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THE NEW HORTICULTURE

H. M. STRINGFELLOW

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BY
H. M. STRINGFELLOW

UNIVERSITY OF
CALIFORNIA

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DEDICATION

WITH feelings of the deepest appreciation for their invaluable services in behalf of the New Horticulture, I now dedicate this new and revised edition. First, to *Farm and Ranch*, the only journal in the whole country that nearly twenty years ago opened its columns to what all others considered the visionary "pipe dreams" of a crack-brained enthusiast and declined to publish, thereby affording me opportunity to present these great natural horticultural truths, and save them from perishing from off the face of the earth.

Second, to Thomas L. Brunk, then professor of horticulture at the Texas Agricultural and Mechanical College, the very first man to whom I confided them, who at once recognized their inestimable value, and the next year verified a part of them at the Maryland Experiment Station, to which he had been called, and from which he was discharged for wasting his time and issuing a bulletin on such wild vagaries. Disgusted at such blind prejudice, he embarked in another line of business successfully.

Third, to E. W. Kirkpatrick, the nurseryman and public-spirited citizen, whom all Texans love to honor, who was not only equally prompt to see these great truths but at once put them into practice, recommending them also in his catalogue to his customers, and boldly advocating them in public. To those three, the fruit-growers of the world owe a lasting debt of gratitude; but for them, they would still be in the bondage of that trio of horticultural tyrants, the plow, the cultivator and the pruning knife, who with their prime minister, the little bacterial devil, "brown rot," have from time out of mind levied a tribute upon their earnings that far surpasses in amount the fortune of a Rockefeller.

H. M. STRINGFELLOW.

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CHAPTER I.

The New Dispensation.

I N presenting the second part of this volume to the attention of the fruit-growing public, I do it with a feeling of confidence that the time is ripe for a new dispensation of horticultural truths, and while they may, with their novelty, startle from their sleepy routine many of the high priests who minister around the altars throughout the country, the kindly reception awarded them in this section is an earnest of their general adoption everywhere in the near future. The public now demand the best of fruit, and they want it cheap. The day of high prices has probably gone forever, and it is a doubtful question whether fruit-growing, with the short-lived, unproductive, diseased and insect-ridden trees of to-day, and their uncertain crops, now pays. To practice the most advanced methods (taught by Mr. J. H. Hale, for instance, on peaches, and by others on apples, pears, etc.) requires an expenditure that is often not even covered by the receipts. The amount of extra nurturing, coddling and special petting, sometimes called "intensive handling," in the way of cultivation, pruning, thinning, fertilizing and spraying, to make pay an orchard grown from three- or four-year-old, long, fibrous-rooted trees, is appalling; and when we contrast it with the certain, cheap and easy-going style in which the twenty-year-old Rambo apple tree, mentioned in the last chapter of this volume, brings in the dollars, we may well cry, "Hasten the good time when all fruits can be thus grown!" That is the mission of this gospel of the "New Horticulture" I now advocate, which, though nominally new, is really as old as the morn in spring in the long, long ago, ages before Eve plucked and Adam ate the apple, when the warm sunbeams kissed the dew from the first modestly opening fruit blooms, whenever that was. Its principles, from which we have now wandered

so far, to our great loss, are identical with those practiced from the beginning by wise Mother Nature. With lavish hand she scattered the seed that fell upon the solid earth, and produced trees after their kind, from which, down through the puzzling maze of ages of evolution and the survival of the fittest, where her original forests stand, she now presents to our admiring gaze majestic evidences of her skill. To illustrate those principles is the main object of this book. Plain as they are, I stumbled over them for years, like the rest of the horticultural world, blind to the patent fact that in all their peculiarities of growth and treatment, both fruit and forest trees are the same. They are both the result of specific conditions and surroundings. No fostering hand of man, with friendly cultivator, spade or plow, was present during the millions of years of their evolution, to kindly aid in their struggles with climatic adversities the sturdy monarchs of the forest, which from the frigid to the torrid zone, in slowly changing cycles of climate, have crowned the rocky hills and mountains and covered the broad valleys with their sheltering boughs. So they have, through succeeding generations, adapted themselves perfectly to their environments by the survival of the fittest, and from age to age found in the firm, unbroken virgin soil, with no disturbance of their surface roots, the conditions best suited to their perfect development. The same law applies to fruit trees as well.

Perhaps, if our horticultural scientists had their way, and through successive generations of like-minded descendants, could but grow fruit trees for a million or so years more, continuously from long-rooted ones, on ground subsoiled and deeply pulverized, they might ultimately, like nature, evolve a race of trees that would prefer and thrive best on such a soil, and fruit perhaps as well as Mr. Pierce's Rambo apple tree, alluded to hereafter, or live as long as the old Seckel or Sudduth pear. But the trees we now have to deal with retain too much of the perversity of their wild parents not to kick at such treatment. The experiments recounted later on, of Mr. Patterson and the squirrels, and the stunted pear trees in my Hitchcock orchard, on a muck bed, with two feet of

rich surface soil beneath them, prove this beyond all doubt. Seeing, then, that they foolishly reject our efforts in their behalf, why not, as it costs so much less, and the trees produce so much more and finer fruit, indulge them in their long-time preferences. However, before entering my plea for this course, I will in a short digression make some remarks: 1st, on the old primitive orchards of our forefathers; and, also, 2d, give a short account of how I happened to hit upon the great fundamental principle of all entirely successful horticulture, that the nearer we can bring a transplanted tree to the form of a seed, the better it will be for the tree, as will be seen by the following recent extract from *Farm and Ranch*:

While viewing the path of the recent tornado that swept through the city of Sherman, Texas, destroying scores of precious lives and happy homes, I noticed the effect of the force on the trees. Some trees were uprooted, some snapped off above ground, some stripped of limbs and bark and others were twisted into splinters. One large post oak, about two feet in diameter, was splintered and twisted like a huge rope. A large apple orchard was uprooted, and I searched in vain for a tap-root on any of those apple trees. They had the appearance of being planted with long roots and tramped into a small hole, with the point of the roots near the surface where they remained and continued to grow. The soil was rich, sandy loam on deep, rich, moist clay. The forest trees were large and strong, and most of them refused to be uprooted and were snapped off. Had these trees been planted so as to induce the growth of strong tap-roots, evidently they would have been larger, stronger, healthier and more fruitful.—E. W. KIRKPATRICK.

CHAPTER II.

Old Primitive Orchards.

THERE is no more interesting subject for investigation, nor one that has puzzled observers more completely, than why we are unable now to grow as healthy, long-lived and productive fruit trees as our forefathers. Many and various have been the theories advanced, but the most general one seems to be that in the early settlement of the country the vast forest area had a mysterious and potent influence on climate and tree diseases, and that the gradual clearing of the land has, somehow or other, changed conditions so radically that fruit trees in general, and certain varieties in particular, no longer succeed as they formally did. Where once in the eastern states the apple and the pear attained the giant proportions of forest trees, now, as a rule, they crouch and cower in valley and on hill, their puny, stunted, blighting offspring a pitiful burlesque, in many instances, of their grand old sires.

I came across a statement a few days ago, that in 1721, a small "settlement of forty families near Boston made three thousand barrels of cider, and another New England village of two hundred families made ten thousand barrels." Presumably they reserved fruit enough for all domestic uses, fresh and dried, and this vast amount of cider was simply from the surplus fruit. Remembering that those were days of small family orchards, not of thousands of acres like we now plant, can we anywhere find a parallel in productiveness to-day? The trees that gave those enormous yields were presumably either seedlings, root grafts or grown from small one-year maiden trees, with few roots when set, except the tap, and those doubtless cut off not far below the surface. The nurseryman, with his large, fine, three and four-year-old, long, fibrous-rooted trees, like those now sold, had not yet

appeared upon the stage to captivate those rustic growers with visions of early fruit. And while on its face there may seem to be some show of reason in this theory of climatic change as the cause for all this acknowledged inferiority and decay, yet when examined in the cold light of statistical climatology and actual experience, it crumbles, a baseless fabric, to the ground. The records, from the earliest times, show no material change in average temperature or rainfall between then and now, and we still have, here and there, all over the country, strong, vigorous and productive old seedling trees, like the Sudduth pear in Illinois, and the Arkansas Mammoth Black-Twig apple, which show beyond all doubt that in certain places, and under certain conditions, it is still possible to grow apple and pear trees fit companions to those of long ago, and which tower among the fruit trees of to-day, like Saul among his brethren, head and shoulders above them all. These hale old mementos of by-gone days are living witnesses against the theory of climatic change, for C. M. Stark, of Missouri, in *American Garden* of January, says: "The original Mammoth Black-Twig apple tree is still standing near Rhea's Mill, in Washington county, Arkansas, and bearing fruit, and at the recent meeting of the State Horticultural Society of that state, at Fayetteville, there was an exhibit of apples from this tree labeled, 'M. B.-Twig, from the original tree, sixty-five years old, two feet eight inches in diameter 2½ feet above the ground.'" And yet, just across the state line in Kansas, the well-known king of apple growers, Mr. Frank Wellhouse, the owner of 1,200 acres of trees, plants sixteen feet apart in the rows, because in twelve or fifteen years he finds that his long-rooted, well sprayed and cultivated trees, standing on thoroughly prepared ground, cease to pay.

These being some of the facts in the case, what is the true answer to the New York Legislature's call last year for information as to the acknowledged decadence of modern orchards, especially the apple? It will not do to talk apologetically, in explanation of repeated crop failures, about the great number of fungous enemies, late frosts, dry seasons, chilling winds

and cold, wet weather at blooming time, as if all those conditions did not prevail in the "Auld Lang Syne" as well as now. Hear what Mr. S. F. Alberger, in a recent issue of the *Orange Judd Farmer*, has to say about the conduct now of some of these old-time apple trees: "The apple trees that pay best now in Western New York are from sixty to one hundred years old. I think it is because their branches seldom intersect, and their roots run deep into the soil, and during our customary dry fall weather, supply to the fruit buds not only moisture, but the kind and quality of food necessary to give them the vital power required to perfect the fertilization of the flowers and the setting of the fruit the next spring. I think the lack of vital force in the buds is one great fault in our commercial orchards of to-day. In many of these orchards, if the trees are dug up, it will frequently be found that they have no tap-roots at all, but the roots start out at almost right angles, and in some cases are found, at fifteen to twenty feet from the trees, to be only six inches or a foot below the surface. Some of these trees showed decay at the center of the trunk; in three cases, where the trees had been grafted, it could be seen between the layers of yearly growth from six to twelve years after planting, but the trunks of a twenty-two-year-old seedling and several seventy-five-year-old seedlings that were limb-grafted do not indicate any decay. Does the insertion of the graft or scion into the crown cause this delay?"

Verily, Mr. Alberger is hitting very close to the truth, in his diagnosis of the commercial orchards of the present day, grown from large, fibrous and long-rooted trees. But to answer the interrogatory of the New York Legislature more fully as to this well-known decadence, let us go back to the time, several hundred years ago, when there were no orchards in America. When the Mayflower glided alongside of Plymouth Rock, folded to rest her white wings, that for many a long, weary day and night had breasted the Atlantic's gales, and from her deck the Pilgrims stepped in search of new homes, we know that they brought seeds, including fruits of various kinds, and when settled, from time to time imported

more. But for many years, in fact generations, compelled, as they were, to battle with the elements and Indians, and clear forests, little attention could have been paid to fruit-growing, except in a small way for individual use, and every one doubtless propagated for himself, by the old and well-known method of root-grafting, or from seed, where the trees were to stand. It is a fair presumption, indeed, that anything like a commercial nursery was then unknown, friends and neighbors performing such kindly offices as budding and grafting for each other without pay. This continued, doubtless, for many generations. In fact, up to the beginning of the present century there were practically no nurseries at all, and the institutions of this description that are so common now all over the country really date back scarcely more than fifty or seventy-five years. But as more and more attention was given to fruit culture, naturally people here and there would grow trees for sale, and many seasons would doubtless have an over-supply. Not wishing to lose them, these would be transplanted once or more, to check growth and keep them from getting too large, and intending purchasers, seeing such big, fine stock, in their desire and haste for immediate bearing, and encouraged by the honest but mistaken nurseryman, would naturally purchase these large trees, in preference to the small ones; and, indeed, if treated right, a two or three-year-old tree, or even one five or six years old is equally as good, and will fruit sooner than a younger one. But the trouble was, then as now, that right treatment was not understood, and in order to preserve a large part of the handsome tops, which the customers of course desired, the nurseryman naturally advised retaining as much as possible of the long and fibrous roots, the result of transplanting once or more. And thus it gradually came about, that there grew up an aristocracy of root, and when dug and graded in the fall, the value and price of the stock was largely determined, just as it is now, by the size and quantity of the roots. I doubt, indeed, whether there is to-day (April 2, 1906) a nurseryman in the whole country who has not numbers of fine trees of all varieties that by accident have been dug

with short roots, for which he will cheerfully take half price.

But to return to our immediate forefathers and their doings in the fields of horticulture. Naturally, in very dry seasons or in case of neglected trees, set with large tops, the tangled mass of feeble, fibrous roots would fail to take hold in the soil, and, exhausted by evaporation from the tops, would die. Then at once went up the cry, "More root!" Why not? Taught to believe that roots were absolutely necessary, naturally the planter would conclude, the more the better, just as is taught in all the books to-day; and indeed, so firmly is it fixed in the minds of many of our most eminent fruit growers that, though earnestly requested to do so, they will not even plant a single close root-pruned tree as an experiment. This has for several years been my general experience, in trying to inaugurate this all-important reform. And yet it is absolutely the foundation of all permanent success in the orchards of the future. We have now got to a point where a small one-year tree is considered worthless, and it is well-nigh impossible to sell a tree that has not been transplanted once, and oftener twice, to give it plenty of roots, and when such trees are planted, with all their matted fibrous roots, the doom of that orchard is sealed, whether it be with blight and scab in the pear and apple, yellows in the peach, or black-knot and root-tumor in the plum and peach. Such orchards are bound to fail early, become diseased, and die. And so, in tracing the probable course and progress of horticulture in this country from the earliest times down until now, we find that of necessity, commencing with seedlings and root-grafts (practically my method), its whole history has been a descent from health, longevity and productiveness in the beginning, as history and tradition both prove, down to disease, early decay and unfruitfulness at the present time, and in an exact and direct ratio to the increased quantity of roots left on, and age of the trees when set. The older the tree and the more root, the worse for the tree ever afterwards. Just how I happened to discover this important truth will be told in the next chapter.

CHAPTER III.

How I Discovered Close Root-Pruning.

AS this principle of horticulture is absolutely the most important, without a single exception, in the whole science, and the foundation of all permanent success, it is most astonishing that men have stumbled over it almost daily from the beginning, and never realized its value. The ordinary root-graft has been the most common form of propagation for most fruit trees for time out of mind, and every nurseryman knows what superior trees can be thus grown in a single season. And yet it has never occurred to any one to say: If a small piece of root will make such a fine tree, why will not the same principle apply the second or any other year afterward? Just how the value of this method did first present itself to me is as follows: Nobody here having any faith in the success of my venture of pear planting, I found it impossible at first to sell but few of the trees I had grown from cuttings, but having hopes that the astonishing vigor and thrift of my orchard would start a demand, I dug the young trees for several years, and transplanted to keep them from getting too large, as they surely would, judging from the way the orchard was doing. So we opened wide furrows and, spreading out the pear tree roots evenly, according to the universal directions, covered them nicely and firmed the ground well. Being an old market-gardener, though a new nurseryman, and a believer in manure, as already shown, I gave the rows of young trees a good dressing of cotton-seed meal, and with fair cultivation, at the end of the year I had no cause for complaint, as they all did well. But even that early I had caught on to the fact that, for some unexplained reason, the cuttings planted at the same time as the rooted trees always averaged much better. Moreover, another great point in their favor was, that when we came to pack the few

trees I did sell, being green at the business I found a world of trouble to make the clumsy, flat-rooted ones from the young trees agree with one another and lie comfortably in the same bundle. Having been planted with quite long ones, they were entirely lateral-rooted when dug. But the trees grown from cuttings, while they gave us a world of trouble to get out with the regulation amount and length of root, when we came to pack, were regular daisies—roots all long, deep and straight, and as easy to pack as sardines in a box. The third year I had extraordinary luck, and grew about seven thousand trees from cuttings. Having again sold only about two thousand, I found quite a job on my hands late in spring, as we had waited, hoping some purchaser would come along. But he did not, so we had to tackle the transplanting job again, and at the same time look forward to next year's packing of those roots, if sales turned out good. I remember well standing before the row where the trees were all nicely heeled in, with the buds ready to leaf out, and my only help, Frank, a colored boy, at my side, who had just as little fancy as I for the job. After holding a council of war for awhile as to the best and easiest way to get all those roots under ground, and Frank had actually gone down once with the plow and was coming back on the furrow, throwing the dirt out, the idea occurred all at once in the form of a self question. Something seemed to say: "If those trees grew so well with no root at all, what's the matter with cutting them all off, and letting them try it over again?" No sooner thought than settled. Frank was within fifty feet of me coming back, and when he got there I astonished him by saying: "Now go back and throw the furrow together again," and told him of my idea. Without a moment's hesitation that colored boy, Frank Bell, caught on to the whole thing, saying, "Good," and started back on the row. And yet I have been writing and urging fruit-growers for the last eight years just to try the method, even on a single tree; but so thoroughly had the long-root idea incorporated itself into the mental machinery of most of them, that until the last year or two it has been in vain. I laid the whole subject in a most exhaust-

ive article before the American Pomological Society five years ago, at Washington, which, if it was ever read, certainly produced no other result except perhaps to stamp me as a wild and woolly Texas crank!

But to return to my story. We pitched in, and in short order had the whole five thousand trees reduced back to cuttings again, at least in appearance, for we did not stop at any half-way close-pruning, like thousands will who try it with fear and doubt. We both agreed that it was a plain case of no need for root at all, and off they came, as close to the ends as we could cut them, for our intention was simply to stick them back in the rows as cuttings, after reducing the tops to one foot. And we treated the whole five thousand just that way. If a single tree died, I never saw it, and by fall those rows presented a picture of vigorous and even growth, many trees being eight to ten feet high, like the tree I hold in my hand in the illustration, though the root-pruned tree in the other hand

TREE IN RIGHT HAND GROWN IN ONE YEAR FROM
ONE LIKE THAT IN LEFT HAND.

has twice as much root as those had. But what shall I say of the great, deep, penetrating roots they had struck! The tree I hold shows exactly the character of their root system, though it has several large roots broken off in digging from the hard-pan pipe-clay subsoil, and the photograph by no means does justice to the size of the ends of the roots next to the floor, which were from the size of a knitting needle to a wheat-straw, showing plainly they had gone far deeper. In fact, I am confident that could all of that tree's roots have been taken up, the extreme length would have been as great as the top, which had to be bent and broken down for photographing, and measured eleven feet. I wish particularly to emphasize the fact that this tree was grown on stiff, black, waxy soil, broken about four inches deep, having a hard-pan yellow pipe-clay subsoil, that positively defies a spade. And yet we find pages in the books about the absolute necessity for a deeply plowed and subsoiled bed for trees, to enable their roots to take hold, forgetting that hard and soft are relative terms, and ground as hard as a rock to us is as soft as butter to a close root-pruned tree.

But a little more about that lot of trees. By this time people began to talk and investigate, and wild rumors of fabulous Le Conte pear crops and profits over in Georgia found their way over here. That fall I sold nearly every tree I had, and, having found out this easy method of planting, I hastened to spread the glad tidings, as well as to "butcher" the tree roots in digging. Frank had a weather eye for an easy job, and when I said, "Dig with short roots," he was quick to obey, and we hustled them out in a hurry. But when I came to deliver, I found that I had made a big mistake, for talk as eloquently as I would about the virtue of short roots, and with the trees in my hands to demonstrate its truth, I actually had several parties refuse to buy, and had to guarantee nearly all I did sell to grow. This wound up my efforts as a close root-pruned tree propagandist for some time, and while knowing they were worse than useless, to my great disgust, I was compelled to dig with all the roots possible. In fact, so disheartening were my efforts for a number

of years that if Prof. T. L. Brunk, then of our Texas A. and M. College, had not, on a visit of several days to my home, urged me so earnestly once more to bring the subject before the public in the *Southern Horticultural Journal*, of which he was the editor, and also in *Farm and Ranch*, it might have rested until now. He saw the philosophy of the whole thing at a glance when I pointed it out, and showed him the trees, and afterwards, when connected with the Experiment Station at Washington, he made the very exhaustive experiments, an account of which is elsewhere in this volume. Had not personal and political motives succeeded in ousting him from Washington shortly afterwards, this most enthusiastic and progressive master of horticulture would, I feel sure, long ago have succeeded in demonstrating, in the public position he held near the capitol, the utility and vast superiority of the close root-pruning over the long-rooted method.

CHAPTER IV.

Close Root-Pruning.

WITH all our knowledge and progress in the other arts and sciences, there is abundant evidence to prove that in the science and practice of horticulture we have retrograded so far that only last year the legislature of New York passed a bill appropriating funds and authorizing the Commissioner of Agriculture to investigate and determine, if possible, the causes for the widespread decadence of the orchards in western New York, both in the matter of the decreasing health and shortened life of the trees, as well as the inferior quality and diminished yield of fruit. This investigation is now in progress, and is awakening great interest in the east. It is a well-known fact that all over the country the same conditions exist that are complained of in New York. While last year gave a phenomenal yield of fruit everywhere, it is the first for several years, and not likely to occur soon again, and it is certain that the sturdy fruit trees which delighted the eye with their grand proportions, and tickled the palates of our forefathers with their regular and abundant crops of fine fruit, are a thing of the past. Something certainly is wrong when apple trees cease to be profitable at fifteen years of age, and peach trees reach their prime in five and die in ten or less, as they do nearly everywhere in our cultivated orchards, and yet old seedlings in fence corners, chicken yards, old fields and around the back doors are standing up cheerily under the weight of twenty or thirty years; and Mr. Hale himself drew his inspiration, when he embarked in his successful career of peach growing, from a sixty-year tree that stood in a neglected but friendly fence-row on his ancestral farm. That there are causes for all this, outside of diminished fertility, want of care or fancied change of climate, is certain.

I will now enumerate the four probable causes which, from a series of observations and experiments for many years, I am sure are at the bottom of the trouble, and in so doing, will confine myself strictly to facts, which anyone can verify for himself.

1. I claim that the best form of tree for planting is exactly the opposite of that recommended by all authorities from time immemorial, inasmuch as the latter departs farthest from nature's method of seed, which experience of the past proves to be the best, and to which I claim my method is superior. The close root-pruned tree, as shown in the accompanying cut (page 21), struck several strong penetrating tap-roots, instead of one, like a seedling, and sent them much deeper, fully ten feet in a single season.

2. I claim that deep preparation of the ground, as now recommended, is equally far from the truth and nature's method of a firm, unbroken soil, inasmuch as such deeply pulverized ground, after excessive rains, even though well drained, will for several days become a bog, to drown and scald the young rootlets in summer and freeze them to death in winter at the North.

3. That all cultivation of trees after several years, when the feeding roots hunt the surface, is wrong *per se*, inasmuch as all trees depend upon these surface roots for the proper development of the fruit, both as to size and quality, and any cultivation must necessarily be destructive to them. Of course, when first planted, the middles can be utilized for several years without serious injury, for growing crops between if desired; but from the very start, except a space around each tree large enough to prevent damage from the mowing blade, frequent and close mowing through the growing season, leaving the clippings on the ground, is the best plan for all close root-pruned trees, with annual fertilizing to perfect the crop. But please take notice that I do not recommend this treatment for poor, handicapped, three and four-year-old, long, fibrous-rooted trees, if planted as they come from the nursery.

4. That all fall, winter and spring pruning, until after

the trees are in full growth, is contrary to nature and common sense, in that it, as well as fall, winter and early spring stirring of the ground tends to break our trees' rest and start a premature motion of the sap.

These four fundamental principles of successful horticulture are in perfect accordance with nature and experience, as demonstrated by all forest trees, as well as old chance seedlings of all fruits everywhere, and constitute the "New Horticulture" I now advocate. To these four points, and my internal theory of all species of tree bacteria, and the causes of their development in the forms of yellows, blight, root-tumor, scab, black-knot, etc., I invite the earnest attention of fruit-growers everywhere, and a full, exhaustive, friendly criticism. I am wedded to no theory, or bound by no prejudice, but simply follow where I think truth points her finger.

As to my theory of inherent bacteria, whether it be right or wrong, it is a matter of small moment, provided I have shown that a close root-pruned tree, if treated rationally, will never afford the conditions for the development of any of those bacterial diseases, and in this I think I have succeeded. And now to the first cause, which I claim to be a radically wrong form of tree when set.

THE REVOLUTION IN TREE PLANTING.—It is about eight years since I first announced in *Farm and Ranch* that the theory and practice of tree planting, as handed down from time immemorial, was wrong, and that, instead of the more roots a tree has when reset the better, the very opposite was true. I then gave a full history of how I happened to hit upon this truth, as well as a detailed account of various experiments upon a great many kinds of fruit and shade trees, that demonstrated beyond all doubt the truth of my statement. I also adduced many isolated facts from the experience of others going to corroborate my own.

So absurd did the idea of cutting off all the roots of a tree seem even to very many prominent horticulturists, that though I then wrote to quite a number all over the country, the invariable answer was: "While such treatment may succeed with you, it would be out of the question here." The

fact is, we inherit our opinions and ideas just as well as the peculiarities of our bodies, and so true is this that the contrary of their beliefs is positively unthinkable to many men. An instance of this came to me in a letter from one of our most progressive Texas nurserymen. He wrote: "I have been practicing close root-pruning with perfect success for some years, and yet my father, who is seventy years old, and sees the good results every year, won't admit them, but persists in saying that 'if the roots were not necessary they wouldn't be put there.'" So firmly, indeed, has this long-root fallacy become imbedded in the human mind by ages of practice, that even a man of Chas. Downing's eminence in horticulture declares in his great work that the "ideal transplanting" would be to take up a tree with its roots entire. That this would be absolutely the very worst form, anyone can easily demonstrate for himself. Let him take, for instance, two peach or other tree seeds, and plant a few inches apart in, say a ten-inch pot of good, rich soil. At the end of next year, let him take them out and carefully shake off all the soil from the roots, and plant side by side in the open ground. Let him spread out in a large hole all the roots of one tree, according to the inherited regulation method, and cut back all on the other to about one inch, and the top to one foot, just enough to allow of its being stuck down about six inches, like a cutting. Treat alike, and in two years the root-pruned tree will be many times larger than the other. And right here I wish to say, very particularly, that the great superiority of close root-pruning is not always so apparent the first year, the tree giving more attention to striking deep roots than making top. Even for several years, we all know that trees as ordinarily set do well, but this is due to the fact that a large amount of root is removed even then. But a comparison with these will prove that when the strain of fruit-bearing comes, the close-pruned tree, with its roots deep and strong, out of reach of the plow, winter's cold and summer's heat and drouth, will stand up for many years, giving good crops, long after the other, with its lateral and surface system, has broken down and died. How else are we to

account for the early decadence of our latter-day orchards? The planter, in his haste for fruit, demands big trees, with plenty of roots and top, to support which, and to make them live, the nurseryman often transplants several times. This gives a mass of fibrous roots, which will undoubtedly, if the season is good, make the trees live, but practically dwarfs them and destroys their future usefulness. While Samson lost his strength by cutting off his hair, a tree is forever weakened by leaving its "hair" roots on when set, for it seems then compelled to re-establish itself by emitting new fibrous roots entirely from these. This results in a permanently lateral and surface system. Sink a spade around such a tree a year, or even two, after planting, and a slight pull will lift it from the ground, but a short root-pruned tree will resist any effort. The whole theory of the latter method is simply copying nature. She starts her trees from seed with neither tops or roots, and universal experience has shown that these, and trees grown from cuttings (which are practically seed), if never moved, are the strongest, healthiest, longest-lived and most productive. The advantages I claim for this method over the all-important one of giving far better trees are:

1. An enormous saving to the nurseryman in digging his stock, which now must be taken up with roots a foot or more long.

2. An equally great saving in packing. Instead of great bales of tops, roots, moss, bagging and rope, and the labor of putting up the same, or large boxes containing thousands of pounds of the same useless dead weight, a thousand root- and top-pruned trees could be packed in a medium-sized tight box, with a layer of wet moss in the bottom to maintain a moist atmosphere, and shipped with perfect safety around the world.

3. The saving to the buyer will be even greater. As an instance, several years ago I ordered five thousand grape vines from California, and wrote specific directions for root and top-pruning, as well as packing, and offered to pay for the extra pruning, the box to be sent by express. The nur-

seryman, setting me down for a crank or fool, packed the vines, top, roots and all, in three immense bales, weighing 1,300 pounds, for which he got a special rate, and yet they cost me sixty-seven dollars charges. I pruned and packed them in a single bale weighing 227 pounds, shipping them 250 miles, after which they were set by being simply stuck down into shallow, pulverized ground and tramped, the whole operation taking but two days. Every vine grew, and the next summer, the third year, I expect to ship grapes by the car load. It would be hard to estimate how many hundreds of thousands of dollars are annually paid by planters to railroads, in charges on worse than useless tops, roots and packing.

4. Thousands of dollars will be saved in the planting. Instead of large holes, and spreading out of roots, working in the soil by hand, etc., as now practiced, the planter will prepare his ground, stretch a strong line, with tags tied at the right intervals, make a small hole with a dibble a couple of inches in diameter, stick the trees down the proper distance, and when a row is done turn back and tramp thoroughly. This is very important.

5. Another most important advantage is, that by this method we reduce to a minimum the danger of spreading all kinds of diseases and insect pests, such as eel-worm, root tumor, scales, root-lice, etc. These are mostly found on the tops or long roots.

6. It enables the planter to set extra-large trees, which the nurseryman now has to throw away, and thus obtain fruit much sooner.

I will now repeat directions for root-pruning. Hold the tree top down, and cut all roots back to about an inch, sloping the cuts so that when the tree is set the cut surface is downwards. Experience has shown that the roots are generally emitted perpendicularly to the plane, or surface of the cut. This final pruning should be done shortly before planting, so as to present a fresh surface for the callus to form on. If trees are to be kept some time, or shipped by a nurseryman, about two inches of root should be left, the planter to

cut back as directed when the tree is set. About a foot of top should be left. More or less makes no difference. If the tree is well staked, three feet may be left without diminishing the growth much. I have had six-foot trees, well staked, to grow finely, but to avoid staking and to secure a new, straight body, it is best to cut back short. Let all shoots grow until a foot or so long, when the straightest and best one should be left and all others rubbed off. I could give the experience and endorsement of quite a number of orchardists who have practiced this method with uniform success, but it is necessary to mention only one. Without waiting for the slow demonstration of experience, he at once put it in practice on his great nine hundred-acre peach orchard of one hundred thousand trees, which he was about to plant in Georgia. I wrote him recently as to how it turned out. Here is the reply:

Dear Sir: I am glad to state that the close root-pruning, which was practiced when planting our entire orchard of one hundred thousand trees at Fort Valley, Georgia, proved to be the most successful operation we ever practiced, less than one-half of one per cent. of the trees failing to grow, and all making the most vigorous and even growth I have ever seen in any orchard in America. The orchard is now three years old, and gave us an enormous crop of fruit this past season. I am thoroughly in favor of this system of root-pruning.

Yours very truly,

J. H. HALE.

And now, in conclusion, in view of the fact that my individual efforts for eight years have amounted to practically nothing, the question is, how to bring about, in the general handling of trees, this radical but needed reform. I see but two ways. The first through the medium of the nurseryman and his catalogue, and the second through the bulletins of the experiment stations.

Quite a number of nurserymen, some of them the most extensive in the Union, have written me that they are now practicing this method exclusively, and with perfect success, in all their nursery transplanting operations, but they dare not advise the people to adopt it, for fear of being accused of trying to induce them to kill their trees, so as to sell them more next season. Now, let all of them make mention of the subject in their future catalogues. Next, let the state experi-

TREE GROWN FROM A ROOT-PRUNED
ONE, AT END OF FIRST YEAR.

TREE GROWN FROM A LONG-ROOTED
ONE, AT END OF FIRST YEAR.

ment stations make exhaustive trials on all kinds of trees, vines and small fruits, planting some with mere stubs of roots, half an inch, and others with five, ten, fifteen and twenty-inch length, setting enough of each to allow of taking up some every year to demonstrate at once that beyond a length of one inch, the quantity and size of the new roots is invariably in an inverse ratio to the amount of old roots left on. The more and longer the old, the more lateral and weaker the new ones. Let them subject trees of different ages and lengths of tops, up to four or five years or more, to the same treatment, and the result will be the same. The older close root-pruned, even with four-foot tops, will, if staked, quickly re-establish themselves on strong, deep, new roots and make fine trees, while the same age long-rooted ones will become permanently surface-rooted and dwarfed forever. But it is much better to cut back the tops to one foot, and form an entirely new head, as from a seed.

In planting an orchard of any fruit after this method, I would most earnestly advise, even on ground thought to be rich, that each tree be well top-dressed, AFTER BEING SET, with cotton-seed meal, well rotted barnyard manure, or other fertilizer, except fresh stable manure. But *never put manure of any kind, except plain bone meal, in the hole or around the base of a close root-pruned tree*, and see then that it is well mixed with the soil. This fertilizing will force a strong initial growth, and thus induce the trees to strike many and deep, perpendicular roots, and if correctly root-pruned, as shown by the tree I hold in my left hand in the cut, few or no lateral roots will be emitted for several years, the trees confining their attention entirely, by instinct, to anchoring themselves deep in the moist earth, thus enabling them to resist any drouth, and face unmoved the fiercest storms. No wind can shake or loosen the hold of a close root-pruned tree, no matter how high the future head, or long the trunk. Such trees will make, as they did for Mr. Hale, a perfectly uniform growth, and if propagated from bearing trees, as all should be, will all come into bearing at the same time, and mature to full size, without thinning, crops that would paralyze trees planted with

long roots. Of course, removing some of the smaller fruit would somewhat increase the size of the balance, but all will be large, and thinning might be necessary only to keep the limbs from breaking. Give full distance between the rows of all close root-pruned fruit trees, and run them north and south, if practicable. Trees propagated from settled bearing ones will fruit full the third year for peaches, apricots and plums, and the fourth or fifth year for pears and apples, and it will be economy to plant in the rows of the latter fruits an extra tree between, to fruit for five or ten years, until those intended to make the permanent orchard require the space. Air and sunshine are necessities for bright, clean, high-colored fruit, and shade breeds fungi, except on grapes, which often thrive in it.

I append the following note of comment on the above article by that prince of careful, painstaking originators, whose name is known and honored wherever fruit is grown, Mr. Luther Burbank, to whom I sent a copy at the time.

SANTA ROSA, *January 8, 1896.*

H. M. STRINGFELLOW.

Dear Sir—Thanks for your courtesy in sending me your very valuable and thought-suggesting essay. From my own past experience, I believe you are right. I have used for years a one-inch root and five-inch scion for root-grafting, and, strange to say, in an experiment ten years ago to test the matter, I used one-inch roots with five-inch scions, and from the same lot of roots and scions some three-inch roots and three-inch scions. In the long rows thus under test, I could see no difference (apple and pear) in the stand, but in the case of the pears, the shorter roots produced the largest and best trees. Apples were nearly alike. I usually cut back very heavily, but so far have not practiced such heroic treatment as you suggest. But as I said before, think you are right, and shall test it here. If it be true, what a grand result your studies have led up to, and in any case can result only in good!

Sincerely yours,

LUTHER BURBANK.

CHAPTER V.

Right and Wrong Close Root-Pruning.

I WISH particularly to call attention to the fact that the chief object in close root-pruning is to concentrate all the vital energy of the newly set tree on a limited root-surface, and compel it to strike several strong, perpendicular tap-roots, and while doing this, not to allow its attention to be diverted to forming side or lateral roots at the same time. By examining the accompanying illustration, Fig. 1, it will be seen that all seedling and transplanted trees should be cut back close below the collar, and just under the first good side roots, and not leave any length of the main or tap-root, with side roots cut back, as in Fig. 2. Such trees will invariably at once strike a great many lateral and surface roots also, while the properly root-pruned tree will, the first season, confine itself almost entirely to making strong, deep ones, with perhaps less top, though the second year will always remedy that. If the trees should be too large to root-prune with the shears or knife, saw off the tops to fifteen or eighteen inches, lay the tree on its side, and saw off all the roots squarely just below the crown or collar. Trim the sawed edges with a knife to make them callus more quickly. As stated elsewhere, large trees can be treated thus, as six-year-old pear and grape vines at Hitchcock are now fruiting, that have renewed their strength like young trees, it being a general law of nature that once a tree, especially an old one, is taken from the ground, the old roots are an encumbrance, and its former strength, vigor and health can only be renewed by compelling it to re-establish itself, as before, on an entirely new system.

And now, in answer to many inquiries as to the size of trees which may be successfully transplanted. If closely root-pruned, there is scarcely any limit. While universal

experience has shown, beyond all doubt, that fruit trees and grape vines over three or four years of age, if set with long and fibrous roots, are inferior to smaller ones, the rule by no means holds good with close root-pruned trees, for a very

1-YEAR OR OLDER ROOT-PRUNED TREE. JUNE-BUD OR SEEDLING ROOT-PRUNED TREE.

valuable and important point in close root-pruning is, that it can be utilized to make living fence posts for newly enclosed farms, fields or orchards. A china, cotton-wood, willow, hackberry or sycamore, and, I presume other forest trees of

large size, even six inches or more in diameter, can be dug, all the roots cut back close to the body and tops to five or six feet, and planted quite deep, just like a fence post, well rammed, and wire stretched, and every one of the trees named will grow off quickly and make nice heads by fall, and large trees the second season. Every orchard should have such a windbreak around and through it at wide intervals. Not an evergreen one, to keep off the cold, but a deciduous one, to break the force of summer and fall winds, that every year lash thousands of bushels of half grown and also ripe fruit from the trees. I lost in a single storm, some years ago, over two thousand bushels of pears, blown down in an hour and buried in the mud. The cottonwood is by far the best of all trees here for such a windbreak, as it grows very tall, and will stand any storm, if grown from cuttings or root-pruned trees. If care be taken to select cuttings from male trees, the nuisance of seed and cotton will be avoided. I had at Hitchcock two ten-acre orchards of Garber and Le Conte pears, that were both bisected each way with cottonwood when the pear trees were set, thus cutting each ten-acre lot into four blocks of $2\frac{1}{2}$ acres, surrounded now on all sides with tall trees, that let in the breezes for comfort, but completely break the force of driving summer winds, that would blow off the fruit. In fact, to plant an orchard without proper protection is pure gambling, as the Missouri and Arkansas growers found out last fall. Car load after car load of windfall Ben Davis and other apples were shipped here last October, that had been whipped off by a strong wind storm that swept those states. While the roots of such a windbreak would be objectionable on vegetable ground, they do no harm at all to fruit trees, if occasionally fertilized, as is clearly shown in my orchards.

CHAPTER VI.

Best Time and Depth to Plant.

I AM afraid that many persons will make the mistake of planting their close root-pruned trees too deep on level ground, under the erroneous impression that, having so little root, such a tree will find it difficult to establish and sustain itself at first. If they will but reflect that the root-graft and the cutting, which will strike, have no such trouble, and that nature plants her seeds upon the bare surface of the firm ground, and trusts to the wind, with leaves and dust, and the rain, to splash a thin covering around or over them, they must see that a strong, close root-pruned young tree, with far more vital energy than a seed, cannot fail to take care of itself, if set five or six inches deep in soil at all moist and well firmed. Of course, if it be dry that depth, the trees must be watered when set. But this applies to sections of the country favored with a reasonably regular rainfall, and more particularly to level and only slightly rolling ground. On elevated uplands and hills, the depth should be increased a little, and all through the dryer, hilly half of our state, comprising West and Northwest Texas, a depth of one foot would be none too much. Of course, this would require a total length of eighteen to twenty-four inches of tree when set. That deep planting is best all through the latter portions of the state, with its rocky, limestone subsoils, was clearly demonstrated by Wm. Cook, of Lampasas, one of the most successful and observing fruit-growers I ever met. I camped for a month near his orchard, in the suburbs of Lampasas, fifteen years ago, and was told by him that the finest, longest-lived and most productive trees of all kinds he ever grew were planted two feet deep, right up on the rocky hillside and top, and that he had practically drilled the holes out of the almost solid limestone soft rock. A little top soil

was put into the bottoms, trees were set two feet deep, the holes filled two-thirds with surface soil, and a bucket of water to each hole, the weather having been dry for a long time. After the ground had settled, the holes were filled level and well firmed with the foot. The trees, of all kinds, not only all grew, but no drouth afterwards even seemed to affect them. The roots had necessarily been cut back quite short, though he knew nothing of the virtue of the method. Of course, such treatment would be ruinous on level or moderately rolling ground with a clay subsoil. No amount of rain can ever water-log the rocky, porous subsoils of West Texas hills, and trees of all kinds should be planted at least twelve inches deep or deeper, all through that section. The rich valleys should be avoided for fruit, not only because of occasional excessive rains, that for a few days render them a bog, but worse still, because such locations are so subject to late spring frosts as to render crops too uncertain.

And now, as to the best time for planting close root-pruned trees in the southern states. If asked the very best month, I would say December. The young trees to be moved have then gone completely to rest, and while the ground is still warm enough to encourage root action, the air is not sufficiently warm to stimulate a new growth of leaves after planting, which often happens to trees moved in November, especially if from a more northern latitude. Still, January is nearly as good a month, and all through February and March, up to the very starting of the leaves, if the soil is moist, such trees may be planted with perfect success. But they will not grow off as rapidly, or make as great a total growth that season, as those planted earlier. At the North and in the Middle States, as Prof. T. L. Brunk remarks elsewhere in his article, if trees with so little root to hold them down are set in the fall, especially on deeply pulverized soil (a worse than useless preparation), there might be danger of heaving from the action of frost. But that heaving could easily be obviated by banking the earth up entirely over the one-foot tops, thus protecting them the first season from the cold, and mice and rabbits as well. The advent of hot

weather is so sudden there that I would earnestly recommend the fall for planting close root-pruned trees all over the Middle and Northern States. By spring new roots several inches long will have been struck, and a much stronger growth secured the first season. As will be seen from Prof. Brunk's experiments in Maryland, his trees were all planted, both fruit and evergreen, on the 16th of April, 1892. That was entirely too late to get the best result the first season. Moreover, something must have been wrong with the trees or conditions, when the althea failed to start and do well, for it grows almost anywhere like a weed, from a cutting even. As to the Norway spruce, hemlock and Lawson cypress, I know nothing, having never seen them. But I do know that the oranges both sour, sweet and trifoliolate, will all grow off with the greatest vigor from close top and root-pruned trees, and thousands of orange trees are being thus treated in Florida the present season. They may also be thus planted all through June, July and August with perfect success, if an additional inch and a few fibrous roots are left on. Last summer I never lost a single one of fifteen hundred young trifoliata, planted from seed in February and transplanted into nursery rows in June, when about six inches high. By fall some of them were three feet high, all having been root and top-pruned when set, and firmly tramped. However, with these and other evergreens each one can experiment for himself, as soil may have something to do with results.

HAVING now discussed fully the first cause—viz., long roots—of the general decadence and unfruitfulness of latter-day apple and pear orchards, and given a summary of my experience as to the best methods of treating and planting close root-pruned trees, I will in the next chapter go on with the investigation.

CHAPTER VII.

Deep Preparation Wrong.

AND now to the second cause of deteriorated orchards, which I claim to be the deep plowing and pulverizing before planting, either of the whole orchard or of several feet where the tree is to stand, in the shape of large holes. It is, indeed, true that such preparation is necessary for long, fibrous-rooted trees, such as our nurserymen now furnish by once or twice transplanting, for such trees invariably re-establish themselves on fibrous roots from the old ones, being unable to penetrate a firm surface or subsoil. Moreover, such a loose, well pulverized hole, or entire plant-bed, will undoubtedly enable such trees to take hold and make an excellent growth, and bear well for some years; but such preparation is entirely artificial, opposed to nature, and infallibly lays the foundation for premature decay and death. In furnishing the trees described a loose, porous seed-bed, we induce, in fact compel, them to confine themselves almost entirely to it. I saw a most remarkable example of this several years ago, near Seguin, in this state. A most painstaking fruit-grower had prepared a peach orchard after this fashion, the trees being trimmed high to allow of cultivation, and the fourth and fifth year gathered crops of excellent fruit. In the summer of the sixth a terrible rain and wind storm swept over that section and laid every single one of those peach trees flat on the ground, with their roots in the air. I wish every fruit grower could have seen this orchard, with its surface and lateral root system scarcely one foot in depth, having had no hold on the subsoil, excepting through its fibrous roots. Doubtless many have had such an experience. But suppose these trees had not fallen? Is it not a fair presumption that their roots, standing for several days in almost liquid mud, under a July sun, would have been injured?

But suppose such an excessive rain had fallen at the North, and the thermometer had dropped below zero, freezing this one foot of slush and roots as solid as a rock? Is there any wonder that trees exposed to such conditions for a few years, and, as a rule, allowed to overbear, should soon yield inferior crops, and die young? While the peach would suffer most, no tree can stand such treatment uninjured. So much for reason and experience against a deeply-stirred surface soil.

Now, let us turn to nature. As I said before, she plants her trees with neither tops or roots, on the surface of the firm, unbroken soil, and whether it be an apple or an oak, in the valleys or on the hills, she grows a tree unequalled by all the care and skill of man. Who subsoiled and pulverized for the giant red-woods of California, the towering pines of Oregon and the South, the monster sycamores and cottonwoods of the Middle States, or dug wide holes and spread out their roots, carefully fingering in the top soil, for the grand old hickories, walnuts, elms and oaks that once crowned New England's rock-ribbed hills? True, these are forest trees; but how about the old original Seckel pear, the old apple tree that shaded Roger Williams' grave, and hundreds of ancient seedlings, of both fruits, that gave bounteous yield to three and four generations of the Pilgrims' sons? So much for nature's testimony in favor of a firm, unbroken soil.

But while all those trees were seedlings, I claim that the close root-pruned tree is far better than a seedling. The life force of a seed, while capable, ultimately, of the grand developments I have named, is primarily very weak. Who would suspect that the great Charter Oak lay wrapped in the tiny acorn, which probably made scarcely a foot of growth the first year, or that the embryo sycamores and cottonwoods that tower in the river bottoms of the Middle States once floated down, almost as light as the air itself, and the first year made but a few inches of growth? And yet a close root-pruned cottonwood tree or a cutting will, in this section, often grow ten feet high the first year. The potentiality of life in the root-pruned tree is many times greater than in the seed, and it has the additional advantage of striking several deep

tap-roots instead of one, at the same time sending them much deeper than a seedling will. I have repeatedly dug Le Conte pear trees thus treated in spring, and by fall found four feet of almost perpendicular roots, and then left them still going down. (See the pear tree I hold in my right hand, page eleven.) I once dug, on the 3rd of July, a spring-set tree, and broke the roots at three feet below the surface, and this on unbroken prairie sod, with a so-called hard-pan subsoil, into which a post hole could not be dug except with a ground auger! The grass was killed with a hoe and the ground kept clean with the same, and top-dressed well with cotton-seed meal raked in. The top measured four feet when dug. The penetrating power of tree roots is almost incredible. Nobody here, on Galveston Island, where ground cisterns are often used, will dare to plant a willow or china tree anywhere near one. I saw an instance where a willow had driven its roots through a twelve-inch brick and mortar wall and filled up the interior almost entirely. I could fill this entire chapter with instances of the wonderful penetrating power of root-pruned trees, to which the firmest soil seems to oppose not the slightest obstruction, but will cite only one—a Herbemont grape vine at Hitchcock, grown from a cutting, where it stood for six years, and of large size. I cut the roots to one-inch stubs and top to twelve inches, after planting about six inches deep the second time, in as small a hole as I could make, in ground never broken, at my back door. It was top-dressed with bone and ashes, after ramming as tight as a post. It grew two six-foot canes the first year, bore full the second, covered a thirty-feet trellis the third, and now rambles half over a large cottonwood tree, and has borne annually immense crops of grapes, with never a spraying or a sign of disease, while all the cultivated Herbemonts in the neighborhood rot nearly every year. It has had liberal dressings of bone and ashes for eight years, and been cultivated entirely with the hoe.

As still further demonstrating the superiority of nature's method of a firm, unbroken soil for seedling and close root-pruned trees, I will say that a part of my Kieffer orchard at

Hitchcock, embracing about one-quarter of an acre, was originally a pond, which I had filled up fully two feet with good surface soil before the trees were set. I expected to see an extraordinary growth on this spot, and was greatly surprised, at the end of two years, to find them steadily falling behind the balance, that stood on ground broken only four or five inches. To remedy this, to me, then, most mysterious condition of things, I yearly applied an increased quantity of fertilizer to this spot, but without avail, and now, at the end of fourteen years, it is plainly discernible by the inferior size of the trees that stand upon it.

I will now close this part of my subject with a letter recently received from Mr. C. B. Patterson, of Payne's Depot, Scott County, Ky.

MR. H. M. STRINGFELLOW.

Dear Sir—Having read with great interest your article in *Texas Farm and Ranch* on the subject of "A Deep Preparation of the Ground for Trees Wrong," please allow me to thank you for a perfectly clear explanation of a mystery in horticulture that greatly puzzled my old father, now dead, as well as myself, and all my neighbors who know the fact. The old man was always a great lover of trees, and as the black walnut is a natural growth here, wherever the squirrels hid the nuts in fall, around in the scattering woods, that stood on his virgin pasture soil, as they often did, he would fence in the young groves in spots where the trees came up, to protect them from the stock. In a few years, tall, vigorous, handsome walnut groves rewarded his care, with no other attention, for the young trees seemed to laugh at the blue-grass sod. But wishing to extend these plantings to a place neglected by the squirrels when they hid their winter store, my father one day announced his intention of beating them as a tree grower, and accordingly fenced off several acres, which he had plowed and harrowed several times, and most thoroughly prepared. When all was ready the places were checked off, and, like the squirrels, he planted the nuts. They came up nicely, and had the best of attention for several years, when he turned them over to the grass as the squirrels' trees were. But all to no purpose, for from the very first, in spite of all his care, he never could make his trees grow like theirs, and died in total ignorance as to how or why they beat him. This was twenty years or more ago, and the trees are still standing here, to show for themselves, not more than half as high or large as those planted by the squirrels on the unbroken virgin sod. It affords me great pleasure to furnish you this living and unanswerable proof of the correctness of your position. that for tree seed, and, I presume, your close root-pruned trees, which you claim to be even superior to seed, a firm, unbroken

soil, like nature chooses, is better than any preparation man can make. I will further add that about ten years ago I turned out a part of a cultivated field adjoining that woodland pasture, and the squirrels have tried their hands on it also, but with no better luck than my father, for the trees are just as scrubby and inferior to those alongside in the woods, as were his, and we call them "cornfield" walnuts, to designate their inferiority.

Yours very truly,

C. B. PATTERSON.

A few days after receiving this letter, I came across the following, in the New York *Sun*, which was so strongly corroborative that I cut it out :

The finest shipment of walnut for 1895 came from Texas, but as a rule Indiana walnut is the best. Kentucky has more than any other state, but it does not average as high as in Indiana. The largest walnut mill in the world is in Chicago, and it uses about three thousand car loads a year. Fifty dollars per thousand is about the average price for the best grade of walnut, and this is all *natural forest growth*, what is known as "cornfield" walnut being hard, irregular, and has more or less windshakes. Figured walnut is very costly, and is used for veneering. One man in West Virginia owns a figured tree which cost him one thousand dollars, for which he has refused three thousand, and asks four thousand, there being over six thousand feet of lumber in it.

With all this indisputable evidence of the vast superiority of the firm, solid seed-bed, on which nature plants her trees, is it possible to resist the conclusion that, while poor, long, fibrous-rooted trees need soft ground and to be "fed with a spoon," the sturdy seedling and close root-pruned tree delight to overcome the resistance of unbroken ground ?

CHAPTER VIII.

Cultivation.

THE following remarks are intended to be of general application all over the country, but in regard to the peach, I would especially commend them to our coast country fruit-growers. If asked the very best location and treatment for a peach orchard here, I would answer most emphatically, one broken just as shallow as possible, and with root-pruned trees, planted in as small holes as possible, and rammed tight. Or, better still, the unbroken prairie sod, the grass being killed for a foot or so where the trees are to stand, and the whole ground "cultivated" with a mowing machine often enough to keep the grass down to within four or five inches at the outside, and better less. Root-pruned trees on fairly well drained ground, thus treated and fertilized moderately, will live for many years and bear fine crops of large fruit, while those on deeply stirred soil and annually plowed will invariably die inside of six years; at least those set with long roots will, and very likely the root-pruned also, for the peach cannot stand a loose surfaced, saturated soil in this level country.

Having shown, first, that a long and fibrous-rooted is a radically wrong form of tree for planting; and secondly, that large holes and a deeply pulverized soil, in which such trees are ordinarily set, and which they fill in a few years with the bulk of their roots, are receptacles for holding the semi-stagnant water, often for days, even on well-drained ground, during and after continued heavy rains, followed by scalding sunshine in summer and also intense cold in winter at the North, I will now take up the third probable cause of the early decline and death of many latter-day orchards, especially the peach, and that is, the annual more or less deep plowing to which nearly all are subjected, all over the country.

The almost universal practice is to plow at least once a year, and then cultivate more or less deeply until midsummer. While the trees are young and vigorous, and for the first few years of bearing, all such orchards give their best results; but when once in full bearing, no surface-rooted trees, especially the peach, such as I am now describing, can stand the drain of a continual cutting of their roots and live long, or give fruit of marketable size unless heavily fertilized every year, and at least four-fifths of the crop removed by hand, early in the season. This is the system hitherto adopted by the successful peach grower, Mr. Hale, with his orchards grown from long-rooted trees, and by which method he manages to make them profitable for ten or twelve years. Having never tested it myself on close root-pruned trees, I am very curious to see how it is going to work on that immense orchard in Georgia, planted after my method and on ground hitherto skimmed over a few inches deep for corn and cotton, according to the usual southern style. For the benefit of those who never read of it, I will say that Mr. Hale, when the cotton was off, without any hole digging or additional plowing, simply inserted a spade about six inches deep where the trees were to stand, and, pushing the handle back just far enough to allow of the little one-inch rooted trees being stuck down behind it, withdrew the spade and pressed the soil back firmly with the foot. Of course, the short roots must have rested flat on the so-called hard-pan or subsoil, that from creation's dawn was never broken. From what I have read, he is now subsoiling the middles, intends to plow every winter, and cultivate clean until midsummer, apply free dressings of bone and potash annually, and thin out the fruit severely by hand. I will watch the results with a great deal of interest. Ground becomes boggy, after excessive rains, only just so deep as it has been stirred, and it will become so after such rains for many years, thus greatly increasing the danger of injury to the roots as the trees on subsoiled ground get older, as well as rendering it almost impossible to drive wagons over it, if a prolonged wet spell should occur when the fruit is ripe.

But to proceed with the surface roots of fruit trees, the

intimate relation between which and the fruit itself has been greatly overlooked. Every careful observer must have noticed that in orchards, even from long-rooted trees, while young and growing, the fine, delicate little feeding roots do not hunt the immediate surface like they do when the trees begin to bear. While the trees have nothing to do but to grow, these roots seem content to forage around six inches or more under the surface, and for this reason, plowing and deep cultivation during that period seems to do no harm, though cultivation deeper than necessary for killing grass and weeds is of no actual benefit to the root-pruned trees, nor in fact to any other, and may, on ground not perfectly drained, as noted above, do harm, after excessive rains. I have often wondered just what the relation was between each leaf and fruit and the root, and whether the former were not dependent to a certain extent on the good offices of certain individual roots on the surface. That in a general way the perfect development of the fruit does depend largely on these surface roots can easily be shown, by selecting a row of trees, for instance, in an apple orchard that has stood several years in sod. Plow one row five or six inches deep in spring, and cultivate and mow the others, never letting the grass get over four inches high. Fertilize neither, and unless apple trees act differently from peach and pear trees here, the fruit on the mowed land will be much the finest. As a further test, apply equal quantities of a good fertilizer to certain trees on the sod and cultivated ground, and the difference in favor of the sod will be surprising. But, returning to the exact relation between the leaves and roots, the diagram on page 38 clearly shows that to a certain extent and in a general way there is such a corresponding relation. The diagram represents a bed or section in the Galveston City Park, through which I pass every day on my way down town. Having no particular use for the scrapings from the paved streets, the superintendent concluded to fertilize as well as raise the grade of the whole park about one foot. This bed was selected as the starting point, and load after load, largely composed of pulverized horse manure, was dumped and evenly spread about one foot deep and nicely

raked off. A start was then made on the section adjoining on the left, but before it was completed a very heavy rain fell, thoroughly saturating the mass and wetting the sod ground below. In forty-eight hours, and before work was begun again, every leaf on the liveoak trees in the center began to turn brown, and in a week were as dry and dead as if they had been parched. Two cedar trees that stood about four feet from the edge were affected similarly, one losing all the foliage and the other about half. But the point to be noticed is that the two large liveoaks standing at the immediate angle of the two manured plots lost their leaves in a triangular

This diagram represents a section of the Galveston City Park. The squares represent trees—1, 1, the large liveoaks; 2, 2, liveoaks; 3, 3, the cedars mentioned in the text--the shaded portions representing living foliage, and the unshaded dead.

shape, just above and corresponding to the shape of the manured ground below, while all the balance of the foliage on both trees over the unmanured ground is still fresh and green, though two months have gone by. An examination of the ground will be made next spring to see the effect on the roots, but so far the young twigs seem to be unhurt. A fair presumption is that only the fine hair roots were hurt or killed by the ammonia, but the question is, if those had been fruit trees about to bloom in spring, would not the destruction of five or six inches of the surface feeding-roots by the plow instead of by the manure, have so weakened their vitality as to cause a

failure of the fruit to set, or a subsequent shedding if the season was bad? Furthermore, suppose a severe drouth followed, as often does, would not the loss of those roots not only interfere greatly with the development of the crop that remained, but seriously impair the vitality of the trees themselves? In thousands of orchards over the country this process is kept up for years, tearing up the roots from spring till summer, then leaving the trees the balance of the season for replacing them, only to repeat the operation of destruction the next spring.

After adopting a form of tree that induces or compels it to root shallow, allowing it to bear all it will, and furnishing it no extra supply of food, is there any wonder, after all this, supplemented by an annual ripping up of the roots themselves, that orchards grow prematurely old? Of course, I am now writing of the general run of orchards, to which there are thousands of honorable exceptions all over the country, both cultivated and in grass, where careful pruning and thinning of fruit, as well as a free use of manure and shallow cultivation, have attained the best results for a time; but the fact still stands that the profitable bearing period of all fruit trees has been steadily shortening of late years, and I feel confident that this is largely due to the three causes now given, aggravated by two others yet to be treated.

I will now briefly allude to a few other benefits from planting close root-pruned trees of all kinds on ground plowed as shallow as possible, or better, in virgin sod, if practicable, and mowing or cultivating shallow immediately around the trees from the day they are set, and a few years later putting the whole ground down to some kind of grass, whatever may be best for different sections, mowing close, at least until the fruit is gone, and top dressing annually with some form of potash and phosphoric acid. Here Bermuda grass would head the list. I know of peach trees standing where they came up in this city, in a compact Bermuda sod, that has been closely cut with a lawn-mower for twelve years, that are to-day pictures of health and vigor. They have been moderately pruned, have never failed of a heavy crop, have never

been thinned, and yet fruit is always large and fine. From time to time the lawn has been manured. Trees of this age that were set with long roots and plowed regularly afterward can nowhere be shown in this whole section. In fact, six years is the utmost limit, in this level country, of the latter treatment, and the fruit is far inferior.

One great advantage of the above general system for all fruit trees is that no tree trunk will ever sun-scald. This comes entirely from the inability of a tree grown from long roots and annually plowed, to supply a free enough flow of sap, during hot and very dry weather, to prevent stagnation and scald on the side exposed to the afternoon sun. A close-pruned tree, with its deeply penetrating roots, will never fail to do this.

A second advantage is that fruit grown on trees standing in firm soil, undisturbed, will in rainy seasons be of far better eating and shipping qualities than that from trees whose roots are gorged with water, in a deep, loose soil, no matter though well drained. This I know to be a fact.

A third advantage will be a great increase in the hardiness of all fruit trees in northern latitudes. I am confident all varieties, especially the peach, can be grown with perfect success where now they winter-kill every year.

A fourth advantage is a firm roadway for hauling out the fruit in wet weather.

A fifth and final advantage is economy. Far superior fruit, and at a cost of twenty-five cents on the dollar, as compared with old methods and long-rooted trees.

As going to show that these principles are true, and that there is an increasing feeling of doubt and dissatisfaction with present methods and their results as exemplified in the orchards of to-day, grown, as all of them are, from long-rooted trees, several years old when set, I will close this part of my subject with a quotation from the April issue of *Green's Fruit Grower*, published at Rochester, in the center of the great fruit-growing district of Western New York. Mr. P. C. Reynolds, a regular contributor, and evidently a horticul-

turist of long and wide experience, writing of their present unproductive apple orchards, says :

"In my earliest recollection, little thought was given to the culture of the orchard for the orchard's sake. So long as profitable crops could be grown among the trees, the orchard was cultivated. When cropping ceased to be profitable, cultivation ceased, or if any was done, it was done by the snouts of swine. And yet I can hardly recall a season, during the first twenty-five years of my life, that apples were not abundant. Some seasons, certain favorite varieties, like Early Harvest, Sweet Bough, Fall Pippin, etc., bore heavier crops than in others, but they were rarely entirely barren.

"The older members of the Western New York Horticultural Society will remember how often this subject came up before the society from twenty to twenty-five years ago. Patrick Barry, John J. Thomas, Elisha Moody, J. S. Woodward, S. D. Willard, and many other gentlemen, eminently successful fruit-growers, urged the importance of thorough cultivation and, after the trees should become so large as to require all the ground, making the growing of annual crops unprofitable and inconvenient, they would continue culture for the benefit of trees and fruit. On the other hand, Dr. E. Ware Sylvester, Henry E. Hooker, Godfrey Zimmerman, James A. Root, and a few others, insisted that after apple trees have reached bearing age, as much, or more, fruit could be produced by seeding down to grass as by cultivation, provided no grass was removed from the orchard, but was mowed and left upon the ground as mulch, or pastured by hogs or sheep. The mooted question was never definitely settled by the society, but comes up frequently of late years. Both parties have been able to instance many proofs of their side of the controversy. From many years of observation among orchardists, and from my own experience, I have come to the conclusion that fruitfulness depends more upon several other conditions than upon cultivation, after the trees have arrived at bearing age.

"Now, I would lend all possible encouragement for the feeding-roots of apple trees to ramify and forage freely in this surface soil, near enough the surface to be benefited by the heat of the sun and the vivifying effects of the atmosphere and its fructifying gases. I would be very careful not to drive those roots to the cold, inert, sterile subsoil, beyond the reach of the benign influences of that atmosphere of heat and gases that permeates the surface soil, where myriads of living organisms, in the humus, carry on the work of nitrification. Subsequent cultivation would be carried on with the purpose of avoiding the disturbance of the roots in their best feeding ground, and keeping the soil pulverized and mellow beyond the roots, for their future occupancy. I would leave, every year, a considerable space around every tree beyond that covered by the branches, to be filled by the season's growth of the roots, upon which I would plant nothing, for it is very poor policy to place the roots of annuals in competition with the roots of the trees for the plant-food and moisture of the soil. Hence, every year, the space around the trees, upon which no annual would be planted, would broaden until but

narrow stripes between the rows of trees would be deeply plowed. Probably the soil above the roots could then be most economically kept mellow by means of a cultivator, or of some of the most effective of modern harrows. When the time arrives that the roots of the trees nearly fill the soil, and the land should be entirely devoted to the trees and fruit, and the growing of temporary crops ceases, the question presents itself: 'Should the surface be still cultivated, or should it be seeded down?' If seeded to grass, I am quite positive that no grass, in any form, should be removed from the orchard; it should be mowed frequently, and left as a mulch upon the ground, or it should be pastured closely with sheep or swine. Which of these species of animals it would be advisable to keep upon the orchard would depend largely upon the fruit-grower's ability to handle the animals with most profit. Most men would probably do better with swine than sheep. There has been less decline in the price of pork, for several years, than in the price of wool. If sheep were kept, mutton sheep are preferable. Mr. Woodward and many others claim that sheep are better gleaners of fallen apples and the insects they contain than swine.

"Another question of momentous importance in connection with this subject is: 'Which would best conserve the moisture in the soil, a mellow surface or a surface covered with grass?' Experience would unhesitatingly say, a mellow surface. Yet, if the grass were mowed before it blossomed, and left spread upon the ground, as a mowing-machine leaves it, before the advent of the dry season, the mulch would afford nearly as much protection to the roots, perhaps quite as much, as a mulch of mellow soil. I really question whether it makes a great deal of difference in the productiveness of orchards, after they have come into bearing, and their roots pretty much fill the soil, whether the surface is kept mellow by frequent cultivation, or is seeded to grass and kept mulched, or pastured with sheep or swine, provided the trees are liberally supplied with plant food. According to my observation for several years, since attention was called to this question, the most productive old orchards have been in sod. Whether the sod was an efficient cause of that productiveness, or some other causes were dominant, I am unable to say."

H. B. Hillyer, of Belton, Texas, closes a letter on the subject of "Cultivation of Orchards" as follows:

"But is cultivation of a bearing orchard necessary? May not Mr. Stringfellow be right? I am leaning to that opinion. I have a beautiful orchard, thirty varieties of peaches, twenty of plums, twenty of grapes, twelve of pears, four of apples, five of figs, five of apricots, two of nectarines, two of blackberries. My orchard is cultivated nicely. I have some twelve or fourteen peach trees in my yard and chicken run. These have never been cultivated, but have been surface manured. Last year, on account of severe cold, fruit in all of this section was almost a failure, was an entire failure in my cultivated orchard, while the trees in my yard and chicken run made good crops, some of them as much as four or five bushels. This season

we had two white frosts, most of the Japan plums were killed, all the apricots are killed, and at least three-fourths of the fruit in the cultivated orchard is killed and some trees have no fruit at all, and some hardy varieties have a fair crop, while all the peach trees in my uncultivated yards are full as they can bear of fruit. This experience of two years has at least convinced me never again to plow an orchard until all danger of frost is over.

"My garden is very rich; is spaded every year with a prong spade. Dirt is not turned over, to avoid injury to the roots as much as possible. These trees have been carefully pruned; have been shy bearers of fine fruit; are five years old and are badly sun scalded—will barely live another year.

"A negro man near me had an orchard a few years ago that he annually planted in corn or cotton; the trees are all dead, but along his fence he put out some trees twenty-five years ago. They have grown in weeds that never have been plowed or hoed or mown down. These trees are still free from sun scald and bearing good crops of fine fruit.

"What does all this mean?"

CHAPTER IX.

Growing Trees from Bearing Ones.

WHILE here and there over the country a few nurserymen recognize the advantage of propagating their stock from bearing trees, and advertise the fact in their catalogues, the great majority of propagators and buyers pay no attention at all to this important subject. There is not the slightest doubt that a tree grown either from a cutting, as the Le Conte and Kieffer are here, taken from a bearing tree, or one propagated by budding or grafting from such bearing tree, will fruit three or four years, often six or seven, before one grown from a young tree that has for a number of generations been grown from young ones that have never fruited. I drew attention to this important point five years ago in our local papers, and proved it beyond all doubt, by my own experience and that of quite a number of growers elsewhere. Since then I have been watching and experimenting in this line, and find that the fruit-bearing principle is carried just as fully by the bud as by the graft and cutting. Four years ago I gave a friend a seedling from a Kieffer pear tree, which bloomed the third year and bore the fourth. The second year of that seedling's life I took some buds from it and top-budded a young Garber pear tree in an orchard of three hundred of that variety and, just like the parent tree, the growth from those buds bloomed the third year, and bore fruit the fourth, though not a single Garber out of the whole lot showed even a blossom. Here is absolute demonstration of the fact that even the bud from a bearing tree will carry the early-fruited capacity in it. Again, in 1896 in the spring, I took buds from an old, bearing orange tree, and put them into nine Trifoliata orange trees only two years old, here in Galveston, and now, March 6th, eight out of the nine, having made a good growth last season, are coming into full

bloom, though I do not expect them to set the fruit. Ordinarily an orange from seed or from a young non-bearing tree takes eight or nine years to bear. Still another instance stands near my home in Galveston. J. C. Trube has two vigorous young Le Conte pear trees, now four years old. They bore quite a number of pears the second and third years, were full the fourth, and are now again white with blossoms. Another friend, C. C. Pettitt, told me recently that Le Conte pear trees I sold him seven years ago, which he planted at Dickinson, have bloomed but sparingly, but that others I sold him two years ago are white with blossoms. The first lot were taken from my orchard before a large part of it began to bear, or before I knew anything of these facts, but the last, now in bloom, were propagated from the bearing trees.

But it is useless to multiply instances which have been furnished me regarding the various fruits, all pointing the same way. While a single remove, or even a second one, from a bearing tree might not affect the time of bearing much, trees grown repeatedly and for years from young trees in nursery rows will certainly be much later in coming into bearing. This accounts fully for the fact that there are a great number of pear trees in this section now six, seven and eight years old that have borne little or no fruit, and pear as well as apple trees all over the country which have behaved the same way. The pear and apple are particularly affected thus, and, being naturally slow to bear, no cions or buds for propagation should ever be taken from young trees in nursery rows, or from other than healthy trees, that have come into full bearing. It is a great injustice to purchasers to thus keep them waiting for fruit years after the time when trees should bear. Every pear or apple tree grown from a settled bearing tree will bear full the fourth or fifth year at farthest.

I will close this subject with several quotations, the first from an unnamed correspondent of *The Rural New-Yorker*, the second from Prof. L. H. Bailey, of Cornell, and the others by the parties whose names are signed, all going to

show the vast importance of propagating from the healthiest and most productive bearing trees, and never from trees in nursery, except new varieties, bearing wood of which cannot be had.

TWENTY-TWO years ago I set an orchard of 180 trees—one hundred Baldwin, forty Rhode Island Greening, and forty Northern Spy, the three most profitable apples, as I thought, to be set at that time. After the orchard had been set five or six years, I concluded to change the tops of the Northern Spy to Baldwin, as the Northern Spy did not do very well about here at that time. Having a few older Baldwin trees which were bearing fine crops of fruit, I selected scions from them, and soon had the tops changed.

The result was that these trees commenced bearing five or six years sooner, have always borne double the quantity, and of better quality, than the trees that were budded to Baldwin at the nursery, and set at the same time, under the same conditions. While all are now fine, healthy trees, those that were budded to Baldwin at the nursery make the most wood growth, and the branches are longer and more reedy. I have also noticed that, while these trees seemed to have as much bloom, they would not perfect more than half as much fruit as those with the changed tops. Who will tell the reason of this?—*The Rural New-Yorker*.

IT is probable that many trees fail to bear because propagated from unproductive trees. We know that no two trees in any orchard are alike, either in the amount of fruit which they bear or in their vigor and habit of growth. Some are uniformly productive, and some are uniformly unproductive. We know, too, that scions or buds tend to reproduce the character of the tree from which they are taken. A gardener would never think of taking cuttings from a rose bush or chrysanthemum or carnation which does not bear flowers. Why should a fruit-grower take scions from a tree which he knows to be unprofitable?

The indiscriminate cutting of scions is too clumsy and inexact a practice for these days, when we are trying to introduce scientific methods into our farming. I am convinced that some trees cannot be made to bear by any amount of treatment. They are not the bearing kind. It is not every mare which will breed or every hen which will lay a hatfull of eggs.

In my own practice, I am buying the best nursery-grown stock of apples (mostly Spy), and am top-grafting them with scions from trees which please me, and which I know to have been productive during many years. Time will discover if the effort is worth the while, but unless all analogies fail the outcome must be to my profit.—L. H. BAILEY.

MY DEAR SIR—I have your letter of the seventh on my return from the North, and beg to say I have read with great interest Mr. H. M. Stringfellow's letter in the *Alvin Sun*, which was enclosed in your letter.

I have fought Mr. S.'s battle here in California. I know he is right. I have seen the same practice which he narrates applied to the olive, and only six berries were produced from an orchard of over thirteen hundred trees, after the most diligent and careful cultivation for six years, while cuttings which I planted at the same time (taken from old bearing trees) all bore fruit the third year. One tree bore eleven gallons the fourth year, and I have had trees bear twenty-three gallons the fifth year and a barrel the sixth year. The difference between an orchard of thirteen hundred trees bearing six olives the sixth year and a single tree of the same age bearing a barrel, thirty-one gallons, of fruit, is worth noticing, and demands investigation. And yet, right here in Southern California, with all these facts before them, there are nurserymen who still persist in planting cuttings from trees which are now forty or fifty years old, which trees never produced a hatfull of olives, which trees should bear one hundred gallons at a crop.

I never plant a cutting from any tree which has not produced fruit, and I am perfectly willing to take cuttings from the oldest bearing tree in the country. I am ready to guarantee every tree I sell to bear fruit if planted here. I will guarantee 75 per cent. to bear the third year and every tree to bear the fourth year.

Very truly,

FRANK A. KIMBALL.

IT OFTEN happens that when apple trees or an apple orchard has arrived at bearing age, from ten to fifteen years (according to variety) (?), while making a good growth of wood every year, they may fail to form fruit buds and bear fruit. In many instances trees have reached the age of twenty years or more, healthy, vigorous trees, that have not produced fruit enough to pay for the first cost of tree and transportation. Now there are a good many who would be glad to know if there are any means by which such trees can be made to bear. It is a well known law of vegetation that a rapid-growing tree or plant is inclined to make wood buds rather than fruit buds, and that sap has a strong tendency to flow into terminal buds rather than into side buds. It is a prevailing opinion of experienced horticulturists that any check of growth has the effect to promote the growth of fruit buds—reproductive organs. I have known instances where flourishing young orchards, that had always been under cultivation, and formed no fruit buds but annually a rank growth of wood, have been seeded down to grass, and fruitfulness followed in two or three years. The owners believed that the sod checked the too rampant growth of wood and induced the growth of fruit buds. Possibly they were right. Again, pear growers are well aware that, to make rapid growing pear trees fruitful, it is necessary to shorten in every year's growth to promote the formation of fruit buds. This fact is so well known as to be unquestioned by well-informed pear growers. Why may not the same methods be applied to apple trees? I know that it would be a tedious operation to go all over the top of a large apple tree and shorten in the previous year's growth, but, if it would cause a barren tree to become fruitful, it would be labor well ex-

pended. I am well aware that many other causes have conspired, of late years, to prevent apple trees with an abundance of fruit buds from producing and maturing fruits—such as cold; protracted rains when in blossom, preventing pollination; severe frosts while in bloom or afterwards; fungus on young fruit, or on fruit stems or on the leaves; but, when no bloom appears and no fruit buds are found, it is in vain that we look for fruit. The shortening-in process would not be necessary every year. If practical once or twice, it might throw the trees into fruitfulness, and then the check upon growth caused by bearing fruit might promote the formation of fruit buds.—P. C. REYNOLDS, in *Green's Fruit-Grower*.

The unfruitfulness Mr. Reynolds here alludes to is plainly the result of propagating from non-bearing or unproductive trees. Instead of the "many other causes" why trees with an abundance of fruit buds fail to bear, if he had laid the trouble to the annual destruction of their surface roots by the plow and cultivator, upon which roots all trees depend for the setting of their fruit, he would have hit the nail on the head. Every fruit-grower can find evidence of this around him, and the experience of others elsewhere in this book confirms it. While it is a fact that evaporation is less from a cultivated surface than one in a close-mowed sod, a fair test with a seedling or a root-pruned tree will demonstrate in every case that this loss of moisture is far over-balanced by the service rendered the tree by its unbroken surface roots. The superiority of all forest, shade and nut trees, as well as seedling fruit trees, in uncultivated ground proves this. But here let me again impress upon my readers that in all I have to say about non-cultivation and close mowing around fruit trees, reference is made solely to those grown from seed where they stand, or to close root-pruned ones. While it will cause surface-rooted trees to frequently shed their fruit, and will ultimately shorten their lives, cultivation for them is a necessary evil.

CHAPTER X.

Winter Budding.

WHILE summer budding is one of the most common forms of tree propagation, a friend of mine, a most progressive horticulturist, James Hancock, of Beeville, Texas, has been for some time practicing a different method with perfect success in winter and early spring, before the sap begins to move or the bark will separate from the wood. I also tried this method in February and later with perfect success. He advises cutting off a little of the wood with bark from the stock, though I tried some with bark alone and all took. The accompanying cut (see next page) will illustrate how it is done. Insert the knife into the limb or stock, just as if a bud was to be cut and draw it downward an inch or less, pressing the cut bark back a little to keep it open. (See Fig. 2, on limb.) The bud is then slipped down next to the cut surface to the bottom. It is best to make the bud fully as long or a little longer than the cut on the limb, and let the upper end lap a little. The flap is then pressed back, and tied firmly, as in budding, completely covering the bud itself. Of course, the leaf stalk must be cut off close, just at the bud, so the flap will fit tight. Buds can be put in thus all winter, and especially in early spring, and not one in a hundred will fail. This method is especially valuable for budding large trees and limbs, instead of top-grafting, which is far more work, and less certain to succeed. An orchard can be cut back and very quickly changed into another variety of fruit at any point above the ground desired, provided the bark on the limbs is smooth enough to bud.

The past spring, just before the leaves pushed, but when the buds were swollen, I saw five hundred four-year-old peach trees thus treated by top-budding without a single failure. Five and six buds were quickly put into the main limbs

WINTER BUDDING.

on each tree, which were at once cut back to within a foot of the buds. These buds have now (May 5) made shoots three feet long. Whether this is absolutely necessary to arrest the movement of the sap, Mr. Hancock has never tested by leaving the limb entire, but as there is practically no movement in winter it would seem not. There would be no objection to cutting back in a cold climate, except dying off of limbs so cut in case of a freeze after the sap began to move from such severe pruning. Of course, after the buds have started well, the limbs should be sawed off with a sloping cut close above the buds, though the bud in the cut was not so treated. Enough shoots of the stock should be allowed to grow below to keep the tree healthy, which could be cut away later in the season or the following year. This method may be very valuable to the orange growers of Florida in the ordinary propagation of trees, as budding by the common method often fails. It will also be exceedingly valuable for turning large trees of pecans and other nuts into the finer kinds, and must entirely supersede all orchard top-grafting, which, from the liability of the scion to dry out, is a very uncertain as well as troublesome process, while this is quick, easy and certain. Moreover, why could it not be used by nurserymen for budding during winter stocks that could not be dormant budded in the fall before? Or perhaps after the bark ceases to slip in the fall the work could be continued by this method then. Mr. Hancock has not found it as convenient or successful during the ordinary budding season as the common method, nor has he ever tried it during the winter before February here, but has had uniform success. At the North, perhaps just when the buds begin to swell would be an excellent time, and for the next month. I omitted saying that after inserting the bud and pressing the flap back, a small piece of cotton cloth dipped in beeswax should be laid over it and then tied firmly, as in common budding. That will prevent air and the rain from entering, and all will live.

CHAPTER XI.

Grafting.

WHILE all the various forms of ordinary grafting are well understood, and need no description, there is a form practiced by my friend, E. W. Kirkpatrick, of McKinney, Texas, an old nurseryman and fruit-grower, that is so simple and uniformly successful with all kinds of trees and vines, that it deserves to be more widely known.

SCION AND STOCK COMBINED.

As seen from the illustration, if the stock to be grafted is growing in the ground, cut off the top as for saddle grafting, but with one of the sloping cuts about twice as long as the other, as shown. Then make an incision into the side of the scion, which should be five or six inches long, about one-third

of the length from the top, and, inserting the lower end of the scion, sharpened as shown, into the ground, fit the cut place on to the stock, placing the long side of the cut surface of the stock next to the scion. Bring the edges together on one side, press the scion down firmly, and no tying will be necessary, but bank the moist earth well over the union, and pack. The scion then becomes practically a cutting as well as a graft, and generally takes root from the lower end, as well as unites with the stock. This method is equally suited for house grafting, if tied to keep the stock and scion together until planted.

Another method, particularly well adapted to the vine, and a modification of cleft grafting, that rarely fails of success on the grape, done either in winter, spring, or after the vine is in full growth, provided the scions have been kept dormant. Select a smooth place on the vine near or just under the ground, and make a downward sloping cut, one-third or one-

SIDE GRAFTING.

half through the stock, according to size, as shown in the illustration. A well-ripened scion with one or two buds is then cut as for cleft grafting, except that the cuts, are made sloping, so as to bring one side of the scion to an edge, which is to be inserted in the side cut of the stock, so as to bring the face or broad side of the scion flush and even with one edge of the cut in the stock. A few wraps of strong string will bring the surfaces on small stocks closer together, but large stocks will bind the scion tight enough. Cover the whole scion with moist earth until

growth starts, when the top should be cut away. I omitted to say that from the middle of September to the middle of October here, perhaps August at the North, is an excellent time to graft all kinds of trees, with scarcely a failure.

CHAPTER XII.

Why Trees in Bottoms never Drown—Aeration.

FEW persons, unless they have tested it, have any idea of that peculiar quality that soils never disturbed deeply have of holding water on the surface, in ponds, for instance, for years, and yet immediately after being drained, if examined, the ground will be found friable and ready for the plow just beneath. I once undertook to grow carp, and for two years kept a small pond filled with water ; but finding the venture a failure, and having drained the water off, the idea occurred to me to examine the bottom at once, and see how deep the mud was. To my amazement, it was only about three or four inches deep, and on being scraped away with a hoe, the bottom was actually ready for the plow. The few inches of previously stirred surface was mud, but the balance firm. This peculiarity of unbroken ground not taking up and holding water in it in a free or mud state is a wise provision of nature, and accounts for the fact that wild grape vines and forest trees in river bottoms are often, for weeks, several feet under water without the slightest harm. Had such ground been deeply plowed, and especially subsoiled, trees in such locations would certainly be killed. But never having been disturbed, the particles of soil are in that peculiar natural relation to each other that, while they readily admit between them a certain quantity of water, and allow its passage through to the roots and subsoil, it is impossible to make such undisturbed ground take more than that specified amount, and so tree roots under such circumstances are not by any means standing in mud several feet deep, as many people ignorantly suppose. While I am sure all my readers can recall instances in their own knowledge of trees standing thus in water for weeks in low places, and apparently enjoying the bath, a most remarkable instance was told me

recently by a gentleman, who knows of three pecan trees that have stood for two years on stiff land in North Texas, with about one foot of water continuously covering the whole surface of the ground for several hundred feet. They bear fine pecans just as regularly as other trees, which fall upon the water every year and are blown ashore by the wind, some of which he has thus gathered and eaten. Could that water be drained off and the earth examined below, it would be found practically just like any ordinary well-drained land after rain. Just that wet, and no more. Who doubts the fate of those trees if the ground had been deeply plowed and then thus flooded? But to a limited degree for a few days after excessive rains, all deeply stirred land is in a condition of mud, and the fine fibrous feeding roots of all fruit trees on such ground must necessarily be either scalded and drowned out, more or less, in summer, or seriously injured by severe cold after such excessive rains in winter. After being once disturbed deeply, it requires many years to again compact the soil and bring it into its original state. This can easily be proved by examining, after continued rains, trees that were planted in large, deep holes, though it readily shows for itself if the rain be accompanied with a strong wind. In such case, fruit trees six or seven years or more of age are often twisted or bent half over from working in the soft earth, and sometimes are blown flat. It is true that this is largely due to long roots when planted, but in any case such a saturated mud condition of deeply stirred soil cannot but be injurious to a tree, and is undoubtedly the chief cause of the development of the different forms of root tumor and rot now so common in the South, and doubtless of yellows and black-knot, as well as other root diseases at the North. Could there be more convincing proof that the whole theory and practice of deep plowing and large holes for trees is wrong and contrary to nature, than the health, vigor and long life of forest as well as all chance seedling fruit trees on firm unbroken soil?

But, referring again to the pecan tree in water, alluded to above, do trees need aëration? While it is undoubtedly of great service to all soils in their preparation for crops, once

in the ground there is not the slightest evidence to prove that the admission of air to the roots of any tree or plant by ploughing or cultivation is of any real benefit. The facts now given will show that the theory or belief that, somehow or other, an extra supply of air over and above that naturally contained in all firm soils is beneficial to tree roots in cultivation is a mistake. I had a row of bearing orange trees many years ago, standing just behind my front fence, in the western part of the city of Galveston. After the great storm of 1875 a vast amount of sand was washed up from the beach, close to which my place was situated, and deposited in the street just outside. By summer the strong south winds had blown the most of it through my picket fence, and banked it up from three to four feet around the bodies of the orange trees. Many people thought it would hurt them, but believing to the contrary, I leveled it all down nicely, leaving the bodies standing fully three feet in beach sand. On this was spread a heavy coat of barnyard manure. The next year those trees made a most remarkably strong growth, and continued to do well until killed by the freeze of 1886.

Another instance occurred last fall. When passing along near the sidewalk of a friend in this city, who had a long row of live oaks five to eight inches in diameter standing on low ground which he was about to fill up, I saw that he had taken up about half of the trees, and raised them several feet, as the sidewalk was being filled in. I told him about my orange trees, and advised him to treat his oaks the same way. He did so, filling in with good earth from the mainland. The result was continued good health, and a fine growth the past season. While the filling on the public square with strong manure, as noted elsewhere, was very injurious, any quantity of soil can be placed around trees with safety, if not actual benefit.

After all, is not cultivation really only a necessary evil? For trees, facts clearly point that way. For certain annual crops, that grow when the weeds do, it is absolutely necessary to cultivate, to prevent the weeds from appropriating a large share of plant food and moisture, and also equally

important to shade the earth around growing plants, and keep down evaporation. Still, do we not, by inverting the soil and putting the humus at the bottom instead of the top, where nature puts it, and also by exposing the pulverized surface to the leaching of heavy rains, which carry off far more soluble plant food than is appropriated by the trees, really do our orchards more harm than good? . We cultivate and crop our lands until, if no fertilizer is added, they ultimately refuse to produce, and we turn them out as old fields. Nature then plants them with trees, and not only grows a vigorous crop from year to year, but rapidly renews the fertility of the soil itself by depositing vegetable matter on the surface where, exposed to air, heat and moisture, it is continually rendering plant food soluble, and returning it to the storehouse of the earth. Why, if nature can rear an immense forest growth on impoverished land, and in the course of time return it to us rich, cannot we grow fruit trees by the same method? The leaves, grass clippings, and annual dying of the surface roots of the sod, leave the vegetable matter just where the elements can, through its decomposition, prepare food for the tree roots, to supplement which I propose an annual top-dressing. And yet, reasonable and natural as this treatment of an orchard is, men will theorize about the vast excess of evaporation from a sod surface over a cultivated one, and demonstrate to a certainty how superior the latter must be; but nature laughs at them, with her vigorous and productive old seedling trees, in out-of-the-way places, while everywhere throughout the country, continually, cultivated trees become diseased early, fail to bear regular crops, and die young.

CHAPTER XIII.

Grapes.

AS TO grapes, and the adaptability of various kinds to the different sections of the country, it is certain that the practice of close root-pruning is going to make some radical changes. As remarked elsewhere, the grape becomes permanently very surface-rooted when grown from long-rooted vines, but roots exceedingly deep from a close root-pruned one. The question is, How far is this going to influence the behavior of vines in given localities? As, for instance, it did the old Herbemont on my former Hitchcock place. That vine, taken up when six years old, closely root and top-pruned and replanted, has made an extraordinary growth, and is bearing enormous crops every year. It is entirely free from all disease, while the same variety, as ordinarily planted and cultivated, rots in the neighborhood nearly every year. The general opinion in South Texas has been, that all the Labrusca and their hybrids are short-lived. As all those grapes bear very heavily, and are nearly always allowed to overbear, may it not be that this and long, fibrous roots are at the bottom of the trouble, if it be true? Not caring to retain any of them after a fair test, and finding them unsuited for distant shipment, owing to early shelling of the berries, I always threw them out, having so many experiments on hand. Thus I never kept any of the Labrusca over four or five years. My tests of the American varieties included over fifty of the latest and most prominent, and out of the whole list, I would unhesitatingly select the Lindley for South Texas, as the very best early light-red grape, though it does not set its fruit well unless planted near or alternated in rows with a staminate variety, such as the Agawam or Salem. The two latter are by far the largest and best dark-red grapes, while Wilder easily stands at the

head of the blacks. The Niagara is the very best white or golden grape, being of larger size and more productive than Moore's Diamond, as well as a much stronger grower. These are the cream of all the American grapes, as table grapes, for South Texas. Of course, in the Gulf Coast and southwestern part of Texas, the old Herbemont and Lenoir or Black Spanish are the standard wine and arbor grapes, though they are of little value for market. But while all the grapes recommended above are excellent for home use and markets that can be reached in one day or less, it would be useless to plant them or any other American grape largely for more distant shipment. They will all shell off, or drop from the bunch, in our hot summer weather, after being gathered, at the end of that time. After July the northern and California grapes take our markets, and prices rule very low. While some of the Munson and other American grapes will hang quite late in the summer, it scarcely pays to leave them, on account of depredations by the birds, unless constantly watched. For wine growing, except on a small scale for local markets, we can never compete with California, as grapes are grown more cheaply there than here. But while most of the *Vinifera* are unsuited to Texas, except the southwestern portion, around Beeville and near the coast, where they are proving very successful, it is highly probable that the Chasselas de Fontainebleu will also prove at home in the eastern coast district, several vines being now in full bearing on Galveston Island.

Grapes mature very early in the Southwest, the Chasselas coming in about the 5th of June, and in Galveston county but a very short time afterwards. Of course, all vines should be closely root-pruned, set in as small a hole as practicable, and well rammed. In the matter of training, they are almost exclusively adopting the California low head, no trellis, system, in Southwest Texas, and the same plan would answer well for the Chasselas in the eastern coast region. But all the American grapes seem to do better on somewhat longer pruning, though I know of vines that have given good crops on the above plan. As a rule, perhaps, the renewal system of several new canes, about three feet long for vines

in full bearing, trained fan-shape to a trellis of three wires, will furnish all the fruit that any vine should carry. I would earnestly caution against overbearing all through the life of a grape vine, and especially of young ones the first few years. This is the cause of the failure and early death of nine out of ten vines that break down. One good bunch to a shoot is all that should be left until the vines get strong.

As to fertilizer, bone and potash will supply all the food a vine requires, and potash is especially important for their health. Where cotton-seed hull ashes or plenty of wood ashes can be had, there is nothing better. As to insects, the most serious enemy to the grape in the South is the leaf roller; and while he never attacks the smooth, thin leaves of the *Vinifera*, he rarely allows the woolly leaves of the *Labrusca* or its hybrids to escape. One spraying with Paris green and a little lime, at the rate of one pound of the green to one hundred or even one hundred and fifty gallons of lime water, when the berries are half grown, will be washed off before the fruit ripens, but will protect entirely until the fruit has been sold, when another will carry the vines through the summer. The birds are the only other enemy, and while there are not so many in Southwest Texas, they are exceedingly destructive everywhere else throughout the South. The very best remedy is to pepper them with peas from a gun, or very fine shot at long range, for a few days, when the fruit begins to ripen. It is astonishing how quickly they will communicate the fact when they are struck. Dead birds, like dead men, tell no tales, but living ones are quick to do it. However, it is highly probable that birds attack grapes much oftener to quench their thirst than to obtain food, and if shallow vessels of water are placed at intervals throughout the vineyard, the loss of fruit will be very small.

In marketing the fruit, it should always be gathered in shallow boxes, with cleats on the ends for handles, so they can be piled up on each other, in hauling to the packing house. There it should remain over until the next day, to allow the stems to wilt, so that the bunches will lose their rigidity and pack more closely without bruising. All broken,

green or decayed berries should be clipped from the bunches with sharp-pointed grape scissors. The 5- and 9-pound baskets are the most common packages, but they are not only more inconvenient for packing in the car, but are too close for the far South, in hot weather. The square box or crate, with four 5-pound baskets, such as seems to be in general use in California, is far better, and they should be well filled, so the cover will fit tightly, to prevent shaking. The catalogues will furnish a very extensive list for those who want variety, even though inferior grapes.

But there is one other grand but neglected old grape for home use, both for the table and for wine. I allude to the Scuppernong, which, while it grows everywhere like a weed, has failed hitherto to set its fruit. The cause is now very plain. Simply the old trouble of pistillate blooms. Mr. S. N. Richardson, of Alvin, tells me that he has tried it, and named a party in Columbia who had the same experience on a large scale. If the common male Muscadine, which blooms just when the Scuppernong does, is planted close by, instead of dropping its fruit, as it always does, the latter will bear every year, and most profusely. This is a very important fact, for this famous old southern vine, if trellised, will cover an acre, and asks no other favors than a good annual dressing of potash in some form, and then to have its roots let alone. For chicken yard, around back doors, or wherever shade is desired, it will not only answer that useful purpose, but also bear loads of delicious grapes for wine or table use.

As to distance for planting, eight feet each way between the *Labrusca* varieties will be sufficient, but twelve feet or more is best for the *Herbemont* and *Lenoir* in the immediate coast country. Around San Antonio and in Southwest Texas, however, they succeed well stump-pruned, like the *Vinifera* in California, but the climate is dryer in that portion of Texas, and vines are less subject to rot. While clean cultivation is now the rule, I propose planting a small vineyard, as an experiment, with twelve feet between rows and vines four feet in the rows. After cultivating for a year very shallow, they will be put down to grass and mowed often

enough to keep it short, and surface roots will not be broken again. There are many isolated vines thus treated that are bearing heavy annual crops with no spraying, while plowed and cultivated vines rot every year. In fertilizing, beware of cotton-seed meal or other manures rich in ammonia, as that element is very apt to produce rot in the fruit. A good annual dressing of some form of potash and phosphoric acid will make vigorous vines and plenty of fruit.

As to spraying, while some have not found any benefit from it on fruit trees, there is no doubt that in most sections of the country it is an absolute necessity for sound grapes, and while it will not prevent blight on the pear, it does add greatly to the appearance of the fruit.

CHAPTER XIV.

The Apple.

HAVING spent the last thirty years of my life on the immediate Gulf coast, my experience with apples is necessarily limited, and as a book on horticulture would not be complete without a notice of this best of all fruits, I append on that subject a most excellent article from the *Southern States*, by Prof. M. B. Hilliard, of the Louisiana Experiment Station. He is known as an authority on horticulture in the far South, and his suggestions are well worth the careful attention of all fruit growers. There is no doubt that the apple as a money maker has been very greatly overlooked in the southern states, even when grown from long-rooted trees, which in our hot climate tends greatly to dwarf them, by compelling them to take on a surface system of roots, instead of penetrating deeply, which they would do if their roots were closely pruned. That this is true is clearly shown by the two very large apple trees now growing near Hitchcock, Galveston Co., on Mr. H. Perthuis' old place. Those trees were a great puzzle for several years, and induced me to plant two hundred apple trees at the same time I planted my pear orchard. While that variety is not suited to this locality, as far as productiveness is concerned (nor is it probable that any apple would pay on the Gulf coast), still those two trees clearly show that if planted right, the apple will make a large tree even here. Those two trees are now about twenty years old, and their history, as given by Mr. Perthuis, is as follows :

During a visit to Houston he saw a thrifty young apple tree in the yard of a friend, and when about to return he cut off a shoot with the intention of grafting several quince trees on his place at Hitchcock. On reaching home he cut the shoot in half and stuck the two pieces into the ground for a

few days. Being busy, they remained there several weeks, and when he finally took them up for grafting, he was surprised to find little roots just starting from the lower ends. He at once set them out about twenty feet apart, where they took root, made a rapid growth, and long ago their branches met, the bodies near the ground being over one foot in diameter. While not very productive, owing to the variety not being adapted this far South, these trees have been models of health and vigor, though for many years they have stood in the sod. The two hundred trees I was induced to plant from the conduct of these two were set with very long roots, and after growing moderately well for several years, finally assumed such a dwarf habit, though given the best of culture and, being between rows of pear trees, that they were dug up and thrown out. I had then found out the value of root-pruning, and was not surprised to see perfectly flat, lateral and surface root systems on them all, not one having struck a single tap-root. That is plainly the cause of the dwarf habit all apple trees assume in the far South, and it is possible that some of the southern winter varieties named in Prof. Hilliard's excellent article may be adapted even here, if closely root-pruned when planted. This is one fruit, however, that should be planted in the valleys all over Texas and the South. It blooms late, is never caught by frost, and, like the pear, loves a moist location. It is hard to hurt an apple tree with water, and its general failure to do well in the far South is due, next to leaving long roots, more to planting on high, dry locations than anything else. In the valley near the Hannah Springs, at Lampasas, are a dozen or more thrifty apple trees, planted nobody knows just when, and being on the Springs property, were turned out on the common fifteen years ago. They have never failed a single crop during that time, as I was informed by a resident who had known of them that long, and when I saw them recently, every tree was overloaded, but looking fresh and green. The remarkable point about those trees was that not a sign of a worm or insect could be found upon either fruit or leaves. Unfortunately, while there are plainly six varieties, nobody knows

what they are, as the fruit is never allowed to get more than half grown before it is carried off by the public. If the suitability of the valleys of the interior of Texas for apple culture is to be judged by the way those trees have done for many years, certainly the fruit-growers of our state are making a great mistake in neglecting to plant extensive orchards of this staple and most profitable of all fruits on some of the rich bottom lands now given entirely to corn and cotton.

But whatever our southern brethren do, the fruit-growers of the apple states will make no mistake to begin now to set close root-pruned apple trees. The orchards of the last decade or more have all been planted with large, long-rooted trees, and no amount of cultivation or care will prolong their usefulness over twelve or fifteen years. It takes but a few full crops to break down trees the bulk of whose roots are in the upper twelve inches of the soil, and the man who selects the best varieties now, root-prunes closely, plants in small holes, rams tight, cultivates well for a few years, and then puts down to Bermuda, blue grass, or other sod, and pastures or mows it, not forgetting to top-dress well around the trees each year with some good fertilizer, will, if his trees are propagated from productive, bearing ones, begin in four or five years to reap a rich harvest, and have an orchard that will long outlive him, and be the safest legacy he can leave his children. As to all the talk about the old, choice varieties of winter apples running out, it may be set down as talk and nothing else. They have been run out by the persistent persecution they have been subjected to, in the form of trees used, and the continual cutting of their roots with the plow, together with overbearing. There is not to-day an apple in the country that, if put upon a vigorous, healthy, close root-pruned stock, will not bear as fine fruit as it did the first crop it ever bore, provided its roots are let alone when the tree begins to bear. As bearing on this point I give the following letter:

CASPIANA, LA., Dec. 15, 1905.

H. M. STRINGFELLOW.

Dear Sir—Seeing your remarks in *Farm and Ranch* on your success with Terry Winter Apple in sod, leads me to inquire why we are now unable to grow winter apples here in the Red River Valley like we did years ago. We live at Caspiana, La., twenty miles below Shreveport, and when we bought the plantation, just after the war, found two large apple trees growing near a small house on the bank of the river. They were different kinds, but both fine large apples, one very red, and never failed to bear full crops. The ground was never disturbed, and we had no trouble in keeping the fruit all through the winter and often took samples to the Shreveport merchants, who said they were far superior, especially in quality, to any of the imported apples. Finally, at their suggestion, we sent Stark Bros. cuttings of both kinds, which we named Numbers 1 and 2, as nobody could identify them, with an order to propagate one hundred trees. They did so, and we planted them twenty feet apart, cultivated clean ever since, until now the branches are lapping; but, though about fifteen years old and apparently perfectly healthy, we have never had a single ripe apple. The trees bloom every spring, set full of fruit, but all of it rots in midsummer and falls off. Shortly after sending the wood to Stark Bros. a big rise in the river caused the bank to cave, carrying away both of the old apple trees. Do you think clean cultivation is the cause of the fruit rotting?

Yours truly,

A. E. HUTCHINSON.

CHAPTER XV.

The Pear.

THE pear having now established itself as the leading fruit of the Gulf coast, except that portion devoted to the orange, and its general management having been so fully given in horticultural journals, as well as books, little remains to be said, except to mention the varieties best suited to the far South. And first, it may be remarked that the experience of the last few years has quite definitely settled the question as to the blight ever becoming a cause for alarm here, if orchards are allowed to take their natural rest during the winter. That bearing orchards should be neither plowed, fertilized nor pruned at that time is certain. There is scarcely a doubt that trees thus treated will remain permanently healthy if not allowed to greatly overbear. It is true that all the bearing orchards have been grown from more or less long-rooted trees, but the native vigor of the Chinese pears is so great, and the water level so near the surface, that the natural motion of the sap is likely always to be maintained during the growing season. This is shown plainly from the fact that the leaves remain fresh and green on the trees until December. It is to this fact that this section owes its remarkable exemption from blight ; for if the trees are not stimulated during winter, the sap will remain dormant until the proper time for growth in spring. As to varieties for the Gulf coast region, it may be well to repeat that the experience of thirty years has shown that none of the old standard American or European varieties can be depended on to produce a paying crop anywhere in the far South. It is true that isolated trees here and there have given some pears, but only in small quantities ; nor are the trees sufficiently vigorous in our climate. The Le Conte, Garber and Kieffer, ripening in succession, are a perfect success everywhere.

The Smith's Hybrid is simply a poor Le Conte. It ripens at the same time, but rots more quickly at the core, and after fruiting several years, my trees were top-budded to Garber, which pear forms a perfect succession to the Le Conte, and is superior in quality to either it or the Kieffer. It resembles the latter closely in shape and size, but has the smooth skin of the Le Conte, and ripens well on or off the tree, never rotting at the core or suffering from the bitter-rot on the outside, as the Kieffer often does. However, with all its good qualities, it has one most serious fault, and that is, its lateness in coming into bearing. This is due, probably, to the fact that it has been grown so continuously from young trees that a full crop cannot now be expected on such trees for ten years or more. But it is of the greatest importance that this variety should be largely grown as a succession to Le Conte, when it becomes necessary to can or evaporate our crop. It ripens at a time that offers a better market for pears than any period in the year, for the California, Bartlett and Le Conte are then gone, the Kieffer still green, and the California varieties on the market are far inferior in quality to it. Fortunately, we now have a way to bring this variety into early bearing—by budding it on Le Conte, Kieffer or young Garber, grown from cuttings. The great difficulty is to obtain wood from bearing trees. The Kieffer is so well known that comment is unnecessary, except to warn growers against allowing it to overbear.

While in remarks elsewhere on the decadence of modern orchards no reference to the pear in the South was intended, there is no question that over cropping and non-fertilizing will quickly reduce the fruit to a very small size, and greatly weaken the tree. I omitted to allude to one other pear that is now growing in my former orchard at Hitchcock, which requires mention only as a warning of its utter worthlessness for any purpose. It has from time to time been put before the public as Early Harvest, Jefferson and Lawson-Comet, but is a fraud under any name. A fourteen-year-old tree that cost me two dollars has never borne more than a dozen pears at a time, and never bloomed until it was ten years old,

though it is one of the most vigorous growers in the orchard, and now over thirty feet high. It is the earliest and most beautiful of all pears, ripening about the first of June, but it rots at the core in a day or so after being gathered, if near ripe, and in quality is about equal to sawdust. Referring again to the Garber, and budding from bearing trees, it would not be advisable to top-bud young two or three-year-old Le Conte trees in orchard, for the labor of keeping the Le Conte shoots rubbed off below would be very considerable for several years. It would be far better to bud within a foot of the ground, and turn the whole tree into that pear.

Having discussed the growing of cuttings fully in a former chapter, it is only necessary to say here that it is practically impossible to grow this pear from cuttings except in the fall, when, if planted the last of September or early in October, in the open ground if sufficiently moist, or closely in a bed and kept watered, 90 per cent. of it, as well as Le Conte and Kieffer, will root.

CHAPTER XVI.

The Plum.

UNTIL the introduction of the Japan varieties, the South, especially the lower portion, bordering on the Gulf of Mexico, has been altogether dependent upon the native or Chickasaw varieties for her plums. I began years ago to test the most prominent sorts, that are so deservedly popular in the Middle and Northern States. While all are reasonably good growers here, they fail entirely in productiveness. Occasionally a few fine specimens will reward one's labor, but nothing more. Of the common sorts, the Wild Goose, if pollenized with some other kind near by, will produce good crops, and the Robinson, Indian Chief and Golden Beauty, a small late plum, are all good bearers also, though they fall far short of filling the bill as first-class market plums. The skin of all is very thin and tender, and they fall an easy prey to the vigorous attacks of the curculio, unless well sprayed with Paris green and lime water, or the latter alone, scented with a pint to the barrel of gas tar. But with the introduction of the Japan varieties, a new era has dawned upon plum culture in the Gulf States. Not only are the members of this class proving early bearers, and exceedingly productive as a rule, but their skin is thicker and, we hope, less liable to damage by the curculio. We may, therefore, rest assured that at last we shall have, with moderate spraying, fine, large, handsome market plums, perfectly adapted to the South. But the all-important and as yet unsettled problem is, Which are the most valuable varieties? The pictures and descriptions of all fruits contained therein are so bewildering in their magnificence, and this class of plums particularly, that one instinctively wants them all. The first to flash across the sky of horticulture were the Abundance and Botan, between which, if there is any real

difference, I have never been able to see it, though there is now a plum called the True Sweet Botan, or Berckmans, that is somewhat different both in growth and bearing, and, like the Botan, a most excellent eating fruit. This plum equals any of the Japan race in quality, though the various catalogues are annually bringing out something that they claim is better. One enterprising nurseryman in Louisiana has a genuine rabbit's foot for getting all sorts and colors, from snowy white to ebony black, fresh by telegraph from Japan, their flavors ranging through such a delicious chord of descriptive adjectives that one wonders that the very angels do not drop their harps and hie them back to earth. Let them alone! The old Kelsey is undoubtedly a splendid fruit where it succeeds, but it is subject to rot in many places, though neither here or in Southwest Texas. It is enormously prolific there, and I saw it in perfection at Beeville, at which place, though plums and peaches have been grown for many years, I saw several very old and extensive orchards that were entirely exempt from curculio and worms. It is plain that this insect has no love for a dry, warm climate, as he also ignores Western Texas generally. But in point of production, good size, solidity and moderate earliness, the Burbank stands far ahead of all Japan plums, though the fruit has been greatly overrated. The quality here is quite poor, unless left on the tree until perfectly mature, when it is passably good. The Hatankio, or Kerr, is also a good eating plum, but a large five-year-old tree at Hitchcock has borne no fruit, the blossoms dropping every year. The Ogon bore well last year, but the quality is very poor, as is that of the Satsuma, which, like the Hatankio, is practically barren. The Red June or Nagate, being boomed this season, like the Willard was last, as the best of all the Japan plums, has failed to bear a plum on a large five-year-old tree at Hitchcock, for which I paid the Starks one dollar, nor has it even formed blossom buds. The Willard is equally worthless here, the trees actually not leafing out until the first of May. The new Wickson comes highly recommended, and ought to be valuable, as it is Mr. Burbank's pride.

However, while in the beginning of this chapter I expressed great confidence in the final success of the Japan plums in the far South, I must admit that the present season of '96 has witnessed a failure throughout the coast country of Texas. This fact is puzzling many who have planted freely and others who desire to plant. There has been no frost at all to damage the blooms, and the Robinson, Wild Goose, Indian Chief and other Chickasaw varieties are all loaded down, yet the Japan plums in the same orchards have not only cast all or nearly all their fruit, on trees of all ages, from three to six years, but straggled along for more than a month in blooming, and to-day, the first of May, blooms are still opening. There is unquestionably a cause for this queer conduct, and after studying over it for a month, and with a full knowledge of the general failure of the Marianna as a stock for these plums elsewhere, I am of the opinion that this freak is largely due to a decided want of congeniality between the Japan race and the Marianna stock here also. While the Marianna has become immensely popular as a stock for other plums, both because of its vigorous growth and the fact of striking so readily from cuttings, and never suckering, and while it may yet, perhaps, be the best of all stocks at the North, there is indubitable evidence to prove that the Japan plums are very short-lived when worked upon it in Texas and the South, and that it will generally kill a peach at the end of the first and always the second year. Complaints on this score have been general for some time, and many nurserymen are abandoning its use altogether, preferring to work the Japan plums entirely on the peach, which experience has shown to be particularly adapted to that race.

I was at Hitchcock recently, and saw a six-year-old Burbank plum tree, one of the four oldest on my former place, which had recently died without the slightest visible cause. A careful examination, after being dug up, showed the roots to have been apparently healthy, with not the slightest sign of root tumor or rot, and its growth had been extraordinary, and yet it is now dead, and one of the others is plainly doomed. I saw the same results in 1895 at

Beeville, in Southwest Texas, and only last week in Beaumont, on the east, where two orchards on Marianna, seven years old, had died the past summer. The same experience has been related by Mr. J. W. Steubenrauch, of Mexia, Texas, one of the most successful orchardists of North Texas, and also by several growers in Tyler, the greatest fruit center in the state, while similar reports come from Louisiana and east of the Mississippi. It may, therefore, be set down as proved beyond all doubt that this stock is unsuited and uncongenial to the Japan race of plums. In a recent letter, Mr. Luther Burbank tells me that it is also of doubtful value in California. Several nurserymen of East Texas are now propagating the Japan plums on the common wild plum of this state, the *Prunus Americana*, and claim that it is well suited to them. I have had some experience with that plum, and so far it seems to dwarf whatever was put upon it even more than the Myrobalan. However, as there are a great number of different seedlings of this species, some differing considerably from others, they may have one better suited than mine. I have seen some seedlings in the woods near Beaumont that suckered badly, though others do not. As it has been only recently that experience has shown the want of congeniality of the Marianna and Japan plums, it is doubtful whether there are trees of the latter race more than five or six years old on the Americana stock, so it is entirely unsettled yet how they will ultimately succeed, and assertions of interested parties must be taken with great caution. Enough money has been fooled away on the oriental plums worked on Marianna to make people go very slow with this new stock. On firm, well-drained ground, fertilized and regularly mowed, but not plowed, I believe the peach is the best stock for the Japan plums, unless the Myrobalan is superior. The latter is almost universally used in California and France, and is said to be especially adapted for stiff soil and damp ground, and is entirely successful as a stock in such locations in California. I have heard no objection to this stock, except that the Japan plums do not grow as fast on it as on Marianna. This is no objection at all, if the trees live

and are productive. In fact, a moderate growth is more likely to be a healthy one.

But, after all, would not all these Japan plums be likely to succeed just as well on their own roots as on any other stock? There would be no difficulty in treating them thus by grafting on the Marianna plum, and then cutting away the stocks after the scions had taken root at the lower ends. Some of the Japan plums, particularly the Satsuma, will sometimes grow quite well from cuttings, and all would likely root if treated as described in the chapter on grafting. It is well worth trying, for naturally vigorous trees like these plums would do best on their own roots. But in the near future Mr. Luther Burbank promises us a far better stock than any we now have. He has crossed the Satsuma on other varieties, and thinks he has something that will fill the long desired want for a vigorous stock particularly adapted to the Japan varieties as well as all other plums.

CHAPTER XVII.

The Peach.

FOR some unexplained reason, the Persian strain of peaches, so successful elsewhere over the United States, is a total failure in lower South Texas, and especially along the coast. The trees grow well, but are all very backward in starting off in spring, and form but few fruit buds. I do not know of a single productive tree of any of these varieties in this whole section. A fine, large Elberta, on Mr. I. Aiken's grounds at Hitchcock, now six years old, has never borne over a dozen peaches at a crop, and has not that many on the tree the present season. However, though we may not grow the Persian varieties successfully, still we are not without kinds that will afford a succession, if not of extra large peaches, still most excellent ones in quality, and unsurpassed in productiveness and regularity of bearing. I allude to the Waldo, Angel, Imperial and Climax, of the Peen-to and Honey strains. Those are all freestones. The Triena is a red-fleshed cling, about the same size as the above, and the best clingstone of those strains. While the catalogues contain an additional list of a great number of these hybrids, they are all practically identical with the above or inferior to them, and ripen precisely at the same time. It is claimed that the Jewell is about a week earlier than Waldo, but proved no earlier with me, and has the bad fault of blooming several weeks ahead of the Waldo. The above are all of the Chinese Peen-to and Honey types. In addition to them, recent experiments have shown that several Chinese hybrids are also very productive in the Gulf region. The Chinese Free, Thurber and Family Favorite are the cream of this type, and will furnish the best and largest peaches yet found that bear well this far South. Though the season has been exceedingly dry, these varieties were heavily loaded with large

fruit of most excellent flavor. There is, perhaps, no country in the world where a peach crop can be counted on with more certainty than on the above varieties here. The warm Gulf breeze beats back the early fall northers, and our peach trees hold their leaves until late in fall; in fact, often almost until Christmas. This causes them to rest late enough in spring, if not winter-pruned, to nearly always miss the killing late frosts, so fatal further up the country. It is true that the Waldo and Angel, which bloom first, sometimes get caught, but they have the remarkable faculty of holding back enough buds, with almost human sagacity, to furnish a full crop, even if the first blooms are killed. This peculiarity, with their good eating and shipping qualities and small pits, makes them not only very desirable for home use, but should make them profitable as a market crop when the interior peaches are killed. The so-called Spanish peaches, Galveston, Onderdonk, Carpenter, Florida Crawford, Countess Victoria, and others, are really nothing more than common seedlings of more than ordinary merit, but not profitable for any except a nearby market. They lack color, nor are all of that list good bearers here, and all are late. I omitted to say that the Dwarf Japan Blood has proved of no value, having been unproductive now for four years.

As stated elsewhere, the peach must have dry feet and a firm soil, both top and bottom, for health and long life here. There is no place for a close root-pruned peach orchard like a rolling, well drained, virgin prairie sod, with close mowing during the growing season. But not for trees set with long roots. By imitating nature, and planting close root-pruned trees, practically seed, on ground like she selects, perhaps even the dread yellows will never appear, and peaches may be grown at the far North with good success, where now they either die of the above disease or winter-kill every year. The curculio and common cotton-boll worm are the only serious enemies to the fruit here, and the best preventive I have ever tried is a thorough spraying with weak whitewash, with a little gas tar added to make it smell. This appeals to both sight and smell, and has given me sound fruit.

CHAPTER XVIII.

Apricots, Figs, Japan Persimmons, and Nuts.

EXPERIENCE in South Texas with several Florida varieties and a large number of the old standard kinds has, up to the present time, failed to develop a single productive apricot. They all grow well and bloom profusely, but fail to set their fruit. Recent experiments, however, with the old Royal, at Arcadia, lead to the hope that it may bear, for it set some fruit the present season, which unfortunately a severe wind thrashed off.

FIGS.—This popular fruit should be in every man's yard in abundance, both for himself and for his poultry, and, being exceedingly surface-rooted naturally, should always be grown from a cutting or very close root-pruned tree. But, except for very nearby markets, it is almost useless to grow figs in quantity. A large preserving establishment was started in New Orleans a few years ago, and a very considerable quantity of the fruit put up, but experience soon showed that the preserves were of such an exceedingly sweet and cloying quality that very few could be eaten at once, and the demand has been very small. The plant suspended operations a year ago, and is now idle. The fig thrives far better in a firm, packed, undisturbed soil, like a back or chicken yard, than when plowed and cultivated. The little Celeste or Sugar is much the most hardy and popular kind, and if trained up as a standard will make a very large and handsome shade tree.

JAPAN PERSIMMONS.—A few years ago it was impossible to sell the fruit of this tree, or even give it away. Dr. Pearle, of Houston, planted quite an orchard twelve or fifteen years ago, and when the trees came into bearing, I happened to visit the place in the fall, and found a large lot of the fruit on hand, for which there was positively no demand. Since then,

however, the public taste has been gradually educated up to a moderate demand, and possibly in a few years they will be very popular. Some varieties are much more hardy than others. I had one sent to me under the name of Hyakume that was killed by a freeze at Hitchcock, while another longer and more pointed kind has never been hurt. I know trees of this variety in Beaumont that have borne enormously for fifteen years, though I do not know the name. Experience has shown that all persimmon trees, as well as pecans, are peculiarly adapted to close root-pruning, and make enormous, deep, strong roots the first year. If set in early winter and well tramped, both will grow freely, even from the tops of trees cut just at or even a little above where the first or upper roots of the seedling are emitted, and will make an astonishing growth the first season. For propagating both persimmons and pecans on large trees, winter budding, as described elsewhere, will be found to be particularly adapted, and much easier and more certain than grafting.

NUTS.—For Texas the pecan, of course, ranks first in importance, and doubtless the exaggerated estimates of the value of a pecan grove as a source of profit have led quite a number of persons to embark in this business, who will be disappointed. While this fine nut generally finds a market at some price, still the vast number of wild bearing trees, the crops of which are free and gathered by cheap labor, at a time when little else can be done, will always depress prices. In some seasons, like the last, values have been so low in many localities, that thousands of pounds have been left for the hogs to eat or to rot on the ground. The common seedling pecan cannot possibly pay as an investment, for even from the best seed inferior and male or unproductive kinds spring. But those who will plant the nuts on firm ground, and then, when two years old, graft, or better still, winter-bud, as described elsewhere, using wood or buds from full bearing trees of the largest thin-shelled varieties, will very likely find a good market for a long time. As to enemies, the frost occasionally blights the blossoms, and the tent caterpillar very frequently strips the leaves from the trees. But, of

course, the enterprising grower could easily combat the latter by spraying.

The English walnut is another nut that ought to succeed here, but we have no trees, as yet, over five years old, and they have borne nothing so far. The chief enemy of this nut is the flat-headed cottonwood borer, but a good coat of white-wash on the trunks every winter will entirely deter the moth from laying her eggs on this and all other trees. Of course, only nuts or close root-pruned trees should be planted, and on firm ground. The Japan walnut, however, is a very early bearer, even from the nut, and in five years will make quite a large tree, and bear full crops. The nuts seem to reproduce quite true, and this tree also has been proved to take most kindly to root-pruning. It is almost entirely free from all insect pests, will likely attain a very large size ultimately, and make a most ornamental shade tree. But the nuts, being small and hard shelled, will have little or no market value.

The Japan chestnut has so far failed to set its fruit when grown from the seed. It is a very vigorous tree, but drops its blossoms every year here. The almond has not had the attention it deserves in Texas, but full experiments are being made, though its value is very doubtful anywhere in the state, as it blooms very early. The hickory nut and black walnut would not pay for the nuts, but the man who will plant a walnut grove from seed, on firm virgin soil, like the squirrels do, if he has the ground to spare, will, in the end, have a most profitable investment anywhere. But "cultivate" all nut trees when old enough to bear with a mowing machine, for every farmer knows that as soon as pecan trees are enclosed in cultivated fields and plowed, they cease to bear. They bloom freely, but the destruction of their surface roots causes them nearly always to shed.

CHAPTER XIX.

The Strawberry and Other Berries.

THIS is by far the most profitable early spring crop for the lower Gulf States, and especially the coast country of Texas, where conditions of climate and transportation are so favorable, and where, unlike sections farther North, a full crop can be grown the following season from summer or fall planting. In choosing a location for strawberries, always select the stiffest and strongest soil, the black, waxy and yellow clay land being ideal ground for this crop. Actual experience has shown, that this is one of the few plants that will do as well or even better here, manured in the drill, as presently described. Its natural tendency is to form surface roots, and they should by all means be drawn or tempted to go down. Broadcast fertilizing mixes the manure both at the top and bottom and, though it may look unreasonable, burying the manure in the drill under the plants will always make the largest fruit. So, instead of scattering the manure, whatever it may be, broadcast, first break the whole ground as deeply as possible, and harrow thoroughly until well pulverized, after which open furrows about two and one-half or three feet apart by running the plow each way. Along in this strew the fertilizer, and be sure to put enough. About half as much will do on the heavy black land, though it is hard to err in putting on plenty everywhere. If barnyard manure is used, and there is no better if enough can be had, fill the bottoms of the furrows several inches deep. Then run a bull tongue up and down, thoroughly stirring and mixing it all. Next, throw the earth back on the furrows from each side by splitting out the middles, quite deep. Do not be afraid to leave the ridges well up. After smoothing off the tops to about a foot wide with a rake, cover the whole surface, ridges and furrows, quite deeply and evenly with hay

or straw, strewing it directly from the wagon, which can be run down between the rows. Spread the mulch thick enough to be at least two or three inches deep after settling. Do this in July or August, so as to catch the summer rains and have moist ground for planting in September and October. I have the present season made careful notes, in many fields, of results from different dates of planting, and find without exception, that plants set in those two months not only grow by February quite as large as the two-year-old ones, but produce just as many and larger berries. The difference in size of fruit from the two ages alongside was in every instance very remarkable in favor of the fall-set plants. The great trouble is that frequently in the fall the weather is so hot and dry that it is very difficult to make plants live when set. This comes entirely from a too high temperature of the soil, which is entirely obviated by mulching as directed. Thousands of plants are annually sacrificed in August and September, from ignorance that unless set with a ball of earth at that time, the earth if clean, is too hot for the plants to take root. But if mulched in July or August, and a good rain falls to wet the earth well, it will remain cool and moist the whole fall.

When ready to set, cut all roots back to about one inch, open a small hole in the mulch and insert the roots, fan-shape, straight down at least fifteen inches apart. *Never spread out the roots of any tree or plant*, as this induces a superficial system. After setting, pull the straw or hay lightly over the plant, as a shade, and go on to the next. Treated thus, and allowed to grow right up through the mulch, a stand can always be secured with good, strong plants, a month or more in advance of those who undertake to plant on clean, unprotected ground. Another great advantage of this method is, that if the mulch has been put on evenly and of moderate thickness, no further work will be required until the crop is gone except, perhaps, the pulling up of a few stray weeds that force themselves up through the mulch in spring. But, even if this fall mulching be not practiced, no one should ever neglect this vitally important operation at some time before the fruit ripens. Sandy, dirty berries are now the

rule, and not the exception, at several points, which has resulted in giving this season's crop a depreciated value of from 25 to 50 per cent. lower than it would have brought had mulching been general. It is hard to understand why otherwise enterprising growers will persist, from year to year, in flooding the markets with such fruit. They not only hurt themselves, but also all other growers who do mulch, for when prices come down for sandy fruit, the clean has to suffer likewise. The matted-row system is another mistake of many growers, and is responsible for this, as it is really impossible to properly mulch plants thus grown. That system is admirably adapted to the North, where the entire tops of the plants are winter-killed, and when growth starts in spring the blooms come early, before the foliage grows too large, so as to shade the fruit too much, as it will here. Strawberries grown in the shade will not ship well, being not only soft, but of inferior quality. The sun should be able to strike all around every plant, and the berries will then be firm and bright. On no crop can be seen more plainly the effect of liberal and judicious fertilizing than on this. Heavy applications of cotton-seed meal, or any fertilizer rich in ammonia alone, will always produce a rank growth of vine, susceptible to the "rust," and soft, insipid fruit. Plenty of potash, and especially phosphoric acid, are absolute necessities for firm, high-colored, well-flavored berries. For those who intend to make this a business, it is a matter of the first importance to provide a full supply of new plants every year, and a bed of sufficient size, rich and convenient to water, should be set with plants about three feet apart, in February or March, for runners. If shaded somewhat by a light frame and brush after June, very little or no water at all will be required until August, when it should be supplied, if dry, to compel the plants to throw out new and strong roots, for re-planting in September and October.

As to marketing, nothing need be said, except that many growers will persist every year in shipping half-ripe fruit, to the great depreciation of their crop later on. Prices have now come down to hard-pan, the public is yearly growing

more critical in its demand for quality in all fruits, and it is the height of folly for berry growers, when the season is cool and there is no danger of the fruit spoiling, to try to force half-ripe, pale and sandy berries on the market. I kept close watch on the reports from the large cities this season, and saw repeated complaints on this subject. The Florida growers do not do it, and their fruit has steadily maintained a good price in New York, and has been invariably quoted in St. Louis and Chicago, the present season, at more than double the price of Texas berries. The strawberry in the South is subject to but one disease—the “rust,” already alluded to—a bacterial one, due to conditions of extreme and sudden variations of temperature and moisture. While the Michel has been most seriously affected by this disease everywhere the present season, the old reliable Nunan has not shown a sign of it, though grown amongst and alongside, and its plants have averaged double the size of the Michel. As to varieties, the latter should be entirely discarded for outside planting, though, as shown farther on, it can be grown with great profit under cover. A very careful examination of many strawberry fields by Mr. E. W. Kirkpatrick, an old berry grower of North Texas, during the season of '96, convinced him that the Nunan and Cloud Seedling are by far the best varieties for South Texas. The latter is a pistillate, and requires every third row to be planted with Nunan which has a perfect flower. The Smeltzer is also an excellent shipping variety, but the fruit is inferior to the Nunan in quality and color.

And now, I would urge all growers to make an experiment with the Michel, on a small scale, at least, under plank and oiled cloth covering. While this is an extra-large, early, and really good eating berry, when the weather becomes warm and dry it is not a long-distance shipper, and has the very serious fault, for open air culture, of beginning to fruit in the fall and early winter. Ordinarily those crops are ruined by a freeze, and the plants have had their work for nothing, besides being damaged by the checking of their sap when in motion, which is probably the prime cause for the general

epidemic of rust on them this spring. It will be remembered that we had early and repeated frosts and light ice, several times last fall, a very unusual thing at that season, and the Michel plants were in full growth. The question is, Can we not utilize this quality of early fall and winter bearing? I would suggest, on a high location, that a bed about eight feet wide be thrown up well with a plow, after being thoroughly

STRAWBERRY BED, UNCOVERED.

fertilized. On top of this place an ordinary coldframe five feet wide, made of 1x10 or 12-inch plank for sides, connected by strips about two feet apart, cut rounding, as shown in the illustration, to support the oiled cloth and shed the rain. After stretching common white cotton cloth of a good grade, to make it last it should be thoroughly oiled with a

STRAWBERRY BED, COVERED.

paint brush, or the cloth might be dipped in the linseed oil and wrung out, and then stretched to dry on the bed. I have used such a covering for tomatoes, and found it will protect from a freeze much better than the ordinary frost-proof cloth sold, or even than glass sash. Of course, the main point is to keep out a freeze. We have an ordinary temperature warm enough in winter to perfectly mature

berries in the open air, but one, or at most two, cold spells every year spoil the crop. No other variety will fruit early and out of season, like the Michel, which makes it an ideal plant for this purpose. I know of no crop that will pay like it, if treated as suggested, and I predict that in a few years every enterprising grower will have one or more beds thus treated, for success then is absolutely certain and good prices assured. A crop thus grown must of necessity be limited, and with two markets like Houston and Galveston at hand, an over-production of fine, ripe fruit would be impossible. But the balance of the state would be ready to take any surplus. Berries like the Michel, grown on rich ground and with plenty of room, and protection from cold and beating rains, would color up handsomely, and always bring a fine price. The people who buy at that season have the money, and will pay well for a first-class article. Of course, a contingency of dry weather must be provided against for best results, and if unable to afford a small windmill, a good hand force-pump, with ordinary well, will furnish abundant water. Our wells are always full in winter. It would be well to water entirely from below, to prevent wetting the fruit.

When preparing the bed, lay a row of common one-inch drain tiles, one foot long, the full length of it and about eight inches beneath the surface. Cover the tiles with an inch of shell, gravel, sawdust or hay, in order to keep the soil from finding its way between the joints and into the tiles. Or, instead of tiles, two pieces of 1 x 3 heart pine, nailed together like a gutter, and the edges notched at intervals of six inches, to allow a free escape of the water. This should be inverted, and laid upon a six-inch plank, at the depth named, and the end next the well, whether tiles or plank, connected by hose to the pump. The fruit when ripe need never be wet, which would greatly improve its appearance and shipping qualities. The plants should be set not less than fifteen inches apart each way, and the bed evenly mulched before putting them out. A strawberry bed of Michel thus treated would be absolutely sure for a paying crop, and the yield from November to March alone would be something wonderful. The cover-

ing (see cut, page 84), which, by the way, should be nailed fast on one side, and the other tacked to long one-inch curtain-rods, and fixed so as to lap and roll back in all ordinary weather, could be removed the last of March and packed away for the next season, and the plank likewise, and both would answer for a long time.

If northern growers can afford expensive houses, and steam heating to grow cucumbers, lettuce, etc., by the acre, surely it will pay to spend the small amount of money required here to grow a much more valuable product like the strawberry, and put it on the market during the winter months.

BLACKBERRIES.—Like the strawberry, the dewberry and blackberry are perfectly at home around the Gulf coasts, and in fact all over the South, though many varieties of the latter are so subject to rust that it pays best to confine ourselves entirely to varieties like the Dallas. The Mayes or Austin Hybrid dewberry and Early Trinity blackberry are new and very promising varieties, that are well worthy of a trial. As these berries are all rank growers, and sucker very badly in our long, warm summers, it is all-important to give plenty of room between the rows, to permit the free use of the plow. Eight feet between the rows is none too much. As soon as the fruit is gone, the old canes should be cut out at once, or by winter they will become so tangled with the new growth that their removal is very difficult and troublesome. A good dressing of bone meal or phosphate will greatly improve the size of the berries.

The raspberry, gooseberry and currant find the far South too warm for their perfect development, and these fruits are of no value there, though some of the black-cap raspberries are cultivated to a limited extent in the upper portions of Texas.

I omitted to note above that the strawberry beds should run north and south, to allow all the plants to have at least half a day of sun.

CHAPTER XX.

A Review.

THE preceding chapters are part of the original New Horticulture, published twelve years ago by myself, because no publisher would bring out what one of them, after looking over the manuscript, called "a mess of nonsense." When I penned them I little thought I should live to see even the faintest streak of dawn that would usher in the happy "Emancipation" day for the fruit-growers of the world. Instead of the easy, delightful and profitable occupation that horticulture should be, when followed in accordance with nature's laws, it has now become, through a strange, unaccountable perversion of those laws, apparently from its very beginning, so burdened with fallacious theories and costly methods, that to be a horticulturist, according to the present accepted orthodox teachings, is to be merely a "hewer of wood and drawer of water" for the railroads, the middlemen, the box factories and the day-laborers. Realizing that all this was coming through the enormous plantings of fruit trees by the cheap and easy method of root-pruning, and seeing that the principles of the New Horticulture, the fruit-grower's only salvation, were making slow headway through the determined opposition of nearly all the experiment stations, professors and many of the largest fruit-growers of the country, about six years ago I moved to Lampasas, to institute crucial experiments in sod culture. Up to that time root-pruning and other of its principles were being rapidly adopted by progressive fruit men, but the one horticultural pill that gagged even them was non-cultivation. Knowing that this was the most important principle of them all, I determined to so sugar-coat it by the exhibition of perfect fruit thus grown as to induce them to swallow it also, and at the same time

crush the opposition of the so-called horticultural scientists by three experimental demonstrations on a scale large enough to convince the most skeptical who were honestly looking for the truth. Of course, I knew that there were thousands so joined to their idol of cultivation that they would not be convinced, even though Charles Downing himself should rise from the dead and denounce it. With this view I set out an orchard here, and then cast about for my northern experiment station and a man to conduct it fairly. I wanted to enlist some journal, and finally selected the editor of *The Rural New Yorker*; and in order to interest him by the novelty of the thing, and indemnify him if the venture proved a failure, I offered to give him outright the plates and copyright of the *New Horticulture* and one thousand copies of the book, on condition that he set out one thousand fruit trees in crowbar holes, on his poorest unbroken land, mulching and fertilizing around each tree and mowing the ground instead of cultivating it. He accepted the offer, though utterly incredulous of success, for, when he received a model tree, he wanted to know if I "really expected a straight stick like that to grow." But he faithfully did his part, giving occasional reports in the paper on the successful behavior of the little "sticks." At this, certain of the horticultural scribes and Pharisees began to hint that he had "an axe to grind" in the sale of the books; so he promptly turned them and the *New Horticulture* over to *The Rural New Yorker*. After they were sold, that journal decided not to publish another edition and returned the plates, etc., to me. Finding from continued inquiries that there is a growing interest in the *New Horticulture*, and feeling, like *The Rural New Yorker* editor, that any future articles I may write would look as if I also "had an axe to grind," I offered *Farm and Ranch* the sole use of the plates free, so long as they keep the book in print. They accepted my offer in the interest of progress, but, never having experimented, leave it to stand strictly on its merits.

With this explanation, I will now return to the New York experimental orchard, planted largely in apples and peaches, which has been such a signal success and excited such general

interest at the North, that a few weeks ago Mr. E. Van Alstyne, a prominent fruit-grower and writer, visited it and made a highly favorable report in *The Rural New Yorker* of January 15, concluding with the following language: "The annual growth of new wood was all that one could wish, and it is good, solid wood, too. The trees are strong and healthy and will compare favorably with the majority of trees of the same age anywhere. I see no reason why in the next eight or ten years this orchard should not return an annual net income that will equal several times the cost of land and trees." In the same issue the editor remarks: "Those were June-bred trees, planted in crowbar holes and cut back so that about one foot of stem was left above ground. The roots were pruned so that not even a stub of a side root was left. We punched a hole with a crowbar right in a brush-grown field where no plowing had been done for at least thirty years. The little trees were put down into the holes and water and sand poured in, then packed down hard around the root with a stick. These trees did not receive the attention they should have had, and they grew slowly at first. I have dug up quite a number of them to see what they were doing, and in every case their first effort seems to be a series of tap-roots which dig straight down into the ground. I have traced them until I feel sure they reached nearly or quite to the water level. Later, after the tap-roots are well fixed, the small feeding-roots come out from below the crown of the tree, when growth proceeds rapidly."

In a former issue of the journal the editor had this to say about cultivation: "I have been criticised more or less for trying what is called the Stringfellow method of handling trees,—that is, close root-pruning, planting in small holes, mulching around the trees and mowing the grass instead of cultivation. Many prominent men warned me in the beginning against these methods, but if I were now to publish their letters it would make those gentlemen very weary. In view of the way my own trees have acted, I am unable to understand just why the scientific men make such fun of these methods. The fact is, those gentlemen will soon not

only find it necessary to take a back seat, especially on the subject of cultivation, but will actually have to stand up." So much for the New York experiment. About the same time it was started, Mr. W. W. Durham, of Austin, Texas, agreed also to plant one thousand fruit trees under my direction as a test of the New Horticulture in the South. The conditions were identical with the former, being unbroken natural sod, crowbar holes and close root-pruned trees, mulching each one, and mowing the middles several times during the growing season. The orchard is now five years old, and last August Mr. Durham wrote me as follows: "My sod fruit is now all gone except a few September peaches. The Elberta, Family Favorite, Sylphide, Bequett, Carman and several others were the largest and highest colored by far that came to the Austin market. A German friend, who has grown peaches all his life, said he never saw Family Favorite have such color before. The Driscoll Hotel let my peaches turn down all the east Texas fruit, on account of fine size, beautiful color and good flavor. There is an orchard just across the Colorado River that has eight hundred trees in it, and Mr. Weaver, the owner, told me they did not bear a single peach this season, due to the late February freeze. That orchard was thoroughly cultivated from early spring." Here we have absolute proof that the destruction of the fibrous surface-roots so weakened the eight hundred trees that they shed all their blossoms; to which cause is also due the well-known "June drop" of cultivated peach trees all over the country, for who ever heard of "June drop" from a fence corner or a back-yard tree?

I will now close my demonstrative proof of the superiority of non-cultivation, with a few words on my own sod orchard, planted at the same time, in the same way, and treated just as were the New York and Austin experiments; except that my trees were set in small, clean circles on Bermuda grass sod, which has been kept well mowed ever since. From these trees I shipped fruit to the World's Fair which the superintendent of Texas exhibits, Mr. Samuel Dixon, and Mr. E. W. Kirkpatrick, President of the National Associa-

tion of Nurserymen, pronounced to be the most beautiful they ever saw. Such being the general good results of non-cultivation, before inviting attention to some of the evil effects of cultivation, no matter how shallow, which necessarily destroys the surface-roots of trees, let us consider for a few moments some of the peculiarities of those fine, hair-like little feeding-roots that trees of all kinds, fruit and forest, instinctively push to the top of the ground, taking complete possession if allowed, but of which neither fruit-growers nor horticultural writers take the slightest notice. Cut and slash them with the plow, cultivator or hoe as we may, back again they come, if given only a few weeks' chance, to the surface, Nature's kitchen, where she kindly spreads, cooked by the action of the elements, her choicest food for the millions of hungry little mouths so eager to partake of it. Alas ! the well-meaning but mistaken fruit-grower, under the delusion that he is thus benefiting his trees, comes along at short intervals with his infernal machines of tree torture, tears the whole surface to pieces, scattering the soluble food for the next flooding rain to carry away to the greedy rivers and sea, while the patient, long-suffering trees at once go to work to replace the poor little innocents that man has so ruthlessly destroyed.

And here let me quote an extract from the *Houston Chronicle* of today, February 8, which so well expresses my own belief for years : " Dr. Henry C. Conrad, of the Botanical Division of Johns Hopkins University, after continued experiments, is convinced that in some form or other plants and trees have all the senses of animals except hearing. ' We have never been able,' said Dr. Conrad, ' to discover any way in which they are susceptible to sound, but in seeing, feeling and tasting they are certainly developed. The Sundew, a plant which grows in the swamps about Baltimore, probably knows the sense of taste to a greater extent than any other. With a single exception,' said Dr. Conrad, ' they can recognize light and the direction from which it comes ; they feel the slightest wound, they discriminate in taste, they have a sense of direction, whether they are

turned in the right direction or not, and are influenced by electric currents passing near them.'"

Who shall say that this is not all true, or deny that trees are endowed by nature with some kind of conscious intelligence and feeling? Their actions plainly show it. The modest, little "sensitive" plant shrinks at the touch of man; all kinds of vines, instinctively, as if they saw, grow toward and stretch their tendrils to grasp a foreign support; while in the crowded woods tree-tops keep away from and leave room for each other with a kindly consideration that puts to shame the selfishness of man. Is it incredible that the great Entity we call God, the "unknown God," who "is in all, over all and through all," of whom all nature and the universe is the visible expression, has also endowed the trees, plants and flowers with some sort of capacity for pain and pleasure; and that, if our dull eyes and ears could but be opened to the mysteries of tree life, we should see their expressions of delight over the opening blooms and flowers with which they decorate themselves in spring, and the golden fruit in summer, and hear their cries of pain under the torture of the pruning-knife, the cultivator and the plow? One cannot look upon the dead and dying fruit trees that abound in all our orchards, stretching out to heaven their poor, blackened limbs and yellow, withering leaves in silent protest against man's inhumanity to trees, without feeling that they have really and truly suffered during the long years of such treatment. But a better day is dawning for so-called inanimate nature, and, with a view to hasten it, I will next point out some of the evil effects of cultivation which have forced themselves under my observation, since the preceding chapter on that subject was written, twelve years ago. But, before doing so, I wish to state that the three sod experiments alluded to were made intentionally under the most trying conditions, and also to show that thousands of acres of New England "abandoned farms," and hilly as well as rocky locations elsewhere, in sections of average rainfall, could be profitably set to fruit trees, especially apples; though, of course, growth would not be so rapid as if they were cultivated a few years, until the trees began to bear, and then put down to a mowed sod.

CHAPTER XXI.

Effects of Cultivation.

WHILE for years I have known in a general way that sod fruit would keep longer than cultivated, I was greatly surprised, during my World's Fair shipments, at a remark in one of Mr. Sam Dixon's letters, that, "while all other fruit rots quickly, yours looks like it would keep forever." Knowing that all of it was full ripe, I was much puzzled, and fell to wondering why my peaches kept longer than others, and could see no possible reason except that they had been grown naturally, upon trees whose feeding roots had never been disturbed, thus enabling them to so perfect their fruit, combining its sugar, acid and color in one harmonious whole, as to form a peach immune to rot. So, last summer I determined to test this theory, so big with possibilities for the fruit-grower, if true, and on the 15th of last July, the first day of that awfully hot wave that swept over the country, I shipped by express two baskets of Elberta peaches to Mr. Williams, of the *Practical Fruit Grower*, Springfield, Mo.; two to Mr. Olcott, of *American Fruits*, Rochester, N. Y.; two to the *Pacific Fruit World*, Los Angeles, Cal., and one to Mr. J. Horace McFarland, of Harrisburg, Pa.,—requesting all of them except Mr. McFarland to return one basket at once to me at Lampasas. The peaches all went in perfect condition and were pronounced "firm, juicy and delicious," "just as fine as if picked fresh from the tree," Mr. Poland, of the *Pacific Fruit World*, declaring "they were magnificent, fit for an epicure." The other three baskets were returned without opening, the one from California by some delay, having taken sixteen days to make the round trip, but all the peaches were still perfectly sound.

Not satisfied with that performance, I closed each basket on arrival and forwarded it to *Farm and Ranch*, Dallas, Tex.,

two hundred and fifty miles distant, where they opened up still in good order. All those peaches were grown on sod trees, and if my theory, as to that being the cause of their wonderful carrying qualities, is not true, then Lampasas is the most remarkable peach country in the world. But I know it is true, for our season was very wet and cultivated fruit rotted just as badly here as elsewhere. But while my peaches were making these remarkable trips by express in the hottest weather, cultivated fruit from East Texas and Georgia was going forward in refrigerator cars and arriving at all markets in such bad condition that little of it brought the charges. An associated press dispatch from New York, July 16, read as follows: "Georgia peaches in heavy receipt. The fruit develops the brown rot very quickly. Lots of green stuff also coming, all covered with rot." Much of that fruit was doubtless from the cultivated orchards of J. H. Hale, in which Mr. J. Horace McFarland was interested, and, if he is my publisher, I must tell a joke on him. The name of the peaches I sent in his basket was not mentioned, so later I got the following letter from him: "The peaches, perfect beauties, came today. We ate the ripest and put the others in a cool room. This peach is certainly very beautiful and seems to be of the Elberta shape and color, but with much more refined flavor. The flesh is thick, pit small, and it and the flesh part readily. Mrs. McFarland remarked at once that it would be a pleasure to can such peaches. What's the name of this peach, please?"

But I do not blame him for not recognizing it as a true Elberta, since he had been accustomed only to the shoddy article. The fact that the skin readily parts from a sod-grown Elberta is applicable to all sod-grown peaches, and if dipped a few seconds in boiling water, the skin will slip as readily as that of a tomato. But it will not part from a cultivated peach. Delighted now, and amazed at my success and its far-reaching consequences, foreshadowing complete emancipation of the fruit-grower from the grinding refrigerator-car monopoly, and lessening the cost of production so greatly as to solve forever the problem of profitable market-

ing of all fruit crops, yet at the same time fearing that possibly climatic conditions here may have had something to do with it, I determined to see whether California, with a still drier climate, could parallel the achievement of my sod peaches with her cultivated ones under a temperature of 100°.

With this in view, I requested our local fruit-dealer to buy one or two crates of California peaches from Houston, ordering that they be sent direct from the refrigerator car on its arrival there. Accordingly, on August 15, a few days after the return of my Los Angeles basket, the two crates arrived, having been taken from the iced car at 7 P. M., and delivered to the Express Company in Houston at once, reaching here the next morning. Being notified, I went down and saw the crates opened, in one of which were five sound peaches, and seven in the other, the balance all more or less rotten in a single night. The peaches were large yellow clings, but so bitter from being picked too green that they were not fit to eat. I at once sent *Farm and Ranch* one rotten and one sound one, who will testify to their condition. Here, then, was the proof that climatic conditions had nothing to do with the shipping qualities of my peaches, which went to Los Angeles and back by express in good order, while California, with a still drier climate, could not under our high temperature get her cultivated ones here sound, even in a refrigerator car with no handling, to say nothing of a return trip. Now, what was the reason? Plainly, as I said before, either Lampasas is the best peach country in the world, or else cultural conditions did it.

But, to demonstate still further that sod fruit is immune to rot, I smeared rotten peaches from a neighbor's tree all over many of mine—green, half-ripe and full ripe—and in not a single case did the disease "take;" the rotten mass simply drying up, leaving my fruit as sound as before. Still not satisfied, I inoculated green and ripe fruit; the green failed entirely to "take," but the ripe ones were slowly infected, requiring eight days to produce a rotten spot as large as a pea. Now, what does all this mean to the fruit-grower? Why, simply that the horticultural millenium has dawned,

when fruit can be grown at one-fourth the cost of the old expensive methods, loaded into plain ventilated cars and shipped across the continent and back without a single case of rot ! And here I will call attention to the government investigation now being conducted in California by Professor Harold Powell, who has been vainly endeavoring to locate the cause of rot in oranges during transit to the east, the loss being estimated at over half a million dollars annually, which he attributes altogether to physical cuts or other damage in picking, though it would not have been one cent had the fruit been grown on a close-mowed sod.

This could easily be demonstrated with fruit from any city lawn ; but the professors will not do it, for that would mean a loss of their fat jobs and an endorsement of the New Horticulture, though this professor is plainly squinting that way from the closing remarks in his recent report on the subject, where he says : " The conditions under which the fruit is grown, such as the character of the soil, the age of the trees, the method of orchard management, undoubtedly exert a wide influence on the shipping and keeping qualities of the fruit. On this branch of the subject there is little definite information. We know that the texture and the quality of the fruit are influenced widely by the cultural conditions, and it is probable that the susceptibility to decay, the rapidity of ripening and other factors that influence keeping quality, are likewise modified. The Bureau is carrying on investigations along this line."

Now Professor Powell was in or near Los Angeles at the time the *Fruit World* of that city received my Elbertas alluded to, when I also wrote the editor fully, telling him all about my theory as to the immunity of sod-grown fruit to brown rot and of the other experimental shipments made to demonstrate its truth, and, being then engaged on the same subject, it is very evident from the Professor's remarks above that he read my letter. I will now close this discussion of cultivation as affecting the keeping qualities of fruits by citing a remarkable instance of its effect on the apple. I have a young bearing Terry Winter tree, a favorite Georgia apple,

like all my other fruit trees, in Bermuda sod, and wishing to compare the keeping qualities of my fruit with that of apples grown on a well-cultivated Terry Winter, I wrote to Messrs. Wayland and Reigel, large orchardists, of Pomona, Ga., telling them of the experiments I was carrying on and requesting them to send me by express, packed carefully, a few Terry apples from a thoroughly cultivated tree. They promptly sent me a small box with ten apples, nicely wrapped in tissue paper, which reached here on December 10 last, three of which were already rotten. I left them as they were, except one of the sound ones which I ate, placed six of my sod Terry in the box, nailed it up and forwarded it to Professor Connell, of *Farm and Ranch*, with request to keep all until they rotted. At the end of five days he wrote me that all the other Georgia apples had rotted and he had exposed mine on a table in their hot office to see how long they would keep. On February 9, just two months after, I received the following letter from Professor Connell: "Dear Sir, I wish to report on the four Terry apples which I have kept under the most trying conditions of a hot office. All of the specimens have shriveled badly and two of them are unsound, rot having begun at the core and worked outward. I have twice added moist excelsior to the box to partially supply moisture, but I am satisfied that the conditions are entirely too trying for any variety to withstand the strain, because they shrivel up to nothing." Now, I had the Professor make that test to see whether the brown rot bacteria, which had destroyed the Georgia Terry in that room in five days, could do the same for my sod apples. The result is a complete vindication of my theory that the conditions in the flesh of sod fruit are such as absolutely to preclude the possibility of brown rot development, which always occurs on the skin first, working inward; for, though my poor little apples gradually withered away under the high, dry, confined temperature, finally succumbing to decay at the core, they resisted the brown rot bacteria to the last and died with their armor whole.

I come now to the second effect of the destruction of the

surface-feeding roots, which is to so weaken the trees that they are unable to resist the disorganizing action of a late spring freeze and retain their blossoms or young fruit, which all sod trees easily do. This was plainly demonstrated in the case of the eight hundred peach trees alluded to previously by Mr. Durham, and the conduct of all fence-corner and back-yard fruit trees.

A third remarkable effect of the integrity of the surface roots is to improve and perfect the eating qualities of all fruit; that on trees in uncultivated ground being far superior to the other, as is plainly shown by the well-known inferiority of all the highly cultivated California fruit, so beautiful to the eye, yet so disappointing to the taste. And yet, with her rainless summer, that state ought to, and could, grow fruit of all kinds as perfect in quality as it is in appearance, if her people would only open their eyes to these plain natural laws of orchard management.

A fourth effect of cultivation, contrary to the present general but erroneous belief, is to decrease the size of the fruit, where sod trees stand on good soil, or a top-dressing of fertilizer is applied equal to that on cultivated trees. For years, as is well known in Texas, my sod-pears, though picked from trees bearing fifteen to twenty bushels, carried off first premium at the Dallas State Fair. On one occasion three Kieffers were weighed by Mr. Sydney Smith, secretary, that amounted to seven and three-quarter pounds, and Le Conte twenty-eight ounces each, while my World's Fair peaches and plums were among the largest. In further proof, Mr. F. T. Ramsey, the well-known Austin nurseryman and erstwhile clean culturist, but now a sod man, exhibited at the last Texas Farmers' Congress Governor Lanham peaches grown in a Bermuda sod that measured eleven and one-half inches around.

A sixth most important effect of sod culture is that it enables all fruit trees to mature their fruit slowly and naturally, as well as hold on to it tenaciously even in high winds and after it is fully ripe. My peaches and plums always hang, if left, a month or more from maturity; yet it is well known that

all cultivated stone fruits in the eastern half of the United States mature their crops within a period of about ten days, and drop very easily from the trees, while last summer the papers told us that California lost vast sums by the sudden and premature ripening of the fruit from intense heat. Is there any wonder, when the trees had been robbed by deep and frequent cultivation of the very roots which are so essential to perfect, natural fruit? But not only does cultivation thus rush all fruit to premature ripening, but it is, beyond all doubt, the sole cause of certain pears like the Le Conte, Clapp's Favorite and other summer pears rotting at the core. Before I put my Le Conte orchard, near Galveston, to sod, they were always thus affected, but never after. There is a sod Clapp's Favorite tree near me whose fruit hangs long and never rots at the core.

I come now to the last and most remarkable of all the bad effects of the destruction of the feeding surface roots of fruit trees,—an effect never before suspected by any observer, nor even by myself, until last summer, and yet so plain that it cannot be doubted. I refer to the fact that long continued cultivation has deteriorated or degraded all our fruits, until many of them are utterly unlike their original types. Some actually have changed the color of the skin and flesh, like the Gonzales plum, and all are far inferior in quality and texture to the same varieties grown continuously on trees whose roots have not been disturbed. For instance, take the Ben Davis apple, which, with the Gonzales plum, seems to be exceedingly subject to this influence. I have often in the past seen Ben Davis barrels opened here, and have eaten the fruit, crisp, juicy, sweet—a really good apple. The next week, perhaps, another lot would be dry, mealy and tasteless. Alluding to this fact, last fall, Mr. F. M. Ramsey, of this place, told me that while on a recent visit to the Boston mountains in Arkansas, he saw a Ben Davis orchard on a small abandoned place that had grown up in brush and some quite large forest trees, and that he had been greatly surprised to find the fruit, of which the trees were full, large and of excellent quality, entirely unlike the dry, mushy Ben usually seen. It

is plain that the great diversity of opinion concerning the quality of this apple can be accounted for only on the hypotheses of sod and cultivation ; the latter producing the inferior type of apple which largely predominates in the markets, for the reason that a large majority of the orchards are butchered at least once or twice a year, or oftener. That this theory is true, was also proved by the cultivated Terry apples sent me from Georgia, to which allusion has been made, the quality of which was little better than Ben Davis, the flesh being dry, spongy and insipid, entirely unlike my sod Terry, which are now, more than two months later, still firm, crisp and of the highest quality. How else shall we account for so marked a difference in the same variety, similar instances of which are often mentioned in fruit journals ? A still further proof of the degradation of fruit by cultivation came to-day in Charles Green's Rochester catalogue for 1906, in which he advertises a new type of Baldwin apple for sale, as follows :

"At the rear of Charles A. Green's (Rochester, N. Y.) dwelling stood a thirty-year-old apple tree, which in every way appeared to be a Baldwin. The apples were placed in the cellar, and the following March we were surprised to find them of a far brighter and better color than Baldwin. The red blush and streaks were brighter and the yellow portions more like gold than Baldwin. On eating these apples, we found the quality was far better than Baldwin. We cannot recall a more tender-fleshed or better-flavored apple. In quality and beauty it is far superior ; in fact, a better strain of Baldwin. Prof. L. H. Bailey says that trees of certain varieties bear better fruit than others, and that by grafting from these peculiar trees we may greatly improve well-known kinds. This is just what we have done. CHARLES A. GREEN."

And thereby Mr. Green will get his "foot in it;" for the people who buy those trees and cultivate them will find that they have the same old Baldwin of to-day, and will come back on him for selling them improved Baldwins at forty cents a tree, when he asks only fifteen cents for the old style. Both he and Prof. Bailey are ignorant of the fact that the destruction of the surface-roots by cultivation not only deteriorates the quality and changes the physical characteristics of many fruits, but is the sole cause of the so-called "running out" of strawberries and potatoes, as well. One has only to look

back at the many once valuable, but now worthless kinds, and eat, as well as compare the color of fruit from cultivated trees with that of the same variety long in sod, to be convinced that Mr. Green's Baldwin tree is a fac-simile of a most remarkable example of change and deterioration in the case of the Gonzales plum, originally a fruit of highest quality, but now so dry and tasteless that in spite of its fine appearance it is almost unsalable. The proof that cultivation has been the cause is beyond doubt, and is as follows: Six years ago I bought from Mr. F. T. Ramsey, of Austin, the original introducer, and an ultra-clean culturist, a Gonzales plum tree that had been propagated from trees long under cultivation. This, after root-pruning and planting in a mowed Bermuda grass sod, fruited the second and third year, but the quality was so poor that I top-budded it with the Shiro plum, about five feet above the ground, leaving all the Gonzales shoots below. The fourth year it bore again, and the fruit was so much better that I was greatly surprised. I did not suspect the cause until last summer, when the Gonzales part of the tree was again loaded with large, beautiful bright scarlet plums, of such superior quality that I regretted greatly having top-budded it, even with Shiro, a fine, large yellow Japan variety, which was also loaded, and I fell to wondering what could be the cause of the marked change. Naturally, being a crank on the subject, the integrity of the surface root system presented itself, and I set out to confirm it. Knowing almost every fruit tree in the town, I went from one Gonzales to another, and, to my delight, found all the sod trees loaded with bright scarlet plums of fine quality, like mine, while all the cultivated ones were a dull maroon-red color and not fit to eat. Knowing that Frank Ramsey, who has often been denounced for introducing such an inferior plum, would be pleased with my discovery, I sent him some of my Gonzales at once, with the confirmation of my theory, and here is his reply: "Your Gonzales plums came to-day, July 15, and are typical in size, color and fine quality of the first specimens sent me from the town of Gonzales, and I believe, as you say, that they grew on hard, uncultivated ground.

There is one thing sure, I have never seen more beautiful plums, or tasted better-eating ones than these of yours. If the sod treatment is the cause, and it seems to be, I am perfectly willing for it to have the credit." Those plums had hung upon the tree, full ripe, for over a month. So much for apples and plums. As to peaches, I have already shown from Mr. McFarland's letter that my sod Elberta was so superior to the cultivated Elberta he had been familiar with for years that he did not recognize it. Another curious effect of cultivation on the peach is that it increases the size of the seed, and, in many cases, causes them to split in the peach,—which I never saw in sod fruit. There is also a remarkable difference in the effect of shade on sod fruit. It is well known that it prevents all cultivated peaches from coloring well and greatly increases their liability to rot; while on sod trees, peaches especially, the fruit in the densest shade, which the sun never touches, is even more highly colored than those in the sun, nor do they ever show a sign of rot. One more peculiarity of sod peaches, and I will then leave the subject of cultivation. It is well known that cultivated ones picked too soon, even though well colored, will never have the flavor of those ripened on the tree. Not knowing that this did not apply to sod fruit as well, when I came to select the Elberta for those long trial shipments, I was greatly worried over which to pick. If I took them too hard and green, I feared they would not be fit to eat, and if too ripe, that they would rot on the long journey. Finally, I concluded it was better to have them go in good order, if not as eatable; so I selected only those that were well colored but perfectly hard, and with a slight show of green, not one of which could be dented by the hardest pressure of the thumb. But, to my surprise and pleasure, they all ripened up so perfectly that Mr. Poland, of Los Angeles, said they were "fit for an epicure;" Mr. McFarland, that "the flavor was most refined;" and Mr. Olcott, of Rochester, "delicious, as fine as if picked fresh from the tree." With this most important discovery, I will now pass to a discussion of blight and other tree diseases.

CHAPTER XXII.

Blight and Other Tree Diseases.

IN the pathology of human diseases, scientific research has developed the most wonderful discoveries. Mysteries that were dark and inexplicable are now made as clear as day by the germ theory of disease in the human system, every form of which is due to the incubation and multiplication of billions of those mysterious little germs, microbes, bacilli and bacteria, good, bad and indifferent, that swarm in the air, in our bodies, and in everything on the earth. With this knowledge, science is now devoting all its energies to the discovery of the laws and conditions which regulate and govern these infinitesimal creatures in their propagation and relation to the various diseases of mankind. But, while the investigators who have turned their attention to man and his bacterial friends and enemies have made wonderful progress, practically nothing has been done in the pathology of tree diseases beyond the bare discovery of the bacteria of blight by Professor Burrill, many years ago ; while nothing of any practical value at all has been accomplished by those of our scientific tree doctors who have turned their attention to crown-gall, root-knot and yellows. But, while the regular practitioners have accomplished nothing beyond killing a lot of pear orchards with cultural methods and scientific cutting-out of blight, disinfecting their pruning shears with acids, etc.,—as they did several years ago for A. S. Newson, of Galveston county, at an expense to him of \$1,500, with a dead orchard as the result in one year, and are now doing the same thing for the California pear orchards, which are being destroyed by blight also,—I believe, though nothing more than a sort of horticultural quack, that during a careful study of all those tree diseases for the last twelve years, I have really accomplished something of value, especially in my study of blight. The

two unsolved problems in this disease are: First, Where do the bacteria of blight come from,—in the case, for instance, of isolated pear trees far distant from any known case of blight? I once saw several large LeConte up in the mountains near Eureka Springs, Ark., and miles away from any other pear tree, with large dead blighted limbs in the center of the trees, caused by an attack some years before, but, from neglect on the part of the owner, never cut out. Now, the authorities all affirm that such dead wood is the nidus, or harbor, for the bacteria; yet there stood those blackened limbs among the other healthy branches, and not a sign of blight that season. Was the whole air filled with blight germs, in the first instance? If so, where did they go, and why did the tree not blight again? The second unsolved problem is, what are the conditions most favorable to an attack of blight?

Now, while our government and other scientists cannot tell us where the bacteria usually come from, they are all agreed that the germs are external to the tree in an original attack, and do come from somewhere. Witness their statements that blight spreads, that the tender shoots are most liable to attack, that the bacteria enter the cut ends of shoots, etc. As to the second problem, they tell us nothing. Now, twelve years ago, seeing that the phenomena of blight were inexplicable on the external theory of an attack from the air exclusively, there was but one other possible hypothesis,—which is that the bacteria are indigenous to, and in the sap of, every pear and apple tree naturally, in limited numbers, and perhaps, under normal conditions, play a specific, useful part in the life and development of the trees. A contrary supposition demands a belief in an actual creation of this germ a hundred or so years ago, when the disease first appeared in New England. But science denies the possibility of spontaneous generation or an actual new creation; consequently, the germs must have been in the trees and developed at that time as a result of certain favorable conditions of temperature, moisture, light and electricity. Therein lies the whole problem of bacterial life.

To illustrate, suppose a man should raise a window-sash

a few inches, and sit with his neck, for instance, exposed to a cold current of air in winter. Almost certainly, in a few moments he would begin to sneeze, nature's danger signal, and if he remained there a while, would "take cold," as we call it; but, really, the man would take nothing. The cold air, blowing on a limited part of his body, broke up his natural heat equilibrium, which we call "health," in the human system, thereby furnishing an unexplained condition, highly favorable to the rapid development and multiplication of the influenza or "cold" germs in all human beings. But the result will not necessarily be a "cold" in the head or neck; for the bacteria will develop at the point of least resistance in the system, and may settle on the lungs, resulting in pneumonia or consumption, or they may attack the nervous system in the form of neuralgia or rheumatism, and often the bowels. But, again, let a person or a number of them, enter a room with a hot stove fire, closing all openings, and shortly most or all of them will also begin to "take cold." Here, again, we find the natural heat condition, or equilibrium, of their bodies broken up by an abnormal high temperature and exhausted atmosphere; but they "took" nothing, for, had the room been ventilated and not over-heated, the "cold" bacteria in their blood would have been unable to develop, just as the brown-rot bacteria could not do so on my Terry apples, but did on the Georgia Terry, grown under different conditions.

Admitting the above facts as to man, and reasoning from analogy, is it not also highly probable that bacteria exist naturally in the sap or blood of plants and trees? It is plain that there is a marked similarity between the diseases of man and of trees. We see the quick and fatal work of cholera duplicated in "fire blight" of the limbs and leaves of the apple, pear and English walnut of California, the slow, insidious methods of consumption in the "yellows," while black-knot, root-rot, crown-gall and root-knot give perfect counterparts to the various forms of scrofula.

May we not go still further, and declare that every known form of mildew, rust and other plant diseases are naturally in the plants themselves, and, under normal conditions, entirely

harmless? That this is true, I can demonstrate by the following facts, to which Mr. E. W. Kirkpatrick was an eye witness: About ten years ago, while on a visit to me, at Galveston, I took him to Alvin to see the orchards, and at one place the owner pointed out what was a great puzzle to him. Adjoining his pear orchard was about one acre in oats, then heading, and, the season having been very wet and the land flat, the whole of it was entirely covered with rust, except the turn rows, or headlands, at opposite sides, both of which had also been sowed in oats, the ground having been burned over and the seed harrowed-in on the unbroken, virgin sod. The puzzle which the owner wanted solved was, why was the grain on the two headlands just as high as on the plowed ground and perfectly green, not a spot of rust upon it? He assured us that he had prepared his land most carefully. Having just then solved the mystery of blight in my Hitchcock pear orchard on the theory of the internal existence of the germs in the trees, and located definitely the causes and conditions under which they had been able to develop, I saw instantly the cause of the remarkable phenomenon before us. It was simply a case of favoring conditions. The continued rains had kept the roots of the oats on the soft plowed land so saturated as either to drown out the fine hair-like feeding ones or else gorge them with excessive moisture; thus paralyzing their normal action and furnishing just the condition of sap most favorable for the development of rust bacteria. The firm, unbroken headlands could not be thus saturated, and the germs remained dormant, under the law of unfavorable conditions. I pointed this out to the owner and friend Kirkpatrick, both of whom saw the truth of it at once. I asked the owner if he had rolled the ground after planting, and he said that he had not. There is not the slightest doubt that millions of dollars are annually lost by rusts, mildews and other bacterial diseases, due entirely to loose, unfirmed seedbeds. All grain should be gone over as often as possible with heavy iron or stone rollers, and once as late as practicable in spring.

But, returning now to pear, apple and walnut blight, I will give a short history of my pear orchard near Galveston—the

one in which the first outbreak of the disease in South Texas occurred fourteen years ago. Up to that time there had never been a case of pear blight within one hundred and fifty miles of it, distant about five miles from the Gulf of Mexico. The orchard was ten years old, and in the spring of 1893 the fifteen hundred trees bloomed like a snow-bank and set an enormous crop. I knew that the pears should be thinned, but the trees being so large, and having matured heavy crops of fine fruit before without thinning, I concluded to let them alone. The ground had been in mowed sod for two years; but, knowing the trees had hard work before them, and ignorantly thinking to help them, the whole orchard was lightly plowed in March and kept absolutely clean until July. The spring and summer were very dry, which, with the enormous crops—many trees having over twenty bushels—checked all growth and sent them to rest as completely as midwinter. Now here was the first condition precedent to blight the next year, viz: suspended growth during the natural growing season. The weather continued quite dry until November, when good rains fell, and, being in the nursery business, mainly growing pear trees from the cuttings, I set twenty men to work, making the cuttings from the early spring growth and much two-year wood. By January, we had in over one million cuttings; and, the winter having been mild and wet, stimulated by it and the heavy pruning, stray blossoms began to show here and there, and shoots to push from the cut ends of the limbs, the sap being in rapid motion.

Well, on the night of January 17 the mercury fell to eighteen degrees, freezing the limbs solid and completely checking all growth. Here was the second unfailing condition precedent to a coming attack of blight. I did not know all this then, nor suspect anything, but three years ago, under similar conditions here where blight was never known, I predicted to many persons, in March, that Lampasas would have a blight epidemic; and I proved a true prophet, for it came and killed many trees and is still with us. We had passed through a year with only twelve inches rainfall; the trees had rested, as mine had, in summer, and a heavy warm winter rain set

the sap in motion, followed on the second of February by a severe freeze. Had the sap been dormant, no harm would have been done.

But, to return to my orchard, which, instead of blooming as usual about the first of March, remained perfectly dormant until about the first of April. Then in a few days the blossoms seemed to break all at once ; and later, instead of dropping off as usual, most of them hung on to the young pears and turned black, though, knowing nothing of blight, I thought little of it. Heavy rains and still, sultry weather followed in May, when, it seemed almost in a day, the fruit-spurs began to blacken and the tender tips of the shoots to droop, until every one of the fifteen hundred trees showed more or less signs of blight, though on most of them it was light and not a single tree died. The ground had not been disturbed since the preceding summer, and never has had a root cut since.

As soon as I realized that the dreaded fire-blight had struck my trees, remembering my experience with the nitrate of potash twenty-five years before, and its good effect on vegetable diseases, I applied, in June, a heavy top-dressing of cotton-seed-hull ashes, containing thirty per cent pure potash. Ignorantly accepting the orthodox theory of the efficacy of cutting out, and feeling it my duty to stamp the disease out if possible, I hired seven men in September and went over every tree, cutting out every sign of the disease far below the infected parts, and finishing up the long, tedious job in December, at a cost of over five hundred dollars. Now for results. The next spring all the trees again blighted but not so much as before, due doubtless to the non-disturbance of their roots, entire cessation of pruning and the free supply of potash. In the meantime I sold the orchard to a near neighbor, E. J. Biering, exacting from him a written promise never to plow or cultivate it, and, contrary to the malicious report that I took advantage of his ignorance to unload it upon him, before I would sign the deed I had him go over the whole place, pointing out the blight and warning him that it might ultimately kill the trees. But

being the only bearing orchard of any size in south Texas, and knowing its previous immense yields, he took the chances and signed a written exoneration, which paper I still have, of all blame on my part if the trees died. E. J. Biering is still living at Hitchcock and will confirm this statement. That was twelve years ago, and neither plow, cultivator nor pruning-knife have ever been used upon that orchard since, the blight having died a natural death. The trees are lapping, though twenty-five feet apart, and will average eighteen inches diameter of trunk near the ground, and were pronounced by Professor Waite, during his experimental work a few miles away on the Newson orchard, before mentioned, to be the finest and largest pear trees in the South. It was also recently inspected by Mr. Stiles, assistant state inspector, who told me that it was "magnificent, the very finest pear orchard he had ever seen." Now, all these years it has cost its owner comparatively nothing except to gather the fruit, the grass having been so dwarfed by decaying leaves and shade as to require no mowing,—and yet thousands of pruned, fertilized and cultivated pear trees all around have been killed by blight.

With this grand, living demonstration of the truth of the principles of the New Horticulture as applied to this disease, it is plain that the theory of an external attack of the bacteria is false; for it will not explain such phenomena as the sudden development of blight on those fifteen hundred pear trees with not a case of blight within one hundred and fifty miles, nor the strange fact that they are now all immune, while blight exists all around them. Nor will it explain the fact that I sent blighted leaves and twigs at the time from those trees to E. W. Kirkpatrick at McKinney, where no blight then existed, and though inoculated freely with a decoction of the leaves and twigs, not a single one of his pear trees could be infected. But a still more remarkable fact against the external theory occurred here last summer, and one that I would not mention unless I had an eye-witness like E. W. Kirkpatrick to prove it. With the owner's permission, a near neighbor, I top-budded in 1904 eight limbs of a quite

large, badly blighting Bismarck apple tree, with buds from my healthy sod Terry and Pearmain trees, with just the faintest idea that shoots thus grown would not blight. To my astonishment, the buds all grew right along among the blighting Bismarck limbs the whole of last season, making shoots three and four feet high, and not a blighted leaf or tip. Mr. Kirkpatrick saw the tree and will testify to the facts, and yet the scientists are now humbugging the California pear-growers with the vain hope of curing blight by cutting out the infected limbs. Of course, for looks' sake, it is the proper thing to do; but if they rely solely upon that, it will inevitably be but a few years before the Bartlett pear will be only a recollection in California.

The same danger threatens their English walnut trees, many of which have been attacked by blight also. And yet, with irrigation to keep up a continuous summer growth the previous season, thus satisfying the tree's natural demands and inducing them to remain entirely dormant during the winter, and sod treatment to preserve the integrity of the surface-roots, there would not in a few years be a blighted fruit tree of any kind in California. Of course, all pruning of bearing pear trees should cease, as that stimulates a movement of the sap to restore the equilibrium between the roots and tops, especially if the winter be mild and wet. It must be especially borne in mind that blight results only from a severe freezing in winter or very early spring under the above conditions, followed by a complete stagnation of the sap and subsequent fermentation, and never from the usual late frosts or light freezes when growth has fully started. In such cases there can be no fermentation, for growth is immediately resumed and no harm done. The idea of a connection between a freeze and blight has always prevailed among fruit-growers who have observed closely, but has been scouted by our scientific horticultural solons, all of whom have failed to discriminate between the two kinds of freeze, and thus understand why all were not followed by blight. I omitted saying that when pear trees are put to sod (preferably Bermuda, or other shallow-rooted grass of short growing

season), a liberal top-dressing of muriate or sulphate of potash should be applied, and annually, for several years, or until the blight disappears, at least three hundred pounds per acre of the same. But wherever pear trees cannot be irrigated, extra-close mowing in time of drought, and fertilizing every spring to keep up a fair summer growth must be resorted to, not forgetting the potash. Of course, in such seasons, thinning of the fruit, necessary more or less every year, should be much more severe, though my former orchard has never been irrigated or had fruit thinned, but is now immune to blight.

And, now, a few words as to the various other forms of disease which attack the roots of fruit trees, such as crown-gall, root-rot, etc., all of which unquestionably have their origin in soils exhausted of potash, deeply stirred and saturated, due to continued rains, followed by high temperature. I have experimented so thoroughly, for years, that I know this to be a fact, and have demonstrated in my orchard here again, that diseased trees, if closely root-pruned and planted on firm ground plentifully supplied with potash, will recover entirely in a year or so. The scientists all make the same mistake in reference to these root diseases that they do to blight, imagining that the germs are external to the trees and in the soil. There is no such thing as infected soil. I have repeatedly root-pruned healthy peach, plum and apricot trees and set them directly in holes from which diseased trees were dug, placing crown-galls in contact with the stub roots, and have never been able to infect a single healthy tree, when the holes were first well supplied with ashes or other form of potash and trees top-dressed with it afterward for several years.

I will again state that every form of bacterial disease attacking grain of all kinds is naturally in the seed, and develops only when the favoring conditions are furnished, such as a deep, loose soil saturated to excess, and followed by high temperature. In all the eastern half of the United States where rains are abundant, the plow should be banished forever from the small grain fields, sowing the seed

upon the firm, unbroken soil and then thoroughly disking it in, no matter how weedy; for that places the vegetable matter just where nature does, in abandoned fields and in the woods, thus adding to their fertility from year to year. But after being thus disked in, the ground should be thoroughly rolled, the oftener the better. Such treatment would banish entirely from all well-drained soils every form of rust, mildew and plant blight, by withholding the conditions of excessive moisture under a high temperature, which facts plainly show are the ones most favorable and necessary to their incubation, and without which they are just as powerless to develop as the yeast germ is in dough, placed in an ice-box or a hot stove.

CHAPTER XXIII.

Pruning, Insects, Fertilizing and Influence of Scion on the Stock.

B EYOND cutting back, for several years, the long canes that form the initial growth of the apple and pear, in order to compel them to broaden out their heads, no further pruning will be required for those trees, especially after they come into bearing. But the almost universal idea among advanced fruit-growers seems to be that it is quite impossible to overdo pruning of the peach. Now, the fact is, but for the continuous cultivation usually given the peach orchard, thus forcing out an unnatural growth of long canes, there would be no occasion to go to the expense of pruning at all. After setting out a peach tree, the top should be cut back to about one foot and all shoots allowed to grow for a month or two, when the strongest and straightest should be selected and all the others cut away. By fall, such a tree, if let alone, will have made a well-rounded, bushy head, branching evenly all around right from the ground up. The peach is naturally a bush, not a tree, and loves to have its entire body shaded, and will need no further pruning until it comes fairly well into bearing, when, in order to bring it to the proper shape for the economical gathering of the fruit, the whole head should be sheared off level about six or seven feet above the ground. I know that the prevailing idea is that a tree allowed to grow naturally up to the third or fourth year would be a mass of branches, and overbear. This is not true, as any one can prove, for, having abundant wood, the peach tree will distribute its fruit-buds evenly all over the shoots at intervals of six inches or more, and not concentrate them continuously, as it will where a large part of the wood has been removed. The top-pruning, advised above, should be done when the fruit is as large as marbles and not before growth starts, as that would allow the tree to renew its head from its

strong initial spring growth. The orchard should then be let alone, mowing occasionally whatever growth comes, or it could be put down to Bermuda or other lawn grass. Thus treated, all peach trees will broaden out and cover themselves with short fruit-spurs a few inches long, and somewhat longer ones on top; but the check of bearing and from the mowed sod will prevent the annual growth of long, sappy canes, which on cultivated trees must be cut back to prevent over-bearing, as well as keep the trees from growing so high as to compel the use of ladders in gathering the fruit. Why exhaust the vitality of the trees, as well as incur expense, by growing useless wood? Of course, after a season of excessive rains the next year thinning of the fruit will be necessary,—in fact, could be practiced with benefit every spring; but it is surprising, where the natural equilibrium between the tops and roots of a peach tree is maintained, what heavy crops it will mature to good marketable size on good ground without thinning at all.

The Edwards' Elberta seedling in a neighbor's yard here, standing on ground never broken, last year bore four measured bushels of fruit, and from it I selected the peaches that went to Los Angeles and back, and which the editor of the *Pacific Fruit World* pronounced to be "magnificent." The accompanying illustration also shows two rows of Elberta that are twenty two years old and have not been pruned, cultivated or fertilized for the last eight years. I am standing by the tree that grew the peaches that went to Rochester, N. Y., and back, but, as the past summer was very wet, it will be noted that the top shoots have pushed unusually high. However, whenever the trees get so high that the fruit cannot be gathered from the ground, the tops should be again cut back. Those two rows ought to have the fruit thinned this season, but the owner says, "They have never laid down on me yet and they will have to stand it." I have watched those trees six years and never saw a rotten peach on any of them. The ground is perfectly bare beneath, all grass having long ago been shaded out and replaced with the decaying leaves, under which, if the earth be scratched ever so little, the feeding

THE SOD ELBERTA THAT BORE THE FRUIT WHICH WENT TO ROCHESTER, N. Y., AND BACK IN GOOD ORDER.

roots will be seen. That photograph was taken October 14, and shows how densely a peach tree will cover itself with foliage in the course of years if let alone; and yet the very finest fruit comes every year from the interior of the trees, where on cultivated ones it would always rot.

I will now make a few remarks on, and some suggestions as to how best to combat insects and other pests. Among the latter, rabbits and mice are the most destructive, especially where snow covers the ground in winter. Undoubtedly the safest protection would be wire cloth or netting, the lower edge sunk in the ground; but an infallible protection here is a thick coat of Indurine, or cold-water paint, applied for about eighteen inches up the trunk, scraping away the soil and daubing it well around the collar. Dissolve two ounces of bitter aloes in a little hot water and stir it well into the paint, and for mice add several ounces of Paris green. Five pounds will make nearly a gallon, and when well applied it will stick perfectly for a year and no rabbit or borer will ever touch the tree. As to insect pests, the experiment stations give the common formulas in their bulletins, which are otherwise of little value, being mostly old straw threshed over for years; but thus far no effective preventive against the curculio and plum gouger have been found, jarring the trees being about the best. But that is tedious, and last year I hit upon a remedy that completely protected all my fruit. Knowing from experiments with lime on vegetables that all insects have an aversion to white, and also to the smell of carbolic acid, I slaked one peck of strong rock lime and then added fifty gallons of water, after which I mixed five pounds of the cold-water paint, adding water little by little and stirring thoroughly all the while until the mass was a dough, resembling perfectly one made of flour. That is the only way to mix that paint, for if poured into water, or much water is poured on the paint, it is impossible to make it mix. I then added more water to the paint, stirred well and poured into the barrel, again stirring thoroughly. Having a bottle of creoleum handy, I poured about a gill into the barrel, which gave the wash a strong smell of carbolic acid,

of which creoleum is a compound. The object of the paint was to make the lime wash adhere better. I then kept close watch on the young peaches and plums for the half-moon cut of the curculio and the round puncture of the gouger, which usually begin their work when the fruit is about as big as a large green pea, never before that. Finally, seeing what looked like a gouger's mark, I strained my wash, stirring well through a thin cheese-cloth, and sprayed all my peach and plum trees, aiming to get it on the fruit especially. I could smell the creoleum (carbolic acid would doubtless have done as well) very strong, and the young peaches and plums showed the white plainly. Of course this treatment was a bluff entirely, not being poisonous, but the appeal to the eye and nose was most effective, for a daily examination showed no punctures of any kind ; but when the fruit was about the size of a large marble or small hickory-nut, I sprayed a second time. Though we had several rains, the wash adhered well, some little showing on the apricots when ripe, though not on any of the later fruit. That was all I did, and, though all my neighbors had their fruit badly damaged, I never found a wormy peach or plum. Possibly a white wash with more acid might have been effective with one application. This season I will conduct more careful experiments, and hope all fruit-growers will do the same. The same treatment applied while apple trees are in blossom should be equally effective against the codling-moth.

As to fertilizers for the orchard, some good brand should be used freely the first year it is put to grass, unless the ground is naturally rich, for all plowed and cultivated trees are without any true surface-root system. Of course, the grass will quickly fill the upper unoccupied layer of the soil, thus robbing the tree roots below, the first season. That is the trying time on all old or young cultivated orchards put to sod, until the trees take full possession of the entire surface with their fine hair roots, as all forest trees do. If a serious drought occurs at that time, by all means thin the fruit severely, especially on trees that were planted with long roots. In such cases, those that were close root-pruned when set

will show a vast superiority in resisting drought. In fact, there was a time when I hesitated to advise the putting of trees planted with long roots, spread out in large holes, down to grass, but I have seen several orchards thus treated and well fertilized that are doing exceedingly well. Anyhow, it is better that than have the trees die in eight or ten years, as all thoroughly pruned, plowed and cultivated ones do all over the southern half of the United States. In higher latitudes, with short and cooler summers, such treatment is by no means as injurious to the life of the trees, but does everywhere greatly deteriorate the quality of the fruit and render it much more liable to rot.

INFLUENCE OF SCION ON THE STOCK.

I will now close this chapter with a few remarks on the reciprocal influence of the stock and scion as affecting the longevity of fruit trees, especially the peach and apple. The general opinion among fruit-growers is that grafted and budded trees are shorter-lived than seedlings. This is undoubtedly true, and due to the fact that every seedling prefers its own wood to that of another, especially a peach. This is plainly shown where a shoot from the stock is allowed to grow, for it will not only rob and check the growth of the scion, but generally in a few years actually kills it. While that is well known, the opposite of this, though true, is not well known, which is that if the scion or tree be planted deep enough to allow it to strike roots it will in a few years establish itself entirely on them and ultimately kill the stock with all its original deeper roots. Of course, that will leave the tree merely a shallow surface system, within easy reach of the plow and cultivator, resulting in a gradual weakening of the tree, until finally during a severe drought, and when loaded with fruit, it fails and dies. That is undoubtedly the cause of the early death of thousands of peach and apple trees when they should be in their prime. The lesson of this is that all budding should be done at least eight or ten inches above ground, to allow the point of union to remain above the

surface after planting. In the case of apples, the method known as "whole root" stocks is consequently the worst possible form for a long-lived tree. By using short cuts and setting the root grafts deep, the young tree will establish itself on its own roots the first season as well as from the piece of root, which must be cut entirely away, also all the lateral ones, when the young tree is planted in the orchard. This will give a clean, close root-pruned apple, free from all subsequent suckering. When varieties are known to be weak growers, they should be propagated entirely by high budding on strong stocks as described above. All "whole root" grafted apple trees should be root-pruned as closely as possible, cutting back to the body, and planted deep to induce the scion or tree to strike its own roots as low as possible.

Since writing this chapter, I noticed today, April 2, that the curculio are attacking my plums, which have just shed their blossoms and are very small. Last year they appeared later, and it would seem to be the safer plan to spray plums just before the blossoms drop. Peaches have not been touched.

CHAPTER XXIV.

Tree Breeding and Origination of New Fruits.

IN discussing this most interesting and important phase of horticulture, I propose to do it along natural lines entirely, leaving the field of plant jugglery and intentional hybridizing to Mr. Burbank, who has proved himself an adept in the business. However, it is much to be regretted that his successes have been confined almost exclusively to the least important of the tree fruits, the plum, nor has he even in that line yet produced an all-round kind equal to many of the old European varieties, all natural seedlings, or to the Botan and Burbank, both imported natural Japanese seedlings, also the latter having been named by Professor Van Deman in honor of Mr. Burbank. In fact, while apparently well adapted to the dry climate of California, nearly if not all of Mr. Burbank's plum creations have proved a distinct disappointment in the eastern half of the United States, and most of them a downright failure. I have fruited a large number myself and seen, as well as eaten, others; but for beauty, health, vigor, productiveness and quality when grown on sod, I have found none of them nearly equal to the old Burbank and Botan. In quality, Botan, or Abundance as it is often called, has long been considered the Japanese plum "par excellence," cultivation seemingly having little injurious effect, but it is a matter of common knowledge that the cultivated Burbank is now a plum of inferior quality. Having planted two nursery-grown trees here in my sod orchard six years ago, I was so disappointed the second year that I top-budded one with several kinds of apricots, but now, like the Gonzales, the fruit on the other tree has been so improved in quality by the preservation of its surface roots that I am sorry for the change. But while Mr. Burbank has had a large measure of success with the plum, it is a remarkable

and perplexing fact that, so far, he has been entirely baffled in all his efforts to produce an apple, peach, pear or apricot that would compare with the hundreds of old standard varieties of those fruits, all chance seedlings, which Nature in her playful, kindly moods scattered here and there all over the country, in old fields, fence-corners, back yards and other out-of-the-way places, apparently in a spirit of fun, to challenge our admiration, tickle our palates and yet mock all our efforts to equal them.

Wipe from our catalogues all Nature's apples, and what have we left? Only Peter Gideon's "Wealthy," grown by him, but yet a natural seedling. Next cut out her peaches, and that industry would so completely disappear that even a single "cobbler" would be an impossibility. In pears we would fare just as badly, while if any hybridizer ever grew an apricot of any value I never heard of it. But having become accustomed to these most astonishing and inexplicable facts, we cease to wonder, and yet when we stop to think of the amazing strides of recent years in all the other arts and sciences, the wonderful discoveries in light, sound, electricity, medicine, machinery, printing and a hundred other things, the horticulturist must hang his head in shame, for even the achievements of a Burbank, in practical value, sink into utter insignificance beside them. Wipe out all that he and the many other meritorious, though less known workers in the field of scientific experimental hybridization have done, and it would not create a ripple of excitement in the horticultural world, so lavishly has Nature showered upon us from her hidden store the beautiful and delicious fruits that now fill the pages of our catalogues to repletion.

But, while others may not have worried in the effort to find out just how Nature worked these fruit miracles in the past, and is still working them like a juggler right before our eyes, and yet we fail to "catch on," it has worried me beyond measure to see her stamp her seal of superiority upon some old chance seedling that happened to escape notice, and lo! a Baldwin, Spy or Jonathan apple, or an Elberta peach springs up to astonish the world by its excellence,

while a Burbank will fruit ten thousand trees or more and find not one worth preserving. But somehow I have always had faith that Nature would some day take me into her confidence and impart this secret, as she has the other great truths of the New Horticulture.

Now I believe she has rewarded my patience, and only a few days ago, and this is how it happened. A gentleman from the adjoining county of McCullough called to see my sod orchard, and, noticing seven kinds of apricots growing on the same tree, began to tell me about a wonderful apricot near the town of Brady, where he lived, of which the history is as follows: Seventeen years ago a neighbor noticed a little seedling with only three leaves, standing on the bare ground near the front door, and, thinking it was some kind of a fruit tree and would be tramped to death, he picked up a small stick, pushed it down carefully under the little waif and carried it, dirt and all, around to the side of the house, setting it again in the hard, unbroken virgin soil. The baby tree, appreciating the kindness, grew off rapidly; and now, with not a single root ever cut, no fertilizing, pruning or thinning of the fruit, that tree has a spread of thirty-five feet, is thirty feet high, practically a forest tree, bears more or less every year and generally full, as much as fifteen bushels having been taken from it one year. The fruit is large and beautiful, averaging six inches in circumference and many reaching eight inches, while the quality is excellent. This was his description after knowing the tree for years, and he further told me that cuttings had been given to Mr. Ramsey, of Austin, and other nurserymen for propagation under the name of the Sheridan apricot. Of course, I listened to all this with intense interest, and when he got through, by some sort of mental suggestion or what not, I seemed to hear the words, "That's the way she does it," and the secret of Nature's skill flashed upon my mind in an instant. Now it may be all a fallacy, but the more I think of it, the more certain it appears that the hidden puzzle of how Nature grows her fine fruits has been solved.

Of course, the scientific hybridizer will pooh-pooh, for

the process is too easy and simple and will largely eliminate him. All that is necessary will be to furnish the exact conditions under which Nature grew that apricot tree, practically the same under which all chance fruit seedlings have been grown; viz., first, a firm, compact seed-bed, breaking only ground enough to plant the seed, if virgin soil all the better. Second, absolute preservation of the entire root system of the tree, and possibly of the tops also, thus maintaining the natural equilibrium between the two. Liberal fertilizing and water in severe droughts would likely aid by giving the seedling a chance to do its best. As to seed, Nature has no choice, but must take what man or the birds cast aside, or what drops from the trees, all of which have been degraded by cultivation and the influence of inferior stocks, as outlined by Charles Downing in the following extract from his great work:

"But there is still another reason for this habit, so perplexing to the novice, who, having tasted a luscious fruit, plants, watches, and rears its seedling, to find it, perhaps, wholly different in most respects. This is the influence of *grafting*. Among the great number of seedling fruits produced in the United States, there is found occasionally a variety, perhaps a plum or a peach, which will nearly always reproduce itself from seed. From some fortunate circumstances in its origin, unknown to us, this sort, in becoming improved, still retains strongly this habit of the natural or wild form, and the seeds produce the same. We can call to mind several examples of this: fine fruit trees whose seeds have established the reputation in the neighborhood of fidelity to the sort. But when a *graft* is taken from one of these trees, and placed upon another stock, this grafted tree is found to lose its singular power of producing the same by seed. The stock exercises some as yet unexplained power in dissolving the strong natural habit of the variety, and becomes, like its fellows, subject to the laws of its artificial life."

Now if Nature in her grand fruit creations, thus handicapped (for all fruit trees are now grown on other roots than their own), has yet been able to accomplish horticultural wonders far beyond the dreams even of a Burbank, what perfection might she not have attained had all her chance seedlings been grown from an Elberta peach, or a Baldwin apple, or other fine variety on its own roots and on unbroken ground? Just how far the latter conditions are determining

factors in the general characteristics of the future tree grown from such seed, we can not tell, but the evidence adduced is unanswerable, that quality and brighter color of the skin are the result of such conditions, while heredity, cross-fertilization and other influences doubtless determine the size, shape and season of ripening.

For instance, we have seen the outcome of chance seed on virgin soil in the Brady apricot, the Gonzalez plum and the Baldwin apple, as restored by Mr. Green to its original perfection; but suppose those three trees had originated on deeply dug garden soil and been cultivated continuously from year to year, would they have turned out to be the same fruits? Plainly not, else the plum and apple would never have changed their bright scarlet and golden color to a deep, dull red, or largely lost their good eating qualities under cultivation now. By all means, let every fruit-grower try these interesting and important experiments which require no scientific skill or knowledge of the principles of tree-breeding, planting seed of selected fruits on firm soil and letting the trees alone, as well as putting even a single one of our finest fruits on their own roots, as suggested in the chapter on "Scion and Stock" and planting the seed. For their encouragement, I will close this chapter with a striking instance of success here in Lampasas. A lady friend, during a visit to her old home in Georgia six years ago, ate a large white clingstone peach known there as the "White English," fine for preserving. Wishing a tree for that purpose and thinking it would reproduce itself, she saved the seed, and on her return planted it in her back yard on virgin soil, digging a small hole with a garden trowel. It came up and has borne fine crops every year since it began to fruit, of extra large yellow freestone peaches, just like Elberta except longer in shape and ripening just after it. Here is what Mr. Sam Dixon, our superintendent at the World's Fair, said of it: "The 'Cauthen' peach attracted the admiration of the Exposition officials and was photographed whole and in sections." The tree has never been cultivated, being in a chicken yard, nor ever pruned until this year, when the lower branches

which rested on the ground were cut away. Shall we not have to go back to nature and learn from the squirrels, who beat Mr. Patterson growing walnut trees, for this lady planted her peach seed just as they did their walnuts.

CHAPTER XXV.

Gathering, Marketing and Storing Fruit.

I WILL now make a few suggestions to those who are without experience as to marketing a sod peach crop, drawn from the lessons learned last summer through my shipping experiments, and also from my success twelve years ago in shipping about nine thousand bushels of pears in a single season to northern and western markets, all from a mowed sod. I would build my packing-shed with water-proof roof and sides, extending to within four or five feet of the ground, closed at the ends, with wide door in each to admit wagons to pass through. As my experiments showed that sod-fruit can be picked while yet hard if well colored, and ripen up a good eating peach, the pickers should be instructed to gather carefully all such fruit, as well as that full-ripe, which should be emptied gently from the baskets on padded tables. The packers should each have two crates before them, and every peach when picked up should be gently pressed with the thumb, a direction never given to handlers of cultivated fruit, for it would cause rot, but not on a sod peach. If it yields at all, showing ripeness, pack it in one of the crates, while all the firm ones should go into the other. Don't be afraid such small dents will show or make a sod peach rot, for as a test I sent some such fruit all the way to Rochester in good order. All the ripe crates or baskets should go to state and local markets or to the cannery and evaporators, while the firm ones are for car-load shipments. Nail up all crates the same day the fruit is picked, but allow them both, hard and soft, to stand over night in the packing-shed to cool. The next morning, before day, the sooner the better, load on spring-wagons, never without springs, and off to the market or depot. With large crops where wagons must run all day, cover the crates with two widths of matting sewed together, and strong strings tied

to the four corners to fasten it down. Matting shades without heating like a tarpaulin. But never ship peaches the same day they are picked. See that your ventilated car is left with both doors open that night to cool; pack as quickly as possible in the morning, closing the door at once and opening the ventilators at each end. That is just how I treated the many car-loads of ripe sod LeConte pears, went with them to Chicago and saw them opened up in perfect order at three o'clock the last day of July, the fruit as cool as when it started. The cars being double-lined and the pears cool when packed, the slight rise of temperature during the day was again lowered at night by the current of cool air passing from end to end through the ventilators.

The peaches that made the record-breaking trips last summer were taken from the trees before sunrise. There is not the slightest doubt that sod-grown peaches picked and treated as described, could be shipped in ventilated cars all over the country for ten days with perfect safety. They will, moreover, ripen up naturally, be of far better quality, and stand up much longer than any cultivated fruit from refrigerator cars. Of course sod peaches would behave as well, or even better in refrigerator cars, and it would pay to use them in years of excessive production, for, if regularly iced, I believe they would hold perfectly for thirty days. But such a thing as over-production would be but an ugly dream of the past, for once the buyers were assured of honest packing and peaches that would open up in perfect order, the entire crops everywhere would be sold upon the track, at prices that would pay the grower a good profit, owing to vastly decreased cost of production, and yet leave the buyer a very large margin also. So much for sod peaches, by far the most difficult of the larger fruits to market fresh, yet a safe and easy job compared to that on cultivated trees, which, owing to loss of sustaining feeding-roots, is rushed by the heat to sudden and often premature ripening, usually not more than ten days to a given variety, after which it drops.

The plum, however, is much more easily handled; from sod trees they can be picked when the first color shows, and

ripen up with as good quality as if left on the tree, and will also hang tenaciously to the stem when ripe. Plain ventilated cars would carry them across the continent and back in good order. The sod pear is much like the plum, but can be picked even earlier. I have had LeConte windfalls, little more than half-grown, if placed in a box and closely covered, ripen up to excellent quality. This, however, does not apply to Kieffer, which must be fully mature and well colored before gathering. With this variety of pear the secret of good quality is thorough maturity and a close, confined atmosphere. Never lay on open shelves to ripen, but pack in bulk and cover well, and it will come out a juicy and delicious fruit.

I will now give some interesting experiments made on a small scale with apples last year, and some now in progress, to test the keeping qualities of those grown on trees whose roots have not been disturbed. In November, 1904, I picked apples so grown, packed them in a box, placing it under my house, which is elevated above the ground. It was covered in freezing weather with hay to protect it, and on the 7th of April, 1905, they were all perfectly sound, and Professor Connell, editor of *Farm and Ranch*, pronounced the fruit excellent. But I was not satisfied, for the apples were rather dry and slightly shriveled from loss of moisture. The question then arose, how to prevent this and how to keep the fruit cheaply in the grower's hands through the winter, with quality unimpaired, and have it come out in spring with capacity to hold up, a sound, good eating apple, until sold. That this is hard to do with cultivated fruit kept at a low temperature in cold storage is plain, for much of the fruit now, March 29, exposed for sale, shows the bad effects of too low temperature, the skin in places having the appearance of scald, after which rot quickly follows.

But, as I said, pondering last fall over this problem of carrying apples through the winter cheaply, which must be done if Texas or the South is ever to go into the business on a large scale, all at once one day, I was carried back on memory's wings nearly sixty years, and lived over again events that occurred when I was a little boy at a large boarding

school in Virginia, my native state. There were quite a number of large apple orchards in the country around, two of which were on very rocky hillsides covered with grass, and, being only about two miles from the school, it was a common thing for several boys to club together and buy one or more bushels of apples at twenty-five cents a bushel. dig a large, deep hole on a hillside in the woods, then cover the bottom with dry leaves, on which the apples were poured from sacks. When about two-thirds full, we drew in a good lot more of leaves, after which the hole was filled with soil, tramped firmly and rounded up to shed the rain. This primitive cold storage plant went by the name of an "apple den," and when finished was top-dressed again with leaves to hide it and left with the utmost confidence born of experience, that late in winter and early spring, when apples were scarce, we would find ours all safe and sound. Nor were we ever disappointed, for when we opened a small hole on the lower side, there would be the big red apples smiling at us, and what a delightful odor and flavor! Once opened, we would go every few days, fill our pockets and stick a wad of straw in the hole until the next visit. I remember well that toward the last, sometimes, heavy rains would wash the soil down among the apples so that often they were so covered with dirt, when dug, that they had to be washed before eating; and yet it was a rare thing to find a rotten apple.

Now, there was my first experience with sod fruit, repeated every winter regularly for five years, with the same results; and little did I think that it was destined to get me into the fight of my life nearly sixty years afterward. So when, last November, the recollection of those miniature cold-storage houses came back to me, the secret of the long-keeping quality of the fruit was plain, and it occurred to me to play school-boy once more, and see what my sod apples here would do. Accordingly, I dug a hole under my house in the moist earth, about eighteen inches deep, covered the bottom with hay, laid one dozen Terry Winter apples upon it and a piece of stiff cardboard on the apples, after which I filled the hole with loose earth to keep them from freezing. That was in Novem-

ber, and an examination today, March 29, shows every one of the apples to be not only plump and sound, but of a delicious flavor that carries me back to the "apple dens" of yore. In view of this result, why could not small growers, everywhere over the country, store sod-grown apples in earthen banks of twenty or more bushels, just as potatoes are kept, the moist earth preventing all shriveling, and imparting a most delightful quality? But still another suggestion presented itself last fall, when I buried those apples. If sod fruit, sixty years ago, kept so well in moist earth, why not place the moisture in the package, whether box or barrel? So, to test the matter, I soaked a small box in water and placed more Terry in it, dipping the apples also in water, and nailed it up tight, after which it was covered with loose dry soil to prevent freezing. Just as I expected, they are now as sound and fine every way as the others,—in fact, cannot be told apart; and all of them, box and earth stored, refuse to have anything to do with the brown rot bacteria; for, though I inoculated one of each lot in three places, three weeks ago with a rotten apple taken from a public fruit-stand, not a single one "took." But three perfectly sound-looking apples from the same stand, inoculated at the same time, did "take" in every place the second day, and all rotted quickly thereafter.

Now, while these experiments have been on a small scale, it takes only one feather to show which way the wind is blowing; as it took but one falling apple to suggest the great law of gravitation, and one boiling kettle the power of steam. So these few apples demonstrate, just as surely as a hundred bushels, that the conditions of the flesh in apples grown with surface roots entire are such as to absolutely prevent the development of the brown-rot bacteria. Of course, they will ultimately break down under the universal law of decay. The second important fact shown is that, to afford such immunity to sod apples, it only requires, at a guess, a temperature of about fifty degrees, while with cultivated fruit it must go nearly to the freezing point; the result of which is to so disorganize the tissues of the skin that when exposed to a higher, open-air temperature, the effect known as "scald" or a dark

softening of the surface follows, and the apple quickly decays. In view of these facts, why could not every large sod orchard have its own cheap, double-walled board storage-house, with chaff or sawdust between the walls and overhead, and a wide, double-lined door at each end for ventilation and chilling, to be opened on favorable occasions so as to keep the temperature down to fifty degrees or lower? The barrels should be perfectly tight and thoroughly wet inside before the fruit is placed in them, and when packed, ready for heading, pour a bucket of water evenly all over the face, so that it will trickle down and wet all the apples, thus furnishing, during their confinement, sufficient moisture to prevent shriveling and preserve their flavor. A small hole in the bottom will allow surplus water to escape.

Of course, I recommend this method of keeping apples only for those grown on sod, though the following corroboration which came today in *The Rural New-Yorker* of March 31 shows that it is practicable to a certain extent with cultivated apples in the colder sections of the country. I say "cultivated," for the fact that some of Mr. Van Orman's apples rotted is proof that they were thus grown.

"Several years ago I met T. B. Van Orman, of Iowa, and, being of one mind, our conversation drifted to fruit. Among other things he said: 'I keep apples right up to May and June, and they keep improving in flavor all the time, and I have the minimum of trouble and loss.' I said: 'How do you do it, for I want to know and have it on paper?' He said: 'Take your apples as soon as gathered. Get good, tight barrels or boxes; line the bottom and sides with paper, then, with a vessel of water by your side and a pile of paper, take the sound apples without worms or bruises, dip each one in the water and wrap it in a piece of paper, and place in the box or barrel; and place also a sheet of paper between each layer of fruit. When the box or barrel is full, head or nail up tight. They can be kept almost anywhere except in a warm place. I usually place mine against the north side of the house, and throw some old trash or carpets over the barrels and let them go. If one rots it will not affect the rest, and the flavor grows better to the end. I never open a box or barrel until I take it in for use. Have kept them in this manner for the last ten years. My first experiment was with leaves, but they affected the flavor somewhat.' If this experiment is true, and it will cost very little to try it, the keeping of apples for the family is solved, and will be as great a boon as water glass for the preservation of fresh eggs. I would leave at least one package where it would

freeze, not in the open air or uncovered, to learn the effect. Let a hundred try the experiment, and something good may come from Mr. Van Orman's experiments and experience.

C. W. KEIFER, Kansas."

Notice that his fruit, like mine, improved in flavor all the time, as will be seen from the following testimony of Professor Connell, of *Farm and Ranch*, and E. W. Kirkpatrick, to whom I sent specimens for trial. Writing of them, the editor says, under date of March 22: "Your apples were firm, sound and good. Several persons tasted them and declared they were better than any cold-storage apples on the Dallas market." E. W. Kirkpatrick, who was present and also ate of them, wrote me as follows: "Your apple was most delicious, equal to the Northern Spy and a better keeper. If we can grow and keep our apples like yours, there will be great profit in it."

I omitted to say above that my suggestion of opening the doors of the cold-storage house at night for chilling purposes, applies only to the southern or warmer part of the country, there being no trouble to keep the temperature down farther north.

And now just two orange "feathers" for Florida and California. Soon after the war, before Texas had railway connection with the world, I saw my friend, Henry Rosenberg, the Galveston philanthropist, pack in the fall several barrels of beautiful oranges from large trees growing on his well-kept Bermuda grass lawn, for shipment to relatives in Baltimore, sending them by way of New York, in the hot hold of one of the old-time side-wheel steamers. It must have taken two weeks to make the trip. He told me afterwards that he was greatly surprised the next spring, on visiting his friends, to find some of his oranges still on hand and in excellent condition. The other "feather" is that about the same time I was in an old Italian's grove of about fifty orange trees, also in Galveston, all of which were trimmed up to clean, straight bodies six or seven feet high, not in sod, for the grass had been shaded out, but uncultivated. I was admiring the beautiful trees with their branches bending under the load

of fruit, when the old man remarked, "It's all very pretty, but all wrong. Come with me," and he led the way to the farthest corner of his grove, and there, with its lower branches lying on the ground, also covered with the finest fruit, stood an enormous orange bush, as it appeared to me, with its great round head thickly studded all over with oranges. "Now," said the old man, "that's the way to grow oranges, and were I planting another grove I would never put a knife to the trees. That tree was a chance seedling which came up there, and has never had a twig cut off." I opened the wall of leaves and fruit to see how it looked inside. To my surprise, there was not a leaf in the interior, nothing but the bare limbs and smaller branches, all the twigs dried up and gone, pruned by the dense shade.

A few years later, a freeze came along, peeling the bark from the tall straight bodies and killing every tree in the grove except the big bush down in the corner. It stood all the attacks of Jack Frost until 1886, when the thermometer fell to five degrees above zero, freezing Galveston Bay over, when the big bush was killed, root and branch. I will here say that no tree takes more kindly to root-pruning than the orange. If the roots are cut back to stubs an inch or less long, and the body to about a foot after planting, ground well rammed and tree let alone forever after, the big bush will be duplicated, for such a tree is practically a seed, and will reestablish itself on several deep, strong tap-roots instead of on one, like a seed.

CHAPTER XXVI.

The Pecan.

IN the former edition of the book, I had very little to say about nut-growing, as at that time no interest was taken in the subject ; but the case is very different now. While the recent successful fruiting, by Mr. G. A. Schattenberg, of Boerne, Texas, of the English walnut budded on the wild Mexican variety, so common in west Texas, opens a wide field for experiment with that valuable nut, the native pecan offers opportunity for profitable investment in the South that cannot be surpassed. Of course, many exaggerated statements as to immediate profits and entire immunity of the tree and nuts from insect pests, as well as the certainty of annual crops, are going the rounds of the papers, and the intending pecan-grower should inform himself well before going into the business ; but, discounting all these, a pecan grove of improved varieties will, in time, say ten or fifteen years, undoubtedly pay good and constantly increasing profits. Or the quicker method of sawing off large trees from 6 to 10 feet above the ground, allowing all shoots to grow the first year and budding three or more of them the following season, can be adopted with great success. All those having natural groves will find in the various bulletins issued from Washington, and also by the State Experiment stations, the necessary information of how to top-bud such trees, so I will confine my remarks entirely to establishing new groves. In so doing the two all-important points are, first, how to prepare and plant the trees, and second, how and where to get young trees grown from bearing ones, thus ensuring earlier fruiting by many years than if trees grown from young nursery ones are used. There is also good evidence to prove that the varieties so successful in the alluvial soils of the Mississippi valley and in the moist

climate of the South Atlantic states are not adapted to the drier climate and more elevated lands of Texas.

Were I planting a pecan grove in this state, if I could not get native budded trees that were every way satisfactory, I would either set common seedlings, treating them as shown hereafter, or plant the nuts where they were to stand, and bud them the third year or later, from the best Texas bearing trees. Common trees, from one to four years old, or even older, can be used. A German newcomer, some years ago, planted near here pecan trees about six inches in diameter, to the amusement of the old-timers, and every one grew. He dug them with short side roots and cut the deep ones about a foot below the surface and planted them deep, ramming just like a fence post after watering well. All transplanted trees should be cultivated thoroughly for four or five years and fertilized, unless the soil is rich. The latter is especially necessary where young trees or nuts are planted in peach or other orchards that are in mowed sod. I will now give the proper method and best form of tree to be used.

The accompanying illustration shows two pecan trees exhibited by me at the recent convention of the National Nut Growers' Association, in Dallas, Texas. The tree on the left was planted with about two feet of the taproot, in a hole deep enough to receive it in its natural position. The hole was then filled with pulverized surface soil and well rammed. The smaller tree on the right was root-pruned to four inches and planted in a dibble-hole about eight inches

deep and also well rammed. The trees stood about three feet apart, were set on April 2, 1905, and the tops of both cut back to about six inches. It will be noted that the tree with the long root, though larger, made less top than the other and emitted only small, fibrous surface roots, the lower two-thirds of the taproot being entirely bare, showing that the tree failed to appreciate my leaving so much taproot. The other tree, as will be seen, at once struck several deep roots from the lower end, the roots being stronger ones than those from the other tree. Unfortunately, the strongest of these new taproots was broken in digging the tree.

Now, in view of this plain proof that the pecan prefers to re-establish itself on a new set of taproots after short root-pruning, are not our horticultural pecan scientists doing inexperienced growers, as well as themselves, a great injustice in planting, and advising others to plant, pecan trees in holes thirty inches deep and thirty inches wide, as was advised by one of our pecan authorities at the Dallas convention?

I take it that every one knows that a pecan tree produced from a nut will, in the end, make a much more vigorous growth than a tree transplanted with long roots. Hence, in cutting back the top and root, as practiced on the smaller tree, it is plain that I reduced it practically to the condition of a nut, the distinguishing feature of which is its ability to strike a deep taproot, with the difference, however, that the root-pruned tree struck several such roots instead of one, and is capable of reproducing itself with a certain variety of nut, which the planted pecan scarcely ever does. Another fact brought out by the above experiment is, that it is simply a waste of money to subsoil, or to dig deep holes, for the penetrating power of a root-pruned pecan tree, like the nut, is almost incredible, the subsoil under the smaller tree having been a compact, hardpan clay about one foot under the ground. Of course, I do not expect the orthodox pecan scientists to be convinced by the above facts, for with them facts cut no figure if the authorities advise to the contrary; but I believe that a great many of the plain growers, who

are looking for the truth, will be convinced, at least so far as to test the matter, which the scientist never does. The "good old way" is always good enough for him even if it does cost five times as much and gives inferior trees.

The foregoing remarks on the pecan were written several days before the recent freeze of March 20, and the book was ready for the printer; but after the fall of the thermometer to 20 degrees, a thing unknown this late for many years, I concluded to wait and give its effects as a guide to the hardness of the various kinds of fruit. I have spent the last few days examining fruit trees in yards and orchards around Lampasas, and noticed some interesting and important things. First, as to the relative ability of sod and cultivated trees to retain their fruit after such a freeze, I find that today, April 1, as far as I know, there is not an Elberta tree around here that has a single peach on it, where it has been cultivated. My sod Elberta suffered worse than most other kinds, but has a good one-fourth of a crop, while the two rows of old Elberta shown on page 115, have about as much; but the tree by which I am standing is so full that it ought to be thinned, though it will not be, as the owner, a lady, has confidence in its ability to mature it all to good size. And I also believe it will, for, appreciating its noble services in the cause of truth and progress last summer (it being the tree that bore the Rochester peaches), last winter I top-dressed the ground around it and the two trees beyond in both rows, very heavily with muriate of potash and old-time Peruvian guano, a new deposit of which has been recently discovered in the Pacific ocean and is now offered for sale by Edmund Mortimer & Co., 13 William street, New York. The effect has been most remarkable, for all the fertilized trees are heavily loaded, while the balance have a very moderate crop and several trees very few peaches. Now, here is an effect just the opposite of what I expected, for I had noticed before the freeze how vigorously the shoots on those trees were pushing and their enormous bloom, and the night of the freeze I thought of them and felt sure they would lose all their fruit, the sap being in such a vigorous

flow. But it seems that any such tenderness was far more than compensated for by the abundant supply of food given them, just where the greedy little surface roots could best appropriate it, thus enabling the trees to resist the action of the freeze and retain their fruit. Could there be a stronger demonstration of the necessity for letting those roots alone? Of course we are not "out of the woods," for, while the little peaches have shed their blooms and look all right, some bad effect of such a freeze may yet show up, though I don't believe it. If, however, these four trees mature their crops, is not the problem of damage to this grand peach from late frosts, to which it is more subject than any other variety, entirely solved? Certainly, at least with sod treatment, and if so every peach-growing community in Texas should send a representative to Lampasas in July to see this object-lesson which will be worth so much to Texas and the South. I will give the result in *Farm and Ranch* when all danger of dropping is over.

But those forty Elbertas are only a part of about 600 other peach and plum trees of many kinds, nearly all of which are loaded. Another sod orchard on the other side of the town, of about 400 trees, seems to be in just as good condition, while all the sod seedlings and transplanted trees around town, except Elberta, are actually overloaded. There are but two large, thoroughly cultivated orchards near Lampasas, with the owner of one of which I talked yesterday, who told me his whole crop was gone. The owner of the other told a friend of mine that he "would not have a peach unless some of the stray blossoms now appearing set."

Now, as to the relative hardiness of varieties under such a freeze. Of the improved kinds, Arp Beauty, Annie Williams and Alexander are too full, while Chilow, Stump, Wheeler, Dewey, Carman, Sneed and Rivers have good crops; Triumph, Victor, Crosby, Frances, Dulce, Pond's Late, Tarbell, Rogers and Mamie Ross, from a few peaches to none at all. Of native seedlings, standing in various yards around in Bermuda sod, which I have named and all of which are loaded, I will mention the Harris, large, snow-

white cling with faint blush, middle of August; Connell, the peach Kirkpatrick carried from here on September 14 and ate three weeks later in Portland, Oregon, a very large yellow cling with red cheek; Lampasas, white freestone with red cheek, medium size and ripens just with Connell, both hanging until the middle of October; Adams, the largest late peach, cling, white flesh and red cheek, middle of October to middle of November. All of these seedlings have very small seeds and are of fine quality except Adams, which is fine for preserving but too late to be of best quality. Believing that these seedlings, which are now all full and have never missed a crop, are worthy of propagation, I will send buds this season free to the following nurserymen, who will doubtless grow them for sale: The Texas Nursery Company, Sherman; F. W. Malley, Garrison; Jno. F. Sneed, Tyler; J. F. Leyendecker, Freylsburg; F. T. Ramsey, Austin; G. A. Schattenburg, Boerne; E. Knox, San Antonio; Orr Nursery Co., Arp, and Fernando Miller, Lampasas, all of Texas. I omitted mentioning the "Cauthen" peach referred to in a previous chapter, which will also be sent, but I cannot furnish the general public.

The Japanese plums have little fruit except Shiro, which has a fair crop. All the Americana and Chickasaw varieties have enough. Of thirteen varieties of apricots, which usually bear well, only two have any fruit left, the Berzetti and Montgamet, both highly esteemed California kinds, which still have considerable fruit on them, the former being the last of all to bloom and having the most fruit. Cuttings of these two apricots will also be sent to the nurserymen named. I will now close this review with a letter just received from W. W. Durham, of the Austin Sod Experiment Station, dated March 30.

"H. M. STRINGFELLOW.

Dear Sir.—I met three cultivating orchardists today, one of whom, Mr. Rutledge, of apple fame, lives nine miles north of Austin, who told me that he had killed most of his orchard by plowing, and what was left had been totally killed by the recent freeze. Mr. Weaver, owner of the 800 peach trees that lost their crop last year by the February freeze, has now lost it all again. Mr. Rutledge

says that all the fruit except apples is gone in his section. I went through my orchard again today and find that I have lots of peaches on my trees.

Yours truly,

W. W. DURHAM."

Mr. Durham is a cotton buyer of Austin, who, with no experience, had the foresight and sound judgment to see the great truths of the New Horticulture when laid before him, and the nerve to go out, drive holes in the virgin sod, in 3-foot hoed circles, and plant 1,000 close root-pruned fruit trees six years ago, to the great amusement of his neighbors. They laughed then, but he laughs now. To him and the following progressive journals which have from time to time opened their columns to a free discussion of the New Horticulture and given it kindly consideration, I feel under lasting obligations. Except for them, its principles would have made slow headway. The names of these unprejudiced journals are the *Practical Fruit-Grower* of Missouri, the *Rural New-Yorker*, *Country Gentleman* and *American Fruits* of New York, the *Pacific Fruit World* of California, the *Peach and Truck Grower* of Georgia, the *Southern Fruit Grower* of Tennessee and the *Florida Agriculturist* of Florida, as well as the general press of Texas. The one exception to this fair treatment of so important a subject has been the *National Nurseryman* of Rochester, N. Y., whose editor, Professor Craig, has taken every opportunity to ridicule and condemn the book and its principles, and several months ago published an attack on my truth and fair dealing by a sneaking correspondent of Texas, who wrote him that my trees were cultivated and not a sod orchard at all. This was because a space of about one foot from the trees is kept clean to prevent damage to the bodies by the mowing machine. To this attack friend Kirkpatrick, who has visited me several times, kindly replied, giving the facts as stated.

CHAPTER XXVII.

Conclusion.

AND now, in closing this little volume on vegetables and trees, their management and diseases, I wish to say that I am well aware that it invites and will receive contempt from some, and perhaps sharp criticism from others. When, years ago, I first announced the facts in regard to close root-pruning, quite a number of horticulturists assailed me promptly, both in Texas and other states, and by argument proved conclusively to their own satisfaction that the thing could not be true—and many, doubtless, think so yet. But the root-pruned tree has come at last, and to stay. Still, so slow, indeed, are men to lay aside old prejudices and adopt new methods, that years may pass before the hoary old fallacies of big holes, deep preparation, fall and winter plowing and pruning, as well as expensive summer cultivation, are laid away to rest in the museum of antiquated and mistaken ideas, alongside the notion that the sun went around the world. They have caused not only a waste of much money but a world of useless labor, as well as bitter disappointment and blighted hopes, and to-day, on hill and in dale, scattered everywhere, stunted, sickly and dying fruit trees bear evidence of their deadly work. However, though reform has always been slow, and though the Pilgrim Progress has ever had to travel rough and thorny paths, wade through the mire of captious criticism, climb with toiling step and slow the steep and rugged sides of great Mountain Doubt, and ever and anon strike down with the club of Fact the lusty giants Conservatism and Authority that block his way—yet in the end he always gets there just the same, and waves his banner from the mountain top. And so, some time in the coming future, the mowing machine will replace the cultivator and the plow. Our close root-pruned trees

will stand on well-kept lawns, or in pastured lots, where, yearly fed with proper food and sprayed, their sturdy limbs, clothed with dark foliage of healthy green, will bend beneath their loads of perfect fruit, while yellows, blight, root-tumor and black-knot will be but ugly recollections of the past. That with rational, natural treatment all this is possible, will be seen from the two following quotations from the January issue of *Green's Fruit-Grower*, published in the heart of the great fruit belt of Western New York. Mr. L. B. Pierce, writing of the "Summer Rambo" apple, says:

We have a tree standing over the south kitchen door that is about twenty years old, from a root-graft, and spreads forty feet, and is thirty feet high. Last year it was the only one on the place that bore apples smooth and large enough to use. This tree bore about three bushels, and furnished pie timber for about two months. The entire apple crop on four hundred other trees [presumably long-rooted, etc.—H. M. S.] was less than a bushel. This year this tree is bending beneath its load of fruit, and about the middle of August I was obliged to pick a part to relieve the burden. The apples were at that date as large as Baldwins and partially colored, and sold readily at twenty cents a peck. The tree should be planted in a sheltered place and the ground strewn with straw, as the apples ripen gradually, and, being large and heavy, drop and bruise.

The editor, Mr. Chas. E. Green, in another place, writes:

I know of a Baldwin apple tree located at the rear of the kitchen, near the house drain, where its roots received weekly ablutions from the wash tubs. I do not dare to state the annual yield of this tree, for it was beyond belief [probably another root-graft or seedling—H. M. S.]. I have two apple trees in Rochester near an old hen-house, on the rich soil of which the roots feed; also two located near my stable. These trees seldom fail to bear crops of fine fruit, though the soil is not cultivated.

Presumably all the latter trees were seedlings, as people do not set two apple trees in a place as were those near the hen-house—or usually plant two near a stable. I leave these nuts for my long root, big hole, deep plowing, summer cultivating readers to crack.

Duplicates of such root-graft or seedling trees are standing all over the country. Will not some advocate of the above-named methods explain fully, and give us the whys and wherefores of the strange fact that everywhere, the world over, fruit trees show such partiality for houses?

I have introduced the accompanying cut (page 144) of a one-year apple tree, grown from a root-graft last season, and although the engraving from the photograph shows only a small portion of the roots, it will be seen that they are all strong and perpendicular, and probably penetrated in one season deeper than the top is high. But are there any other causes for the phenomenal success of this representative apple tree, standing on hard, uncultivated ground? I will here quote an extract from a critic of mine in *Texas Farm and Ranch*, who undertook to answer this question, and suggests that, first, "the soil near a dwelling is likely to be rich, deep and full of vegetable matter;" and secondly, that "the noise, smoke and smell of a human habitation tend to drive harmful insects from nearby fruit trees." Possibly some one may add that the slops and wash-water from the kitchen played an important part. As to the first statement, is it a fact that such was likely true? I see no reason why, but if so, what part would so small and circumscribed an area play in developing the last full crop on a tree with a forty-feet diameter of head and lateral feeding roots, certainly covering, at a small estimate, one hundred feet in diameter? I have traced oak roots, in a field near a wood, that far in a single direction, and found them still travelling. His second statement is absolutely unfounded in fact, for we all know that screens are everywhere a necessity to keep out the swarms of beetles, candle-bugs and moths of every kind that, drawn by the lights, flock to our houses after dark. The live oaks here in Galveston are much worse eaten by the canker worms near the electric lights than farther away. Thirdly, as to the wash-water and kitchen slops, in this day of cleanliness and sewer drains, it is hardly likely that Mr. Pierce allows such things to be thrown around his house, and if he did, as the tree stood at the back door, its feeding roots were far removed, and would receive small benefit from such applications near the trunk.

But let us examine a little farther into the facts concerning this apple tree. It is not only of remarkable size for its age and neglect, but seems ordinarily to bear enormous crops,

ROOT-GRAFT—NATURAL SIZE.

APPLE TREE ONE YEAR OLD, FROM
ROOT-GRAFT.

and the fruit, though immature and only partially colored, was, without thinning, as "large as Baldwins," and Mr. Pierce suggests a sheltered place to protect its wonderful crops, and also a mulch of straw to save the "large and heavy apples" from bruising when they fall. Remembering that results come only from adequate causes, and not by chance, is there any adequate cause for the regular and abundant crops on this tree, except that it had struck its several tap-roots, as shown in the cut (page 144), deep down to permanent moisture, and that its surface roots were left entirely undisturbed?

I will now bring this chapter and the book to a close, submitting it to the serious consideration of fruit-growers all over the world, for its principles are of universal application.

There is not a single really important operation of our modern orchards, starting with the form of tree, character of ground preparation, planting of the tree, and its after-treatment, all through its poor, persecuted life, that is not a plain violation of nature's methods, by which she grows trees so far superior to ours that any but a blind man must stand abashed at the comparison. Being so revolutionary, The New Horticulture has met with determined opposition and ridicule from a large majority of the Professors, Horticultural Scientists and Experiment Stations, who seem to be bound with the strong chains of prejudice, Prometheus like, upon the rock of blind conservatism. They will not experiment fairly, and yet condemn. While there are other honorable exceptions to this charge, I will close with two quotations, the first from Prof. T. L. Brunk's bulletin, issued from the Maryland Experiment Station sixteen years ago, in which, with prophetic vision, he says :

"I believe I am safe in stating that these methods of treating trees are destined to supplant old methods to a large extent, and with a larger range of species and varieties than has yet been tried, and that they have a number of important advantages over old methods which will give a new stimulus to fruit-growing and result in a new system of training and after-treatment of orchards."

That he was a true prophet is proved by the fact that thousands of progressive men everywhere have planted, and still are planting, root-pruned orchards, and putting them

down to mowed sod when in bearing. The other quotation is from a bulletin issued by Prof. H. N. Starnes, of the Georgia Experiment Station seven years ago, which concludes as follows :

“Whether or not Stringfellow’s methods ultimately become universally adopted, they can not, in view of the various successful tests in which they have figured, be any longer criticised as visionary or ridiculous, and so dismissed. The Stringfellow theories have now gone beyond this point, and must be treated with the respect which their grave importance to the fruit-growers demands.”

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