THE

THEORY

OF

HORTICULTURE.

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1. HORTICULTURE is that branch of knowledge which relates to the cultivation, multiplication, and amelioration of the Vegetable Kingdom. It divides into two branches, which, although mutually dependent, are, in fact, essentially distinct: the art and the science. Under the art of horticulture is comprehended whatever concerns the mere manner of executing the operations connected with cultivation, multiplication, and amelioration; the science explains the reasons upon which practice is founded. It is to the consideration of the latter subject that the following pages are dedicated.

2. It must have been remarked by all intelligent observers, that in the majority of works upon horticultural subjects, the numerous directions given in any particular ramification into which the art is susceptible of being divided, are held together by no bond of union, and that there is no explanation

of their connexion with general principles, by which alone the soundness of this or that rule of practice may be tested; the reader is therefore usually obliged to take the excellence of one mode of cultivation and the badness of another, upon the good faith of gardening authors, without being put into possession of any laws by which they may be judged of beforehand. Horticulture is by these means rendered a very complicated subject, so that none but practised gardeners can hope to pursue it successfully; and, like all empirical things, it is degraded into a code of peremptory precepts.

3. It will nevertheless be found, if the subject is carefully investigated, that in reality the explanations of horticultural operations are simple, and free from obscurity; provided they are not encumbered with speculations, which, however interesting they may be in theory, are only perplexing in practice, in the present state of knowledge. When, for example, chemical illustrations, unless of the simplest kind, or minute anatomical questions, or references to the agency of the electrical fluid, are discussed, the subject becomes embarrassed with considerations which are too refined for the apprehension of the majority of readers of gardening works, and which have little obvious application to practical purposes. Instead, therefore, of introducing points of obscure or doubtful application, or such as are not absolutely requi-

site for the explanation of phenomena, all which necessarily tend to complicate the theory of horticulture, it seems better strictly to confine our attention to the action of the simplest vital forces; for the general nature of these has been undoubtedly ascertained, and is easily understood by every class of readers. It is certain, for instance, that plants breathe, digest, and perspire; but it may be a question whether the exact nature of their respiration, digestion, and perspiration is beyond all further explanation; it is therefore better to limit our consideration to the naked fact, which is all that it imports the gardener to know, without inquiring too curiously into those phenomena. For it must always be remembered that the object of a work like the present is not to elucidate the laws of vegetable life in all their obscure details, but to teach, to those acquainted with the art of gardening, what the principles are upon which their practice is founded.

4. In order to attain this end it is necessary, in the first place, to explain briefly, but distinctly, the nature of those vital actions which have a direct reference to cultivation; omitting every thing that tends to embarrass the subject or which is not susceptible of a direct practical application; and in the next place, to show how those facts bear upon the routine of practice of the horticulturist, by making them explain the reason of the treat-

ment which is employed in various branches of the gardener's art.

5. The first part of this work will therefore embrace the principal laws and facts in vegetable physiology, as deduced from the investigations of the botanist; and the second the application of those laws to practice, as explained by the experience of the horticulturist.

6. If the laws comprehended in the first book are correctly explained, and the facts connected with them rightly interpreted, they must necessarily afford, in all cases, the reasons why one kind of cultivation is better than another; and all kinds of practice at variance with those laws must be bad. Since, from the very nature of things, this cannot be otherwise, it follows that, by a careful consideration and due understanding of these laws, the intelligent cultivator will acquire the most certain means of improving his practice.

BOOK I.

OF THE PRINCIPAL CIRCUMSTANCES CONNECTED WITH VEGETABLE LIFE WHICH ILLUSTRATE THE OPERATIONS OF GARDENING.

7. A PLANT is a living body composed of an irritable, elastic, hygrometrical matter, called tissue. It is fixed to the earth by roots, and it elevates into the air a stem bearing leaves, flowers, and fruit. It has no power of motion except when it is acted upon by wind or other external forces; it is therefore peculiarly susceptible of injury or benefit from the accidental circumstances that may surround it; and, having no free agency, it is above all other created beings suited to acknowledge the power of man.

8. In order to turn this power to account, it is necessary to study the manner of life which is peculiar to the vegetable kingdom, and to ascertain what the laws are by which the numerous actions essential to the existence of a plant are regulated. It is, moreover, requisite that the causes which modify those actions, either by increasing or diminishing their force, should be understood.

9. The vital actions of plants have so little re

semblance to those of animals, that we are unable to appreciate their nature in even the smallest degree by a reference to our own sensations, or to any knowledge we may possess of animal functions. Nor, when we have thoroughly studied the phenomena of vegetation, are we able to discover any analogies, except of a general and theoretical nature, between the animal and vegetable kingdoms. It is therefore necessary that plants should be studied by themselves, as an abstract branch of investigation, without attempting to reason as to their habits from what we know of other organic beings; and consequently we are not, in this part of Natural History, to acknowledge any theory which is not founded upon direct experiment, and proved by the most satisfactory course of enquiry.

10. In discussing this subject, it will be most convenient for my present purpose, if I divide the matter into the heads of, 1. Germination; 2. Growth by the Root; 3. Growth by the Stem; 4. Action of the Leaves; 5. Action of the Flowers; and, 6. Maturation of the Fruit. By this means the life of a plant will be traced through all its principal changes, and it will be easy to introduce into one or other of these heads every point of information that can be interesting to the cultivator; who will be most likely to seek it in connexion with those phenomena he is best acquainted with by their effects.

CHAPTER I.

GERMINATION.

The Nature of a Seed. — Its Duration. — Power of Growth. — Causes of Germination. — Temperature. — Light. — Humidity. — Chemical Changes.

11. A SEED is a living body, separating from its parent, and capable of growing into a new individual of the same species. It is a reproductive fragment, or vital point, containing within itself all the elements of life, which, however, can only be called into action by special circumstances.

12. But while it will with certainty become the same species as that in which it originated, it does not possess the power of reproducing any peculiarities which may have existed in its parent. For instance, the seed of a Green Gage plum will grow into a new individual of the plum species, but it will not produce the peculiar variety called the Green Gage. This latter property is confined to leaf-buds, and seems to be owing to the seed not being specially organised after the exact plan of the branch on which it grew, but merely possessing the first elements of such an organisation, together with an invariable tendency towards a particular kind of developement.

13. Under fitting circumstances a seed grows; that is to say, the embryo which it contains swells, and bursts through its integuments; it then lengthens, first in a direction downwards, next in an upward direction, thus forming a centre or axis round which other parts are ultimately formed. No known power can overcome this tendency, on the part of the embryo, to elevate one portion in the air, and to bury the other in the earth; but it is an inherent property with which nature has endowed seeds, in order to insure the young parts, when first called into life, each finding itself in the situation most suitable to its existence; that is to say, the root in the earth, the stem in the air.

14. The conditions required to produce germination are, exposure to moisture, and a certain quantity of heat; in addition, it is necessary that a communication with the atmosphere should be provided, if germination is to be maintained in a healthy state. A seed, when fully ripe, contains a larger proportion of carbon than any other living part, and so long as it is thus charged with carbon, it is unable to grow. The only means it possesses of ridding itself of this principle, essential to its preservation, but forming an impediment to its developement as a new plant, is by converting the carbon into carbonic acid; for which purpose a supply of oxygen is necessary. It cannot obtain

oxygen in sufficient quantity from the air, for it is cut off from free communication with the air by various means, either natural, as being enclosed in a thick layer of pulp, or in a hard shell or stone; or artificial, as being buried to a considerable depth below the surface of the soil. It is from the water absorbed in germination that the seed procures the requisite supply of oxygen; fixing hydrogen, the other element of water, in its tissue: and thus it is enabled to form carbonic acid, which it parts with by its respiratory organs, until the proportion of fixed carbon is lowered to the amount suited to its growth into a plant.

15. But the formation and respiration of carbonic acid takes place most freely, though not exclusively, in darkness; if exposed to light, the seed again parts with some of its oxygen, and again fixes its carbon by the decomposition of its carbonic acid.

16. In addition to this, the absorption of water causes all the parts to soften and expand; many of the dry, but soluble, parts to become fluid; sap, or vegetable blood, to be formed; and a sort of circulation to be established, by means of which a communication is maintained between the more remote parts of the embryo.

17. Heat seems to set the vital principle in action, to expand the air contained in the numerous microscopic cavities of the seed, and to produce a

distension of all the organic parts, which thus have their irritability excited, never again to be destroyed except with death. What degree of heat seeds find most conducive to their germination, probably varies in different species. Chickweed (Alsine media) and Groundsel (Senecio vulgaris) will germinate at a temperature but little above 32° Fahr.

18. Germination being established, by the absorption and decomposition of water, and by the requisite elevation of temperature, all the parts enlarge, and new parts are created, at the expense of a mucilaginous saccharine secretion which the germinating seed possesses the power of forming. With the assistance of this substance, the root, technically called the radicle, at first a mere point, or rather rounded cone, extends and pierces the earth in search of food; the young stem rises and unfolds its cotyledons, or rudimentary leaves, which, if they are exposed to light, decompose carbonic acid, fix the carbon, become green, and, by processes hereafter to be explained, when speaking of leaves, form the matter by which all the pre-existing parts are solidified. And thus a plant is born into the world; its first act having been to deprive itself of a principle (carbon) which, in superabundance, prevents its growth; but, in some other proportion, is essential to its existence.