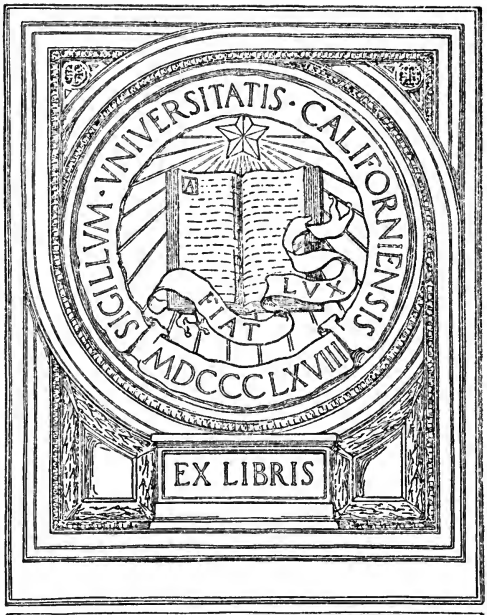
The New Horticulture



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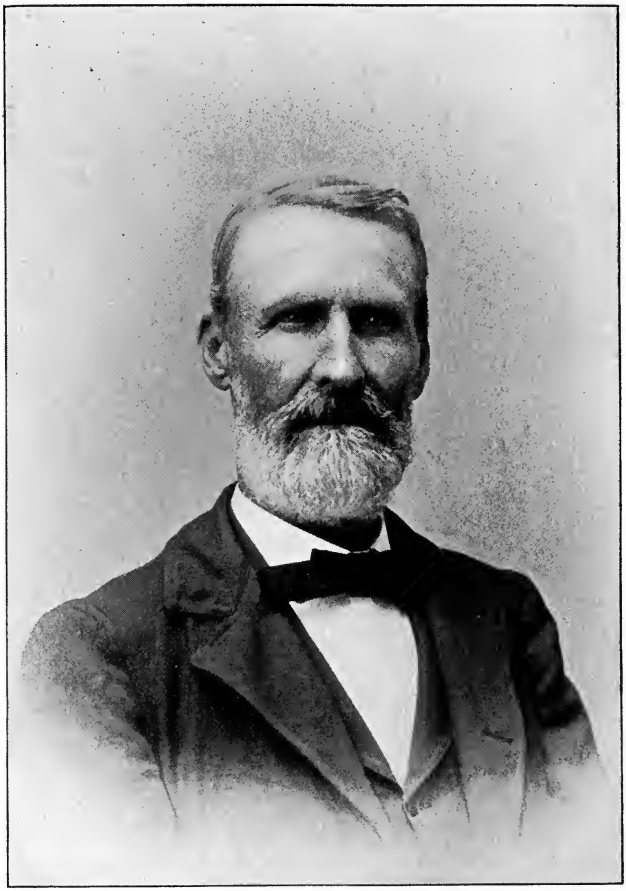
THE NEW HORTICULTURE



H. M. STRINGFELLOW

THE NEW HORTICULTURE

BY

H. M. STRINGFELLOW

GALVESTON, TEXAS
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PREFACE.

SEVERAL months ago I contributed to *Farm and Ranch*, Dallas, Texas, the fruit-growers' organ for the Southwest, four articles on the best form of tree for transplanting, as well as the best preparation of the ground and after-treatment of the orchard. To these was added an inquiry into the causes and prevention of pear and apple blight. Having received quite a number of requests to embody the whole in print, I concluded to do so, and to add in a narrative sort of way some pages from my own personal experience of thirty years in fruit and vegetable growing, the whole of which seems to contain enough new points of interest to justify the title of "The New Horticulture," and to warrant laying them before my fellow fruit-growers. While directly applicable, in some of the details and varieties, to the far South only, many of the suggestions are of general interest all over the country. There is no doubt that some of them will meet with decided opposition, but I feel confident that a fair trial will in the end prove me right in the main. My object has been to show that some of the principles of horticulture to-day are wrong, and also to suggest a more natural, cheaper and better way to grow good fruit than the laborious and expensive methods now in use. While in the analysis of manures and destruction of insects we have made good progress,

horticulture has not kept up in the procession with the other arts and sciences, and a little radical shaking up will at least start a spirit of inquiry and experiment.

And now, before entering upon my task, I wish to disclaim any pretensions to a set treatise in regular form. In view of the general information and the great number of excellent works on the subject, it occurred to me that it would be more interesting to embody the facts, endorsements of them, and my own observations, in the form of a rambling sort of personal history, and to do that it has been most convenient to use very often the personal pronoun in the first person, for which I hope my readers will excuse me.

H. M. S.

GALVESTON, TEXAS,
August 1, 1896.

CONTENTS.

Part I.

Part II.

PART I

THE NEW HORTICULTURE.

CHAPTER I.

How I became a Horticulturist.

IN looking back over the past, nothing strikes one more forcibly than the fact that most of us are literally creatures of circumstance. The most trivial incidents often break in upon our plans, changing the whole course of our lives. Never was there a more complete illustration of this truth than the apparent accident which drew my attention to horticulture, and finally resulted in developing a most intense interest, where before there was complete indifference. It is an old saying, that the boy is father of the man, but in many cases, nothing could be farther from the truth. I am sure I can, and doubtless many of my readers can, recall instances among their friends, where the future man or woman has turned out to be absolutely no kin at all to the boy or girl, in all the peculiarities and traits that went to form the future character.

My own is a case in point, for as a boy, and in fact up to a certain day in April, 1866, when a young man, I had not the remotest idea that an ardent love for every form of horticulture was slumbering within, which needed but the slightest spark to kindle. I cannot recall that the sight of any orchard, garden or flower, in my whole previous life, ever excited the slightest desire in me to own or grow one like it, or in any way to work the ground, my whole attention being entirely devoted to trading in cotton and real estate, until the morning alluded to in April. Being an ideal spring day, a party of us concluded to spend a few hours fishing from the wharf here in Galveston, and, seeing a rusty-looking old chap near

by me drawing out some fine specimens, while I had no success at all, with legs dangling over the wharf's edge I inched along towards him to try and share his luck. The old man took it very kindly, and gave me a pleasant "good morning," from which we soon got well acquainted, and it needed but little questioning to draw him out. While proud of his skill as a fisherman, by which he then made his living, he soon let me know that he was originally cut out for better things than that. He told how, many years before, on the classic banks of the Rhine, in a snug little vine-clad home, his eyes first saw the light of day, and how as a boy, and then man, he had helped to terrace the rocky hills, and carry the earth from below in baskets on his back, to make the beds where grew the grapes that made the sparkling wines of the Rhine. At first I was much more interested in fish than grapes, for while I did know they grew on vines, I certainly knew no more, but as the old fellow rambled on, he finally jumped in his narrative clear over the ocean and landed at Bolivar Point, across Galveston Bay, where he went on to tell how he just missed a fortune in grape-growing by a mere scratch. It seemed that after a life-time of wandering he had saved up a little money, and bargained for a few acres of land, but needing his cash to buy his vines, had paid nothing on it. The vines were planted and growing finely in the spring of '61, when, alas for the old man's fortune, the war came on. The big Yankee ships steamed up and down the coast, and finally into the harbor, and anchored quite near the Point. Now, while the old fellow was greatly interested in the grape, it was not the kind they cultivate aboard a man-of-war, so he abandoned the place and moved to Houston. When the war ended, however, he returned to look at his vineyard, but the fence was all down and the cattle had trampled his poor vines to death. Disheartened, and having no money to buy more, he had moved over to Galveston Island shortly before, and so it happened we met on that bright April morning. While this is the outline, he filled in with many interesting incidents, and none more so than the fabulous profits that could be made on grapes. I do not remember now the vines he put to

the acre, or the pounds to a vine, or the price per pound, all on paper, like many another fruit crop, but I do know that before he got through with his wild, enthusiastic harangue he had me so excited over grape-growing that I was prepared to throw cotton and real estate to the winds and grow grapes galore. And thus while fishing for trout with shrimps, I was caught myself, with a bait of grapes. Little did the old man think that day that, like the Apostles of old, he had turned out a "fisher of men." And what, indeed, are we all but fishermen, wandering along the stream of life with rods in hand, and hooks baited for each other? Whether it be stocks or bonds, cotton or corn, money or love, we all have baits out for somebody, in which the hooks are as carefully concealed as those in the shrimp, and, whether by accident or design, somebody is always being caught.

Well, the time had passed quickly, though the fishing was bad, and, after thanking the old man for his pleasant chat, I bade him good-bye, and never saw him again.

In our journey from the cradle to the grave, our paths crossed but a single time, and yet in those few hours he had completely changed the whole course and future of my life. On my way home, I stopped in the different book stores to hunt for lore on the grape, and bought the only two books they had. These were soon at my fingers' ends, and not satisfied with learning something about grapes, a desire sprang up to know something about all other fruits and flowers as well, and everything I could find was read. While now completely infatuated with horticulture (and it is wonderful how completely it does capture some people), it is doubtful whether I would ever have made it a business, unless unfortunate speculations in cotton and real estate, just prior to the storm and yellow fever epidemic of '67, had decided the question for me. Those events left me with no bank account against which to draw, so I concluded at once to follow my inclinations, and draw on the sand banks of Galveston Island. Just how those banks will honor a draft, if properly indorsed with manure and industry, I leave the old vegetable dealers and residents of the city, who used to visit my home in the West End, to say.

CHAPTER II.

Early Experiences and Seed-beds.

I WILL now give a few details of my first experiences in gardening for profit, and will ever look back to those early days as the very happiest of my life. Imagination, with her unclipped wings, ever bore me up, and hopes fluttered around as thick as moths over a cabbage patch. Not yet had I sounded all the mysterious depths of vegetable arithmetic, or proved by the double rule of three that if one lettuce plant will bring two cents, it does not necessarily follow that 43,500 on an acre at one foot apart will bring $870. The doubtful propriety of counting chickens before they are hatched, with the consequent inconveniences often resulting therefrom, had not yet impressed itself fully on my confiding mind. To me the world was a vast stomach of unlimited capacity, and my mission to help fill it, by the aid of a natural and considerate disposition on the part of all vegetables to assist, with a minimum of effort on my part.

Soothed and sustained by these pleasant anticipations, and in blissful ignorance of the festive bug of high and low degree, as well as the hilarious moth, ever intent on combining business with pleasure, as she flits from plant to plant, I set out in my first attempt on two and a-half acres of nearly pure sand, in the suburbs of the city of Galveston. This area was increased in a few years to five acres, on which I soon had a fine little orange grove coming on, as well as a small vineyard behind the friendly shelter of oleander and salt cedar trees, which kept off the blighting salt winds. Here, by continuous and heavy fertilizing and tireless work, stimulated by intense love for it, I managed, with the high prices then and for many years prevailing, to make a very satisfactory success of market-gardening, even though my bright anticipations were never realized. Starting absolutely

ignorant of every branch of horticulture, and yet with an ardent love for it, I have always believed that the fair success I have made was more due to that ignorance than anything else. In those days there were very few market-gardeners on Galveston Island, and those here were exceedingly jealous of each other, so when I started out and went around for a little friendly information on various points, I found them literally a lot of know-nothings. This turned out to be the very stimulus needed to throw me on my own resources, and compelled me to inaugurate a thorough system of experiments for myself. So, getting a very large blank-book, as everything was to be learned, I made it a daily rule for fifteen years to make full notes of the weather, and enter a complete statement of all the garden operations performed each day, which turned out to be a most delightful and instructive task, for in a few years I could strike an average, and know just when and how each operation should be performed, and probable results.

Taking Henderson's Market-Gardening as my guide, with proper allowances for climate, I shall ever feel under obligations for the valuable information contained therein, especially his earnest advice as to a free, in fact almost extravagant, use of manure. After thirty years in the garden and orchard, I attribute whatever measure of success has crowned my efforts more to an apparently reckless style of fertilizing than all else combined. Manure means both water and cultivation, for I have often seen excellent crops made, even in grass and weeds, on very rich ground, while clean culture on that only half fertilized gave a practical failure. Food in proper proportions, not a glut of any one element, but a fairly complete manure, and in abundance, is the one absolute essential for the highest success, in the garden as well as the orchard. Thirty years ago this necessity for a complete fertilizer was not recognized, and especially the need for potash, for while its use on onions was generally recommended, the idea seemed to be prevalent that somehow it suited that crop better than any other. But while, as I have said, I will always thank Henderson for his injunctions about manuring, he gave

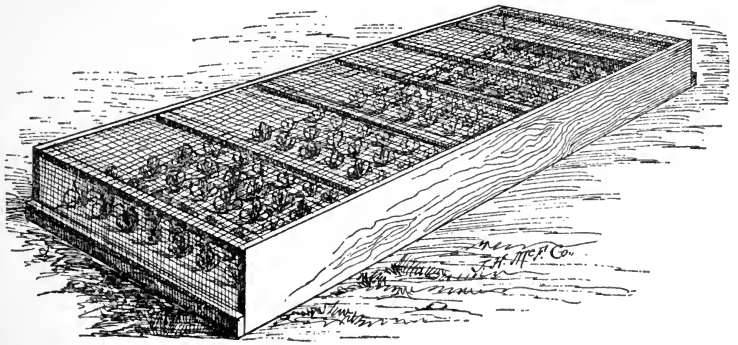
another direction that, as far as I know, is still given in the books, for which I owe him a most serious grudge. The first edition of his work, "Gardening for Profit," advised that no matter how long-stemmed (or legged, as we call it) a plant may be, to set it down to the bud, and gives apparently a very good reason, for the North; viz., to protect the stem from freezing and splitting open. Yet I am confident that no single piece of general advice ever given has caused and still continues to cause so much loss of plants as that. While I can only speak from actual experience here, I am sure, under general conditions, it must be the same elsewhere. For several years I regularly had to grow, for the fall crop of cabbage and cauliflower, just three times as many plants as I needed, for fear of accidents, until I found out the trouble. For several seasons the plants were set as directed, with the greatest care, and yet in summer and fall, if the stems happened to be a little long, let a heavy shower fall just after they were planted, or if set during rain and the plants were at all sappy and tender, or even if set after a good rain and down to the bud, invariably a large proportion would damp-off. In the face of such a positive direction to set to the bud, I racked my brain to find out the cause, and have to admit that, after all, it came by pure chance.

We had, one morning early in September, a splendid rain, and being cloudy all day, we rushed out about twelve-thousand plants after dinner, and kept it up until dark, and when we knocked off, I happened to have left over a few plants in my hand. I stopped at the end of a row, and stooping down, made shallow holes with the end of my finger, and barely inserted the roots as deep as they stood before, leaving the entire stems out. That night another fine rain fell, none too much, that I could see, and yet, in three days, more than half my plants had damped off at the ground, while every one of that handful started off to grow.

I saw at a glance the cause of all my past trouble. Simply burying the tender stems under the ground. While this is so fatal here in summer and fall, deep planting is equally undesirable in cool weather, especially in spring, when time is

money. No kind of plants thus set, when the ground is cold, will strike root quickly, or make much growth until new roots are emitted near the warm surface. I have repeatedly proved a difference of ten days, and several times much more, in favor of those planted just a shade deeper than they stood before, and then in a few days either drawing up the earth or laying the stem flat, if long, and covering with surface-soil. But take him all in all, Peter Henderson may well be called the father of modern market-gardening in this country, and few men ever achieve such signal and well-deserved success in the business as he.

And now, as a successful seed-bed is the foundation of all profitable market-gardening, I present a form I hit upon from necessity, in 1869, which, though adopted now by many gardeners in this section, I have never seen described in any book. I found that the green and bud-worms, grasshoppers, crickets and flea-beetles were so bad on my cabbage plants that, failing with sprinkling the plants with foreign substances



SEED-BED, WITH MOSQUITO-NET COVERING.

to kill or drive them off (poisoning being unknown then), it struck me that prevention was better than cure. So I made my seed-beds the second summer like common coldframes, without the ends, as shown in accompanying illustration:

Set up on edge two 10 or 12-inch planks as long as the bed is to be, and about 5 feet apart. Nail small strips from one to the other, at intervals of about 2 feet, and at each end

next to the ground, nail a piece of 1 x 3-inch plank, to which the ends of the mosquito-bar are to be tacked. Stretch a bar over the frame after the seeds are sown and covered. The shade afforded by the mosquito-bar is just what the young cabbage, cauliflower, lettuce, or other seed requires in summer, though, if at the South, and more is desired, a light sprinkling of hay, free from weed seeds, for a few days, will be sufficient. Water can be applied from the sprinkler on and through the bar, which is not to be removed, except once for hand weeding, when the plants are half-grown. This should always be done in the morning or at mid-day, when the moths are at rest, never late in the evening. This form of bed and covering will answer perfectly for all kinds of flower or vegetable seeds to be planted in warm weather or when glass is not required, and if carefully done, will afford perfect protection and give nice, clean plants when the time comes to set. See that the mosquito-bar fits close all around, and is free from even a small hole, for the ingenuity and perception of moths is simply wonderful, and they will find the smallest opening, if one be left.

As, next to good, healthy plants, rich ground is of the utmost importance, I will discuss the subject of fertilizers in the following chapter.

CHAPTER III.

Fertilizers—Cotton-seed Meal.

WHILE cotton-seed meal is the cheapest and one of the best fertilizers for new soils, or those not too much exhausted of their potash and phosphoric acid, many people have bad luck with it from a want of knowledge as to how to apply it. The trouble has been that it is either used in the hill or drill, fresh, with the seed, or else planting is done too soon after applying it to the ground. It should always be evenly scattered and well mixed with the soil at least a month ahead, for it not only heats at first, but also breeds thousands of little maggots in cool weather, that bore into seeds of every kind when they sprout, and often into the stems of cabbage and other tender plants. In hot summer and early fall weather, decomposition occurs so quickly that this never occurs. In a month, however, all fermentation is over, the maggots are dead, and then cotton-seed meal is the very best and cheapest of all manures for new land in the coast country. It costs about $18 per ton, while bone meal is $28 to $30, and a ton of it will, the first season, produce more of a crop than two tons of the bone meal.

The latter is a most excellent fertilizer, and either raw, or, better still, in the form of super-phosphate, will, in the course of a few years, when the soil has been partially exhausted of its soluble phosphoric acid by crops, furnish the best supply of that element. Bone meal is usually too coarse to allow of more than a very small per centage becoming available as plant food the first season, and it is poor economy to bury so valuable a fertilizer a year or two before it can be used by plants.

Cotton-seed meal contains about 8 per cent. of ammonia, 1½ per cent. each of potash and phosphoric acid, and as our lands are well supplied at first with the two latter, even these

small percentages will furnish, for most crops, all the mineral elements needed for some years.

For berries and tomatoes, more potash will brighten the color and make firmer the fruit of the first, and render that of the latter less liable to rot. For these two the New Orleans complete fertilizer, with some potash, and its nitrogen in the form of nitrate of soda, gave me excellent results, but for a cheap and valuable all-round manure for general crops and fruit trees, cotton-seed meal heads the list for new lands.

That ammonia is the element of all others most needed in this section was plainly demonstrated by the snow last winter. While the mineral constituents are fixed in the earth, nitrogen in the form of ammonia is continually escaping into the air by the action of fermentation and decay, and constantly being returned to the soil in rain and snow. We all know that no watering will make plants grow like rain, and the snow is a still more effective ammonia catcher. The difference between rain and snow in this respect is that the former, while it brings down ammonia, also in heavy downpours not only carries off most of it in floods, but actually washes out much of this very soluble element from the soil itself. Everyone has noticed how, after excessive rains, even on the best drained ground, plants seem to stand still. But that snow came last winter after a three months' drouth, and was slowly absorbed by the earth, depositing an equivalent of thousands of tons of cotton-seed meal, and resulted in crops of all kinds, even on fresh broken sod, that fairly astonished all the older settlers. We must not delude ourselves into the belief that a repetition of such a yield is likely to occur the coming season on ground poorly prepared. Better trust to thorough stirring and cultivation, with a judicious application of fertilizers for the most valuable crops, than another snowfall from the clerk of the weather!

But while ammonia is most required at first, there comes the time, in a few years, when lands from which continuous crops have been taken will require an addition of more of the mineral elements also. No analysis will tell this as effectively as the plants themselves. In fact, the great difficulty of

determining the exact amount of plant food in a soluble or available condition for immediate use, renders all soil analyses of little practical value, as compared with actual experiments that can be made by everyone for himself in a single season. Whenever the tomato runs to vine and makes little fruit, it is a plain call for phosphoric acid, or if the fruit rots at the blossom end, it shows that potash is wanted. If the strawberry leaves begin to spot considerably, and the lower ones to dry up, or cabbages when half grown burn around the edges and also dry up or shed their lower leaves, and particularly when the plants assume a pale, yellowish green tinged with red, after rain or cold, and fail to head well, unless there is some local cause, such as bad drainage, it may be set down as certain that potash is required. When this element is present in abundance, cabbage leaves are always of a rich, dark green.

But there is no plant that indicates a poverty of potash in the soil like the watermelon. The saying, "new ground for watermelons," is as old as the hills. What I have now to say pertains to all soils, but is particularly applicable to the sandy land of Bolivar Point and Galveston Island. As is well known, these are much lighter than the mainland, and have no clay subsoil, and, consequently, little potash. The main spring crop for money on these warm, early soils is the watermelon, and the growers are in tribulation over the gradual deterioration for several years, and almost failure last summer, of all the melons on old lands, although well manured in the hill with rich compost.

The trouble is what may be called the "die back." The plants generally start well and make a good growth for awhile, but when the melons begin to set, or perhaps are half-grown, a shoot on one side will wither away and die. Then another will go, and if the whole hill does not die out the vines make poor growth, the melons are small and of very poor quality, and the roots are alive with a minute little wriggler, known as the "eel worm." While I never saw a sample of the Bolivar worm, I recognized in the descriptions of him and his work, an old acquaintance that I made the third year of

my gardening experience on Galveston Island, though I never knew him by that name.

When, in 1868, I first went into the gardening business, I had but five acres at the corner of Forty-fifth street and Avenue N, and knew absolutely nothing about the business. In those good old days of little gold but lots of greenbacks, nothing sold like melons, cabbage and cauliflower. Anything less than $10 per dozen for good lots of either, if moderately early, was not thought of, and when a few years later the price dropped to $4 and $5 per dozen, we all cried out that we were positively being robbed. Arming myself with Henderson's "Gardening for Profit," I determined to grow nothing but melons in spring, and cabbage and cauliflower in the fall, at least as long as I could. In May, 1868, I turned my first acre, breaking that year only one block of two and a-half acres. After plowing and harrowing several times, the question arose as to the best manure for my first venture. I had studied Henderson until I knew him by heart, and while he had excellent words for pure bone flour (not coarse meal), his recommendation of 1,200 pounds per acre of the genuine, old-time, 12 per cent. ammonia and 25 per cent. phosphoric acid Peruvian guano, struck my fancy most. When a boy I had seen spring up, almost as if by magic, most wonderful crops of wheat from the worn-out fields of old Virginia, when only a few hundred pounds per acre were applied, and my expectations were on tiptoe to see what 1,200 pounds would do. So, without further debate, I ordered my seed from Henderson, and the $100 gold per ton Chinca Island Peruvian guano, the supply of which gave out years ago, from Mapes, of New York.

In August I measured off an acre that was well prepared, scattered 1,200 pounds as evenly as I could, harrowed it in, having already sowed my cabbage seed. Shortly after a splendid rain fell, and taking advantage of it, about the first of September I set this acre down with cabbage. Nearly every plant lived, and though the green worms were bad, the season was so favorable, and the growth so rapid, that little damage was done, and in November I began to market a crop

that I never saw equaled but once, and that was in 1876, of which more anon.

Only the man who has a genuine love for gardening can appreciate my feelings when I went out, on clear, calm mornings, to watch the first rays of the sun gleam down the long rows of great plants, with their ten and fifteen-pound heads, as regular as pig tracks down a lane, and nestling in a wilderness of rich, dark leaves, silvered over with the sparkling dew. That I had the "world by the tail and a down-hill pull," I felt sure, and I did for a few years, only to find out later on that the pull was the other way, and I couldn't let go.

Well, the cabbage was cleared off at the biggest kind of prices, and the whole block planted down in spring to the old-time red-seed and white-rind "island" melon, and as an experiment, for I began experimenting then, and have never quit to this day, I manured the balance of the 2½ acres with barnyard manure in the hills only. While this turned out to be a first-class experiment, it cost heavily, as the yield in size and number of melons on the cabbage ground far exceeded that on the other. This was due to the great amount of fruit-producing element, phosphoric acid, left over from the guano on the former. As we all know, that element, potash and nitrogen, commonly known in the form of ammonia, are the three main constituents of plants, and the only elements of plant food it ever becomes really necessary to supply. While lime also enters largely into their composition, it is found so abundant in all soils except pure sand that its use, except on ground made over-rich for years with barnyard manure, is unnecessary. As a corrective of what is known as humic acid in such soils, it is very valuable, and, with an application of hardwood ashes, would regenerate the flower and vegetable gardens of Galveston City and Island, many of which have been dosed to death with animal manures.

While this digression may seem to have no connection with the eel worm, it has, most intimately, and, to bring it out more clearly, a few further remarks in the same line are necessary. While ammonia, potash and phosphoric acid, with

lime, form the bulk of plants as a whole, the three former, to a large extent, play distinct parts in their development, and an abundance of all is absolutely necessary to healthy foliage and full crops of fruit. The office of ammonia is chiefly to make growth, phosphoric acid to make fruit, while potash heightens the color and quality of the fruit, and contributes most largely to the general health of all plants. Just in proportion as one or the other of these elements is lacking in soils, will there be a deficiency in the corresponding particular. Everyone has noticed that a heavy dressing of stable manure, with its ammonia, will make tomatoes, for instance, run all to vine, and continued applications "burn" anything it is put around.

Now, at the time I write of, I did not know all this, and especially the office of and need of potash. Nor, in fact, did anybody else know it. Peter Henderson and every farmer knew that the continued use of guano would "burn," barnyard manure in excess produce club-root, bone meal fail in its effect if used continuously, stable manure cease to produce healthy crops if applied in succession on the same ground, and so on, but the only distinct recognition of the value of potash as a fertilizer thirty years ago was for onions. All the writers on gardening invariably noted that onions could be grown year after year successfully on the same ground, and farther on the remark always followed: "Ashes are a special manure for onions."

But to the balance of my story. Year after year, in continually increasing quantities, I applied first one and then another of the above manures, except potash, including nitrate of soda, all abounding in ammonia and phosphoric acid, but, with the exception of a small amount in stable manure, entirely deficient in potash. Beginning with the third year, my cabbage and cauliflower commenced to spot and shed their lower leaves when half grown, split open and rot in the stems, the tomatoes went mostly to vine, and the fruit rotted badly at the blossom end, the melons set less fruit and failed to grow large, and the vines took the "die back" and eel worm, an almost microscopic little creature that infests both

melon and egg-plant roots in great numbers when grown on ground deficient in potash, as Galveston Island and Bolivar sandy soil necessarily become after several crops have been taken off. On clay soils a year or so of rest, and the plowing in of peas or grass, will turn loose more potash, but on pure sandy soils there is little more on hand.

So, there I was, with a good home, then increased to five acres, and pleasant surroundings, but my ground "played out." This state of things culminated in 1875, and I was thinking seriously of hunting some new ground, when one morning, in passing a powder house, situated near my back fence, I saw the door open, and looking in found old Colonel McKeen, then in business on the Strand and agent for a northern powder company. With him were several gentlemen, who were discussing the best method of getting rid of the large lot of damaged powder in the house. The high water of that year had wet some, and the dampness injured all of it considerably, and Colonel McKeen was just saying that the best thing to do was to dump the whole lot into the gulf. Knowing the composition of powder, and that 75 per cent. was pure nitrate of potash, the most expensive and valuable of fertilizers, I offered at once to save them the drayage, if they would give it to me. While evidently wondering what I intended to do with it, they gladly accepted my offer, and turned me over the keys and about five tons of blasting and gunpowder.

I had it hauled away at once, and on knocking in the heads of the kegs found most of it apparently as good as ever.

We prepared about four acres, and in a few days, to the astonishment of my neighbors, I was sowing powder at the rate of 1¼ tons per acre, the costliest, from a money standpoint, and probably the most excessive application as a fertilizer ever made on ground. Each ton of powder contained about 800 pounds of ammonia and 700 pounds of pure potash, and as cotton-seed meal has but 160 pounds of ammonia and 30 pounds of potash to the ton, it will be seen what a waste it was. However, as it cost nothing, and was dangerous to keep, I put it all on.

After harrowing in well, the ground was thrown up into 3-foot ridges, and in August the four acres were set with cabbage and cauliflower, at the rate of 7,000 to the acre, giving a total of 28,000 plants. The growth was extraordinary, and not a spotted leaf or diseased plant in the whole lot, from first to last. I never before or since saw such heads, and many of the older members of the Cotton Exchange will remember, that when they occupied the old building on Strand, near Twenty-first, I exhibited on their floors, for several weeks, in half-barrels, three giant cauliflowers and three cabbages, taken up with balls of earth, the smallest head of which, when stripped of the outer leaves, weighed 17 pounds, and several, both of the cauliflower and cabbage, weighed 20 pounds, and were as large as a half-bushel measure.

The winter was very mild, and the whole crop was sold on the grounds, netting considerably over $6,000, after which the four acres were planted to melons, and the crop was equally fine, and not a sick plant, where the eel worm and "die back" were plentiful before.

Here, then, was the secret of "played out" and diseased soil. Simply a want of that great tonic of the vegetable system, potash.

I had for years been applying heavy doses of ammonia and phosphoric acid, while the sandy soil had been drained of its potash, resulting in diminished and diseased crops. From then until 1883, when I left the island, I invariably applied the muriate of potash at first, and after the oil mill was established, cotton-seed hull ashes, which I got then, load for load of sand, and though cabbage was planted regularly every year, and twice a spring and fall crop were grown on the same ground, I was never troubled with diseased cabbage or melons again.

Just how potash works I cannot say. Whether it actually destroys the bacteria of fungous diseases, and such minute pests as the eel worm, which is exceeding small, or whether it simply gives health and vigor to the plants themselves, strengthening and hardening the tissues of both leaves and roots, and thus enabling them to resist attack, I leave for

others to determine. The result is what we want, and I am satisfied that if the island and Bolivar growers, and others with old soil, will use potash freely, such trouble will not occur again, here or elsewhere.

If hull ashes, containing 30 per cent. potash, and about 8 per cent. phosphoric acid, could be obtained pure, there is no better supply, but the mills now have such ready sale for the hulls that they find it does not longer pay to burn them, and when they do, it is often in conjunction with coal. But, both the muriate and sulphate of potash can be obtained from the German Kali Works, 93 Nassau street, New York, who also publish a valuable pamphlet on their use, and send it free on application. Just how little of either will do I cannot say, as I always applied the ashes freely, but as 50 per cent. of both muriate and sulphate is pure potash, about 300 or 400 pounds per acre ought to answer. Experiments on a small scale should be made with from 200 to 500 pounds. The muriate is mostly used at the North, but our agricultural and mechanical station, if I remember aright, found the sulphate to give the best results. It should always be broadcasted as evenly as possible, and well mixed with the soil. Both the hull ashes and the chemicals should be used with great care in the hills with seed. The safe plan would be to scatter broadcast. Use no animal manure or compost for melons where plants have shown disease before, but as a starter, a few handfuls of bone meal, or the New Orleans fertilizer, now being used largely on the mainland with fine success for tomatoes and berries, should be worked into the hills, if unable to fertilize the whole ground.

And now, in closing my remarks on fertilizers, I would call attention to the fact that while top-dressing seems to be generally recommended at the North, and may be useful there, this practice ruined several crops of vegetables and strawberries for me before I found out the danger of it here. All fertilizers should be applied before the crops are planted, and thoroughly mixed with the soil, especially in spring and early summer. I would much rather trust to poor soil than resort to this method at those seasons. For cabbage and

cauliflower in fall, it is admissible, if those greedy crops show the need of it, but it is almost certain ruin to a strawberry crop in this section. It invariably induces the roots to come to the surface, and any extreme of either wet or dry will bring out what is commonly known as "rust." Of course, these remarks apply to annual crops only, and not to orchards, which should be fertilized on the surface about the time growth starts in spring, and not in the fall.

CHAPTER IV.

Winter and Early Spring Cultivation.

THE general directions for cultivating all crops are to stir the soil repeatedly, which, while excellent advice under certain conditions and at certain times, is very bad advice at others. We all know the benefits from such treatment in hot weather, when the little clods and loose soil shade and keep the earth cool, as well as break the capillary attraction and retain the moisture. But there are times and places where this is just what we do not want. All through the lower Gulf states, where winter gardening is practiced, the very opposite from the above is the proper treatment, and thousands of dollars are wasted annually at that season in worse than useless cultivation. What is sauce for the goose is also sauce for the gander, and winter cultivation not only very greatly reduces the temperature of the earth itself, but after heavy rains the stirred soil, acting like a sponge, retains more water than is needed, thus reducing the temperature and checking growth. The toper's theory of drinking whiskey in summer to keep cool, and in winter to keep warm, will not work in this case.

The truth is, the same results follow cultivation, both in summer and winter, and the effect in each is to shade the ground and prevent the absorption of heat by the surface during the day, as well as to increase radiation from freshly stirred ground at night. Every one knows that smooth, firm ground will heat up much more quickly and intensely in summer, and should be stirred; but in winter at the South, and early spring both South and North, as heat is absolutely necessary to plant growth, and the ground is damp and cold, the proper thing then is to leave the surface smooth and firm until later on, when the earth warms up. If some one objects that plants left thus can get no air to the roots, the

answer is that air is in no way necessary or beneficial to the roots of plants or trees, this being another of the ancient fallacies handed down from the past. Nothing is more injurious to roots than air. Exposed to it, they always suffer at once. I can say from extensive and repeated practice, that in cool fall, winter and early spring weather, the less the soil is stirred about growing plants the better.

Hand picking of weeds around young melons, cucumbers or other early crops while small will pay well, or if hoed, simply scrape the surface as lightly as possible. If any one doubts these facts, let him work a small space deeply in early spring, and the next sunny day sink a thermometer into it, and then place it in a hole dug to the same depth on clean, smooth ground along-side. It is surprising how much warmer the latter will be, and warmth means growth. After a heavy rain the difference will be much more marked, when, as noted above, deep, loose soil retains water and chills the ground.

As illustrating the value of letting well enough alone, a clipping from a neighboring paper, the Alvin *Sun*, published on the 14th of February, 1896, is appended:

"T. M. Savel brought to our office this week a head of cabbage that measured in circumference 58 inches, and weighed 18¾ pounds. It has been growing in the patch all the winter, and the ground was well fertilized with barnyard manure; but, strange to say, was never stirred around it, or the rest of the patch, but once, when young; and he has lots more nearly as large."

The knowledge of this truth about cultivation in cool weather has been worth a great deal of money to me in the past, as I was thus often able to surprise my first, last and all-the-time-cultivating neighbors by bringing in the first early truck. I learnt it, however, as we do most things of value, by a severe experience, which I will now give.

Soon after I began gardening I had, one spring, a splendid stand of cucumbers and cantaloupes with the third leaf nicely out. Being very busy, the ground had not been stirred around them, though the beds were clean. A smart Aleck came along and insisted that it was a shame to neglect such a beautiful patch (and they really were fine, the ground being very rich); so to do the proper thing, I concluded to work

them myself, for fear my hired man would not do them full justice. Arming myself with a pronged hoe, I went at it with a will, and by night had all but one row nicely forked up quite deeply. While it nearly broke my heart to think that the poor little plants in that last row had to go neglected another night, still it could not be helped, as it was actually too dark to work any longer. But about daylight a heavy soaking rain fell for two hours, and I lay there thinking how those plants would grow, and felt more sorry than ever for those poor little fellows in the packed ground, who got no working. The sun shone out warm and clear in the morning, but a cold north wind came up later, and that night the thermometer went to thirty-eight degrees, but no frost. The next day was bright and warm, but instead of growing off rapidly, as I expected they would, the last one of the worked plants, after turning a sickly yellow for a few days, laid down and died, while not one of the unworked row was damaged at all. The result was, that I finally made more clear money from that one row than all the balance that had to be replanted.

The reason was plain. The deep, loose soil held the cold water like a sponge around the roots, giving chilly feet, while the warm sunshine made their heads too hot. That is good for neither man nor plant, and from that day to this I never worked another heat-loving plant deeply again in early spring, and have, moreover, just finished, this 14th day of February, marketing the last of a crop of very fine lettuce on very rich ground, that has never had an hour's work since it was planted, in December.

I append, as bearing on the subject in connection with trees, as well as vegetables, an extract from *Farm and Ranch*, by Mr. H. B. Hillyer, a thoughtful and progressive horticulturist of this state, who makes these remarks in a friendly criticism of an article by me :

* * * * * "But friend Stringfellow's articles have set us all to thinking, and the oldest will do well to read and ponder them. Farmers have long known that if you plow to-day a few rows or less in a corn field, and at night a frost comes on, the corn well plowed will every stalk be killed, while the unplowed will escape unhurt, and often does, especially if deeply planted.

"But how about an orchard? My soil is light, black prairie, partly covered with live oak and mesquite. My orchard proper is young. This is its third year, and hence I am cultivating three rows of potatoes or corn in the middles. This leaves the trees on the middle of an eight-foot bed that has not been plowed. The past two weeks we had two frosts, thermometer barely to thirty-two degrees. I have thirty varieties of peaches in my orchard. Excepting some Alexanders next to the cow lot, the fruit is entirely destroyed; apricots also.

"In one of my chicken yards, which has never been cultivated, I have five peach trees and plum trees, all in full bloom. I never saw heavier crops of fruit, and but little damage by frost. If we have no more frost I will have to unload the trees to fully one-half. Moreover, these same trees last year bore heavy crops, despite the cold weather, that destroyed almost the entire fruit crop of all this section. In my yard I have five peach trees, one *Prunus Simoni*, one quince, three pear trees and several plums not at all injured by the frost. These all bore heavily last year except the pear and quince, which are too young yet to bear, and are again full. Two neighbors had plowed their orchards and lost all their fruit; one neighbor had not plowed, and his fruit is but little injured.

"Is not this an object lesson well worthy of our serious study? From it I would deduce the following rule for cultivation: Never put a plow into the orchard until all danger of frost is over.

"Now, don't understand me to say that frost or freeze cannot destroy the fruit on non-cultivated trees, but only that an orchard freshly plowed is far more susceptible to freeze and frost than unplowed soil. My orchard was plowed at least three weeks before the frost, for the Irish potatoes were just beginning to come up.

"Live, study, learn!"

The true cause of the plowed trees losing their fruit was the loss of a large quantity of their surface feeding-roots, upon which the setting and development of the fruit largely depend.

CHAPTER V.

Cabbage.

THIS is a most important crop everywhere, and in the Gulf States the seed for the early fall crop should be sown in July, in a frame, under a mosquito-bar, as described elsewhere. After the seeds are planted, the mosquito-bar must be stretched very carefully, so as to leave no possible opening for the moths to creep in, which they will surely do if given half a chance. Shade the bed with hay or some covering on top the bar until the plants come up, when most of it must be removed, leaving just enough to afford a light shade until the third leaf is out, after which it may all be removed. The bed should be watered right through the bar once every day or so, until the plants get strong, and this can be done with perfect safety any time of the day, even at noon, though the general but erroneous idea is, that water at such times will scald the plants. We know that rain often falls when the sun is shining, or comes out hot a few minutes after it, and no harm results.

An ounce of seed will produce about two thousand plants, but it is well to provide seed enough, in case of failure, and a new seed-bed should be sown in about two weeks, for fear of accidents. The plants can always be sold, if not needed. The ground should be heavily fertilized and well prepared at least a month ahead, throwing it up in quite high ridges, which will retain the moisture and allow of knocking off the tops when ready to plant. I will again repeat, that in all the level gulf-coast country everything should be planted well up, for excessive rains are liable to come at any time, and that means absolute ruin on flat, level ground. The plants can be set as soon as large enough. If dry at the time of planting set them shallow, pressing the earth down firmly, so as to leave a depression into which about a pint of water can be

poured, but by no means fill the hole up with soil for several days, until the plants take root, after which the earth can be drawn in and around the stems, and damping-off be thus obviated. Cultivate well during October, but after a good rain that month, let the ground alone, so that the surface roots can form and help push the plants along during the many cool days of fall, as noted elsewhere on winter cultivation.

If the green worms appear, and they surely will, go over the plants, when the dew is on them, with a powder bellows with flour and just enough Paris green to color it. If sifted just before using, the flour will scatter much more readily. This application will kill the worms, and does no harm, for all the first leaves of every cabbage are gone long before the head appears; besides, the rain will soon wash it off. This dose may have to be repeated, though usually one good application is sufficient for plants on rich ground—and no other should be used for cabbage—and the plants will grow rapidly ahead of the worms after cool weather sets in. If, when headed in November and December, the heads show signs of bursting, go over and pull gently all such plants until the strong roots crack, and let them settle back, when growth will be checked and the head only get the harder.

Seed for the winter crop should be sown in October and set in November, and if we miss a heavy freeze, as we have this year, and often do, these plants will make the largest heads in the year. For spring planting, sow in December, in cold-frames, to be protected by glass or oiled cloth, and set the last of January, on well prepared ridges thrown up at least a month before, so that the ground will be clean and free from cut-worms. If seeds are sown here in spring, there is rarely a market for the product, as the gardeners farther up in the interior plant at that time, and a glut usually follows. Before leaving this subject, I must call attention to a very erroneous notion which many growers entertain, and that is, that if the central, original bud of the plant is eaten out by a worm or other insect, that plant will not head, a side shoot being useless for that purpose. Thousands of plants are annually pulled up after getting a good start, and others

put in their places, by growers ignorant of the fact that one bud is just as good and sure to head as another, if all but one shoot is rubbed off.

As to varieties, of course locality and soil will decide this largely, but the extra early kinds are of no value in the far South, as the market is well supplied in early fall with northern cabbage. The old Fottler's Brunswick was my favorite for years. It makes a very large, hard, flat head, but is not quite as hardy for January weather as the common Flat Dutch and Drumhead varieties of selected strains. The Fottler and Early Summer are excellent for spring, though the latter is hardly large enough for a market cabbage. The Winnigstadt and other pointed kinds are not popular at the South, and do not stand the heat in spring as well as the flat kinds.

CHAPTER VI.

Cauliflower.

SOUTH TEXAS, especially near the coast, is admirably adapted to this vegetable as a fall crop, but it is entirely useless to undertake its growth here in spring. No matter how good the seed or rich the ground, the flowers will be loose and open, and of small size. The cauliflower likes a gradually decreasing temperature, as in the fall. It should be sowed at the same time and treated exactly like cabbage in every respect, and is quite as easy to grow, except that if the center bud or heart is destroyed by any insect, the plant rarely sends up a new one, though occasionally from near the ground, a new sprout will start, but so late that it pays better to pull it up and replant. The most important point for success, next to very rich ground, is the right variety of seed. When Henderson first introduced his Snowball cauliflower, now so well and favorably known, I paid him $10 per ounce for several years, and made big money by it, for the heads were by far the finest in the market, and brought fancy prices. As showing the intrinsic value of first-class cauliflower seed, the Henderson Snowball is still held by that firm at $4 per ounce, and is cheaper, really, at that than most of the cauliflower seed would be as a gift. There is no early variety equal to it, but there is a large amount of so-called Snowball seed that is of no value at all.

After setting out as directed for cabbage, the plants should be well cultivated until half grown and the weather begins to get cool, after which the ground should not be again disturbed. I state this as an absolute fact, after years of experiments. While cabbage can be preserved through the winter at the north and put upon the market as demand requires, it is not so with cauliflower. After heading, it is impossible to store the crop away long for future use, consequently there

should always be a good winter demand for this vegetable up there, and there is no good reason why the coast country of Texas should not ship in car-load lots to northern cities at a fair profit, after their crops are gone. The cauliflower will stand uninjured a temperature of twenty-five degrees, and younger plants, not yet showing the flower, a little lower. When the flower is three or four inches in diameter, several of the surrounding leaves should be broken down over it to exclude the light, which turns its creamy color to a dull yellow.

The ground can scarcely be made too rich for this crop, and should always contain a full supply of potash and salt. The latter is a special addition for both cauliflower and cabbage, and should never be omitted, for though it does not seem to stimulate growth at all, it is for certain plants a wonderful tonic, so to speak. It gives to both the above-mentioned ones a rich, dark green color, and also very greatly thickens the leaves and enables them to stand much more cold. Cultivating, as I did for many years, ground that was occasionally partly overflowed by the gulf, I had full opportunity to study its effects, and know that salt will render these plants more hardy as well as healthy. While not a full substitute with them for potash, it acts very much like it. It will pay well to apply 1,000 pounds per acre for these crops, while beets, carrots, ruta-bagas and kohl-rabi are also greatly benefited by its presence in the ground. Tomatoes, melons, cucumbers, corn, squash and lettuce have no use at all for it. In applying, mix well with the soil some time before planting, or it can be top-dressed without damage, after the plants get well off to growing, and with equally as good effects if rain falls to carry it in.

In growing cauliflower plants, make a frame with mosquito-bar, as for cabbage, but as the seeds are so costly, instead of raking in, it is better to sow in very shallow drills, or else broadcast rather thinly, to give stout plants, and after watering, cover lightly by hand with fine soil, and shade. The seed will not stand quite as deep covering and come well as cabbage. In this section from the first to the last of July

is the proper time to sow the seed for the fall crop, but those who are willing to gamble with the clerk of the weather, can continue to plant through August and September, and often win, as was the case this season. However, for the later plantings, the Italian Autumn Giant variety, sold by Frotscher, of New Orleans, is more hardy, though the flowers are not so handsome. I have had heads of that variety in February and March that weighed fifteen to twenty pounds, as for instance, those exhibited at the Cotton Exchange in this city. I again repeat, plant this crop on a good, high ridge in all level locations.

CHAPTER VII.

The Tomato.

WHILE the general belief is that the tomato does best on only moderately manured land, this depends entirely on what kind of manure is used. My experience has been that ground can hardly be made too rich in phosphoric acid and potash, though undoubtedly a surplus of ammonia will cause the vines to grow too rank and fruit sparingly, as well as make the tomatoes rot at the blossom end. And now, a few points to beginners about growing the plants. While hotbeds are necessary farther north, here a coldframe is all that is needed. Nothing is gained by sowing the seed before January 1st to 15th, as it is always very risky to set out in the open ground before the 10th to the 20th of March, and the ground is usually too cold to stimulate growth if set before. Make a well pulverized, rich bed, about one foot above the surface, on well drained ground, and large enough to hold a plank frame of 1 x 6-inch stuff 3 x 6 feet, or the proper size to fit the sash. A frame of that size will easily hold 3,000 plants from the seeds, which should be sown quite thickly, then watered well and covered thinly and evenly by sprinkling soil over them. Put on the sash, and keep down until the seeds are up nicely, when the back should be raised slightly every sunny day, to give air. Now make up a larger bed and frame at once, to hold what plants it is intended to set outside for the crop, and be sure to have it on clean ground, free of cutworms. Old barnyard manure is excellent to fertilize with, though fine bone meal is also good. But use no cotton-seed meal unless applied a month before. Having raked fine and smooth, lay off rows both ways with a long, straight-edged strip pressed on the soil, and let them be about four or five inches apart each way. This will afford room enough, if sash

are scarce, provided the plants have the buds nipped out when five or six inches high, which should always be done to make them stocky. Afterwards, as they grow larger, it is well to clip off some of the older leaves, which will give more air and room. After the lines are drawn, set a plant at each intersection, and be sure to have the rows straight and at equal distances apart, so when the plants are nearly ready to go out, a large case or butcher knife can be drawn deeply from one side of the frame to the other each way between the rows. This is to be done a week before planting in the open ground, and a good watering given just after. The effect of this will be to start a multitude of fine, hair roots in the squares whereon stand the plants. In three days run the knife again, and in a few days more the front board of the frame can be taken out and a sharp spade run under the plants about three inches deep, when they will come up with nice, firm balls of earth, and hardly know they were moved.

In preparing the ground for the crop, it should always be plowed in the fall, if possible, and kept clean through the winter in this warm climate, where the cut-worm moths are often active even then, and are sure to lay their eggs near the young weeds and grass if the ground is foul. Then in January scatter about 600 pounds of cotton-seed hull ashes, 30 per cent. potash, and the same quantity of ammoniated superphosphate, broadcast, per acre. This should be plowed in, throwing the ground up into five-feet beds, with a deep furrow between. Along in the bottoms and on the sides of the furrows a second dressing of the phosphate must be scattered, and then the beds plowed back as deeply as possible on these furrows, and a light harrow passed once over each bed to smooth it down. The ground is now ready for the plants, which should be set about the middle of March, three feet apart in the rows and but little deeper than before. Watering is not necessary for plants grown as directed, at the time of planting, unless the ground is very dry, which will never be the case if prepared ahead, as advised. But if the weather continues dry, a moderate watering a week after planting, with five pounds nitrate of soda to fifty gallons of water, will

start a rapid growth. When the plants begin to bloom, run around them lightly with the plow, throwing the entire bed up a second time, leaving a high, warm ridge, perfectly drained, upon which the fruit can lie without rotting. One hoeing around the plants, and one or two cultivatings, will make the crop, running the plow or sweep in the furrows after each one to open it out clean.

And here, as elsewhere through this book, I must urge all growers in the level coast country of Texas to plant all crops on well raised beds or ridges. While on high, rolling land flat culture may do, I believe that for early spring planting all through this coast country, the ridge system is the safest and best. While the general impression is that plants on a level will stand drouth the best, I have found scarcely any difference on rich ground, even in dry spells, but if heavy rains occur, flat planting simply means ruin. The hot sun on a saturated, loose, flat soil, even for a few hours, will furnish the conditions for the development of rust or burning, as well as rot in the fruit. On high, broad beds, as herein advised, staking of the plants is not necessary, as the surface quickly dries off after rains, and very few of the tomatoes that rest upon the ground will rot. I made a fair trial of growing to a single stake and stem, with pinching back of laterals, but growth here is so rapid and strong on rich ground, that the method involves too much labor, nor is there any material advantage in earliness. I omitted to say that after the plants are set out, if the stems are a little long it is a good plan to peg them down, all one way, with two cross sticks, to prevent damage from whipping winds. This is excellent for egg-plants, also, which and sweet peppers should be grown from the seed and treated in the frames just as the tomatoes were. If a freeze seems inevitable after the plants are set out, take a spade full of pulverized surface soil and gently slide it on the plants from the bottom of the stem up, pressing the plants down, and if too large to cover entirely, and the exposed tops are killed, cut them off at once, remove the covering of earth, and the plants will quickly renew themselves.

The only insect that troubles tomatoes in this section is

the Spanish fly or blister beetle, the boll worm, so destructive in Mississippi and elsewhere, not yet having done serious damage. About the last of May, the time the Spanish fly may be looked for, it is well to go over the patch early every morning, as they invariably fly at night, and always settle in a bunch over a few plants at first. They can then be easily driven into the furrows and covered with earth by the spade and tramped; or, if two teaspoonfuls of Paris green are well stirred in a bucket of water and sprayed over the few affected plants, most of the flies will eat and die.

As to picking, packing, etc., it is hardly necessary to say more than that it always pays to put good, sound fruit of uniform size and ripeness in the same box, and except very early, ship only first-class fruit.

I will now close my remarks on the tomato with an account of a most remarkable instance of the effects of electricity on vegetable life, a parallel to which I have never heard or read of. As the electricity could not have acted directly on the tomato plants, seeing that those on the opposite side of a fence were unhurt, there is only one solution, viz., the almost instantaneous generation of millions of bacteria in the sap and leaves of the plants, somewhat similar to blight in the pear. The effect of such an excessive application of ammonia to the soil, and so little phosphoric acid and potash in proportion, was evidently to produce a peculiar sensitive, perhaps attenuated, so to say, state of the sap, upon which the electricity acted as a disorganizer, by furnishing the proper conditions for the rapid development of the tomato bacteria, just as a sudden lowering of the temperature in the winter, when the sap happens to be in motion, affords the most favorable conditions for those of the pear. But to the facts. A few years after embarking in the business, and the first time I ever used cotton seed as a fertilizer, having bought ten tons of damaged whole seed very cheap, and ignorant of the true principles of fertilizing, I undertook to grow an acre of tomatoes, to which I had applied three tons of whole seed and plowed them in well. The plants made a most phenomenal growth, running and climbing all over each other, more

like vines than bushes, until they formed a tangled mass several feet deep, to my astonishment and disgust. I do not remember of gathering as much as a dozen bushels of fruit from the whole acre, the plants bloomingly profusely, but dropping them as fast as they formed. About the time the few that did set began to ripen, the severest thunder storm I ever witnessed passed over Galveston Island, several houses near by being struck, and two persons killed a short distance away, by the lightning. The whole air was filled for a short time with a sulphurous smell, and after a tremendous down-pour of an hour, a yellow deposit greatly resembling sulphur appeared in many places on the ground. The tomato patch was just in front of my house, and as soon as the rain ceased, though the lightning was still vivid, I opened the door and looked out. I was at once struck with the peculiar and slightly ashy hue that the plants all had, and walked over for a closer examination. To my amazement, while I stood there looking intently at the leaves, I saw them slowly turning to a dark gray, and gradually twist and curl until the whole ground was visible, when before the storm, it was totally hidden by the luxuriant mass of green. This transformation occupied about a quarter of an hour, at the end of which time it was complete. The next day the sun came out hot, and by night every plant was dead, and the stems brown. But the strangest thing was, that immediately adjoining my patch, and just over a fence, my father-in-law also had half an acre of tomatoes, the ground having been fertilized the year before, but not at all that season. The vines had made an ordinary, healthy growth, were loaded with fruit, and showed not a sign of damage.

Is it not probable that a great deal of the rust, blight and fungoid disease that attack farm and field crops, as well as fruits and vegetables, is due to intensified electrical conditions?

CHAPTER VIII.

The Onion.

THE cultivation of this popular vegetable differs considerably in the various sections of the country, and I will only undertake to describe the methods best adapted to the gulf coast country, extending around to Florida. As for everything else, it is well to apply manure freely for onions, and especially the elements of phosphoric acid and potash, for it is a crop that requires a good deal of painstaking labor, and it will not do to run the risk of failure. Tens of thousands of bushels are annually grown around New Orleans, where they mature, as they do here, at the best time to strike a good northern market in spring. The variety used there almost exclusively is the Creole, which has been grown time out of mind, and has proved the best there as well as here. Both the Red and White Bermuda are good, but do not keep or ship near as well as the Creole. The Prize Taker has also given very fine onions this season, and is well worthy of further trial.

The seeds are best sown in this section from the 1st of October to the 15th of November, in well manured beds, which should be made up some time ahead, and raked over several times after showers, to kill the weed seeds. If much ground is to be planted, it is best to prepare a large bed. The seeds should be sown rather shallow, and covered by hand with soil, which, after being watered well, must be shaded with moss from the woods or clean old hay, free from weed seeds. In four or five days they will come up, when the covering must be removed at once. Nothing more is necessary, except to keep clean until the plants are large enough to be set out. The ground, as well as the seed-bed, should have been prepared a month or so ahead, for it happens occasionally that heavy rains occur in the fall, and it is impossible to prepare the land. This, in fact, applies to all fall and

winter crops where land is at all level, and I will again repeat, that it is best, by far, to plant all crops, at this season especially, on good, high beds and ridges. Never risk anything flat, for growth has to be made during the short, cool winter days, and the plants require all the heat they can get.

Onion beds here are generally made about four feet wide, and the rows across the beds about one foot apart, as this is most convenient for setting from each side. The plants are set when about the size of a quill, and should have half the tops sheared off before digging, and all the roots cut back to one-half inch or less. A crop thus treated, especially if the sets are rather large, will do far better than when planted with long roots. About four inches apart in the rows is a good distance.

By this method of onion growing, a world of work in weeding and thinning is saved, for two acres can be set and worked, where one could be grown from seed and thinned. Just who originated this method of growing onions in the Gulf States, nobody can now remember, as it has been the common, in fact the only, plan since long before the war. In January, 1863, I remember well seeing five acres thus planted in this county, at Lamarque, which made an immense crop, for which, rumor had it, the owner received $5,000, as there were no onions in this country at that time. And yet, in the face of this well-known fact in the South, an author of New York a few years ago came out with his new discovery in onion growing, and has published a pamphlet, with these directions as new, that have been practiced here for thirty years to my certain knowledge!

As to cultivation of the onion, as long as the ground is clean, the less the better in winter. The onion makes roots close to the top of the ground as it grows larger, and deep working is very injurious. As noted elsewhere, a clean, smooth surface in winter absorbs far more heat than one that is cultivated, and heat is the all-important thing. I saw to-day, the 24th of February, while on a visit to Hitchcock, a most beautiful and vigorous field of onions, that have never had a moment's work since shortly after they were

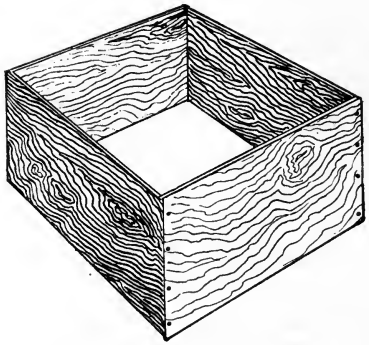
set out last fall. Of course, it will be hard to make the majority of my readers in other sections swallow this doctrine just yet, but if they will only give it a fair trial in the South during winter, and in early spring at the North, they will find it true. This whole method of transplanting onions, it must be remembered, is only adapted to winter culture here, our climate being entirely too hot to make a success of it in spring, though it seems to be perfectly successful at that season everywhere at the North. For those who have extra clean ground, however, and are willing to give extra pains and work, I am bound to say the old plan, from seed, will nearly always make much the earliest and largest onions, and several good growers here are adopting it. By sowing moderately thin with a seed drill, on very rich soil, there is no doubt that fully double the number of bushels can be grown on the same area as by the transplanting method, for on such soils I have seen onions develop to full market size, when they were so close as to look as if they were piled upon one another. Every one should try a small planting, at least, from seed, as the onion is a sure money crop here.

For the interior of Texas, where the winters are considerably colder than on the coast, I know of several growers who make large crops of fine onions every year by sowing the seed thickly in rows about a foot apart, in March or early in April, in rather poor soil. When the tops die down then pull up and hang in a cool, dry place in sacks, or spread out under a house, but keep dry. Prepare and manure the ground thoroughly in September, and plant the sets in October, as directed above for plants here, and about the first of May the crop will mature fine, large onions. The Silver King thus treated will grow to a very large size, and perhaps the Prize Taker would give equally good results. This method could be practiced with equal success with the Creole variety here, I presume, unless the plants should shoot to seed in spring more readily.

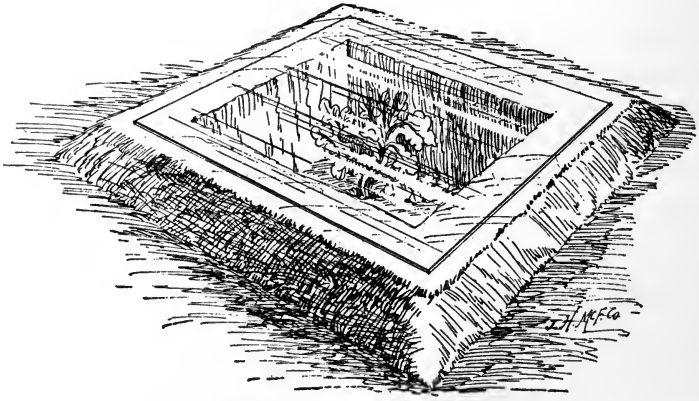
CHAPTER IX.

Melons and Cucumbers.

AS thousands of acres are annually devoted to these plants, and as the profits largely depend on the earliness of the crop, any method by which an increased earliness can be economically secured is well worthy the attention of growers. While the common plan of boxes and glass answers well, boxes are not only clumsy to handle and pack away every year, but the cost of material, labor and handling is quite an item. Many years ago, realizing these facts, I hit upon a plan that answers much better than the wooden box. The glass, once bought, if carefully handled, will last a long time. The accompaning cut, page 50, shows how it is done. A 10 x 12 glass is large enough, and a pattern box 4 inches deep and 7 x 9 inches, is made of dressed lumber, the smooth side being out, to prevent soil from adhering. This has neither top or bottom, and after ridges about three feet wide have been thrown up at the proper distances, and smoothed off ready for the seed, the frame is placed on the center, the damp soil drawn up around it to the top and well pressed by hand, leaving a hollow hill four inches deep and about four inches wide on top all around from the edge of the box to where it slopes down. After firming well on top with a smooth piece of plank, so that the hill will not settle or run after heavy rains, lift the frame out and the ground is ready for the seeds, which are to be planted rather shallow in the bottom. A pane of 10 x 12 glass is then laid over the hole, resting on the surface of the hole or future hill. By gently pressing the glass down the air can be entirely excluded, and seed can be thus planted long before the usual time. They come up very quickly, and incur no danger from cutworms or other insects, or from a freeze, as the natural warmth of the earth will always carry melon or cucumber



Box Frame, ready for use.



Melon Box, with glass cover.

EARTH OR MELON BOX. See page 49.

plants through any cold spell, even one that would kill plants in a box with glass on it, for it can never be made air-tight, like the earth box. After the seeds come up, the glass should be drawn down half way in good weather, until the third leaf is out, to prevent running up ; then thin out to a stand, to prevent crowding. In all cold, chilly and rainy weather keep the glass down tight, and never leave a crack at night. When all danger is over and the vines crowd the hole, level down and stick the pane of glass slanting over the plants on the north side. This will entirely break any ordinary frost.

As to the proper fertilizing for melons, I have alluded to it, and especially the need for potash, in my powder article on cabbage. Bone meal, or a good complete fertilizer, will give, with plenty of potash, a much sweeter and better netted cantalope than barnyard manure or cotton-seed meal, and mature the crop earlier. I have never seen any mention made of the fact that a free use of ammonia will cause cantalopes to become smooth and net poorly, but it is a fact that it does have that effect, as well as to make the quality very much inferior, and also causes them to split open more easily at the blossom end. I have time and again tested the effect of pinching the ends to increase earliness and productiveness, but with no adequate advantage.

While the watermelon is not liable to rot on the under side in wet seasons, thousands of cantalopes are lost from this cause, even in seasons of ordinary moisture. It is always best, when the fruit is about half grown or larger, to go over and pick the melons out of the little nests they make themselves by settling after rain, and place them on the firm ground nearby, but always with the same side exposed to the sun, as the skin quickly blisters in hot weather if the tender under side is turned up. The great enemies of melons and cucumbers are lice, and they are so difficult to kill, and spread so rapidly, that the best plan by all odds is to keep a sharp lookout, and remove promptly every affected plant. Whale-oil soap, as well as the kerosene emulsion, will kill them while the plants are young, but I never knew them to fail to come back later on the same plant. Prompt removal is by

far the safer plan. For market, especially distant ones, it will not pay to grow large cantalopes. The small, solid, well-netted ones sell for as much and weigh far less. Remember that it is useless to try to grow good crops of either cantalopes or watermelons year after year on the same ground, unless potash in some form is liberally supplied each crop, and a good supply of vegetable matter turned under. Potash is the element in new ground that makes it so well adapted to melons, and it must be supplied, and if freely, then melons can be grown year after year with perfect success, the oft-quoted and common notion to the contrary notwithstanding.

CHAPTER X.

The Potato.

SINCE the introduction of the Triumph potato, with its peculiarity of making a good fall crop from home-grown spring seed, the Irish potato is likely to come more prominently to the front as a money crop in the far South. One drawback heretofore has been, that it required a considerable outlay for the seed every year. Now, experience shows that we can grow our own seed in the fall, and when planted in spring, even the smallest sized tubers will yield more potatoes by far than the old northern varieties. While I am a crank on potash for most things, I am bound to admit that additional applications of it have shown no appreciable effect on Irish potatoes here. Evidently the coast country of Texas has potash enough to satisfy this crop for some years. The very best yield I ever had was from my orchard ground at Hitchcock the first year, to which one ton per acre of cotton-seed meal was applied broadcast in November, the ground plowed a second time in February, and planted about the 15th. That was a remarkable yield, and not a very good season either, as it turned out very dry toward the end. But, as elsewhere remarked, manure is water and tillage, for very rich ground will nearly always make a good crop with little of either.

As to the best time to plant, it is all a gamble. This season the early January settings came through all right. Last year they were killed and rotted. If we grow our own seed, however, every one should risk a barrel or two early, on good, high ground, and as the tops push through, draw the soil up several times to keep them well under. Then, if a freeze does come, and the patch is gone over promptly the next morning, and the plants are cut off an inch under the surface, they will quickly come again. If left, however,

the frosted sap will rot the stems down to the sets, and often the set itself. The Triumph outyields all other potatoes here, and every one should grow at least enough for his own use. The only trouble with fall planting is the risk of drouth. The seed should be laid away thinly in a cool place to sprout, and by August will be ready if the ground is in good order. They should go into the ground in August, and the man who has a good windmill and well is sure of a crop. There is not the slightest doubt that the Michel strawberry, treated as described elsewhere, and the Triumph potato in the fall, would both yield an absolutely certain and highly remunerative crop to any one who will furnish a reasonable supply of water for irrigation. As a preventive to scab, one ounce of corrosive sublimate dissolved in about five gallons of water, and the potatoes immersed for two hours, is recommended, though I have never tried it.

The culture of the sweet potato is so well known that little need be said except as to fertilizing and the potato worm. While ordinary soil will make a fair crop, no vegetable appreciates rich ground more highly. During my last year at Hitchcock I opened three experimental furrows, and used equal quantities of cotton-seed hull ashes and cotton-seed meal and the New Orleans ammoniated phosphate, putting each by itself in the bottoms of the furrows, and stirring well with a bull tongue, after which high ridges were bedded up on them. This is all-important for the sweet potato; no matter how dry the weather, ridge up high, for the feeding roots run very deep. The result of the above experiment was to prove that potash and phosphoric acid are the special fertilizers for sweet potatoes, the row with the hull ashes, containing 8 per cent. phosphoric acid and 30 per cent. potash, not only producing the most but the largest tubers, though both the other fertilizers gave an excellent yield. The meal on new land is hard to beat. Next, as a preventive to the worm that bores into the potatoes when grown, the best plan is to set the vines quite deep, and after every rain sprinkle a little air-slacked lime over each hill, immediately around the stem of the vines where they enter the ground. All moths

have a dread of lime, and will not lay their eggs near it, and, as is well known, this moth lays hers just at the surface, the young worms afterwards boring into and down through the stems to the tubers below. But while the worm does a great deal of injury, the growers themselves are responsible for much more every year by not digging their crops in the month of October, which is usually dry. Dug that month, potatoes will keep better than after the vines are killed by frost, and all risk of rotting from the heavy, cold rains of November is avoided. The present crop was almost entirely lost in the ground from rot, caused by the heavy rains of that month. As the method of banking is so well known, if is not necessary to allude to it here.

CHAPTER XI.

Celery.

IN mild seasons like the present, celery can be grown to as great perfection in the coast country of Texas and the Gulf States as anywhere in the world, and to-day, the 25th of February, the Galveston *News* was presented with a lot that measured 34 inches in length, perfectly bleached and of most excellent quality. Its culture here is just as elsewhere, only the seed should be well shaded if sown in August, when some persons plant, though September is a better month, and from then on to December seed may be sown, and will make finely in spring. It will greatly facilitate the coming up of the earlier plantings if the seeds are soaked in water a few hours, and then put up in a cloth with a few handfuls of soil, to sprout for a week. The late sowings must be made in coldframes, and carefully protected in severe weather, which sometimes occurs here, and does serious damage to mature crops also. The latter can be perfectly protected by going to the small expense of 8 or 10-inch planks, to be laid flat on top of the rows in case of a freeze, after the plants have had their last hilling. However, the young and half-grown ones, where exposed, even if cut down to the ground, will shoot out quickly again, and make fine celery in the end. In earthing up, it is necessary to be careful, and never handle the plants when they are wet with dew or rain, else they are likely to take the rust, which is about the only enemy the crop has here. Of course, rich ground is just as important for this as other crops. Close planting each way is not suited here, as it would require flat culture, and the plants could not be protected from the cold, as can that grown in rows by the old method. Settings may be made all through the fall and winter, and prices are always good for this crop, as it stands shipping well.

CHAPTER XII.

Lettuce.

THIS vegetable can be grown in great perfection here in the fall, and many seasons all through the winter and spring. But it is almost useless to sow the seed before the first of September for fall planting, as the green worms are very troublesome on a crop set out earlier, and the plants are almost sure to run to seed before heading. The seed for earliest sowing should be mixed with a little earth and tied up in a rag to sprout, after being well dampened. As soon as signs of sprouting show, scatter soil and seed over the bed and water in with a sprinkler, after which cover lightly with fine soil and put down the mosquito-bar over the frame, which should be made just as for cabbage. However, as the ants often carry off lettuce seed very rapidly, it is well to sow a few handfuls of fine grits, sifted bran or meal, as a bait, over the bed, before putting on the bar. Be sure to make it fit very close all around, for if there is the slightest opening, the moths will find it and get in. Seed can be sown all through the fall in the gulf coast country, but when planted in December and January, it should be well protected in case of a freeze. The most profitable crop is the one thus treated and planted out the last of January for the upper country markets, and even for points beyond Texas. The best preventive against the green worm in fall, I omitted to state, is air-slaked lime, dusted occasionally over the plants after setting in the field. This worm, however, disappears after November.

The old Royal Cabbage lettuce is about the best variety.

CHAPTER XIII.

Asparagus.

WHILE this is one of the most important and profitable crops at the North, it has been greatly neglected by southern truckers. But I believe it is destined in the near future to be the principal vegetable grown for shipping from the far South during the season of its maturity, seeing that it comes in just with the early strawberry crop, and continues right along with it in Florida, Texas and Louisiana. The great value of asparagus to this whole strawberry section is that it can be utilized to divide car loads with the berries, and thus prevent throwing a whole car load of the latter on any one market at the same time. While not so popular at the South as in the North, yet our home markets have never yet been even half-way supplied, and there is no reasonable fear that there will for many years be a glut of this delicious vegetable anywhere. That it can be successfully grown here has been fully demonstated time and again, and a really excellent article has been on the market in Galveston the present season, while it is well-known that the common wild asparagus grows everywhere in South Texas with the persistency and vigor of a weed. The only fault so far found with this vegetable, as grown in the gulf coast region, is its failure to develop shoots of the thickness and size they attain farther north. This probably comes more from a lack of plenty of salt and a sufficient quantity of manure, as well as deep, loose soil, than anything else. While I have never grown any, I have taken the trouble to look into the subject with care, and will sum up my conclusions from the experience of others. In France, where they grow it to great perfection, the earth is scraped away every fall from the crowns, in order to expose them to freezing, while in America, at the North, the almost universal custom is to protect them by a heavy

mulch of manure, both claiming that their respective methods make the largest stalks; and it must be remembered with this crop that both its eating and market value increase very rapidly with the size and beauty of the individual shoots. The French plant the roots about two feet apart each way, and rather shallow, on deeply dug and very rich ground. They then manure heavily and repeatedly, to furnish a loose surface soil, to force an abnormally large, quick growth. Americans recommend planting the crowns six inches deep to escape drought, and both parties are very particular to advise the old fallacy of spreading out the roots. This may be one of the causes of its failure to make as large shoots here as elsewhere, for it has enormous roots, and if all have been spread out as directed, there is little wonder if the plants lacked vigor enough to develop strong, thick stems. By all means root-prune this plant very closely, for it is a difficult thing to kill if you try; but it must have deep, strong roots and plenty of moisture to sustain the forced growth that is demanded of it. Both nations agree that any good garden soil will do, but it must be light and loamy on top for at least six or eight inches, to allow the shoots to push readily through, and also to facilitate breaking off from the crowns. It is claimed that cutting injures other young shoots often, and also leaves a short stump, from which smaller sprouts spring and exhaust the plant. In gathering, the loose soil is gently drawn away and the shoot selected, bent over and broken squarely off from the crown. The hole is filled with a movement of the hand, and so on over the patch. Many, however, still adhere to the old plan of cutting. Both nations are fully agreed on the importance of perfect drainage, the crop maturing, as it does so early, while the ground is cold; therefore well drained soil is a necessity for rapid growth. Both also agree on a deep, rich plant-bed, down below the crown. On high, well drained upland, it would be best, they say, to plow very deep, manure heavily, and apply at least three tons of salt per acre, in addition to other manures.

It must be remembered that this is a saline plant, and perfectly at home along the sea coast marshes. As to distance,

as noted above, in France they set from two to three feet apart each way. In California and other parts of this country, they prefer to make the rows from four to six feet apart and plant about sixteen inches in the rows, thus leaving room enough to cultivate other crops between for a year or two, until the plants require all the ground. The surface is kept level during the summer, but just before growth starts in spring a good-sized ridge or mound of soft earth is thrown or drawn up over the crowns to furnish the necessary depth of loose soil for bleaching the shoots, which is to be drawn down level again after the crop is marketed.

If it be proposed to save time, one or two-year-old plants can be bought, the Conover Colossal and the newer Palmetto seeming to be the favorite kinds, the latter claiming to be somewhat the earlier variety. If one is willing to wait, four pounds of seed will grow plants enough for an acre, and the plants are easily raised. As for the immediate level coast country between Galveston and Houston, I would recommend, in addition to the above suggestions, that beds twelve feet wide be thrown up finally, with wide and deep furrows or paths between, and see that these open into a free outlet for perfect drainage. It will be necessary to complete the work with the spade, so as to make the beds sufficiently high. There is no danger of hurting an asparagus plant seriously with drouth, for its roots will easily penetrate to permanent moisture. The nearness of that to the surface here makes ours a natural asparagus country. The beds will then hold two rows at six feet apart, with plants sixteen inches in the rows, and should be planted not deeper than five inches below the surface, in a shallow furrow, to be left open until they become well established and growing freely, when the ground should be leveled. Perhaps if the twelve-feet bed is full high and well drained, they might be set the five inches depth on the level at once, though the growth would be slower at first. The distance of six feet between the rows will afford abundant earth for placing loosely over the crowns every spring for bleaching. It would be an excellent plan to prepare the ground for strawberries, thoroughly fertilizing and

mulching the entire beds in the summer, and set with strawberries in September, leaving the two asparagus lines or rows vacant until winter or spring, when convenient to plant them. This would necessitate the application of salt, the first year or two, only on the asparagus rows, or until they required the whole ground. The vegetable crop could by this plan be brought to marketing condition at little or no extra expense, for full crops of berries could be grown. After the asparagus came into full bearing the expense would be very light, as the tops shade the ground all the summer, and could be mowed off every fall and thrown for bedding in the cow lot to make manure. I omitted to say, that the heavy mulching of the berries the first two years would render the whole surface of the beds light and loose, for after-covering of the asparagus crowns.

This plant is exceedingly long-lived, and the beds would last almost a life-time with proper after care and fertilizing, especially the latter, for it seems to be a perfect gourmand after food. I hope the gulf-coast growers especially will investigate this subject fully, for I am sure it is one of the keys to the future prosperity of this immediate section. The demand seems unlimited for a good article, and it is such a perfect shipper—just pack in boxes, as for beans—the product being sold everywhere by weight, and at 10 cents per pound, the minimum price I have seen quoted anywhere. It has no enemies, and is never hurt by frost. Reduce, then, the berry acreage very largely, and devote some of it to this vegetable, and with a moderate supply also of lettuce, radishes, beets, etc. There would then be no necessity for shipping straight cars of berries, and dozens of towns would be able to handle a well-mixed car, where one can now use a car of any one article straight.

CHAPTER XIV.

Cow Peas and other Vegetables.

EGG-PLANTS and sweet peppers should be treated just as tomatoes, and like them, must, in this section, be protected from the ravages of the Spanish fly by Paris green, and the [illegible] that are treated. Snap beans are also a good crop generally, both spring and fall, but as the rabbits are very fond of their leaves, the vines must be lightly sprayed with water that has had a small quantity of coal or gas tar mixed with it, and then strained out. A rabbit will touch nothing that has a trace of that smell about it. It is almost useless here to sow beans before the first of March, if then, as the spring winds whip the vines to pieces. Green peas are nearly always hardy through the winter, especially if not in bearing when a freeze comes. Their main enemy is the black-bird, who is particularly fond of them, and must be driven off with a gun. Beets, carrots, spinach and other vegetables are so well understood that comment is not necessary.

A book treating of crops for the South and soil improvement would be incomplete without a full mention of that wonderful plant, the southern cow pea. An experience of many years' use has convinced me and all who have tried it of its great value. Every waste place on the farm or in the garden which needs enriching should every season be covered with its luxuriant foliage and penetrated by its deep, far-reaching roots. The old idea was to plow the vines under green, and I practised it for several years, but soon found out that it was a much better plan to let them mature and die on the ground, and then turn them under in the fall. Such treatment will nearly always cure the dead or alkali spots, as well as those where plants turn yellow, that occur at intervals, particularly in the coast country of Texas. The penetrating

power of a cow pea root is astonishing, and they will so completely break up and fill such spots with the decaying vegetable matter of their roots, as well as leaves, and shade them from the sun, that if a good growth of vines can only be had the spots will disappear entirely. It will stand any amount of drouth and heat, and can be planted any time after the ground gets warm, all along through the season, if rain enough falls to bring up the seed. In many parts of the South the roots of the cow pea are affected with what are known as nematode galls or knots, which in fact are so common in all soils deficient in potash, that the general opinion seems to be that they are a natural condition of the plant, and aid in some way in storing up nitrogen. But this is certainly a mistaken idea, as far as the naturalness of galls on cow pea roots in good land is concerned. I have grown cow peas for the vegetable matter, on land well supplied with potash, for over thirty years in this section, and have never seen a nematode gall on a single plant, nor do I believe that they ever will be seen on new land, or where the soil is well supplied with potash. The conditions for their development are excessive moisture on a soil deficient in potash, and as all old soils are in that fix from exhaustion, especially in the southern states, these nematode galls are almost universal, and have come to be considered a natural development of the plant. But as I said above, this is a mistake, as any one can prove by planting them where potash has been applied. The nematode galls are simply a disease, but may be a beneficial one, for aught I know.

PART II

CHAPTER I.

The New Dispensation.

IN 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 nurturing, or "doping," as the turfmen call it on their horses, 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 Gushing 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 succcessful 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 Fayettville, 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 (February 8, 1896) 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 87), 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

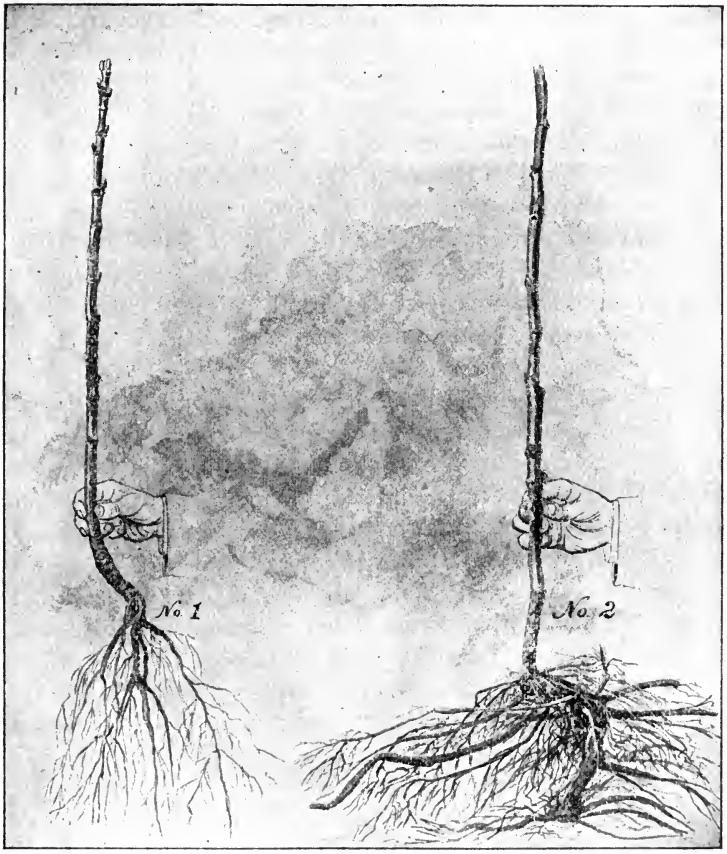
cut back as directed when the tree is set. About a foot of top should be left. More or less makes no difference. If the tree is well staked, three feet may be left without diminishing the growth much. I have had six-foot trees, well staked, to grow finely, but to avoid staking and to secure a new, straight 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 last winter:

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.

As corroborative of the great fundamental truth of close root-pruning, thus imitating nature's method of seed, I will next introduce the exhaustive experiments made and published some years ago by Prof. T. L. Brunk.

CHAPTER V.

Root Pruning—How Demonstrated at Washington.

A SYSTEM OF TREATMENT AT TRANSPLANTING WHICH DISPROVES OLD THEORIES.

BY THOS. L. BRUNK,

Former Professor of Botany and Horticulture, Maryland Agricultural College and Experiment Station, Mayfair, Cook County, Ill.

IT has long been the belief that in removing a tree from the nursery, the ideal operation would be to save every root and rootlet intact, that the shock of transplanting may be reduced to the minimum. Downing states: "A transplanter should never forget that it is by the delicate and tender points or extremities of the root that trees take up their food, and that the chance of complete success is lessened by every one of these points that is bruised and destroyed. If we could remove trees with every fiber entire, as we do a plant in a pot, they would scarcely show any sign of their change of position. In most cases, especially in that of trees taken from nurseries, this is, by the operation of removal, nearly impossible. But, although we may not hope to get every root entire, we may, with proper care, preserve by far the larger portion of them, and more particularly the small and delicate fibers."

Thomas says: "If a tree could be removed with all its roots, including the numerous thread-like radicals and all the spongelets, and placed compactly in the soil, precisely as it stood before, it would suffer no check in growth. The nearer we can approach this condition, therefore, the greater will be our success."—*American Fruit Culturist*, p. 59.

Numerous citations could be made similar to the above; in fact, I do not find that any of our highest authorities vary from the ideas expressed in them. They all advocate trans-

planting a tree with as many roots attached as it is practicable to remove with it. It would seem at first that there is overwhelming evidence against any other course of reasoning that may be applied to this subject. The roots are the absorbing organs, which take up from the food-stored soil all the water and the larger part of the mineral and solid foods which enter into the composition of a tree. It seems irrefutable that if any of the absorbing area is removed, the tree is thereby shortened in its food supply in the same direct proportion. It must be admitted that this is true if done during the growing season, when the "sap" (*protoplasm*) of a tree is in a state of activity; but is it the case during the period of rest, when the "sap" is in a thickened, inactive, non-transferable condition? It is the conditions a plant takes on during its inactive stage that do not seem to have been considered by our older writers on practical horticulture. Plant physiologists have understood these conditions well, and have shown that "sap" does not "go down to the roots" in fall and return to the parts above ground in spring, as is so commonly believed. They tell us (and common observation proves it) that the "sap" toward fall gradually thickens and ripens as growth above lessens, till finally it becomes completely immobile; but during this inactive stage it does not lose its power to return to active life when the warmth of spring returns.

In this stage of a woody plant, parts of it may be removed that may become new individuals if placed under proper conditions of heat and moisture. Most of our fruit trees may be propagated from either cuttings of shoots or of the roots. If a piece of tree (cutting) will grow without roots, what must that argue as to the condition and nature of the sap within such cuttings? Microscopic sections of such cuttings show that the young wood cells are stored full of starch and other concentrated food materials. When spring comes, with plenty of heat and moisture, this stored food is transformed into these simpler and more easily transferred food materials which a plant can use in growth.

This requires but a small amount of water, which is

readily absorbed through the bark of young shoots and through the thin walled cells at the cut end. This starts growth and activity. But before growth can proceed to any appreciable extent, the cutting must make provision for a specialized absorbing surface in the soil. This is done by throwing out at first a set of delicate multiplying cells from the layer of young, growing and dividing cells just beneath the bark at the lower end. This white ring of protruding cells is known technically as the "callus." Nurserymen usually assist cuttings to form this callus early in the season, and before placing them in the nursery row, so that root growth may be sure to precede leaf growth, as leaf growth before the initial steps of root formation take place usually proves fatal to the cutting.

From this callus the young rootlets proceed rapidly, and as they operate in an area so near the cutting, it is fed with less effort and more rapidly by a few roots than it could be by a greater number located farther away. Moreover, it is learned from a rooted cutting, that it forms a set of roots that take a direction in the soil similar to those of a seedling of the same variety; or, in other words, forms its roots, both of direction and penetration into the soil, and in a uniform radiation about the trunk, compatible with its nature and habits of growth.

Some authorities state that a cutting makes a "duck-footed" set of roots. Observation over a wide field of cuttings, and of latitude and climate in which they have been grown, to my mind thoroughly disproves any such statement. I have seen Le Conte pear cuttings grown upon the heaviest clay subsoils of the coast region, near Galveston, Texas, that had sent down vertical roots, penetrating the soil over four feet the first season. Some tests, made in a small way with nursery trees and stock, gave results conclusive enough to show that an important subject had been undertaken, and that it would justify a test on a larger scale. In April, 1890, 170 Reeves Favorite peach trees, budded on Japan stock, ninety-five Ben Davis and ninety-five Red Astrachan apple trees—all budded, maiden trees—were procured for this test.

One-third of each of these kinds were root and top-pruned, leaving only prongs of roots one to three inches long; one-third were pruned so that the roots were from five to seven inches long, and the remaining third were not root-pruned, except that the ends of badly mutilated roots were removed. The tops were in every case removed, leaving the apples about 2½ feet long, peaches twenty inches, and pears about sixteen inches. No selection was made from the total number of trees for each lot, except that the poorest rooted ones, when otherwise of the same vigor, were selected to be pruned, thus giving a seeming advantage to the unpruned trees. The pear trees were cut at a point about sixteen inches from the root, and with special reference to five or six good buds to be used as the basis of future limb growth.

The trees were all set side by side in a uniform soil, about six inches deep, in a common plow furrow. Those that were root-pruned were set with three or four times the speed of those with a mass of roots, to be carefully placed and arranged as they were in the nursery. They all received fair culture, such as would be given by any orchardist, with a common Iron Age cultivator. Notes were taken several times during the growing season, and at intervals a few of each set were taken up and the growth and character of the roots noted. Photography was freely used to record the features of growth.

By July 11 the unpruned peach trees had made considerably more growth than the root-pruned trees. The apples and pears showed at that time only slight differences of growth in favor of the unpruned trees. The first few months the root-pruned trees do not start a very rapid growth, but by fall overtake or exceed the growth of the un-root-pruned. We did not lose a single tree from any of the sets.

By fall the unpruned peach trees had made a little more growth than the root-pruned, but they were not of as even a growth as the root-pruned.

In case of the pears, the root-pruned were far more uniform in growth, and anyone could see that they had outgrown those that started the season with a full set of roots.

The apples showed about the same growth in both cases; no one could have told which was which by fall without the map. The examinations of the roots during the summer developed some interesting facts. The first thing noticed on removing the trees from the soil was that the old roots had retained all their malformations, twistings and the horizontal position they had acquired some way in the nursery or in packing. At least they were just the same as they would have been if cut by the most careful planters. The several figures bring out this feature very forcibly. Nearly all the young feeding roots grew from the tip ends of the old roots, leaving them bare, even when over a foot long. Only an occasional new lateral root was found. This threw all the absorbing surface some distance from the trunk. Plant physiology gives us a general law which states that the farther sap has to travel, and the more devious its path of transfer from the root absorbents (root hairs) to the leaves, the less the growth and vigor of that plant in a given period of time. Sap is retarded in its circulation, and wood formation cannot go on as rapidly as in cases where the sap travels short, direct paths. In all young trees, wood is the first and indispensible product of growth to form a proper basis for future fruitfulness. After a tree is well developed and supplied with strong, stocky branches, it is then time to retard the sap flow and cause fruit buds to form.

In the root-pruned trees, the young rootlets sprang as readily from the large circle of cambium at the ends of the short root stubs as from the ends of the longer roots. They came out, too, in greater numbers than on the old roots on unpruned trees, the ratio being about ten to three. These young roots clustered close about the trunk of the tree, making the least possible distance for the sap to travel. It seemed evident, also, that new roots developed much faster where the sap traveled short distances. The cut ends by fall had in most cases completely healed over, leaving no place for rot to start.

Another very important feature in the growth of young rootlets noted, is that those on the unpruned roots took

about the same direction of growth in the soil as the old root was placed when planted. If horizontal, the young roots grew off horizontally; if inclined downward at an angle, the young roots assumed about the same angle. In the root-pruned trees the young roots had very little to guide their growth, leaving them to take such angles as are found in seedling roots of the same variety. In other words, they were put into such a condition by a removal of nearly all the roots back to the collar, that they could take on a new root system compatible with their nature, needs and seedling habits of growth. By the old method, an unnatural system of roots are forced upon a tree. This system of roots is usually irregular, one-sided and poorly directed in its growth. Such trees are usually surface-rooted, having but few, if any, deep, penetrating roots, with which to supply the tree with an abundance of water. Drouth and deep freezing are agents that act upon and shorten the lives of such trees.

The newly formed roots on the root-pruned peach trees were found to penetrate the soil at an average angle of about forty degrees. Those on unpruned trees were horizontal and surface-feeding. The pear was about the same as the peach, with perhaps more that penetrated deeper from the root-pruned trees. The Ben Davis apple followed its old record of holding its roots rather close to the surface.

The next season other kinds of trees, and more of peaches and apples, were added to the experiment, to note the effects of a different season and to give a wider range to the tests. Wild Goose and Marianna plums on Marianna roots, Black Tartarian cherry on Mazzard roots, Mahaleb cherry, Norway spruce, hemlock, Lawson cypress, altheas, privet and red cedar were added to the list. By June 23 the peach and apple trees—root-pruned the same as those of last season—succeeded about the same as those planted last year. This season had not been as wet as last, and we had just passed through a fairly severe drouth. The root-pruned plums are outgrowing the unpruned. The Black Tartarian cherry trees are not doing as well. Two have died, and others are not thriving. This may be due, however, to the wetness of the

location and the tendency of the soil to bake just where they stand. Those top-pruned and roots left intact are thriving best. The Mahaleb trees are doing well.

The Norway spruce trees show but little signs of living under the treatment. Only one out of three is living, but it has made a fair growth. Those with roots left on are growing freely. The hemlocks fared even worse than the Norway spruce. Two out of three are yet living, but have not grown any, and dry weather will likely kill them. Of the Lawson cypress, one is living, but has made very little growth. It will probably live. Those, however, not pruned at all are doing very well. Two have made no new growth. There is very little difference between the two sets of California privet. Both have thrown out shoots from four to eight inches long, those with unpruned roots slightly in the lead. The root-pruned altheas are starting slowly, but none have died or will likely die. The red cedar (*Juniperus Virginiana*) shows no difference between the two sets. All these trees were set April 16, 1892. [Entirely too late.—H. M. S.]

This season shows that the root-pruned peach trees set out last year are equal in growth and size to those unpruned. The apple trees are equal in size, and the root-pruned pears are larger than their checks.

Some of the trees planted last year that were taken up during the fall and winter to be photographed and examined were root-pruned and set out again last April. They have thus far made a growth equal to and even greater than a few that were not root-pruned. This shows the successful growth of a two-year-old root-pruned tree. This is about the extent of the evidence thus far gathered from the tests I have made. As the trees acquire age, they will show, no doubt, other facts that cannot be presented now, except as observed in orchards in other parts of the United States, where the root-pruned trees excel.

For further evidence on this important and even revolutionary system, I will cite some trials that point very emphatically to the merits of this system.

The honor of first discovering the practicability of this

method of treating trees, and of recently bringing the system prominently before the public, is due to Mr. H. M. Stringfellow, of Hitchcock, Texas, near Galveston. Mr. Stringfellow is a well-informed gentleman, a college graduate, a careful and close observer of nature, and is an enthusiastic, sagacious fruit-grower and nurseryman on the coast plains of Texas. Fourteen years ago he planted a Le Conte and Kieffer pear orchard, which was pronounced by about sixty members of the American Horticultural Society who passed through it in February, 1890, to be the finest orchard of the kind they had seen, and probably the finest in America, for its uniformity of growth and the utility and beauty of its training. From the first of this orchard enterprise, Mr. Stringfellow began a study of tree growth, and made many tests which proved to him that our old methods of transplanting and training were very erroneous, and he concluded that the nearer we can approach to a seedling when our trees are set, the longer lived, healthier and more productive they will be.

His tests were all made in the coast regions of Texas, where pear trees grow freely from cuttings; and, in fact, cuttings of most trees grow easily. But the evidence of others shows that root-pruning succeeds in various parts of our country.

Samuel Edwards, of North Peoria, Ill., gives an account in the *Fruit-Growers' Journal*, of a lot of three-year-old assorted trees he bought from a Rochester (N. Y.) nurseryman, and which were so delayed on the road and so frozen that the roots were badly damaged. He cut off the tops to about two feet and the roots close to the bodies, and set them out as an experiment. He says they all grew finely, making handsome, fruitful trees.

O. E. Hine, of Vienna, Va., told me that several years ago he received a number of two-year-old silver maple trees, with badly mutilated roots. He cut away most of the roots, reduced the tops and planted them. They have proved to be fine, thrifty trees.

A. W. Harrison, of Alexandria, Va., tells me that when

living at Montclair, N. J., he transplanted a number of elm trees from the forest to his land. He pruned away nearly all the roots and all the top except a straight pole about eight feet high. These trees are living to-day, and are fine models of vigor and beauty.

C. W. Campbell says in the *Florida Dispatch and Fruit Grower* of December 31, 1891: "For a month during our dryest weather I had been transplanting orange trees, and will here say that I followed the plan of cutting the roots short and cutting back the top so severely as to leave but little of it. As a result, I have never had so good success. Out of five hundred trees, I will not lose one, though I never planted when it seemed so unfavorable as last October. In February, 1886, to save as much top as possible, I dug the roots as long as I could possibly get them, and out of five hundred I don't believe there are fifty living to-day, and they have never made a good growth."

J. H. Hale, of South Glastonbury, Conn., writes me thus: "You will recollect talking with me at the Pomological Meeting in Washington last September in regard to root-pruning of peach trees at time of planting. Perhaps it will interest you to know that in planting an orchard of more than one hundred thousand trees at Fort Valley, Ga., the past winter, we root-pruned the whole of them; and now our orchard superintendent reports that they are making a wonderful new growth, and so far, not a missing tree can be found in the whole hundred thousand."

M. B. Sturgus, of Hanover, Jefferson County, Ind. (southern part, in Ohio Valley), tells me that he planted an orchard of peach trees, and the roots of a large part of the trees were so poor and mutilated that he cut them back severely. After a year's growth, the root-pruned, to a tree, were much finer than those not root-pruned.

I have heard of other smaller tests that resulted the same as those cited above. It is needless, however, to multiply instances where root-pruning at the time of transplanting has been successfully tried. The best and most conclusive evidence is that resulting from a personal trial, and that at

least every grower of trees should make. It should be stated that it is best to set root-pruned trees in the spring, as they are more apt to be heaved than other trees if planted in the fall. In the South they can be set in November to advantage, as they will callus at once and form roots somewhat during the late fall and winter.

With all this empirical evidence from the various sections of our country, and my own experiments, I believe I am safe in stating that this method of treating trees is 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 it has 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.

NOTE.—See chapter on "Best Time and Depth to Plant Close Root-pruned Trees," for remarks on Prof. Brunk's article.

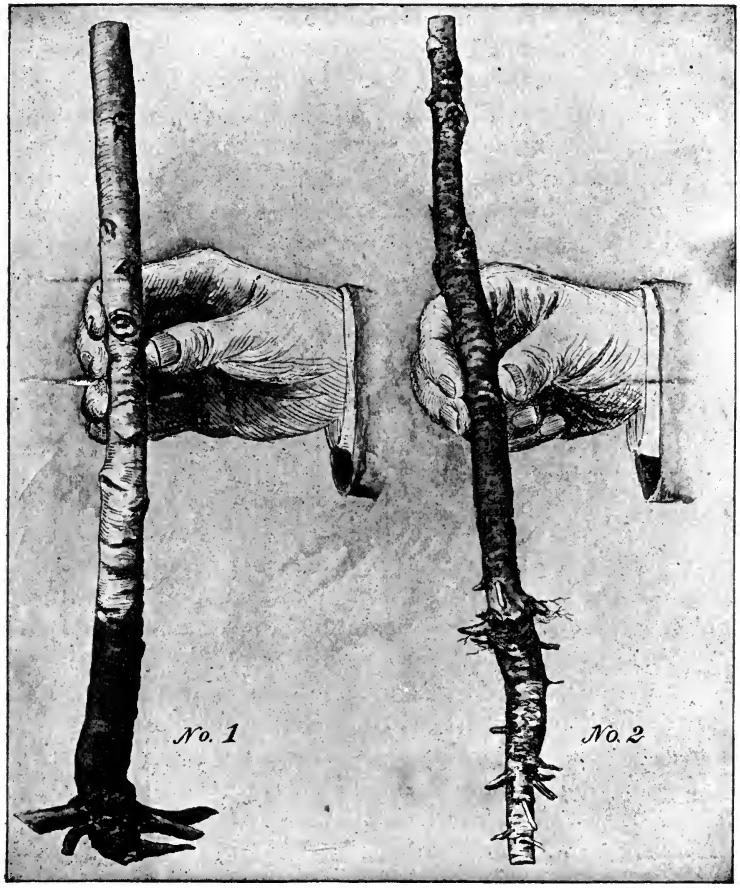
CHAPTER VI.

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



RIGHT CLOSE ROOT-PRUNING. WRONG CLOSE ROOT-PRUNING.

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 2½ 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 VII.

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 new 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 trifoliate, 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 VIII.

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 permature 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, elsewhere.) 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-feet 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 IX.

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 114 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, aud 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 X.

Blight.

HAVING discussed three of the causes that are at the bottom of the general complaint of declining orchards everywhere throughout the eastern half of the United States, we now come to the fourth; that is, disease.

In human physiology, the last few years of scientific research have developed the most wonderful discoveries. Mysteries that were dark, and problems hidden for ages, are now made as clear as day by the germ theory of disease in the human system. And not only are diseases accounted for and explained on this theory and by actual observations under the microscope, but also the commonest functions of our bodies, such as digestion, and other useful fermentations, as those of yeast, wine, beer, the nitrification of the soil, are all due to the incubation and multiplication of millions of those mysterious little spores, germs, microbes, bacilli, bacteria, etc., good, bad and indifferent, that swarm everywhere in the earth, the air, our bodies, and everything on the earth. These facts are, of course, known and admitted everywhere, and science has been and 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 disease in the human system. But, while the majority of scientists have turned their attention to man and his bacterial friends and enemies, Professors Burrill, Galloway and others are giving their best endeavors to the study and elucidation of the subject in connection with the diseases of plants, especially the various forms of blight of the apple and pear, and the yellows in the peach. That these diseases, as well as root-rot and black-knot of the peach and plum, are due to the presence in the sap of minute organisms known as bacteria, seems clearly established, and that probably epidemics, as

well as local attacks on trees, occur from a vastly increased generation of them, brought about by certain favorable conditions. Herein lies the whole problem of bacterial life, both in man, trees and everything. It is simply a question in both of conditions. For instance, if yeast be mixed with dough and placed in a temperature below freezing, the mass will not rise; nor if placed at once in a heated stove will it rise. Both are wrong conditions. Now, let scientists find out for us just what are the conditions under which these bacteria multiply so enormously in the sap of trees as to cause the phenomena we call blight, yellows, etc. With a view to aid in solving this problem, I present some observations from my own experience, as well as a few suggestions on the subject.

There are two main points to be considered: 1. Where do the bacteria of blight, for instance, come from? 2. What are the conditions most favorable for their propagation in numbers sufficient to produce the effect called blight? There are but three possible answers to the first question. Leaving out the one-time accepted theory of spontaneous generation, which science has demonstrated to be false, air sterilized by heat and kept from contact with the atmosphere showing no signs of bacterial life so long as thus excluded, the bacteria of blight come either from the soil, from the air, or they are indigenous to the sap itself, of course in numbers ordinarily harmless. That they are taken up by the tree from the soil has no advocates that I am aware of, the generally accepted theory being that they are strictly external to the tree, and make their attack from the outside. Witness the statement that blight spreads, that the fruit spurs and tender shoots are most liable to attack, and directions to cut back the affected parts. Of course, the latter would do no good if the bacteria were already in the sap of the tree. That they are thus indigenous to and in the sap of every pear and apple tree now, and always have been, is the only possible hypothesis which will explain all the phenomena of blight. For instance, an apparently healthy pear tree may be planted miles away from any other tree, and yet when the proper conditions arise, which I will presently explain, it will show blight. Are we

to suppose, on the external theory, that the whole atmosphere is alive with the bacteria of blight? Again, as a rule, blight develops worst on the most vigorous, healthy trees, in clean, cultivated ground? How shall we account for this, when all experience with man, animals and trees, under the attacks of insect pests, goes to show that the strongest and most vigorous always best resist injurious attacks? Again, why, if the bacteria of blight are in the air and attack from the outside, does any tree escape? All are equally exposed, and the weakly tree should certainly succumb as readily as the strong. But the hypothesis that these bacteria are in and a part of all pear and apple trees in limited numbers, and, under certain normal conditions play, perhaps, a specific, useful part in the life and development of the trees, will cover and explain all the phenomena of blight. A contrary supposition demands the belief in an actual creation one hundred years or so ago, when this disease first appeared, else why were pear and apple trees never attacked before? Simply because the conditions for their development in destructive numbers had never been furnished. That the eastern half of the United States, say from Kansas and Texas to Canada, with its extremes of wet and dry, heat and cold, often in rapid succession, present ideal conditions for all bacterial diseases of trees, there is no doubt, and if there is a region in the world where they could originate it would be there. I have often wished that we knew the exact history of the trees upon which blight originally appeared in New England, from the time they were planted until the disease broke out. I think, however, it would read somewhat thus:

The ground was deeply plowed, well pulverized and manured, or naturally rich, and the trees when set were about three years old, well provided with long as well as fibrous roots, which were nicely spread out in large holes. They were then well cultivated and cared for, especially in the way of a good plowing every year, until they came into bearing, the first light crops being very fine, and when loaded down with their first very heavy crop, all of which the owner left on, the season turned out very dry. Being largely surface-

rooted, they made practically no wood growth, having all they could do to mature the fruit. The owner, seeing the strain put upon them, concluded to relieve them the next year, and pruned heavily during the fall or early winter. The weather subsequently was very mild and open, and having practically rested during summer from severe drouth and their heavy load, and stimulated by the removal of a large part of the tops, the sap began to move freely. Then came a stinging freeze, perhaps just after a heavy rain, freezing the roots as well as tops, completely checking the moving sap for a month or two. That was not a late spring but a late winter freeze, producing a stagnation, so to speak, of the sap. Had that freeze occurred after growth had started well no harm might have occurred, as motion would have been resumed at once, but standing for a month or more the sap, to use a common expression, "soured."

Now, there, in that sap, was the ideal condition in which the hitherto harmless blight bacteria love to revel, run riot, fondle one another, perhaps, in amorous dalliance, and multiply by billions. The owner was surprised to see how slow the leaves were in putting out, the blossoms, if any, having opened profusely and dropped before a shade of green appeared. When the time came for some of the young pears to drop from each cluster, they largely refused to do so, but dried up on the fruit spurs, and turned black. There, before a leaf or shoot had shown a sign, was the blight, and those fruit spurs, the tender, vital points of its first development; just as the bacilli of consumption, lurking through heredity for years in the system of an apparently healthy man, if favoring conditions of development are given, such as extreme overheating, followed by sudden change to wet or cold, will concentrate upon their favorite point, the lungs, and multiply rapidly into millions. The former were the conditions for blight, the latter for consumption. Had the trees or man not furnished them, both might have lived, and died from other causes.

I will now furnish proofs that will show beyond all reasonable doubt—proofs which can be verified by observation and

experiment—that blight is entirely a matter of conditions of temperature, moisture and pruning. Also, that all its varying phases, as well as hitherto unexplained phenomena, can be completely accounted for under the hypothesis of a natural, or at least present, existence of the germs in limited numbers in the sap of all pear trees, which, under certain given conditions, are capable of multiplying beyond conception, resulting in what we call "blight." I will show plainly how, from analogies drawn from the known actions of such organisms in the human system, that bacteria, having once effected a lodgment or developed in the sap, corresponding to the blood in us, of those pear trees in New England, all other pear trees in the country must almost necessarily now have some of the bacteria in their sap. I will also make it clear why this dreaded disease has never prevailed in California, or but twice to a very limited extent in the whole coast country of Texas, though pear trees of the old varieties, unproductive but healthy, have been growing here for twenty-five years. I think I can also satisfy everyone that the conditions of blight are so completely under our control that pear orchards may be planted from henceforth which, like the old original (the January number of the *Horticultural Visitor*, Kirmundy, Ill., contains a photograph of this tree) seedling Sudduth pear tree, now standing near Springfield, Ill., ten feet in circumference of trunk, fifty-five feet high and seventy-five years old, will long outlive the planter. This grand old pear tree, in perfect health, still bearing enormous crops, a landmark for all the surrounding country, is a towering monument to the infinite superiority of nature and her methods. While man, with his science and his plows, his hoes and his cultivators, has ripped and torn and scratched the surface of the ground; has dug his big holes and spread the roots most carefully by hand, a single tiny seed was dropped upon the firm but kindly bosom of the earth, and there to-day stands in silent majesty this evidence of her skill. Where, now, are the cultivated, pruned and fertilized pear orchards of that state and the whole country, upon which untold money and weary days of labor have been wasted, as well as bright hopes wrecked in those

seventy-five long years? But now to my theory of blight, its cause and prevention, and in certain cases perhaps its cure.

It is well-known that long before bacilli or bacteria were ever heard of, eminent medical authority had declared that few, if any, human beings were perfectly healthy, a close examination always revealing some weak point in every one. Ifby healthy we mean blood absolutely free from the bacilli or germs of disease, then we may, in view of the wonderful revelations of bacteriology, assert with the utmost confidence, that there is not such a human being on the earth. With all the various germs of malaria floating in the atmosphere, and those of every variety of epidemic that at one time or another has scourged humanity, taken into the blood through the lungs; the bacilli of typhoid and other malignant fevers introduced into the system through milk and water, and once there, though never developed in numbers sufficient to produce specific attacks, still there, for not only our lives, but, through heredity the lives of our descendants to the remotest generation, is it credible that there exists to-day a single absolutely healthy being? In the blood of every person who has at any time visited a consumptive friend lurks the dreaded bacilli of that scourge of the human race, and so with all other diseases. That in so few instances they show it by an active outburst is simply due to a want of the proper conditions for the rapid and infinite multiplication of the germs. Thus we see that we are carrying around in our blood chained tigers, so to speak, ready at any moment to devour us, if we slip their chains by furnishing the conditions for an abnormal development.

But while all this is true of man, science tells us that it is partially true of plants also. But thus far science has failed to determine their relation to plants, or define their exact methods of attack and development in the sap or blood of the tree. The general, if not universal hypothesis is, as stated above, that the bacteria are in the air primarily, and when plants or trees furnish the proper conditions, the phenomena which we call blight, for instance, occurs from an external attack. But reasoning from analogy, is this necessarily so? It is plain

that there is a most marked similarity between the diseases of man and trees. We have the quick and fatal work of the cholera germs duplicated in the blight; the slow, insidious method of consumption in the yellows, while the black-knot and root-rot furnish an excellent counterpart to the various forms of scrofula.

Now, then, admitting that the germs are already in the human blood, if we can show how a like condition probably exists in the sap of all trees, the problem of blight, yellows, black-knot and root-rot will be solved, provided we can show how the conditions for their development can be prevented. However, I do not mean to say that, while the bacteria are already in the sap, they may not also be in the atmosphere, and in epidemics of blight or yellows, for instance, very greatly aggravate the attack.

Now, then, for the proof that all pear trees, for instance, are probably infected with the bacteria of blight. It will be no valid objection to say that if so, the microscope would show it, for the quantity of sap exposed beneath a powerful instrument is so exceedingly small that while the bacteria in the sap of a badly diseased tree might be seen, they could easily exist in that of an apparently healthy tree in numbers that would escape detection.

Remember, then, that when the first outbreaks of blight occurred at several points in New England and the eastern states, and admitting, for argument's sake, that the attacks were strictly external, fruit culture there, as a science, was far in advance of the balance of the country, nurseries much larger, as well as more numerous, and orchards more extensive, we see how easily and rapidly the bacteria of blight must have spread. Every breeze bore them by millions, not only in the air, but in the pollen of infected trees, to other trees in bloom, or dropped them on surfaces cut or wounded by the hoe or plow. Every insect and bee carried them for miles around. The busy woodpecker and sapsucker took them on their bills from diseased trees and drilled them into healthy ones, whence buds and cuttings carried them to the nurseries. Once there, dissemination, of course, took a wider range, until

in a few years the whole East was infected. To prove how rapidly this can be accomplished, I need only refer to the recent introduction of the San José scale into New Jersey, and elsewhere throughout the country. If a slow traveling fly and insect could so quickly be scattered far and wide, what shall we say or how limit the spread of the subtle bacteria? Of course, I am presuming that, once in the sap of a tree, they remained there, often in numbers, perhaps, too limited, or from want of proper conditions for development, unable to produce the blight. The eastern states, the nursery grounds at that time for the whole country, once thoroughly infected, we see how almost of necessity the bacteria were rapidly scattered in nursery stock from the Atlantic to the Pacific, and the Lakes to the Gulf of Mexico. That this infection did actually occur all over the eastern half of our country is proved by continuous developments of blight, from time to time, in different localities throughout this whole region, following rapidly after its original appearance in the East.

While, then, the presumption of the present existence of these bacteria in all pear trees is a fair one, it is a known fact that they do pervade the sap of all pear trees on which the external evidences of blight have manifested themselves, fruit growers having been repeatedly warned to cleanse their knives and shears thoroughly after pruning diseased trees. Now, then, admitting, as the authorities on this subject do, that the sap of all such trees does contain the bacteria, the presumption is that they remain there in greater or less numbers, and the burden of proof is on them to show the contrary.

We come, now, to the vital question: What are the actual causes of, or rather conditions for, the visible manifestations of blight? I stated in another place that temperature, moisture, and pruning in certain cases were at the bottom of it, and foreshadowed in my supposed history of its original appearance a theory, and the only one that will completely account for all the phenomena. And right here I have to make an assertion, positively true, but quite as revolutionary as that regarding the best form of a tree for planting, which is, that the universal statement that the "best

time to prune a tree is when it is at rest" is exactly the opposite of the truth, the best time to prune being when the sap is in motion.

As pointed out all along, there is a close analogy between man and trees in the matter of diseases, and the same is equally true as to their physical growth and development. They both have alternate periods of activity and rest, the latter following as an apparent necessity from the former. Man's rest is the half or a portion of every day, and to wake him up every night at eleven or twelve o'clock and repeat it several times before day, on the score of hygiene, would be considered queer treatment. A tree's rest is the half or a portion of every year, and that is the very treatment we adopt for our trees. No sooner have the leaves fallen and the trees settled themselves for a comfortable winter's rest, than many owners, having leisure at that time, and to save work in spring, come along with their manure, perhaps, or else plow the ground, thus making soluble plant food that would have lain dormant until spring. However dormant trees may appear, if with our variable climate a prolonged warm spell occurs, and particularly if the owner prunes considerably at this same time of leisure, the equilibrium between the tops and roots being destroyed, there must be more or less motion of the sap to repair the damage. This plowing, pruning and cultivating during the winter and early spring are our methods of breaking the rest of our trees, and so effectual are they that the blooms and leaves often start long before they would had the trees been let alone. But there is a condition, in this variable climate of ours, that greatly increases the danger of this winter movement of the sap, and that is a prolonged drouth the preceding spring and summer, which is the almost infallible condition precedent of blight the next year, if followed by a late winter or early spring freeze.

Remember, now, that rest in trees can be produced by excessive heat and drouth, as well as excessive cold, for I have seen orange trees curl and shed their leaves under such conditions in July, and become more dormant than usual in midwinter here. If pear trees are forced to rest in summer

from such conditions, and all surface-rooted ones from long-rooted trees are necessarily compelled to rest, especially if carrying a heavy crop, then, stimulated by the plowing, fertilizing and winter pruning described, if a mild spell occurs any time in winter, a movement of the sap is sure to take place. It may not show itself in leaves or blooms, for it does not in the grape; but the movement will be there, and if that motion be checked by a freeze, and the sap stagnate or sour, so to speak, for a month or more before growth starts again, then blight is certain to occur. We have furnished, then, the conditions for an abnormal development and propagation by millions of the bacteria, and I pointed out above the course of that development. The blooms first show it, next the fruit spurs, then after warm rains and muggy weather later on, the tender shoots blacken and droop, and the disease spreads to the limbs around the base of the fruit spurs. Now, then, for some of the unexplained phenomena of blight.

1. Why do the most vigorous trees in well cultivated ground suffer oftener than the weakly ones alongside, or in grass? Because, given the conditions for blight described, the vigorous tree will certainly be most susceptible to the stimulating treatment named, and in addition, the owner is sure, in his desire to produce a more uniform appearance of the orchard, to cut back the long canes on it very severely, while the weakly tree often, in fact generally, escapes the knife altogether. I years ago treated trees just that way myself, and know that the sap in a heavily pruned, vigorous young tree will be in full flow or motion in a warm spell in winter, when the other is still quite dormant, and fails to furnish the conditions for the bacterial development within. The germs were in the sap of the weaker one also, but, the proper conditions not being furnished, failed to develop, just as in every cholera or yellow fever epidemic, certain persons escape those diseases, and yet in food, water and air the germs must have gotten into their blood, if not there before. Science has yet to determine the exact conditions in man and trees that govern their development.

2. Why has blight never appeared in California? First,

because trees are irrigated there, and, consequently, always make a normal summer growth ; they never rest entirely at that season. Secondly, because they are never exposed to the proper extremes of temperature in winter, the climate being cool, moist and uniform during that period, and the trees, having performed their work throughout the long summer, are content to rest. Having been brought mostly from the east, the pear trees must necessarily have the blight bacteria in their sap, but the extremes of heat, drouth, floods and cold are lacking for their development.

Now, lastly, why did blight break out in my pear orchard in 1894, after years of bearing, and when a case was never known in this section before ? But as the experience of this orchard furnishes an absolute demonstration of my hypothesis that blight bacteria exist at all times in all pear trees, in perhaps a modified form and subject to certain conditions, which, being given, they are capable of rapid as well as almost infinite multiplication, I will defer the discussion of it until the next chapter, when some experiments in pruning at different times from spring until summer will also be given, which go to show beyond all doubt that the proper, and, in fact, the only time when any tree should be pruned is, though contrary to general teaching, when the sap is in motion.

CHAPTER XI.

Blight.

I WILL now give final and conclusive evidence in favor of the internal theory of blight, from an experience with that disease in my well known pear orchard at Hitchcock, in 1894. Up to that spring, not a case of blight had ever been known in the coast country of Texas, and as this orchard had borne heavy crops for five years none was expected. It contained 1,250 Le Conte and 250 Kieffer, standing on thirteen acres of ground, 500 eight, 500 nine and 500 ten years old, and while all had been heavily fertilized every year, the 500 oldest received per acre one ton of cotton-seed meal, and 500 pounds of the hull ashes, containing 30 per cent. potash and 8 per cent. phosphoric acid, annually for five years. The trees bloomed like a snow bank in the spring of 1893, and set an enormous crop. I knew that the pears should be thinned, but having had heavy crops of fine fruit before without it, concluded to break all records and let them alone. No cotton-seed meal was applied that or the preceding year, but a double quantity of the hull ashes.

The ground had been in grass and mowed several times for two years, but knowing that the trees had big work ahead, ignorantly thinking to help them, the whole orchard was lightly plowed in March and kept absolutely clean until July. This was an easy task, for after May no more rain fell for nearly three months. It may well be imagined what a strain this put upon the trees, but, ever hoping rain would come, they were let alone. The 250 oldest Le Conte were ten years of age, and the heavy fertilizing had produced a growth that was phenomenal. Many of them measured about fourteen inches in diameter one foot above ground, were thirty to thirty-four feet high, the limbs lapping across twenty-five-feet rows, and a single tree gave twenty-seven 50-pound

boxes of pears. The eight and nine-year trees had received less than a third as much fertilizer, and were just as small in proportion, but still fine trees. The total yield was over nine thousand bushels actually shipped, and good judges estimated that fully two thousand bushels were knocked down and bruised in gathering. These facts will be testified to by J. C. Glover, station agent at Hitchcock, who shipped the fruit.

The summer continued dry, with light showers, until October, when good rains fell, and in November, being in the nursery business at that time, I set twenty men to work, and by the first day of January had largely over one million cuttings in the ground, all from those trees, and had cut out heavily besides, to prevent a repetition of such a crop next year. The fall and winter were very mild, and having rested so completely all through the summer, by the 17th of January a few stray blossoms were showing, and shoots everywhere were pushing from the cut ends of the canes and limbs, a very unusual thing. On that day the thermometer fell to eighteen degrees, completely checking all growth. About the first of March, instead of leafing out and blooming as usual, the trees were perfectly dormant, and remained so until April.

In the meantime, having determined to experiment most thoroughly with Bordeaux mixture for prevention of what is known here as "bitter rot," which attacks Kieffer pears, more or less, every year while ripening, I selected three Kieffer and also three Le Conte adjoining, and before a bud opened sprayed them well. This was repeated at short intervals the whole season, and especially after rains, though the spray adhered well even then. In fact, those six trees were literally blue-washed from spring until fall. Though suspecting nothing, having had absolutely no experience with blight, I noticed the peculiarity about the failure of the blossoms to drop promptly, but thought nothing of it, until immediately after a heavy rain in May, followed by calm, hot weather, when in a few days everywhere the fruit spurs began to blacken and the tender tips of the shoots to droop. In a few weeks the whole orchard showed more or less signs of blight,

not a single tree escaping, though on many the evidence was light, and confined to the fruit spurs alone. In spite of it all, however, they bore a moderate crop, and not a tree died. This was due entirely to the fact that the natural water level here is only from four to five feet below the surface, and consequently the sap kept in motion more during the preceding drouthy summer than if the water had been twenty or more feet below.

This explains clearly why blight has never prevailed before here, as it has not in California, where irrigation does the same for their trees in summer. Four hundred six-year-old Garber pear trees alongside of this orchard showed no signs of the disease, nor did another Le Conte orchard of one thousand trees, six years old, which I owned, about six hundred yards distant, having been neither pruned nor plowed. Moreover, two trees the same age, and set when my oldest were, which I gave to a neighbor who helped me plant, both having borne heavy crops, but neither pruned or plowed, also escaped entirely. The six sprayed trees blighted quite as badly as any, and the Kieffer pears showed equal signs of rot. Now, then, on the external theory, why did those six trees blight, though completely covered with the most effective known germicide the whole season, and, as the bacteria could not have come from the gulf, how did it happen that in their journey from the blighting districts to the north of us, they passed over a great number of pear trees fourteen miles above me at Alvin and other points, without attacking a single tree? There is but one intelligent explanation. No other trees bore as heavily as mine the year before, nor did any other man commence to prune as early as I did, or do it as severely. The preceding drouth and heavy crop, with early and severe pruning, aided by the freeze of January 17, produced the conditions in my trees favorable to a greatly increased multiplication of the germs already in the trees, and the result was what is known as blight. And in passing, I will say here that thousands of dollars have been wasted in useless going over and cutting out the affected shoots as they appear. I tried it most thoroughly on a few trees, and found

by fall that there was no difference at all in the actual amount of pruning done, or in the appearance of the trees alongside that received but one pruning the next winter, another evidence that the disease is internal and beyond the control of the knife.

This theory, also, accounts fully for the well known fact that blight does not prevail every season, because the proper conditions of moisture, or rather, lack of it, and temperature, are not forthcoming, and without these, blight is just as impossible as it is to make dough "rise" in an icebox. But on the external hypothesis, where in these non-blighting seasons do the bacteria go? Having now given a reasonable explanation of all the phenomena of blight, it only remains for those intending to plant pear or apple trees hereafter to follow nature, in order to grow them just as free from blight as her old seedlings are, in fact, even more so, for a close root-pruned tree will drive its several tap-roots much deeper into the moist subsoil than any seedling will. Plow shallow afterwards for a few years, giving liberal supplies of food on poor ground, and then let the grass grow, keeping it well mowed through the growing season. While such trees, if not fertilized or cultivated before growth starts, will stand light winter pruning while young, perhaps, everywhere, and heavy pruning here, still after bearing a knife should never be applied until the leaves are out. A tree can be literally cut to pieces after that, and while active growth continues, with perfect impunity. I have several times cut both peach and pear to the ground, and they sprang up with increased vigor, and everybody knows that the grape is best grafted at that time. And, by the way, I am satisfied, both from experience and observation, that fall and early winter plowing and pruning of grape vines that have been planted with roots spread out laterally are the potent, probably the sole, causes of subsequent rot in the fruit. The old root-pruned Herbemont at Hitchcock, before mentioned, that bears annually such enormous crops, free from all disease, is strong evidence of this. No tree or plant will become so completely surface-rooted from long roots as the vine, and none penetrate more deeply from

close root and top-pruning. While I have often pruned single vines after the buds were swollen, and once when breaking, and had the sap to flow freely from the cuts for several days, I never saw the slightest damage from it. Perhaps this very flow may be a relief to the vine, the sap of which seems to move in spring with more intense activity than that of any other plant. Perhaps thus pent up by the dry surfaces from winter pruning the vines may become gorged or congested, thereby furnishing the proper conditions for subsequent rot in the fruit, especially if a late freeze has occurred.

Here is a wide field for experiment, especially with close root-pruned vines. If pruning can be delayed, as I am sure it can, as well with vines as trees, until growth actually starts in spring, it is plain that a crop of fruit will never be lost, as the terminal buds start first, while those that are to furnish the fruit are more backward and no risk is ever run of knocking off the shoots in pruning, or, being killed by frost. However this may be with the grape, it will readily be seen that by deferring pruning of fruit trees until the fruit has set, in fact, become well developed, we do away almost entirely with all necessity for thinning. By removing parts of all the bearing shoots and spurs the crop can be reduced as desired, resulting in a marked and surprising increase of development in the remaining fruit in a few days. This I have proved time and again.

And now, having shown the causes of blight and the methods for its absolute prevention in all pear orchards planted hereafter, provided these methods be adopted, the question naturally arises, What is to be done to prevent blight in orchards already surface-rooted from planting long-rooted trees? The answer is plain. Put them down at once and for all time to grass, to preserve every root for an emergency of severe drouth. Often light summer showers will stimulate growth in such trees where a dry bed of three or four inches of loose soil would not be wet through. Keep the grass closely mowed the whole season, and top-dress annually with free applications of some complete fertilizer or barnyard manure, to obtain a healthy growth until the trees begin to

bear. After that apply potash freely, also, to give health to the trees, as well as color and quality to the fruit. And here come into play the surface-roots of trees, between which and the size as well as quality of the fruit there is a most intimate relation. I am confident that the well known deficiency of quality in nearly all California fruit is due entirely to the fact that, under their system of cultivation, no surface roots are ever allowed to form. In the east it is well known that dry seasons make good shipping, high-flavored fruit, and yet there, where they have perfection in climate and water under control, we find poor quality. Their method is to keep the plow and cultivator going practically the whole growing season, compelling the trees to form what may be called surface roots six inches below the ground. This is entirely artificial and contrary to nature, for while all young trees root primarily as deep as they can, a bearing tree has sense enough to know that its cookshop is on the surface, where air, heat and rain prepare its food, and having something to do besides grow, it avails itself of every means to obtain that food. If allowed, it quickly fills the whole surface with its hungry little feeders. Cut them as often as you will, if given the slightest chance back they come again. There is where the value of a firm, closely mowed surface comes in. The sod protects these tender rootlets from the summer heat and cold of winter, and yet if kept mowed, being allowed no evaporating surface, takes but little food and moisture from them, nor will it hold surplus water after excessive rains, like loose soil, to scald and drown them out.

And here I would call particular attention to the fact that the sod is not really the compact ground it appears to be, as is evidenced by the fact that after heavy rains the water is much more rapidly absorbed by grass land than clean compacted ground. The pores, so to speak, of such are run together and somewhat closed, but the grass roots keep the soil lighter, and by their decay from time to time afford minute natural avenues of absorption, which allow the water to find its way into and through the soil.

Adopt, then, the lawn system for a pear tree now grow-

ing, and annual fertilizing after growth starts, never putting a knife to them until after the leaves are out in spring. If water can be had in addition, that ought to furnish absolute immunity from blight, for it is simply a question of healthy, uniform, continuous motion of the sap during the preceding growing season. The sap must not be allowed to thicken prematurely and go to rest. Of course, every one knows that it does not rise or fall, as we commonly express it, but keeps in motion for a stated period and then rests. Where water cannot be applied freely in severe spring or early summer drouth, the next best thing for such trees is to remove a large part of the fruit and prune heavily. This will stimulate a movement of the sap. The universal exemption of old seedling pear trees everywhere, and, with the exception given, the general exemption of this whole coast country, where the water is at no time lower than four or five feet from the surface, proves that a continuous movement of the sap in summer has a great deal to do with the absence of blight the following season. Whether clean culture or sod be adopted, pear trees should not go completely to rest during the natural growing period.

And now, in closing the discussion of this important subject, for a clearer understanding of it and the relation of the external and internal origin theory to the facts in the case, I will recapitulate and give a condensed statement of the most important of them, so that my readers can clearly see that my internal theory perfectly covers and explains, while the external theory of attack is at variance with them all.

1. Blight attacks isolated trees, miles away from all other pear trees. I saw a large bearing Le Conte away up in the mountains, near Eureka Springs, Ark., thus situated, with three large dead, blighted limbs in the center, from an attack the year before, but from indifference on the part of the owner, never cut out. Is the whole air filled with blight?

2. Though all authorities affirm that such dead wood is the nidus or harbor for the bacteria, there those three limbs stood, right among the green leaves, and not a sign of blight that season.

3. Weakly growing trees escape, while the vigorous and strong are often attacked and killed alongside. This is contrary to general experience and all analogy in resisting disease.

4. The attacks are often sporadic, some bearing and some young trees near by being affected, while others escape.

5. Trees whose limbs and leaves were coated continuously with sulphate of copper, the best known germicide, from spring till fall, blighted just as badly as those not treated.

6. Continued cutting out has no preventive effect, nor does it cause apparently healthy shoots on blighting trees, or those near by that are cut back, to become diseased at the cut ends, where sap is exposed to external attack.

7. Blight was never known in Galveston county during thirty years of pear culture until it appeared in my twelve-year old orchard in 1894. How did it happen that the bacteria, when borne on the breeze or by insects, if thus brought from the interior blighting districts of the state, passed through all the pear orchards, many of them in bearing, at Alvin and Arcadia, without stopping, and settled in my orchard, within a few miles of the Gulf of Mexico, and furthest removed from the point of infection?

8. A careful inquiry showed that the growing season preceding a bad blighting one was always dry everywhere, thus checking normal growth and forcing a long period of unnatural rest, and that heavily loaded trees, having rested most completely, were most susceptible to premature motion of the sap during warm weather in the following winter.

9. A bad blighting season is invariably preceded by a late winter or early spring freeze which is preceded by unseasonably warm weather.

10. California, with its equable winter climate, and irrigation to keep up continuous motion of the sap during the growing season, has little or no blight.

11. While it has been claimed that healthy pear trees

could be inoculated with blight, facts now strongly prove that any supposed inoculation must have been simply a local irritation that could not have resulted in blight. On the 1st of June I steeped blighted leaves, wood and bark in water, leaving, them four days, until the liquid became dark red. This was inserted freely into cuts made as for budding, and the young pear shoots dipped into it. The experiments were made on a three-year-old Bartlett, a five-year-old Idaho and an eight-year-old bearing Le Conte. At this time, six weeks after, there is not the slightest sign of blight on any of the trees. At my request, Mr. E. W. Kirkpatrick, of McKinney, in North Texas, and Mr. S. K. Wheeler, of Arcadia, in South Texas, also vainly attempted to inoculate healthy trees with blighted sap and bark, not a single case showing the slightest effect. This demonstrates absolutely that this disease is of internal origin, and results only when trees are subjected to the aforementioned conditions. While I have suggested in this chapter a preventive treatment for trees now growing, it may be of doubtful value. No surface-rooted trees, like those in nearly all pear orchards elsewhere, can keep the sap in free motion during a severe drouth, especially if bearing a crop of fruit. Even though not pruned or stimulated out of season, much would depend on the character of the winter and spring.

Having now shown from the foregoing incontrovertible facts that the bacterial disease of blight is of internal origin, and the result of certain conditions, the question naturally arises, May not other forms of bacterial tree diseases, such as yellows, black-knot, root tumor, etc., be of similar origin? Reasoning from analogy, we would naturally come to the same conclusion, nor will any other theory cover the cases. All such diseases must be the result of inherent weakness aggravated by favoring conditions, and none will deny that the more vigorous we can make our trees the less liable they will be to attack. On this principle I have demonstrated that the virulent root tumor of the South can be entirely cured by planting affected trees in very small holes, after cutting off the roots very closely and fertilizing them well. One thousand plum trees thus treated four years ago were examined recently, and

found to be entirely healthy, and my experience is corroborated by the following testimony:

EDITOR FRUIT-GROWERS' JOURNAL:

Your journal has been very interesting for the last few months. I will give you my experience with Stringfellow root-pruning. In '93 I planted peach seed in a corn field and budded all that came up the following summer and fall. In '94 I planted about 125 trees where peach seeds failed to grow. I pruned the roots very close because they were diseased, and cut down tops to from one to one and a half feet. After two years' growth the 125 trees are as large as the trees two years from bud. All that I plant in the future I will prune roots short.

LEAVENWORTH, IND. CHAS. SACKSTEDER.

EDITOR FARM AND RANCH:

I planted an orchard of peach, plum and almonds fifteen years ago, and was with my boys until about half the trees were set. Ground is alluvial, with hard clay subsoil. Trees were two years old. Was careful to have holes dug large, so as to allow of roots being all spread out. The digging was very hard. Being called away, the boys set the last half, and "played off" on me. They dug small holes, cut off the roots and hid them, and to-day the best trees by far in the orchard are the root-pruned ones. Most of the long-rooted ones have died, and the balance got the root-rot. I ruined part of my orchard four years ago by deep plowing and breaking the roots.

BURNET, TEXAS. J. J. M. SMITH.

CHAPTER XII.

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 fruiting capacity in it. Again, a year ago 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. Petitt, 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 blooms. 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 pollenation; 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.

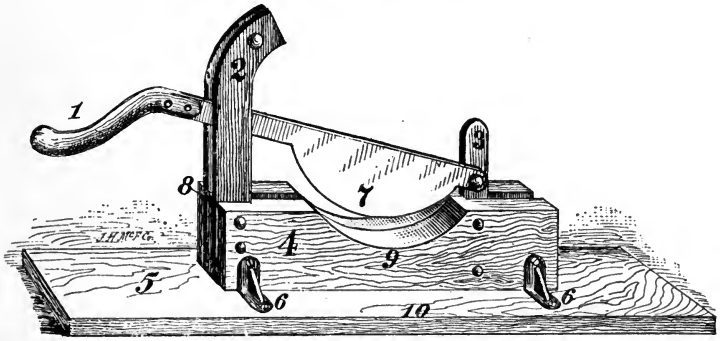
CHAPTER XIII.

Propagation by Cuttings.

WHILE a great variety of other trees and plants grow well from cuttings at the North, here, in South Texas, we find the conditions so favorable that the Le Conte, Garber and Kieffer pears also grow more or less freely from cuttings. But having from the beginning kept up my habit of experimenting, some years ago, after losing most of our cutting crops several times, either from too much or too little rain in the winter, I concluded to try early fall planting. So, beginning about the first of August, I stripped the leaves from the young pear canes as soon as cut off, and every Saturday planted one hundred cuttings. I kept this up until December, and found, to my surprise, that of those set between the 15th of September and the 15th of October, if the ground was reasonably moist, or if well watered, fully 90 per cent. grew, and for the last three years I practised this method with perfect success. I have had them to grow six inches before cold weather, if the fall was seasonable. The philosophy of it is, that at that time the wood is mature and the ground still warm, while the gradually decreasing temperature gives a cool atmosphere or head. In fact, in early fall the earth is a natural hotbed, and grape cuttings, as well as pear and many other trees, will also root well. I see no reason why the same conditions should not prevail about the first of August at the North.

I will now give a method for the rapid making of cuttings and scions, which will prove very valuable to nurserymen. Figure 1 in the cut (page 147), represents the end of the handle of the machine, with a thin, sharp cutting blade at 7, all made in one piece and with the end of the blade fastened by a bolt, on which it works, to a standard (3), which is made of ⅛-inch thick and 2-inch wide sheet iron. Figure 2 repre-

sents a similar but double standard, bolted together at top and bottom, just wide enough apart to allow the handle of the knife to work easily between. Figure 4 represents a piece of 2 x 10-inch plank, with a similar piece on the opposite side, between which the double standard (2) is bolted. These two sides meet closely beneath the knife blade, so as to furnish a support for it when pressed through the bundle of cuttings, which are to be inserted at 9, in the curve. There is an iron stop at 8, between the double standards, just low enough to allow the blade to enter the crack at 9 about ¼-inch. In order to regulate the length of cuttings, a piece



CUTTING MACHINE.

of 1 x 14-plank one foot long must be nailed on edge against and to the base along at 10 and opposite the knife, against which the feeder pushes the ends of the cutting wood. Eight inches is long enough for any cutting. Have the blade made of good steel, thin and smooth, and keep it sharp. To operate to the best advantage, four men are required, though two can work it. But, with one man on a stool at the handle, another to assort the wood, so as to have the buds all the same way and ends together, a third to receive and feed, and a fourth to hold the ends about to be cut, and when cut lay carefully in flat baskets or boxes with hoop handles, this machine will make more cuttings in a day than twenty men, and of as good quality. Any slight bruising of the edges or sides of the cuttings does no damage, as anyone can prove by making a small lot with a sharp hatchet; they will

grow just as readily as if made with the sharpest knife. I have used, for years, a pair of No. 4 sliding pruning shears for cuttings, simply bolting the handle with the curved jaw down flat on the 2-inch plank; but last year, on retiring from business, I told my friend, F. W. Malley, who was just starting, of this method, and suggested that he rig up something larger, and the machine here represented is the result of his ingenuity. There is no patent on it, and we present it to all who choose to make and use it.

In planting, always set cuttings perpendicular, and not slanting, as is often directed, under a mistaken idea that they root better thus. There is no difference in the rooting, but a slanting cutting makes a crooked and unsalable tree. All cuttings should also be made with a square cross cut, as they strike better that way, and make a much more evenly-balanced system of roots, than from a sloping cut. A large pile of cutting wood should be collected before going to work, and it will greatly facilitate matters if, in picking or gathering it up in the orchard, all the buds or ends are kept one way.

While on the subject of bruising roots or ends of cuttings, to prove that all the injunctions about making smooth cuts of either is humbug, one only has to dig a tree with the spade and heel it in a few weeks, to see that roots strike from the rough cut ends just as freely as if made with a sharp knife. The main point in growing cuttings in the early fall is to plant a little deeper than in winter or spring. Eight inches is about the best length of cuttings, and six inches put under the ground for early fall planting, but in winter and spring thousands of cuttings are annually lost from being planted too deep. It is always best to plant on a good ridge everywhere in winter, for the ground is dryer and warms up more quickly, and three or four inches is deep enough, and, if the ground remains very wet, a cutting inserted only two inches will nearly always grow. If the ground is a little dry it is a good plan to pass over and press firmly, next to the rows, with the foot. I did it always, unless the soil was too wet.

Now, in view of what is said elsewhere on pruning pear

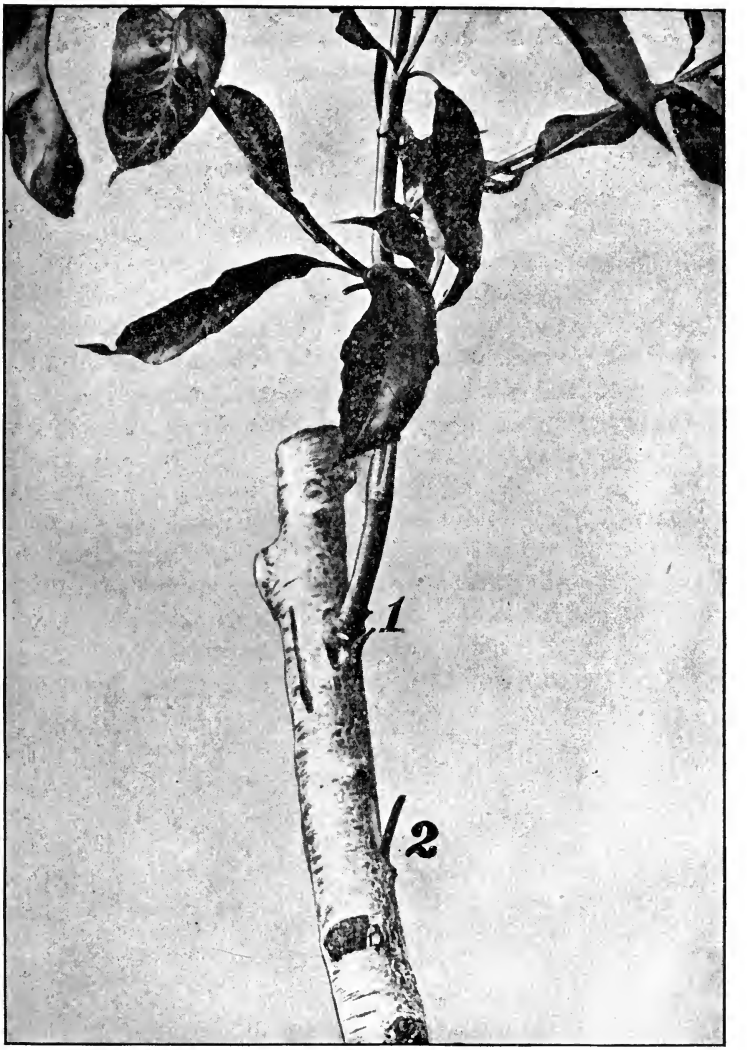
trees, of course judgment must be used in the quantity of pruning done to each tree. While no amount here in September or early in October will do any harm to bearing trees, it will be safer to let them alone after that time, though it is hard to hurt young pear trees in this section with pruning at any time, as the water is so near the surface, and the flow of sap is never entirely suspended in summer. I have pruned severely at all times, and never saw any damage except after that heavy crop, dry summer and severe early winter pruning, in '93. At the North, however, where blight is so much more prevalent, I would never prune a pear or apple tree until the leaves were all out in spring. The Cape Jessamine is also largely grown here from cuttings, and under proper conditions the cuttings root with scarcely a failure. June is the best month to plant, or just after the spring bloom is gone. Make the cuttings about eight inches long, leaving one or two leaves on the upper end of each. Bury in shallow trenches, running east and west, and incline a 12-inch plank over the trench, supported on slanting stubs driven into the ground. This will keep the evening sun off and should be left until fall, when every one will be rooted if the ground has been kept moist all the time. They can be buried quite thickly and still root well, after which set in nursery rows, removing nearly all the root, and they will make fine bushes the next season. Roses can also be rooted very readily the same way, and doubtless many other evergreen plants. The Cape Jessamine will also root with great certainty if the leaves are all stripped off and the cuttings made about six inches long, and planted the last of February or in March.

CHAPTER XIV.

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



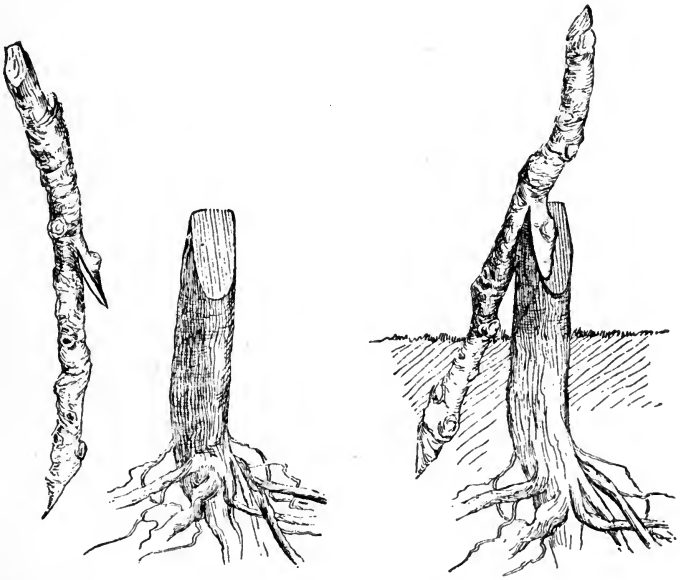
WINTER BUDDING.

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.

CHAPTER XV.

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.

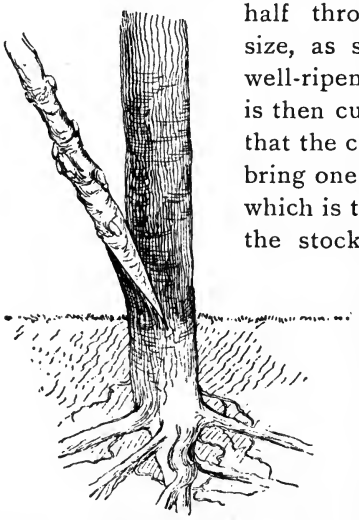


SCION AND STOCK COMBINED.

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-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.



SIDE GRAFTING.

CHAPTER XVI.

Fruit Changed by Pollination.

THE almost universally accepted idea is, that the characteristics of fruit are never affected or changed by pollination the same season. And yet there is nothing more certain than that the contrary is true, and I intend to demonstrate it this season to competent witnesses. I will now give several instances. The first will be an arbor of six Niagara and six Lindley grape vines here in Galveston, owned by Col. S. T. Fontaine. The vines are four years old, and bore a very heavy crop last year, all of which was white except a few stray pink bunches, but not a single genuine Lindley-colored bunch. The Lindley bore the first year and the Niagara did not, and every grape was of the natural red color, but when dominated by the Niagara pollen, the second year, all but a few were white. The second instance of this came under my observation for several years in the yard of N. N. John, of this city, where the Niagara again dominated and changed the Jefferson to white. The third instance was on my own grounds at Hitchcock, where a black grape, the Holmes, grafted on Golden Chasselas, with a shoot of the latter allowed to grow and fruit also, was dominated by the Chasselas, and the fruit of the Holmes turned to a pale pink. A fourth instance is the following, clipped from a recent issue of *The Rural New-Yorker:*

"Some years ago D. S. Marvin, of Watertown, N. Y., set out a Brighton layer, from a dry clay knoll, among some Delawares, where the soil was made moist by slop water. This vine no longer bears Brighton grapes, but the fruit is red, ripening a week later than Brighton. The skin is thicker, and these grapes now keep as well as Catawbas, not deteriorating after picking, like the Brighton, but remaining firm, with much sprightliness and substance. The leaf is stronger and thicker and the notches less coarse."

But the grape is not the only fruit thus affected. There

stands in Mr. Joe Marcos' yard, on firm, unbroken soil, a seedling tree that for several years bore freestone peaches, which I know to be a fact, having eaten of them. A second seedling came up near by a few years later, and when it bore it proved to be a cling. Ever since then its pollen has dominated, and both trees have borne clingstone fruit. Another instance is an orange tree that stands in Capt. W. Dugat's yard, in Beeville, Texas, which bore for some years a very thin-skinned orange with few seeds. Later on a sour orange close by began to bear, the fruit being very thick-skinned and full of seeds. The skin of the first became coarse, also, and the number of seeds increased, while the flavor deteriorated greatly. A final instance is from a letter of inquiry printed in the April issue of *Green's Fruit-Grower:*

MR. CHAS. A. GREEN: I have one grape trellis 208 feet long, and a few vines of Brighton, Green Mountain, Wyoming Red and Moyer; perhaps two of each variety, the larger number of Moore's Early and Diamond; there are two vines of F. B. Hayes; these two do not ripen quite as early as what we have called the Diamond. The Diamond, on the side of my house, is greenish white, with a very slight golden color. The Diamonds on the trellis are a dark amber or light maroon in color, about the same color of your Moyer grape—a little lighter in color. The vines on the house grow about the same, and appear to be the same in wood and leaf. Is it caused by the grapes mixing with the Moore's Early when in bloom?

I have three apple trees; two of them are Talman Sweets, one is Hubbardston Non-Such. The Hubbardston is planted half way between and the limbs interlace. This year the Hubbardston cannot be told from one of the Talman Sweets. One of the Sweets is large and flattish in form. The other is round and slightly conical. I have shown the apples to some of my friends—one to J. P. Wentworth, of the City Council. When you cut the Sweets they turn a yellowish color. The other, the Hubbardston, is sound, and tastes more like the Hubbardston. From the outside we could not tell them apart. Even the line on one side is there. Is it caused by the pollen getting mixed? I have one or two apples of the Talman and Hubbard in my cellar. Now, what I want most is, to know what the grapes are. Are they Diamonds or Brightons? I bought them for Diamonds.

Respectfully yours,

H. A. CHANNELL, Maine.

Reply: While I cannot say positively in regard to your individual case, I am certain that varieties of fruits are changed in appearance, size and quality by the influences of surrounding blossoms. Where an Early Harvest apple tree threw its branches into the tree of a

winter apple tree I have seen Early Harvest apples growing on branches of the winter apple, which were not grafted there. There are many strange things in nature, which are not as yet understood by any one.—C. A. GREEN.

While this action of pollen is rare, still it does happen, and it would be well to look out for such effects in planting orchards where varieties of the apples named are used. Especially should care be taken to keep the Lindley and Jefferson away from the Niagara grape vine, if it be desired to maintain the red color. Of course, some of our latter-day authorities, rooted and grounded in the wisdom of the past, will scout these facts, and show just as conclusively by argument that the thing cannot be true, as they did about my close root-pruning method, five or six years ago.

CHAPTER XVII.

Hybridism by Grafting and Budding.

WHILE it is known that hybrids have been formed by grafting as well as by crossing through the pollen, it is considered so rare that very little attention has been paid to the subject, and the general opinion among a large majority of fruit-growers is that such a thing is impossible. Chas. Downing, on page 4, paragraph 4, of his work on fruits, makes the following interesting remarks on the subject:

"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."

In a marginal note the editor comments on the above, and clearly expresses the general belief of to-day, that the stock has no effect on the seed of fruit grown on the scions. He says:

"The doctrine here advanced has, perhaps, no foundation in fact, nor has there been any test made that, to our knowledge, would controvert it. Observation of many years, however, leads to the belief that the mere engrafting a variety upon another stock in no way affects its habit or capacity for reproducing itself just the same as it would if retained upon its parent root."

The uniformly negative opinion as to graft or bud hybrid-

ism has, doubtless, arisen from the great difficulty, in fact impossibility heretofore, of obtaining definite proofs of such hybridism in the resulting products between individuals of the same species. The different varieties of apples, pears, peaches and plums have leaves resembling each other sufficiently closely to prevent any cross from a stock and scion showing with marked distinctness in the product of the seed. But in the instance I will presently offer, we have two kinds of the same species so entirely distinct in every point that when grafted, or rather top-budded, one upon the other, and the seed of the scion planted, we are able to detect in the product the distinct peculiarities of both so plainly that the conclusion as to a genuine hybridism seems irresistible. And why, indeed, should there be such incredulity or doubt as to not only the possibility of such a result, but even the probability of an actual cross in every case of trees grown from seed taken from grafted or budded trees of the same species? Remembering that the stock is the actual provider and dispenser of all the plant-food received by the scion, and that general experience has shown that certain stocks do give additional vigor to other weakly growers, as a Delaware grafted on a Niagara grape vine, and also add size to the berry, as always results from such a union, I see no physiological reason for doubting that the stock must, of necessity, stamp some of its characteristics on the seed also. It is freely admitted that vigor, longevity and productiveness, as well as size of fruit, can be imparted by the stock to the scion; and yet, when asked to go to the logical conclusion, and add, "affect the seed also," a prompt negative is given. May not the overlooking of this important fact be the reason why, considering the vast number of seedlings of every kind that have been grown and tested, the number of meritorious varieties of recent years that are equal to the older sorts is so small? The really valuable varieties can almost be counted on the two hands. Now, why this great scarcity of improved kinds from so many millions of seeds? Is there any reasonable explanation, except that we start out with a "degenerate" as one of the parents of our seed? For instance, in

our efforts to originate new varieties, do we not select our seed from perhaps a Bartlett pear, an Elberta peach, or a Baldwin apple, grafted or budded on some common, scrub seedling stock, and then are greatly surprised to find the children inferior to the parents? I will now give a plain case of stock and scion hybridism which is of peculiar interest, because it furnishes an almost perfect demonstration of this most important principle, which, if true in this instance, ought to hold equally good with all other fruits.

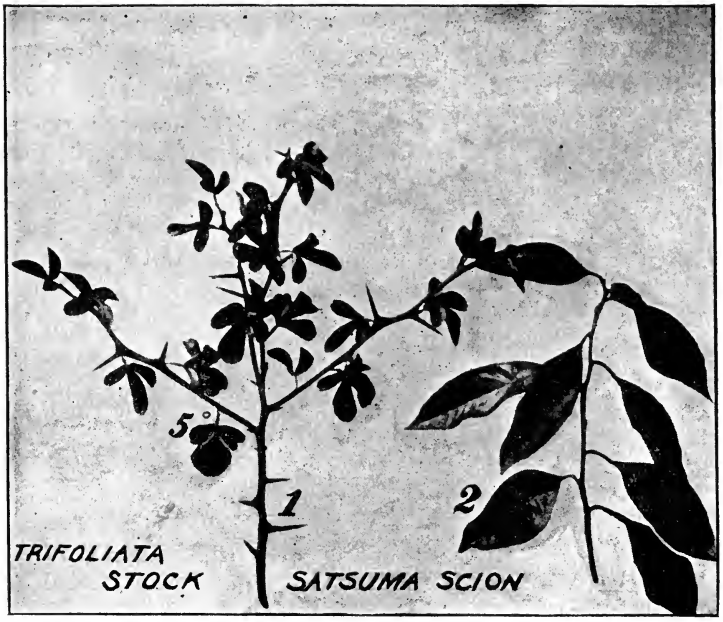
About seven years ago, in my first experiments with the Satsuma orange, I found that a temperature of eighteen degrees killed it to the ground, though it had been falsely claimed to have stood a temperature of twelve degrees in California. Having about five hundred Trifoliata stocks, which I had planted for budding before I found this out, and finding the Satsuma too tender when grafted low down in the ground, the idea occurred to me that, as the Trifoliata was perfectly hardy, a deciduous orange, and went to rest more completely and remained so later than the Satsuma, if the buds were inserted about two feet above ground, perhaps the tops would be unable to stimulate a movement of the sap in the body so early as if budded near the ground. If it could not, then the Satsuma would be more hardy than when grafted low down; for the whole question of the hardiness of orange trees in winter here is the condition of the sap. So, acting on this notion, I top-budded the whole lot except four, which I budded as low down as possible for trial. The buds all made a good growth the next season, but in the following January, quite a severe freeze occurred, and in a few days the four low-budded trees showed severe damage, and in a week were all dead, while not a shoot on the top-budded trees was hurt. Overjoyed at this, the whole lot was taken up carefully with small balls of earth, and set out in a grove to fruit, where they remained, grew finely for four years, until killed, and bore quite a number of oranges. When the fruit was ripe, being too few to sell, we ate them, and nearly all had seed, some oranges having as many as three, though it is well known that the fruit from low-grafted trees is practically

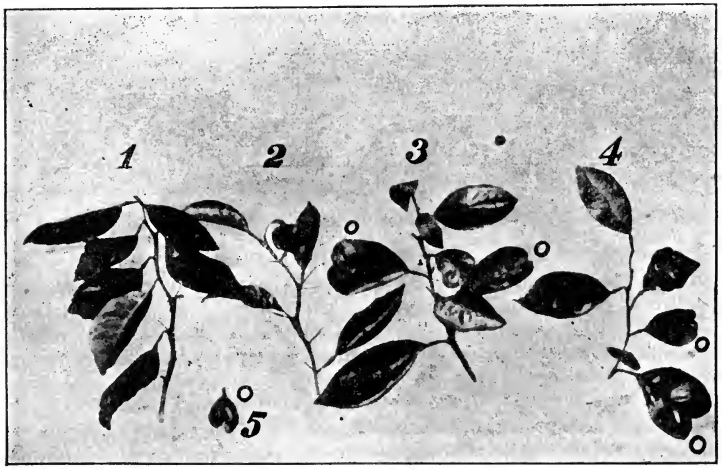
seedless. Here, then, was a decided change and influence of the stock on the Satsuma, both in hardiness and the putting of seed into the fruit, where few were ever seen before. While I had paid no attention to this subject, these facts suggested the probability of obtaining a genuine hybrid thus, so some of the seeds were saved and planted. When they were up a foot or so high, I had a visit from a scientific and prominent fruit grower of Texas, and on taking him, with great pride, to see my pets, and explaining the facts, he laughed heartily at my enthusiasm, and said the whole idea of their being hybrids was absurd. I then pointed out, that while all were plainly sweet oranges, from the peculiarities of the leaves, yet nearly all were more or less thorny, some as much so as the Trifoliata, while the Satsuma has no thorns at all. Moreover, a sign of the Trifoliata leaf was plainly visible on several trees. But all to no purpose; and in answer to my direct question, What sort of fruit I would get, he replied confidently, "Satsuma." Having sold my place shortly after, these seedlings were moved, and last year stood a temperature of ten degrees, all other sweet orange trees being killed, and I feel confident, unless the trees happened to be in a peculiarly dormant condition, that they will prove hardy here, and perhaps over the whole lower part of Texas, showing plainly that they are true hybrids of the Satsuma and the entirely hardy Trifoliata. Just what the fruit will be, of course, nothing can be known yet, but there is no reason why some of the oranges will not be sweet. Of course, if they are, and they continue to prove hardy, it will work a revolution in orange growing; for by the same method hybrids can be obtained between any of the finer and larger sweet oranges and the Trifoliata, and thus many new and hardy varieties can be grown with perfect success all through the Gulf States generally; and by repeated crosses on Trifoliata the hardiness in the end can be increased, until varieties may be originated that will stand the climate even of the whole South.

The accompanying illustrations (see page 163) will demonstrate the truth of all I claim. The first shows a branch of

the thorny and very seedy Trifoliata stock, on which, two feet above the ground, was budded the thornless and seedless Satsuma, shown alongside. The result was to put seed into the fruit of nearly every Satsuma orange, as well as to increase the hardiness of that variety, thus top-budded. The seeds, when planted, produced apparently sweet orange trees, as far as can be judged from the leaves. While some of the twenty-seven trees are entirely thornless like the Satsuma, others have thorns of varying lengths, from very short to very long, as shown in the second illustration (which is a photograph of four shoots from among the twenty-seven seedlings); and one tree, No. 1, actually intermits its thorns, just as grape vines do their tendrils, there being three intermissions, as shown at the bottom, middle and top, and two thorns between. Moreover, those twenty-seven seedlings have stood a temperature without injury of ten degrees, a degree of cold that no common orange has ever survived. I wish to call particular attention to the leaves designated with a ring, showing plain markings, in their round and split ends, of the Trifoliata leaf, and especially to the small leaf of the hybrid marked 5, which is identical in shape with a part of a leaf of the Trifoliata also marked 5.

Of course, the most interesting and conclusive part of this experiment has yet to come, in the shape of the fruit. Whether some of these seedlings will take after one parent and some the other, or whether all will be moderately sour and require another cross, for instance with the seedless Navel, is an important question. But, applying this principle to all other kinds of fruits, why may it not be equally true also? I now have experiments under way to find out whether any fruit tree put upon its own roots, like the Trifoliata, by the method of Japan or saddle grafting, shown elsewhere, and then cutting away the stock after the cion has struck root on itself, will not reproduce itself to a great extent from seed at first, and perfectly in a few years, when planted apart from other trees of the same species. How far the principle of heredity will affect the fruit, or how long, remains to be seen. I think we may reasonably conclude that an Elberta peach,





BRANCHES FROM FOUR OF TWENTY-SEVEN HYBRID SEEDLINGS. SEE PAGES 160-162.

for instance, on its own roots as a stock, and top-budded with another valuable variety, will give better fruit from the seed than if that variety had been grown on an inferior seedling stock.

This opens a new and wide field for experiment and improvement, especially of our earlier varieties, on the point of size. Of course, experiments must be conducted at a reasonable distance from the pollen of other trees, or selected branches protected from foreign pollination, when a true hybrid is desired. If this principle of graft and bud hybridism be true, and the facts point strongly that way, it will afford for the ordinary fruit-grower an easy and certain method of experimenting with all kinds of fruit, and will add greatly to his interest in horticulture, as well as result in new and improved varieties. My efforts are now being directed not only toward originating hardy sweet oranges, but also larger and finer peaches than will now bear well this far South. With that view I have now growing for stock, on their own roots, the Elberta, Mamie Ross, Sneed and Triumph, none of which are productive here, and have top-budded them with Waldo, Angel and Imperial, all of the oriental type, and exceedingly productive and of excellent quality, though the fruit is almost too small for market. As the latter bloom long before the former Persian varieties, it has been impossible heretofore to cross them by the pollen. The same difficulty lies with the Trifoliata and common sweet oranges, the latter all blooming first. I herewith append a statement from Mr. E. P. Stiles, editor of the *Horticultural Gleaner*, published at Austin, which bears on this subject:

Dear Sir—I have a very fine seedling peach, which I have been fruiting for many years, using until lately common seedlings indiscriminately for stocks. I have noticed a very great variation in the conduct of this peach on different stocks, both in vigor and productiveness, as well as size and appearance of the fruit. By chance I propagated several trees on Mountain Rose seedlings, and found them so superior on that stock that I am now using it exclusively, and find that it continues to maintain its superiority. This difference in the fruit is not due to any local causes, tests having been made to determine that point. Referring to the subject of graft hybrids, on which you are experimenting, I must say that I can see no reason

why the Mountain Rose should not affect the seed of my peach as well as other points. Truly, E. P. STILES.

I will now conclude this subject with a short letter from Prof. W. F. Massey, of the North Carolina Experiment Station, to whom I sent leaves and copies of the accompanying photographs (see page 163), with the simple statement that the four branches were from trees grown from Satsuma oranges, and that I believed they were hybrids of that orange and the Trifoliata. Wishing him to be totally unbiassed in his judgment, I did not state just how they were grown, and asked his opinion on the bare facts. I knew that he had been experimenting with both of these oranges, and felt sure that he would give me a clear and impartial opinion, which he did, and which goes far to confirm me in my own view:

N. C. AGRICULTURAL EXPERIMENT STATION,
Horticultural Division, RALEIGH, N. C., *June 9, 1896.*
W. F. Massey, Horticulturist.

H. M. STRINGFELLOW, *Galveston, Texas:*

Dear Sir—Yours of the 2d came to hand in due time, and would have had earlier attention but for the press of work just at commencement time. I am now much interested in the cross-bred plants, and believe you have a hybrid, or more than one. Will be glad to test them for you here. Yours truly,

W. F. MASSEY.

CHAPTER XVIII.

Dwarfing Trees on Their Own Roots.

AND now, a few suggestions on the dwarfing of trees on their own roots, after the Japanese method, whereby those people were able to exhibit forest trees at the World's Fair over two hundred years old and only two and three feet high. The principle of the whole process is just what Charles Downing says would be "ideal transplanting," namely, to move with roots entire. Doubtless they do this repeatedly, leaving all the tops on; also withholding food and water except enough to keep the tree fairly alive until completely dwarfed; then from generation to generation planting the seed of the dwarfed tree, whatever it may be. Such trees are doubtless the result of many hundreds of years of selection and propagation, handed down as heirlooms. But at the same time it is almost incredible how completely even a vigorous tree like the cottonwood may be dwarfed by a single transplanting with very long roots. To illustrate, I will state that fourteen years ago, when I moved to Hitchcock and planted my orchard, I had such confidence in its success that, wishing to break the force of the strong south winds and keep the fruit from being blown off, I planted a row of cottonwood cuttings along the south and long side. About six inches of soil from a shallow ditch was thrown up under the lower wire of the fence, and cuttings planted forty feet apart in the loose soil, the lower ends resting on the unbroken top soil below. My intention was to alternate with sycamore between, but this was never done. Now the limbs of most of them are lapping between, and they tower fully seventy-five feet or more in the air, and several of them are two feet in diameter two feet above ground. This applies generally to all but two. One is about one foot in diameter and thirty-five to forty feet high, and the other about six inches and twenty-

five feet high. Being alongside of the road, the whole row has been kept perfectly clean on one side all the time, and half the row, including the two latter, have had constant clean culture on both sides, being in the center of an avenue. None have ever been plowed. The two smaller trees, moreover, have had annual dressings of cotton-seed meal and ashes to make them grow, and the smallest has had several dressings of thirty pounds of the meal. Now, if I had not posted my readers half-way already, I would wager that not one could tell the reason of this wonderful disparity in size. Perhaps they will not believe me when I tell them, but it was simply a case of too much root. The first year those two cuttings failed to grow and, as the others had all done well, I concluded to plant two extra fine trees in extra fine style, and make them keep up with the procession. So I went over to Lamarque, where some young trees were growing, and, selecting two, cut back the bodies, that were two and one-half to three inches in diameter, to six feet, and proceeded to dig. Like most people now, I had unlimited faith in the efficacy of long roots, and started the first at six feet from the tree. We all worked manfully spading out the soil, to preserve every root that was possible, and we finally got that tree out in fine shape, leaving a twelve-foot hole and the bottom well watered with sweat. This is now the smaller of the two. But, finding the job more than we bargained for, we compromised on a three-foot root system for the other, and soon had it out also. I forgot to say that the trees had both been transplanted once before, and had what I thought was a most beautiful lot of roots. Well, on reaching home, being all tired out and not wishing to slight the work, the replanting was put of until the next day, when we went at it afresh, and at last finished just the nicest transplanting job ever done, the holes being nearly two feet deep, top soil thrown to one side, carefully beat up and pulverized before filling in to one foot, then more fine soil hauled and worked in carefully among the roots, after the most approved fashion now laid down in all the books. The work at last completed, I called my wife to see what a beautiful job we had made, with the

nice clean stems as straight as an arrow. While I had no fear of their not keeping ahead of the balance of the row, about four feet high and as large as my thumb, still, when I came to fertilize all, I gave these two a double dose of cotton-seed meal. Well, to cut the story short, in spite of all I could do in the way of annual fertilizing and absolutely clean culture, from that time until a year ago, when my health failed from overwork and I sold the place, the figures given above tell the tale of too much root. The tree that had six feet of root is half the size of the one that had three, and the latter is less than half the size of the balance of the row that had no roots at all. But both of the smaller trees are of nice shape, perfectly healthy, and the smallest a real beauty, and from it I took the hint as to how the Japanese worked the dwarfing trick. Those who wish to try it might start with, say, a live oak acorn or other tree seed in a small pot of sand or poor soil. At the end of the season shift to a size or two larger, shaking off all the soil and leaving on all the roots and top. This alone would dwarf it greatly, but if repeated the second year much more so. How often this transplanting with roots and tops entire would be necessary experience alone could demonstrate. Now the question is, could this be utilized for dwarfing apples, pears, cherries, etc., in small areas where desirable, and the trees maintain their health? Judging from the health of the small cotton-wood described above, I believe it could, providing the trees were never pruned when at rest, and the roots never disturbed. Any two or three-year apple or other tree can certainly be permanently dwarfed by a single transplanting, if taken up with several feet of root and reset with a large part of the top, taking care to spread the roots out laterally, as directed in the books.

CHAPTER XIX.

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 necessairly 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 XX.

Wrapping Fruit.

WHILE nobody claims that either Le Conte, Kieffer, or Garber, the only successful pears here, are as good in quality as some of the old varieties, still, if properly ripened, they are excellent eating, and both Prof. Bailey, of Cornell, and the editor of *The Rural New-Yorker* (the latter the Kieffer's long-time enemy) pronounced specimens of Kieffer I sent them a few years ago as almost equal to any pear. There is no question that after a crop or two of Le Conte have been taken off, and the potash of the soil somewhat exhausted, that the fruit is liable to rot more quickly at the core, and also to deteriorate in quality, as well as hang on less tenaciously. I have noticed these points particularly. But the most important observation from experience is, that if taken off just before or when full grown, and packed in quite tight boxes or barrels, the quality of the fruit is greatly improved. If, however, it is picked at that stage before fully developed, and exposed to the air or wrapped in paper, the fruit not only shrivels in a few days, but that wrapped in paper will become quite tasteless. It is certain that besides losing quality, as noted elsewhere, from the trees not being allowed to form genuine surface roots, the California fruits shipped east are also greatly damaged in their eating qualities by being picked immature and wrapped in paper. When perfectly ripe such effects do not follow. But fruit at all green, or only partially ripe, as most of their fruit has to be picked to stand shipment, certainly loses flavor by the wrapping. I learned this very important point at a cost of nearly one hundred dollars for paper, that was bought at the urgent solicitation of my commission merchant in Chicago, who insisted that he could get twice as much for wrapped pears as for the plain. So I

bought the paper, when about to ship the first car load of that phenomenal nine thousand bushel crop, and we wrapped all but about fifty boxes, which were left unwrapped to test the quality, as the fruit was not fully mature. On arrival, and after ripening, he tasted the wrapped and those not, and at once telegraphed me to wrap no more. He explained by letter that the wrapped fruit had not only shrivelled slightly, the dry paper having absorbed the moisture from the immature fruit, but was also quite insipid, while that in the fifty boxes not wrapped was of excellent quality. The Kieffer is also positively damaged in quality by wrapping if not perfectly mature. There seems to be something in a confined atmosphere that greatly improves the quality of both apples and pears. We can all remember of making, when boys, apple "dens," or holes in the ground, where, buried in soil or straw, apples would keep for months, often, and come out with a most delicious flavor. In fact, I never in my life ate apples that tasted like those from an apple "den." The same holds good of Kieffer pears. For years this fruit was abused for its poor quality and hard and tasteless flesh, by those who knew not how to ripen it, and still is abused by some ignorant people, though it can be ripened up to almost equal Anjou or the best of the older winter varieties. When the Kieffer was awarded a very high premium at the Centennial of 1876, I read an account of it and its delicious flavor as described by Thomas Meehan, of Germantown, who was a neighbor of old Peter Kieffer, and had often eaten the fruit as ripened by the old originator. Mr. Meehan went so far as to say that he felt, after eating one of old man Kieffer's pears, like never eating any other pear again, for fear of losing the recollection of its delicious flavor. It was that extravagent statement that induced me to plant the Kieffer in 1883, and when it came into bearing, like everybody else who tries to ripen it exposed to the air or on shelves, it proved to be a great disappointment. By a mere accident I hit upon what I am sure must have been old Peter's method, yet, strange to say, he died without telling any body of it, though he lived long enough to hear its quality condemned. When

once shipping a lot of fruit in October, by oversight a close bushel box was left nailed up under a bench in the packing house, and there remained several weeks before being discovered. On opening, the fruit was found to be a beautiful yellow and of delicious quality, showing that confinement in its own atmosphere was the secret of making it a most excellent table fruit. After that I had no more trouble about the quality of Kieffer pears, an experience that has since been verified by hundreds of others. As the best methods for handling and shipping fruits are well known, it is useless for me to more than call attention to the absolute necessity for spring wagons, even where fruit for distant shipment is only to be hauled a few hundred yards. Especially are all berries liable to be jolted and bruised by a springless vehicle in a very short haul, and the slightest bruise means quick decay. While it is very doubtful that much ventilation of strawberries in cool weather, such as we ship in, is a benefit, there is no question that all vegetables that are at all liable to heat should have plenty of air, nor should vegetables or fruits for long shipment ever be washed or wet, especially strawberries. For the early February and March crop of the latter it is a serious question whether a practically tight package would not be best for them. In distant shipments evaporation is very great, and the upper tier of boxes, on opening the crate, always shows a shriveling of the berries and loss of gloss. The second tier, which is practically tight, shows up bright and firm. This, however, applies only to ventilated or refrigerator cars. When shipped far, in a heated express car, air would be an absolute necessity.

CHAPTER XXI.

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 lives 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 Scuppermong 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 XXII.

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.

I would call attention, in the following interesting article, to a prophecy as to the South, which will hold equally good for all sections, wherein this eminent horticulturist takes the same views expressed in this volume: "And in less than a

quarter of a century you will find large droves of hogs in orchards sodded with Kentucky blue grass."

M. B. HILLIARD in *Southern States.*]

A large apple orchard is something very rare in the far South, at least within the zone of my observations. Of course, my area of observation did not cover the entire South, and I have not been much of a traveler for the past fifteen years; but, while there is a tendency to enlarge, or, rather, to begin apple raising, it is a very recent thing, very limited in its belt, and mostly confined to the summer varieties.

There is a good deal of reason for the insignificance of apple raising South. The fruit raising furore communicated to the South through the small fruits and plums principally. The last two varieties bear earlier than the apple and outsell it. The small fruits pay well, yield well, and bear at once, so to speak. Then the apple of the South (the early varieties) finds all sorts of competition from the other fruits and from southern and eastern peaches and small fruits—New Jersey, Delaware, Michigan; raspberries, strawberries, blackberries and peaches from Delaware to a long way South. For the winter apples of the South there is found such a competitor in the whole apple belt of this continent that the South may be said, at this time to be not "in it," as to raising winter apples, at all.

Another reason why the South is in the business of raising winter (or fall) varieties of apples in the small way now marking the condition of affairs, is that the favorite varieties of northern apples will not succeed South, except with few exceptions. The writer well remembers how, when a young man, he saw the delicious and superb winter apples (that succeed so well in New York, New England and Michigan) on exhibition at an agricultural fair in Dover, Del. The agent sold trees at a great pace, no doubt. But none of the apples succeeded in Delaware; such choice varieties as Baldwin, Spitzenberg, Rhode Island Greening, Seek-no-Further and others. The above experiment in Delaware is a type of what the South has experienced with regard to winter apples, introduced from the North, that have failed South. The tree pedlar, with his highly-colored plates, his smooth tongue, and his shameless deception, for all these years has talked the South into buying varieties of apples that are failures South. If these northern nurserymen would propagate varieties of apples that would succeed South, and sell them here, there would not be so much ground for criticism. But their present plan is as much a fraud as it would be for southern nurserymen to go North and East and sell to horticulturists there varieties of the fig or orange, by assuring purchasers that these were hardy and would succeed there. If the northern horticulturists are less gullible than those South, that does not alter the principle.

Then, undoubtedly, this prevalent disfavor of the winter apple South interferes much with an acquisition or attempt at production of new varieties. If a person South should discover a new very early peach, that carried well and was fine in size and color, it would be a fortune to him. The same principle would apply to a new

strawberry, in large measure also to a cherry. But to find a new and great variety of winter apple would be worth nothing, because there would be no demand for it; as witness the amazing inconsideration with which the South treated the Shannon apple, that wonder of Arkansas, which took the premium over all competitors at the Cotton Centennial here in New Orleans, 1884–85. I remember well with what exultation I hailed the victory, and said: "Now, we shall have a new era in apples. We shall soon see the Shannon on sale here in New Orleans, and measurably disuse this wretched but popular Ben Davis, and such." And yet I don't suppose you could find a barrel of Shannons on sale anywhere in any city of the South; and I doubt if one southern nurseryman in a hundred propagates it, or if he does, sells any but the fewest number of the trees. And another illustration of the comparative disregard is the Johnson, a seedling originating in Mississippi, with which Dr. H. E. McKay, of Madison Station, Miss. (the Strawberry King, as he is designated), took the premium as the best new fall apple at the same great exposition just mentioned, where the Shannon took its premium. Had two such apples been discovered North or West, the whole horticultural world would have been agog, and millions of trees would have been sold in a very few years. I remember, in Delaware, we horticulturists thought we were getting the Hale's Early peach very cheap at one dollar a tree, one year old. Look, too, at the Idaho pear, discovered a few years ago, and its price.

I have mentioned the Shannon and Johnson apples only by way of illustration. Doubtless there are many others very good. I would undertake to find on the southern branch of the Illinois Central Railroad, in Mississippi and Tennesse, and in Northwest Louisiana, at least half a dozen new varieties of fall and winter apples—seedlings that constitute great accessions to the really large list of these apples that are hardly known to anyone, unpropagated and unappreciated; I hardly ever fail to discover something new in any trip I make, because I keep my eyes open. Only a few years ago I discovered two seedling pears in Louisiana, both fine, one of which, if propagated, would be the greatest accession to the varieties of that fruit within the last twenty-five years. But I was not situated to push it, and did not care to "give it away." Why the Secretary of Agriculture does not see his way clear to put some one in the field to discover new varieties of fruit South is a mystery. Not but that something has been done, but there is such a broad, rich field totally unexplored. The South, for illustration, among her most foreknowing horticulturists, is yearning to propagate the cherry. And I have been hunting it for twenty-five years, and have found much which I hope to give to the readers of the *Southern States*. But why should this be left in such a disregarded condition?

Undoubtedly the South at large could add scores, if not hundreds, of varieties of choice fall and winter apples to the list in propagation, if there were a demand. The question is, Will there ever be a demand? or, rather, the question is, Will the South ever meet the demand? For the South consumes really an immense quantity of

northern apples. They sell, generally, higher in the South than oranges. You can buy choice oranges at the fruit stands in New Orleans at twenty-five cents per dozen, when you must pay fifty or sixty cents for a like number of choice Newtown Pippins, Bellflower, or Maiden's Blush. And even the Ben Davis, here as everywhere the popular variety, outsells choice oranges.

The winter apple, North and West, is a staple; and I have observed that in Illinois lands where the apple was successful, and the farms contained good apple orchards, sold for far more money than ordinary farming lands. The home consumption of the fruit, the demand for export to Europe, and the southern demand, make the business profitable, and many new orchards are being planted.

But the South has so many new things pressing her attention for adoption, that raising winter apples has never come home to the consideration of her horticulturists. We buy northern vinegar made of chemicals; northern pickles preserved in it. We have been buying our pork packed from hogs raised largely in their orchards; we buy their cider and champagne cider, and we buy their apples. But it is quite certain that the immense number of northern and western emigrants who are moving from their homes to various places South will not be content to go without apples, when they find they can raise as good here as in their old homes, and even better, as to many varieties. And in less than a quarter of a century you will find large droves of hogs in orchards sodded with Kentucky blue grass; the orchards the planting of these northern and western emigrants. And there will be plenty of home-made apple cider and home-made cider vinegar, and pickle factories and "apple butter" will abound, and the ever-present and dyspeptic pie. And, like as not, Newtown Pippins will be going from Charlestown, S. C., and Savannah, Ga., to Europe, and the first or early ripe to New York, Boston, Philadelphia and Chicago; for I firmly believe that not only Piedmont, Va., but the mountains of North and South Carolina, Georgia, East Tennessee and Alabama can raise that celebrated apple. It is a very shrewd bit of advertising to call it the Albemarle Pippin in Virginia, and thus commend it to the world as peculiar in merit in that locality. Georgia is well playing the same game with the Elberta peach, and Crystal Springs, Miss., with her tomatoes, as North Carolina had her "golden belt" for her bright tobacco, and New Jersey, fifty years ago, for her peaches, and Herkimer county, N. Y., for her cheese, and Orange county, N. Y., for her "Goshen" butter. And I am happy to know how the Albemarle Pippin was exempted by England from the tariff imposed on apples, by special act of Parliament, and admitted duty free on account of the superior excellence of that fruit.

I have been greatly impressed with the merits of Mr. James Blakey's article in the *Southern States* for August, 1894, on the "Fruit Industry of Piedmont, Virginia." It is particularly valuable in the information conveyed to the practical horticulturist, as to what varieties of apples are successful there. One of the most dispiriting effects of experimenting in fruit culture is in the losses in time and money of fruitless experiment.

Another point of the utmost import is that it demonstrates that there is a field for the southern apple, which is one of the aims of this article to show. I firmly believe that the first yield, or early part of the crop, of the southern apple may find in any year something of a market North and West, and in failure of the apple crop there a considerable market, and that all the time the South will furnish a market for southern raised fall and winter apples and largely supplant the apples of these seasons raised North and West, and now consumed so largely South. I have more than conjecture for this, because some years ago, while on a tour of investigation in the mountains of North and South Carolina, I found luscious home-raised apples selling everywhere, and, my impression is, to the almost (if not altogether) exclusion of northern apples.

As to summer apples South, one may say that almost everywhere the favorite northern varieties do well. Certainly as low as (if not below) latitude 31 degrees, except, perhaps, Western Texas. For some inexplicable reason, some varieties that do well in one locality seem not to do at all in other places where they might be expected to succeed. Thus you will find, for illustration, the Red Astrachan, Summer Queen, Early Harvest and Red June highly commended where the Yellow June or Early Strawberry are not.

In the year 1873, Dr. H. A. Swayse, D. Redmond and myself were sent as delegates from the Louisiana Fruit-Growers' Association to the quarter-centennial meeting of the American Pomological Society, held at Boston, Mass., in September. There we made a report of the fruits adapted to what we deemed the association or its territory. It is not necessary to inform the older horticulturists of the country who Messrs. Swayse and Redmond were. Suffice it to say that they were practical men, and had a national reputation. At that date we made this report as to apples: "We would recommend Early Harvest, Red Astrachan, Carolina Red June, Primate, Garretson's Early, Yellow June, Early Strawberry, Bevan, Golden Sweet, American Summer Pearmain, Rhodes' Orange, Bruce's Summer, Yellow Horse, Cane Creek Sweet, Bachelor, Taunton, Hoover, and Carter."

After years of investigation, over enlarged territory, I added to these a list in my book ("The New South," Manufacturer's Record, 1887,) the following list, found on page 281: "Summer—Striped June, Sweet Bough, Early Red Margaret, Hames, Carolina Watson, Family, Julian, Aromatic Cheese, Stanley's Seedling. Autumn—Bonum, Yopp's Favorite, Pennsylvania Cider, Tuscaloosa Seedling, Mamma, Philippi, Lawren's Greening, Carter's Blue, Buncombe, Junaluskee, Maverick Sweet, Yates, Ben Davis, Disharoon, Carolina Greening. Winter—Ferdinand, Cannon, Pearmain, Oconee Greening, Moultries, Nickajack, Hockett Sweet, Stevenson's Winter, Holly, Pryor's Red, Stansil, Shockley, Romanite, Santa, Limbertwig. Cider apples—Dean Crab, Hewes' Virginia Crab."

Last summer I spent quite a while on the southern branch of the Illinois Central Railroad, in the great fruit and vegetable centers of Crystal Springs, Terry, Madison, *et al.* There I got much informa-

tion and had many notes on the apple, which I unfortunately can not now find. I find allusions by Mr. J. W. Day, a large fruit-grower, to the Buckingham, a seedling brought by him from Anna, Ill.; a large, flat, red apple, yellow fleshed; also the Benoni (a summer variety, red striped), introduced by him, bearing at three years old from the bud. But of all the surprising information I got on apples was that from Doctor McKay, the "Strawberry King," already mentioned. He told me that the Russet family, in his latitude, Madison, Miss., succeeds better than in latitude 40, especially the Roxbury Russet. I confess to having been amazed at this, and it opens a field to the South that surely some very considerable number of apple raisers will occupy ere long. Possibly it may not be news to some southern apple raisers, but it will be to a great many. When it becomes known generally that the South can raise superb Newton Pippins and Roxbury Russets, one hardly knows what better can be said.

As to the Ben Davis in parts of Mississippi (likely elsewhere), such superb apples can be raised that the average Ben Davis bears no comparison with it. Here, too, is a field, and the people who plant large orchards of this variety will take time by the forelock and do a smart thing. It is the apple of great demand everywhere, and particularly South. It will be a good deal earlier here than North and West.

The Red Astrachan, South, is far superior to the fruit in any other location I have seen.

A very choice apple belt is in the clays of Northwest Louisiana. And part of Arkansas now is effectively advertised as "The Land of the Big Red Apple."

Of course, I have omitted a good many varieties of apples that are successful in many places South, and I have named varieties that may not succeed in a number of localities. I have aimed mainly to show that the South is naturally a fine apple country, and that there is a great future for it. The next quarter of a century will teem with revelations as to the production of this fruit in the South.

CHAPTER XXIII.

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 XXIV.

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 [illegible] 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 very general and entirely unexplained failure. 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 the past season 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 XXV.

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 XXVI.

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 whitewash 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 enongh 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 XXVII.

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

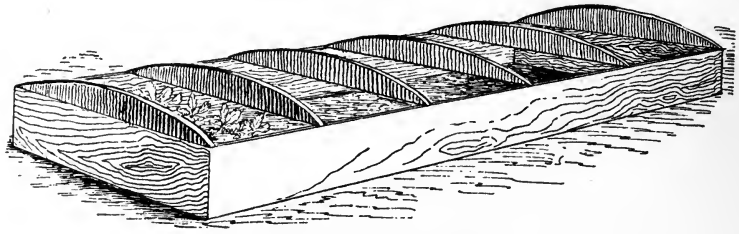
rule, and not the exception, at several points, which has resulted in giving this season's crop a depreciated value of from 25 to 50 per cent. lower than it would have brought had mulching been general. It is hard to understand why otherwise enterprising growers will persist, from year to year, in flooding 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 replanting 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, the present 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.

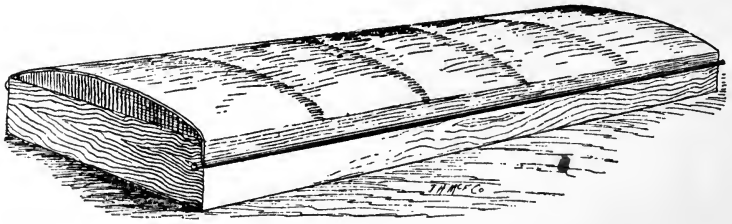
And now, I would urge all growers to make an experiment with the Michel, on a small scale, at least, under plank and oiled cloth covering. While this is an extra-large, early, and really good eating berry, when the weather becomes warm and dry it is not a long-distance shipper, and has the very serious 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 1 x 10 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 206), 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 XXVIII.

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 century, 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 strewed 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.

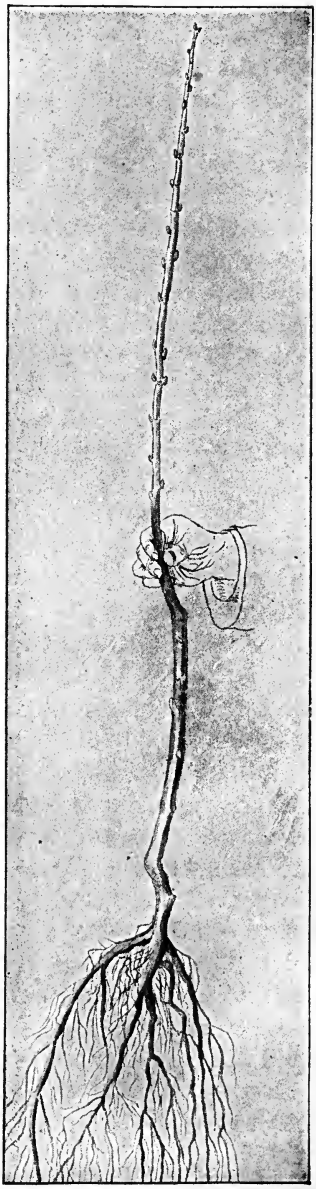
Presumably all the latter trees were seedlings, as people do not set two apple trees in a place as were those near the hen-house—or usually plant two near a stable. I leave these nuts for my long root, big hole, deep plowing, summer cultivating readers to crack.

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 212) 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 212), deep down to permanent moisture, and that its surface roots were left entirely undisturbed?

I earnestly invite a calm, unprejudiced consideration of the various facts and suggestions contained in this little book, which, though opposed to the current opinion sof the day, are founded on the bed-rock of nature's teachings. 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.

APPENDIX.

More Light from Experience.

SINCE the foregoing went to press I have had an opportunity of conversing with a friend of Mr. J. H. Hale who had just returned from a visit to Mr. Hale's famous close root-pruned Georgia peach orchard, which last (the third) year bore an enormous crop, and set as fine a one the present season. But the ever-watchful curculio was on hand, and, after the peaches that were stung had dropped or had been removed by hand and destroyed, the actual yield from one hundred thousand trees was only fifty-two car loads of fruit, or a half-bushel per tree at five hundred crates to the car. An orchard of eleven hundred acres near by, from which no affected fruit was destroyed, gave a return of only eighteen car loads. Mr. Hale waged a vigorous war from the start, going over his orchard repeatedly, picking up the fallen fruit, and taking from the trees that which showed signs of disease. He has also kept the entire orchard continually cultivated, with the determination to allow the curculio no food when they first hatch out, and thus, if possible, to exterminate them. But I fear this Napoleon of horticulture will meet his Waterloo in Georgia. Such absolutely clean culture will not only be enormously expensive, but actually impracticable in many seasons. Let a continued rainy spell of several weeks occur, and the grass will get too large to handle with the cultivator, and must be plowed; and nine hundred acres means a great deal of work and expense. How much more economical to put the whole down to sod, and pasture with sheep, or hogs with rings in their noses to prevent rooting, and thus save all labor except an occasional mowing of weeds. The animals would eat the fallen fruit, as well as keep the grass down, and Mr. Hale could raise mutton, wool or pork as well

as peaches, and much finer ones from those deeply rooted trees, with their surface roots undisturbed, than he will ever grow with all his expensive cultivation. In fact, no other kind of large commercial peach growing can now be made to pay. Even were spraying a complete success, the expense of it and of clean culture, with other outlays, and the frequent failures from frost, superinduced by the destruction of surface roots, thus weakening the vitality of the trees at the time of setting, will leave little or no profit. The only labor really necessary in a peach orchard, as outlined above, except gathering the fruit, would be that of shortening-in the ends of all shoots after the fruit was as large as marbles, if the trees were overloaded, and giving an annual free application of fertilizer when growth starts in the spring. I would here repeat that I know of peach trees from seed, now fourteen years old, in close mowed Bermuda sod, that are in perfect health, and bear annual crops of fine fruit, while cultivated trees of that age can nowhere be found here.

But while the curculio and the frost make the southern peach grower's life a burden, the northern grower is not without his troubles. I append an extract from the July 30th issue of *Cultivator and Country Gentleman:*

PEACHES IN DELAWARE.—The article reprinted by you July 23, p. 575, from a New York paper, in regard to "Delaware peaches," savors of an effort by interested parties to bear down the prices of that fruit. It is a fact that the winter and spring were favorable to the production of a good peach crop, and that the orchards set unusually full is also true; but that potent causes have intervened to curtail the early promise of a phenomenal yield is also true. In a large measure the "June drop" has decimated the crop, and much more than forstalled any necessity of thinning; and within the past six weeks the disease known as the "yellows" has invaded orchards heretofore exempt from its ravages, and curtailed the crop to the extent of one-quarter or one-third of what was promised. Heretofore the disease has been rather confined to the northern part of the state, where the production of peaches has become practically a nullity; but this season it has made gigantic strides southward, and the "center of the peach belt" is only the center of the region remaining comparatively unaffected by this plague. With the failure of the Jersey crop and that of the further north regions, there is no reason to believe there will be anywhere near enough to glut the market, and no reason for crying down prices. The question of peach raising on this peninsula is only a question as to whether the peach "yel-

lows" will ever be brought under control, and stamped out. If it is not, the industry is doomed—for orchards are being destroyed this year by its ravages as never before; and the yield, instead of being 9,000,000 baskets, will not be 50 per cent. of it.—L. M., *Kent Co., Del., July 24, 1896.*

Here we find the "yellows" and the "June drop" putting in their work on the long-rooted and cultivated trees. But did anybody ever hear of "yellows" or the "June drop" bothering seedling peach trees around the house, in the chicken yard, in the fence corners, or any place where the plow could not reach them? In fact, do not even the curculio give such trees the go-by? As to "yellows," deep preparation of the ground, making a boggy root-bed, surface-rooted trees, continual yearly or even more frequent cutting of the roots, winter or early spring pruning, fertilizing and plowing, resulting in a premature movement of the sap and subsequent freezing, will easily account for that disease. But it will disappear as soon as growers treat their trees rationally, just as pear and apple blight will. I have proved that blight is not contagious, and that healthy trees cannot be inoculated with it, and have no doubt that it will not only be equally impossible to communicate "yellows" that way to a close root-pruned peach tree in sod or firm ground, but that young trees already affected, if thus set and treated, and top-dressed freely with potash, will recover at once. Those, and doubtless all bacterial tree diseases, are the effect of wrong treatment, resulting in favorable conditions for their development, as shown in the chapters on blight.

THE END.