moisture by *draining when needful.* When a soil is saturated with water, the air is excluded from the roots of the plants, and prevented from acting upon the manure ; while the low temperature produced by continual evaporation from the surface, has an additional powerful effect in retarding the progress of vegetation.

9. *To lay manure upon wet soils is*, in truth, *to throw money away;* but were draining universally effected, the whole of the now comparatively unproductive soil of the country would, to a vast extent, be rendered capable of receiving the benefit of the numerous modes of fertilizing. Its returns are immediate as well as compensative ; and to hesitate to drain the land, is to hesitate to confer a benefit upon one's self, of which a strong proof has been lately brought forward in a statement of the profit resulting from the drainage of 467 acres, and the employment of the drain water over 89 acres of land, on the estate of Lord Hatherton, in Staffordshire, England—*affording a clear annual interest on the outlay of full thirty-seven per cent. !*

## Section III.

## HARVEST HYMN.

1

God of the year !—with songs of praise,
  And hearts of love, we come to bless
Thy bounteous hand, for thou hast shed
  Thy manna o'er our wilderness ;—
In early spring time thou didst fling
O'er earth its robe of blossoming—
And its sweet treasures, day by day,
Rose quick'ning in thy blessed ray.

2

And now they whiten hill and vale,
  And hang from every vine and tree,
Whose pensile branches bending low
  Seem bowed in thankfulness to Thee,—

The earth with all its purple isles,
Is answering to thy genial smiles,
And gales of perfume breathe along
And lift to Thee their voiceless song.

3

God of the seasons! Thou hast blest
The land with sunlight and with showers,
And plenty o'er its bosom smiles
To crown the sweet autumnal hours;
Praise, praise to Thee! Our hearts expand
To view these blessings of thy hand,
And on the incense-breath of love,
Go off to their bright home above.

## Section IV.

1. **The physical qualities and chemical constitution of a soil may be changed by art.**—Each soil establishes upon itself—so to speak—a vegetation suited to its own nature, one that requires most abundantly those substances which actually abound in the soil—and the art of man cannot long change this natural connection between the living plant and the kind of land in which it delights to grow.

2. But he can change the character of the land itself. He can alter both its physical qualities and its chemical constitution, and thus can fit it for growing other races of plants than those it naturally bears—or, if he choose, the same races in greater abundance, and with increased luxuriance. It is, in fact, in the production of such changes, that nearly all the labour and practical skill of the husbandman—apart from local peculiarities of climate, &c.—is constantly expended For the attainment of this end he drains, ploughs, subsoil-ploughs, and otherwise works his land. For this end he clays, sands, marls, and manures it.

3. By these and similar operations, the land is so changed as to become both able and willing to nourish and ripen those peculiar plants which the agriculturist wishes to raise. On this practical department of the art of culture, the principles explained and illustrated in preceding Sections throw much light. They not only explain the reason why certain practices always succeed in the hands of the intelligent farmer—but why others also occasionally and inevitably fail—they tell him which practices of his neighbors he ought to adopt, and which of them he had better modify or wholly

reject,—and they direct him to such new modes of improving his land as are likely to add the most to its permanent productive value.

4. The operations of the husbandman in producing changes upon the land, are either mechanical or chemical. When he drains, ploughs, and subsoils, he alters chiefly the physical characters of his soil—when he limes and manures it, he alters its chemical constitution. These two classes of operations, therefore, are perfectly distinct. Where a soil contains all that the crops we desire to grow are likely to require, mere mechanical operations may suffice to render it fertile—but where one or more of the inorganic constituents of plants are wanting, draining may prepare the land to benefit by further operations, but it will not be alone sufficient to remove its comparative sterility.

5. I shall, therefore, consider in succession these two classes of practical operations:—First, *Mechanical methods* of improving the soil, including draining, ploughing, mixing with clay, sand, &c.; Secondly, *Chemical methods*, including limeing, marling and the application of vegetable, animal, and mineral manures. To satisfy fully, however, in regard to the absolute necessity for such changes, if we would render the land fit to produce any given crop, I will illustrate, by a few brief examples, the intimate relation observed in nature between the kind of soil and the kind of plants that grow upon it.

6. *The connection between the kind of soil and the kind of plants that grow upon it.*—That a general connection exists between the kind of soil and the kind of plants that grow upon it, is familiar to all practical men. Thus clay soils are generally acknowledged to be best adapted for wheat—loamy soils for barley—sandy loams for oats or barley—such as are more sandy still for oats or rye—and those which are almost pure sand, for rye alone of all the corn-bearing crops. But in a state of nature, we find special differences among the spontaneous produce of the soil, which are more or less readily traceable to its chemical constitution in the spots where the plants are seen to grow. Thus—

7. *First*, On the sandy soils of the sea shores, and on the salt steppes of Hungary and Russia, the sand-worts, salt worts, glass-worts, and other salt loving plants abound. When these sands are enclosed and drained, the excess of the salt is gradually washed out by the rains, or in some countries is removed by reaping the saline plants annually, and burning them for soda (barilla), when wholesome and nutritive grasses take their place; but the white clover and the daisy, and the dandelion, must first appear, before, as a general rule, it can be profitably ploughed up and sown with corn.

8. *Secondly*, The dry drifted sands, more or less remote from the sea, produce no such plants. They are distinguished by their own coarse grasses, among which the *elymus arenarius* (upright sea lyme-grass) often, in our latitudes, occupies a conspicuous place. On the downs of North Jutland, it was formerly almost the only plant which the traveller could meet with over an area of many miles.

9. *Thirdly*, on ordinary sandy soils leguminous plants are rare, and the herbage often scanty and void of nourishment. With the presence of marl in such soils, the natural growth of leguminous plants increases. The colt's-foot also, and the butter bur, not only grow naturally where the subsoil is marly, but infest it sometimes to such a degree as to be with great difficulty extirpated. So true is this indication of the nature of the soil, that in the lower vallies of Switzerland these plants are said to indicate to the natives where they may successfully dig for marl.

10. On calcareous soils, again, or such as abound in lime, the quicken or couch-grass is seldom seen as a weed, while the poppy, the vetch and the darnel abound. *Fourthly*, So peaty soils, when laid down to grass, slowly select for themselves a peculiar tribe of grasses, especially suited to their own nature, among which the *holcus lanatus* (meadow soft grass) is remarkably abundant. Alter their constitution by heavy limeing, and they produce luxuriant green crops and a great bulk of straw, but give a coarse thick-skinned grain, more or less imperfectly filled. Alter them further by a dressing of clay or keep them in arable culture, and stiffen them with composts, and they will be converted into rich and sound corn-bearing lands.

11. *Fifthly*, in the waters that gush from the sides of lime-stone hills—on the bottoms of ditches that are formed of lime stones or marls—and in the springs that have their rise in many trap rocks, the water-cress appears and accompanies the running waters, sometimes for miles on their course. The mare's-tail *(equisetum)*, on the other hand, attains its largest size by the marshy banks of rivulets in which not lime but silica is more abundantly present. So the Cornish heath *(erica vagans)* is found only over the serpentine soils of Cornwall, and the red broom rape *(orobanche rubra)* only on decayed traps in Scotland and Ireland.

12. These facts all point to the same natural law, that where other circumstances of climate, moisture, &c., are equal, *the natural vegetation—that which grows best on a given spot—is entirely dependent upon the chemical constitution of the soil.* But both the soil, and the vegetation it willingly nourishes, are seen to undergo slow but natural changes.

13. Lay down a piece of land to grass, and, after a lapse of years, the surface soil—originally, perhaps, of the stiffest clay—is found to have become a rich, light, vegetable mould, bearing a thick sward of nourishing grasses, almost totally different from those which naturally grew upon it when first converted into pasture. So in a wider field, and on a larger scale, the same slow changes are exhibited in the vast natural forests that are known to have long covered extensive tracts in various countries of Europe.

14. Thus it is a matter of history that Charlemagne hunted in the forest of Gerardmer, then consisting of oak and beech—though now the same forest contains only pines of various species. On the Rhine, between Landau and Kaiserlautern, oak forests, of several centuries old, are seen to be gradually giving way to the beech, while others of oak and beech are yielding to the encroachments of the pine.

15. In the Palatinate, the Scotch fir (*pinus sylvestris*) is also succeeding to the oak. In the Jura, and in the Tyrol, the beech and the pine are seen mutually to replace each other—and the same is seen in many other districts. When the time for a change of crop arrives, the existing trees begin to languish one after another, their branches die, and finally their dry and naked tops are seen surrounded by the luxuriant foliage of other races.

16. These facts not only show how much the vegetable tribes are dependent upon the chemical nature of the soil—they indicate, likewise, the existence of slow, natural changes in the constitution of the soil, which lead necessarily to a change of vegetation also. We can ourselves, in the case of ancient forests, effect such changes. When in this country a forest of oak or maple is cut down, one of pine springs up in its place; while on the site of a pine forest, oak and other broad-leaved trees speedily appear.

17. But if the full time for such changes has not yet come, the new vegetation may be overtaken, and smothered by the original tribes. Thus when the pine forests of Sweden are burned down, a young growth of birch succeeds, but after a time the pines again appear and usurp their former dominion. The soil remains, still, more propitious to the growth of the latter than of the former kind of tree. We may, therefore, take a practical lesson from the book of nature. If we wish to have a luxuriant vegetation upon a given spot, we must either select such kinds of seed to sow upon it as are fitted to the kind of soil, or we must change the nature of the land so as to adapt it to our crop.

18. And, even when we have once prepared it to yield abundant returns of a particular kind, the changes we have produced can

only be more or less of a temporary nature. Our care and attention must still be bestowed upon it, that it may be enabled to resist the slow natural causes of alteration, by which it is gradually unfitted to nourish those vegetable tribes which it appears now to delight in maintaining.

## Section V.

1. Improvement of the Soil by Mixing.—There are some soils so obviously defective in constitution, that the most common observer can at once pronounce them likely to be improved by mechanical admixtures of various kinds. Thus peaty soils abound too much in vegetable matter; a mixture of earthy substances, therefore, of almost any common kind, is readily indicated as a means of improvement. In like manner we naturally impart consistence to a sandy soil by an admixture of clay, and openness and porosity to stiff clay by the addition of sand.

2. The first and obvious effect of such additions is to alter the physical qualities of the soil—to consolidate the peats and sands, and to loosen the clays. But we have already seen that the fertility of the soil, or its power of producing a profitable return of this or that crop, depends in the first place on its chemical constitution.—It must contain in sufficient abundance all the inorganic substances which that crop requires for its daily food.

3. Where this is already the case, as in a rich stiff clay, a decided improvement may be produced by an admixture with siliceous sand, which merely separates the particles mechanically, and renders the whole more porous. But let the clay be deficient in some necessary constituent of a fertile soil, and such an addition of siliceous sand would not produce by any means an equal benefit. It may be proper to add this sand with the view of producing the mere physical alteration, but we must add some other substance also for the purpose of producing the necessary chemical change.

4. The good effects which almost invariably follow from the addition of clay to peaty or sandy soils are due to the production at one and the same time of a physical and of a chemical change.—They are not only rendered firmer or more solid by the admixture of clay, but they derive from this clay at the same time some of those mineral substances which they previously contained in less abundance.

5. The addition of marl to the land acts often in a similar two-fold capacity. It renders clay lands more open and friable, and to all soils brings an addition of carbonate, and generally of phosphate of lime, both of which are proved by experience to be not

only very influential, but to be absolutely necessary to healthy vegetation.

6. That much benefit to the land would in many instances accrue from such simple admixtures as those above adverted to, where the means are available, will be readily granted. The only question on the subject that ought to arise in the mind of a prudent man, is that which is connected with the economy of the case. Is this the most profitable way in which I can spend my money? Can I employ the spare labour of my men and horses in any other way which will yield me a larger return? It is obvious that the answers to these questions will be modified by the circunstances of the district in which he lives.

7. It may be more profitable to drain,—or labour may be in great request and at a high premium,—or a larger return may be obtained by the investment of money in purchasing new than in improving old lands. It is quite true that the country at large is no gainer by the mere transfer of land from the hands of A to those of B, and that he is undoubtedly the most meritorious citizen who, by expending his money in improving the soil, virtually adds to the breadth of the land, in causing it to yield a larger produce.

8. Yet it is no less true that the employment of individual capital in such improvement is not to be expected *generally* to take place, unless it be made to appear that such an investment is likely to be as profitable as any other within the reach of its possessor. It seems to be established beyond a doubt that in very many districts no money is more profitably invested, or yields a quicker return, than that which is expended in draining and subsoiling—and yet in reality one main obstacle to a more rapid increase of the general produce of the British soil is the practical difficulty which exists in convincing the owners and occupiers of the soil that such is the case, or would be the case, in regard to their own holdings.

9. The more widely a knowledge of the entire subject, in all its bearings, becomes diffused, the less it is to be hoped will this difficulty become—for the economist, who regards the question of improvement as a mere matter of profit and loss, cannot strike a fair balance unless he knows the several items he may prudently introduce into each side of his account.

## SECTION VI.

1. LIME.—Lime is never met with in nature except in a state of chemical combination with some other substance. That which is usually employed in agriculture is met with in the state of *carbo-*

*nate*. Carbonate of lime, or common lime-stone, consists of lime and carbonic acid, and when perfectly pure and dry, in the following proportions:—

| | Per cent. | |
|---|---|---|
| Carbonic acid, | 43.7 | or one ton of pure carbonate of lime contains 11¼cwts. of lime. |
| Lime, | 56.3 | |
| | 100 | |

2. Limestones, however, are seldom pure. They always contain a sensible quantity of other earthy matter, chiefly silica, alumina, and oxide of iron, with a trace of phosphate of lime, sometimes of potash and soda, and often of animal and other organic matter. In lime-stones of the best quality the foreign earthy matter or impurity does not exceed 5 per cent of the whole—while it is often very much less.

3. The chalks and mountain lime-stones are generally of this kind. In those of inferior quality it may amount to 12 or 20 per cent., while many calcareous beds are met with in which the proportion of lime is so small that they will not burn into agricultural or ordinary building lime—refusing to slake or to fall to powder when moistened with water. Of this kind is the Irish *calp* and the lime-stone nodules which are burned for the manufacture of hydraulic limes or cements.

4. It is easy to ascertain the quantity of earthy matter contained in lime stone, by simply introducing a known weight of it into cold diluted muriatic acid and observing or weighing the part which, after 12 hours, refuses to dissolve or to exhibit any effervescence. It is to the presence of these insoluble impurities that lime-stones in general owe their colour, pure carbonate of lime being perfectly white.

5. *Of the quantity of lime which ought to be used.*—The quantity of lime which ought to be added to the soil is dependent upon so many circumstances, that it is impossible to state any general rule by which, in all cases, the practical man can safely regulate his procedure. *Firstly*, to soils which contain no lime, or to which it is added for the first time, a larger dose must be given.

6. We have seen that a certain *minimum* portion of lime is indispensable to a productive soil. If we suppose this smallest quantity to be no greater than 0.2 per cent. in the surface, then with a soil six inches in depth—which *contains no lime*, we ought to mix a ton and a half, say 40 bushels of slaked lime, and by successive yearly additions to supply the annual waste.

7. But to mix this feeble dose of lime intimately with the soil to

a depth of six inches would obviously require an expenditure of labour which the practical farmer could rarely afford. It would be greater economy, therefore, in most cases to add a dose several times larger, and this not only because the same amount of labour would diffuse it more generally through the whole soil, but because this large liming would render less necessary the immediate addition of new supplies to repair the unavoidable waste.

8. But there is reason to believe that the proportion of lime which the soil ought to contain, if it is to be successfully subjected to arable culture, ought to be much larger than is above assumed as the smallest or minimum quantity. If we suppose one per cent. to be necessary, then eight tons of lime-shells, or upwards of 300 bushels of slaked lime, must be mixed with a soil six inches in depth, to impart to it this proportion—or half the quantity if it be kept within three inches of the surface. Even a very large dose of lime, therefore, does not, if it be well mixed, materially alter the constitution of the soil.

9. *Secondly*, but experience has proved that the quantity of lime which a skilful farmer will add to his land will vary with many other circumstances besides the depth of his soil, and the proportion of lime it already contains. Thus—on clay lands more lime is necessary than on light and sandy soils. This may be partly ascribed to the physical effect of the lime in opening and loosening the stiff clay—but independent of this action the particles of lime are liable to be coated over and enveloped by the fine clay, and thus shut out from the access of the air. These particles, therefore, must be more numerous in such a soil if as many of them are to be exposed to the air as in lighter land, through which the atmospheric air continually permeates.

10. On wet and marshy soils, a larger application still may be made with safety, and partly for the same reason. The moisture surrounding the lime cannot perform its important functions. The same moisture tends to carry down the lime and lodge it more speedily in the subsoil. The continued evaporation also keeps such soils too cold to allow the chemical changes, which lime in favorable circumstances produces, to proceed with the requisite degree of rapidity.

11. The soluble compounds which are formed as the consequence of these changes are, in wet and marshy soils, dissolved by the moisture, and so diluted as to enter in smaller quantity into the roots of plants. And lastly, in certain cases, new compounds of the lime with the earthy and stony matters of the soil are formed, which may either harden into visible lumps of mortar and cement,

or into smaller particles of indurated matter, in which the lime is no longer in such a state as to be able to act in an equal degree as an improver of the soil.

12. In cold and wet clays, in which all these evil conditions occasionally meet, it is not surprising, therefore, that large doses of lime should sometimes have been added without producing any sensible benefit whatever. Again, when the soil is also rich in vegetable matter, lime may be still more abundantly applied.—Thus, when a field is at once wet and marshy, and full of vegetable matter, as our peat bogs are, lime may be laid on more unsparingly than under any other circumstances.

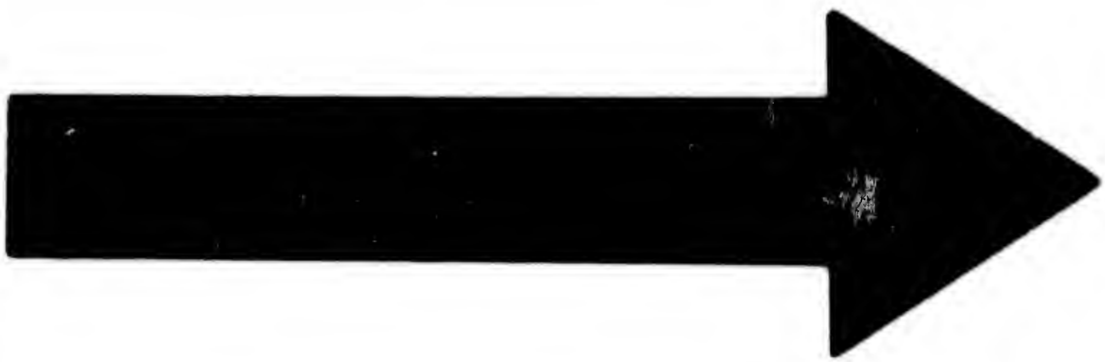
13. For in this case, besides the action of the access of water, as above explained, the vegetable matter combines with and masks the ordinary action of a considerable quantity of the lime. By this combination, no part of the ultimate influence of the whole lime upon the soils is necessarily lost; in most cases the *immediate* effect only is lessened, which the same quantity applied to other soils would have been seen to produce. In favourable circumstances its action is retarded and prolonged, the compounds it forms with vegetable matter decomposing slowly, and, therefore, remaining long in the soil.

14. To the exact chemical constitution of the compounds thus formed, *as soon as* lime is mixed up with a soil rich in vegetable matter, and to the chemical changes which these compounds gradually undergo, it will be necessary to direct our atention when we come to study the *theory* of the action of lime, as an improver of the soil. Not only the natural depth of the soil, as already stated, but also the depth to which it is usually ploughed, and to which it is customary to bury the lime, will materially affect the quantity which can be safely applied.

15. A dose of lime which would materially injure a soil into which the plough rarely descends beyond two or three inches, might be too small an application where six or eight inches are usually turned over by the plough. When new soil, also, is to be brought up, which may be supposed to contain no lime, or in which noxious substances are present, a heavier dose of lime must necessarily be laid upon the land.

16. *Thirdly*, such are the circumstances in which large applications of lime may be usefully applied to the land. In soils of an opposite character not only will smaller quantitios of lime produce an equally beneficial effect, but serious injury would often be inflicted by spreading it too lavishly upon the fields.

17. The more dry and shallow the soil, the more light and



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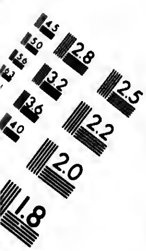
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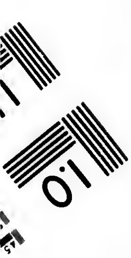
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sandy, the less abundant in vegetable matter, the more naturally mild its locality, and the drier and warmer the climate in which it is situated—the less the quantity of lime which the prudent farmer will venture to mix with it. It is to the neglect of these natural indications that the exhaustion and barrenness that have occasionally followed the application of lime are to be ascribed. It is only in rare cases, such as the presence of much noxious mineral matter in the soil, that these indications can be safely neglected.

## Section VII.

1. **Whether Lime ought to be used in larger doses at greater intervals, or in smaller doses at shorter intervals?**—The quantity of lime which ought to be applied to the land must, as we have seen, vary with its quality, and with the conditions in which it is placed. Hence the practice in this respect necessarily varies in every country and in almost every district.

2. But a difference of opinion also prevails among practical men, as to whether that quantity of lime which land of a given kind may require ought to be applied in large doses at long intervals, or in small quantities frequently repeated. The indications of theory in reference to this point are clear and simple.

3. A certain proportion of lime is indispensable in our climate to the production of the greatest possible fertility. Let us suppose a soil to be wholly destitute of lime—the first step of the improver would be to add to this indispensable proportion. This would necessarily be a large quantity, and, therefore, *to land limed for the first time theory indicates the propriety of adding a large dose.*

4. We may consider it, as a principle recognised or involved in the agricultural practice both of our own and of foreign countries, that nearly the same *annual* addition of lime ought to be made to the land, whether it be applied at long intervals or at the recurrence of each rotation. There is, therefore, on the whole, no saving in the cost of lime, whichever method you adopt. A slight consideration of the subject, however, may satisfy us that there is a real difference in the comparative economy or profit of the two methods.

5. Let us suppose two acres of the same clay land to be limed respectively with 200 bushels each, and that the one is cropped for twenty years afterwards without further liming, while the other at the end of every five years is dressed with an additional dose of 40 to 50 bushels. In both cases the land would have attained the most productive condition in five or six years.

6. Let us suppose that in this condition it produced annually a

crop of (or equivalent in nutritive value to) 30 bushels of wheat, and that on neither acre did a sensible diminution appear before the end of ten years. Then during the second ten the crops would gradually lessen in the one acre, while in consequence of the *re*-addition of the lime as it disappears, the amount of produce would remain sensibly the same in the other acre.

7. Suppose the produce of the former gradually to diminish from 30 to 20 bushels during these ten years,—or that while the one has continued to yield 30 bushels during the whole period, the other has on an average yielded only 25 bushels during the latter ten years. If now the second large dose of 200 bushels be added to this latter acre, the cost of liming both will have become sensibly the same, but the amount of produce or of profit from the two acres during the second ten years will stand thus—

10 crops, of 30 bushels each, amount to 300 bushels.

10 crops, of 25 buchels each, amount to 250 bushels.

difference in favour of frequent liming, 50 bushels per acre, *or nearly two whole crops every lease of twenty years.*

8. Thus it appears, *firstly*, That according to the practice of different countries the quantity of lime which ought to be added, and consequently the cost of adding it, is very nearly the same, whether it be applied in larger doses at longer intervals, or in smaller doses more frequently repeated. *Secondly*, that, *after the first heavy liming*, the frequent application of small doses is the more natural method—and *thirdly*, that it is also the most economical or profitable method.

9. One thing, however, must be borne in mind by those who, in adopting the best system of liming, do not wish both to injure their land and to meet with ultimate disappointment. Organic matter, in the form of farm-yard manure, of bone or rape dust, of green crops ploughed in, or of peat, and other composts—must be abundantly and systematically added, if at the end of 20 or 40 years the land in which the full supply of lime is kept up is to retain its original fertility.

10. High farming is the most profitable—for the soil is ever grateful for skilful treatment—but he who farms high in the sense of keeping up the supply of lime, must also farm high in the sense of keeping up the supply of organic and other manures in the soil—otherwise present fertility and gain will be followed by future barrenness and loss. If this is not to be done, it were better to add lime at long intervals, since as the quantity of lime diminishes, the land begins to enjoy a little respite, and has had time in some measure to recover itself—the crop in both instances being the same—before the new dose is laid upon its surface.

## SECTION VIII.

1. **FORM AND STATE OF COMBINATION IN WHICH LIME OUGHT TO BE APPLIED TO THE LAND, AND OF THE USE AND ADVANTAGES OF THE COMPOST FORM.**—The form and state of combination in which lime ought to be applied to the land depend upon the nature of the soil, on the cropping to which it is subjected, and on the special purpose which the lime is intended to effect. The soil may be heavy or light, in arable culture, or laid down to grass, and each of these conditions indicates a different mode of procedure in the application of lime.

2. So the lime itself may be intended either to act more immediately or to be more permanent in its action—or it may be applied for the purpose of destroying unwholesome herbage, of quickening inert vegetable matter, of generally sweetening the soil, or simply of adding to the land a substance which is indispensable to its fertility. The skilful agriculturist will modify the form and mode of application according as it is intended to serve one or other of these purposes.

3. From considerations already presented in regard to the changes which quick-lime undergoes in the air, it appears to be expedient, *firstly*, to slake lime quickly, and to apply it immediately upon clay, boggy, marshy, or peaty lands—upon such also as contain much inert or generally which abound in other forms of vegetable matter.

4. *Secondly*, to bents and heaths which it is desirable to extirpate, it should be applied in the same caustic state, or to unwholesome subsoils which contain much iron (sulphate of iron), as soon as they are turned up by the plough. In both these cases the unslaked lime-dust from the kilns might be laid on with advantage. *Thirdly*, where it is to be spread over grass lands without destroying the herbage, it is in most cases safer to allow the lime to slake spontaneously, and in the open air rather than in a covered pit.

5. It is thus obtained in an exceedingly fine powder, which can be easily spread, and, while it is sufficiently mild to leave the tender grasses unharmed, it contains a sufficient quantity of caustic lime to produce those chemical changes in the soil on which the efficacy of quick-lime depends.

6. *Fourthly*, where lime is applied to the fallow, is ploughed in, well harrowed or otherwise mixed with the soil, it is generally of little consequence in which of the above states it is laid on. The chief condition is, that it be in the state of a fine powder, and that it be well spread and intimately mixed with the soil. Before these operations are concluded the lime will be very nearly in the state of

combination in which it exists in spontaneously slaked lime, whatever may have been the state of causticity in which it has been applied.

7. As there are many cases in which lime ought to be applied unmixed and in the caustic state, so there are others in which it is best and most beneficially laid upon the land in a mild state and in the form of compost. *Firstly*, when lime is required only in small quantities, it can be more evenly spread when previously well mixed with from 3 to 8 times its bulk of soil.

8. *Secondly*, on light, sandy, and gravelly soils, when of a dry character, unmixed lime will bring up much cow-wheat *(melampyrum)* and red poppy. If they are moist soils, or if rainy weather ensue, the lime is apt to run into mortar, and thus to form either an impervious subsoil, or lumps of a hard conglomerate, which are brought up by the plough, but do not readily yield their lime to the soil. These bad consequences are all avoided by adding the lime in the form of compost.

9. *Thirdly*, applied to grass lands—unless the soil be stiff clay —or much coarse grass is to be extirpated,—it is generally better and safer to apply it in the compost form. The action of the lime on the tender herbage is by this means moderated, and its exhausting effect lessened upon soils which contain little vegetable matter.

10. *Fourthly*, in the compost form the same quantity of lime acts more immediately. While lying in a state of mixture, those chemical changes which lime either induces or promotes have already to a certain extent taken place, and thus the sensible effect of the lime becomes apparent in a shorter time after it has been laid upon the land.

11. *Fifthly*, this is still more distinctly the case when, besides earthy matter, decayed vegetable substances, ditch scourings, and other refuse, are mixed with the lime. The experience of every practical man has long proved how very much more enriching such composts are, and more obvious in their effects upon the soil, than the simple application of lime alone.

12. *Sixthly*, it is stated as the result of extended trial in Flanders and in parts of France, that a much smaller quantity of lime laid on in this form will produce an equal effect. For this one cause may be, that the rains are prevented from acting upon the mass of compost as they would do upon the open soil—in washing out either the lime itself or the saline substances which are produced during its contact with the earthy and vegetable matter with which it is mixed.

13. *Seventhly*, the older the compost the more fertilizing is its action. This fact is of the same kind with that generally admitted in

respect to the action of marls and unmixed lime—that it is more sensible in the second year, or in the second rotation, than in the first. In conclusion, it may be stated that this form of application is especially adapted to the lightest and driest soils, and to such as are poorest in vegetable manner. In this form, lime has imparted an unexpected fertility even to the white and barren sands of the *Landes* (Puvis), and upon the dry hills of Derbyshire it has produced an almost equal benefit.

## Section IX.

1. When ought Lime to be Applied.—In regard to the period of the year and of the rotation, there are three principles by which the procedure of the practical man ought chiefly to be directed. *Firstly, that lime takes some time to produce its known effects upon the soil.*—It ought, therefore, to be applied as long as possible before the crop is sown. That is, in the early autumn, where either winter or spring corn is about to be sown,—on the naked fallow where the land is allowed to be at rest for a year,—or on the grass fields before breaking up, where the pasture is to be immediately succeeded by corn.

2. *Secondly, that quick-lime expels ammonia from decomposed and fermenting manure.* When such manure, therefore, is applied to the land, as it is in all our well-farmed districts, quick-lime should not be so laid upon the land as to come into immediate contact with it. If both *must* be applied in the same year, they should be laid on at periods as distant from each other as may be convenient, or if this necessity does not exist, the lime should be spread either a year before or a year after the period in the rotation at which the manure is usually applied.

3. It is for this reason, as well as for the other already stated, that lime is applied to the naked fallow, to the grass before breaking up, or along with the winter wheat after a green crop which has been aided by fermented manure. When ploughed into the fallow, or spread upon the grass, it has had time to be almost completely converted into the mild state (that of carbonate) before the manure is laid on.

4. In this mild state it has no sensible effect in expelling the ammonia of decomposing manure. Again, when it is applied in autumn along with, or immediately before the seed, the volatile or ammoniacal part of the manure has been expended in nourishing the green crop, so that loss can rarely accrue from the admixture of the two at this period of the rotation.

5. The excellent elementary work of Professor Lowe contains the following remark:—"It is not opposed to theory that lime should

be applied to the soil at the same time with dung and other vegetable substances, as is frequent in the practice of farmers." This is strictly correct only in regard to marls, lime-sand &c., or to perfectly mild lime, any of which may be mixed, without loss, with manure in any state. Of quick or caustic lime it is correct only when the animal or vegetable matter has not yet begun to ferment. With *recent* animal or vegetable matter quick-lime may be mixed up along with earth into a compost, not only without the risk of much loss, but with the prospect of manifest advantage.

6. *Thirdly, that quick-lime hastens or revives the decomposition of inert organic matter.*—This fact also indicates the propriety of allowing the lime as much time as possible to operate before a crop is taken from land in which organic matter already abounds. Or where fermenting manure is added, it advises the farmer to wait till spontaneous decomposition becomes languid, when the addition of lime will bring it again into action and thus maintain a more equable fertility.

7. The above remarks, in regard to the best time for applying lime, refer chiefly to *quick-lime*, the state in which, in England, it is so extensively used. Marls and shell-sands can cause no loss when mixed with the manure, and therefore may with safety be laid on at any period of the rotation. The same remark applies with greater force to the lime composts. These may be used precisely in the same way as, and even instead of, the richer manures—may be laid, without risk, upon grass lands of any quality, and at any period—or as a top dressing on the young corn in spring, when the grass and clover seeds are sown by which the corn crop is to be succeeded.

8. And as the compost acts more speedily than lime in any other form, it is especially adapted for immediate application to the crop it is intended to benefit. To wet lands also, it is well suited, and to such as are subject to much rain, by which, while the surface is naked, the soluble matters produced in the soil are likely to be very much washed away.

## Section X.

1. Effect of Lime on the productions of the Soil.—*Firstly, it alters the natural produce of the land*, by killing some kinds of plants and favouring the growth of others, the seeds of which had before lain dormant Thus it destroys the plants which are natural to silicious soils and to moist and marshy places. From the grain-field it extirpates the corn-marigold (*chrysanthemum segetum*), while, if added in excess, it encourages the poppy, the yellow cow-wheat

(*melampyrum pratense*), and the yellow rattle (*rhinanthus crista galli*), and when it has sunk, favours the growth of the troublesome and deep-rooted coltsfoot.

2. Similar effects are produced upon the natural grasses. It kills heath, moss, and sour and benty (*agrostis*) grasses, and brings up a sweet and tender herbage, mixed with white and red clovers, more greedily eaten and more nourishing to the cattle. Indeed, all fodder whether natural or artificial, is said to be sounder and more nourishing when grown upon land to which lime has been abundantly applied. On benty grass the richest animal manure often produces little improvement until a dressing of lime has been laid on.

3. It is partly in consequence of the change which it thus produces in the nature of the herbage, that the application of quicklime to old grass-lands, some time before breaking up, is found to be so useful a practice. The coarse grasses being destroyed, *tough* grass land is opened and softened, and is afterwards more easily worked, while, when turned over by the plough, the sod sooner decays and enriches the soil. It is another advantage of this practice, however, that the lime has time to diffuse itself through the soil, and to induce some of those chemical changes by which the succeeding crops of corn are so greatly benefitted.

4. *It improves the quality of almost every cultivated crop.* Thus, upon limed land, *the grain* of the corn crops has a thinner skin, is heavier, and yields more flour, while this flour is said also to be richer in gluten. On the other hand, these crops, after lime, run less to straw, and are more seldom laid. In wet seasons wheat preserves its healthy appearance, while on unlimed land, of equal quality, it is yellow and sickly. A more marked improvement is said also to be produced both in the quantity and in the quality of the spring sown than of the winter-sown crops.

5. *Potatoes* grown upon all soils are more agreeable to the taste and more mealy after lime has been applied, and this is especially the case on heavy and wet lands, which lie still undrained. *Turnips* are often improved both in quantity and in quality when it is laid on in preparing the ground for the seed. It is most efficient, and causes the greatest saving of farm-yard manure where it is applied in the compost form, and where the land is already rich in organic matter of various kinds.

6. *Peas* are grown more pleasant to the taste, and are said to be more easily *boiled soft*. Both beans and peas also yield more grain. *Rape*, after a half-liming and manuring, gives extraordinary crops, and the same is the case with the *colsa*, the seed of

which is largely raised in France for the oil which it yields. On *flax* alone it is said to be injurious, diminishing the strength of the fibre of the stem. Hence, in Belgium, flax is not grown on limed land till seven years after it has been applied.

7. *It hastens the maturity of the crop.*—It is true of nearly all our cultivated crops, but especially of those of corn, that their full growth is attained more speedily when the land is limed, and that they are ready for the harvest from 10 to 14 days earlier. This is the case even with buck-wheat, which becomes sooner ripe, though it yields no larger a return, when lime is applied to the land on which it is grown.

8. The liming of the land is the harbinger of health as well as of abundance. It salubrifies no less than it enriches the well cultivated district. I have already drawn your attention to this as one of the incidental results which follow the skilful introduction of the drain over large tracts of country. Where the use of lime and of the drain go together, it is difficult to say how much of the increased healthiness of the district is due to the one improvement, and how much to the other. The lime arrests the noxious effluvia which tend to rise more or less from every soil at certain seasons of the year, and decomposes them or causes their elements to assume new forms of chemical combination, in which they no longer exert the same injurious influence upon animal life.

9. How beautiful a consequence of skilful agriculture, that the health of the community should be promoted by the same methods which most largely increase the produce of the land! Can you doubt that the All-benevolent places this consequence so plainly before you, as a stimulus to further and more general improvement —to the application of other knowledge still to the amelioration of the soil.

## Section XI.

1. Circumstances by which the effects of lime are modified.—These effects of lime are modified by various circumstances. We have already seen that the quantity which must be applied to produce a given effect, and the form in which it will prove most advantageous, are, in a great measure, dependent upon the dryness of the soil, upon the quantity of vegetable matter it contains, and on its stiff or open texture. There are several other circumstances, however, to which it is proper still to advert. Thus: Its effects are greatest when well mixed with the soil, and *kept near the surface within easy reach of the atmosphere.* The reason of this will hereafter appear.

2. On arable soils of the same kind and quality, the effects are

greatest upon such as are newly ploughed out, or upon subsoils just brought to day. In the case of subsoils, this is owing partly to their containing naturally very little lime, and partly to the presence of noxious ingredients, which lime has the power of neutralizing. In the case of surface soils newly ploughed out, the greater effect, in addition to these two causes, is due also to the large amount of vegetable and other organic matter which has gradually accumulated within them. It is the presence of this organic matter which has led to the establishment of the excellent practical rule—"*that lime ought always to precede putrescent manures when old leys are broken for cultivation.*"

3. Lime produces a greater *proportional improvement* upon poor soils than on such as are richer (Dr. Anderson) This is also easily understood. It is of poor soils in their *natural state* of which Dr. Anderson speaks.* In this state they contain a greater or less quantity of organic matter, but are nearly destitute of lime, and hence are in the most favorable condition for being benefitted by a copious liming. Experience has proved that by this one operation such land may be raised in money value eight times, or from 5*s.* to 40*s.* per acre ; but no practical man would expect that arable land already worth £2 per acre could, by liming or any other single operation, become worth £16 per acre of annual rent.

4. The greater proportional improvement produced upon poor lands by lime is only an illustration, therefore, of the general truth —that on poor soils the efforts of the skilful improver are always crowned with the earliest and most apparent success. In certain cases, the addition of lime, even to land in good cultivation, and according to the ordinary and approved practice of the district, produces no effect whatever. This is sometimes observed where the custom prevails, as in some parts of Ayrshire and elsewhere, to apply lime along with every wheat crop, and on such farms especially where the land is of a lighter quality. Where from 40 to 60 bushels of lime are added at the end of each rotation of 4 or 5 years, the land may soon become so saturated with lime that a fresh addition will produce no sensible effect.

5. Thus Mr. Campbell, of Craigie, speaks of a trial made by an intelligent farmer in his neighbourhood, where alternate ridges only were limed without any sensible difference being observed.

* "I never met," he says, "with a poor soil in its natural state, which was not benefitted in a very great degree by calcareous matter when administered in proper quantities. But I have met with several rich soils, which are fully impregnated with dung, on which lime applied in any quantity produced not the smallest sensible effect."

No result could show more clearly than this—that for one rotation at least the expense of lime might be saved, while at the same time the land would run the less risk of exhaustion. Another fact mentioned by Mr. Campbell proves the soundness of this conclusion. The lime never fails to produce obvious benefit where the land is allowed to be four or five years in grass—where it is applied, that is, only once in eight or nine years.

6. The fair inference is, therefore, that in this district, as well as in others where similar effects are observed, too much lime is habitually added to the land, whereby not only is a needless expense incurred, but a speedier exhaustion of the soil is insured. Good husbandry, therefore, indicates either the application of a smaller dose at the recurrence of the wheat crop—or the occasional omission of lime altogether for an entire rotation. The practical farmer cannot have a better mode of ascertaining when his land is thus fully supplied with lime—than by making the trial upon alternate ridges, and marking the effect.

7. On poor arable lands, which are *not* naturally so, but which are worn out or exhausted by repeated liming and cropping, lime produces no good whatever.* Such soils, if they do not already abound in lime, are, at least, equally destitute of numerous other kinds of food, organic or inorganic, by which healthy plants are nourished,—and they are only to be restored to a fertile condition by a judicious admixture of all. This truth is confirmed by the practical observation, that on soils so exhausted farm-yard manure along with the lime does not produce the same good results as in other cases. *All* that the soil requires is not supplied in sufficient abundance by these two substances laid on alone.

8. On lands of this kind, and on all in which vegetable matter is wanting, lime may even do harm to the immediate crop. It is apt to *singe* or *burn* the grain sown upon them—an effect which is probably chemical, but which may in part be owing to its rendering more open and friable soils already by long arable culture too open.

9. A consideration of the circumstances above adverted to explains why, in some districts, and even in some whole provinces, the use of lime in any form should be condemned and even entirely given up. The soil has been impoverished through its unskilful

* "It is scarcely practicable to restore fertility to land, even of the best natural quality, which has been thus abused; and thin moorish soils, after being exhausted by lime, are not to be restored." (Brown.)

application—or, by large admixtures of lime or marl for a series of years, the soil has been so changed as to yield no adequate return for new additions. Thus for a generation or two the practices of liming and marling are abandoned, to be slowly and reluctantly resumed again, when natural causes have removed the lime from the soil, and produced an accumulation of those other substances which, when associated with it, contribute to the productiveness of the land.

## Section XII.

1. Effects of an overdose of lime and of the sinking of lime into the soil.—There are several effects which are familiar to the practical man as more or less observable when lime in any form is laid too lavishly upon the land. Thus, *firstly*, it is rendered so loose by an overdose as to be capable of holding no water. Upon stiff clays a very large quantity indeed will be required to produce this effect.

2. *Secondly*, by an overdose of quick lime the land is hardened to such a degree as to be impervious to water or to the roots of plants. Several parts of the Carse of Gowrie are thus rendered so hard as to be unfit for vegetation. This effect will be observed only in soils which are naturally wet and undrained, or where much rain has fallen and lingered on the land after the lime has been applied.

3. *Thirdly*, but the most injurious effect of an over-liming, whether it be laid on at one or at successive periods, is the exhaustion by which it is succeeded. "An overdose of shell-marl," says Lord Kames, "laid perhaps an inch thick, produces for a time large crops, but at last renders the soil capable of bearing neither corn nor grass, of which there are many examples in Scotland." The same is true of lime in any form. The increased fertility continues as long as there remains an adequate supply of organic (animal and vegetable) matter in the soil, but as that disappears the crops every year diminish both in quantity and in quality.

4. An interesting illustration of this exhausting power of lime is afforded by the observed effects of long-continued marling upon certain poor soils in the province of Isere, in France. The marl there employed is a sandy marl, containing from 30 to 60 per cent. of carbonate of lime—very much like the lime-sand of Ireland, or the shell-sand of the Western Islands. A layer of this marl one-third of an inch thick, applied at intervals to a soil producing in its natural state only a *three-fold return of rye* every other year, causes it to yield for the first 10 or 12 years an *eight-fold return of wheat.*

5. But after 40 years' marling, the farmers now complain that the land will give only a four-fold return of wheat. But the cause of this reduction is to be found in the constant cropping with corn, in the growing of no green crops, and in *the addition of no manure*. Yet even with this treatment the land is still more productive than before the marling was commenced. It produces four returns instead of three, and it grows wheat where before only rye would thrive and ripen.

6. From the possession of this exhausting property has arisen the almost universally diffused proverb, that *lime enriches the fathers but impoverishes the sons.* The fault, however, is not in the lime, but in the improvident fathers, who in this case, as in so many others, exhaust and inconsiderately squander the inheritance of their sons. If care be taken to keep up the supply of organic matter in the soil—by copious additions of manure or otherwise—lime may be added freely and a system of high farming kept up, by which both the present holder of the land and his successor will be equally benefitted.

7. The opinion expressed by some of the highest authorities among practical men, that too much lime *cannot* be added, provided the soil abound sufficiently in vegetable matter, may perhaps be rather overstated; but it undoubtedly embodies the result of long-continued observation—that the exhausting effect of lime may be postponed indefinitely by a liberal management of the land.*

8. One of the causes of this gradual diminution of the action of lime is to be found in the singular property it possesses of slowly sinking into the land, until it almost entirely disappears from the surface soil. It has been long familiar to practical men that when grass lands, which have been limed on the sward, are after a time broken up, a white layer or band of lime is seen at a greater or less depth beneath the surface, but lodging, generally, where it has attained its greatest depth, between the upper, loose and fertile, and the lower, more or less impervious and unproductive soil.

9. In arable lands the action of the plough counteracts this tendency in some measure, bringing up the lime again from beneath, and keeping it mixed with the surface mould. Yet, through ploughed land it sinks at length, especially where the ploughing is shallow, and even the industry of the gardener can scarcely prevent it from descending beyond the reach of his spade.

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* In Germany the necessary union of manure and marl is in the mouth of every peasant—

———————Ohne mist
Ist das Gold fur mergein verquist.

10. The chief cause of this sinking is to be found in the extreme minuteness of the particles into which slaked lime naturally falls. If a portion of slaked lime be mixed with water it forms a milky mixture, in which some lime is dissolved, but much more is held in suspension in an extremely divided state. When this milk is allowed to stand undisturbed, the fine particles subside very slowly, and are easily again disturbed, but if thrown upon a filter they are arrested immediately, and the lime-water passes through clear. Suppose these fine particles to be mixed with the soil, and the rain to fall upon them, it will carry them downwards through the pores of the soil till the close subsoil acts the part of a filter, and arrests them.

11. This tendency to be washed down is common not only to lime but to *all minutely divided earthy matter of a sufficiently incoherent nature.* Hence the formation of that more or less impervious layer of finely divided matter which so often forms the subsoil beneath free and open surface soils. And that lime should appear alone or chiefly to sink on any cultivated field, may arise from this circumstance—that the continued action of the rains had long before carried downwards the finer incoherent particles of other kinds which existed naturally in the soil, and therefore could find little else but the lime on which this action could be exercised.

12. This explanation is satisfactory enough in the case of light and open soils, which are full of pores, but it appears less so in regard to stiff clays and to loamy soils, which are not only close and apparently void of pores. but seem themselves to consist of particles in a sufficiently minute state of division to admit of their being carried down by the rains in an equal degree with lime itself. This difficulty induced Lord Dundonald to suspect the agency of some chemical principle in producing the above effect.

13. As the lime, however, is unchanged after it has descended, is still in a powdery state, and exhibits no appearance of having been dissolved, it is difficult to imagine any chemical action by which such a sinking could have been brought about. It is possible that in grass lands the earth-worms, which contribute so much to the gradual production of a fine mould, may, by bringing up the other earthy matters only, contribute to the apparent sinking of the lime, as well as of certain other top-dressings.

14. The effects of this sinking are to remove the lime from the surface soil, and to form a layer of calcareous matter which in wet or impervious bottoms will harden and form a more or less solid bed or *pan*, through which the rains and roots refuse to penetrate, and which the subsoil plough in some districts can tear up with

difficulty. On our stiffer soils it encourages the growth of the troublesome coltsfoot, and in the open ditches of the wholesome water-cress.

15. The practical remedies for this sinking are of two kinds:— 1st, the ploughing of a deeper furrow, and hence one of the benefits which in many localities follow the use of the trench plough; 2dly, the sowing of deep roo'ed and lime-loving crops, such as lucerne and sainfoin, which in such soils not only thrive, but bring up in their stems, and restore to the surface, a portion of the lime which had previously descended, and thus make it available to the after-crops.

## Section XIII.

1. Theory of the Action of Lime.—Lime acts in two ways upon the soil. It produces a *mechanical* alteration which is simple and easily understood, and is the cause of a series of *chemical* changes, which are really obscure, and are as yet susceptible of only partial explanation. In the finely divided state of quick-lime, of slaked lime or of soft and crumbling chalk, it stiffens very loose soils, and opens the stiffer clays,—while in the form of limestone gravel or of shell sand, it may be employed either for opening a clay soil or for giving body and firmness to boggy land. These effects, and their explanation, are so obvious to all, that it is unnecessary to dwell upon them.

2. The purposes served by lime as a chemical constituent of the soil are at least of four distinct kinds: It supplies a kind of organic food which appears to be necessary to the healthy growth of all our cultivated plants. It neutralizes acid substances which are naturally formed in the soil, and decomposes or renders harmless other noxious compounds which are not unfrequently within reach of the roots of plants. It changes the inert vegetable matter in the soil, so as gradually to render it useful to vegetation.

3. It causes, facilitates, or enables other useful compounds, both organic and inorganic, to be produced in the soil,—or so promotes the decomposition of existing compounds as to prepare them more speedily for entering into the circulation of plants. These several modes of action it will be necessary to illustrate in some detail.

4. *Of Lime as the food of Plants.*—In considering the chemical nature of the ash of plants, we have seen that lime in all cases forms a considerable proportion of its whole weight. Hence the reason why lime is regarded as a necessary food of plants, and hence also one cause of its beneficial influence in general agricultural practice.

5. The quantity of the pure lime contained in the crops produced upon one acre during the years' rotation amounts, on an average, to 242 lbs. which are equal to about 430 lbs. (say 4 cwt.) of carbonate of lime, in the state of marl, shell sand, or lime-stone gravel. It is obvious, therefore, that one of the most intelligible purposes served by lime, as a chemical constituent of the soil, is to supply this comparatively large quantity of lime, which in some form or other must enter into the roots of plants.

6. But the different crops which we grow contain lime in unlike proportions. Thus the average produce of an acre of land under the following crops contains of lime—

| | *Grain or Roots.* | *Straw or Tops.* | *Total.* |
|---|---|---|---|
| Wheat, 25 bushels, | 1.5 | 7.2 | 8.7 lbs |
| Barley, 38 " | 2.1 | 12 9 | 15 " |
| Oats, 50 " | 2.5 | 5.7 | 8.2 " |
| Turnips 25 tons, | 45.8 | 93.0 | 138.8 " |
| Potatoes, 9 " | 6.6 | 259.4 | 266.0 " |
| Red clover, 2 tons, | — | 126.0 | 126.0 " |
| Rye grass, 2 " | — | 33.0 | 33.0 " |

7. These quantities are not constant, and wheat especially contains much more lime than is above stated, when it is grown upon land to which lime has been copiously applied. But the very different quantities contained in the several crops, as above exhibited, shew that one reason *why lime favours the growth of some crops more than others* is, that some actually take up a larger quantity of lime as food. These crops, therefore, require the presence of lime in greater proportion in the soil, in order that they may be able to obtain it so readily that no delay may occur in the performance of those functions or in the growth of those parts to which lime is indispensable.

8. *The chemical action of Lime is exerted chiefly upon the organic matter of the soil.*—There are four circumstances of great practical importance in regard to the action of lime, which cannot be too carefully considered in reference also to the theory of its operation. These are, that lime has little or no effect upon the soils in which organic matter is deficient. That its apparent effect is inconsiderable during the first year after its application, compared with that which it produces in the second and third years.

9. That its effect is more sensible when it is kept near the surface of the soil, and gradually becomes less as it sinks towards the subsoil. And, that under the influence of lime the organic matter of the soil disappears more rapidly than it otherwise would do, and that after it has thus disappeared fresh additions of lime produce no

ther good effect. It is obvious from these facts, that *in general* the main beneficial purpose served by lime is to be sought for in the nature of its chemical action upon the organic matter of the soil—an action which takes place slowly, which is hastened by the access of air, and which causes the organic matter itself ultimately to disappear.

10. *Of the forms in which organic matter usually exists in the soil, and the circumstances under which its decomposition may take place.*—The organic matter which lime thus causes to disappear is presented to it in one or other of five different forms: In that of recent, often green, moist, and undecomposed roots, leaves, and stems of plants In that of dry, and still undecomposed, vegetable matter, such as straw. In a more or less decayed or decaying state, generally black or brown in colour—and often in some degree soluble in water.

11. In what is called the *inert* state, when spontaneous decay ceases to be sensibly observed. And, in the state of chemical combination with the earthy substances—with the alumina for example, and with the lime or magnesia—already existing in the soil.—Upon these several varieties of organic matter lime acts with different degrees of rapidity.

12. The final result of the decomposition of these several forms of organic matter, when they contain no nitrogen, is their conversion into carbonic acid and water only. They pass, however, through several intermediate stages before they reach this point—the number and rapidity of which, and the kind of changes they undergo at each stage, depend upon the circumstances under which the decomposition is effected. Thus the substance may decompose *alone*, in which case the changes that occur proceed slowly, and arise solely from a new arrangement of its own particles. This kind of decomposition rarely occurs to any extent in soil.

13. *In the presence of water only*—This also seldom takes place in the soil. Trees long buried in moist clays impervious to air, exhibit the kind of slow alteration which results from the presence of water alone. In the bottoms of lakes, ditches, and boggy places also, from which inflammable gases arise, water is the *principal* cause of the more rapid decomposition.

14. *In the presence of air only.*—In nature organic matter is never placed in this condition, the air of our atmosphere being always largely mixed with moisture. In dry air decomposition is exceedingly slow and the changes which dry organic substances undergo in it are often scarcely perceptible.

15. *In the presence of both water and air.*—This is the almost

universal condition of the organic matter in our fields and farm-yards. The joint action of air and water, and the tendency of the elements of the organic matter to enter into new combinations, cause new chemical changes to succeed each other with much rapidity. It will of course be understood that moderate warmth is necessary to the production of these effects.

16. *In the presence of lime*, or of some other alkaline substances (potash, soda, or magnesia).—Organic matter is often found in the soil in such a state that the conjoined action of both air and water are unable to hasten on its decomposition. A new chemical agency must then be introduced, by which the elements of the organic matter may again be set in motion. Lime is the agent which for this purpose is most largely employed in practical agriculture.

## Section XIV.

1. Laying down to grass.—One of the most common methods of improving the soil is that of *laying down to grass*. This may be done for two, three, or four years only, or for an indefinite period of time. In the latter case, the land is said to be laid down permanently, or to permanent pasture.

2. *Temporary pasture or meadow.*—If the land be sown with grass and clover-seeds, only as an alternate crop between two sowings of corn, the roots which are left in the soil enrich the surface with both organic and inorganic matter, and thus fit it for bearing a better after-crop of corn. If, again, it be left to grass for three or five years, the same effect is produced more fully, and therefore this longer rest from corn is better fitted for soils which are poor in vegetable matter.

3. The quantity of organic matter which has accumulated becomes greater every year, in consequence of the annual death of stems and roots, and of the soil being more closely covered, but this increase is probably never in any *one* after-year equal to that which takes place during the first. The quantity of roots which is produced during the first year of the young plants' growth must, we may reasonably suppose, be greater than can ever afterwards be necessary in an equal space of time. Hence, one good year of grass or clover will enrich the soil more *in proportion to the time expended*, than a rest of two or three years in grass, *if annually mowed.*

4. Or, if instead of being mown, the produce in each case be eaten off by stock, the result will be the same. That which lies longest will be the richest when broken up, but not in an equal proportion to the time it has lain. The produce of green parts, as

well as of roots, in the artificial grasses, is generally greatest during the first year after they are sown, and therefore the manuring derived from the droppings of the stock, as well as from the roots, will be greatest in proportion during the first year. That farming, therefore, is most economical—where the land will admit of it—which permits the clover or grass seeds to occupy the land for one year only.

5. But if, after the first year's hay is removed, the land be pastured for two or three years more, it is possible that each succeeding year may enrich the surface soil as much as the roots and stubble of the first year's hay had done; so that if it lay three years it might obtain three times the amount of improvement. This is owing to the circumstance that the whole produce of the field remains upon it, except what is carried off by the stock when removed—but very much, it is obvious, will depend upon the nature of the soil, and upon the selection of the seeds being such as to secure a tolerable produce of green food during the second and third years.

6. *Permanent pasture or meadow.*—But when land is laid down to permanent grass it undergoes a series of further changes, which have frequently arrested attention, and which, though not difficult to be understood, have often appeared mysterious and perplexing to practical men. Let us consider these changes. When grass seeds are sown for the purpose of forming a permanent sward, a rich crop of grass is obtained during the first, and perhaps also the second year, but the produce after three or four years lessens, and the value of the pasture diminishes.

7. The plants generally die and leave blank spaces, and these again are slowly filled up by the sprouting of seeds of other species, which have either lain long buried in the soil or have been brought thither by the winds. This first change, which is almost universally observed in fields of artificial grass, arises in part from the change which the soil itself has undergone during the few years that have elapsed since the grass seeds were sown, and in part from the species of grass selected not being such as the soil, at any time, could permanently sustain.

8. When this deterioration, arising from the dying out of the sown grasses, has reached its utmost point, the sward begins gradually to improve, natural grasses suited to the soil spring up in the blank places, and from year to year the produce becomes greater and greater, and the land yields a more valuable pasture. Practical men often say that to this improvement there are no bounds, and that the older the pasture the more valuable it becomes. But this

is true only within certain limits. It may prove true for the entire currency of a lease, or even for the lifetime of a single observer, but it is not generally true. Even if pastured by stock only and never mown, the improvement will at length reach its limit or highest point, and from this time the value of the sward will begin to diminish.

9. This, again, is owing to a new change which has come over the soil. It has become, in some degree, exhausted of those substances which are necessary to the growth of the more valuable grasses—less nutritive species, therefore, and such as are less willingly eaten by cattle, take their place. Such is the almost universal process of change which old grass fields undergo, whether they be regularly mown or constantly pastured only—provided they are left entirely to themselves.

10. If mown they begin to fail the sooner, but even when pastured they can be kept in a state of full productiveness only by repeated top dressings, especially of saline manure—that is, by adding to the soil those substances which are necessary to the growth of the valuable grasses, and of which it suffers a yearly and unavoidable loss. Hence, the rich grass lands of our fathers are found now in too many cases to yield a herbage of little value. Hence, also, in nearly all countries, one of the first steps of an improving agriculture is to plough out the old and failing pastures, and either to convert them permanently into arable fields, or, after a few years' cropping and manuring, again to lay them down to grass.

11. But when thus ploughed out, the surface soil upon old grass land is found to have undergone a remarkable alteration. When sown with grass seeds, it may have been a stiff, more or less grey, blue, or yellow clay—when ploughed out it is a rich brown, generally light and friable vegetable mould. Or when laid down it may have been a pale-coloured, red, or yellow sand or loam. In this case the surface soil is still, when turned up, of a rich brown colour—it is lighter only and more sandy than in the former case, and rests upon a subsoil of sand or loam instead of one of clay. It is from the production of this change that the improvement caused by laying down land to grass principally results. In what does this change consist ? and how is it effected ?

12. If the surface soil upon stiff clay lands, which have lain long in grass, be chemically examined, it will be found to be not only much richer in organic matter, but often also poorer in alumina than the soil which formed the surface when the grass seeds were first sown upon it. The brown mould which forms on lighter lands will exhibit similar differences when compared with the soil on

which it rests; but the proportion of alumina in the latter being originally small, the difference in respect to this constituent will not be so perceptible.

13. The effect of this change on the surface soil is in all cases to make it more rich in those substances which cultivated plants require, and therefore more fertile in grain. But strong clay lands derive the further important benefit of being rendered more loose and friable, and thus more easily and more economically cultivated. The mode in which this change is brought about is as follows:—

14. The roots, in penetrating, open and loosen the adjacent stiff clay. Diffusing themselves every where, they gradually raise, by increasing the bulk of, the surface soil. The latter is thus converted into a mixture of clay and decayed roots, which is of a dark colour, and is necessarily more loose and friable than the original or subjacent unmixed clay.

15. But this admixture of roots affects the chemical composition as well as the state of aggregation of the soil. The roots and stems of the grasses contain much inorganic—earthy and saline—matter, which is gathered from beneath, wherever the roots penetrate, and is by them sent upwards to the surface. A ton of hay contains about 170 lbs. of this inorganic matter.

16. Suppose the roots to contain as much, and that the total annual produce of grass and roots together amounts to four tons, then about 680 lbs. of saline and earthy matters are every year worked up by the living plants, and in a great measure permanently mixed with the surface soil. Some of this, no doubt, is carried off by the cattle that feed, and by the rains that fall, upon the land—some remains in the deeper roots, and some is again, year after year, employed in feeding the new growth of grass—still a sufficient quantity is every season brought up from beneath, gradually to enrich the surface with valuable inorganic matter at the expense of the soil below.

17. Nor are mechanical agencies wanting to increase this natural difference between the surface and the under soils. The loosening and opening of the clay lands by the roots of the grasses allow the rains more easy access. The rains gradually wash out the fine particles of clay that are mixed with the roots, and carry them downwards, as they sink towards the subsoil.

18. Hence the brown mould, as it forms, is slowly robbed of a portion of its alumina, and is rendered more open, while the under soil becomes even stiffer than before. This sinking of the alumina is in a great measure arrested when the soil becomes covered with

so thick a sward of grass as to break the force of the raindrops or of the streams of water by which the land is periodically visited.—Hence the soil of some rich pastures contains as much as 10 or 12, of others as little as 2 or 3 per cent. of alumina.

19. The winds also here lend their aid. From the naked arable lands, when the weather is dry, every blast of wind carries off a portion of the dust. This it suffers to fall again as it sweeps along the surface of the grass fields—the thick sward arresting the particles and sifting the air as it passes through them. Everywhere, even to remote districts, and to great elevations, the winds bear a constant *small* burthen of earthy matter; but there are few practical agriculturists who, during our high winds, have not occasionally seen the soil carried off in large quantities from their naked fields. Upon the neighbouring grass lands this soil falls as a natural top-dressing, by which the texture of the surface is gradually changed and its chemical constitution altered.

20. Another important agency also must not be overlooked. In grass lands insects, and especially earth-worms, abound. These almost nightly ascend to the surface, and throw out portions of finely divided earthy matter. On a close shaven lawn the quantity thus spread over the surface in a single night often appears surprising. In the lapse of years the accumulation of the soil from this cause must, on old pasture fields, be very great. It has often attracted the attention of practical men, and so striking has it appeared to some, that they have been inclined to attribute to the slow but constant labour of these insects, the entire formation of the fertile surface soils over large tracts of country.

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