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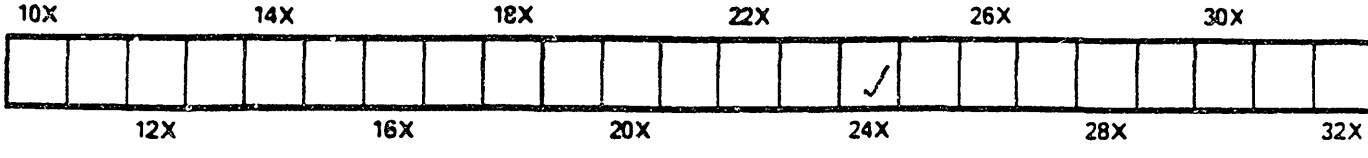

# THE COLONIAL FARMER,

DEVOTED TO THE AGRICULTURAL INTERESTS OF NOVA-SCOTIA, NEW-BRUNSWICK AND PRINCE EDWARD'S ISLAND.

VOL. 2. HALIFAX, N. S., FEBRUARY 16, 1843. NO. 16.



THE COLONIAL FARMER.

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## SECOND PUNIC WAR.

Many a schoolboy will remember this, and reflect with little pleasure on the time that he has been puzzled with translating it from a language which he could not well understand; but there are few young men who may not profit by reading it over again with attention; not to learn the art of war, but to learn to avoid danger by looking out for it in proper season; and what is perhaps of more importance; to learn the very great prospect of ultimate success which awaits undaunted perseverance in times of extreme danger and difficulty. As this paper may be seen by some who have not read, or who have forgotten the history, we shall give a short summary of it. The Romans were at that time a powerful nation who had always been engaged in wars with their neighbours. They possessed all the skill and ease of military honor which could be acquired by a long habit of successful war. Their opponents the Carthaginians were also a powerful and warlike people; the remains of the greatest commercial nation of antiquity; who being driven from Tyre had established themselves on the coast of Africa, and were in possession of a considerable part of Spain. Hannibal their great Commander was a man of extraordinary Genius, possessing uncommon talent for war; early in the season he led a numerous army across the Alps into Italy having to make a road in very severe weather the Mountains being covered with snow to a great depth. After the Mountains were passed he was obliged to march for a number of days on land overflowed by the spring floods. He lost many thousands of his men by the extreme severity of the weather, but the remainder were hardened to cold and fatigue by the same sufferings, and much more fit for service than when they commenced their march The Romans raised great armies and opposed him with their usual courage, but notwithstanding their skill and valour they found themselves greatly overmatched, and lost one great battle after another. Hannibal did not confine himself to the common arts of war, but on many occasions introduced some new practice by which he entrapped his enemies before they were aware one of his stratagems may serve for a specimen. He fought a great Army on such a piece of flat ground as we call an Interval, bounded on one side by a river, and on the other by a very steep hill. The space being narrow the two armies approached each other in solid columns, whose breadth extended from the hill to the river, Hannibal however had taken the precaution to leave a small space between his column and the river, this space was occupied by troops formed in line. His front was composed of Gauls, then accounted strong men and good soldiers. When the two armies came in contact it was found that Hannibal's front was formed in a curved line projecting in the centre. The Romans immediately closed up to their enemies, and by so doing made their front also a curved line, but hollow in the centre and projecting on each flank All the lines which composed their column by closing up, were bent in the same way. After an hours hard fighting the Romans had gained considerable ground, and pushed the enemy back, but as they were facing partly towards the center of their line they had before they were aware become so crowded that they could not use their arms, and all the lines of their column were in the same condition, jammed shoulder to shoulder. Hannibal then making the troops wheel back, who formed a line from the front of his column to the river, sent forward through this space his best soldiers who had been reserved for this purpose, and they falling on the crowded mass of Romans who could neither fight nor fly cut down the greater part of them almost without resistance. After losing most of their best men the Romans found it necessary to avoid pitched battles with great armies, as they could not equal Hannibal in skill; but as no loss daunted them, after a very long and most destructive war they at last completely vanquished and ruined the Carthaginians, although for years the advantage had been greatly on their side.—What is particularly worthy of remark is, first, the indomptable perseverance of the Romans. They had resolved to conquer, nor did the greatest losses make them change their resolution. When money failed, all who could support themselves agreed to serve without pay, while the rich readily placed their wealth in the hands of the government. When their young men were slaughtered and sufficient numbers for their armies could not be found, they armed their slaves. promising them freedom if they fought well—when the enemy offered to let them have their prisoners for a small ransom, they refused to redeem men who could yield rather than die. Much of their produce was destroyed by the enemy's army who were living in the heart of their country, but although it was very uncertain who would reap the crops, the farmers cultivated their land as industriously as if they were perfectly secure, often ploughing the enemy's camp as soon as they had marched out of sight. The greatness of the danger had roused the full energy of the nation, their petty quarrels were forgotten, and one spirit seemed to pervade the whole.

Not the less worthy of our attention were the effects of success and failure even upon the mighty minds of both parties. The first was almost invariably followed with a degree of negligence which exposed the party to a reverse—while defeat produced increased application, watchfulness, and activity, on both sides, for each believed that they could, and determined that they would conquer. The cautious Hannibal having destroyed great armies resolved to give some repose to his troops after their extraordinary fatigues. He took up his winter quarters in one of the richest cities of Italy where every kind of luxury was to be had in abundance. There they spent the winter in amusements; but when the season enabled him again to take the field he found himself at the head of a different kind of troops from what they had been when they emerged

from the snows of the Alps—luxury had enervated them; not all the eloquence of their great Commander could prevent them from quailing before the dauntless Romans, or make them willing again to make forced marches in storms of rain and snow. The Romans in their turn elated by success entrusted a large body of troops to a rash man of whose abilities they had had no experience, and in consequence this army was soon destroyed by their more knowing opponent. Without following the detail farther it may be observed that success invariably caused the successful party in some degree to remit their exertions, while defeat had a contrary effect for a long time, upon both parties, but the Romans being the most persevering, finally triumphed, although there were few nations on earth who would not have yielded to such dreadful overthrows as they met the first years of the war. This history is in part the history of all men in whatever business they are engaged. We often see men by great industry and application acquire wealth, and then by negligence and extravagance let it slip out of their hands. We often feel disposed to wonder at their folly, yet should, most of us, probably, in the same circumstances have done the same, for we see the wisest of men have often behaved in this way. It is an infirmity in our nature, and we ought to know it, and be upon our guard against it. Unremitted application is very fatiguing, and he that has been successful naturally thinks he may now indulge himself in a little repose. But let him not push this too far, lest like Hannibals troops in Capua he should disqualify himself for future exertion. He also who has once succeeded by industry and application and afterwards failed by remissness has no occasion to be disheartened and think he can never succeed again. He has but been led by an insidious weakness attached to his race, to do a foolish action which many whose names are recorded among the great men of the earth have done before him. He can yet do as well as ever he has done if he will exert his abilities with a moderate portion of the resolution which the Romans displayed in the most desperate circumstances. The man who has lost all his property, will not, if he has saved his honor, have great cause to feel mortified, when he reflects how many, and what men he has to bear him company, nor when he considers the success which crowned the unyielding perseverance of the Romans, will he doubt that success may attend his efforts if conducted with the same determined resolution. Zeal is always more successful than even good sense. The ancient motto, "ye wretched hope; ye fortunate be cautious;" should never be forgotten.

## GOOD IMPLEMENTS.

A Farmer should always work with good tools because he can do a much greater quantity of work with the same exertion of strength. The most ancient plough, one still used by the South American Spaniards, was made of two crooked sticks without any iron; but even this clumsy implement is preferable to the stone hoe or oyster shell of the Indian; great improvements have been made in farming implements long ago, yet even at this day many are in general use that are far from the best. It has always happened that men of talents have at certain periods applied their powers principally to one subject which became fashionable, and have made more improvements in a short time than had been made during many preceding Centuries. At the present time many are applying their talents to the improvement of agriculture and the arts necessarily connected with it. Among these arts the science of Mechanics holds an important place. It requires a person acquainted with this science and capable of reasoning upon it, to *invent* a good implement; when invented, others can make it. The following experiment from Babbage shews how much skill exceeds brute force. A roughly chiselled stone weighing 1080lb required to drag it along the floor of the quarry a force equal to..... ..... 720lb
To drag it on a floor of planks..... 640
Placed on a platform of wood and dragged over the plank floor 640
After soaping the two surfaces of wood which slide over each other..... ..... 162
Placed on three inch rollers it was moved on the floor of the Quarry by..... ..... 34
To drag it by these rollers on a wooden floor..... 28
Laid upon a wooden platform and the rollers placed between that and a plank floor it required to move it only 22

The huge stones which compose the Pyramids of Egypt were raised to their present elevation by the use of the lever and the roller. Fortified towns were anciently built upon the tops of high and steep hills. The ancient Romans when besieging a strong walled and fortified town were accustomed to make at the foot of the hill a strong Frame of many stories in height, and of a size sufficient for ten thousand men to stand upon the upper floor. Upon this cranes were erected from which large spars were suspended by chains fastened near their middle, which being made to swing backwards and forwards were designed to shake the wall to pieces by the heavy blows they gave with the butt end which was formed of iron in the shape of a rams head. When this enormous frame was completed is was moved up the steepest hill to the side of the wall within three days. It is very certain that at a remote period the art of moving great weights was well understood; yet the ordinary implements that are used in many places have been often contrived with very little attention to the principles of mechanics. The value of the axe, the hoe, the pickaxe, the shovel, the drawing knife, and many other tools, depends much upon their form. Many of the descendants of the "Pilgrims" sixty years ago used axes made upon the model of those of their forefathers had brought from England which being three inches longer in the "bit" than was necessary, occasioned a great waste of strength. It is much more profitable to go thirty miles for a good axe, than to use a bad one, even if it cost nothing. A bad scythe should always be immediately thrown aside, if a good one can be procured. The scythe with the narrowest blade is the best for heavy grass. There is reason to believe that scythes that will not hold an edge may be cured by burying them for several years in a swamp. When the mowing season is past if the scythes are put into the swamp mud they will neither rust nor have their temper lowered by the heat of the sun.

The common Dutch strawcutter is a very useful implement cutting fast enough for those who have not more than a dozen head of neat cattle, provided a strawknife can be procured made in Germany, or by the manufacturers of German scythes in Maryland and Pennsylvania; for it appears to be an art wholly unknown in England. We have indeed formerly seen tons of German scythes of English manufacture imported, but have never known a person who purchased one of them, to use it for more than one day. Great quantities of what are called improved farming implements are now manufactured both in Europe, and among our ingenious neighbours in New England. It is certainly a kind to produce in which not a little chaff is mixed with the valuable grain, nor would it be wise in this age of puffing to purchase immediately everything that is offered; yet it is most true that some valuable implements have been invented. Two men will do much work with the American spring steel manure forks as they can with those formerly in use. Some kinds of horse rakes are

reat deal of labour on smooth ground. Threshing Machines have roved very useful where it was important to dispose of a great uantity of grain at short notice, for although grain keeps well in he stack, it is difficult to preserve it long after it is threshed. It oes not however appear to have been proved that it is *cheaper* to resh with machinery than to beat it out the grain with a flail, or read it out with horses, according to the old Dutch method.

Some of these mills that thresh oats very well, waste a great uantity of wheat and barley by breaking off the heads instead of ating the grain out.

There are a great number of ploughs of different kinds lately reated, which are each praised by different parties, but it should e remembered that no one plough can suit every kind of soil. A ery short plough is drawn easier than one that is longer, and for ome kinds of work may be the best, but to turn the sod completely certain length is necessary. It is useful to have a wing of conderable breadth to the share in a free loose mould, but in stoney round the wing can hardly be too narrow, and there are soils hich ought not to be entirely cleared of small stones. Many ayey soils are of this description, and there are some grounds hich are very fertile while they are allowed to remain very full f pieces of decaying limestone, which are quickly impoverished hen cleared of stones.

The German forked hoe appears to be unknown in some part f the Province, but it is an excellent tool in hard sticky ground. The thin cast steel hoe is necessary for hoeing turnips that are own broad cast on land made quite mellow; few will ever learn o hoe their acre in a day with the common heavy hoe

Many different implements are used to cut grain The cradle is he most expeditious, but when the grain is tangled by high winds t wastes a considerable quantity. Long practice is required to arn to reap fast, and it is to most people very fatiguing; but e are inclined to think that the scythe is the best upon the hole; a good mower will soon learn to lay the grain so that it can e bound with but little more labour than when reaped; the straw s cut close to the ground, and there is not nearly so much grain helled out as is done by the cradle. Whenever a man is working ith a bad tool he should consider whether he will not lose enough y it in one week to purchase a good one, as if this is the case he ought immediately to change it for a better. Some say that they ork with bad tools because they cannot afford better, but in reality it is more frequently the consequence of that kind of indolence idiculed by Sterne in his account of the bad hinge whose creaking had tormented Mr. Shandy for ten years, although it could ave been mended at any time in two minutes. A very poor man an much better afford to buy a new axe, hoe, or fork, than he can o work with a bad one for two months.

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For the Colonial Farmer.

## ELEMENTS OF AGRICULTURAL CHEMISTRY AND GEOLOGY.

### INTRODUCTION.

In introducing the subject of Agricultural Chemistry, it would would be useless to insist on the importance of Agriculture, or the ecessity of practical skill and industry to its successful pursuit. Of the value of theoretical knowledge however, farmers are not usually so well aware. Agriculture is not merely a mechanical rt, but one whose success depends on some of most delicate and ysterious processes, which are carried on by nature or influenced y human labour. Every soil tilled by the farmer is a complex ixture of mineral substances, the presence or absence of any one of which, may render it comparatively barren or fertile; every heap of manure or compost is a chemical laboratory, wherein are proceeding changes, it may be wasteful and injurious, or saving and beneficial; every plant which he cultivates, is a complicated structure, requiring for its growth and maturity, a variety of delicate chemical processes; and every crop which he takes from his fields deprives the soil of some ingredients, the want of which if they are not restored by art or nature, may in time impair or destroy its productiveness From these and many similar considerations, which might be adduced, it is evident that economical and profitable agriculture, requires much scientific knowledge. It is true that it may be carried on, in an imperfect way without this, or with only a small amount of information; yet is it also true, both with respect to individuals and nations, that if they are content to follow imperfect modes of culture, and refuse to avail themselves of the new facts constantly resulting from scientific enquiry, they will soon be left far behind in wealth and comfort, by those who are more enlightened. Neither should we be ready to suppose, that our knowledge is already sufficiently extensive, for though every man is well aware of the extent of his own information, he can form but a very imperfect estimate of the extent of that which he does not know; and it may often happen that his ignorance of one fact, may neutralize much otherwise valuable knowledge.

The object of the writer of these papers is to lay before the farmers of Nova Scotia, a short and simple sketch of those chemical and Physiological principles which are more immediately connected with Agriculture; and to direct attention to the important discoveries which have been recently made respecting their practical application. The utility of such an attempt at the present time is apparent from the facts, that the works of Davy and of our own Agricola, though still of great utility, are in many respects left behind by the late rapid advancement of Chemical science, and that the more recent treatises of Liebig, Johnston, and other writers, are not yet either generally known or well understood.

In studying Agricultural Chemistry, the following arrangement may be adopted. We may *first* consider the nature of chemical combination and decomposition, and of simple substances particularly of those of which plants consist. *Secondly*, The structure of plants and its uses; with the relations of light and heat to plants. *Thirdly*, The substances which are the results of vegetation, their origin, and the changes which accompany the germination, flowering, ripening, and decay of plants. *Fourthly*, The modes in which the supply of food for plants is kept up,—and relations of the atmosphere to plants. *Fifthly*, The inorganic substances contained in plants—and the composition of soils, with its influence on cultivated plants. *Sixthly*, Geological relations of soils, soils of Nova Scotia, &c. *Lastly* The applications of those principles to modes of culture which are, or might be, pursued in this Province.

From the extensive subject embraced in this outline, it will be attempted to select the most important truths and render them generally intelligible.

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### I.—CHEMICAL COMBINATION AND DECOMPOSITION,—SIMPLE SUBSTANCES OF WHICH PLANTS CONSIST—AND STATES IN WHICH THESE OCCUR IN NATURE.

#### COMBINATION, DECOMPOSITION, &c.

If we take 100 pounds of pure limestone, and expose it for some time to red heat, and invisible air or gas escapes from it, and at length we have only 56 pounds of quick lime remaining. If however we have collected the gas which has been given out, it will be

found to be 44 pounds, or as much as the limestone has lost, and it will also be found to consist of a peculiar substance known to chemists as carbonic acid. Limestone therefore is a *compound* substance, and can be *decomposed* or separated into two other substances. But this process may be carried still farther; we can obtain, from the 44 pounds of Carbonic Acid, 12 pounds of Carbon or charcoal, and 32 pounds of gas named Oxygen, and from the 56 pounds of quicklime 16 pounds of oxygen and 40 of a white silver-like metal named Calcium. Here then we have

12 Carbon and 32 Oxygen forming 44 Carbonic Acid,
40 Calcium " 16 Oxygen " 56 Lime

Forming, when united ..... ..... ... 100 Limestone or Carbonate of lime.

First then it is evident that such a union is not a mere mixture of carbon calcium and oxygen, it is that more intimate union termed *Combination*, and we see, that *when two bodies thus combine, the result is a third substance very different from either.*

Secondly. If we take a number of specimens of *pure* limestone from all parts of the world, we will find them all to consist of the same substances, and in the same proportion: or if we form carbonic acid or lime by causing their ingredients to unite, it will be found that weights of these corresponding to those which are found in limestone, are alone capable of combining to form these substances. These ingredients therefore, *combine in uniform and definite proportions.*

Thirdly. If we put some pounded limestone in a glass, and pour upon it a little sulphuric acid or oil of vitrol, an *effervescence* or boiling up will take place, in consequence of the carbonic acid of the limestone escaping, and after this has subsided, we will find that the sulphuric acid has combined with the lime, forming sulphate of lime or gypsum. In this case then, the sulphuric acid has expelled the carbonic, in order that it might itself combine with lime. *The tendencies of bodies to combine with each other, are not then equally powerful,* so that previously existing combinations may be decomposed by the addition of new substances.

Fourthly. After having decomposed limestone, and obtained carbon, calcium, and oxygen, separately, we cannot decompose these three substances, or separate anything farther from them; they are therefore termed *simple or elementary* bodies.

Fifthly. It is found that these principles apply to nearly all the objects known to us, that these are, like limestone, compound bodies, and that they are all composed of 55 simple substances, which may be arranged as follow—

4 *Gases*—Oxygen, Hydrogen, Nitrogen, Chlorine.

9 *Liquids or Solids at common temperatures,—non-metallic,*—Sulphur, Selenium, Phosphorus, Bromine, Iodine, Fluorine, Carbon, Boron, Silicon.

42 *Metals,*—Potassium, Sodium, Magnesium, Aluminum, Calcium, Manganese, Lead, Iron, Copper, &c.

Some of these substances are familiarly known in an uncombined state, for example sulphur and copper, but the greater number are found in nature, only in different forms of combination.

We may now examine the properties of

THE SIMPLE SUBSTANCES OF WHICH PLANTS CONSIST.

All the forms of matter which we observe on the globe, may be bedivided into two great classes, *Organic* and *Inorganic* matter. To the latter belong all those rocks, waters, metals and other substances, which neither are nor have been the seat of life, and which constitute the mass of our earth. To the former belong the bodies of animals and plants, and the various substances produced by them, such as flesh, milk, sugar, wood, &c. These substances are never produced in any other way than by means of bodies possessing life, and organs for its maintainance and manifestations, and hence they are properly named Organized or Organic. Organic substances are all compound, and when exposed to air and moisture they decompose, and gradually disappear. When burned or exposed to heat, they are decomposed, and some such as fat, gum, and sugar, are entirely dissipated in a gaseous state, while others, as wood and lean beef, leave a small quantity of ash. The ash as will be afterwards seen is an important and necessary part of many vegetable structures. It consists however of substances which the plants have taken from the soil unchanged, and which are therefore inorganic. These inorganic matters contained in the ashes of plants, may be left for the present unnoticed, while we attend more particularly to their strictly organic parts.

It was before stated that all the known varities of matter consist of but 55 simple substances, but it is a still more remarkable fact, that plants of every description, with all their endless variety of appearance and properties, consist (with the exception of a little inorganic matter) of but four of these elements, Carbon, Nitrogen, Oxygen, and Hydrogen. The same remarks apply with almost equal truth, to animal substances. The following table shows the proportions of these elements contained in some of the most common objects of cultivation:—

| | Carbon. | Oxygen. | Hydrogen. | Nitrogen. | Ash. |
|---|---|---|---|---|---|
| Wheat ..... | 445 | 430 | 57 | 35 | 23 |
| Oats ..... | 507 | 367 | 64 | 22 | 40 |
| Hay ..... | 458 | 387 | 50 | 15 | 90 |
| Turnips..... | 429 | 422 | 56 | 17 | 76 |
| Potatoes. ..... | 441 | 439 | 58 | 12 | 50 |

The numbers above refer to 1000 pounds of each seed or plant, thoroughly dried.

"To the agriculturist, therefore, an acquaintance with these four constituent parts of all that lives and grows on the face of the globe, is indispensable. It is impossible for him to comprehend the laws by which the operations of nature in the vegetable kingdom are conducted, or the reason of the processes he himself adopts in order to facilitate or modify these operations, without this previous knowlege of the nature of the elements—of the raw materials as it were—out of which all the products of vegetable growth are elaborated."* First then we shall notice the properties of these four elements of organic matter, and shall then proceed to enquire whence they can be obtained by plants.

1. *Oxygen*—In its pure state, is a gaseous or aeriform substance, void of colour, taste and smell. It may be distinguished from common air by two remarkable properties. If a vessel be filled with it, and a lighted taper introduced, the flame is greatly increased in size and brilliancy, and if an animal be introduced its vital functions are stimulated and excited to such an extent that fever and death in a short time result. Oxygen is rarely met with in a pure state, but it enters into a vast number of combinations. It constitutes 21 per cent. of the bulk of the atmosphere, where its presence is necessary to the breathing of animals, and the support of combustion. It exists in still larger proportion in water, every nine pounds of which contain eight of it. If Iron be exposed to air and moisture, it rusts and increases in weight. This rust is a combination of iron with the oxygen of the air, and water; and is identical with some of the ores from which iron is obtained. Many of the ores of other metals, and the majority of rocks and earths comprising the surface of our globe are similar compounds of metals and other substances with oxygen, so that

* Johnston's Lectures.

this gas, in its pure state invisible, and only a little heavier than common air, is capable, when combined with metals and other substances, of assuming the liquid and solid states, and in these forms constitutes nearly one half of the weight of the crust of our globe, and of the bodies of its animal and vegetable inhabitants.

2. *Carbon*—Is most familiarly known as common wood charcoal, which consists of carbon with a small mixture of potash and earthy and other matters; it also exists in a large quantity in mineral coal; black-lead is almost pure carbon; and the diamond exhibits it in its purest form. The diamond differs from wood charcoal only in being more pure, and in a chrystalline* state. Wood and animal charcoal possesses the remarkable property of absorbing from the air large quantities of gases and other exhalations, hence its use in depriving putrid meat and other decaying substances of their offensive smell; it also absorbs from water any organic substances which it may contain and even some of the inorganic saline substances. Many of these matters afford valuable nourishment to plants, and as charcoal retains them unaltered, and is always ready to give them to the roots of vegetables, it is a valuable ingredient in soils, or of preventing the most valuable parts of manures from being dissipated in the air. If in clearing forest land, the wood or any considerable part of it, instead of being wholly consumed, were burned into charcoal, and this mixed with the soil, a permanent source of fertility would be secured. This use of charcoal will however be afterwards more fully considered.

When charcoal is burned, it combines with oxygen, forming carbonic acid gas, which disappears in the atmosphere; and when animals breathe, the oxygen of the air which enters their lungs, combines with carbon derived from the blood, and is returned to the atmosphere as carbonic acid. This gas thus exists in the air, and as it is soluble in water, is found in rain and springs, hence it affords to plants a supply both of carbon and oxygen; and as carbon in its pure state, is insoluble both in air and water, this source of obtaining it is of the utmost importance to vegetation, and will afterwards be particularly considered. Carbon constitutes from 40 to 50 per cent. of the weight of *dried* plants,

3. *Hydrogen*—is, like oxygen, a colourless gas, without taste or smell; it is however 16 times lighter than oxygen,† and will not support life or combustion, but on the other hand is itself very combustible. Combined with oxygen, it forms water; with carbon, it forms common coal gas; and in this state it also exists where vegetable substances are decaying in swamps. It also combines with sulphur and phosphorus, and in these states is often disengaged from bogs and marshes. The latter componnd (Phosphoreted Hydrogen) undergoes, when exposed to the air, a spontaneous combustion, and is the cause of the well known "Will-o'-the-wisp" or Ignis Fatuus. As hydrogen is not found in nature in a state of purity, plants must derive that which they contain, from its compounds, and principally from water.

4, *Nitrogen*—sometimes also named Azote, is a gas without colour, taste, or smell, it does not itself burn, neither will it support the combustion of other bodies and animals and plants die when confined in it. It is less abundant in nature than any of the other organic elements, yet it is found in the bodies of all animals and plants, and is absolutely necessary to their growth. It forms 79 per cent. of the atmosphere, and serves to dilute the oxygen of the air, and to prevent it from acting on both living beings and dead matter, with too great violence and rapidity. Combined with oxygen in a different proportion than that in which these two bodies exist in the atmosphere, it forms Nitric Acid; and in combination with hydrogen, it forms Ammonia; both of which substances, as we shall hereafter see, perform important functions in reference to the growth of plants.

It thus appears that three of the four elements which constitute the solid structures of animals and plants, are, in their pure state, invisible gases, yet into how great a variety of beautiful forms, and valuable products are they transmuted by nature, and how interesting and instructive must be the study of the ways in which these wonderful processes are effected. From what has been already stated, it is evident that plants cannot obtain any considerable quantity of these four organic elements in their simple state, they must take them from those compounds, in which they exist in nature. It becomes therefore an object of importance to ascertain the properties of these combinations, the quantity and condition in which they are found, and the degree of their utility to vegetation. The substances most worthy of consideration in this point of view, are, 1 Atmospheric Air; 2, Water; 3, Carbonic Acid and Carbonic Oxide; 4, Carburetted Hydrogen; 5, Ammonia; 6, Nitric Acid; and lastly, the vegetable and animal substances existing in the soil.

* If we throw common salt into water, it is dissolved, that is, it becomes divided into minute particles, which are diffused through the water. If a drop of this solution of salt be placed on a piece of glass, as it dries the particles of salt unite, and become *regularly arranged*, forming little transparent cubes. This is a chrystallization, and it may take place either in bodies which have been dissolved in water, or which have been melted or dissipated by heat.

† For this reason Hydrogen is used for inflating balloons.

## THE PROPER AGE FOR BREEDING.

The proper age at which the process of breeding may be commenced will depend on various circumstances. Even with the early maturity of the short-horns, if the heifers could be suffered to run until they were two and a half, or three years old, they would become larger, finer, and more valuable; and their progeny would be larger and stronger; but the expense of the keep for so long a time is a question that must be taken into serious consideration. The custom which at one period was beginning to be so prevalent in the breeding districts, of putting the heifer to the male at one year old, or even at an earlier period, cannot be too much reprobated. At the time when they are most rapidly growing themselves, a sufficient quantity of nutriment cannot be devoted to the full delopment of the fœtus, and both the mother and the calf must inevitably suffer.

From two, to two-and-a-half years, according to the quality of of the pasture, will be the most advantageous time for putting the heifer to the bull. In fair pasture, the heifer will probably have attained sufficient growth at two years. If the period is prolonged after three years, and especially with good keep, the animal will often be in too high a condition, and there will be much uncertainty as to her becoming pregnant.* At an early age there

* When heifers of this age will not stand their bulling, a couple of doses of physic, or the turning on shorter pasture until they next come into season, will set all right.

Mr. Parkinson's opinion, although somewhat different in one point from that we have stated, deserves consideration:—"I had three heifers, when I lived at Slane, took the bull at one year old, I believe, in consequence of their being reared in the open air at the haystacks, which caused them to be forwarder. I had not the least idea of this happening, or I should have prevented it, as I think it very injudicious. It is the opinion of some persons, that by suffering heifers to be three or four years old they make fine cattle, but I never found any material difference; while there is a loss of one year, besides the danger of not standing the bulling; and it adds very much to the profit of the heifer if she can be given to the bull at two or two-and-a half years old, for the time she is in calf, added to that of the calf sucking and the time she will be fattening, bring her to four or four years and a half when she is slaughtered. A heifer that has a calf will fatten quicker and tallow better than one of the same age that has not, while a calf is gained, worth, if of a good breed, eight or ten pounds as a store beast."—*Treatise on Live Stock*, vol. i p. 99.

will often be danger in calving from the heifer not having attained her proper size; and another, that has her first calf too late, will be in danger from fever.

It will be evident from this that the bull should not be suffered to run with the young stock; and although it is said that cows are quieter, and thrive better, and are more readily and surely impregnated as they come in season when they have the bull with them in the pasture, yet it is becoming more the practice, and often very advantageously so, to separate him from them altogether. By watching them as they come into season, and keeping them back when the time of parturition would be inconvenient, the farmer will be enabled to get them to calve at the periods that best suit his pasture or his arrangements. The calves may be dropped at the beginning of the year, when veal and butter will yield the greatest profit; or later in the season, when the spring grass is preparing to come in, and when the young animal will thrive better, and a greater secretion of milk, and the habit of yielding it at every subsequent calving, will be established in the mother.*

The repeated return of the period of heat during the spring and summer months will, if the farmer keeps his bull apart from the cows, enable him to arrange the periods of parturition almost at his pleasure.

That which has been said as the best age for beginning to breed in the cow will equally apply to the bull. It is absurd and dangerous to begin to use him as some have done when a yearling. He will come into season at two years old—he will be better at three; and although the farmer may not deem it prudent to keep him more than two or three years, he may then be sold advantageously, in his full prime, to another breeder.

### ABORTION, OR SLINKING.

The usual period of pregnancy in a cow is nine calendar months, or 270 days; but there is often considerable variation in the time of what seems to be a natural delivery, and when the calf is likely to live.†

The cow, however, is more than any other animal subject to abortion. This takes place at different periods of pregnancy, from half of the usual time to the seventh, or almost the eighth month. The symptoms of the approach of abortion, except the breeder is very much among his stock, are not often perceived; or if perceived, they are concealed by the cowherd, lest he should be accused of neglect or improper treatment.

The cow is somewhat off her feed—rumination ceases—she is listless and dull—the milk diminishes or dries up—the motions of the fœtus become more feeble, and at length cease altogether—there is a slight degree of enlargement of the belly—there is a little staggering in her walk—when she is down she lies longer than usual, and when she gets up stands for a longer time motionless. As the abortion approaches, a yellow or red glairy fluid runs from the vagina (this is a symptom which rarely or never deceives)—her breathing becomes laborious and slightly convulsive. The belly has for days lost its natural rotundity, and has been evidently falling—she begins to moan—the pulse becomes small, wiry, and intermittent. At length labour comes on, and is often attended with much difficulty and danger.

If the abortion has been caused by blows or violence, whether arising from the brutality of the cowherd, or the animal being teased by other cows in season, or by unskilfully castrated oxen, the symptoms are more intense. The animal suddenly ceases to eat and to ruminate—she is uneasy, paws the ground, rests her head on the manger while she is standing, and on her flank when she is lying down—hemorrhage frequently comes on from the uterus, or when this is not the case, the mouth of the uterus is spasmodically contracted. The throes come on, they are distressingly violent, and they continue until the womb is ruptured. Should not all these circumstances be observed, yet the labour is protracted and dangerous.

Abortion is sometimes singularly frequent in particular districts, or on particular farms. It seems to assume an epizootic or epidemic form. This has been accounted for in various ways. Some have imagined it to be contagious. It is destructively propagated among the cows, but this is probably to be explained on a different principle than that of contagion. It has been stated that the cow is an animal exhibiting considerably imaginative, and highly irritable during the period of pregnancy. In abortion the fœtus is often putrid before it is discharged; and the placenta, or afterbirth, rarely or never immediately follows it, but becomes decomposed, and, as it drops away in fragments, emits a peculiar and most noisome smell. The smell seems to be singularly annoying to the other cows—they sniff at it, and then run bellowing about. Some sympathetic influence is produced on their uterine organs, and in a few days a greater or less number of those that had pastured together likewise abort. Hence arises the rapidity with which the fœtus is usually taken away and buried deeply, and far from the cows; and hence the more effectual preventive of smearing the parts of the cow with tar or stinking oils, in order to conceal or subdue the smell; and hence, too, the ineffectual preventive of removing her to a far distant pasture.

Chabert, in his "Veterinary Instructions," relates a singular case of this—a kind of pest or plague in the dairy of a farmer at Toury. For thirty years his cows were subject to abortion. His cowhouse was large and airy; his cows were apparently in good health; they were fed like others in the village; they drank from the same pond; there was nothing different in the pasture; his servants were not accustomed to ill-use the cattle, and he had changed these servants many times in the thirty years. He had changed his bull many a time—he had pulled down the cowhouse, and he had built another in a different situation, with a different aspect, and on a different plan; he had even (agreeably to the superstition of the neighbourhood) taken away the aborted calf through the window, that the curse of future abortion might not be entailed on the cow that passed over the same threshold; nay, to make all sure, he had broken through the wall at the end of the cowhouse, and opened a new door, in order that there might not be the possibility that an elf struck fœtus had previously gone that way; but still a greater or less number of his cows every year slunk their calves.

Thirty years before he had bought a cow at a fair, and she had warped, and others had speedily followed her example; and the cow that had once slunk her calf was liable to do the same in the following year, and so the destructive habit had been perpetuated among his beasts.

Several of the cows had died in the act of abortion, and he had replaced them by others; more of those that had aborted once or twice, or oftener had been sold, and the vacancies filled up. M. Chabert advised him to make a thorough change. This had never occurred to the farmer, but he at once saw the propriety of the counsel. He sold every beast, and the plague was stayed.* The sympathetic influence is one main cause of the slinking of calves. There is no contagion, but the result is as fatal as the direst contagion could have made it.

Another cause of abortion is the extravagantly high condition in which cows are sometimes kept. They are in a continual state of excitement; and from the slightest cause inflamation is set up in the uterus, rendered more susceptible by the state of pregnancy, and abortion is the frequent consequences of that inflamation.

M. Cruzel has given an instructive account of abortion thus produced. He was consulted by a farmer who had ten breeding cows, that occasionally worked at the plough, as is often the case in France. During the first year three of them aborted. They recovered, and were soon again in calf. Two of them slunk their calves a second time, between the fifth and sixth month of pregnancy; the third went her full time, and produced a weakly calf that died on the second day. In the following year a fourth aborted, and M. Cruzel was sent for. He was immediately struck with the unnecessary high condition in which all the cows and their calves were: he searched carefully, but could discover no other probable cause for these repeated accidents, and he at once attributed them to the state of plethora in which the beasts were kept. He ordered their quantity of food to be materially reduced—he bled

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* Most of the various recipes to bring a cow into season are absurd and dangerous. One given by Mr. Parkinson is the simplest the most harmless, and the most successful too:—"Give a quart or more of milk immediately drawn from a cow that is in season, before the bull has been admitted to her, and in three or four days it will have the desired effect. —*Treatise on Live Stock*, vol. i. p. 101.

† M. Tessier, in a Memoir read to the Royal Academy of Sciences at Paris, says, that in 1131 cows, which he had the opportunity of observing, the shortest period of gestation was 240 days, and the longest 321—difference 81 days; and counting from nine months, 51 days over and 30 days under.

* Instructions Vétérinaires, tom. vi. p. 117.

very one of them—the farmer took care that nutriment should not afterwards be so dangerously wasted upon them, and abortion ceased to appear on the farm.*

Mr. Wedge in his "Survey of Cheshire," confirms this. He says that "slinking happens generally in wet seasons, or *when the cattle are in very high condition*, and generally continues for two or three years together. In several parts of North Wales, where the cattle through necessity are kept in lower condition, instances of the kind very rarely happen."

The pastures on which the blood or inflammatory fever is most prevalent are those on which the cows oftenest slink their calves. Whatever can become a source of general excitation and fever is likely, during pregnancy, to produce inflammation of the womb; or whatever would, under other circumstances, excite inflammation of almost any organ, has at that time its injurious effect determined to this particular one.

There are some curious illustrations of this. It is well known cattle of all kinds are sometimes seriously injured by feeding in the autumn on grass thickly covered with hoar frost. Inflammation of the bowels of a dangerous character, and sometimes palsy of the rumen have been thus produced. In Switzerland, the commencement of the hoar-frost is the signal for the appearance of abortion. It is occasionally seen at other times in all the cantons, but now its victims are multiplied tenfold. M. Barruel, V. S. of Castres, speaks of sixteen cows that aborted at different periods of pregnancy from this cause, and most of whom died †

It has been stated (page 505) that acrid plants are often prejudicial to cattle. "There is no farmer who is not aware of the injurious effect of the coarse, rank herbage of low, marshy, and woody countries, and he regards these districts as the chosen residence of red-water;" it may be added, that these districts are also the chosen residence of abortion.

Hard and mineral waters are justly considered as laying the foundation for many diseases in cattle, and for this among the rest. A writer in a German periodical gives the following account:—"In 1832 twelve of his in-calf heifers cast their calves, and in the following year the like accident happened to twelve others, the whole of which used to drink from ponds the water of which was strongly impregnated with iron. In 1824 ten cows that were watered at other places all calved safely, while a single cow that was allowed to drink of the ferruginous water cast her calf. The same occurred in two following years‡."

Some careful observers have occasionally attributed abortion to the disproportion in size between the male and female. Farmers used to be too fond of looking out for a great overgrown bull for their dairy or breeding cows, and many a heifer or little cow was seriously injured: she either cast her calf or was lost in parturition. This error has been long exploded among the breeders of sheep; and breeders of cattle are beginning to act more wisely.§

Cows that have been long afflicted with hoose, and that degenerating into consumption, are exceedingly subject to abortion. They are continually at heat—they rarely become pregnant, or if they do, a great proportion of them cast their calves. When consumption is established, and the cow is much wasted away, she will rarely retain her calf during the natural period of pregnancy.

An in-calf beast will scarcely have hoove to any considerable extent without afterwards aborting The pressure of the distended rumen seems to injure or destroy the fœtus. Even where the dilatation of the stomach does not wear a serious character, abortion often follows the sudden change from poor to luxuriant food. Cows that have been out and half-starved in the winter, and injudiciously turned on rich pasture in the spring, are too apt to cast their calves from the undue general or local excitation that is set up; and, as has been already remarked, a sudden change from rich pasture to a state of comparative starvation will produce the same effect, but from an opposite cause. Hence it is that when this disposition to abort first appears in a dairy, it is usually a cow that has been lately purchased. Fright, from whatever cause, may produce abortion There are singular cases on record of whole herds of cows slinking their calves after being terrified by an unusually violent thunder storm§. Commerce with the bull soon after some pains is a frequent cause of abortion. The casting of the calf has already been attributed to the sympathetic influence of the effluvia from the decomposing placenta; there are plenty of instances in which other putrid smells have produced the same effect, and therefore the inmates of crowded cowhouses are not unfrequently subject to this mishap.

Besides these tangible cause of abortion, there is the mysterious agency of the atmosphere. There are certain seasons when abortion is strangely frequent and fatal; while at other times it in a manner disappears for several successive years. In the "Leipsic Agricultural Gazette," March 22, 1777, it is stated, that "by an unheard of fatality, the abortion of cows in that district was almost general, and that after the most anxious research, no assignable cause for it could be discovered, nor would any medecine or medical treatment arrest the plague."

In 1789, all the cows in Beaulieu aborted. This, however, was traced to the long continuance of wet weather †

In 1782 the cows near Granvilliers slinked their young, and this was attributed to the excessive heat of the preceding summer. In 1784 almost all the cows and mares at Châlons aborted, and the cause was unknown‖ In 1787 all the cows at Bournonville cast their calves. They had not been out of the cowhouse during the whole of the winter and had been well taken care of.§ There is no doubt that this must be added to the number of epidemic diseases.

The consequence of premature calving are frequently of a very serious nature It has been stated that there is often considerable spasmodic closure of the mouth of the uterus, and that the calf is produced with much difficulty and pain, and especially if a few days have elapsed after the death of the young one. When this is the case the mother frequently dies, or her recovery is much slower than after natural parturition. The coat continues rough and staring for a long time—the skin clings to the ribs—the appetite does not return, and the milk is dried up. Some internal chronic complaint now takes its rise, and the foundation is laid for consumption and death.

When the case is more favourable, the results are, nevertheless, often annoying The cow very soon goes again to heat, but in a great many cases she fails to become pregnant; she almost certainly does so if she is put to the bull during the first heat after abortion. The heat again and again returns, but she does not stand to the bulling; and so the season is wasted, while she becomes a perfect nuisance by continually worrying the other cattle.‖

If she should come in calf again during that season, it is very probable that about the same period of utero-gestation, or a little later, she will again abort; or that when she becomes in calf in the following year, the same fatality will attend her. Some say

* Journ. Theor. et Prat., 1832, p. 157.

† Journ. Theor. et Prat., 1832, p. 154.

‡ Landund Hauswirth, March, 1827, p. 132.

§ Mr. Wedge in his "Survey of Cheshire," says that a whole dairy of nearly twenty cows cast their calves in one year. The farmer sold the bull he had used to a neighbour, and the whole number of cows to which he was put cast their calves also. The original owner took back the bull, and three of his cows were again put to him, and they also lost their calves. In this instance there was clearly some defect in the male.

* Instruction Vétérinaires, vol. vi. p. 154. Dr. Rudge, in his "Survey of Gloucestershire," says that there was an enclosure near Arlingham; close to which was a dog-kennel. Eight heifers and cows out of twenty warped, in consequence, as it was supposed by the farmer, of the frequent exposure of flesh, and the skinning of dead horses before them. The remainder were removed to a distant pasture and did well.

† Instructions Vétérinaires, tom. vi. p. 137.

‡ Ibid. pp 130, 131.

§ Somewhat analogous is an account given by White, in his most interesting and instructive work, the "Natural History of Selborne." Dr Johnson says, that in 1771 the season was so severe in the Isle of Skye, that it is remembered by the name of the *black spring*. The snow, which seldom lies at all, covered the ground for eight weeks; many cattle died, and those that survived were so emaciated that they did not require the male at the usual season. The case was just the same with us here in the South Never were so many barren cows known as in the spring following that dreadful period: whole dairies missed being in calf together — P. 396.

‖ The French have a very expressive name for these cows: they call them *taureilleres*. A kind of nymphomania is produced, under the influence of which the cow frequently wastes away and becomes a perfect skeleton.

that disposition to cast her young one gradually ceases, that if she does miscarry, it is at a later and still later period of pregnancy; and that, in about three or four years, she may be depended upon as a tolerably safe breeder: he, however, would be exceedingly inattentive to his interest who kept a profitless beast so long.

The calf very rarely lives, and in the majority of cases it is born dead or putrid. If there should appear to be any chance of saving it, it should be washed with warm water, carefully dried, and fed frequently with small quantities of new milk, mixed according to the appearent weakness of the animal, either with raw eggs or good gruel; while the bowels should, if occasion requires, be opened by means of small doses of castor oil. If any considerable period has to elapse before the natural term of pregnacy would have expired, it will usually be necessary to bring up the little animal entirely by the hand.

The treatment of abortion will differ little from that of parturition, presently to be described. If the farmer has once been tormented by this pest in his dairy, he should carefully watch the approaching symptoms of casting the calf, and as soon as he perceives them, should remove the cow from the pasture to a comfortable cowhouse or shed. If the discharge is glairy, but not offensive, he may hope the calf is not dead: he will be assured of this by the motion of the fœtus, and then it is possible that the abortion may yet be avoided. He should hasten to bleed her, and that copiously, in proportion to her age, size, condition, and the state of excitation in which he may find her; and he should give a dose of physic immediately after the bleeding. The physic beginning to operate, he should administer half a drachm of opium and half an ounce of sweet spirit of nitre. Unless she is in a state of great debility, he should avoid above all things the *comfortable drink*, which some persons so strangely recommend and which the cow-leech will be almost sure to administer. He should allow nothing but gruel, and he should keep his patient as quiet as he can. By these means he may occasionally allay the general or local irritation that precedes or causes the abortion, and the cow may get to her full time.

Should, however, the discharge be fœtid, the natural conclusion will be that the fœtus is dead, and must be got rid of, and that as speedily as possible. Bleeding may even then be requisite, if much fever exists, or, perchence, the aforesaid comfortable drink may not be out of place. In other respects, the animal must be treated as if her usual time of pregnancy had been accomplished.

Much may be done in the way of *preventing* the formation of this habit of abortion among the cows. *The fœtus must be got rid of immediately.* It should be buried deep, and far from the cow-pasture. Proper means should be taken to hasten the expulsion of the placenta. A dose of physic should be given; the ergot of rye, as hereafter to be described, should be administered; the hand should be introduced, and an effort made, cautiously and gently, to detach the placenta; all violence, however, should be carefully avoided, for considerable and fatal hemorrhage may be speedily produced. The parts of the cow should be well washed with a solution of the chloride of lime, and this should be injected up the vagina, and also given internally. In the mean time, and especially after the expulsion of the placenta, the cowhouse should be well washed with the same solution, in the manner that was recommended when the treatment of the malignant epidemic was under consideration.

The cow, when beginning to recover, should be fattened and sold. This is the first and the grand step towards the prevention of abortion, and he is unwise who does not immediately adopt it. All other means are comparatively inefficient and worthless. It was the charm by means of which Chabert arrested the plague which for thirty successive years had devastated the farm of Toury. Should the owner be reluctant to part with her, two months at least should pass before she is permitted to return to her companions. Prudence would probably dictate that she should never return to them; but be kept, if possible, on some distant part of the farm.

Abortion having once occurred on the farm, the breeding cows should be carefully watched. Although well fed, they should not be suffered to get into too high condition. Unless they are decidedly poor and weak, they should be bled between the third and fourth months of pregnancy, and a mild dose of physic should be administered to each. If the pest continues to reappear, the owner should most carefully examine how far any of the causes of abortion that have been detected may exist on his farm, and exert himself in carefully removing them.




"THE COLONIAL FARMER,"

TITUS SMITH, EDITOR; R. NUGENT, PROPRIETOR,

Is published semi-monthly at the Novascotian Office, Hal

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