must consider the composition of the soil, and that of the crop to be raised. Those substances may be profitably added that are either deficient in the soil, or are largely required by the crop. Another point claims attention here, and that is that the inevitable deterioration that is the fate of a soil from which more elements of plant food are taken than are restored, cannot be prevented by any improved mechanical methods of farming The evil day may be postponed by these means, but the ruin, when it does come, will be more complete. Draining, deep ploughing, subsoiling, and a judicious rotation of crops, are by no means to be neglected. They are of the very highest value to the farmer, and if carried on in connection with a proper system of manuring, will produce the best results. But they will not do alone. They are to the plant what fresh air, and exercise, warm clothing, and dry and well-ventilated houses are to the human being—highly conducive to health and good digestion, but utterly incapable of supplying the place of food. The usefulness of each of them depends on the assistance it gives to the plant in absorbing the nourishment stored up in the soil. They give nothing of themselves. Draining removes excess of water, admits air, promotes warmth, and assists the action of manures. Ploughing breaks up the soil, and renders it suitable for the growth of plants, admits the air, and allows the roots of the growing plant to penetrate freely in all directions. Deep ploughing and subsoiling increase the depth of available soil, and in addition to their mechanical benefits bring into play the important mineral constituents of the deeper layers, and thus increase the available capital of the farmer. By a rotation of crops the land is prevented from being too quickly exhausted of any one constituent, and the deep roots of one plant are made to bring to the surface food which can be afterwards appropriated by another, whose roots do not penetrate so deeply. But all these add no mineral constituent to the land. They increase the vegetable constituents, the quantity of decomposing matter yielding up water, ammonia, and carbonic acid, but they do not increase the total quantity of ash ingredients; and if any one of the ash ingredients fails, the soil will cease to produce remunerative crops, no matter how much of the other materials of plant food it may contain

From these considerations we see the great importance of the subject of artificial manures. In subsequent articles we intend alluding to these manures in detail.

Nature's Laboratory—*(Continued.)*

Vegetable Manures.

This class of manures although containing a large amount of mucilaginous, saccharine and starchy materials, includes a great excess of fibrous and insoluble matter which must necessarily undergo a chemical change before it can be assimilated. In order to bring about such change, the presence of the former class of bodies is necessary, or at least some substance which is susceptible of that change in the constitution of its atoms called *fermentation*. An instance of how little tendency the fibrous or woody portion of vegetables has towards decomposition is afforded in the composition of peat.

If one part of barn-yard manure be mixed with three parts of peat-earth, the fermenting process is communicated to the earth and its materials brought into a soluble condition. The chief products of vegetable decomposition are carbonic oxide, carbonic acid, various compounds of carbon and hydrogen (hydrocarbons, acetic acid (vinegar), and where *albumen and gluten have been present we find volatile alkali. Another mode of inducing the necessary change is by the action of lime, which abstracts the elements of water, and leaves the carbon, hydrogen and nitrogen under such conditions as are favorable for their union with other elements. It is thus seen that the most generally applicable mode of applying these manures is in the form of composts; excepting where the material is green and succulent, in which state it is readily fermentable and may be incorporated directly with the soil as in the process of ploughing under clover, buckwheat, &c. Among substances included in this division are such as leaf-mould, peat-earth, tan-bark, saw-dust, wood-shavings, straw, stable-litter, &c.

*Albumen and gluten are substances containing carbon, hydrogen, oxygen and nitrogen. Gluten is that substance left after extracting the starch from flour by water.

Mineral Manures.

Mons. Ville's experiments have shown that the cereals require chiefly the nitrates; that potash is necessary for the growth of peas, beans, clover, &c.; and that roots require the phosphates. His perfect manure is composed of 352 lbs. each of phosphate of lime (bone-ash), and pearl-ash, 132 lbs. of quick-lime and 488 lbs. of nitrate of soda (Chili salt petre); forming a quantity sufficient to fertilize one acre of barren sand. The principles governing the application of these have already been briefly explained. It may not be amiss to remark concerning the valuable artificial manure now largely used, namely, super-phosphate of lime, that the proportions of the various ingredients in a good specimen are, according Prof. Croft, those mentioned below :—

Salts of ammonia	10
Soluble phosphate	13
Animal matter	20
Bone hposphate and sulphate of lime	40
Water	17
	100

It is absolutely necessary, in order that the farmer may not be disappointed in results, that he should either obtain this fertilizer from a reliable manufacturer, or make it himself according to the following simple plan :—"The bones are pounded into a coarse powder, then put in a boiler, with a little water, steamed for half an hour, and removed to a half a barrel or other convenient vessel; then to every cwt. of the *dry* bones add 50 lbs. of good oil of vitriol diluted with a third of its bulk of water; the mixture is stirred daily for a week, after which it is mixed with its own bulk of water and poured on a quantity of hen manure placed on an earthen floor, the compound thoroughly mixed; a barrel of charcoal dust, dried earth or peat is then added for every 20 lbs. of bones, again mixed and allowed to heat, after which it must undergo the process of mixing and heating sufficiently often to convert it into a dry powder." This particular mineral manure is especially recommended for its beneficial effects on root crops.

Soot.

This substance contains ammonia, carbon and a certain oil; and is therefore applicable to corn, wheat, &c. Some writers have asserted that if the seed of Indian corn be mixed with this substance and ashes, it is not so liable to be affected with smut. But it seems more probable that the growth of the fungus, or rather its development, depends on a lack of vitality in the plant from some cause, and, consequently, there is afforded a resting place for the spores in the same way as other fungi are produced on decaying trees and logs. If this is the case, the soot can only act like other manures in stimulating the growth and vitality of the corn, thus giving it a greater power of resistance against the intrusion of the *puccinia*. In order to made a successful application of the mineral manures, the agriculturist must have an approximate idea of the natural composition of his soil, as well as a knowledge of the particular elements necessary to and exhausted by each kind of crop; and the want of such knowledge has been the cause of the numerous failures in attempting to make a profitable application of these. On the other hand in applying barn-yard manure and its various composts, he cannot fail to supply the materials necessary; for such manures possess all the elements which assist in the formation of the root, leaves, stem and fruit.

Composts.

It is only within the province of this article to mention the main principles governing the manufacture of these mixtures which constitutes, as it were, the *beef-tea* for the *sick* and exhausted land. These may be stated as follows.—*The insoluble and fibrous portions of the vegetable portion of the mass is to be rendered soluble by ensuring fermentation, the liquid portion is to be absorbed by muck or loam, and the volatile compounds (ammonia) retained by the use of lime and protecting from exposure either by sheds or a covering of earth.* The most economical modes of manufacturing the best composts have already been described in former numbers of this journal.

This brings the list of plant-foods, natural and artificial to a close; and, in the succeeding articles, it is intended to give a brief description of the chemical changes and combinations taking place during germination, and the development of the perfect plant.

Entomological Department.

Orchard Insects.

The following valuable article recently appeared in the *New York Weekly Sun*; though we have often brought the same matters before our readers, we feel that an annual repetition is by no means too much, in order to render every farmer a gardener—every individual, indeed, who posseses an apple tree, perfectly familiar with the chief insect enemies he has to contend against. For such a purpose, it is often better to quote the descriptions of another, rather than to go over the same ground ourselves.

Apple Tree Borers.

There are several insects known as apple tree borers, but the one most destructive to the trees in the Eastern States is the larva or grub or the two-striped Saperda *(Saperda candida)*. This beetle is about three-quarters of an inch long, of a buff color, with two distinct white stripes extending from the head to the tip of the wing covers. It is very shy, hiding in crevices of the bark, and up among the leaves of the tree during the day, and flying about at night. The beetles appear in spring, the females usually depositing their eggs on the bark of the trees near the ground, where they soon hatch, and the grubs bore into the sap wood of the trees, frequently completely girdling the stems. The grubs are nearly cylindrical, tapering slightly from the head to the end of the body. The head is small, brown and horn-like in appearance. Apple trees that are cultivated with the stems surrounded by grass and weeds, are much more likely to be attacked than those receiving the opposite treatment.

The grubs can be found in the trees at this season and during the summer, their presence being readily detected by the sawdust-like excrement pushed out from the furrows made by them. They should be dug out and killed; a small gouge or a strong sharp-pointed knife being used for this purpose. Lime or ashes are frequently recommended as preventives, being heaped or strewn thickly about the stems; but we are inclined to believe that their efficacy, if they possess any, is mainly due to keeping the grass and weeds from growing up and shading the very place which the beetle selects for depositing her eggs. The Saperda attacks trees of all ages, but appears to prefer those that are young, probably because the bark is thinner and affords more ready access to her young. The only certain method of preserving our apple orchards from destruction is to examine the trees once or twice every season, and dig out every grub found in them. If the base of the stem, for a foot or more from the ground upward, is enclosed in oiled or tarred paper, or any similar material, the female will seldom attack the trees. But even with these precautionary measures the trees should be annually examined.

The next most troublesome insect is the "flat-headed borer." This grub is the larva of a small, flattish beetle about half an inch long, of a greenish-black color above and a bronze appearance underneath. The name of this beetle is *Chrysobothris femorata*, and it appears at various times during the summer, the females depositing their eggs on the stems as well as in the forks of the main branches. It does not, however, confine its ravages to the apple or trees belonging to the same family, like the saperda named above, but attacks the peach, oak, and several of our forest trees, as well as other kinds of fruit-trees. The grubs bore almost entirely between the bark and wood, the latter dying as they advance. They are very flat and the head appears very large in proportion to the body; hence the common name, "flat-headed apple tree borer." In some parts of the country this insect is very abundant, and large patches of dead, shrunken bark mark their presence in the trees. The only preventative with which we are acquainted is painting the trees at least twice each summer with strong soap. Of course the application, to be effectual, must extend from the ground up to and among the larger branches. Frequent examinations are also necessary, and every grub should be dug out and the wounds made by it covered with some kind of wax to prevent decay of the exposed wood.

The Tent Caterpillar.

This is one of our most destructive as well as common insects. The large web-like nests of these caterpillars, located among the branches of apple-trees, are objects far too common in all parts of the country to require any further description. The caterpillars are the larvæ of a small, rusty or reddish-brown moth known as the *Clisiocampa Americana*,