JOHN ASTON WARDER

AMERICAN POMOLOGY. APPLES

John Aston Warder

American Pomology. Apples

Warder J.

American Pomology. Apples / J. Warder — «Public Domain»,

Содержание

J. A. Warder
American Pomology. Apples

PREFACE

All patriots may realize a sense of pride, when they consider the capabilities of the glorious country in which we are favored to live; and while fostering no sectional feelings, nor pleading any local interests, yet, as Americans and as men, we may be allowed to love our own homes, our own neighborhoods, our States and regions; and we may be permitted to think them the brightest and best portions of the great Republic to which we all belong. Therefore the writer asks to be excused for expressing a preference for his own favored *Northwest*, and while claiming all praise for this noble expanse, he wishes still to be acknowledged as most devotedly an American Citizen, who feels the deepest interest in the prosperity of the whole country.

His fellow-laborers in the extensive field of Horticulture, who are scattered over the great Northwest, having called upon him for a work on fruits which should be adapted to their wants, the author has for several years devoted himself to the task of collecting materials from which he is preparing a work upon American Pomology, of which this is to be the first volume.

The title has been adopted as the most appropriate, because the book is intended to be truly American in its character, and, though it may be especially adapted to the wants of the Western States, great pains have been taken to make it a useful companion to the orchardists of all portions of our country.

When examining this volume, his friends are asked to look gently upon the many faults they may find, and they are requested also to observe the peculiarities by which this fruit book is characterized. Much to his regret, the author found that it was considered necessary to the completeness of the volume, that the general subject of fruit-growing should be treated in detail, and, therefore, introductory chapters were prepared; whereas, he had set out simply to describe the fruits of our country. To this necessity, as it was considered by his friends, the author yielded reluctantly, because he felt that this labor had already been thoroughly done by his predecessors, whose volumes were to be seen in the houses of all intelligent fruit-growers. From them he did not wish to borrow other men's ideas and language, and therefore undertook to write the whole anew, without any reference to printed books. But, of course, it is impossible to be original in treating such familiar and hackneyed topics as those which are discussed at every meeting of horticulturists all over the country, and which form the subject of the familiar discourse of the green-house and nursery, the potting-shed and the grafting-room, the garden and the orchard.

After the introductory chapters upon the general or leading topics connected with fruit-culture and orcharding, the reader will find that especial attention has been paid to the classification of the fruits under consideration in this volume. Classification is the great need of our pomology, and, indeed, it is almost a new idea to many American readers. The author has fully realized the difficulties attendant upon the undertaking, but its importance, and its growing necessity, were considered sufficient to warrant the attempted innovation. It is hoped that American students of pomology will appreciate the efforts which have been made in their behalf. The formulæ which have been adopted may not prove to be the best, but it is believed that they will render great assistance to those who desire to identify fruits; and that, at least, they may lead to a more perfect classification in the future.

On the contrary, with these simple formulæ, under which the fruits are arranged, the student has only to decide as to which of the sub-divisions his specimen must be referred, and then seek among a limited number for the description that shall correspond to his fruit, and the identification is made out.

In the systematic descriptions of fruits, the alphabetical succession of the names is used in each sub-division. An earnest endeavor has been made to be minute in the details without becoming prolix. A regular order is adopted for considering the several parts, and some new or unusual characters are brought into requisition to aid in the identification. Some of these characters appear to have been strangely overlooked by previous pomologists, though they are believed to be permanent and of considerable value in the diagnosis.

In deciding upon the selection of the names of fruits, the generally received rules of our Pomological Societies have been departed from in a few instances, where good reasons were thought to justify differing from the authorities. Thus, when a given name has been generally adopted over a large extent of country, though different from that used by a previous writer, it has been selected as the title of the fruit in this work.

To avoid incumbering the pages, authorities for the nomenclature have not been cited, except in a few instances, nor have numerous synonyms been introduced. Such only as are in common use have been given, and those of foreign origin have been dropped.

The attention of the reader is particularly directed to the catalogue of fruits near the close of the volume, which also answers as the index to those which are described in detail. This portion of the work has cost an immense amount of labor and time, and, though making little display, will, it is hoped, prove very useful to the orchardist. In it the names of fruits are presented in their alphabetical order, followed by information as to the average size, the origin of the variety, its classification, from which are deduced its shape, flavor and modes of coloring; next is noted its season, and then its quality. This last character is, of course, but the result of private judgment, and the estimate may differ widely from that of others; the quality, too, it should be remembered, is here intended to be the result of a consideration of many properties besides that of mere flavor.

This catalogue will furnish a great deal of information respecting the fruits it embraces. Unfortunately, it is not so full nor so complete as it should be, but it is offered as the result of many years' observations, and is submitted for what it is worth.

Acknowledgments.—It is but an act of common justice for an author to acknowledge his indebtedness to those who have aided him in his labors, especially where, from the nature of the investigations, so much material has to be drawn from extrinsic sources. Upon the present occasion, instead of an extended parade of references to the productions of other writers, which might be looked upon as rather pedantic, it is preferred to make a general acknowledgment of the important assistance derived from many pomological authors of our own country and of Europe. Quotations are credited on the pages where they occur.

But the writer is also under great obligations to a host of co-laborers for the assistance they have kindly rendered him in the collecting, and in the examination and identification of fruits. Such friends he has happily found wherever he has turned in the pursuit of these investigations, and there are others whom it has never been his good fortune to meet face to face. To name them all would be impossible. The contemplation of their favors sadly recalls memories of the departed, but it also revives pleasant associations of the bright spirits that are still usefully engaged in the numerous pomological and horticultural associations of our country, which have become important agencies in the diffusion of valuable information in this branch of study.

To all of his kind friends the author returns his sincere thanks.

With a feeling of hesitation in coming before the public, but satisfied that he has made a contribution to the fund of human knowledge, this volume is presented to the Horticulturists of our country, for whom it was prepared by their friend and fellow-laborer,

JNO. A. WARDER.
Aston, January 1, 1867.

INTRODUCTION

IMPORTANCE OF ORCHARD PRODUCTS—GOVERNMENT STATISTICS—GREAT VALUE OF ORCHARD AND GARDEN PRODUCTS —DELIGHTS OF FRUIT CULTURE—TEMPERATE REGIONS THE PROPER FIELD FOR FRUIT CULTURE, AS FOR MENTAL DEVELOPMENT—PLANTS OF CULTURE, PLANTS OF NATURE—NOMADIC CONDITION UNFAVORABLE FOR TERRA-CULTURE—NECESSITIES OF AN INCREASING POPULATION A SPUR—HIGH CIVILIZATION DEMANDS HIGH CULTURE—HORTICULTURE A FINE ART, THE POETRY OF THE FARMER'S LIFE—MORAL INFLUENCES OF FRUIT-CULTURE—SINGULAR LEGISLATION RESPECTING PROPERTY IN FRUIT—INFLUENCE UPON HEALTH—APPLES IN BREAD-MAKING; AS FOOD FOR STOCK—SOURCES AND ROUTES OF INTRODUCTION—AGENCY OF NURSERYMEN—INDIAN ORCHARDS—FRENCH SETTLERS—JOHNNY APPLE-SEED—VARIETIES OF FRUITS, LIKE MAN, FOLLOW PARALLELS OF LATITUDE—LOCAL VARIETIES OF MERIT TO BE CHERISHED—OHIO PURCHASE—SILAS WHARTON—THE PUTNAM LIST.

Few persons have any idea of the great value and importance of the products of our orchards and fruit-gardens. These are generally considered the small things of agriculture, and are overlooked by all but the statist, whose business it is to deal with these minutiæ, to hunt them up, to collocate them, and when he combines these various details and produces the sum total, we are all astonished at the result.

Our government wisely provides for the gathering of statistics at intervals of ten years, and some of the States also take an account of stock and production at intermediate periods, some of them, like Ohio, have a permanent statistician who reports annually to the Governor of the State.

Our Boards of Trade publish the amounts of the leading articles that arrive at and depart from the principal cities, and thus they furnish us much additional information of value. Besides this, the county assessors are sometimes directed to collect statistics upon certain points of interest, and now that we all contribute toward the extinction of the national debt, the United States Assessors in the several districts are put in possession of data, which should be very correct, in regard to certain productions that are specified by act of Congress as liable to taxation. By these several means we may have an opportunity of learning from time to time what are the productions of the country, and their aggregate amounts are surprising to most of us. When they relate to our special interests, they are often very encouraging. This is particularly the case with those persons who have yielded to the popular prejudice that cotton was the main agricultural production of the United States; to such it will be satisfactory to learn that the crop of corn, as reported in the last census, is of nearly equal value, at the usual market prices of each article. Fruit-growers will be encouraged to find that the value of orchard products, according to the same returns, was nearly twenty millions, that of Ohio being nearly one million; of New York, nearly three and three-quarters millions; that the wine crop of the United States, an interest that is still in its infancy, amounted to nearly three and one-quarter millions; and that the valuation of market garden products sums up to more than sixteen millions of dollars' worth. It is to be regretted that for our present purpose, the data are not sufficiently distinct to enable us to ascertain the relative value of the productions of our orchards of apples, pears, peaches, quinces, and the amount and value of the small fruits, as they are termed, since these are variously grouped in the returns of the census takers, and cannot now be separated. Of their great value, however, we

may draw our conclusions from separate records that have been kept and reported by individuals, who assert the products of vineyards in some cases to have been as high as three thousand dollars per acre; of strawberries, at one thousand dollars; of pears, at one hundred dollars per tree, which would be four thousand dollars per acre; of apples, at twenty-five bushels per tree, or one thousand bushels per acre, which, at fifty cents per bushel, would produce five hundred dollars.

But, leaving this matter of dollars and cents, who will portray for us the delights incident to fruit-culture? They are of a quiet nature, though solid and enduring. They carry us back to the early days of the history of our race, when "the Lord God planted a garden eastward in Eden … and out of the ground made the Lord God to grow every tree that is pleasant to the sight, and good for food … and the Lord God took the man and put him into the garden of Eden, to dress it and to keep it." We are left to infer that this dressing and keeping of the garden was but a light and pleasant occupation, unattended with toil and trouble, and that in their natural condition the trees and plants, unaided by culture, yielded food for man. Those were paradisean times, the days of early innocence, when man, created in the image of his Maker, was still obedient to the divine commands; but, after the great transgression, everything was altered, the very ground was cursed, "thorns and thistles shall it bring forth to thee, and thou shalt eat of the herb of the field. In the sweat of thy face shalt thou eat bread."–From that day to the present hour it has been the lot of man to struggle with difficulties in the cultivation of the soil, and he has been driven to the necessity of constant watchfulness and care to preserve and to improve the various fruits of the earth upon which he subsists. In the tropics, it is true, there are many vegetable productions which are adapted for human food, even in a state of nature, and there we find less necessity for the effort of ingenuity and the application of thought and labor to produce a subsistence. Amid these productive *plants of nature*, the natives of such regions lead an idle life, and seldom rise above a low scale of advancement; but in the temperate regions of the globe, where the unceasing effort of the inhabitants is required to procure their daily food, we find the greatest development of human energies and ingenuity—there man thinks, and works; there, indeed, he is forced to improve the natural productions of the earth—and there we shall find him progressing. As with everything else, so it is with fruits, some of which were naturally indifferent or even inedible, until subjected to the meliorating influences of high culture, of selection, and of improvement. Here we find our *plants of culture*, which so well repay the labor and skill bestowed upon them.

In the early periods of the history of our race, while men were nomadic and wandered from place to place, little attention was paid to any department of agricultural improvement, and still less care was bestowed upon horticulture. Indeed, it can scarcely be supposed that, under such conditions, either branch of the art could have existed, any more than they are now found among the wandering hordes of Tartars on the steppes of Asia. So soon, however, as men began to take possession of the soil by a more permanent tenure, agriculture and horticulture also, attracted their chief attention, and were soon developed into arts of life. With advancing civilization, this has been successively more and more the case; the producing art being obliged to keep pace with the increased number of consumers, greater ingenuity was required and was applied to the production of food for the teeming millions of human beings that covered the earth, and, as we find, in China, at the present time, the greatest pains were taken to make the earth yield her increase.

High civilization demands high culture of the soil, and agriculture becomes an honored pursuit, with every department of art and science coming to its assistance. At the same time, and impelled by the same necessities, supported and aided by the same co-adjutors, horticulture also advances in a similar ratio, and, from its very nature, assumes the rank of a fine art, being less essential than pure agriculture, and in some of its branches being rather an ornamental than simply a useful art. It is not admitted, however, that any department of horticulture is to be considered useless, and many of its applications are eminently practical, and result in the production of vast quantities of human food of the most valuable kind. This pursuit always marks the advancement of a community.—As our western pioneers progress in their improvements from the primitive log cabins to the more elegant

and substantial dwelling houses, we ever find the garden and the orchard, the vine-arbor and the berry-patch taking their places beside the other evidences of progress. These constitute to them the poetry of common life, of the farmer's life.

The culture of fruits, and gardens also, contributes in no small degree to the improvement of a people by the excellent moral influence it exercises upon them. Everything that makes home attractive must contribute to this desirable end. Beyond the sacred confines of the happy hearthstone, with its dear familiar circle, there can be no more pleasant associations than those of the garden, where, in our tender years, we have aided loved parents, from them taking the first lessons in plant-culture, gathering the luscious fruits of their planting or of our own; nor of the rustic arbor, in whose refreshing shade we have reclined to rest and meditate amid its sheltering canopy of verdure, and where we have gathered the purple berries of the noble vine at a later period of the rolling year; nor of the orchard, with its bounteous supplies of golden and ruddy apples, blushing peaches, and melting pears. With such attractions about our homes, with such ties to be sundered, it is wonderful, and scarcely credible, that youth should ever be induced to wander from them, and to stray into paths of evil. Such happy influences must have a good moral effect upon the young. If it be argued that such luxuries will tend to degrade our morals by making us effeminate and sybaritic, or that such enjoyments may become causes of envy and consequent crime on the part of those who are less highly favored, it may be safely asserted that there is no better cure for fruit-stealing, than to give presents of fruit, and especially of fruit-trees, to your neighbors, particularly to the boys—encourage each to plant and to cherish his own tree, and he will soon learn the meaning of *meum* and *tuum*, and will appreciate the beauties of the moral code, which he will be all the more likely to respect in every other particular.

Some of the legislation of our country is a very curious relic of barbarism. According to common law, that which is attached to the soil, may be removed without a breach of propriety, by one who is not an owner of the fee simple; thus, such removal of a vegetable product does not constitute theft or larceny, but simply amounts to a trespass: whereas the taking of fruit from the ground beneath the tree, even though it be defective or decaying, is considered a theft. An unwelcome intruder, or an unbidden guest, may enter our orchard, garden, or vineyard, and help himself at his pleasure to any of our fruits, which we have been most carefully watching and nursing tor months upon trees, for the fruitage of which we may have been laboring and waiting for years, and, forsooth, our only recourse is to sue him at the law, and our only satisfaction, after all the attendant annoyance and expense, is a paltry fine for *trespass* upon our freehold, which, of course, is not commensurate with our estimate of the value of the articles taken: fruits often possess, in the eyes of the devoted orchardist, a real value much beyond their market price.

Were I asked to describe the location of the fabled fountain of Hygeia, I should decide that it was certainly situated in an orchard; it must have come bubbling from earth that sustained the roots of tree and vine; it must have been shaded by the umbrageous branches of the wide-spreading apple and pear, and it was doubtless approached by alleys that were lined by peach trees laden with their downy fruit, and over-arched by vines bearing rich clusters of the luscious grape, and they were garnished at their sides by the crimson strawberry. Such at least would have been an appropriate setting for so valued a jewel as the fountain of health, and it is certain that the pursuit of fruit-growing is itself conducive to the possession of that priceless blessing. The physical as well as the moral qualities of our nature are wonderfully promoted by these cares. The vigorous exercise they afford us in the open air, the pleasant excitement, the expectation of the results of the first fruits of our plants, tending, training and cultivating them the while, are all so many elements conducive to the highest enjoyment of full health.

The very character of the food furnished by our orchards should be taken into the account, in making up our estimate of their contributions to the health of a community. From them we procure aliment of the most refined character, and it has been urged that the elements of which they are composed are perfected or refined to the highest degree of organization that is possible to occur

in vegetable tissues. Such pabulum is not only gratefully refreshing, but it is satisfying—without being gross, it is nutritious. The antiscorbutic effects of ripe fruits, especially those that are acid, are proverbial, and every fever patient has appreciated the relief derived from those that are acidulous. Then as a preventive of the febrile affections peculiar to a miasmatic region, the free use of acid fruits, or even of good sound vinegar made from grapes or apples, is an established fact in medical practice—of which, by the by, prevention is always the better part.

Apples were esteemed an important and valuable article of food in the days of the Romans, for all school boys have read in the ore rotundo of his own flowing measures, what Virgil has said, so much better than his tame translator:

"New cheese and chestnuts are our country fare,
With mellow apples for your welcome cheer."

But in more modern times, beside their wonted use as dessert fruit, or evening feast, or cooked in various modes, a French economist "has invented and practiced with great success a method of making bread with common apples, which is said to be very far superior to potato-bread. After having boiled one-third part of peeled apples, he bruised them while quite warm into two-thirds parts of flour, including the proper quantity of yeast, and kneaded the whole without water, the juice of the fruit being quite sufficient; he put the mass into a vessel in which he allowed it to rise for about twelve hours. By this process he obtained a very excellent bread, full of eyes, and extremely light and palatable."[1]

Nor is this class of food desirable for man alone. Fruits of all kinds, but particularly what may be called the large fruits, such as are grown in our orchards, may be profitably cultivated for feeding our domestic animals. Sweet apples have been especially recommended for fattening swine, and when fed to cows they increase the flow of milk, or produce fat according to the condition of these animals. Think of the luxury of eating apple-fed pork! Why, even the strict Rabbi might overcome his prejudices against such swine flesh! And then dream of enjoying the luxury of fresh rich milk, yellow cream, and golden butter, from your winter dairy, instead of the sky-blue fluid, and the pallid, or an anotto-tinted, but insipid butter, resulting from the meager supplies of nutriment contained in dry hay and fibrous, woody cornstalks. Now this is not unreasonable nor ridiculous. Orchards have been planted with a succession of sweet apples that will sustain swine in a state of most perfect health, growing and fattening simultaneously from June to November; and the later varieties may be cheaply preserved for feeding stock of all kinds during the winter, when they will be best prepared by steaming, and may be fed with the greatest advantage. Our farmers do not appreciate the benefits of having green food for their animals during the winter season. Being blessed with that royal grain, the Indian corn, they do not realize the importance of the provision of roots which is so great a feature in British husbandry; but they have yet to learn, and they will learn, that for us, and under our conditions of labor and climate, they can do still better, and produce still greater results with a combination of *hay* or *straw*, *corn meal* and *apples*, all properly prepared by means of steam or hot water. Besides, such orchards may be advantageously planted in many places where the soil is not adapted to the production of grain.—The reader is referred to the chapter on select lists in another part of this volume, in which an attempt will be made to present the reader with the opinions of the best pomologists of various parts of the country.

It were an interesting and not unprofitable study to trace the various sources and routes by which fruits have been introduced into different parts of our extended country. In some cases we should find that we were indebted for these luxuries to the efforts of very humble individuals, while in other regions the high character of the orchards is owing to the forethought, knowledge, enterprise,

[1] Companion for the Orchard.—Phillips.

and liberality of some prominent citizen of the infant community, who has freely spent his means and bestowed his cares in providing for others as well as for his own necessities or pleasures. But it is to the intelligent nurserymen of our country that we are especially indebted for the universal diffusion of fruits, and for the selection of the best varieties in each different section. While acting separately, these men were laboring under great disadvantages, and frequently cultivated certain varieties under a diversity of names, as they had received them from various sources. This was a difficulty incident to their isolation, but the organization of Pomological Societies in various parts of the country, has enabled them in a great measure to unravel the confusion of an extended synonymy, and also by comparison and consultation with the most intelligent fruit-growers, they have been prepared to advise the planter as to the best and most profitable varieties to be set out in different soils and situations.

Most of our first orchards were planted with imported trees. The colonists brought plants and seeds. Even now, in many parts of the country, we hear many good fruits designated as English, to indicate that they are considered superior to the native; and we are still importing choice varieties from Europe and other quarters of the globe.

The roving tribes of Indians who inhabited this country when discovered and settled by the whites, had no orchards—they lived by the chase, and only gathered such fruits as were native to the soil. Among the earliest attempts to civilize them, however, those that exerted the greatest influence, were efforts to make them an agricultural people, and of these the planting of fruit-trees was one of the most successful. In many parts of the country we find relics of these old Indian orchards still remaining, and it is probable that from the apple seeds sent by the general government for distribution among the Cherokees in Georgia, we are now reaping some of the most valuable fruits of this species. The early French settlers were famous tree-planters, and we find their traces across the continent, from the St. Lawrence to the Gulf of Mexico. These consist in noble pear and apple trees, grown from seeds planted by them, at their early and scattered posts or settlements. These were made far in advance of the pioneers, who have, at a later period, formed the van of civilization, that soon spread into a solid phalanx in its march throughout the great interior valley of the continent.

On the borders of civilization we sometimes meet with a singular being, more savage than polished, and yet useful in his way. Such an one in the early settlement of the northwestern territory was Johnny Apple-seed—a simple-hearted being, who loved to roam through the forests in advance of his fellows, consorting, now with the red man, now with the white, a sort of connecting link—by his white brethren he was, no doubt, considered rather a vagabond, for we do not learn that he had the industry to open farms in the wilderness, the energy to be a great hunter, nor the knowledge and devotion to have made him a useful missionary among the red men. But Johnny had his use in the world. It was his universal custom, when among the whites, to save the seeds of all the best apples he met with. These he carefully preserved and carried with him, and when far away from his white friends, he would select an open spot of ground, prepare the soil, and plant these seeds, upon the principle of the old Spanish custom, that he owed so much to posterity, so that some day, the future traveler or inhabitant of those fertile valleys, might enjoy the fruits of his early efforts. Such was Johnny Apple-seed—did he not erect for himself monuments more worthy, if not more enduring, than piles of marble or statues of brass?

In tracing the progress of fruits through different portions of our country, we should very naturally expect to find the law that governs the movements of men, applying with equal force to the fruits they carry with them. The former have been observed to migrate very nearly on parallels of latitude, so have, in a great degree, the latter; and whenever we find a departure from this order, we may expect to discover a change, and sometimes a deterioration in the characters of the fruits thus removed to a new locality. It is true, much of this alteration, whether improvement or otherwise, may be owing to the difference of soil. Western New York received her early fruits from Connecticut, and Massachusetts; Michigan, Northern Illinois, and later, Wisconsin and Iowa received theirs in a great degree from New York. Ohio and Indiana received their fruits mainly from New Jersey,

and Pennsylvania, and we may yet trace this in the prevalence of certain leading varieties that are scarcely known, and very little grown on different parallels. The early settlement at the mouth of the Muskingum river, was made by New England-men, and into the "Ohio-purchase," they introduced the leading varieties of the apples of Massachusetts. Among these, the Boston or Roxbury Russet was a prominent favorite, but it was so changed in its appearance as scarcely to be recognized by its old admirers, and it was christened with a new name, the Putnam Russet, under the impression that it was a different variety. Most of the original Putnam varieties have disappeared from the orchards. Kentucky received her fruits in great measure from Virginia; Tennessee from the same source and from North Carolina, and these younger States sent them forward on the great western march with their hardy sons to southern Indiana, southern Illinois, to Missouri, and to Arkansas, in all which regions we find evident traces in the orchards, of the origin of the people who planted them.

Of course, we shall find many deflections from the precise parallel of latitude, some inclining to the south, and many turning to the northward. To the latter we of the West are looking with the greatest interest, since we so often find that the northern fruits do not maintain their high characters in their southern or southwestern migrations, and all winter kinds are apt to become autumnal in their period of ripening, which makes them less valuable; and because, among those from a southern origin, we have discovered many of high merit as to beauty, flavor, and productiveness—and, especially where they are able to mature sufficiently, they prove to be long keepers, thus supplying a want which was not filled by fruits of a northern origin. There may be limits beyond which we cannot transport some sorts to advantage in either direction, but this too will depend very much upon the adaptability of our soils to particular varieties.

In every region where fruit has been cultivated we find local varieties grown from seed, many of these are of sufficient merit to warrant their propagation, and it behooves us to be constantly on the look out for them; for though our lists are already sufficiently large to puzzle the young orchardist in making his selections, we may well reduce the number by weeding out more of the indifferent fruit, at the same time that we are introducing those of a superior character. It has been estimated that there may be as many as one in ten of our seedling orchard trees that would be ranked as "good," but not one in a hundred that could be styled "best."[2] Certain individuals have devoted themselves to the troublesome though thankless office of collecting these scattered varieties of decided merit, and from their collections our pomological societies will, from time to time, select and recommend the best for more extended cultivation. Such devoted men as H.N. Gillett, Lewis Jones, Reuben Ragan, A.H. Ernst, who have been industriously engaged in this good work for a quarter of a century, are entitled to the highest commendation; but there are many others who have contributed their full share of benefits by their labors in the same field, to whom also we owe a debt of gratitude. Two of the chief foci in the Ohio valley from which valuable fruits have been distributed most largely, were the settlement at the mouth of the Muskingum, with its Putnam list given below; and a later, but very important introduction of choice fruits, brought into the Miami country by Silas Wharton, a nurseryman from Pennsylvania, who settled among a large body of the religious Society of Friends, in Warren Co., Ohio. The impress of this importation is very manifest in all the country, within a radius of one hundred miles, and some of his fruits are found doing well in the northwestern part of the State of Ohio, in northern Indiana, and in an extended region westward.

There are, no doubt, many other local foci, whence good fruits have radiated to bless regions more or less extensive, and in every neighborhood we find the name of some early pomologist attached to the good fruits that he had introduced, thus adding another synonym to the numerous list of those belonging to so many of our good varieties.

A.W. Putnam commenced an apple nursery in 1794, a few years after the first white settlement at Marietta, Ohio, the first grafts were set in the spring of 1796; they were obtained from Connecticut

[2] Elliott—Western Fruits.

by Israel Putnam, and were the first set in the State, and grafted by W. Rufus Putnam. Most of the early orchards of the region were planted from this nursery. These grafts were taken from the orchard of Israel Putnam (of wolf-killing memory) in Pomfret, Connecticut. In the Ohio Cultivator for August 1st, 1846, may be found the following authentic list of the varieties propagated:—

"1. Putnam Russet, (Roxbury.)
2. Seek-no-further, (Westfield.)
3. Early Chandler.
4. Gilliflower.
5. Pound Royal, (Lowell).
6. Natural, (a seedling).
7. Rhode Island Greening.
8. Yellow Greening.
9. Golden Pippin.
10. Long Island Pippin.
11. Tallman Sweeting.
12. Striped Sweeting.
13. Honey Greening.
14. Kent Pippin.
15. Cooper.
16. Striped Gilliflower.
17. Black, do.
18. Prolific Beauty.
19. Queening, (Summer Queen?)
20. English Pearmain.
21. Green Pippin.
22. Spitzenberg, (Esopus?)

Many of these have disappeared from the orchards and from the nurserymen's catalogues."

CHAPTER II

HISTORY OF THE APPLE

DIFFICULTIES IN THE OUTSET—APPLE A GENERIC TERM, AS CORN IS FOR DIFFERENT GRAINS; BIBLE AND HISTORIC USE OF THE WORD THEREFORE UNCERTAIN—ETYMOLOGY OF THE WORD —BOTANICAL CHARACTERS—IMPROVABILITY OF THE APPLE—NATIVE COUNTRY—CRUDE NOTIONS OF EARLY VARIETIES—PLINY'S ACCOUNT EXPLAINED—CHARLATAN GRAFTING—INTRODUCTION INTO BRITAIN—ORIGINAL SORTS THERE—GERARD'S LIST OF SEVEN —HE URGES ORCHARD PLANTING—RECIPE FOR POMATUM—DERIVATION OF THE WORD—VIRGIL'S ADVICE AS TO GRAFTING —PLINY'S EULOGY OF THE APPLE: WILL OURS SURVIVE AS LONG?—PLINY'S LIST OF 29—ACCIDENTAL ORIGIN OF OUR FRUITS—CROSSING—LORD BACON'S GUESS—BRADLEY'S ACCOUNT —SUCCESS IN THE NETHERLANDS—MR. KNIGHT'S EXPERIMENTS—HYBRIDS INFERTILE—LIMITS, NONE NATURAL—LIMITS OF SPECIES —HERBERT'S VIEWS—DIFFICULTIES ATTEND CROSSING ALSO—NO MULES—KIRTLAND'S EXPERIMENTS AND RESULTS OF—VAN MONS' THEORY—ILLINOIS RESULTS—RUNNING OUT OF VARIETIES.

In attempting to trace out the history of any plant that has long been subjected to the dominion of man, we are beset with difficulties growing out of the uncertainty of language, and arising also from the absence of precise terms of science in the descriptions or allusions which we meet respecting them. As he who would investigate the history of our great national grain crop, the noble Indian maize, which, in our language, claims the generic term corn, will at once meet with terms apt to mislead him in the English translation of the Bible, and in the writings of Europeans, who use the word corn in a generic sense, as applying to all the edible grains, and especially to wheat—so in this investigation we may easily be misled by meeting the word apple in the Bible and in the translations of Latin and Greek authors, and we may be permitted to question whether the original words translated apple may not have been applied to quite different fruits, or perhaps we may ask whether our word may not originally have had a more general sense, meaning as it does, according to its derivation, any round body.

The etymology of the word apple is referred by the lexicographers to *abhall*, Celtic; *avall*, Welsh; *afall* or *avall*, Armoric; *aval* or *avel*, Cornish; and these are all traceable to the Celtic word *ball*, meaning simply a round body.

Worcester traces the origin of apple directly to the German *apfel*, which he derives from *æpl*, *apel*, or *appel*.

Webster cites the Saxon *appl* or *appel*; Dutch, *appel*; German, *apfel*; Danish, *æble*; Swedish, *aple*; Welsh, *aval*; Irish, *abhal* or *ubhal*; Armoric, *aval*; Russian, *yabloko*.

Its meaning being fruit in general, with a round form. Thus the Persian word *ubhul* means Juniper berries, and in Welsh the word used means other fruits, and needs a qualifying term to specify the variety or kind.

Hogg, in his British Pomology, quoting Owen, says, the ancient Glastonbury was called by the Britons *Ynys avallac* or *avallon*, meaning an apple orchard, and from this came the Roman word *avallonia*, from this he infers that the apple was known to the Britons before the advent of the Romans.

We are told, that in 973, King Edgar, when fatigued with the labors of the chase, laid himself down under a wild apple tree, so that it becomes a question whether this plant was not a native of England as of other parts of Europe, where in many places it is found growing wild and apparently indigenous. Thornton informs us in his history of Turkey, that apples are common in Wallachia, and he cites among the varieties one, the *domniasca*, "which is perhaps the finest in Europe, both for its size, color, and flavor." It were hard to say what variety this is, and whether it be known to us.

The introduction of this word apple in the Bible is attributable to the translators, and some commentators suggest that they have used it in its general sense, and that in the following passages where it occurs, it refers to the citron, orange, or some other subtropical fruit.

"Stay me with flagons, comfort me with apples."—Songs of Solomon ii, 5.

"As the apple-tree (citron) among the trees of the wood, * * * I sat me down under his shadow with great delight, and his fruit was sweet to my taste."—Sol. ii, 2.

* * * "I raised thee up under the apple-tree."—Solomon viii, 5.

"A word fitly spoken, is like apples of gold in pictures of silver."—Prov. xxv, 11.

The botanical position of the cultivated apple may be stated as follows:—Order, *Rosaceæ*; sub-order, *Pomeæ*; or the apple family and genus, *Pyrus*. The species under our consideration is the *Pyrus Malus*, or apple. It has been introduced into this country from Europe, and is now found in a half-wild state, springing up in old fields, hedge-rows, and roadsides; but, even in such situations, by their eatable fruit and broad foliage, and by the absence of spiny or thorny twigs, the trees generally give evidence of a civilized origin. It is not that the plant has changed any of its true specific characters, but that it has been affected by the meliorating influences of culture, which it has not been able entirely to shake off in its neglected condition. Sometimes, indeed, trees are found in these neglected and out-of-the-way situations, which produce fruits of superior quality—and the sorts have been gladly introduced into our nurseries and orchards.

Very early in the history of horticulture the apple attracted attention by its improvability, showing that it belonged to the class of culture-plants. Indeed it is a very remarkable fact in the study of botany, and the pivot upon which the science and art of horticulture turns, that while there are plants which show no tendency to change from their normal type, even when brought under the highest culture, and subjected to every treatment which human ingenuity can suggest, there are others which are prone to variations or sports, even in their natural condition, but more so when they are carefully nursed by the prudent farmer or gardener. These may be called respectively the plants of nature and the plants of culture. Some of the former furnish human food, and are otherwise useful to man; but the latter class embraces by far the larger number of food-plants, and we are indebted to this pliancy, aided by human skill, for our varieties of fruits, our esculent vegetables, and the floral ornaments of our gardens.

The native country of the apple, though not definitively settled, is generally conceded to be Europe, particularly its southern portions, and perhaps Western Asia: that is, the plant known and designated by botanists as *Pyrus Malus*, for there are other and distinct species in America and Asia which have no claims to having been the source of our favorite orchard fruits. Our own native crab is the *Pyrus coronaria*, which, though showing some slight tendency to variation, has never departed from the strongly marked normal type. The *P. baccata*, or Siberian crab, is so distinctly marked as to be admitted as a species. It has wonderfully improved under culture, and has produced some quite distinct varieties; it has even been hybridized by Mr. Knight, with the cultivated sorts of the common Wilding or Crab of Europe, the *P. Malus*. Pallas, who found it wild near Lake Baikal and in Daouria, says, it grows only 3 or 4 feet high, with a trunk of as many inches diameter, and yields pear-shaped berries as large as peas.

The *P. rivularis*, according to Nuttall, is common in the maritime portions of Oregon, in alluvial forests. The tree attains a height of 15 to 25 feet. It resembles the Siberian Crab, to which it has a

close affinity. The fruit grows in clusters, is purple, scarcely the size of a cherry, and of an agreeable flavor; sweetish and sub-acid when ripe, not at all acid and acerb as the *P. coronaria*.[3]

Among the early writers upon the subject of pomology, we find some very crude notions, particularly in regard to the wonderful powers of the grafter, for this art of improving the Wilding by inserting buds or scions of better sorts, and thus multiplying trees of good kinds, was a very ancient invention. Pliny, the naturalist, certainly deserves our praise for his wonderful and comprehensive industry in all branches of natural history. In regard to grafting, which seems to have been well understood in his day, he says, that he had seen near Thuliæ a tree bearing all manner of fruits, nuts and berries, figs and grapes, pears and pomegranates; no kind of apple or other fruit that was not to be found on this tree. It is quaintly noted, however, that "this tree did not live long,"—is it to be wondered that such should have been the case? Now some persons may object to the testimony of this remarkable man, and feel disposed to discredit the statement of what appears so incredible to those who are at all acquainted with the well-known necessity for a congenial stock into which the graft should be inserted. But a more extended knowledge of the subject, would explain what Pliny has recorded as a marvel of the art. The same thing has been done in our own times, it is a trick, and one which would very soon be detected now-a-days by the merest tyro in horticulture, though it may have escaped the scrutiny of Pliny, whose business it was to note and record the results of his observations, rather than to examine the modus of the experiment. By the French, the method is called Charlatan grafting, and is done by taking a stock of suitable size, hollowing it out, and introducing through its cavity several stocks of different kinds, upon each of which may be produced a different sort of fruit, as reported by Pliny. The needed affinity of the scion and stock, and the possible range that may be successfully taken in this mode of propagation, with the whole consideration of the influence of the stock upon the graft, will be more fully discussed in another chapter.

Though it be claimed and even admitted that the wild apple or crab was originally a native of Britain, and though it be well known that many varieties have originated from seed in that country, still it appears from their own historians that the people introduced valuable varieties from abroad. Thus we find in Fuller's account, that in the 16th year of the reign of Henry VIII, Pippins were introduced into England by Lord Maschal, who planted them at Plumstead, in Sussex.

After this, the celebrated Golden Pippin was originated at Perham Park, in Sussex, and this variety has attained a high meed of praise in that country and in Europe, though it has never been considered so fine in this country as some of our own seedlings. Evelyn says, in 1685, at Lord Clarendon's seat, at Swallowfield, Berks, there is an orchard of one thousand golden and other cider Pippins.[4] The Ribston Pippin, which every Englishman will tell you is the best apple in the world, was a native of Ribston Park, Yorkshire. Hargrave says: "This place is remarkable for the produce of a delicious apple, called the Ribston Park Pippin." The original tree was raised from a Pippin brought from France.[5] This apple is well-known in this country, but not a favorite.

At a later period, 1597, John Gerard issued in an extensive folio his History of Plants, in which he mentions seven kinds of Pippins. The following is given as a sample of the pomology of that day:—

"The fruit of apples do differ in greatnesse, forme, colour, and taste, some covered with red skin, others yellow or greene, varying infinitely according to soil and climate; some very greate, some very little, and many of middle sort; some are sweet of taste, or something soure, most be of middle taste between sweet and soure; the which to distinguish, I think it impossible, notwithstanding I heare of one who intendeth to write a peculiar volume of apples and the use of them." He further says: "The tame and grafted apple trees are planted and set in gardens and orchards made for that purpose; they delight to growe in good fertile grounds. Kent doth abounde with apples of most sortes; but I have

[3] North American Sylva, Nuttall II, p. 25.

[4] Diary.

[5] History of Knaresborough, p. 216.—Companion of the Orchard, p. 34.

seen pastures and hedge-rows about the grounds of a worshipful gentleman dwelling two miles from Hereford, so many trees of all sortes, that the seruantes drinke for the moste parte no other drinke but that which is made of apples. * * * Like as there be divers manured apples, so is there sundry wilde apples or crabs, not husbanded, that is, not grafted." He also speaks of the Paradise, which is probably the same we now use as a dwarfing stock.

Dr. Gerard fully appreciated the value of fruits, and thus vehemently urges his countrymen to plant orchards: "Gentlemen, that have land and living, put forward, * * * * * graft, set, plant, and nourish up trees in every corner of your grounds; the labor is small, the cost is nothing, the commoditie is great, yourselves shall have plentie, the poor shall have somewhat in time of want to relieve their necessitie, and God shall reward your good minde and diligence." The same author gives us a peculiar use of the apple which may be interesting to some who never before associated *pomatum* with the products of the orchard. He recommends apples as a cosmetic. "There is made an ointment with the pulp of apples, and swine's grease and rose water, which is used to beautify the face and to take away the roughness of the skin; it is called in shops *pomatum*, of the apples whereof it is made."[6] When speaking of the importance of grafting to increase the number of trees of any good variety, Virgil advises to

> "Graft the tender shoot,
> Thy children's children shall enjoy the fruit."

So high an estimate did Pliny have of this fruit, that he asserted that "there are apples that have ennobled the countries from whence they came, and many apples have immortalized their first founders and inventors. Our best apples will immortalize their first grafters forever; such as took their names from Manlius, Cestius, Matius, and Claudius."—Of the Quince apple, he says, that came of a quince being grafted upon the apple stock, which "smell like the quince, and were called *Appiana*, after Appius, who was the first that practiced this mode of grafting. Some are so red that they resemble blood, which is caused by their being grafted upon the mulberry stock. Of all the apples, the one which took its name from Petisius, was the most excellent for eating, both on account of its sweetness and its agreeable flavor." Pliny mentions twenty-nine kinds of apples cultivated in Italy, about the commencement of the Christian Era.[7]

Alas! for human vanity and apple glory! Where are now these boasted sorts, upon whose merits the immortality of their inventors and first grafters was to depend? They have disappeared from our lists to give place to new favorites, to some of which, perhaps, we are disposed to award an equally high meed of praise, that will again be ignored in a few fleeting years, when higher skill and more scientific applications of knowledge shall have produced superior fruit to any of those we now prize so highly; and this is a consummation to which we may all look forward with pleasure.

In this country the large majority of our favorite fruits, of whatever species or kind, seem to have originated by accident, that is, they have been discovered in seedling orchards, or even in hedge-rows. These have no doubt, however, been produced by accidental crosses of good kinds, and this may occur through the intervention of insects in any orchard of good fruit, where there may chance to be some varieties that have the tendency to progress. The discoveries of Linnæus, and his doctrine of the sexual characters of plants, created quite a revolution in botany, and no doubt attracted the attention of Lord Bacon, who was a close observer of nature, for he ventured to guess that there might be such a thing as crossing the breeds of plants, when he says:—"The compounding or mixture of kinds in plants is not found out, which, nevertheless, if it be possible, is more at command than that

---

[6] Our lexicographers give it a similar origin, but refer it to the shape in which it was put up. Others derive it from *poma*, Spanish, a box of perfume.

[7] Phillips' Companion, p. 32.

of living creatures; wherefore it were one of the most noteable experiments touching plants to find it out, for so you may have great variety of new fruits and flowers yet unknown. Grafting does it not, that mendeth the fruit or doubleth the flowers, etc., but hath not the power to make a new kind, for the scion ever overruleth the stock." In which last observation he shows more knowledge and a deeper insight into the hidden mysteries of plant-life than many a man in our day, whose special business it is to watch, nurse, and care for these humble forms of existence.

Bradley, about a century later, in 1718, is believed to have been the first author who speaks of the accomplishment of cross-breeding, which he describes as having been effected by bringing together the branches of different trees when in blossom. But the gardeners of Holland and the Netherlands were the first to put it into practice.[8]

The following extract is given to explain the manner in which Mr. Knight conducted his celebrated experiments on fruits, which rewarded him with some varieties that were highly esteemed: —"Many varieties of the apple were collected which had been proved to afford, in mixtures with each other, the finest cider. A tree of each was then obtained by grafting upon a Paradise stock, and these trees were trained to a south wall, or if grafted on Siberian crab, to a west wall, till they afforded blossoms, and the soil in which they were planted was made of the most rich and favorable kind. Each blossom of this species of fruit contains about twenty chives or males (stamens,) and generally five pointals or females (pistils,) which spring from the center of the cup or cavity of the blossom. The males stand in a circle just within the bases of the petals, and are formed of slender threads, each of which terminates in an anther. It is necessary in these experiments that both the fruit and seed should attain as large a size and as much perfection as possible, and therefore a few blossoms only were suffered to remain on each tree. As soon as the blossoms were nearly full-grown, every male in each was carefully extracted, proper care being taken not to injure the pointals; and the blossoms, thus prepared, were closed again, and suffered to remain till they opened spontaneously. The blossoms of the tree which it was proposed to make the male parent of the future variety, were accelerated by being brought into contact with the wall, or retarded by being detached from it, so that they were made to unfold at the required period; and a portion of their pollen, when ready to fall from the mature anthers, was during three or four successive mornings deposited upon the pointals of the blossoms, which consequently afforded seeds. It is necessary in this experiment that one variety of apple only should bear unmutilated blossoms; for, where other varieties are in flower at the same time, the pollen of these will often be conveyed by bees to the prepared blossoms, and the result of the experiment will in consequence be uncertain and unsatisfactory." * * *

In his Pomona Herefordiensis, he says:—"It is necessary to contrive that the two trees from which you intend to raise the new kind, shall blossom at the same time; therefore, if one is an earlier sort than the other, it must be retarded by shading or brought into a cooler situation, and the latest forwarded by a warm wall or a sunny position, so as to procure the desired result."

We must distinguish between hybrids proper and crosses, as it were between races or between what may have been erroneously designated species, for there has been a great deal of looseness in the manner of using these terms by some writers. A true *hybrid*[9] is produced only when the pollen of one species has been used to fertilize the ovules of another, and as a general rule these can only be produced between plants which are very nearly allied, as between species of the same genus. Even such as these, however, cannot always be hybridized, for we have never found a mule or hybrid between the apple and pear, the currant and gooseberry, nor between the raspberry and blackberry, though each of these, respectively, appear to be very nearly related, and they are all of the order *Rosaceæ*.

[8] Phillips' Companion, p. 41.

[9] Balfour's Manual.

In hybrids there appears to be a mixture of the elements of each, and the characters of the mule or cross will depend upon one or the other, which it will more nearly resemble. True hybrids are mules or infertile, and cannot be continued by seed, but must be propagated by cuttings, or layers, or grafting. If not absolutely sterile at first, they become so in the course of the second or third generation. This is proved by several of our flowering plants that have been wonderfully varied by ingenious crossing of different species. But it has been found that the hybrid may be fertilized by pollen taken from one of its parents, and that then the offspring assumes the characters of that parent.[10]

Natural hybrids do not often occur, though in diœcious plants, this seems to have been the case with willows that present such an intricate puzzle to botanists in their classification, so that it has become almost impossible to say what are the limits and bounds of some of the species. Hybrids are, however, very frequently produced by art, and particularly among our flowering plants, under the hands of ingenious gardeners. Herbert thinks, from his observations, "that the flowers and organs of reproduction partake of the characters of the female parent, while the foliage and habit, or the organs of vegetation, resemble the male."

Simply crossing different members of the same species, like the crossing of races in animal life, is not always easily accomplished; but we here find much less difficulty, and we do not produce a mule progeny. In these experiments the same precautions must be taken to avoid the interference of natural agents in the transportation of pollen from flower to flower; but this process is now so familiar to horticulturists, that it scarcely needs a mention. In our efforts with the strawberry, some very curious results have occurred, and we have learned that some of the recognized species appear under this severe test to be well founded, as the results have been infertile. Where the perfection of the fruit depends upon the development of the seed, this is a very important matter to the fruit-grower; but fortunately this is not always the case, for certain fruits swell and ripen perfectly, though containing not a single well developed seed. It would be an interesting study to trace out those plants which do furnish a well developed fleshy substance or sarcocarp, without the true seeds. Such may be found occasionally in the native persimmon, in certain grapes, and in many apples; but in the strawberry, blackberry, and raspberry, the berry which constitutes our desirable fruit, never swells unless the germs have been impregnated and the seeds perfect. In the stone-fruits the stone or pit is always developed, but the enclosed seed is often imperfect from want of impregnation or other cause —and yet the fleshy covering will sometimes swell and ripen.

One of the most successful experimenters in this country is Doctor J.P. Kirtland, near Cleveland, Ohio, whose efforts at crossing certain favorite cherries, were crowned with the most happy results, and all are familiar with the fruits that have been derived from his crosses. The details of his applying the pollen of one flower to the pistils of another are familiar to all intelligent readers, and have been so often set forth, that they need not be repeated in this case—great care is necessary to secure the desired object, and to guard against interference from causes that would endanger or impair the value of the results.

Van Mons' theory was based upon certain assumptions and observations, some of which are well founded, others are not so firmly established. He claimed correctly that all our best fruits were artificial products, because the essential elements for the preservation of the species in their natural condition, are vigor of the plant and perfect seeds for the perpetuation of the race. It has been the object of culture to diminish the extreme vigor of the tree so as to produce early fruitage, and at the same time to enlarge and to refine the pulpy portion of the fruit. He claimed, as a principle, that our plants of culture had always a tendency to run back toward the original or wild type, when they were grown from seeds. This tendency is admitted to exist in many cases, but it is also claimed, that when a break is once made from the normal type, the tendency to improve may be established. Van Mons asserted that the seeds from old trees would be still more apt to run back toward the original type, and

[10] Balfour's Manual.

that "the older the tree, the nearer will the seedlings raised from it approach the wild state," though he says they will not quite reach it. But the seeds from a young tree, having itself the tendency to melioration, are more likely to produce improved sorts.

He thinks there is a limit to perfection, and that, when this is reached, the next generation will more probably produce bad fruit than those grown from an inferior sort, which is on the upward road of progression. He claims that the seeds of the oldest varieties of good fruit yield inferior kinds, whereas those taken from new varieties of bad fruit, and reproduced for several generations, will certainly give satisfactory results in good fruit.

He began with seeds from a young seedling tree, not grafted upon another stock; he cared nothing for the quality of the fruit, but preferred that the variety was showing a tendency to improvement or *variation*. These were sowed, and from the plants produced, he selected such as appeared to him to have evidence of improvement, (it is supposed by their less wild appearance), and transplanted them to stations where they could develop themselves. When they fruited, even if indifferent, if they continued to give evidence of variation, the first seeds were saved and planted and treated in the same way. These came earlier into fruit than the first, and showed a greater promise. Successive generations were thus produced to the fourth and fifth, each came into bearing earlier than its predecessor, and produced a greater number of good varieties, and he says that in the fifth generation they were nearly all of great excellence. He found pears required the longest time, five generations; while the apple was perfected in four, and stone fruits in three.

Starting upon the theory that we must subdue the vigor of the wilding to produce the best fruits, he cut off the tap roots when transplanting and shortened the leaders, and crowded the plants in the orchard or fruiting grounds, so as to stand but a few feet apart. He urged the "regenerating in a direct line of descent as rapidly as possible an improving variety, taking care that there be no interval between the generations. To sow, re-sow, to sow again, to sow perpetually, in short to do nothing but sow, is the practice to be pursued, and which cannot be departed from; and, in short, this is the whole secret of the art I have employed." (*Arbres Fruitiers.*)

Who else would have the needed patience and perseverance to pursue such a course? Very few, indeed—especially if they were not very fully convinced of the correctness of the premises upon which this theory is founded. Mr. Downing thinks that the great numbers of fine varieties of apples that have been produced in this country, go to sustain the Van Mons doctrine, because, as he assumes, the first apples that were produced from seeds brought over by the early emigrants, yielded inferior fruit which had run back toward the wild state, and the people were forced to begin again with them, and that they most naturally pursued this very plan, taking seeds from the improving varieties for the next generations and so on. This may have been so, but it is mere assumption—we have no proof, and, on the contrary, our choice varieties have so generally been conceded to have been chance seedlings, that there appears little evidence to support it—on the contrary, some very fine varieties have been produced by selecting the seeds of good sorts promiscuously, and without regarding the age of the trees from which the fruit was taken. Mr. Downing himself, after telling us that we have much encouragement to experiment upon this plan of perfecting fruits, by taking seeds from such as are not quite ripe, gathered from a seedling of promising quality, from a healthy young tree (quite young,) on its own root, not grafted, and that we "must avoid 1st, the seeds of old trees; 2d, those of grafted trees; 3d, that we must have the best grounds for good results"—still admits what we all know, that "in this country, new varieties of rare excellence are sometimes obtained at once by planting the seeds of old grafted varieties; thus the Lawrence Favorite and the Columbia Plums were raised from seeds of the Green Gage, one of the oldest European varieties."

Let us now look at an absolute experiment conducted avowedly upon the Van Mons plan in our own country, upon the fertile soil of the State of Illinois, and see to what results it led:—

The following facts have been elicited from correspondence with H.P. Brayshaw, of Du Quoin, Illinois. The experiments were instituted by his father many years ago, to test the truth of the Van Mons' theory of the improvement of fruits by using only the first seeds.

Thirty-five years ago, in 1827, his father procured twenty-five seedling trees from a nursery, which may be supposed to have been an average lot, grown from promiscuous seed. These were planted, and when they came into bearing, six of them furnished fruit that might be called "*good*" and of these, "four were considered *fine*." One of the six is still in cultivation, and known as the *Illinois Greening*. Of the remainder of the trees, some of the fruits were fair, and the rest were worthless, and have disappeared.

Second Generation.—The first fruits of these trees were selected, and the seeds were sown. Of the resulting crop, some furnished fruit that was "good," but they do not appear to have merited much attention.

Third Generation.—From first seeds of the above, one hundred trees were produced, some of which were good fruit, and some "even fine," while some were very poor, "four or five only merited attention." So that we see a retrogression from the random seedlings, furnishing twenty-five per cent, of good fruit, to only four or five per cent. in the third generation, that were worthy of note.

Fourth Generation.—A crop of the first seed was again sown, producing a fourth generation; of these many were "good culinary fruits," none, or very few being of the "poorest class of seedlings," none of them, however, were fine enough "for the dessert."

Fifth Generation.—This crop of seedlings was destroyed by the cut-worms, so that only one tree now remains, but has not yet fruited. But Mr. Brayshaw appears to feel hopeful of the results, and promises to continue the experiment.

Crops have also been sown from some of these trees, but a smaller proportion of the seedlings thus produced were good fruits, than when the first seeds were used—this Mr. Brayshaw considers confirmatory evidence of the theory, though he appears to feel confidence in the varieties already in use, most of which had almost an accidental origin.

He thinks the result would have been more successful had the blossoms been protected from impregnation by other trees, and recommends that those to be experimented with should be planted at a distance from orchards, so as to avoid this cross-breeding, and to allow of what is called breeding in-and-in. If this were done, he feels confident that "the seedlings would more nearly resemble the parent, and to a certain extent would manifest the tendency to improvement, and that from the earliest ripened fruits, some earlier varieties would be produced, from those latest ripening, later varieties, from those that were inferior and insipid, poor sorts would spring, and that from the very best and most perfect fruits we might expect one in one thousand, or one-tenth of one per cent., to be better than the parent." This diminishes the chance for improvement to a beautifully fine point upon which to hang our hopes of the result of many generations of seedlings occupying more than a lifetime of experiments.

Mr. Brayshaw, citing some of the generally adopted axioms of breeders of animals, assumes that *crosses*, as of distinct races, will not be so likely to produce good results, as a system of breeding in-and-in, persistently carried out. This plan he recommends, and alludes to the quince and mulberry as suitable species to operate upon, because in them there are fewer varieties, and therefore less liability to cross-breeding, and a better opportunity for breeding in-and-in. He also reminds us of the happy results which follow the careful selection of the best specimens in garden flowers and vegetables, combined with the rejection of all inferior plants, when we desire to improve the character of our garden products, and he adopts the views of certain physiologists, which, however, are questioned by other authorities, to the effect that violent or decided crosses are always followed by depreciation and deterioration of the offspring.

The whole communication referring to these experiments, which are almost the only ones, so far as I know, which have been conducted in this country to any extent, to verify or controvert the Van

Mons' theory, is very interesting, but it is easy to perceive that the experimenter, though apparently very fair, and entirely honest, has been fully imbued with the truth and correctness of the proposition of Van Mons, that the first ripened seed of a natural plant was more likely to produce an improved variety, and that this tendency to improvement would ever increase, and be most prominent in the first ripened seeds of successive generations grown from it.

The theory of Van Mons I shall not attempt in this place to controvert, but will simply say that nothing which has yet come under my observation has had a tendency to make me a convert to the avowed views of that great Belgian Pomologist, while, on the contrary, the rumors of his opponents, that he was really attempting to produce crosses from some of the best fruits, as our gardeners have most successfully done in numerous instances, in the beautiful flowers and delicious vegetables of modern horticulture, have always impressed me with a color of probability, and if he were not actually and intentionally impregnating the blossoms with pollen of the better varieties, natural causes, such as the moving currents of air, and the ever active insects, whose special function in many instances appears to be the conveyance of pollen, would necessarily cause an admixture, which, in a promiscuous and crowded collection, like the "school of Van Mons," would at least have an equal chance of producing an improvement in some of the resulting seeds.

The whole subject of variation in species, the existence of varieties, and also of those partial *sports*, which may perhaps be considered as still more temporary variations from the originals, than those which come through the seeds, is one of deep interest, well worthy of our study, but concerning which we must confess ourselves as yet quite ignorant, and our best botanists do not agree even as to the *specific* distinctions that have been set up as characters of some of our familiar plants, for the most eminent differ with regard to the species of some of our common trees and plants.

RUNNING OUT OF VARIETIES

It has been a very generally received opinion among intelligent fruit-growers, that any given variety of fruit can have but a limited period of existence, be that longer or shorter. Reasoning from the analogies of animal life this would appear very probable, for it is well known that individuals of different species all have a definite period of life, some quite brief, others quite extended, beyond which they do not survive. But with our modern views of vegetation, though we know that all perennial plants do eventually die and molder away to the dust from whence they were created, and that many trees of our own planting come to an untimely end, while we yet survive to observe their decay, still, we can see no reason why a tree or parts of a tree taken from it, and placed under circumstances favorable to its growth from time to time, may not be sempiternal. Harvey has placed this matter in a correct light, by showing that the true life and history of a tree is in the buds, which are annual, while the tree itself is the connecting link between them and the ground. Any portion of such a compound existence, grafted upon another stock, or planted immediately in the ground itself and established upon its own roots, will produce a new tree like the first, being furnished with supplies of nourishment it may grow indefinitely while retaining all the qualities of the parent stock—if that be healthy and vigorous so will this—indeed new life and vigor often seem to be imparted by a congenial thrifty stock, and a fertile soil, so that there does not appear to be any reason why the variety should ever run out and disappear.

The distinguished Thomas Andrew Knight, President of the London Horticultural Society, was one of the leading advocates of the theory that varieties would necessarily run out and disappear as it were by exhaustion.

In his Pomona Herefordiensis, he tells us that "those apples, which have been long in cultivation, are on the decay. The Redstreak and Golden Pippin can no longer be propagated with advantage. The fruit, like the parent tree, is affected by the debilitated old age of the variety." And in his treatise on the culture of the apple and pear, he says: "The Moil and its successful rival, the Redstreak, with the Must and Golden Pippin, are in the last stage of decay, and the Stire and Foxwhelp are hastening rapidly after them." In noticing the decay of apple trees, Pliny probably refers to particular trees, rather than the whole of any variety, when he says that "apples become old sooner than any other tree, and the fruit becomes smaller and is subject to be cankered and worm-eaten, even while on the trees."—Lib. XVI, Chap. 27.

Speechly combated the views of Mr. Knight, and says: "It is much to be regretted that this apparently visionary notion of the extinction of certain kinds of apples should have been promulgated by authors of respectability, since the mistake will, for a time at least, be productive of several ill consequences."

Some of the old English varieties that were supposed to be worn out or exhausted, appear to have taken a new lease of life in this country, but we have not yet had a long enough experience to decide this question. Many of the earlier native favorites of the orchard have, for some reason, disappeared from cultivation—whether they have run out, were originally deficient in vigor, or have merely been superseded by more acceptable varieties, does not appear.

Mr. Phillips, in his Companion, states "that in 1819, he observed a great quantity of the Golden Pippin in Covent Garden Market, which were in perfect condition, and was induced to make inquiries respecting the health of the variety, which resulted in satisfactory replies from all quarters, that the trees were recovering from disease, which he thought had been induced by a succession of unpropitious seasons. He cites Mr. Ronald's opinion, that there was then no fear of losing this variety; and Mr. Lee, who thought that the apparent decay of some trees was owing to unfavorable seasons. Mr. Harrison informed him that this variety was very successfully grown on the mountains of the island of Madeira, at an elevation of 3000 feet, and produced abundantly. Also that the variety was

quite satisfactory in many parts of England, and concludes that the Golden Pippin only requires the most genial situation, to render it as prolific is formerly."

It is quite probable, as Phillips suggests, that Mr. Knight had watched the trees during unfavorable seasons which prevailed at that period, and as he found the disease increase, he referred it to the old age of the variety, and based his theory to that effect upon partial data.

Mr. Knight's views, though they have taken a strong hold upon the popular mind, have not been confirmed by physiologists. For though the seed would appear to be the proper source whence to derive our new plants, and certainly our new varieties of fruits, many plants have, for an indefinite period, been propagated by layers, shoots or scions, buds, tubers, etc., and that the variety has thus been extended much beyond the period of the life of the parent or original seedling. Strawberries are propagated and multiplied by the runners, potatoes by tubers, the Tiger Lily by bulblets, some onions by proliferous bulbs, sugarcane by planting pieces of the stalk, many grapes by horizontal stems, and many plants by cuttings, for a very great length of time. The grape vine has been continued in this way from the days of the Romans. A slip taken from a willow in Mr. Knight's garden pronounced by him to be dying from old age, was planted in the Edinburgh Botanic Garden many years ago, and is now a vigorous tree, though the original stock has long since gone to decay.[11]

[11] Balfour's Manual, p. 284.

CHAPTER III

PROPAGATION.—SECTION I

ALL GROWTH IS DEPENDANT UPON THE DEVELOPMENT OF CELLS—THE SEED AND THE BUD; THEIR RESEMBLANCE—THE INDIVIDUALITY OF BUDS—THE BASIS OF ALL PROPAGATION—BUDS ARE DEVELOPED INTO TWIGS; HAVE POWER OF EMITTING ROOTS—IMPORTANCE OF THE STUDY OF CELL-GROWTH—BY CUTTINGS: PREPARATION AND SELECTION—HEEL-CUTTINGS—SOFT WOOD—HARD WOOD—SEASONS FOR EACH—FALL PLANTING—THE CALLUS, OR DEVELOPMENT OF CELL-GROWTH—BOTTOM HEAT; WHY BENEFICIAL—WHY SPRING CUTTINGS FAIL—STIMULUS OF LIGHT UPON THE BUDS, CAUSES THEM TO EXPAND, AND THE LEAVES EVAPORATE TOO FREELY—ROOT CUTTINGS; DIFFERENT FRUITS THUS PROPAGATED—BY SUCKERS: OBJECTIONS TO ANSWERED—SUCKER ORCHARDS; BEAR EARLY—SUCKER TREES APT TO SUCKER AGAIN—BY LAYERS: A NATURAL METHOD—HOW PERFORMED—THE RASPBERRY AND THE GRAPE—ILLUSTRATIONS OF NATURAL AND ARTIFICIAL METHODS—QUINCE STOCKS—ADJUVANTS TO LAYERING, NOTCHING, ETC—BY SEEDS: HOW IT DIFFERS FROM THE OTHERS—APPLE SEEDLINGS—THEIR TREATMENT, SEPARATING, AND PREPARING THE SEED—APPARATUS—SPROUTING—SOWING—CULTIVATION—SEEDLINGS—TREATMENT—SORTING—PACKING.

All propagation of plants must depend upon the development of seeds or of buds, and all will arise from the growth and extension of cells. The seed and the bud are much more nearly related than a casual observer would at first sight suppose. The early phylologists thought they discovered that in the seed was enwrapped the image of the future tree—a dissection of the seed would appear to demonstrate this. It is composed of separate parts which are capable of being developed into the root, stem, and appendages, but they have yet to be so developed; the several parts that we find in the seed are merely the representative parts. But the seed has the future of the tree within itself, it has certain qualities of the future tree impressed upon it in its primary organization, within the capsule of the fruit of the parent plant, so that in a higher sense the image of the future tree does exist within the seed. Within the bud, still more plainly and more distinctly visible, is the future tree manifest, and we may produce a tree from a bud as certainly as we do from a seed. Subjected to circumstances favorable for growth, the bud, as well as the seed, will emit roots, will form its stem, branches and appendages, and will become a tree; differing from the product of the seed only in this, that in the latter the resulting organism constitutes a new individual which may vary somewhat from its parent, in the former it is only a new development of a part of a previously existing organization. The similarity existing between the two is exceedingly close, and is a matter of great importance in horticultural operations. Dr. Lindley, in the Gardener's Chronicle, says very truly, that "every bud of a tree is an individual vegetable, and a tree, therefore, is a family or swarm of individual plants, like the polype with its young growing out of its sides, or like the branching cells of the coral insect." Similar opinions, more or less modified, have been expressed by subsequent physiologists, and are familiar to men of science in every country and, we may add, are also universally accepted as true by all who claim a right to express an opinion upon the subject.—Men of science recognize the individuality of

buds.—Nobody doubts the individuality of buds.—In a gardening aspect, the individuality of buds is the cardinal point upon which some of our most important operations turn; such, for example, as all modes of propagation whatever, except by seed. If this be not fully understood, there is no possible explanation of the reasons why certain results are sure to follow the attachment of a bud, or the insertion of a graft, or the planting of a cutting, or the bending of a layer, or the approach of a scion, or the setting of an eye—our six great forms of artificial multiplication. In his Elements of Botany, the same writer says: "An embryo is a young plant produced by the agency of the sexes, and developed within a seed—a leaf bud is a young plant, produced without the agency of the sexes, enclosed within the rudimentary leaves called scales, and developed on a stem." "An embryo propagates the *species*, leaf-buds propagate the *individual*." He shows each to be "a young plant developing itself upwards, downwards and horizontally, into stem, root, and medullary system."

Dr. Schleiden thus beautifully expresses his views of their individuality: "Now the bud essentially is nothing more than a repetition of the plant on which it is formed. The foundation of a new plant consists equally of a stem and leaves, and the sole distinction is that the stem becomes intimately blended at its base with the mother plant in its growth, and has no free radical extremity like that exhibited by a plant developed from a seed. However, this distinction is not so great as at the first glance it appears. Every plant of high organization possesses the power of shooting out adventitious roots from its stem, under the favoring influences of moisture; and very frequently, even plants that have been raised from seed, are forced to content themselves with such adventitious roots, since it is the nature of many plants, for instance the grasses, never to develop their proper root, although the radicle is actually present. We are, it is true, accustomed to look upon the matter as though the buds must always be developed into twigs and branches, on and in connection with the plant itself; and thus in common life, we regard them as parts of a plant, and not as independent individuals, which they are in fact, although they, like children who remain in their paternal home, retain the closest connection with the plant on which they were produced. That they are at least capable of becoming independent plants, is shown by an experiment frequently successful when the necessary care is taken, namely the breaking off and sowing of the buds of our forest trees. The well-known garden operations of grafting and budding are also examples of this, and layering only differs from the sowing of the buds, in that the buds on the layers are allowed to acquire a certain degree of maturity before they are separated from the parent plant. All here depends upon the facility with which these bud plants root as it is called, that is develop adventitious roots, when they are brought in contact with moist earth. * * * Nature herself very often makes use of this method to multiply certain plants in incalculable numbers. In a few cases, the process resembles the artificial sowing of buds, as when the plant spontaneously throws off the perfect buds at a certain period; an instance of this is afforded by some of our garden Lilies, which throw off the little bulb-like buds which appear in the axils of the lower leaves. The more common mode of proceeding is as follows: Those buds which have been formed near the surface of the soil, grow up into shoots provided with leaves; but the shoots are long, slender and delicate, the leaves too are stunted into little scales; in their axils, however, they develop strong buds, which either in the same or in the following year take root, and the slender shoot connecting them with the parent plant, dying and decaying, they become free independent plants. In this manner the strawberry soon covers a neglected garden."[12]

Upon the development of a cell in any living tissue, and its power of reproducing other cells, and upon its function of communicating by endosmosis and exosmosis with other like cells, depend all our success in propagating vegetables, whether from seeds or buds, and parts containing these. We must study the circumstances that favor the development of cells, if we would be successful in propagating plants. Each bud being considered an individual, and capable, under favorable circumstances, of taking on a separate existence, we can multiply any individual variety indefinitely, and be sure of

[12] The Plant, a Biography: M.J. Schleiden, p. 68.

having the same qualities of foliage and fruit that we admire in the original, and that we may desire to propagate. This applies equally to a group of buds, as in cuttings, grafts and layers, etc.; but, more wonderful still, there are cells capable of developing buds where none existed before, and even in tissues or parts of a plant where we do not usually find buds—hence we have a mode of propagation of many woody plants, by root cuttings, and by leaves, and even parts of leaves.

Propagation by Cuttings.—Many fruits are multiplied by this means. Healthy shoots of the previous year's growth are usually selected and taken when the parent is in a dormant state, or still better, when it is approaching this condition. Sometimes a small portion of the previous year's growth is left with the cutting, making a sort of *heel*; when this is not to be had, or not preferred, the slip is to be prepared for planting by cutting it smoothly just below a bud, as this seems to be the most favorable point in many plants for the emission of roots. Some plants will throw out radicles at any point indifferently along the internodes or merithallus. The preference for heel-cuttings depends upon the fact, that near the base of the annual shoot there are always a great number of buds, many of which, however, being imperfectly developed, are inconspicuous, but though dormant, they seem to favor the emission of rootlets. Cuttings may be made to grow if taken at any period of their development, but when green and soft, they require particular conditions of heat and moisture in the soil, and atmosphere, that are only under the control of the professional gardener. They are usually taken in the dormant state, because they are then susceptible of being made to grow under the ordinary conditions of out-door gardening. If cut early in the season, on the approach of autumn, after the wood-growth has been perfected, they may be planted at once with good prospect of success, or they may be put into the soil, out of doors, in the cellar, or in a cold frame or pit, and a very important step in the progress of their growth will commence at once. The leafless sticks are not dead, and whenever the temperature will admit of the quiet interchange of fluids among their cells, this curious function will go on, and will be accompanied by the development or generation of new cells that soon cover the cut surfaces, constituting what the gardeners call the *callus*. This is the first step toward growth, and it most readily occurs when the earth is warmer than the air; hence the value of fall planting, whether of trees or of cuttings, if done before the earth has been chilled, and hence also, the importance of bottom heat in artificial propagation. If on the contrary the air be warm and the ground cold, the buds are often stimulated to burst forth, before the rootlets can have started. The expanding foliage which so delights the tyro in propagation, offers an extended surface for evaporation, the contained juices of the cutting itself are soon exhausted, no adequate supply is furnished, and the hopeful plant soon withers, or damps off, and dies.[13] The cutting, like the seed, must have "first the root, then the blade." The length of time that is allowed for cuttings to prepare for rooting, if they are designed for spring planting, should be as great as possible, and the circumstances under which they are kept should be such as to favor the development of the cells, so that roots may form freely with the breaking of the buds, if not before.

Root-cuttings should be made in the spring, just before the usual period of the bursting of the buds in the plant to be propagated. The tendency to develop buds appears to be then most active. Gentle bottom heat, though not essential, is still very desirable, and will conduce to the success of the operation. Some plants are best propagated by this means, and those too, which never naturally produce suckers, may often be successfully grown by sections of the roots. All plants do not equally admit of propagation by division as cuttings, some woody tissues refusing to emit roots under almost any circumstances.

Nobody thinks of propagating the stone fruits, such as the cherry, plum, peach, or apricot, by attempting to plant cuttings, and yet some of these will emit roots very freely, as we may often observe when the shoots or trimmings are used as supports for plants in the green-house. The plum tree is exceedingly apt to form new roots when planted too deeply, and upon this fact depends the success or

[13] Because it had no root, it withered away. Mat. 13, 6.

failure of the finer varieties when worked upon certain varieties of the wild stock. If the young trees are earthed up in the nursery, and set rather deeply in the orchard, they will soon establish a good set of roots of their own, emitted above the junction of the scion and stock, which is very preferable to the imperfect union and consequent enlargement that often results from using uncongenial stocks. The raspberry and blackberry do not grow so well from cuttings of the wood, which is always biennial in this genus, as they do from root-cuttings.

In some parts of the country, peaches are mainly produced, or the favorite varieties are multiplied, by planting the sprouts that come from the base of the trunk of the trees; these have little or no roots when taken off with the mattock, but they soon establish themselves and make good trees, bearing fruit like their parents, in soils and climate that are well adapted to this fruit.

Refined and scientific horticulture has been extensively applied to the multiplication of the grape, which is now produced in immense numbers, from single eyes, or buds. Formerly our vineyards were formed by planting long cuttings at once in the field in the stations to be occupied by the vines, or by setting them first in a nursery, whence they were transplanted to the vineyard, when one or two years old. Only the most refractory kinds, which would not grow readily in the field, or such as were yet rare, were propagated from cuttings, by using the single eye and artificial bottom heat. Now, however, the appliances of our propagators are called upon for the production of grape-vines by the million, and they find it advisable to multiply all the varieties in this manner. The propagation of the grape by using single eyes affords the most beautiful illustration of the subject of the individuality of buds, and though denounced by some as an unnatural, steam-forcing process, it is really an evidence of the advance of horticulture, since every step is supported by a philosophical reason, and the whole process, to be successful, is dependent upon the application to practice of well established scientific truths.

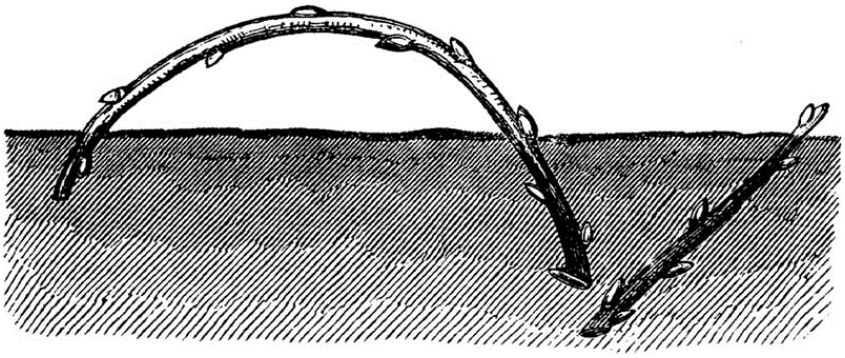

Fig. 1.—FRENCH AND COMMON MODES OF SETTING CUTTINGS.

It has already been stated that the first effect of cell-growth upon a cutting, is the production of a callus. This callus may form upon any cut surface, or even where the bark has been abraded. It is the first effort of nature to repair an injury by the reproduction of new parts; it is most generally found at the base of the cutting, but under favorable circumstances, it will be seen also at the upper end of the shoot if this has been placed in contact with the earth. Cuttings will sometimes be set up-side down, when we find the callus upon the smaller end, and roots will be emitted from that portion whence we should have expected to see the branches issue. Upon this fact, and to multiply the chances of living, has been based the French method, as it is called, or that of inserting both ends of the cuttings. The common mode, (fig. 1), is to set the cuttings in a slanting direction in the ground, so placed that the upper eye or bud only shall reach the surface. Formerly there was a preference for long cuttings, and these were often made eighteen inches or more in length. The practice with most of our cultivators has been modified in this particular, and they have reduced the length of the slips to six and eight inches, so as to have in grape wood about three or four eyes. Some have gone still further,

and use but two, even for out-door planting of the grape, and some have been very successful when using but a single joint. The Germans have advocated longer cuttings, upon the theory that there was a retroaction in the pith of the internodes and in all the buds of the cutting, upon the lower point, enabling it to push roots more strongly from a long than from a short cutting. This theory has for its support the fact, that there is in such a cutting a larger amount of organizable matter to be developed into the new parts to be produced, and certainly, if neglected, short cuttings will be very apt to suffer from drought, but in practice, it is found that the short cutting plants have better roots, which are near the surface, and even those plants, grown from single eyes, are better burnished than long cuttings produced upon the old plan, which placed the roots deep in the soil.

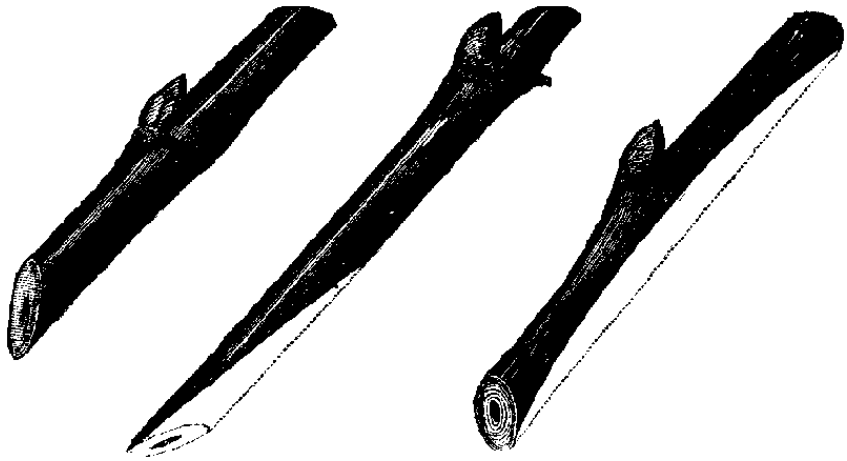

Fig. 2.—ONE-EYE CUTTINGS OF THE GRAPE.

There are various methods of preparing the single-eye cuttings, some of which are represented in fig. 2.

Among our cultivated fruits there is but a limited number that need to be propagated by cuttings, though, where it becomes necessary, many of them may be grown in this manner, to which procedure there are no serious objections, though there are some of a theoretical nature. The currant and the gooseberry are increased almost exclusively from cuttings, they strike root very readily, and are multiplied to any extent; their seeds are sown only to produce new varieties. The grape is propagated very extensively by cuttings; the slips are often planted in the field and in the stations where the vines are wanted for the vineyard; but some varieties are so unsatisfactory in their results, that other more elaborate and scientific means must be taken for their propagation. Among the larger fruits, those constituting our trees, we do not depend upon cuttings, except in the quince, which is not only grown for its fruit, but is also largely produced as a stock for the dwarfed pear, and is extensively propagated from cuttings. The Paradise apple, a dwarf stock, is multiplied in the same way. Pears and apples may be grown from cuttings, but this plan is not pursued with them to any extent. Those that are root-grafted, or budded very low, especially the pear on quince stocks, will often produce roots if favorably situated, but there is a great difference in varieties, some rarely produce a root, while others are very prone to do it; from observations of this fact, a new phase of dwarf-pear culture has been inaugurated.

Suckers.—One of the simplest methods of multiplying varieties consists of increasing and encouraging the suckers thrown up by the roots; these are separated and set out for trees. We have been told by some physiologists that there was an absolute difference in structure between the root and the stem, that they could not be substituted the one for the other; and yet the oft quoted marvel of the tree which was planted upside down, and which produced flowers and leaves from its roots, while its branches emitted fibres, and became true roots, is familiar to every one. Here, as in other cases, our teachers have led us into error by attempting to trace analogy with animal anatomy and physiology, and by directing our attention to the circulation of plants, as though they, like the higher

animals, possessed true arterial and venous currents of circulating fluids. The cell circulation is quite a different affair, and can be conducted in either direction, as every gardener knows who has ever layered a plant, or set a cutting upside down. So with the roots—they are but downward extensions of the stem; under ordinary circumstances they have no need for buds, but these may be, and often are developed, when the necessity for their presence arises. Buds do exist on roots, especially upon those that are horizontal and near the surface, and from them freely spring suckers, which are as much parts of the parent tree as its branches, and may be planted with entire certainty of obtaining the same fruit, just as the twigs when used as cuttings, or scions, when grafted, will produce similar results.

Whole orchards are planted, in some sections of the country, with the suckers from old trees; apples, pears, plums, and even peaches, as well as raspberries and blackberries, are multiplied in this primitive way. There are some varieties of apples that have been so propagated for half a century, and extended for hundreds of miles in this way by the pioneer emigrants, without ever having been grafted, until their merits have at length accidentally become known to the Pomological Societies and nurserymen, when the propagation of them by grafting soon supercedes the more primitive method. Sucker trees are objected to upon the grounds that they are not healthy and thrifty, that they do not have good roots. Inherent disease of the parent tree will of course be transmitted with its other peculiarities, but I cannot imagine that this would be any more likely to occur in a sucker than in a layer, or cutting, or graft. As to the roots, they may be more developed upon one side than another in the young tree, and this state of things may continue in the adult; we often observe the same condition in the stumps of the monarchs of our forests, which were never suspected in the day of their glory and pride of having such a fault. But such a condition of roots is not essential to the sucker, which may be made to have as fine a system of lateral roots, and as evenly and regularly distributed as those of a seedling tree. Another objection to this mode of propagation has much truth and some force; that is, that suckers are very apt to produce suckers again. This is particularly the case with the Morello cherry, which is a favorite stock, upon which to work many of the choice varieties. As an offset to this it may be urged, that the small fibrous roots, which are supposed to conduce to early fruitfulness, abound in trees propagated by this means, and this may be the reason why the fruit trees that have been thus multiplied, are very generally remarkable for their precocious fruiting. Some of the apples that have been long increased in this manner, bear so early, and so bountifully, as to prevent them from ever forming very large trees; they often have a stunted appearance, and not infrequently present a peculiar inequality upon the bark, portions being swollen or enlarged like warts—from which, in some cases, it is easy to force out shoots or sprouts; they are indeed true gemmules like those of the old olive trees, and like them might be used for the propagation of the variety; a similar condition, no doubt, exists in the roots, whence the tendency to sucker. The common Morello cherry; the Damson; the Chickasas, and other varieties of plum; the blackberry, and many raspberries, are multiplied almost exclusively in a similar manner.

Layers are portions of the branches of a plant that have been induced to throw out roots, and which can thus set up an independent existence if removed from the parent tree. This mode of propagation is a very natural one, and was probably an accidental discovery. In its traits, it is the reverse of the mode we have just been considering. Here the branch emits roots, instead of the root emitting branches, as in the case of the sucker. Layering is frequently resorted to as a mode of propagation, it is very simple, easily performed, and, with some species, very certain in its results. Some plants will root readily if merely placed in contact with the ground, or very slightly covered with soil; others require some artificial interference, such as ringing, or twisting, or slitting. The raspberry, known as the *Rubus occidentalis* or Black-cap, belongs to the first class, and it even places itself in contact with the soil by recurving its branches so as to bring the tips to the earth, where they strike root, and make new plants. The grape comes under the second category, needing only a little assistance, and it is multiplied to a considerable extent in this manner. In the spring, the vines are laid out in a little shallow trench, and pegged down closely; as the buds burst, they throw up shoots which

are trained vertically by tying them to sticks, and as soon as these shoots have acquired a certain degree of maturity and firmness, the mellow earth is drawn up to them and they emit a beautiful system of roots, and by the fall they form very fine plants, (fig. 3). The layered branch is then taken up and the several plants are separated, when it will be found that the best roots are chiefly from the lower joints of the new wood, rather than from the old canes that were laid down in the spring.

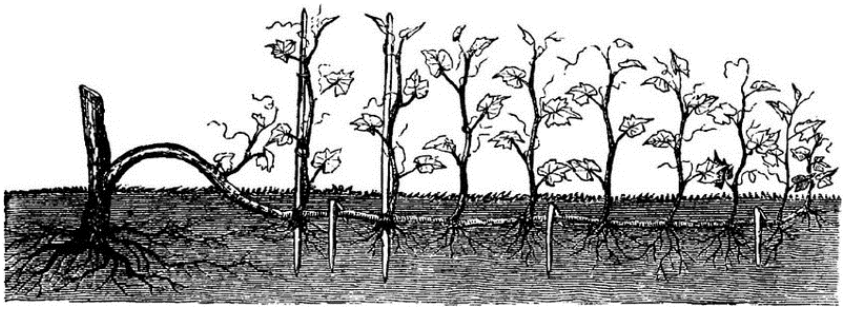

Fig. 3.—PROPAGATING THE GRAPE BY LAYERING.

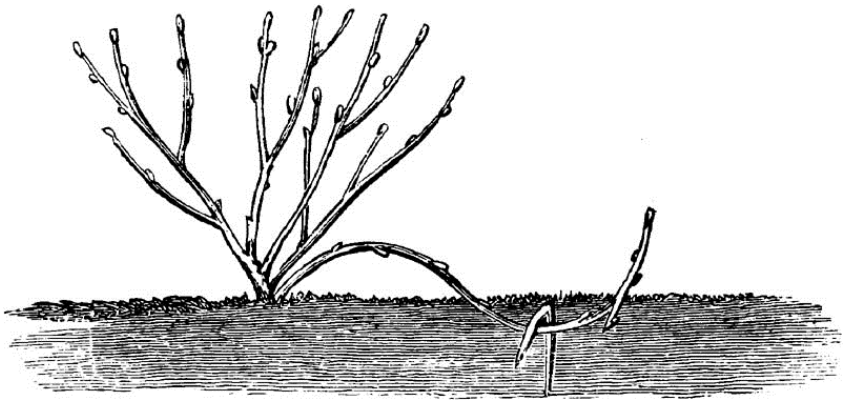

Fig. 4.—LAYERING THE QUINCE.

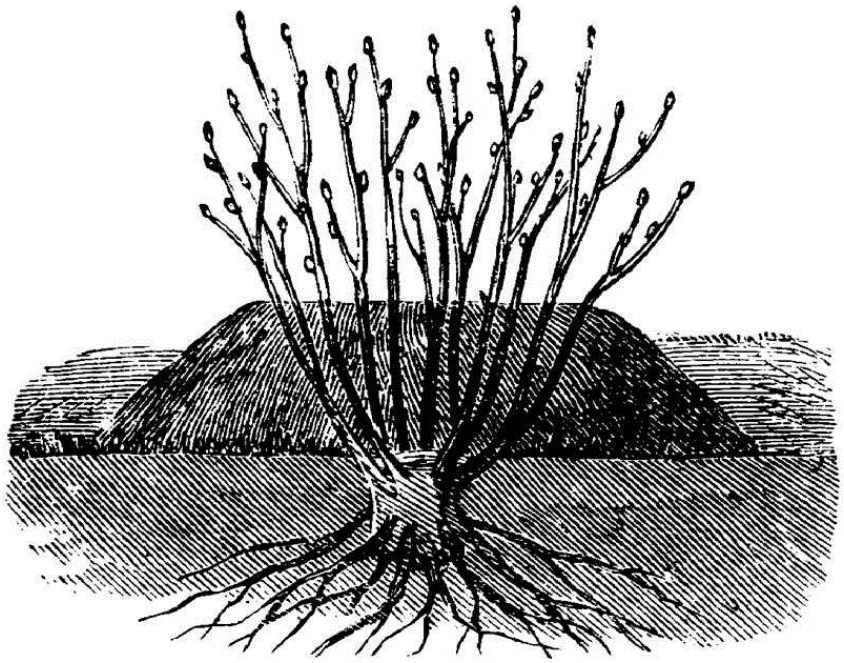

Fig. 5.—STOOL LAYERING THE QUINCE.

Quinces are considerably increased by a sort of layering, as the twigs emit roots very freely; they are often bent down, slightly twisted, or not, as the case may be, and covered with mellow soil, when they readily emit roots, become firmly established, and may be set out by themselves, (fig. 4). There is, however, another method of layering, much practiced in the multiplication of the quince; that called propagation by stools. The plants are set in open rows, four feet wide, and three or four feet apart in the rows; they should be so planted as to stand below the general surface, that is in trenches. When cut off at the ground in the spring, they throw up a great number of shoots, and the earth is gradually worked up to these to encourage their rooting, (see figure 5), which is often sufficient for removal the first season; if, on inspection, the roots are not found to be sufficiently large or abundant, the earthing is continued until the autumn of the next year, when they are removed, the stools trimmed of their lower roots, and reset in new trenches. The plants, thus raised from stools, are cut back severely, and are then ready to set out in nursery rows for budding. With the quince, cultivated in this manner, nothing is required but to accumulate the mellow earth about the shoots; but in many plants it is necessary to notch the wood by splitting, or cutting it for an inch or two, (as in fig. 6), making a tongue that separates from the lower portion of the shoot, and from which the roots are emitted. This slit should be commenced just below a bud, and the knife is drawn upward, cutting halfway through the wood. If commenced at one side instead of at the depending portion, the tongue is more sure to be separated from the stock, to which it might otherwise reunite. To insure rooting, some persons insert a little stick or chip between the separated portions, to prevent a re-union of the parts. The shoot, after being notched, is fastened down, and fine soil or compost is brought about it to encourage the development of roots. Few of the hard wooded fruit trees have been extensively propagated by means of layers; they might be so produced, but it has not been found profitable nor necessary.

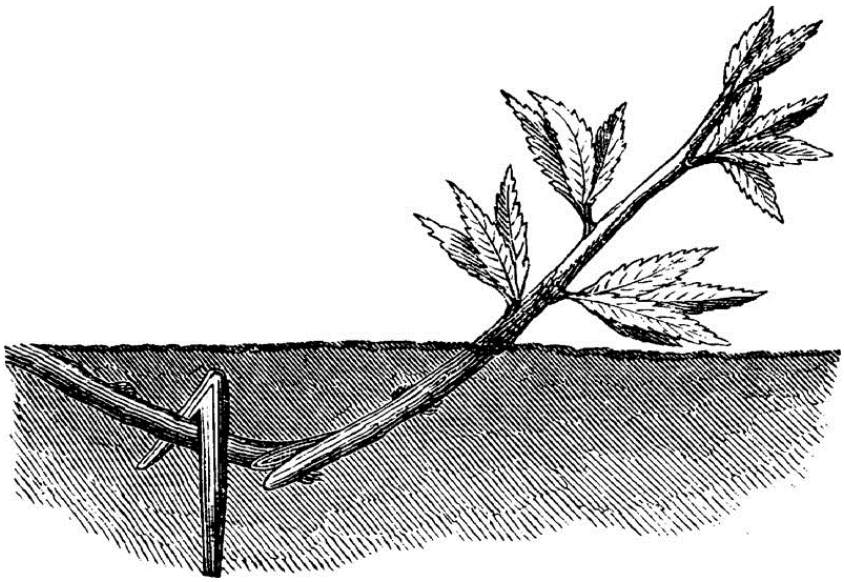

Fig. 6.—MANNER OF CUTTING AND PEGGING DOWN A LAYER.

A very common opinion prevails that layering exhausts the mother plant, or vine, which is used in this mode of propagating. If properly conducted, there is no reason why this should be; but if the whole top of any plant is bent down and made to take root, and to form independent roots, there can be little or no return from the branches to the original stock to strengthen it. A certain amount of healthy growing wood should always be left in its natural position, and no danger to the plant need be apprehended.

The wood growth of the strawberry, when allowed to take its natural bent, is directed into the stolons or runners, which form natural layers. Their production detracts from the central wood-growth

of the plant, and exhausts its strength to such a degree, that it often dies, whereas, by a constant removal of the runners, as fast as they appear, we practice a sort of summer pruning or pinching, which results in the production of a large branching stool, with many points or centers for the production of foliage and flowers, and thus insure the greatest abundance of fruit. The strawberry, like one species of the raspberry, and many other of our native plants, offers illustrations of natural layering.

Seeds.—The most common as well as the most natural mode of multiplying the individual plants of most of our fruit trees, is by sowing the seed; from this source we procure stocks upon which are worked, by budding or grafting, the several varieties we may desire to propagate. As an illustration of this process, I propose to speak of apple seedlings.

The almost universal means of increasing the number of apple trees, is by sowing the seed. This is generally selected and separated from the fresh pomace left on the press in cider-making. The old and slow process of hand-washing has given way, in this age of labor-saving machinery, to more economical methods. The most approved apparatus is constructed upon the principle of separating the seeds from the pulp by means of their greater specific gravity; it is, indeed, much like a gold washer, being a series of boxes or troughs through which a current of water is made to flow; this carries the lighter portions away from the seeds, the contents of the boxes being agitated from time to time. At the close of the process, the clean seed is found in the bottoms of the boxes, whence it is removed and carefully dried, by putting it in an airy place, and stirring it frequently to prevent mildew and fermentation. Well prepared seed is plump and bright, and should feel cold to the hand. When the pips are broken, they should be white and clear within; but the best test of their quality, is to sprout a portion, and count the plants produced by a given number of seeds.

Sowing.—The seeds may be put into the ground, either in the fall, or spring. The soil having been well prepared, and deeply pulverized, is thrown up in beds a few feet wide, and the seed sown in close drills across; or without the beds, it may be sown in broad drills, by hand, or with a machine, the rows at such a distance as to allow of culture by horse-power. It is desirable, in either case, to get an early start and a good stand; the weeds must be kept under from the very first, and not allowed to have the mastery for a single day. Thorough culture during the season, upon a deeply tilled soil, of such a character as to retain moisture, will be found highly advantageous in the production of this crop, and will insure immunity from leaf-blight and other adversities. Some recommend sprouting the seed a little before planting. If it have been kept during the winter mixed with its bulk of sand, which is a good plan, the whole may be subjected to a gentle heat as in a hot-bed, for a few days, just before planting. During this time the mass must be stirred and turned every day, to prevent fermentation and to secure an even start. Whenever the germ makes its appearance at the points of the seeds, which is called *pipping*, the sowing must begin, and should be done as quickly as possible; the covering is to be slight, and the earth should be friable and not disposed to bake. The depth at which the apple seed is to be covered will depend upon the present and prospective state of the weather, lighter if moist, heavier if dry, for a continued drouth might be fatal to sprouted seed, if it were planted too near the surface; but when the weather is not dry, it is advised that the shallower the seed is sown, the better. The objection has been made to sprouting, that if the process have advanced too far, the seedlings will be apt to have a crook at or near the collar, instead of the straight fusiform appearance they should possess when presented to the grafter.

These seedlings furnish the stocks upon which to work the finer varieties of the apple. They are taken up in the autumn with their long clean roots, which are often longer than their tops, the leaves are stripped off, and they are assorted; the larger are packed away in earth or saw-dust in the grafting department, or heeled-in out of doors, and covered in such a way as to be accessible at any time they may be needed during the winter. The smaller stocks are heeled-in for spring planting in nursery rows for budding, or they may be left in the original rows for another year's growth as seedlings. If the plants have been well grown and not too thick, so that the majority are of sufficient size, it will be better to take them all up at once and assort them as just indicated, otherwise the largest only

may be drawn separately when the ground is soft with autumnal rains, leaving the smaller seedlings for another year's growth. In assorting and selling the stocks, nurserymen make about three classes. The very largest, as thick as a lead-pencil, are called extra, or two-year old, and command a higher price. The next size, called 1st class stocks, are large enough for co-aptation to the average scions, and long enough to make two cuts each for grafting; and those that fall below this requisition are considered second class, and are either thrown aside or set out for budding, and for stock or collar-grafting in the rows.

PROPAGATION.—SECTION II.—GRAFTING

A MODIFICATION OF CUTTINGS—SUCCESS DEPENDANT UPON CELL-GROWTH. FORMING A UNION WITH THE STOCK—LIMITS TO GRAFTING DEPENDANT UPON THE ANATOMY OF THE PLANT —PHYSIOLOGICAL BOUNDS—SUCCESS IS IN PROPORTION TO THE AFFINITY—SEVERAL SPECIES AS STOCKS—DISTINCT GENERA —NARROW LIMITS—REQUISITES—EFFECTS OF UNCONGENIAL STOCKS—NATURAL GRAFTING IS INARCHING—GRAFTING BY APPROACH—VARIOUS METHODS OF GRAFTING—WHIP, CLEFT, SADDLE, SIDE, ETC—ILLUSTRATIONS—TYING, WAXING, ETC—RE-GRAFTING OLD ORCHARDS—RENEW SUCCESSIVE PORTIONS OF THE TREE; TOP FIRST—GRAFTING MACHINES—ROOT-GRAFTING— PREPARATION OF THE SCIONS—OF THE ROOTS—PRESERVATION OF THE GRAFTS—DIVISION OF LABOR—DIFFERENT PORTIONS OR SECTIONS OF THE ROOTS—STOCK-GRAFTING—GRAFTING-WAX— SEASONS FOR—PROLONGED—SELECTION OF SCIONS—TIME FOR CUTTING—MODE OF PRESERVING—TREATMENT OF GRAFTS.

Grafting is but a modification of propagation by cuttings. The scion is a cutting of the variety we wish to propagate, which, instead of being committed to the ground to emit its own roots, is placed in contact with tissues of a nature similar to its own, through which it is to form a connection with the roots and the soil. The success of the operation depends upon the formative cell in this instance also, as in the cutting; new cells are formed upon the cut surface, and the intercommunication takes place through them. Hence we have anatomical limits to grafting; there are physiological bounds beyond which we cannot pass, in our combinations of scion and stock. Our success is in the direct ratio of the affinity that exists between them; thus apple grows best on apple, and even among these we find the *closest union* and the best results, where there is a similarity between the style of growth, and probably in the character of the cells.

We say, as a general rule, that stone fruits must be grafted upon stone fruits, those bearing seeds, upon seed fruit; but there are limits even here which confine us upon one hand, and give us more latitude upon the other. Thus the cherry may be worked upon the wild cherry (*Prunus Virginiana*) but it forms a very poor union; the pear will grow upon the thorn, which has a very different seed, but the union is very imperfect and the tree is short-lived; the apple would appear to be much nearer of kin, since it belongs to the same genus, but though the pear will grow vigorously upon this stock, it is no more permanent than upon the thorn: either of them will answer when grafted low, or in the root, to start the cutting, as the scion may then be considered, and to sustain it until it shall have supplied itself with roots. In top-grafting the pear upon a tree of either species, it is found essential to success, and it conduces to the greater durability of the tree, for some branches of the original stock to be left intact to secure the circulation of the trunk, as the union of the dissimilar cells is so imperfect that it does not furnish sufficient vent for the sap. In the case of the cherry we find that the varieties appear to have a greater affinity for those of their own race; thus the Dukes and Morellos do well when grafted upon the Morello stocks, whereas the Hearts and Bigarreau sorts do not make a good union upon these stocks, but prefer the Mazzard, which has a freer growth more like their own. Most varieties will do well upon the Mahaleb stock, which is used as a means of dwarfing this fruit, though not a dwarf. Upon the wild cherry, which belongs to quite a different section of the genus, the cultivated varieties will grow, but they form a very imperfect union.

The peach may be worked upon the plum stock, and is claimed to be somewhat dwarfed by it, and to produce superior fruit. This stock is more congenial to the apricot, which is frequently propagated upon it. Both plums and apricots may be worked upon the peach stock, and they will grow very vigorously, as they will upon the wild plum, but they soon over-grow, and are very apt to break off. When either of these species is used as a stock for the plum or apricot, they should be considered merely as a nursing mother, like the apple or thorn to the pear, which may be wanted to help the cutting until it shall be prepared to stand alone, and feed itself from its own roots. In other words, they should be grafted, *not budded*, into these uncongenial stocks, and the operation should be performed in the collar or below it, in the root, so that the growing scion may be earthed up, and encouraged to furnish itself with a good system of roots of its own. The success will then depend upon the ability of the scion to emit roots freely.

We must never forget that in grafting, we are confined to very narrow limits. Our scion must be of a similar nature with the stock, each must have cells of a similar character, capable of transmitting their nutritious fluids from one to the other. We must recollect likewise, that the parts must be so co-apted that the cells of wood growth shall be brought into as close connection as possible, in both scion and stock; these cells are found in the layer, called the cambium, which is between the wood and the bark. The crude sap from below will often pass from cell to cell, when the elaborated sap of the cells in the scion is wholly unfitted for the formation of wood cells in the stock below it; of course the union in such a case must be very imperfect, and the product of such a grafting will be subject to accident, and will be short-lived, though the result in fruit, while the union continues, may be very precocious, abundant, and of superior flavor.

Natural grafting may often be observed by the student of nature when wandering among his favorites of the sylvan shades. There can be no doubt that the first hint was thus communicated to the early gardeners. In nature we always find the grafting to be inarching, or grafting by approach; two limbs or even two trees approximating closely, have abraded one another, and have afterward united their tissues most firmly together. This is generally a union of two trees of the same variety or species; but such is not always the case; sometimes trees of very dissimilar natures unite in this manner, but when we examine them we find only a dove-tailing, only a mechanical union, but no vital action subsists between them. The ancients give us some fancy sketches of the unions by grafting of very dissimilar trees, and some moderns who have no higher claim to poetry than their romancing, tell us that we may graft the peach upon the Willow and Buttonwood, and form other equally impossible unions.

The different methods of performing the operation of grafting vary with the character and size, and condition of the stocks to be worked; thus we have splice grafting, whip, cleft, saddle, and side grafting with modifications, and also grafting by approach, which is generally called inarching —though sometimes also practiced where we desire to renew the roots of a tree that are unhealthy, or to restore those that have been removed by accident or by the erosion of some rodent animals.

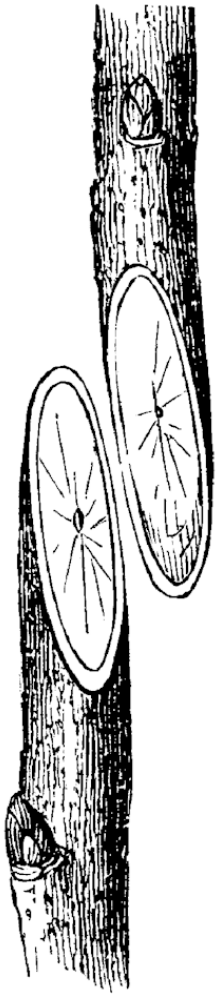

Fig. 7.

Splice Grafting is the simplest process, and is applicable only where the size of the stock and of the scion correspond pretty nearly; the two are cut with a sloping curve, each of which being made at the same angle, will coincide with the other when they are applied together, as represented in the engraving, fig. 7.

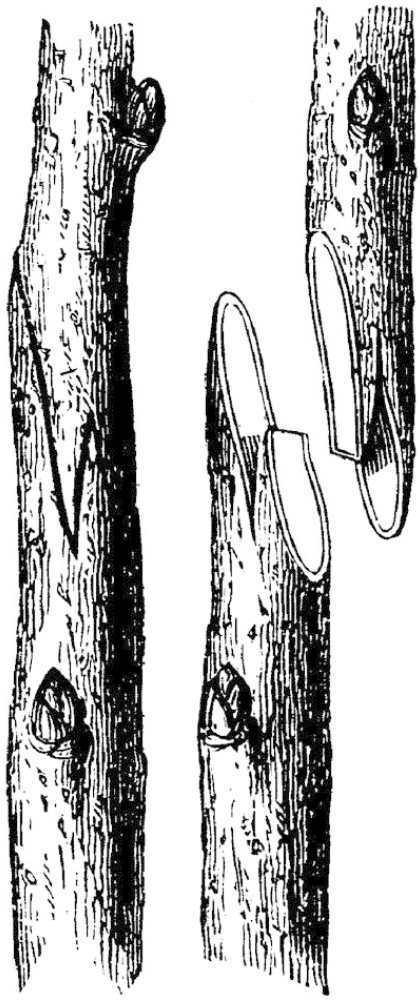

Fig. 8.—WHIP GRAFTING.

Whip Grafting is a modification of the above. Each portion is cut in a sloping manner as in the splice grafting, but each is also split with a thin-bladed knife, as represented in fig. 8. The object in this is to give a firmer union to the two portions, and also to present a more extended surface for the effusion of the new cell tissue that is to form the bond of union in cementing them together. In both these methods, but especially in the first, the parts must be held together in co-aptation by some kind of bandage; this is generally composed of grafting wax, spread upon cloth or paper, or even, as now extensively practiced, upon fine thread. Cotton yarn *No*. 3 is drawn through melted grafting wax, and as it cools, it is wound upon a reel at the other side of the room, whence it is drawn as wanted by the grafter or tyer. Tying or wrapping is always a good precaution, and when the splice or cleft graft is not very close, it becomes necessary; but thousands of grafts will unite equally well where the parts are covered with earth, without any such appliance.

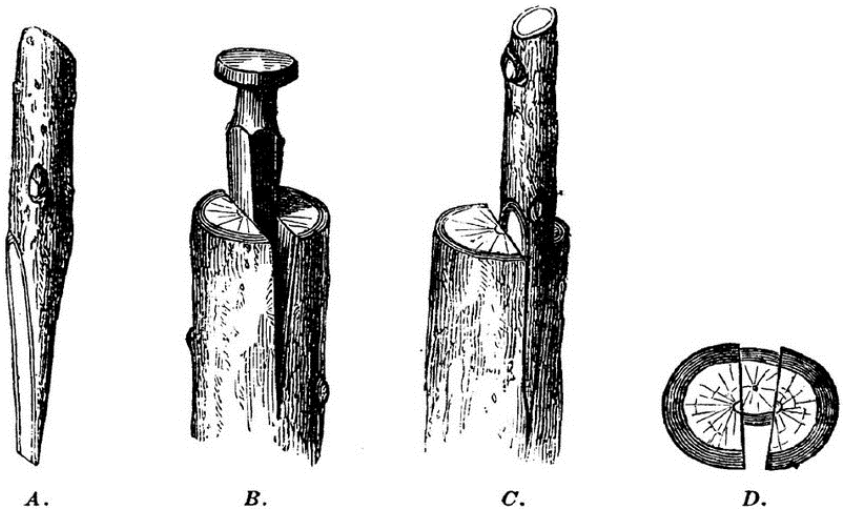

Fig. 9.—DIFFERENT STEPS IN CLEFT GRAFTING. *A*, SCION PREPARED FOR SETTING. *B*, THE CLEFT OPENED BY A WEDGE.

C, THE SCION INSERTED. *D*, SECTION OF STOCK AND SCION TO SHOW THE CO-APTATION OF THE PARTS OF THE TWO.

Fig. 10.—CLEFT GRAFTING WITH
BOTH SCIONS INCLINED INWARD.

Cleft Grafting is generally done when the stock is larger than the scion, and also where the operation is performed at a point above the ground. The stock is split downward, after having been cut off at the point where the grafting is to be done. The knife should be sharp, and the bark should be cut through first, to avoid its being torn, and so that the sides of the cleft shall be smooth. A wedge is inserted to keep the cleft open for the insertion of the scion, which is cut on each side like a fine wedge; but the two planes not being parallel, the bark will be left on one side to the very point of the wedge, while on the other it will be removed a part of the way, making a feather edge, *A*, fig. 9. The object of this is to have the pressure of the cleft greatest upon the outer side, where the union is to be effected. It is well to have a bud on the strip of bark left between the two cuts used in forming the graft, this should be near the top of the cleft. One or two grafts may be inserted into a cleft, or more clefts may be made, in large stocks, or in re-grafting the large limbs of an old tree, but usually one is sufficient to leave growing; and in the young tree, only one should ever be allowed to remain. When the scion is nicely set into the cleft, so that the inner bark of the stock and graft shall coincide, or rather cross a very little, (see fig. 10,) the wedge, whether of hard wood, or of iron, should be gently withdrawn, and then the elasticity of the stock will hold the scion firmly to its place; this pressure should not be too severe. In this kind of grafting, if the pressure be sufficiently firm, and if the operation have been performed below the surface of the ground, it may not be necessary to make any other application than to press the moist earth about the parts, and cover all but the top of the graft with soil, and place a stick to indicate the plant and protect it from injury. If, on the contrary, the pressure of the cleft be not sufficient to hold the scion firmly, as in small stocks, the graft must be tied. For this a piece of bass matting, or cotton twine, may be used; and if the operation has been performed above ground, the whole must be covered with grafting wax, applied, either hot with a brush, or cold, after having been worked with the hands, or by wrapping with strips of muslin or paper previously spread with the wax. In old times grafting clay was used, and applied with the hands as a lump around the junction; but this disagreeable and clumsy appliance has given way to more elegant and convenient arrangements.

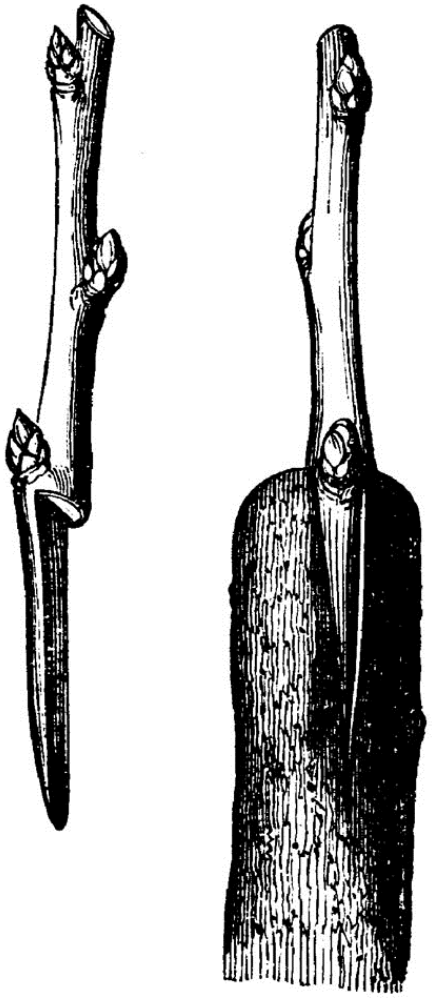

Fig. 11—SIDE GRAFTING.

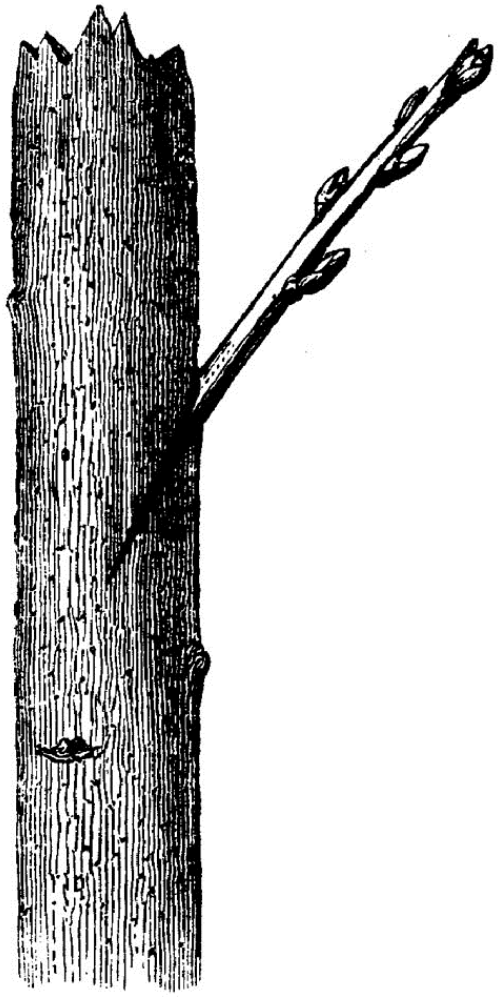

Fig. 12—SIDE GRAFTING—THE STOCK NOT CUT BACK.

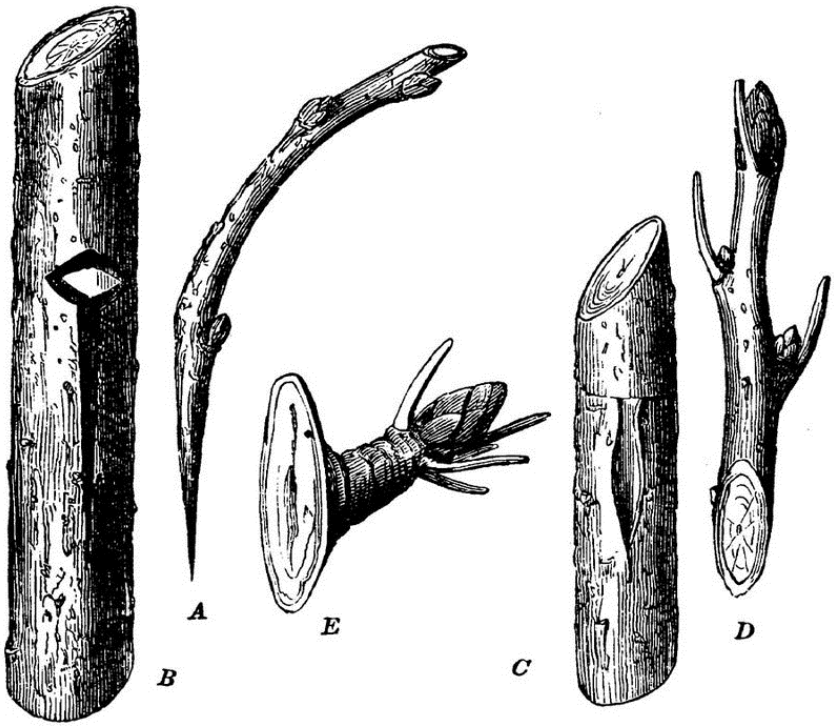

Fig. 13.—TWO FORMS OF SIDE GRAFTING.—*A*, *B*, THE SCION AND STOCK FOR THE RICHARD SIDE GRAFT. *C*, STOCK FOR THE GIRARDIN SIDE GRAFT. *D*, SCION, AND *E*, FRUIT BUD FOR THE SAME.

Side Grafting is performed in two ways. In one it is a modification of cleft grafting in which there is no cleft, but the bark is started from the wood, and the scion, cut as shown in figure 11, is pressed down between the wood and bark. This can only be done late in the spring, after the sap has begun to flow in the stock, so that the bark will run; it is indeed more like budding than grafting. The other modification is done without cutting off the stock. The knife is applied to the side of a stock of medium size, and a cut is made downward and extending to one-third the diameter, fig. 12; the scion is cut as for cleft grafting, and inserted so as to have the parts well co-apted, and then secured as usual. This plan is useful where there is danger of too free a flow of sap from the roots. Two other kinds of side graft are shown in fig. 13. The left-hand figures show the Richard side graft, in which an arched branch, *A*, is used. This is inserted under the bark of the stock, *B*; above the graft an incision is made in the stock down to the wood, to arrest the flow of sap. After the insertion, the wound is covered with grafting wax. The Girardin side graft is illustrated at the three right-hand figures. A fruit bud, *E*, or a graft with a terminal fruit bud, *D*, is inserted under the bark of the stock, *C*, in August, or whenever suitable buds can be obtained and the bark will run. The wound is tied and covered with wax, as before. The object of this grafting is to secure immediate fruitage. Another kind of side grafting consists in plunging a dirk-shaped knife directly through the tree, inclining the point downward, into this opening the graft is inserted; the object being to establish a limb on a naked portion of the trunk.

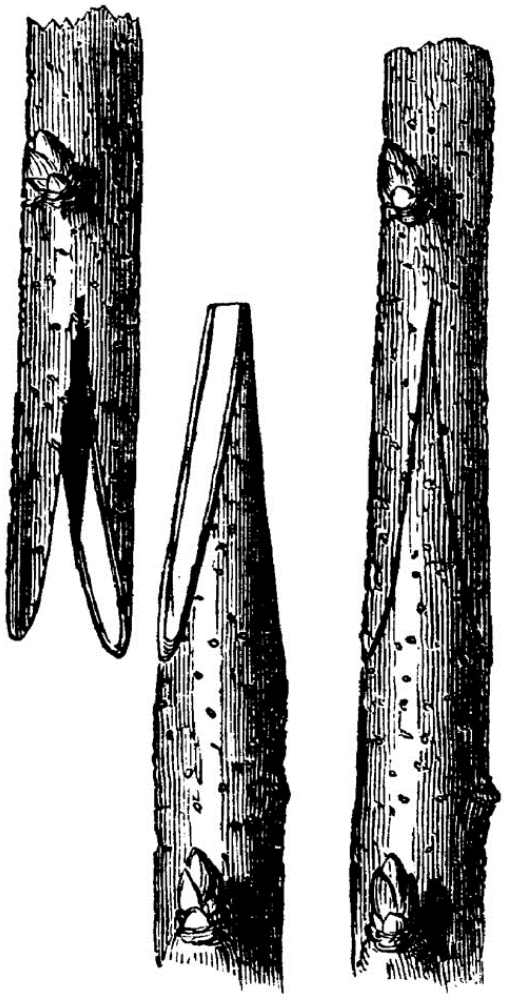

Fig. 14.—SADDLE GRAFTING.

Saddle Grafting is used only with stocks of small size; it is performed by making a double slope upon the stock, and by opening a corresponding space in the graft, by cutting two slopes in the scion, from below upwards, so that they shall meet in the centre, as seen in *fig.* 14. Some merely split the scion.

Grafting by Approach, or as it is generally termed, *inarching*, is often practiced where there is difficulty in making the scion unite with the stock; it is not often needed in the culture of our orchard fruits, but may be here described. The stock upon which we wish to graft the scion, must be planted near the variety or species to be increased. A small twig of the latter, which can be brought close to the stock, is selected for the operation; a slice of bark and wood is then removed from the twig, and another of equal size from the stock, so managed, that these cut surfaces can be brought together and secured in that position until they have united, after which the twig, that has been used as a scion, is cut from its parent tree, and the top of the stock is carefully reduced until the scion has sufficiently developed itself to act as the top of the ingrafted tree, which may afterward be transplanted to its proper station.

A modification of this grafting by approach, is, however, sometimes of great service, where we have a valuable tree that has suffered from disease in the roots, or from injury to them. It consists in planting some thrifty young stocks, with good roots, about the base of the tree, after having prepared the ground by thorough digging, and by the addition of good soil if necessary. These stocks are then inserted upwards into the healthy portion of the trunk, by the process of side grafting reversed or inverted, or by the usual method of inarching.

Ring Grafting or Bark Grafting is not much used, and in small stocks it is rather a kind of budding, for then a ring of bark is removed at the proper season of year, generally about midsummer, and it is replaced by a similar ring of bark from a shoot of the same size, taken from a tree of the variety to be propagated; this ring of bark must be furnished with a healthy bud. This method has little to recommend it, and can only be applied when both the stock and the scion are in a growing condition, so that the bark will run freely; care also must be exercised to avoid injuring the eye of the bud, in peeling off the ring. A modification of bark grafting may be applied with great advantage, however, to an old tree, that has met with an injury to a portion of its bark. The injured part should be pared smoothly to the sound bark and wood. This may be done with a sloping cut, or the edge may be made abrupt and square with a chisel and mallet; a piece of fresh wood and bark is then to be cut from a healthy tree and fitted precisely to the fresh wound, and secured in its place with bandages, and grafting clay or wax is then applied, thus making what the surgeons would call a sort of taliacotian operation. Instead of a single piece of wood and bark, a number of young shoots may be used to make the communication complete; these are set close together and secured in the usual manner; see fig. 15.

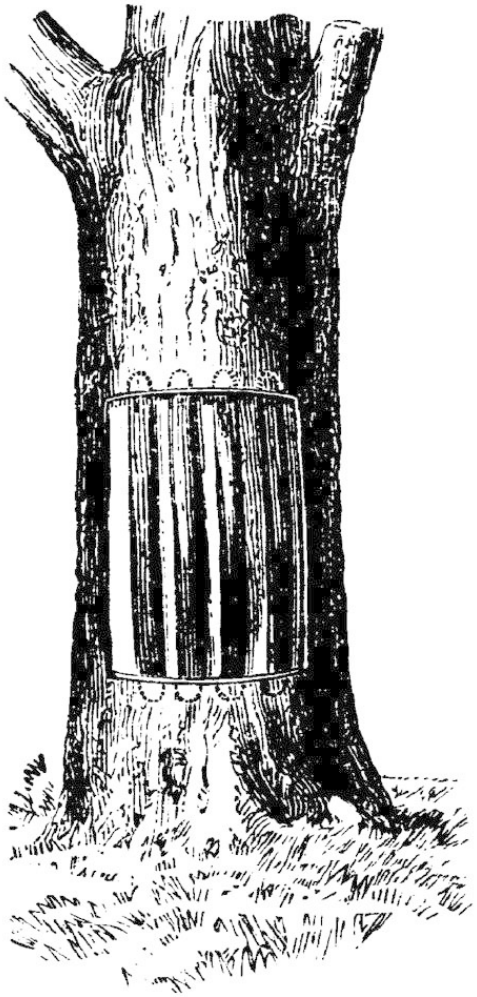

Fig. 15.—BARK GRAFTING,
TO REPAIR AN INJURED TREE.

Re-grafting Old Orchards.—Old orchards of inferior fruit may be entirely re-made and re-formed by grafting the limbs with such varieties as we may desire. A new life is by this process often infused into the trees, which is due to the very severe pruning which the trees then receive; they are consequently soon covered with a vigorous growth of young healthy wood, which replaces the decrepid and often decaying spray that accumulates in an old orchard, and the fruit produced for several years by the new growth is not only more valuable in kind, according to the judgment used in the selection of grafts, but it is more fair, smooth and healthy, and of better size than that which was previously furnished by the trees. Certain varieties are brought at once into bearing when thus top-grafted, which would have been long in developing their fruitful condition if planted as nursery trees. Others are always better and finer when so worked, than on young trees. Some of the finest specimens of the Northern Spy apple, exhibited at the fairs, have been produced by grafts inserted into the terminal branches of old bearing trees. There is a theory held by some orchardists, that the further the junction of the graft with the stock is removed from the root, the better will be the fruit. This, however, is not well supported, and the circumstance, when observed, is probably dependent upon other causes.

In renewing an old orchard by grafting its head, it will not be a good plan to attempt the whole tree at once; the pruning would be too severe, and would be followed by a profusion of succulent shoots breaking out from the large branches, such as are called water-sprouts. Those who have practiced most, prefer at first, to remove about one-third of the limbs for grafting, and those should be selected

at the top of the tree. The new growth thus has an open field for its development, and the lower limbs will be invigorated, while they tend also to preserve the equilibrium of the tree in a double sense, physically and physiologically. The next year another third of the limbs may be grafted, and the remainder the year following, as practiced by Mr. Geo. Olmstead, of Connecticut, who, on the sixth year from the first grafting, harvested 28-½ bushels of choice apples from a single tree that was 75 years old, and which before only produced inferior fruit. J.J. Thomas recommends, "to give a well-shaped head to such newly formed trees, and to prevent the branches from shooting upward in a close body near the centre of the tree; that the old horizontal boughs should be allowed to extend to a distance in each direction, while the upright ones should be lopped;" see fig. 16. The same writer also advises, "instead of cutting off large branches and grafting them at once, it is better to prune the top in part, which will cause an emission of vigorous shoots. These are then budded, or grafted. * * * And as the grafts gradually extend by growth, the remainder of the top may, by successive excisions, be entirely removed."

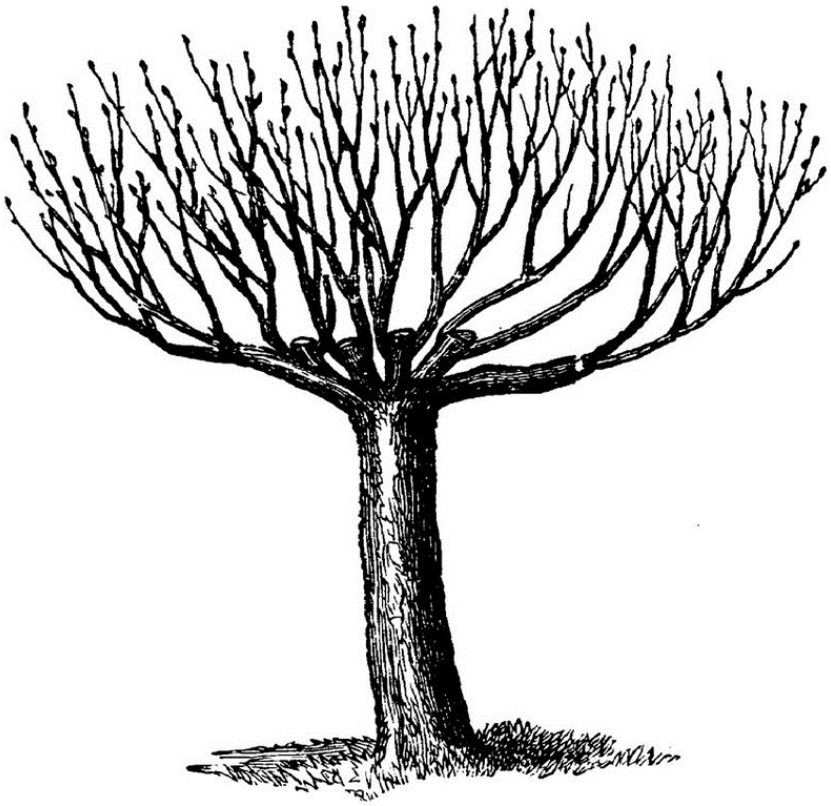

Fig. 16.—RENEWAL OF THE TOP OF AN OLD TREE.

Grafting in the Nursery is either done at or near the collar of the stock, or it is performed in-doors upon the roots or sections of roots of young stocks. The latter may be first described, as it constitutes the most extensive means of multiplying fruit trees. It is a sort of machinery, with division of labor, and appliances, that enable the operators to turn out immense numbers. Machinery has indeed been applied to the business; we have grafting apparatus to facilitate the work. The Minkler machine consists of a frame or gauge which regulates the angle of the slope, which is cut with a broad chisel that reduces the roots and scions to a condition for putting them together; by its use an immense number of grafts can be cut, and another hand binds them together with the waxed thread, without any tie. Mr. Robey's machine consists of a complicated shears to cut the slope and tongue at one operation, preparing the pieces for whip grafting. Mr. S.S. Jackson, of Cincinnati, has also invented an apparatus for this purpose, which proves to be very useful.

Root Grafting.—The methods of performing the operation vary somewhat, but all agree in the object to be attained: the co-aptation of the scion with a piece of root. Some grafters use only the upper portion of the root, thinking the original collar of the seedling stock the only point at which the most perfect and successful union between the aërial and terrestrial portions of trees should or can be effected—theoretically this may be very well, but the practice constantly pursued, in myriads of cases, abundantly proves that the grafting need not be restricted to this part, and that a perfect union may be effected at any point of the root, and that this may even be inverted. The very common practice has been to take two or more cuts from the root, when it is of sufficient size and length; and though some of our best propagators restrict themselves to two cuts from each, others, who have experimented carefully, insist that the third section will average as well as the others. A lot of trees, worked especially for a test in this matter, gave the following results.

In 1859 an average lot of roots and scions, about fifty in each lot, were treated as follows, White Pippin and Willow-leaf being used as scions:—

White Pippin—No. 1, being on the first cut of the root, had made a fair growth.

No. 2, being on the second cut, were quite as good or better.

No. 3, being on the third cut, were not quite so good as the others, the ground being partially shaded by a large tree.

Another, of Willow-leaf—No. 1, on the 3d cut of root, very good growth.

No. 2, on very slender roots, nearly as good.

No. 3, only 1 inch of root to 1 inch of scion; not so good growth nor so good a strike, but shaded by a tree.

No. 4, on 2d cut of root, not so good as the third.

No. 5, on average lot, not waxed, as good as any.

No. 6, roots worked upside-down, mostly failed.

D.O. Reeder exhibited some 2-year old apple trees, worked on the root inverted, they were of very good growth.

For root grafting, thrifty stocks are wanted of one or two years' growth, the smoother and straighter the roots, the better. These should be taken up from the seed-bed in the fall, selected, tied in bundles, and stored in the cellar or cave, or buried in the soil where they shall be accessible at any time, and where they will be kept fresh and plump. The roots and scions having been prepared and under shelter, the work of grafting may proceed at any time during the winter. The stocks, if not clean, should be washed, and one hand trims off the side rootlets. The grafter cuts a hundred scions of the appropriate length, which he puts into a shallow box on the table; he takes up a stock, cuts the slope near the collar, and a dextrous hand will at the same time make the sloping cut to receive the first graft and also the tongue, if that style of grafting is to be done, as is usually practised. He then picks up a scion, from a lot which himself or another hand has already prepared with a slope and tongue, and adapts it to the root, the tongue keeping the two together; a portion of the root is then cut off with the graft, and the process is repeated upon the next section. Two or three or more grafts, are thus made from one seedling root; the length of the sections vary from two to four inches, according to the fancy of the operator, or of his employer. Some persons recommend a long scion with a short root, and others prefer to reverse those terms. The whole root graft should not be more than six or seven inches long.

When any given number of scions are fitted to the roots, a boy completes the process of grafting, by applying melted wax with a brush, in which case they are dropped into water to harden the wax, or they are wrapped with waxed strips of muslin or paper, or, better still, they are tied with waxed thread. No. 3 cotton yarn is drawn through a pan of melted wax, and wound upon a reel placed at the other side of the room, so that the wax may harden. This waxed thread is a very convenient tie; the graft being held in the left hand, the thread is wound about it two or three turns; as the wax causes

the bandage to adhere to itself where it crosses, no knot is needed, and the thread is broken off with a quick jerk.

In splice grafting, whether performed with any of the machines, or if the slopes of root and scion be cut with the thin grafting knife, the tying must be done by the same hand that selects and places the scion upon the root. This does not admit of the same division of labor, and the fingers, becoming sticky from the wax, cannot be so nimble, and are unfit for cutting. When the lot is tied, they are set into the box, which should be inclined at an angle, and interspersed with earth or saw-dust; for transportation. Saw-dust, just as it comes from the mill, neither wet nor dry, is preferred by some as a packing material, and it has been found very efficacious, excluding and admitting the air just in the right proportions to prevent desiccation, and to promote the union, which very soon takes place between the graft and the root, if the boxes be stored in the cellar. In an ice-house root grafts have been kept in saw-dust more than a year, and then planted and grown successfully. The boxes should be deep enough to receive the whole graft—say from 10 to 12 inches—and then they can be packed upon one another without injuring the scions; these should be distinctly marked with the name and number, so as to be ready for planting out in the spring.

Much discussion has been had upon the merits and demerits, or disadvantages of root grafting, and much theoretical argument has been brought against the practice; but beautiful trees are thus made in immense numbers in the extensive nurseries of our country, and until better arguments can be produced against the practice, nurserymen will continue to graft on sections of root, such varieties, as are suitable for this procedure—especially apples, in a large proportion of the varieties cultivated, some pears, some peaches, grapes, and other fruits.

Root grafting is now of almost universal application with the apple. It has many advantages, which may be summed up as follows: Two or more plants may be produced from the root of one stock; these may be made with great rapidity; the work may all be performed in-doors and during the whole winter season, when nothing can be done outside; they are of small bulk, and great numbers may be stowed away in little space, they may be transported to any distance in this condition, and are ready for planting with the opening of spring, when they may be set in the nursery rows at once; or, they may be bedded out in a small space and mulched, to protect them from drouth, and the weeds can easily be kept under. Another advantage of bedding out the root-grafts is, that they may be assorted according to their size the next season, when transplanted into the nursery rows. This very transplanting too is a great advantage, for the roots will be much improved by the process.

The theoretical objections to root grafts have yielded to sound philosophy, based on and supported by practical observation. The very many advantages of this more economical and convenient and agreeable process, will necessarily sustain root-grafting in this fast age, when so many millions of trees are needed for the rapidly extending wants of this nation of tree planters. We may, however, consider some of the practical objections which have been brought forward against this plan of multiplying the apple. In our very changeable climate, and particularly in the North-west, upon the prairies, the cold of winter often supervenes with great suddenness, after the young trees have made a prolonged and vigorous growth in the fertile soil, and produces terrible devastation among those that are there exposed, without protection of any kind, to the rude blasts of the storm-king: in a less degree, injury is very frequent with many such late-growing kinds, at the first access of a severe frost; this is manifested in the bursting of the bark near the base of the stem. The same thing is not so often seen in the same varieties, when they have been budded or stock grafted a foot or more from the ground upon hardy seedling stocks, hence judicious propagators have selected the "tender" varieties for this kind of working, and confine their root-grafting to those less liable to the injury. There are other varieties which do not readily and promptly form a strong upright growth, so as to be profitable trees to the nurseryman if root grafted; these are selected for stock working, either on strong seedlings, or upon hardy upright sorts that have been root grafted for the purpose of being thus double-worked. This plan has been pursued to a limited extent only, but its advantages in the

production of good trees of the slender growing varieties, begin to be appreciated, and as the demand increases, our intelligent nurserymen will very soon furnish the requisite supply.

Planting.—When the weather is fine, and the soil in good condition, the root-grafts are to be set out with a dibble, by the line; they should be planted rather deeply, one bud projecting above the surface of the ground. The culture must be thorough, the plants should be kept perfectly clean, but it is questionable whether the growth should be pushed, late in the season; indeed, it is preferable to check the vegetation at mid-summer. For this purpose it has been recommended to cease cultivating the soil, or even to sow the ground with a heavy seeding of oats, so as to check the growth before winter. In good soils, with good culture, the average hight in the rows will be two feet, but there is a great difference in the kinds; some will considerably exceed this hight. Intelligent nurserymen no longer endeavor to have an excessive growth in the first year, and many prefer the bedding plan above alluded to.

Trimming, Pinching, or Heading.—The growth during the first year is generally a single shoot, sometimes two. If there be a second, it should be subordinated by pinching off its extremity, never by trimming it off; indeed, laterals should always be encouraged, and this will be more and more the case, since the demand for low-headed trees is increasing, as the laws of physiology are better understood. A young tree, well furnished with laterals, is always more stocky, and every way better, though not so tall as that which has been drawn up to a single stem. To encourage this condition, some advise the pinching out the terminal bud in the midst of the growing season, which will cause the swelling and subsequent breaking of the lower buds, so as to furnish plenty of laterals. If done later in the season, especially with strong-growing varieties, a branching head may be formed higher up, during the first season, making very pretty trees. This is, however, seldom attempted with root-grafts the first season, though it is very common for collar-grafted trees, and for buds on strong stocks to make a fine branching growth the first year. The second season the trees should all be headed-in, and the laterals spurred-in early in the spring, or in mild weather during the winter, if the scions are wanted. This method of making stocky plants cannot be too highly commended, nor can the opposite plan, of trimming off all the side branches, and even of stripping the leaves from the lower part of the shoots, during the first summer, be too severely condemned.

Stock Grafting has many advocates, and for some varieties this plan is preferable. The union may be effected at any point from the collar upward. Formerly, the place was selected to suit the convenience of the grafter, and many old orchards show very plainly where they were worked, the stock or the scion having overgrown, and it is very curious that some varieties may be indicated as good feeders of the stock below them, and the contrary. At present, tree planters are more fastidious, and object to these irregularities in the stems of their trees. They will purchase nothing that shows the point of union above ground, hence the more common use of collar grafting, as it has been called, or the insertion of the scion at or near the surface of the ground. Stocks that have been cultivated one or two years in the nursery row, are selected for this purpose; the earth is removed from them, they are cut off and grafted as they stand, and with their fine strong roots undisturbed, the result of one summer's growth is very satisfactory, making beautiful trees fit for the orchard. Older trees, especially those with straight clean stems, are often grafted standard high, so as to produce a fine salable tree at once, or in one season. This is a very good plan with some of the slender and straggling varieties, such as are called poor growers, and which are unprofitable to the nurseryman when propagated in the usual manner. Grafting or budding upon such stocks is also resorted to very often, when it is desirable at once to furnish large, or salable trees of new varieties.

In grafting upon a large stock, or upon the tops of an old tree, the process called cleft grafting is generally used. Here, as in all forms of this process, the object to be attained, is the co-aptation of the inner bark of both stock and scion. The latter is held in its place by the clasping of the former, and is also covered by some material that is pliant, and which will exclude the air and moisture.

The advantages of stock-grafting are the changing of an old tree from bad to good fruit, which is produced in a few years; it is also applicable to large stocks, and produces an immediate result, making salable trees in one year. It is also desirable for some poor-growing varieties, which are slow in making a tree from the ground; but it has its disadvantages also. The nurseryman must wait until his stocks have been grown one or more years in the nursery, his trees will sometimes be larger than he desires, they will be apt to have the mark of the grafting as a blemish upon the stalk sometimes during the life of the tree; and worse than all, he is restricted to a brief period in the spring, when he is obliged to perform the operation out of doors, and often in very unpleasant weather.

As a result of all the discussions upon this subject, it is found that stock-grafting, whether at the collar or at some distance above the ground, is still practiced, and has many warm advocates, as a better means of making the best trees. The only objections are the greater expense of culture of the stocks, and greater labor in grafting; the limited period at which the work can be performed, and the exposure of the workman during its performance, which is often at a stormy season, and always during a busy portion of the year. The trees too, in the orchard, are often somewhat deformed by an irregularity of growth, and have an enlargement either above or below the union, which is unsightly.

The kind of grafting will depend upon the size of the stocks; splice and whip-grafting on the smaller, and cleft-grafting on the larger ones, must be practiced. The waxing may be done by any of the methods indicated, according to the fancy; but it must always be more thoroughly done in aerial, than in underground grafting, whether this be in the collar or upon sections of the root; in the former the whole of the cut surfaces must be covered, to prevent desiccation by the winds, or the inroads of insects, or of wet from rains.

Wax.—Various combinations of the materials used in the preparation of grafting-wax, have been recommended by different operators. The desideratum being to have a material that shall be sufficiently pliant, and at the same time firm enough to withstand the elevated temperatures to which it may be exposed. A mean is preferred, neither too hard nor too soft, and the proportions of the ingredients are varied according as it is proposed to use it out of doors, or in the house, in cold weather or warm.

A favorite recipe, with a practical nurseryman of great experience, is:

Rosin, six parts, Bees-wax, one part, Tallow, one part,		melted together.

This is to be used warm, when grafting in the house.

For out-door work he used the following:

Rosin, four or five parts.
Bees-wax, one and one-half to two parts.
Linseed oil, one to one and one-half.

This is made into a mass to be applied by hand. A very pleasant and neat mode of using the wax is to pour it when melted, upon thin muslin or strong paper, and spread it thin with a spatula. The tissue is then cut into strips of convenient size. The application to cotton yarn for root-grafting, has already been mentioned.

The French use the preparation given below, sufficiently warm to be liquid, but not so hot as to injure the tissues of the tree, and apply it with a brush:

Black pitch	28 parts.
Burgundy pitch	28 parts.
Bees-wax	16 parts.
Grease	14 parts.
Yellow ochre	14 parts.
Making	100 parts.[14]

[14] Du Breuil, Culture of Fruit Trees; English Translation.

Mr. Du Breuil also refers to Leport's liquid mastic in terms of commendation, but speaks of it as a secret composition.

Downing recommends melting together:

Bees-wax	3 parts.
Rosin	3 parts.
Tallow	2 parts.

He says, the common wax of the French is

Pitch	one-half pound.
Bees-wax	one-half pound.

To be boiled together, and laid on with a brush, and for using cold or on strips of muslin, equal parts of tallow, bees-wax, and rosin, some preferring a little more tallow.

J.J. Thomas, whose practical knowledge is proverbial, recommends for its cheapness

Linseed oil	one pint.
Rosin	six pounds.
Bees-wax	one pound.

Melted together, to be applied warm with a brush, or to be put on paper or muslin, or worked with wet hands into a mass and drawn out into ribbons.

The season for grafting is quite a prolonged one, if we include the period during which it may be done in the house, and the ability we have of retarding the scions by cold, using ice. It should be done while the grafts are dormant, which is at any time from the fall of the leaf until the swelling of the buds. As the grafts would be likely to suffer from prolonged exposure, out-door grafting is done just before vegetation commences in the spring, but may be prolonged until the stocks are in full leaf, by keeping back the scions, in which case, however, there is more danger to the stock unless a portion of its foliage is allowed to remain to keep up the circulation; under these circumstances, too, side-grafting is sometimes used with the same view.

The stone fruits are worked first; cherries, plums, and peaches, then pears and apples. With regard to grafting grapes, there is a diversity of opinion. Some operators prefer very early in the season, as in February, and others wait until the leaves have appeared upon the vine to be grafted.

Scions or Grafts are to be selected from healthy plants of the variety we wish to propagate. They should be the growth of the previous year, of average size, well developed, and with good buds, those having flower buds are rejected. If the shoots be too strong, they are often furnished with poor buds, and are more pithy, and therefore they are more difficult to work and are less likely to grow. Grafts, cut from young bearing orchards, are the best, and being cut from fruiting trees, this enables

us to be certain as to correctness of the varieties to be propagated; but they are generally and most rapidly collected from young nursery trees, and as an orchardist or nurseryman should be able to judge of all the varieties he cultivates by the appearance of their growth, foliage, bark, dots, etc., there is little danger in taking the scions from such untested trees.

Time for cutting Scions.—The scions may be cut at any time after the cessation of growth in the autumn, even before the leaves have fallen, until the buds burst in the spring, always avoiding severely cold or frosty weather, because of the injury to the tree that results from cutting at such a time, though the frost may not have injured the scion. The best nurserymen prefer to cut them in the autumn, before they can have been injured by cold. They should be carefully packed in fine earth, sand, or sawdust, and placed in the cellar or cave. The leaves stripped from them, make a very good packing material; moss is often used, where it can be obtained, but the best material is saw-dust. This latter is clean, whereas the sand and soil will dull the knife. If the scions should have become dry and shriveled, they may still be revived by placing them in soil that is moderately moist, not wet—they should not, by any means, be placed in water, but should be so situated that they may slowly imbibe moisture. When they have been plumped, they should be examined by cutting into their tissues; if these be brown, they are useless, but if alive, the fresh cut will look clear and white, and the knife will pass as freely through them as when cutting a fresh twig.

The after-treatment of the grafts consists in removing the sprouts that appear upon the stock below the scion, often in great numbers. These are called robbers, as they take the sap which should go into the scion. It is sometimes well to leave a portion of these as an outlet for excess. When the graft is tardy in its vegetation, and in late grafting, it is always safest to leave some of these shoots to direct the circulation to the part, and thus insure a supply to the newly introduced scion; all should eventually be removed, so as to leave the graft supreme.

It may sometimes be necessary to tie up the young shoot which pushes with vigor, and may fall and break with its own weight before the supporting woody fibre has been deposited; but a much better policy is to pinch in the tip when but a few inches long, and thus encourage the swelling and breaking of the lateral buds, and produce a more sturdy result. This is particularly the case in stock-grafts and in renewing an orchard by top-grafting.

PROPAGATION.—SECTION III.—BUDDING

ADVANTAGES OF—LONG PERIOD FOR—CLAIMS OF GREATER HARDINESS EXAMINED—LATE GROWERS APT TO BURST THE BARK —BUD TENDER SORTS. STOCKS NOT ALWAYS HARDY—PHILOSOPHY OF BUDDING, LIKE GRAFTING, DEPENDS UPON CELL-GROWTH—THE CAMBIUM, OR "PULP"—THE BUD, ITS INDIVIDUALITY—THOMSON QUOTED—UNION DEPENDS UPON THE BUD—SEASON FOR BUDDING —CONDITIONS REQUISITE—SPRING BUDDING—CONDITION OF THE BUDS—BUD STICKS—SELECTION OF—THEIR TREATMENT— RESTORATION WHEN DRY—THE WEATHER—RAINS TO BE AVOIDED —USUAL PERIOD OF GROWTH BY EXTENSION—SUCCESSION OF VARIETIES—CHERRY, PLUM, PEAR, APPLE, QUINCE, PEACH—HOW TO DO IT—DIFFERENT METHODS—AGE OF STOCKS—PREPARATION OF—THE KNIFE—CUTTING THE BUDS—REMOVAL OF THE WOOD —THE AMERICAN METHOD—DIVISION OF LABOR TYING—RING BUDDING—PREPARATION OF SCIONS FOR EARLY BUDDING— IMPROVEMENTS IN TYING—BAST, PREPARATION OF—SUBSTITUTES —NOVEL TIE—WHEN TO LOOSEN THE BANDAGE—HOW DONE— INSPECTION OF BUDS—SIGN OF THEIR HAVING UNITED—KNIGHT'S TWO BANDAGES—WHY LEAVE THE UPPER ONE LONGER. HEADING BACK THE STOCKS—RESUME.

Budding, or inoculating, is the insertion of eyes or buds. This is a favorite method of propagation, which is practiced in the multiplication of a great variety of fruits. The advantages of budding consist in the rapidity and facility with which it is performed, and the certainty of success which attends it. Budding may be done during a long period of the growing season, upon the different kinds of trees we have to propagate. Using but a single eye, it is also economical of the scions, which is a matter of some importance, when we desire to multiply a new and scarce variety.

It has been claimed on behalf of the process of budding, that trees, which have been worked in this method, are more hardy and better able to resist the severity of winter than others of the same varieties, which have been grafted in the root or collar, and also that budded trees come sooner into bearing. Their general hardiness will probably not be at all affected by their manner of propagation; except perhaps, where there may happen to be a marked difference in the habit of the stock, such for instance as maturity early in the season, which would have a tendency to check the late growth of the scion placed upon it—the supplies of sap being diminished, instead of continuing to flow into the graft, as it would do from the roots of the cutting or root-graft of a variety which was inclined to make a late autumnal growth. Practically, however, this does not have much weight, nor can we know, in a lot of seedling stocks, which will be the late feeders, and which will go into an early summer rest.

Certain varieties of our cultivated fruits are found to have a remarkable tendency to make an extended and very thrifty growth, which, continuing late into the autumn, would appear to expose the young trees to a very severe trial upon the access of the first cold weather, and we often find them very seriously injured under such circumstances; the bark is frequently split and ruptured for several inches near the ground. The twigs, still covered with abundant foliage, are so affected by the frost, that their whole outer surface is shriveled, and the inner bark and wood are browned; the latter often becomes permanently blackened, and remains as dead matter in the centre of the tree, for death does not necessarily ensue. Now intelligent nurserymen have endeavored to avoid losses from these causes, by budding such varieties upon strong well-established stocks, though they are aware that these are

not more hardy than some of the cultivated varieties: a given number of seedling stocks has been found to suffer as much from the severity of winter, as do a similar amount of the grafted varieties taken at random.[14] That the serious difficulty of bark-bursting occurs near the surface of the ground, does seem to be an argument of some weight in favor of budding or stock-grafting at a higher point. The earlier fruiting of budded trees than those which have been root-grafted, does not appear to be a well established fact, and therefore need not detain us; except to observe that the stocks, upon which the buds were inserted, might have been older by some years than the slip of root upon which the graft was set, so that the fruiting of the former tree should count two or three or more years further back than from the period of the budding. There are so many causes which might have contributed toward this result of earlier bearing, that we should not be too hasty in drawing conclusions in this matter.

The philosophy of budding is very similar to that of grafting. The latter process is performed when the plant-life is almost dormant, and the co-apted parts are ready to take the initiative steps of vegetation, and to effect their union by means of new adventitious cells, before the free flow of sap in the growing season. Budding, on the contrary, is done in the hight of that season and toward its close, when the plants are full of well matured and highly organized sap, when the cell circulation is most active, and the union between the parts is much more immediate than in the graft; were it not so, indeed, the little shield, with its actively evaporating surface of young bark, must certainly perish from exposure to a hot dry atmosphere. The *cambium*, or gelatinous matter, which is discovered between the bark and the wood when they are separated, is a mass of organizable cells. Mr. Paxton, using the gardener's expression, calls it the "pulp." Budding is most successfully performed when this matter is abundant, for then the vitality of the tree is in greatest degree of exaltation.

The individuality of the bud was sufficiently argued in the first section of this chapter, it need not now be again introduced, except as appropriately to remind us of the fact where the propagation depends upon this circumstance—the future tree must spring from the single bud which is inserted. Mr. A.T. Thomson, in his Lectures on the Elements of Botany, page 396, says:—"The individuality of buds must have been suspected as early as the discovery of the art of budding, and it is fully proved by the dissection of plants. * * Budding is founded on the fact, that the bud, which is a branch in embryo, is a distinct individual. It is essential that both the bud and the tree into which it is inserted should not only be analogous in their character, as in grafting with the scion, but both must be in a state of growth at the time the operation is performed. The union, however, depends much more upon the bud than upon the stock—the bud may be considered a centre of vitality—vegetative action commences in the bud, and extends to the stock, connecting them together."—"The vital energy, however, which commences the process of organization in the bud, is not necessarily confined to the germ, nor distinct from that which maintains the growth of the entire plant; but it is so connected with organization, that when this has proceeded a certain length, the bud may be removed from the parent and attached to another, where it will become a branch the same as if it had not been removed."

The season for budding has already been indicated in general terms, it is usually done in mid-summer and the early part of autumn, reference being had to the condition of the plants to be worked; these should be in a thrifty growing state, the woody fibre should be pretty well advanced, but growth by extension must still be active, or the needful conditions will not be found. The "pulp" must be present between the bark and the wood of the stock, so that the former can be easily separated from the latter; in the language of the art, the bark must "run;" this state of things will soon cease in most stocks, after the formation of terminal buds on the shoots. The success of spring budding, however, would appear to indicate that the cambium layer is formed earlier in the season than is usually supposed; for whenever the young leaves begin to be developed on the stock, "the bark will run," and the buds may be inserted with a good prospect of success. In this case we are obliged to use

[14] A.R. Whitney, Franklin Grove Nurseries, Lee Co., Ill.

dormant buds that were formed the previous year, and we have to exercise care in the preservation of the scions, to keep them back by the application of cold, until the time of their insertion.

The condition of the bud is also important to the success of the operation. The tree from which we cut the scions should be in a growing state, though this is not so essential as in the case of the stock, as has been seen in spring budding—still, a degree of activity is desirable. The young shoot should have perfected its growth to such an extent as to have deposited its woody fibre, it should not be too succulent; but the essential condition is, that it should have its buds well developed. These, as every one knows, are formed in the axils of the leaves, and, to insure success, they should be plump and well grown. In those fruits which blossom on wood shoots of the previous year's growth, as the peach and apricot, the blossom buds should be avoided; they are easily recognized by their greater size and plumpness. In cutting scions, or bud-sticks, the most vigorous shoots should be avoided, they are too soft and pithy; the close jointed firm shoots, of medium size, are much to be preferred, as they have well developed buds, which appear to have more vitality. Such scions are found at the ends of the lateral branches. These need immediate attention, or they will be lost. The evaporation of their juices through the leaves would soon cause them to wither and wilt, and become useless. These appendages are therefore immediately removed by cutting the petioles from a quarter to half an inch from the scion; a portion of the stem is thus left as a convenient handle when inserting the shield, and this also serves afterward as an index to the condition of the bud. So soon as trimmed of their leaves, the scions are tied up, and enveloped loosely in a damp cloth, or in moss, or fresh grass, to exclude them from the air. If they should become wilted, they must not be put into water, as this injures them; it is better to sprinkle the cloth and tie them up tightly, or they may be restored by burying them in moderately moist earth.

The early gardeners were very particular as to the kind of weather upon which to do their budding. They recommended a cloudy or a showery day, or the evening, in order to avoid the effects of the hot sunshine. This might do in a small garden, where the operator could select his opportunity to bud a few dozen stocks; but even there, wet weather should be avoided, rather than courted. But in the large commercial nurseries, where tens of thousands of buds are to be inserted, there can be no choice of weather; indeed, many nurserymen prefer bright sunshine and the hottest weather, as they find no inconvenience arising to the trees from this source. Some even aver that their success is better under such circumstances, and argue that the "pulp is richer."

Most trees in their mature state make all their growth by extension or elongation very early in the season, by one push, as it were; with the first unfolding of the leaves, comes also the elongation of the twig that bears them. In most adult trees in a state of nature, there is no further growth in this way, but the internal changes of the sap continue to be effected among the cells during the whole period of their remaining in leaf, during which there is a continual flow of crude sap absorbed by the roots, and taken up into the organism of the tree to aid in the perfection of all the various parts, and in the preparation of the proper juice and the several products peculiar to the tree, as well as its wood and fruits. When all this is transpiring within its economy, the tree is said to be in its full flow of sap; at this stage the young tree is in the best condition for budding, but it continues also, if well cultivated, to grow by extension for a greater or shorter portion of the season, and this is essential to the success of the operation as already stated. After the perfecting of the crop of fruit, the main work of the tree seems to have been done for the year, and we often observe, particularly with the summer fruits, that the trees appear to go to rest after this period, and begin to cast their foliage. Now, to a certain extent, this is true of the young trees. The varieties that ripen their fruit early, make their growth in the nursery in the earlier portion of the summer, they stop growing, and their terminal bud is formed and is conspicuous at the top of the shoots. Very soon the supply of sap appears to be diminished, there is no longer so much activity in the circulation, the bark cleaves to the wood, it will no longer run, and the season of budding for those stocks has reached its terminus; hence the nurseryman must be upon the look-out for the condition of his trees. Fortunately, those species which have the shortest

season, are also the first to be ready, the first to mature their buds, and they must be budded first. We may commence with the cherry, though the Mahaleb stock, when it is used, continues in condition longer than other varieties, and may be worked late. The plum and pear stocks also complete their growth at an early period in the season; the apple continues longer in good condition, and may be worked quite late. Grapes, if worked in this way, should be attended to about mid-season, while they are still growing; but quinces and peaches may be kept in a growing state much later than most other stocks, and can be budded last of all.

How to do it.—The stocks being in a suitable condition as above described, they should be trimmed of their lateral shoots for a few inches from the ground. This may be done immediately in advance of the budder, or it may have been done a few days before the budding. The stock may be one year old, or two years; after this period they do not work so well. The usual method is to make a **T** incision through the bark of the stock, as low down as possible, but in a smooth piece of the stem; some prefer to insert the shield just below the natural site of a bud. The knife should be thin and sharp, and if the stock be in good condition, it will pass through the bark with very little resistance; but if the stock be too dry, the experienced budder will detect it by the different feeling communicated through his knife, by the increased resistance to be overcome in making the cut. The custom has been to raise the bark by inserting the haft of the budding knife gently, so as to start the corners of the incision, preparatory to inserting the bud; but our best budders depend upon the shield separating the bark as it is introduced. The bud is cut from the scion by the same knife, which is entered half an inch above the bud, and drawn downward about one-third the diameter of the scion, and brought out an equal distance below the bud; this makes the shield, or bud. The authorities direct that the wood should be removed from the shield before it is inserted; this is a nice operation, requiring some dexterity to avoid injuring the base of the bud, which constitutes its connection with the medulla or pith within the stick. The base of the bud is represented by *b*, figure 17. Various appliances have been invented to aid in this separation, some use a piece of quill, others a kind of gouge; but if the bark run freely on the scion, there will be little difficulty in separating the wood from the shield with the fingers alone. All this may be avoided by adopting what is called the American method of budding, which consists in leaving the wood in the shield, (fig. 18, *b*) that should be cut thinner, and is then inserted beneath the bark without any difficulty, and may be made to fit closely enough for all practical purposes. Like everything else American, this is a time-saving and labor-saving plan, and therefore readily adopted by the practical nurseryman, who will insert two thousand in a day.

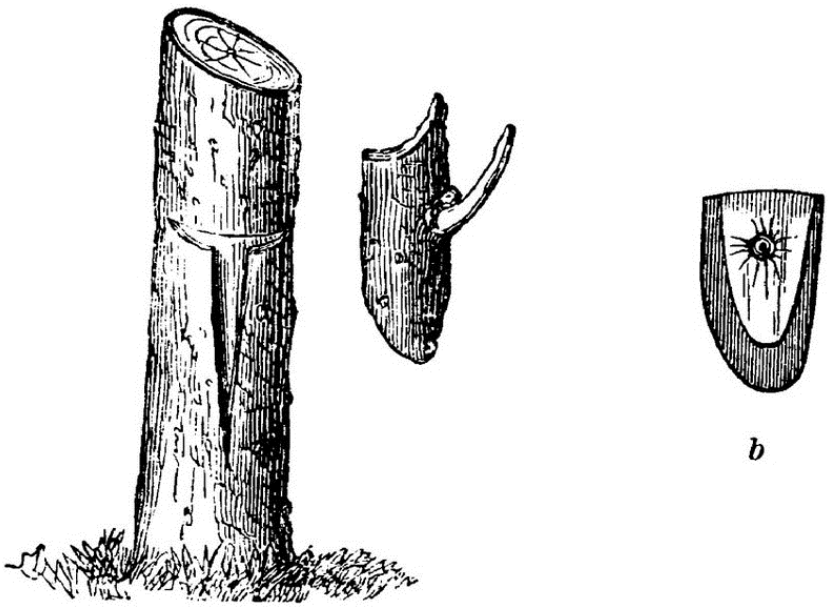

Fig. 17.—BUDDING, WITH THE WOOD REMOVED. *b*, THE INSIDE OF THE SHIELD SHOWING THE BASE OF THE BUD.

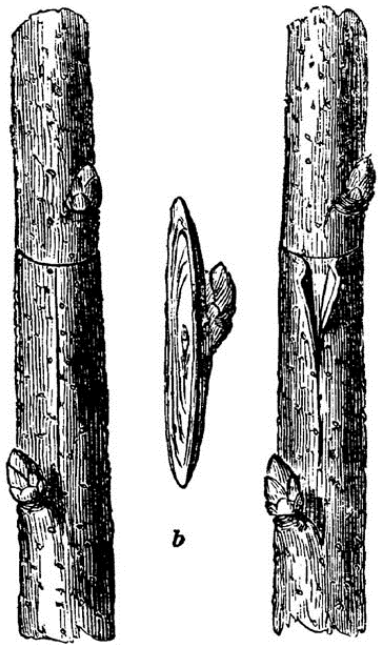

Fig. 18.—AMERICAN BUDDING. *b*, THE BUD WITH THE WOOD REMAINING.

A division of labor is had generally, so far as the tying is concerned; for this is done by a boy who follows immediately after the budder, and some of these require two smart boys. S.S. Jackson has carried this principle of division of labor still further, and, as appears, with advantage; one hand cuts the shields for another who inserts them. He never uses the haft of his knife to raise the bark, but, after having made the longitudinal cut through the bark, he places the knife in position to make the transverse incision, and as he cuts the bark, the edge of the blade being inclined downward, the shield is placed on the stock close above the knife, which is then still further inclined toward the stock, resting upon the shield as a fulcrum; thus started, the bark will readily yield to the shield, which is then pressed down home into its place.

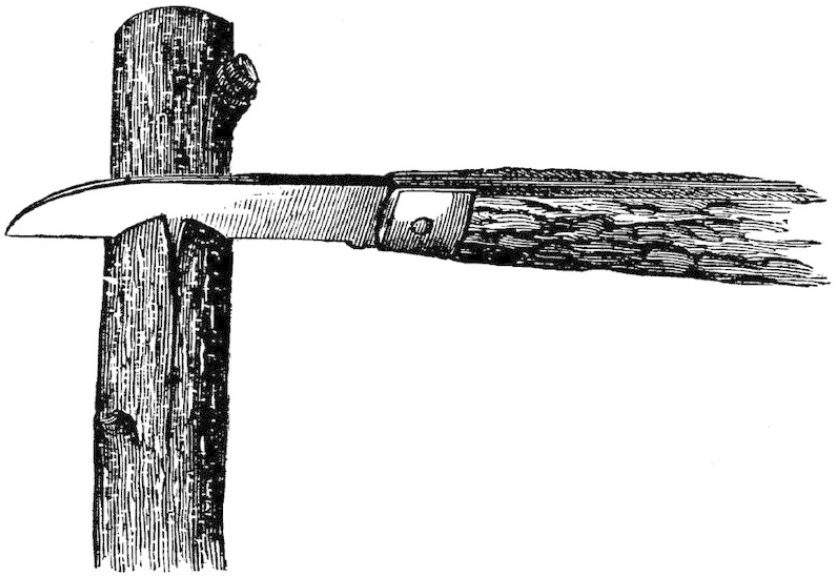

Fig. 19.—MR. JACKSON'S METHOD OF MAKING THE INCISION.

J.W. Tenbrook, of Indiana, has invented a little instrument with which he makes the longitudinal and transverse incisions, and raises the bark, all at one operation, and inserts the bud with the other hand. On these plans, two persons may work together, one cutting, the other inserting the buds; these may change work occasionally for rest. In all cases it is best to have other hands to tie-in the buds, two or three boys will generally find full occupation behind a smart budder. It will be apparent that the above processes can only be performed when the stock is in the most perfect condition of growth, so that the bark can be pressed away before the bud; a good workman will not desire to bud under any other circumstances.

In budding, it is found that the upper end of the shield is the last to adhere to the stock; it needs to be closely applied and pressed by the bandage, and if too long, so as to project above the transverse incision, it should be cut off.

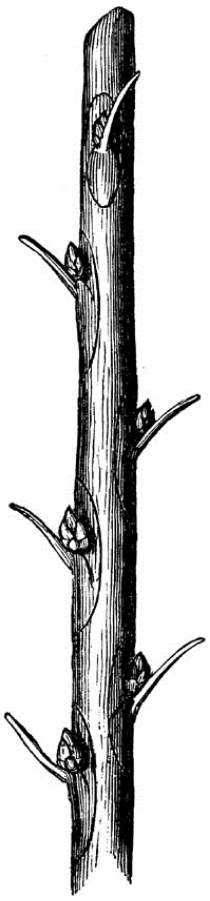

Fig. 20.—STICK OF BUDS.

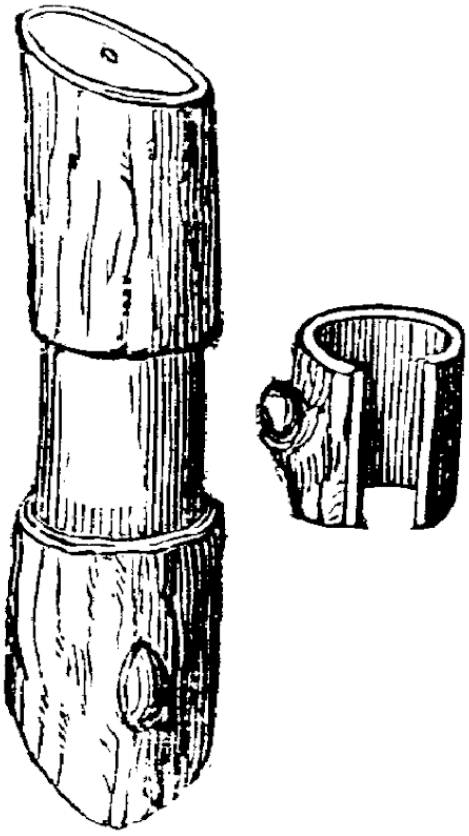

Fig. 21.—RING BUDDING.

Another expedient for facilitating the operation of budding is made use of by some of the nurserymen who grow peach trees extensively. It consists in, preparing the stick of buds, as shown in the engraving, figure 20. A cut is made, with a sharp knife, through the bark, around each bud, as in the figure. The budder then removes the buds as they are wanted, with a slight sidewise pull, and has the shield in the right condition to insert, without the trouble of removing the wood. When working in this manner, the stick of buds must not be allowed to dry, and the work must be done at a time when the bark parts with the greatest ease.

Among the modifications of the process of budding, that, called ring-budding, fig. 21, may be mentioned, rather as a curiosity however, though preferred by some, especially for the grape, which is said to be very easily budded, though we seldom see the operation practiced.

Those who are anxious to commence budding early in the season, prepare the scions they expect to use, by pinching the ends and cutting off a portion of the leaves; the effect of this check to the wood growth is to hasten the ripening or development of the buds, which rapidly swell, preparatory to breaking, in their attempt to reproduce the foliage that had been removed.

Tying should be done as soon as convenient after the buds have been inserted; though under very favorable circumstances the bud may adhere and do well without any bandaging, no one thinks of leaving the work without carefully tying in the buds, and most budders lay a great deal of stress upon the necessity for covering the whole shield and cut with a continuous bandaging, that shall exclude the light, and air, and moisture. The material most used is bass matting, brought from Russia, as a covering to the packages of sheet iron for which that country is famous. This is the inner bark of the *Tilia Europea*, but our own Bass-wood, *T. Americana*, furnishes an excellent bass, and is procured by our nurserymen directly from the trees, by stripping the bark in June, and after it has lain a few days in water, the inner portion separates easily, is dried, and put away for future use. Those who have not provided the bass, are content to apply woolen yarn to tie in the buds; its elasticity adapts

it well to the purpose. The ingenious budder, without bass, often finds a substitute for it, and a very good tie, in the soft husks of corn ears, the inner husks are torn into strips and used a little damp, when they are pliant and easily tied, answering a very good purpose. Many nurserymen, who have tried the corn-husk, prefer it to all other material, because it saves them the trouble of removing the bandages, as it decays rapidly, and yielding to the growth of the stock, it falls off before it cuts the bark, which a firmer bandage is apt to do.

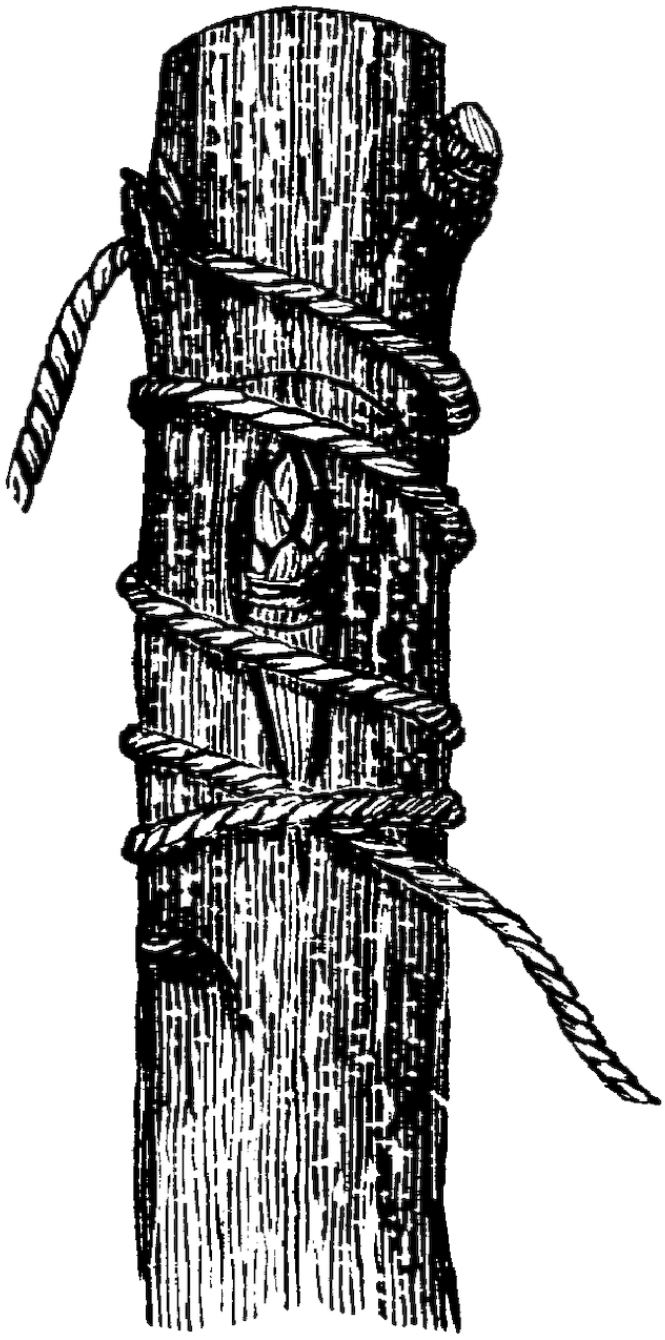

Fig. 22.—MR. JACKSON'S MANNER OF TYING THE BUD.

S.S. Jackson, whose improvements in budding have already been mentioned, also adopts another in tying. He holds that it is not at all necessary to hide the bud with the tie, the only requisite being to retain the parts in contact. He uses No. 3 cotton yarn, cut in lengths of a few inches, more or less, according to the size of the stocks; a couple of strands are pulled out from the cut bundles; the

first turn around the stock secures the end of the string by its own pressure, one turn more is taken below the bud and one or two above it, when the free end is passed into a cleft made through the bark above the point where the bud is inserted. This is found to secure the string sufficiently, and is easily loosened when necessary to relieve the tension caused by the continued growth, (fig. 22).

All ties should be loosened in the course of a couple of weeks, if the stocks be growing freely; otherwise they will injure the tree by strangulation. Sometimes it will be necessary to replace the bandage to prevent the effects of desiccation upon the bud, this is particularly the case with the cherry, and other fruits, that are budded early; but the tie is often left on the stock all winter, as a sort of protection to the bud. When loosening the ties, the buds are inspected and their condition ascertained; if they have failed, they may be replaced, if the stocks continue in a suitable condition. It is very easy to tell the success of the budding; the portion of the petiole left upon the shield is a very good index; if the bud has withered, this will also be brown and will adhere firmly to the shield; but, on the contrary, the bud and its shield having formed a union with the stock, the leaf-stalk remains plump, but changes color. Like a leaf-stem in the autumn, it assumes the tint of ripeness, and it will separate with a touch, and soon falls off.

The common method of removing the ties is to cut them with a single stroke of a sharp knife, when the bandage is left to fall off. Mr. Knight recommended two distinct ligatures, and left the one above the bud for a longer time uncut. When the buds have not been very fully developed, and when the stocks are very thrifty, it sometimes happens that the excessive growth about the incisions made for the insertion of the bud, completely cover up this little germ of a future tree, which is then said to be "drowned." Judicious pinching and shortening of the stock will prevent this effect, but care is needed not to pursue such treatment too far.

The stocks are generally headed back to within an inch or more of the bud, just as vegetation starts the next spring; but early set buds may be headed back so soon as they have taken, and will often make a nice growth the same season. This, however, is not generally preferred, and a late start in the growing weather of our autumns is particularly to be avoided, as the young shoot will not become matured before winter, and may be lost.

The advantages of propagating by budding may be summed up in the following remarks, which are presented even at the risk of some repetition.

This favorite method of multiplying varieties has some advantages over grafting, and is by many preferred on account of the facility with which it can be performed, and because it affords a means of increasing sorts in the nursery that have not been grafted, and of filling up gaps in the rows where grafts have missed; and it has been reported, that budded trees of certain varieties were more hardy than those which had been root-grafted. The objections, if such they can be called, are, that the period of performing the operation is limited, and that the young shoots from the buds generally have a curve that makes a crook or blemish in the tree when it goes from the nursery—neither of these objections constitute any real difficulty; on the contrary, the advantages quite over-balance them: as already suggested, it is a good plan for double-working certain varieties. The season for budding is at the period when the longitudinal growth of the stock is nearly completed, and when the wood-forming process is most active, so that the bark will part most freely from the wood—in other words, while the stock is still quite active in its circulation, but has, in a measure, made its growth. The scions used must have so far completed their growth for the season as to have filled their buds handsomely, but yet be so young as to allow the wood to part freely from the bark of the shields when they are cut. Those who desire to bud early, may accelerate the development of the buds by nipping off the points of the shoots to be used, this, in a few days, causes the buds to swell. The season of budding will thus depend upon the high culture of the nursery, and upon the condition of the trees from which the scions of buds are to be cut. Budding should never be done unless the stock is in perfectly good condition, if otherwise, it is labor lost. The old writers recommended damp, cloudy, or even showery weather; but under our bright summer skies our large establishments would never be able to dispose of their

work, were they to wait for such suitable weather. Fortunately it is not found necessary to select such a season, but the greatest success attends the budding that is done in fine bright and even hot weather. The scions should be kept wrapped in a damp cloth, excluded from the rapid evaporation to which they would be subjected if exposed—this is better than to keep them in water, which exhausts them by dilution of the sap they contain. The scions should have their leaves removed, so soon as they are cut from the tree; this is done with a knife or the thumb nail, leaving a short piece of the leaf-stalk for convenience when inserting the buds.

Spring budding is sometimes desirable, either to fill up gaps in the nursery-rows, or to secure varieties, the scions of which may have been received too late for grafting, or when it is desirable to multiply them as much as possible, by making every bud grow. When the operation is to be performed in the spring, the scions must be kept back, by placing them in the ice-house until the stocks are in full leaf, when the bark will peel readily, and the buds may be inserted with a pretty fair prospect of success; of course, the American method must be used in this case, as the wood and bark of the dormant scion will not separate.

The stocks should be cut down as early in the spring as the buds begin to swell, with a sharp knife, applied just above the bud, and on the same side; the whole upper portion of the stock must be removed by a clean cut; this is better than to leave a stump of three or four inches, as is often recommended, as a support to which to tie up the buds in their tender growth. All shoots from the stock should be rubbed out while young; this may need repeating a second time.

If the stocks were strong, the buds will make handsome sturdy trees the first season; the branched form may be assisted by pinching the points when a few inches high, as recommended with the grafts. Two year old stocks should make pretty trees, at one year old from the bud.

PROPAGATION.—SECT. IV.—THE NURSERY

APOLOGY—NURSERYMEN NEED NOT BE JEALOUS—SITE AND SOIL—ROOTS AFFECTED BY SOIL—FIBROUS ROOTS DESIRABLE —ROOT PRUNING—THE PLOW PRUNER—DIGGING TREES—HIGH MANURING—OBJECTIONS—CROWDING THE ROWS IS STILL WORSE —PREPARATION OF NURSERY SOIL—DRAINING—LAYING OUT— DISTANCES—BEDDING APPLE GRAFTS—MULCHING—THE ROLLER AS A CULTIVATOR—LAYING BY TREES FOR WINTER WITH THE PLOW—THE SUBSOIL LIFTER—THE PRONGED HOE—THOROUGH PREPARATION OF CUTTING BEDS—MANAGEMENT OF CUTTINGS— AUTUMNAL PLANTING—WINTER MULCHING—GRAPE CUTTINGS— FALL PLANTING—LONG CUTTINGS—SHORT CUTTINGS—TRIMMING —VALUE OF THE LEAVES—STOCKY TREES.—SIDE BRANCHES— SHORTENING-IN—WHEN TO REMOVE—HEADING-IN THE TREES —WHEN TO DO IT—AGE OF TREES FOR PLANTING—MAIDEN TREES—DISADVANTAGES OF LARGE TREES—BENEFITED BY ROOT PRUNING—THE HOME NURSERY—FIELD'S PLAN—THE NURSERY ORCHARD OF WHITNEY—WINTER KILLING—PREVENTION OF BY EARLY RIPENING THE WOOD—INJURIOUS ANIMALS—MOLES—MICE —RABBITS—PREVENTIVES—INSECTS.

The Nursery.—Be not alarmed, brother nurseryman, think not that all the arcana of your craft are to be exposed to the public; one small chapter cannot injure you, even were it wise and proper to retain knowledge exclusively in the hands of the guild; on the other hand, ye need not be afraid that one who owes you so much would turn tell-tale, and expose all your weaknesses to the gaze of the multitude. From my friends in the craft, the many intelligent men and keen observers, who have ever been foremost in the ranks of our country's pomologists, no censure is apprehended for attempting to dash off a few brief directions for the amateur, or even the nurseryman, who is just beginning to pursue as a business the pleasant occupation of growing trees. Any censure from others, if such there be, who would feel afraid to trust their knowledge to the world, and who might think in this enlightened age that such a thing as secrets of the trade could be long retained in their own hands,—any censure, from such a source, would fall harmless—it is not dreaded. Indeed, though not of the trade, it would be easy to expose the ignorance that is sure to be found among those who might claim to be the exclusive conservators of knowledge, such however is not the object in view, it is rather to extend useful knowledge, to popularize it and to bring it within the reach of those who may need it, that this chapter is undertaken; and the labor is the more willingly entered upon, in the firm conviction that the more the knowledge of plants and the love for them is diffused among the masses of our population, the greater will be the success of those who are engaged as professional nurserymen and gardeners, who need not fear the competition of amateurs, but should rather encourage it, upon the score of such persons being and continuing to be their best customers—if not from any higher and more noble sentiments of affiliation with men of congenial tastes and pursuits.

Site and Soil for the Nursery.—A somewhat elevated position should be selected for the ground that is to be appropriated for the production of trees; the surface water should be able to escape rapidly, instead of standing in the paths, and furrows, and trenches. The fresh air should be able to blow freely over the young trees, swaying them about, trying their fibres, and at the same time giving them new strength and vigor: not that they should be too much exposed to the rude blasts, as they might be upon the vast savannas of the West, where a protecting belt of deciduous and evergreen

trees, to a moderate extent, will be found of service, and conducive to the healthy development of young trees in the nursery. But even the naked prairie, exposed for miles in every direction, would offer a better location for the nursery, than a few acres cleared out among the heavy timber. Here the little trees, if crowded together, must be drawn up to meet the light, and will be poorly furnished with lateral branches, and unprepared to meet the rude battle with the elements that awaits them in their future orchard homes, which, indeed, too often become rather their graves, into which they are thrust, buried, not planted, and whence they rise no more, but after a fruitless struggle, dwindle and die.

A somewhat elevated situation is also valuable, on account of its greater probable immunity from frost, than a lower level; and this is often a matter of great importance in the successful cultivation of fruit trees.

The soil should be a good strong sandy loam, one that contains the needful elements for the growth of trees, and at the same time has a composition that will freely permit the passage of water through it, and be easily worked by the cultivator. Heavy soils, abounding in clay, are strong; but they are more retentive of water, they require more labor to keep them in a friable condition, and they are sometimes objectionable on account of the character of the roots produced in them. These are less abundantly furnished with fibres, as a general rule, when the tree has been grown in a stiff clay, than when it has been produced in a lighter and more porous soil. Mucky soils are too light, and should not be used for permanent nurseries, though valuable for seedlings, cuttings, and newly transplanted forest evergreens for a short period; unless the muck be underlaid by clay, and that it is near enough to the surface to be reached in the preparation of the soil, and to become mixed with its staple in cultivating it. Trees, for the orchard, should never be grown upon a mucky or peaty soil.

The different character of the roots formed by trees growing in particular soils, should not be overlooked by the propagator, since much of his reputation as a nurseryman, and the success attendant upon the labors of his customers, will depend upon the healthy development of these important organs, which have been called the mouths of plants. As elsewhere observed, peaty and mucky soils do not produce roots of a character well adapted to transplanting into upland soil. Very stiff clays furnish trees with long straggling roots that have feeble and scattered fibres; such roots do not present themselves in a good condition, nor are they easily separated from the soil, the tenacity of which often injures the slender fibrous portions, which it is desirable to preserve in transplanting. Sandy soils and sandy loams produce the very best roots, most evenly distributed, and also most easily preserved and removed when the trees are dug from the earth.

Much may be done by the intelligent cultivator, in any kind of land, to make good roots by proper treatment of his soil and trees. A thorough preparation of the ground, and disintegration of the soil, will conduce to this result; and thorough culture will maintain the good condition thus produced. Frequent transplanting will encourage the production of new roots from the cut ends of those that were ruptured in digging, and these will be within reach at the next removal. When taking up young trees, or when setting out seedlings in the nursery rows, the tap roots, and indeed all long straggling roots, should be cut back, with a view to producing the same result. When trees have remained for three or four years in the nursery rows, the fibres will have extended so far in search of food and moisture, that in digging them, the best portions of the roots will be left in the ground, and the young trees will suffer upon being transplanted in this mutilated condition. Such should be root pruned the season previous to their removal. This process is performed by removing the earth on either side of the row, until the roots are exposed, when they are cut off at from ten inches to a foot, from the tree, and the earth replaced upon them, the object being the formation of new fibres that shall be within the reach of the spade when they come to be dug for the orchard. Another plan for root pruning is, to use a very sharp spade, which is set down and pressed deeply into the ground, a few inches from the tree, so as to cut all roots that pass that limit. This, though a ruder method, is followed by good results.

Digging the Trees, is a process that should be conducted upon very different principles from those exercised in grubbing a thicket. The nurseryman wishes to clear his block, but the purchaser

hopes to save his trees, and to have them live, he wants a good share of their roots with them. No one need expect, however, to have anything like a large proportion of the roots of a tree removed from the ground; that is out of the question, unless they have been grown in walled stations, confining the roots, like those of green-house plants in their flowerpots. In open culture, they will have spread through the soil in every direction, and cannot be preserved and removed. Repeated root pruning will be of the greatest service in furnishing a great many fine roots within reach; but at the best, a great deal of damage is necessarily inflicted upon the roots by digging, and the older and larger the tree, the greater will be the injury, and the smaller the proportion of roots to the branches.

In digging trees, it is important to remove the soil very carefully on each side of the row to expose the roots, always holding the spade in such a position that its side and edge shall be in the direction of a radius, from the stem of the tree as a centre. Never stand facing the tree to be dug, but keep it next the elbow, at one side. On finding a root, withdraw the spade, and try again; and, having ascertained its direction, endeavor to loosen the outer extremities first. Proceed all around in this manner, and by gently swaying the trunk, the points of resistance will be indicated; these should be loosened and freed until all appear to be free, when, by grasping the collar as low down as possible, the tree is to be lifted gently and freed from the soil; no force should be used beyond that which is absolutely necessary, to lift the plant from its bed.

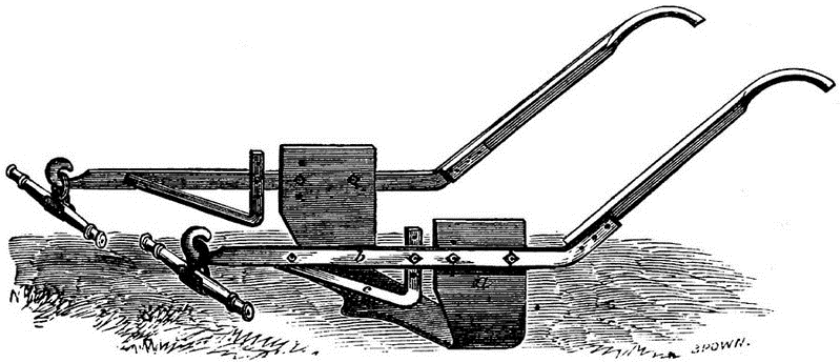

Fig. 23.—HARKNESS' TREE DIGGER.

In the great commercial nurseries, all this care cannot be exercised; everything must be done in the large way, and labor-saving appliances, the valuable results of human thought, but still not thinking nor observing intelligences, must be used. One of this class is the tree-digger, which, in the prairie soils, is used with very good success. It consists of a very large deep plow, without any mold-board, but with a wide sharp steel share, which is turned up at the edges, so as to cut the lateral roots at some distance from the trees. It is drawn on each side of the row, by four horses, hitched *ad tandem*. The trees may then easily be lifted from the loose prairie soil. The accompanying engraving shows the tree digger of Mr. E. Harkness, which is much used in the nurseries of Illinois and other Western States. The figure is sufficiently clear, without much explanation. The broad steel blade runs under the rows and is drawn by four horses, two working one before the other, or *tandem*, each side of the row. Some of our Western nurserymen find great advantage from the use of this digger in their free soils, and also for root pruning trees that are to remain in the rows.

In the sandy loams of New Jersey, a similar tool is used for digging peach trees, which is drawn by a span of heavy horses that are attached to the two separate beams, one being on each side of the trees. This implement is found to be entirely satisfactory in its operations.

High manuring in the nursery has been objected to by some orchard planters, who say that trees, which have been forced into a too luxuriant growth in their infancy, receive so severe a shock upon being transplanted to the open field, that they never recover. With the neglect which is so commonly accorded to young trees in the orchard, it is really wonderful how they ever survive at all, whether they

had been stimulated in their culture or not. The large majority of purchasers at the nursery always select those trees which are most vigorous, notwithstanding the prejudice against stimulating the trees, and then with mutilated roots, they probably omit cutting back the limbs sufficiently, and when their neglected orchard fails, they complain of the forced trees. The change from the good cultivation of the nursery to the careless culture and even neglect of the farm, is certainly hard for the poor things to bear. Late growth, encouraged by high manuring, is injurious. There is a much more serious fault of the nursery than stimulating with manure and high cultivation, and that is the too common error of crowding the trees; but even this has its origin partly with the purchaser, who too often wishes to have his trees drawn up as high as possible; instead of demanding low heads he asks for high ones, and will sometimes offer a premium for trees that have grown in one season, the second from the root graft, eight or ten feet in a single shoot, so that he may at once calculate upon forming the head where he wants it, out of the reach of his horse; a calculation, however, which he will not realize.

The Preparation of the Soil for a nursery should be as deep and as thorough as possible, for some things it is best even to trench the ground; but generally, the thorough plowing, with a deep-tiller, or a trench-plow, will be sufficient, and if followed by the subsoil lifter, so much the better. One of the most intelligent horticulturists, and most successful nurserymen in the country, finds that he can produce a better result in depth and fineness of tilth, by using the Double Michigan plow, than he can with the spade. A piece of clover-sod thus plowed in the fall, and subsoiled at the same time, will be in fine order for nursery purposes, after a thorough cross-plowing and harrowing in the following spring. If the land has been under-drained, so much the better. There is little good land that would not be much improved for nursery purposes by tile draining.

If manure is to be applied, it may be spread upon the clover-sod before plowing, or it may be thrown upon the plowed ground at once or at any time during the winter, to be worked into the soil by the spring plowing; if composted, it may be spread just before the spring stirring.

Laying Out.—In laying out the nursery, some taste may be exercised by the planter; the sections and blocks should be distinct, and alleys should be located at convenient distances, so that all parts may be easily accessible with the wagon. The rows should be laid out straight, and they ought to be far enough apart—four feet might be a good average for nursery trees; cuttings and seedlings may, of course, be nearer. The trees should not be set too closely in the rows, one foot apart is plenty close enough for most kinds, and that is little enough room for the development of good lateral branches, or for those which have to remain three or four years before transplanting. For peaches, for dwarf pears, and indeed for any of the varieties that are to be taken from the nursery as maiden trees, a less space may be allowed—say eight inches apart. Apple stocks for budding, or for collar grafting, may be set ten inches apart, and they will have room to make very good plants, even should they remain until two years old.

Most nurserymen set out their apple grafts in the rows where they are to be grown to full size, and cultivate them from two to three years; while this saves the trouble of transplanting, the trees will not be as well assorted for size, nor will they have the benefit of the transplanting, (which will enhance their value much more than it costs, in the improved character of their roots), as have those that have been treated on the bedding plan, practiced by some nurserymen. This consists in setting the root grafts closely together, in a bed of very well prepared ground; they are covered at once with a good mulching of sawdust, which keeps the ground moist, and insures the growth of almost all the plants, while for the first season they occupy very little space, and are readily kept clean, as the mulching prevents the growth of weeds. In the fall, or in the following spring, they are taken up, assorted for size, and re-planted in the nursery-rows where they are to stand. This transplanting improves the character of their roots, which are more fibrous and shorter than in those trees which have stood three or four years without being disturbed. Purchasers, now-a-days, begin to look at the roots of their trees, as well as the tops; and it may become necessary for the nurserymen to gratify this fancy for low-headed, stocky trees, that have abundant fibres to insure their growth, and their early fruitfulness.

Culture of the nursery should be thorough; the soil should be frequently stirred, and kept mellow and loose, to insure cleanliness and thriftiness, and to make handsome trees. The mellow soil upon the surface, is, by some persons, considered equal to a good mulching, and indeed it answers the indications of one. Cultivation, to kill the weeds as fast as they appear, will admit both air and moisture; a share of both of these is retained by the mellow earth, which, thus treated, is indeed a very good mulch. The cultivation may be done with the small turning plow, with the double shovel, or with any of the many approved cultivators in use everywhere throughout the country. The surface should be kept as level and even as possible. In some soils the roller, made short enough to pass between the rows, is highly esteemed, and is considered a most valuable implement in the nursery. As a general rule, cultivation should not be continued too late in the season, but should be suspended about mid-summer, so as to prevent a late growth and to encourage the plants to finish their summer's work in time to ripen their wood thoroughly before the advent of winter. This is particularly necessary where the climate is severe, especially on new lands, where the trees are very vigorous. Upon the approach of winter, it is a good practice to plow a light furrow against the trees on each side; this protects the collar from cold, prevents heaving by the frost, and gives a good surface drainage to excess of water.

For deeply loosening the ground between the rows, the one-horse subsoil lifting plow is a very valuable instrument; this can be used in very narrow spaces. This plow prepares the ground admirably for the pronged hoe, and it may be used between rows of cuttings and seedlings.

The Pronged Hoe.—One of the most valuable implements in the nursery to clean out the weeds from between the trees, and also to work among cuttings, and other plants, that are set too closely for the use of the horse, is the pronged hoe; it makes the best shallow culture, prevents the soil from becoming hard, and it is the best destroyer of small weeds that can be used. The flat hoe is never sharp enough to cut all of the weeds effectually, it produces little tilth, and the result of its use is too often a disappointment, but half killing the weeds, in some places, and dragging them out by the roots in others, and often leaving the ground hard and in miserable condition.

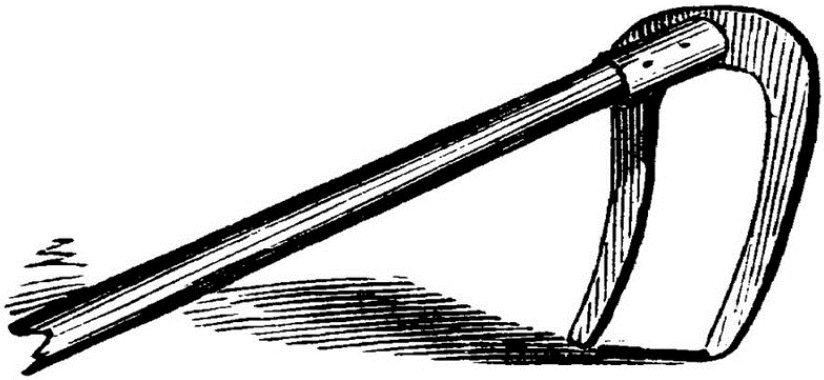

Fig. 24.—THE PRONGED HOE.

Planting Cuttings.—Some of the small fruits, as currants, gooseberries, as well as the quince, are propagated, to a great extent, by cuttings. The ground for growing them, should be very well prepared by trenching or trench-plowing; the difference in the growth between cuttings set on well or on poorly prepared ground is astonishing, and the advantage in favor of trenched land is sufficient to pay for the extra expense bestowed upon the preparation. The soil should be rather sandy, decidedly loose and mellow, and rather moist than dry.

In setting the cuttings, the rows may be quite close, as horse labor is seldom employed among them; but they are tended by hand, or the ground is mulched. They may also be set quite thickly in the row, as they are to remain but a short time in the cutting bed, from which they are transplanted at one year old, though sometimes alternate rows may be left over another season. When the trench is

opened for them, the cuttings are set, three or four inches apart, next the line, so that only the top bud shall reach the surface; a little mellow soil is thrown upon them, and they are tramped firmly at the base, when the remainder of the earth is thrown in and the next trench is opened for another row. If they be planted in the autumn, it is well to cover them with a mulch, and for this leaves from the forest are an excellent material. Some propagators insist very strongly upon the necessity for removing all the buds from the lower portion of the cutting, particularly in the currant and gooseberry, so as to prevent suckering and to grow the bush as a miniature tree, with a single stem. This is not desirable when the bushes are liable to have the stems destroyed by the currant borer. Indeed, the nature of the currant appears to require a renewal of the wood by these shoots, which come to replace the old exhausted branches.

The grape is grown in immense quantities from cuttings, which are either planted in a nursery, or set at once in the vineyard. In the former they are planted closely in rows, that are about twenty inches apart. Sometimes the ground is trenched, and the cuttings set at the same operation. When the first trench is opened in a rich mellow loam, which may be sod or clover lea, the edge of the dug soil is dressed to the line with the spade, then the cuttings are placed so as to have one eye at or above the surface, and soil is thrown in and tramped closely to the base of the cuttings. Then the next trench is made with the spade, digging the ground as you proceed.

Grape cuttings are generally made eighteen or twenty inches long; and those which have a heel of old wood are preferred, and command a higher price. The earlier these are taken from the vines, after the fall of the leaves, the better success will attend the plantation; provided they are not too long exposed to the air. Fall planting is very desirable, but if not then planted, the cuttings should be put into the ground and covered as soon as convenient, and they will be better prepared for spring planting. A deep trench is opened, into which the bundles are set in a vertical position, and loose earth filled in about them, and slightly covered over them; they will then be ready for planting by the spring. The length of the cuttings has latterly been much reduced, with advantage; some of the most successful planters make them from six to eight inches long: these are much more easily dug than the longer slips, and are better provided with roots.

Trimming should be practiced in the nursery with a definite object in view, and not at random; much less with any expectation of increasing the hight of the trees by trimming them up. The object in pruning nursery trees should be to develop them in every part, to produce a stout stocky sturdy little tree, one that may be turned out upon the bleak prairie, and be able to withstand the blasts. To produce this result, the leaves should never be stripped from the shoots to make them extend their growth, for the sake of making more leaves; the nurseryman should know the value of leaves, as constituting the great evaporating surface that plays a most important part in causing the ascent of the crude sap, and also in its elaboration after it has been taken up into the organization of the plant. Leaves should be carefully preserved, and in the trimming, which is necessary, this should be borne in mind. To make vigorous, stocky trees, the side branches should be encouraged rather than pruned off. The tops may sometimes need to be pinched, to force out the laterals, and to encourage their growth; if two shoots start together as rivals, one of them should be topped or cut back, or twisted and broken, but not cut off at its origin, unless there be plenty of lateral branches or twigs to furnish the tree. When these become too long, they may be spurred-in, either in the fall and winter when cutting grafts, or in the summer, during the growing season. Whenever it becomes necessary to trim off any of these laterals, it is best to do it at mid-summer, as the healing of the wounds made at this period is very rapid. Heading off the nursery trees is done to force them to branch out uniformly the second year, to form their heads at the right place; this is to be done toward spring, and is applicable especially to those varieties that are prone to make a single shoot the first year without branching, and which have not been pinched-in or headed during the previous summer to force out side branches. Cherries, plums, and pears, and some apples, are very apt to make this kind of growth. It should have been premised that all nursery trees ought to be grown to one main stem, or leader, from which all

the branches arise, and to which they should all be made to contribute their quota of woody fibre. It has been asserted that the wood of a tree, instead of being a cone, as its stem appears to be and is, it should be a column of nearly equal size from the bottom to the top; that is, the mass of all the branches taken together, should equal the diameter of the trunk at any point below. A well-grown stocky nursery tree, with its abundance of lateral branches approximates this idea; but the main stem of such an one is very perceptibly a cone, rapidly diminishing in diameter from the collar upwards.

Age of Trees for Planting.—This depends so much upon the views of planters, that the nurseryman cannot always control the period at which he shall clear a block of trees. Peaches should always be removed at one year from the bud. Plums and dwarf pears will be ready to go off at two years from the bud or graft; so with apples and cherries. But many persons, purchasers and sellers, prefer larger trees, and they recommend that the trees should remain one, two, or even three years longer in the nursery. Others, a new school of planters, prefer to set out the maiden tree, in most of the species above named, except some very feebly growing varieties, that will scarcely have attained sufficient size to risk in the orchard. The nurseryman should beware of keeping his trees too long on his hands; they may become unprofitable stock, and are sure to require much more labor in the digging and handling. The purchaser is his own master, and his tastes and wishes must be consulted; if he wants large trees, by all means, let him be indulged; he will have to pay in proportion, he will have more wood for his money, more weight to carry, or more transportation to pay for, more labor in planting, and vastly increased risk of the life of his trees; but, let him be indulged with his five year old trees, while his neighbor, for a smaller sum invested, with less freight, less wood, less labor, and infinitely less risk, will plant his maiden trees, and five years hence will market more fruit.

The risk of transplanting large or old trees from the nursery, may be greatly diminished, and their value will be vastly enhanced, by judicious root pruning in the nursery-row. This may be done by digging, on either side, on alternate years, and cutting off the straggling roots, and particularly those that run deeply; this will be followed by the production of a multitude of fibrous roots that put the tree into a good condition for transplanting. In the great nurseries of the West, there is a peculiar plow, which is used for root pruning the nursery rows.

The Home Nursery has been recommended by Mr. Field in his *Pear Culture* as a means of enabling the orchardist to amuse himself, and to grow his trees in such style as he may prefer. He advises to select trees "of two or three years' growth, and prepare a piece of ground for the home nursery. For this a rich, deep, dry soil should be spaded and thoroughly pulverized to the depth of two feet, (trenched). In it plant the trees in rows four feet distant, and three feet apart in the rows. Two hundred trees would thus occupy a space fifty feet square. The roots having been carefully examined, and, as before mentioned, the laterals pruned to six or eight inches, are spread out horizontally, and gently covered with earth. It will be seen that the labor of pinching, pruning, and cultivating, will be much less on so small a spot, than when the cultivator is obliged to travel over three or four acres upon which they are ultimately to be planted.

"If at the end of two years it is still desirable to allow them to remain, a sharp spade should be thrust down around them, at a distance of fifteen or eighteen inches, in order to cut the long straggling roots, and thus induce the formation of fibres nearer home. This will fit them for transplanting at an advanced stage of growth. In this case, if at the end of two or three years, they are removed at the proper season, and with care, they will suffer scarcely any check. By pursuing this plan, they receive better care, grow faster, and are not liable to damage; and as only the good trees will, in this case, be set in the fruit grounds, none of those unseemly breaks in the rows, caused by the injury or death of a tree, need occur. Where, however, older trees, at least once transplanted, cannot be obtained, and it is desirable to set out the orchard at once, stout two-year old trees are decidedly preferable. Such trees have not stood sufficiently long to send their roots beyond a limit whence they can be removed; and with careful digging, removal and planting, the purchaser need not fear a loss of more than two per cent."

The Nursery Orchard, as practiced by A.R. Whitney, of Lee Co., Ill., now one of the largest orchardists of the country, is well worthy of imitation by all those nurserymen, who desire also to become fruit-growers. In laying off the blocks of nursery stock, the varieties that are wanted for the orchard, should be planted in such a manner, that they shall be in every fourth row, so that the orchard trees will stand in rows sixteen to twenty feet apart, according as the nursery-rows are four or five feet wide. In cultivating and trimming these rows in the nursery, a plant is selected, every twelve or sixteen feet, which is to remain as the orchard tree when the block shall be cleared. A good tree is selected, and special care in the pruning is bestowed upon it to secure the desired form, and low branches; if necessary, the tree on either side of it is removed, to give it room. By the time the block is cleared, these orchard trees are often in bearing, and while his customers are struggling to save their trees, and nursing them after their transplanting, the nurseryman will have become an orchardist, and is enjoying his fruits. The nursery will have become an orchard—one rather closely planted to be sure—but the trees can be dwarfed by root pruning with the plow, they shelter one another from the prairie blasts, and when too thick, alternate trees may be removed to the wood-pile, and thus cheer the owner on a winter's day.

Winter-killing is a serious evil in the nursery, as by it whole rows and blocks of certain varieties are sometimes destroyed, or very seriously injured. It has been observed to be most marked in its effects upon those sorts of trees that make the most vigorous and sappy growth, and those which continue to grow late in the season. Such varieties have very naturally acquired the epithet of *tender* especially as orchard trees of the same kinds, even in a bearing state, have been similarly affected; in some sections of the country, these kinds have been thrown out of cultivation. The bark looks shriveled and withered, the twigs seem dry when cut, and resist the knife; when thawed by the fire, or on the return of spring weather, the bark seems loose, and the inner bark, instead of being greenish-white, becomes brown, and the whole tree looks as though it was dead. In old trees, large portions of the bark start from the stem and large limbs, and hang loosely for awhile and then fall off. The buds alone retain their vitality, and upon the return of spring they sometimes succeed in establishing the necessary connection with the soil, and restore the circulation of the sap; the results are the deposit of the usual annular layer of woody matter, which encases the dead portions within, that become like a *sequestrum* of dead bone in an animal. The best treatment for the trees that have been winter-killed, is to cut them back very severely, in the hope of producing a vigorous wood-growth the next season, to repair the injury.

A partial winter-killing often affects small nursery trees, especially on low and wet, undrained soils; the plants recover, but for years they have a black point in the heart which embraces all of the wood-growth that was affected—all their wood at the period of the disaster. This is enclosed and surrounded by clear, healthy wood; but such trees are not desirable, they are so fragile, as to be easily broken.

The best preventive for winter-killing in the nursery, is to encourage early ripening of the wood, and to drain the land, is one of the best means of producing this effect; another is the cessation of culture at mid-summer, and the sowing of oats very thick at the last cultivation, has been practiced, and, it is thought, with excellent effects. The rank growth absorbs the superfluous moisture, robbing the trees, and afterwards forms a good protective mulch during the winter. The objections to it are, that it encourages the mice, which, by girdling the trees, effectually winter-kills them.

Many nursery and orchard trees often present a black discoloration of the bark, which is quite unsightly, and excites alarm for the health of the tree. This is often caused by trimming at unfavorable periods; in the spring pruning of bearing trees, the large stumps sometimes bleed, but in the nursery trees it arises from cutting them, and especially in the barbarous trimming up, during severely cold weather, when they are frozen.

Injurious Animals and Insects.—The nurseryman sometimes suffers from the depredations of some of the smaller animals, which cause him great annoyance. The mole, though highly

recommended by the naturalists as a harmless beast, who is an aid to horticulture by his insectivorous habits, is nevertheless injurious in his *ways*; for he often makes his run in the seed bed, or along a row of root grafts, and raising them from their stations break their tender rootlets, when the sun and air soon destroy them. Mice, of different kinds, are still more destructive, particularly in the winter, when they will often girdle young trees near the collar, and do much mischief. They also devour many seeds after they have been committed to the ground, particularly those sown in the autumn. For both of these animals, the best preventive is to catch them, which may be done with traps. They may also be poisoned. The young trees may be protected from the mice by keeping them clear of rubbish, that would shelter these animals, and when snow falls, it should be trodden down closely about the trees. Owls and cats will do their share in the destruction also, but they will also take the friendly little birds.

Rabbits are also very apt to bite off young shoots, and to bark trees of larger growth in the nursery, as well as those that have been set out in the orchard. Various methods have been suggested to prevent their injuries. Wrapping the stems with strips of rags or with ropes of hay, was formerly the method practiced by those who wished to save their young trees; the process is tedious and troublesome. A few pieces of corn-stalk have been placed by the stem of the tree and tied to it; this, too, is a troublesome procedure, though, like the others, it is efficacious. A still better plan in this class of preventives, is a half sheet of common brown wrapping paper, made to encircle the stem, like an inverted funnel; this need be fastened only at the top, by a little thin grafting wax applied with a brush at the instant, or the paper may be tied with some common white cotton string. This envelope keeps off the rabbits, and lasts through the winter; the string will decay before the growing season returns, so there is no danger of strangulation. All the other wrappings must be removed, or they will injure the trees and afford harbor for insects. It will be observed that all applications of this class, are adapted only to trees that have a clean hole without branches, but are not suited for those which are made to branch at or near the ground. Besides, in countries where snow abounds, these little marauders are elevated above the wrappings, and have fair play at the unprotected parts of the tree—on this account another class of preventives has been adopted.

These consist in applications that are obnoxious to rabbits, which, being nice feeders, are easily disgusted. White-wash, and white-wash made with tobacco water, soap, whale-oil soap, grease, blood, and especially the dead rabbit itself, freshly killed, have all been used with happy results, in that they have driven these animals to seek their food elsewhere. A very good application, and one that may be used upon a low-branched tree as well as to the smooth clear stem of one that is higher, is blood. This is put on with a swab; a few corn husks tied to a stick, answers very well. Dipping this into the vessel of blood, the swab is struck gently against the stem or the branches, as the case may be, and the fluid is spattered over it. A very little will answer to keep the rabbits away, and the effect will continue all winter, notwithstanding the rains.

Certain insects also prove injurious in the nursery, among these the most numerous are the *aphides*, which are found upon the roots of some fruit trees, especially the apple. Others of this disagreeable insect appear upon the foliage, among these one of the most disgusting is the one which causes the black curl, on young cherry trees. The pear tree slug, (*Selandria cerasi*), destroys the foliage of many young trees in the nursery; caterpillars also do their share of mischief. A serious trouble in old nursery grounds, especially where manure is used, is the grub of the May beetles, of which there are several species. These grubs are whitish, nearly as thick as the little finger, with a brownish head. They cut off the young nursery trees at three or four inches below the surface. We have seen two-year old stocks cut in this manner, and the work of destruction was so complete, that the proprietor of the nursery was a long time in attributing it to such an apparently inadequate cause as this sluggish, soft-bodied grub. All of these, with other insects injurious to fruit, will be considered in their appropriate place.

CHAPTER IV

DWARFING

DEFINITION OF—OBJECTS—EARLY FRUITAGE—DEFINITION OF TERMS. DWARFING STOCKS—OTHER MEANS OF DWARFING—DWARFS AND STANDARDS. PYRAMIDS OR CONICAL—ESPALIERS—LAYING BARE THE MAIN ROOTS IN SUMMER, TO DIMINISH THE VIGOR OF THE TREES—REMOVING A PORTION OF THEM—ROOT-PRUNING—TRANSPLANTING—EUROPEAN ESPALIERS AND WALL FRUITS—DU BREUIL'S CORDONS—CROWDING, AS A MEANS OF DWARFING—PINCHING, TWISTING, AND FRACTURE—FIELD'S PEAR HEDGES—OUR CLIMATE DOES NOT REQUIRE THESE MEANS OF TORTURE—FACILITY OF PROTECTION MAY RENDER THEM DESIRABLE—GENERAL INTRODUCTION OF QUINCE-DWARFED PEARS IN THIS COUNTRY—MANY FAILURES—SUCCESS DEPENDS UPON CARE—FRENCH SUCCESS—CHINESE—UNCONGENIAL STOCKS—IMPERFECT UNION—PINCHING—HIGHEST PERFECTION OF THE ART OF HORTICULTURE—EQUALIZE THE FLOW OF SAP—NATURALLY FLOWS TO HIGHER PARTS AT EXPENSE OF LOWER, MAY BE REGULATED BY TRIMMING—BY DISBUDDING—BENDING DOWN—PINCHING THE STRONGER, AND ENCOURAGING THE WEAKER—ILLUSTRATION IN THE STRAWBERRY—DWARFING THE APPLE—PARADISE STOCK—THE DOUCIN; UNFIT FOR ORCHARDS—ROOT-PRUNING—HOW IT OPERATES—TIME TO BEGIN—HOW TO BE PURSUED—SEASON FOR—EXPENSE—ROOT-PRUNING PLOW.

Dwarfing consists in so controlling the growth of plants as to reduce the natural size of any of our fruit trees, and bring them within comparatively narrow bounds. The objects of dwarfing are to enable us to plant a large number of specimen trees, or of varieties upon a small piece of ground, or to have small trees beside the alleys of our gardens. Such plants are also well adapted for growing in pots, or in the borders of an orchard-house. It is claimed for dwarfed trees, that they are more prolific than those which are worked on free stocks, which are often erroneously called standards, and it is also asserted that these dwarfed trees will bear sooner and produce finer and larger fruit.

The terms used may as well be explained at once. When we speak of dwarfing stocks, we mean such as are so uncongenial as to check the wood-growth; and thus, while producing smaller trees, they have a tendency to early fruitfulness if properly managed. But this condition may be superinduced by other means than these. Hence in speaking of dwarf pear trees, it does not follow that they have been worked on the quince or other uncongenial stock. A dwarf tree, of whatever kind, is simply one that has been caused to assume diminutive proportions. Dwarfing stocks are contrasted with free stocks, or those which would have attained the full size of the species, and which, when grafted, produce large trees. These are often mis-called standards, when contrasted with those that have been worked on the quince, or other dwarfing stock. Whereas, the trees propagated on free stocks, may also be dwarfed, by means that will be presently detailed; and the term standard refers really to the mode in which the training of the specimens has been performed. Those which are trimmed up as orchard trees are usually treated as standards, and are said to be trimmed to standard hight. Those branching at a lower point are called half standards. Those which are branched so low as to conceal the stem of the

tree, and in which the limbs are so well managed that the lower ones are always the longest, and those above them gradually contracted to the point at the top, are called pyramids, or more properly conical trees. Whether dwarfed or not, trees may be trained in a variety of forms, such as the columnar, sometimes called the *quenouille*; the vase or goblet form may be given them, or the parasol shape, and they may be made to assume the form of a fan or other mode of extension laterally, when trained upon a wall or espalier frame, as may be seen in the illustrations given by Du Breuil; but it is seldom that our gardeners are willing to bestow the care and attention necessary to produce these results.

The vertical and oblique *cordons* represented and recommended by Du Breuil are very attractive, and admirable methods of training and dwarfing fruit trees, and of crowding a great many into a small space. His method of making an edging to the fruit-border with dwarf apples, inarched together so as to form a connected tree for its whole length, is a capital illustration of the control we may exercise upon vegetation.

Standards and pyramids are often trained as weeping trees, for the sake of gratifying the fancy of the cultivator, and with a view of bringing on that early productiveness which results from the check of the upward current of sap that is incident to such a mode of treatment. This is really a kind of dwarfing so far as it goes, and if commenced early in the life of the tree, it may become very effective, especially when combined with other means of reducing the growth. These are formed by arching the branches, tying their tips to a ring of wire or hoop secured near the ground, or simply by fastening weights to them sufficient to keep them in the desired position, and by tying the upper limbs to the lower ones. As is well known, the sap flows most readily toward the shoots that occupy a vertical line; it will be seen that its ascent will be seriously retarded in those that are bent, and their vigor will be diminished, and fruit-bearing will be promoted. This process must not be continued too perseveringly, lest the tree become exhausted by over-production.

Du Breuil recommends laying bare the principal roots of the tree in the spring of the year, so as to expose them for the most of their length, and leaving them in this condition during the summer. This exposure of roots to the sun and air diminishes the vigor of the tree, and hence it tends to the production of fruit. He also recommends the removal of a part of the roots in the spring, and replacing the earth; considering this a more energetic operation than the preceding, he advises caution, lest we injure the tree. This is simply root-pruning, a plan that has been pretty thoroughly tested in this country, where, perhaps, its beneficial effects are more needed than in any other, and where we shall even find it advantageous to have recourse to mechanical means for its performance in large orchards by horse-power, as will be set forth in another place.

Конец ознакомительного фрагмента.