

What is the annual course of operations on a farm? In spring time the farmer ploughs his land, drops his seed, covers it up, and forthwith the young crop arises; day by day it increases in stature, and in autumn it realizes his just hopes by a golden harvest. Here is a mystery that may well arrest our attention. The seed grain, with its germ of life, has grown up into a living being, and it yields seed after its kind. Let us see how its growth is accomplished.

The first statement I wish to make is that plants are living beings like ourselves. I might illustrate this by pointing, as the physiologists of olden times did, to some remarkable instances of irritability and movements exhibited by certain plants, such as the moving plant of India, the sensitive plant, and many others. But I do not found my statement that plants are living beings upon the evidence afforded by such exceptional examples as these. We have far more satisfactory evidence in the minute structure of these plants, which, in its essential character, closely resembles that of animal bodies.

[Here the minute structure and cellular development of plants, and the chemical changes that take place in their tissues, were explained.]

Now, what are the sources of the plant's food which enable it to perform the phenomena of growth? which enable it to increase in size, and furnish food for man and beast? We find that all the elements of which the plant is composed are found in the inorganic world. It therefore creates nothing. When we partially burn a plant (or a piece of wood) we drive off water and other volatile matters and leave a black mass of charcoal, or *carbon*; if this carbon is burned in the air it disappears, leaving the ash behind, which does not volatilise. This is mineral inorganic matter, which, along with water, has been derived entirely from the soil; the carbon is derived from the atmosphere which the plant breathes.

[Here absorption and the mode of feeding in the plant were explained, and the stomata were described by which it abstracts from the carbonic acid of the atmosphere the carbon of which its tissues are in great part built up.]

We see then that plants are endowed with life, and exercise all the functions belonging to organized beings. Like animals they feed and breathe, and in our cultivation of them we must see that their wants are ministered to. But all plants are not alike in their choice of conditions of growth: some grow in the sea; some grow in hot water; some grow in cold fresh water; some grow on snow; some grow in wet soils; some grow in dry ground; some grow in arid sands; some grow on decaying matter; some grow on other plants, as parasites. All this teaches us that we must imitate the conditions necessary for the plant we cultivate. The atmosphere, which forms one source of the food of plants, is, to a great extent, beyond man's control, but not so the soil. It is in many respects capable of improvement.

[Here the chemical characters of soils were referred to in detail, and also their mechanical conditions.]

One of the most frequent difficulties with which the farmer has to deal is a superabundance of moisture. There are various ways of remedying this, but a few general principles are applicable to all. [These were explained.]

In regard to ordinary drainage there are many points that can only be considered fully on the spot. Much discussion has taken place as to the direction, and especially the depth, of drains. It seems to be well established that on light soils drains act more effectively the deeper they are placed; but it is necessarily very different on clays where the water cannot percolate. In such soils, while the actual depth must depend upon the depth of available soil, and other circumstances, it must never be carried too far, otherwise the clay will resist the passage of the water, and thus the drains will remain useless.

It is also a question of frequent discussion in England: what is the proper distance apart for drains? And here it is necessary to take into account the differences in regard to capillary attraction of soils, or that power by which they are enabled to suck up water from below.

[Here the effects of different modes of drainage were explained by diagrams.]

In a comparatively short time draining has completely changed the aspect of extensive tracts of country in Britain, converting the cold morass into fertile fields and greatly increasing the annual produce, even on soil which was before bearing crops sufficient to satisfy the most exacting expectations. One reason, I believe, why so little has been done in the way of draining in this country is that drain-tiles are expensive, and not readily attainable. The same objection existed in Britain not very many years ago; but the demand for the article soon led to its increased production, and