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VEGETATION.

Having described the soil, we now come to the elements of vegetation sustained through its instrumentality. Vegetation, or growth, is produced by the action of certain elementary gases, on the roots, stems, and leaves of plants, and of which the earth may be termed the agent through which the application is made. The elements which constitute the greatest part of vegetable matter, are oxygen, hydrogen, aud carbon, with, in some of the products, a little of azote. But in addition to these, chlorine, sulphur, phosphorus, calcium, magnasium, silicum, aluminum, potassium, and sodium, with small portions of iron and manganese, enter, either in their simple or compound forms, into the fibre and texture of plants, or into the agents which operate upon them.—These fifteen elements, by the power of chemical attraction, unite with each other into an immense variety of substances, and compose that beautiful and harmonious assemblage of living forms, which, by means of their roots, stems, leaves, and blossoms, weave the verdant and flowery carpet that spring extends beneath our feet, and that the summer heightens and decorates with the most glowing and animated tints. Before they pass into the more complex arrangement of plants, shrubs, and trees, they previous unite into the simpler combinations, and constitute water, air, acids, alkalis, and various salts. These latter are again acted upon by the powers of growth, and after entering with the sap into the system, assimilate to the organs, and assume the characters of life.

The water which nature furnishes to the vegetable organs is never perfectly pure; for besides containing air, in which there is constantly a certain proportion of carbonic acid gas, it has always acquired, by percolation through the soil, various earthy and saline particles, together with materials derived from decayed vegetable or animal remains. Most of these substances are soluble, in however minute a quantity, in water; and others finely pulverized may be suspended in that fluid, and carried along with it into the vegetable system. It does not appear, however, that pure carbon is ever admitted, for Sir H. Davy, on mixing charcoal, ground to an impalpable powder, with the water into which the roots of mint were immersed could not discover that the smallest particle of that substance had been in any case absorbed. But in the form of carbonic acid, this element is received in great abundance, through the medium of water, which redily absorbs it; and a considerable quantity of carbon is also introduced into the fluids of the plant, derived from the decomposed animal and vegetable materials which the water generally contains. The peculiar fertility of each kind of soil depends principally on the quantity of these organic products it contains in a state capable of being absorbed by the plant, and of contributing to its nourishment

Animals and vegetables are compounded of nearly the same elementary principles, which enter into their systems by the food, water, and air they are constantly consuming, and which encourage their growth and increase their bulk. As long as animals and vegetables are endowed with the principle of life, these elementary properties are sustained in action for their benefit; but so soon as they cease to exist, quite a new process ensues. After death comes putrefaction, or the dissolution of the elementary properties of which the animal or plant was composed, and which properties escape either in juices, or æriform products, or an indissoluble residum. These component parts, thus set free, remain not long inactive, but rush speedily into new compounds. The oxygen which escapes from a decaying flower mixes with the air, and the next minute may perhaps enter the lungs of the man who is bending over it in contemplative mood at the precariousness of its short-lived beauty. It is thus that all decomposing vegetable and animal substances serve the purpose of manures, because their elementary principles are dissolving and separating from each other; and in this way are prepared, by the wonderful and mysterious economy of nature, for feeding and sustaining the different orders of organized beings which are then enjoying existence.

One is not able to contemplate the putrefactive process, and the uses it serves in the vegetable kingdom, without being struck with the admirable contrivance of the Creator, to remove from our sight the putrid remains of animal and vegetable bodies, and change them into new and nutritious forms. The beauty of the universe would have been marred, and our senses continually offended, without this expedient of putrefaction, which sweeps away all trace of former organized beings, by converting them into pure and uncontaminated gases. In a similar manner, the excrementitious matter passing from animals is disposed of. In the form of manures, it is buried in the grounds, which absorbs all its noxious effluvia; and in place of exciting in us revolting sensations, it becomes the most powerful restorer of our exhausted fields. There it is decomposed by the solvent powers of heat and water, and supplies abundance of nourishment to the grasses and corn vegetating over it. Thus, the soil supports plants, plants support animals, and animals and plants support man; while the soil, again, absorbs the whole, in order to pursue the same everlasting process.

The soil, as we have said, is however only an agent, but one of first rate utility. It forms the bed in which the roots sink and extend themselves, both for the purpose of seeking nourishment, and of sustaining the plant in such a firm position as not to be injured by the agitation of the winds. The soil is also the laboratory in which putrefaction is carried on Some of the primitive earths are much more capable of resolving animal and vegetable bodies into their elementary principles than others. In stiff clay, putrefaction goes on at a very slow rate; in sand and gravel the process is more rapid; and in lime and magnesia, it is the quickest of all; yet every one of them possesses this power to a certain extent. The earth has not only the property of discomposing animal and vegetable substances, but, what is more essential, it has the property of retaining the putrid streams which arise from them. Were the gases into which bodies dissolve themselves to escape immediately from the ground, as through a sieve, at the moment of their disunion, it would be unfit for the purpose of vegetation: but when it absorbs and gradually gives them out according to the action of chemical affinities, we behold it endowed with an admirable quality for the support of vegetable life. The earth not only absorbs all the effluvia of corrupted animal and vegetable matter lying in itself, but it attracts these effluvia when set at liberty and floating in the atmosphere. Fresh mould greedily inhales the putrid vapours with which the atmosphere may happen to be loaded; and the more the land is turned up, the more will this take place. On this circumstance depend the great salubrity of the atmosphere in the country, and the healthiness of those who are employed either in following the plough, or digging the ground.

It only remains that we should give a short account of the process of vegetation. All vegetables are reproduced from seeds or germs of their own species. Seeds may be defined as a kind of eggs, containing a vital principle or embryo, which, when developed in favourable circumstances, is in all respects like the parent, unless art interfered to change its form and qualities. The vital principle is perfectly dormant when the seed is shed by the parent; but when placed in the soil, the matter is excited into action by heat, air, and moisture. Expansion of the membrances takes place, the outer husky coverings are burst asunder, and fibre to form the roots descends in search of humid and gaseous food, and fixes itself in the earth. Soon after, a fibre shoots upward from the seed, pierces the surface of the ground, and expands in the air. In this early part of the process of the vegetation, the principal portion of each seed, serves to nourish both descending and ascending fibres; and when this end is accomplished, it is exhausted and decays. Some kinds of vegetable reproduce by means of *sporule*, or parts separated from the parent plant; and their action is somwhat different; but these do not require particular notice here.

As soon as the first spur-like root issuing from a seed enters the soil it emits small fibres from its point and along its sides, some of these become branches, which in their turn also eject fibres, according to the demand of the plants for nourishment. The small fibres or *spongioles*, are the real root or mouths of the plant, by which imbibe or extract nourisment from the earth. This nourishment consist of water, oxygen and hydrogen gases, and certain earths and salt, particular potash In seeking their appropriate food from the mass of soils which surrounds them, the fibres exercise a selection or properly speaking only receive that kind of nourishment which their constitution permits or demands. The greater the difficulty in finding nourishment, the more widely do the roots and fibres penetrate. A vast number of invisible hollow tubes, which pervade the stem and branches of the plant, conduct the moisture, or sap from the roots though the body of the plant, till it arrives at the leaves. In daylight, about two thirds of the oxygen and hydrogen contained in the sap flies off in vapour through multitudes of invisible pores spread over the upper part of the leaves. Similar pores in the under sides are at the same time engaged in inhaling the carbonic acid gas, which forms a small part of the atmosphere, and is receiving constant accessions from the lungs of animals. The sap, thus relieved of so large a portion of the oxygen aud hydrogen, and charged with carbonic acid gas, returns, in most plants, along the exterior of the branches and stem immediately under the bark or skin, where it deposits itself in new vegetable matter, so as to add to their thickness. The growth aud increase in bulk of plants thus proceed on a most elaborate scheme, requiring a number of concurring circumstances to attain the desired end. The soil must possess the elementary matters necessary to form the sap; pure air must be permitted to reach the root through the surface of the ground, and if the soil be so stiff as to prevent this, vegetable growth will cease; there must be a sufficiency of, but not too much, moisture and the solar rays must be allowed to shed light upon the plant only.

In the night time, or when planted in a dark place, plants, as already mentioned, grow sickly and white. The cause of this is, that they do not give out the hydrogen and oxygen of the ascending sap; on the contrary, they take in oxygen, and give out carbonic acid gas. Hence a constant abstraction of the light from plants renders them unhealthy. It is the carbon, that mingling its dark hues, with the yellow of the sap, forms the green colour so prevalent in the vegetable creation, and so refreshing to the eyes of man. The manifest purpose of vegetable life appears to be the production of seed, or reproduction through the means of seeds and shoots. When the plant has attained this important end of maturing its seeds, which in trees are concealed in the heart of the fruit, it in many cases withers and dies, or ceases for a season to flourish. In the case of grains, or cereal plants, the seeds are the grains; and to produce by art the largest number and weight of these, is the great object of the agriculturist.

When the leaves of potatoes fall in ripening, if the crop be large, it will be necsssary to go over the ground and cover all the naked potatoes that can be seen, if this is not done, they will turn green and become unfit use, and should there be a heavy frost the parts that are uncovered may be frozen, when they will, by decaying in the cellar, rot all the potatoes that