MANURES.

A FIRST ESSAY, BY S. L. DANA.

SECTION FIRST.

Clearing and Breaking up, and Making Compost.

There is one thing settled in farming, stable manure never fails. It always tells. There are no two ways about it. There is here neither theory, nor speculation, nor doubt, nor misgiving. "Muck it well, master, and it will come right," is an old proverb. It is considered a fact so well established, that nobody thinks of disputing it. There is advantage in asking why bare-yard manure never fails. The answer is easy. It conains all that plants need for their growth. If we know then what plants contain, we can easily tell what is in manure. The whole doctrine of manures, then, falls into two plain principles, on which hang all the law and the "*profits*" of agriculture:—

1. Plants contain and need certain substances which are essential to their growth.
2. Manure contains all those substances, which plants want.

If, then, we find out what it is which manure contains, that makes plants grow, we must find out what a grown plant contains. This cannot be done without some little a very little knowledge of chemistry. Do not be startled, reader, I suppose that you may know nothing of chemistry, no, not even its terms. As a very sensible man, who wrote letters on Botany to a young lady, said to encourage his pupil, it was possible to be a very good Botanist without knowing one plant by name, so is it possible to become a good agricultural chemist, without knowing little more than the chemical names of a very few substances. You know nothing of chemistry it may be, and as little of law; yet you will go to law, and learn some of its terms by a dear bought experience. The law terms are harder to learn than the chemical terms. Now I fear that some persons, who have followed me thus far will shut up the book. It is, say they, all stuff, book-farming, stand beyond us. If one may not understand what manure is without this learning, we may as well begin where our fathers ended, and that was where our forefathers began ages ago. By a little law, however, picked up as a juryman, or witness, selectman, town clerk, justice of the peace, yea, perhaps, hearing an indictment read, men come to understand what a lawyer means when he talks. So too, by a little chemical talk, a man may learn what a chemist means when he talks of oxygen, hydrogen, nitrogen, chlorine, and carbon; potash, soda, lime, (ah, these are old friends, the very name makes us feel at home again,) alumina, magnesia, iron, manganese, and silex, sulphur, and phosphorus. Here is a long list. Long as it is, perhaps it will be thought worth learning. when you are told, that these are the names of all the substances found in plants, every substance which they want. Out of these is made every plant. Every part of every plant, from the hyssop on the wall to the mountain cedar, contains some or all of these. Be not disheartened. Look over, read the list again carefully; see how many are old names of things which you know. Of the fifteen you know nearly one half by name and by nature. These are potash, soda, lime, magnesia, iron, sulpher. Perhaps you will add, that you know carbon is coal, or rather coal carbon. You have heard from some travelling lecturer at your town Lyceum, that oxygen and hydrogen together warm water. That oxygen and nitrogen form the air we breath; that nitrogen and hydrogen form ammonia, or sal volatile, which gives the sharp smell to the smelling bottle. Besides the thing has been said so often that you must have heard it, that chlorine, the substance which bleaches in bleaching salts, united to soda, makes common salt, or if Chlorine is united to ammonia, sal ammoniac is formed. Now by changes and combinations among these fifteen things, nature makes every thing we find in plants. Many of these are invisible as is the air. The substance called chlorine, perhaps you have never seen, but if you ever smelt it you will never forget it. It is often smelt in a piece of bleached cotton, when opened in the shops. It gives the smell to bleaching powder used to disinfect the air, during cholera and other diseases. If you should see it, it would appear merely a faint yellowish green air. It is all-powerful on vegetation. As it forms a part of common salt, say half of its weight, we may dismiss the further consideration of it, by saying, that in some shape or other, chlorine is universally diffused in soil and plants.

The list above may be divided as follows:—First, the airy or volatile, Secondly, the earths and metals; Thirdly, the alkalies; Fourthly, the inflammables. Only the third and fourth divisions require to be explained or defined. The substance called potash and soda are termed alkalies. They are said to have alkaline properties. Touch your tongue with a bit of quicklime, it has a hot, burning, bitter taste. These are called alkaline properties. Besides these they have the power of combining with and taking the sour out of all soda liquids or acid that is, the acid and the alkali neutralize each other. This word alkali is of Arabic origin; its very name shows one of the properties. "Kali," is the Arabic word for bitter, and "al," is like our word super, we say fine and superfine; so kali is bitter; alkali, superlatively bitter, or truly alkali means, the dregs of bitterness. I wish, reader, for your own sake, as well as my own, that you should fix in your mind what I said about alkali and alkaline properties. Alkali is a general term. It includes all those substances which have an action like the ley of wood ashes, which you use for soap-making. If this ley is boiled down dry, you know it forms potash. Now lime fresh slacked, has the alkaline properties of potash, but weaker, and so has the calcined magnesia of the shops, but in less degree than lime. Here we have two substances, earthy in their look, having alkaline properties. They are called, therefore alkaline earths. But what we understand chiefly by the term alkalies, means potash, soda, and ammonia. Potash is the alkali of land plants; soda is the alkali of sea plants; and ammonia is the alkali of animal substances. Potash and soda are fixed, that is, not easily raised in vapor by fire. Ammonia always exists as vapor unless fixed by something else. Hence we have a distinction among alkalies which is easily remembered. This distinction is founded on the source from which they are procured, and upon their nature when heated. Potash is vegetable alkali, derived from land plants; soda is marine alkali derived from sea plants; ammonia is animal alkali, derived from animal substances. Potash and soda are fixed alkalies; ammonia is a volatile alkali. Potash makes soft soap, with grease, and soda forms hard soap. Ammonia forms neither hard nor soft; it makes, with oil, a kind of ointment used to rub a soar throat with, under the name of volatile linement. But though there be these three alkalies, and two alkaline earths, I want to fix in your mind, reader, that they all have common properties, called alkaline, and which will enable you to understand their action, without more aid about their chemistry. The inflammables, or our fourth addition, are sulpher and phosphorus; both used in making friction matches. The phosphorus first takes fire in rubbing, and this sets the sulphur burning. Now the smoke arising from these is only the sulphur and phosphorus united to the vital part of the common air. This compound of vital air or oxygen, as it is called, and inflammables, forms acids, called sulphuric and phosphoric acids. So if you burn coal, or carbon, it is well known you form fixed air, or carbonic acid. This is, by burning, the coal or carbon unites with the oxygen or vital part of common air, which arises from burning charcoal, has all the properties of an acid. And now let us see what these properties are. All acids unite or combine with the alkalies, alkine earths, and the metals. When acids and alkalies do thus unite, they each lose their distinguishing properties. They form a new substance, called a salt. It is very important you should fix in your mind this definition of a salt. You are to confine your idea of a salt to common salt. That is a capital example of the whole class. It is soda, and alkali, united to an acid, or chlorine, or to speak in terms the most intelligible, to muriatic acid. So saltpetre is a salt. It is a Potash united to acqua-fortis. Yet in saltpetre you perceive neither potash nor aqua-fortis. These have united, their characters are neutralized by each other. They have formed a neutral salt. Our list of substances found in plants is thus reduced from things which you did not know, to things which you do know; and so we have saved the trouble of learning more of their chemistry.

We have reduced the airy or volatile into water, formed of oxygen and carbon—as the sulphuric, formed of oxygen and phosphorus; and having thus got water and acids, these unite with all the aldaline, earthy and metallic bodies, and form salt. To give you new examples of those I may mention Glauber's salts and Epsom salts. Glauber's salt is formed of soda and sulphuric acid; white vitriol, of zinc and sulphuric acid; plaster of paris, of lime and sulphuric acid, bones, of lime and phosphoric acid; chalk and limestone, of lime, and carbonic acid. These are all examples of salts; that is an acid, or a substance acting the part of an acid, united to an aldali, metal, or earth.

We have thus gone over, in a very general way, enough of chemistry for any one man to understand the chemical nature of manure. You see, reader, that with common attention bestowed for an evening's reading one may learn these chemical terms and their meaning. And now, having learned this first lesson, let us review the ground gone over, fix, once and for all, these first principles in our minds. Let us do this, by a practical application of the knowledge we have gained. Let us analyze a plant. Do not be startled at the word. To analyze, means to separate a compound substance into the several substances which form it. This may be done by a very particular and minute, or by a more general division. It may be done for our present purpose, by separating the several substances of a plant into classes of compounds. You are already chemist enough to undertake this mode of analysis; in truth you have already done it again and again. For our purpose the ancients had a very good division of all matter into four elements. You are reader though perhaps you do not know it, somewhat of a practical chemist. Whenever you have burned a charcoal-pit, what did you? You separated the wood into air, water, and earth.

You drove off by heat or fire the airy or volatile parts of the plant, you left its carbon, or coal; if you had burnt this, you would have left ashes. Now these ashes are earthy parts of plants. If you burn a green stick of wood, you drive off first its water and volatile parts, which form soot. You burn its carbon, and leave its ashes or salt. So that by simply burning, you reduce the substance or elements of plant to water, carbon, salts. All plants then without exception, contain the several substances in our list above, as water, carbon, and salts. To apply this knowledge to manure, we must say a word on the form in which some of these, which we call the elements of plants exist in them. The sap is water; it holds dissolved in it some salts of the plant. This sap or juice, forms a pretty large proportion of the roots, say seventy five to eighty parts in one hundred, of potatoes, turnips, beets, &c. This may be called the water of vegetation. If we dry beet root, or any other plant, we merely drive off this water of vegetation. Now what have we left? To go back to our process of analysis, let us char the dried root. We drive off more water and volatile parts. This water did not exist, as such, in the plant. It existed there as hydrogen and oxygen gas. Now this word gas is a chemical term, and it means any substance in vavour, which cannot be condensed into a liquid or solid, at common temperatures. Different gasses may unite, and so become solids or liquids. Steam is not gas, for it is the vapor of water, and immediately returns to the state of water, below 212 degrees. Perfect steam is invisible, so are most gases. The air we breath is composed of two gases, oxygen and nitrogen. We do not see them; we cannot, by cooling or compression, make air take other shape than invisible air. This is the general property of gas, as distinguished from vapor or steam. Oxygen and Hydrogen, in plants exists in just the proportions to form water, but we do not know that they are united in these proportions. We have compelled them to unite, by heating the substance or root. The carbon is by this same process consumed, and you know, has thus formed carbonic acid. Besides this, a portion of the carbon unites with some of the hydrogen of the plant. This forms light inflammable air. Now you may recollect this light, inflammable air, in any stagnant water where plants are decaying. Decay gives eqactly the same products, as performed in making charcoal. Decay