memory, let them "make a note of it." The illustration accompanying this—the last article of the series—is Messrs. Howard's engine, showing the reverse side of that figured at p 353 Vol II

Familiar Talks on Agricultural Principles.

WHAT PLANTS ARE MADE OF.

A MANUFACTURER who commences business with a view to the production of a certain article, must know of what that article consists, what raw materials are needed for its manufacture, and how they are to be wrought up into the article desired. Thus the carriage-maker knows that a finished vehicle will require wood, iron, steel, leather, cloth, paint, varnish, &c He must have a stock of these materials on hand, he must know how to prepare them, how to combine them, and by the joint operation of theoretical knowledge and practical skill, he is enabled to produce a carriage So in other occupations The farmer is in a sense, a manufacturer His workshop is out of doors; the materials he has to work with are found in the air and soil; his tools are the implements of husbandry; and his products are the various plants that form the food of man and beast. If he would produce wheat, ought he not to know of what it consists, out of what raw material it can be made, and by what means it is to be furnished? So if he would produce grass or turnips, ought he not to know what they are made of, whence the raw material is to be supplied, and how it is to be transmuted into the desired articles? Other manufacturers find their material in the form of certain compound substances, while the farmer must look for his material in the simple elements of nature. What these are, and how he is to avail himself of them, it is the office of Agricultural Chemistry to explain.

A plant is a compound thing It may be separated into its original elements The simplest way of doing this is by burning it If a plant be subjected to the action of fire, the greater part of it "burns away" as we are accustomed to say; - that is, it goes off in various gases or vapours, until at length only a little ash is left. That which "burns away" is called the *organic* part of the plant, that which remains in the form of ash is called *inorganic*. Sometimes these two classes of material are called combustible and incombustible. It is a singular fact, that plants of all kinds consist, as to their organic parts, of but four simple substances known as Carbon, Oxygen, Hydrogen and Nitrogen. The inorganic matter found in them, and which is but small in proportion to the quantity of organic matter they contain, embraces a variety of substances, the chief of which are *phosphoric acid, sulphuric acid, silicic acid, potash, soda, lime, magnesia, iron,* and *chloride of sodium*. As an illustration of the extent to which the organic constituents of plants preponderate over the inorganic, it may be stated, that if an oak-tree be cut down and burnt, for every 100 pounds of wood, there will be left only about 3½ pounds of ash. Small, however, as the inorganic element is, it were a great mistake to regard it as comparatively unimportant. It is absolutely necessary to the life and growth of the plant, so much so, that if any portion of it be absent, the plant cannot be produced in perfection. The following table shows the proportion of the elements just spoken of, as they are found to exist in some of our most common crops. It will be understood that the figures refer to 1000 pounds of each seed or plant in a dry state:

	Carbon.	Oxygen.	Hydrogen.	Nitrogen.	Ash.
Wheat	455	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

Every farmer ought to be familiar with the names and properties of *carbon, oxygen, hydrogen* and *nitrogen*. They form the four chief constituents of all that lives and grows on the face of the globe. They are the raw materials as it were, which the tiller of the soil is to manufacture into the various forms of vegetable growth. Once familiar with these elementary substances, it is comparatively easy to understand the functions of plants, and the circumstances favourable to their production. Before going farther, a few words in reference to the nature and properties of these elements, will help to simplify the subject, and prepare the way for future progress.

CARBON is familiarly known as common charcoal, and is widely distributed throughout nature. You have only to charr a piece of wood, to find out how large a proportion of vegetables consists of this substance. It cannot be dissolved in water, but it possesses the property of absorbing a certain amount of moisture, and being at once porous and incapable of putrefaction, it absorbs the offensive smells emitted by decaying matter, and retains the lighter parts of manures. It is when combined with oxygen in the form of carbonic acid gas, that this substance becomes available for plant food. Strange to say, this gas is a narcotic poison, which, if inhaled by human beings in sufficiently large quantities, produces stupor, insensibility and death. It is this gas which destroys life when a person stays too long in a close room where there is a pan of burning coals. By a remarkable provision of nature, what is fatal to the animal system is a great source of life, health and growth in the vegetable world.

OXYGEN is the vital part of the air we breathe. It is essential to animal life, and without it there could be no combustion. In its pure state, it cannot be easily distinguished from common air. It is void of colour, taste and smell. It forms 23 per cent. of the air we breathe, and eight parts out of nine in the composition of water. It is widely diffused, and has a tendency to penetrate everything with which it comes in contact. The rust that forms on iron exposed to air or moisture, is caused by the action of oxygen, which, combining with the iron, oxidizes it, and makes what is familiarly known as *rust*, but is called by chemists *oxide of iron*. Oxygen combines with metallic ores, enters into the composition of most of the rocks and earths on the surface of the globe, and the bodies of animals, while, as the foregoing table shows, it constitutes more than one-third of the weight of most vegetable substances.

HYDROGEN is, like oxygen, a gas, without colour, taste, or smell, and, when pure, is scarcely distinguishable from common air, though it is fourteen times lighter. On account of its extreme lightness, it is used to inflate balloons. It does not usually exist in a gaseous state, though it can be easily obtained in that form. It combines with all animal and vegetable substances, abounds in water, and is found in coal. Combined with oxygen, it forms water; and, with carbon, it forms the common coal-gas, with which the streets of towns and cities are illuminated. Plants derive what hydrogen they contain from the compounds of this substance, chiefly from water.

NITROGEN is another gas, without colour, taste, or smell. It exists largely in the atmosphere, forming about 77 per cent. of its bulk, and being apparently designed to dilute the oxygen of the air, and prevent its acting too powerfully on living beings and dead matter. Combined with hydrogen, it forms *ammonia*, which is a most essential article of plant food. The smell given off by a dung-heap, and lingering about stables, is caused by ammonia, which, being very light and volatile, escapes almost as quickly as formed, unless means are adopted to retain it as a prisoner for future service. It is a most valuable commodity, but one which is recklessly wasted by nearly everybody who keeps a living creature on his premises.

Such is a brief account of the simple elements of which the organic or destructible part of vegetable substances is formed.

Protecting Implements and Machinery.

IT is safe to state that more tools and machinery are used up by rust and exposure to the weather, than by the actual wear and tear of use. Very few tools are thrown aside because they are *worn* out. Harrows are frequently left with the teeth in the ground all winter, and many people think because the teeth are iron, they are not injured. But the scale of rust that sometimes forms on harrow-teeth destroys more iron during the winter than is worn off by all the harrowing done in one year. The same is true of ploughs. How often do we see good ploughs standing in the furrow all winter! Water not only fills the cracks in the wood, but enters every joint, causing the grain of the timber to expand and then shrink in dry weather, and at length rot, before the plough is worn out, and the formation of a scale of rust on the iron where it comes in contact with the soil, rapidly uses up the iron parts, so that implements not protected, go to destruction with astonishing rapidity, whether made of wood or metal. If the surface is well painted, water will still find its way into the joints, tenons will decay, and the wood about the mortises will often rot in a few years. Waggon wheels that are allowed to stand in the storms and sunshine, even when well painted, rust out faster than they wear out. Water soaks into joints of the fellies and spokes, and between the tires and wood, rusting the iron and destroying the solidity of the structure. This is why waggon tires must be re-set so frequently. More iron will rust off sleigh shoes in one season, when they rest on the ground, even under shelter, than will wear off while running all winter in a snow track. The same is equally true of hoes, shovels, and many other tools. On a farm properly furnished with cellars and sheds, of course all implements should be kept under cover at all seasons. They ought to be off the ground, the wood-work, except handles of tools, well painted, and the iron-work painted or protected by a simple coating of boiled linseed-oil. But the question may be asked how may a farmer protect his implements and machinery, when he has not suitable buildings which can be appropriated to such a purpose. There are several ways in which it may be done very satisfactorily. The farmer on the prairies with no out-buildings or lumber to make them, can set two rows of posts in the ground, about 16 feet apart, and saw off the tops square about three or four feet high, pin a pole on each row of posts for plates, make rafters of poles, and pin them to the plates, and split out thin rails and pin them to the rafters about one foot apart, then cover the whole with straw two feet thick. The straw should be spread on very evenly, and after it has settled down and the surface is wet, raked lightly so as to turn all the straws on the surface down, to carry off the rain. The rafters should have about "one-third pitch." This will be sufficiently steep to carry off all the rain. By nailing or pinning thin rails, like collar beams, from one rafter to another, and making a straw floor, an excellent warm apartment may be made for fowls of any kind. Even geese and ducks will ascend to it, on an inclined plane. Such a frame may be also covered with fence boards, or saw-log slabs, and subserve an excellent purpose for protecting tools. If it should not carry off every drop of rain, it need not be denounced. It is the drying wind and sunshine, not rain alone, that injures implements.—*American Agriculturist.*

Manx Farming.

THE four course shift is generally pursued on the Isle of Man, although by nature it is adapted for, and would require to be upon, the six-course—viz., oats; potatoes or other green crops; wheat or oats; then turnips, of which at least one-half should be eaten on the ground with sheep; as this has never been done to any extent, it would be something new to it, and would not only consolidate the land but put it in a far richer condition than it ever was before. The high land soil is for the most part thin and stony at the bottom. In proof of this, although it rains for a week (which it often does,) so soon as it is fair overhead you can commence to plough with the land in good order. No soil is better adapted for sheep; and as the land gets no manure except artificial, it is much in want of this system; but the farmer would require to have at all times a field of old grass where he could cart on turnips for the sheep. When heavy rains continue, the winds, generally from south-west, are exceedingly high. During the rains and high winds, the sheep poach the land and keep themselves very dirty, having no dry bed to lie down upon; the only way to avoid this is to put them on the lea during wet weather. The land would thus be much