CULTURE OF THE GRAPE.

BY

W. C. STRONG.

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PREFACE.

WITHIN a few years, the cultivation of the Grape has become a subject of extraordinary interest in the United States. New varieties have been so multiplied, and the expectation is so strong that some of these will prove to be of superior value, that almost every landholder is induced to grow this favorite fruit. The success of its culture has indeed proved so encouraging, that multitudes are planting extensive vineyards in all parts of the country, both for the purpose of supplying our markets with an abundance of this fruit, unequalled in its health-giving qualities, and also for the more questionable purpose of wine-making.

Grape-growing is destined to become a vast interest in our land. Our soil and climate, though not adapted for the open-air culture of European varieties, yet encourage the most luxuriant growth of native kinds almost throughout the length and breadth of our vast domain. Bountiful Nature has done for us all that we can reasonably ask. The work left for us is to seek for good varieties, and give them generous culture. Difficulties there are and will be; yet these are such as ought to stimulate rather than discourage.

The general principles of grape-culture are well understood; and yet there are differences of opinion, different modes of pruning and training, which, however slight they may seem to be in themselves, become of great importance when applied to so vast an interest. It is with a desire to contribute my mite from my own experience that I have prepared this treatise. In order that the work may embrace the combined experience of practical and scientific minds, I have availed myself of such helps as were at hand, especially relying upon Prof. Harris for descriptions of injurious insects, and upon numerous writers in our horticultural Monthlies for practical suggestions.

In order that it may be a guide to the inexperienced, it has been my aim to give plain, simple, concise rules, not novel, but practical and approved.

Recent authors have done good service in this direction; yet it has appeared that further suggestions might be made. Especially is it hoped that the collected experience in regard to rot and mildew, and the modified methods of training, may prove to be of general value. In this hope, I submit the book to the public.

W. C. STRONG.

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CHAPTER I.

HISTORY AND CHARACTERISTICS OF THE VINE.

THE apple tempted our first parents to their fall. So also Noah's vineyard brought shame to himself, and a curse upon Ham; and untold evil has followed in the train. Yet we cherish these best gifts of Mother Earth, and acquit them of all complicity in guilt. The vine is indigenous to Asia, and, as we see in the case of Noah, was cultivated in the very infancy of our race. Mention of the vine is constantly made in the Bible. Canaan is called "a land of wheat and barley and vines." It is a well-authenticated fact, that the vines and the bunches of grapes in Palestine were of an almost incredible size; so that the description of the cluster cut at the Brook Eshcol, and borne "between two upon a staff," by the spies, is not at all improbable. Stephen Schultz relates, "At Beitdjin, a village near Ptolemais, we took our supper under a large vine, the stem of which was nearly a foot and a half in diameter, the height about thirty feet, and covered with its branches a hut more than fifty feet long and broad. The bunches of these grapes are so large, that they weigh from ten to twelve pounds; and the grapes may be compared to our plums." Foster, in his Hebrew Dictionary, under the word "Eshcol," says, "I knew at Nurnburg a monk of the name of Acacius, who had resided eight years in Palestine, and had also preached at Hebron, where he had seen bunches of grapes which were as much as two men could conveniently carry." Christopher Neitzschutz, who travelled through Palestine in the year 1634, speaking of his excursions on the Jewish mountains, says, "I can say with truth that I saw and ate of bunches of grapes which were each half an ell long, and the grapes two joints of a finger in length." These accounts are worthy of entire credence, and are indeed surpassed by the grapes of Damascus at the present day, which are often found to weigh twenty-five pounds to the bunch. According to Heutius, the vines in Crete and Chios afforded clusters of from ten to forty pounds weight each. A bunch of Syrian grapes, produced in a vinery at Welbeck in England, weighed nineteen pounds. It was sent as a present from the Duke of Portland to the Marquis of Rockingham, and conveyed a distance of twenty miles on a staff by four laborers, two of whom bore it in rotation.

That great attention was given to the culture of the vine in the earliest ages is evident from the fact that Homer and Herodotus make frequent mention of it, and that Theophrastus and Dioscorides treat of it in several chapters. Yet it was known to the Egyptians long before these times; representations of the careful culture of the vine, of the treading-out of the juice, and of the storing of the wine in jars, being all discovered in the paintings within their tombs. A still stronger implication is found in the dream of the chief butler, in Gen. xl. 9: "In my dream, behold, a vine was before me, and in the vine were three branches; and it was as though it budded, and her blossoms shot forth; and the clusters thereof brought forth ripe grapes. And Pharaoh's cup was in my hand; and I took the grapes and pressed them into Pharaoh's cup, and I gave the cup into Pharaoh's hand." Probably, however, the vine was not native to Egypt. The most ancient writers mention it as a native of the hilly region on the southern shore of the Caspian, in the Persian province of Ghilan. Strabo says, that "in the Margiana, a country south-west of the Caspian Sea, now called Ghilan, there are vines which two men can scarcely span, the bunches of which are of extraordinary length." Speechly, in his treatise on the vine, page 182, says, "Such another in Margina is spoken of by Strabo, that was twelve feet in circumference." Probably this is the estimated distance, by Speechly, which two men would be able to span. But it must be regarded as an over-estimate, as it is scarcely credible that a vine could be twelve feet in circumference. We know, however, that columns in Juno's temple at Metapont, and also a statue of Jupiter for the city of Apollonium, were made from the wood of the vine. The great doors of the cathedral at Ravenna are made of vine-planks, some of which are twelve feet long and fifteen inches broad.

The Hampton-Court vine is the most famous in England. It was planted in 1769, and now covers over twenty-two hundred square feet; having a stem thirty inches in circumference at three feet from the ground, and bearing an annual crop of about a ton of Black Hamburg grapes. It has produced twenty-five hundred large bunches in a single season; but the crop is not as large as formerly. The main cane is a hundred and twenty feet long, and covers the entire roof of the houses, which is seventy feet long and thirty feet wide.

In this country, until recently, the largest vine was supposed to be at Burlington, N.J. Two feet from the ground, it measured, in 1858, six feet two and a half inches in girth: four feet high, it is about six inches less. On pacing the circumference covered by the branches, it was found to exceed a hundred feet. It has never borne a grape in the memory of a lady now ninety-eight years old, to whom it was a wonder in her youth. In the "Horticulturist," vol. i. p. 530, it is described as standing on a farm called West Hill, two miles from Burlington, and measuring six feet one inch round the trunk at three feet from the ground, and at ten feet high it is three feet in circumference. "Its giant folds run over and cover four trees, one of which is a full-sized oak, and the others are quite large." But it was reserved for our Golden State to eclipse the world in natural products. The "Alta Californian" thus describes it: "At Monticito, four miles from Santa Barbara, there is a grape-vine, probably the largest in the world. Its dimensions and yield would be incredible, were it not that my informant is a man of veracity, and speaks from personal observation. It is a single vine, the main stock being ten feet in circumference. It is trained upon a trellis sixty feet in diameter. My informant, with another person, counted seven thousand bunches; and the estimated yield was eighteen thousand pounds of fruit. Can this be beaten?"

It is difficult to estimate the longevity of the vine, the yearly growth not being distinctly marked, as is the case with many trees. That it, however, attains a great age, is beyond question. Pliny names a vine which was six hundred years old. The vines of Italy bear fruit for three hundred years, and vines a hundred years of age are accounted young. Professor Bosc states that there are vines in Burgundy upwards of four hundred years old. Doubtless there are vines of much greater age, were we able to ascertain the fact. At least, it is evident that the vine, under favorable circumstances, may be regarded as "a permanent institution."

It is surprising under what variety of conditions the vine exists. The instances of size which are cited above indicate that the vine aspires to overtop the mightiest monarchs of the forest, and overspreads a surface of even two hundred feet in circumference. In contrast, the vines in the most famous vineyards of France and the Rhine are the merest bushes,—only from two to three feet in height. By nature, it is evident the vine is a great rambler. We are to study this nature, and control it to our greatest advantage.

The paramount object in the culture of the grape has been the obtaining of wine. This has been, and will continue to be, more especially true of some countries than of others. The extent of this manufacture will be surprising, and almost incredible, to those who are unacquainted with the statistics. The following table, extracted from a recent work by Gustave Rawald, and reduced to Federal currency by A. Haraszthy, gives some idea of the immense value of this interest:—

AVERAGE WINE PRODUCTION OF EUROPE.

	Acres.	Gallons.	Gal. pr Acre.
Austria	2,685,950	714,000,000	$265\frac{5}{6}$
Greece and islands	41,781	8,160,000	$195\frac{3}{10}$
Ionian Islands (for raisins over 42,000,000 lbs.)	35,812	1,224,000	$34\frac{1}{6}$
Italy	2,887,970	1,275,000,000	$441\frac{1}{2}$
Switzerland and Belgium	76,490	2,550,000	$33\frac{3}{8}$
France	5,013,774	884,000,000	$176\frac{2}{7}$
Spain	955,004	144,500,000	$151\frac{7}{10}$
Portugal	238,751	25,500,000	$106\frac{8}{10}$
Germany	350,338	52,105,000	$148\frac{72}{100}$
Total	12,285,780	3,107,039,000	250

In round figures, the aggregate number of acres in cultivation in Europe for the production of wine is twelve millions. The number of gallons produced is three billions.

The value, at an average price to the producer of twenty-five cents per gallon, would give the enormous sum of $776,759,750. But this estimate of twenty-five cents per gallon is really applicable only to the common wines, which, it is true, are produced in much larger quantity than the choice brands. Though the table indicates great inequality in the number of gallons produced per acre, yet the actual profit on each acre may not be so unequal. For example, Italy is put down in the table as averaging four hundred and forty-one gallons per acre. This must be very light wine, commanding a low price; probably less than twenty-five cents to the producer. On the other hand, the Swiss wines of the Rhine, produced at an average of thirty-three and three-eighths gallons per acre, will probably yield a larger revenue than the same amount of land in Italy. In the examination of a list of sales by auction at Eberach, of wine in barrels, of the vintages of 1857–8 and 9, of which Mumm and other celebrated dealers were purchasers, I find that but little was sold under two dollars per gallon, while the average was between three and four dollars;

some lots running up to ten dollars, and one lot of a hundred and twenty-five gallons being struck off to the King of Hanover at twenty dollars per gallon. It should be borne in mind that this is the vintner's price before bottling, and previous to any impost duty or trade profit.

As a general rule, the quality of the wine is found to be in inverse ratio to the quantity produced. Hence, if we take the average product of European vineyards to be two hundred and fifty gallons per acre, and if we estimate the average price to be twenty-five cents per gallon, we have, as a result, a yield of sixty-two dollars and fifty cents per acre. This is probably not far from a correct estimate. It will be seen that the Rhine acre, with its low product of thirty-three and three-eighths gallons, considering the high price of its wines, will yield a much larger result than the average.

In regard to the value of lands in Europe suitable for wine-making, only a very general estimate can be made. In the Burgundy wine-district, clear lands for planting rent at the low rate of about ten dollars per acre per annum for a term of twenty to thirty years. Planted lands rent for about twice this sum. The fee of first-class vineyards is held quite out of proportion to the rental, varying from three to five thousand dollars per acre.

Even common second-class vineyards are worth fifteen hundred dollars per acre and upwards. This dispropor tion between the price of the fee and the rental seems strange to an American, but is, to some extent, accounted for by the hereditary dislike to sell real estate, and also by the low rate of interest prevailing in Europe. The following are the prices for which some of the celebrated vineyards of the Bordeaux district have been sold, estimating the franc at twenty cents:—

Château Margaux (200 acres) sold in 1804 for $130,200, equal to $651 per acre. The same was resold in 1836 for $260,000, or $1,300 per acre; an advance of 100 per cent in thirty-two years.

Gruaud-Larosse (127 acres) sold in in 1814 for $70,000, about $551 per acre.

Langon, St. Julien (100 acres), sold in 1851 for $130,000, or $1,300 per acre.

Mouton (62 acres) sold to M. Rothschild in 1853 for $225,000, or $3,629 per acre.

Château d'Issan (107 acres) was adjudged to the heirs of the Blanchy estate in 1859 at $95,000, or $887.85 per acre.

On the Rhine, the choicest sites are held by wealthy proprietors, and are not for sale at any price. Most of the lots are small, containing from a quarter of an acre to an acre each: though the celebrated Steinberg, belonging to the Duke of Nassau, contains about a hundred acres; and the Johannisberg, belonging to Prince Metternich, contains about sixty acres. In this section of the Rhine, there has been no instance of a sale for many years. In case a division takes place among heirs, and the vineyard is too small to divide, it is appraised at eight thousand dollars the morgen, which is somewhat less than an acre; and the retainer pays a due proportion to each of the heirs. It will be observed that the above prices are for lands in the most famous districts. It should also be remembered that the percentage of income on these investments, though it may content a European, would be far from satisfactory to an American. Indeed, it will be found that the European methods and estimates will all require essential modification *when applied to this country.*

The first attempts to cultivate the vine in the United States were confined to the European varieties. The London Company planted vineyards in Virginia prior to the year 1620, and with such encouraging prospects, that they imported several *vignerons* from France in the year 1630. Many succeeding attempts were made by Penn, and by French, Swiss, and German settlers; but, having depended upon foreign varieties, their efforts have invariably proved unsuccessful. We are indebted to Mr. John Adlum for the first really successful efforts, and for laying a sure foundation for future success. In the early part of this century, Major Adlum planted a vineyard near Georgetown, D.C., consisting principally of native kinds. We shall all agree with him that his obtaining and introducing the Catawba variety into general cultivation was a new era in our grape history. Major Adlum states that he procured it from Mrs. Schell, at Clarksburg, Md., and that it was called Catawba by Mr. Schell; but the family knew not whence he procured it. It is said that one exactly similar was found growing wild in Pennsylvania about this time.

Major Adlum soon discovered the merits of this variety, and pronounced it "the very best wine-grape in the United States;" which opinion has certainly been sustained up to the time of the introduction of the Delaware variety, and is still maintained by many vintners up to this date. The Catawba has been planted far more extensively than all other varieties put together, for the exclusive purpose of wine-making. In a letter subsequently written by Major Adlum to N. Longworth, he remarks, "In bringing this grape into public notice, I have rendered my country a greater service than I would have done had I paid the national debt."

Since its first introduction, grape-culture has gradually increased, both for the purposes of fruit and for wine-making. In some States, the last has already become an important interest. Dr. Mosher reports the number of acres devoted to vineyards in the year 1852, within a circle of twenty miles diameter around Cincinnati, O., to be twelve hundred. Of this, the late Nicholas Longworth owned a hundred and twenty-two and a half acres. The annual product of these twelve hundred acres is estimated to be two hundred and forty thousand gallons of wine, or an average of two hundred gallons per acre. Since that time, the interest in the grape has become general throughout the country, and the extent of culture has vastly increased.

But it seems to be reserved to our Golden State to eclipse the world in the products of the vine, as well as in other products of the field, the forest, and the mine. In no country does the grape require so little care, and have such entire exemption from disease, and at the same time yield such large and certain returns. The peculiar grape region is said to extend from the southern boundary to a distance of six hundred miles north, with an average breadth of about a hundred miles. In this region, the amount of rain-fall is surprisingly small, — the annual amount at Los Angeles being less than ten inches; and, of this, eight-tenths fall during the winter and spring months. In a work upon "The Resources of California," Mr. Hittel, the author, says, —

"The soil of the vineyards at Los Angeles and Anaheim is a deep, light, warm sand. To the inexperienced eye, it looks as though it were too poor to produce any valuable vegetable growth. In Sonoma and Napa Valleys the vineyards are planted in a red, gravelly clay, near the foot of the mountains, or in a light, sandy loam, in the centre of the valley. Of late, the vine-growers of these valleys have done without irrigation. In Santa Clara Valley, most of the vines have been placed in a rich, black loam; but their vineyards are unhealthy. The Sacramento vines are planted in sandy loam; those of the Sierra Nevada, in sandy loam or in gravelly clay."

It is worthy of consideration, as exhibiting the nature of rot and mildew, that while California is remarkably exempt from these diseases on account of its dry climate, yet "in Santa Clara, Sonoma, and Alameda Counties, where the vines are planted in a wet, black loam, or stiff clay," both of these diseases make their appearance. The statistics of the enterprise of the vineyardists of that State are unparalleled in the history of the grape. In 1861, we have an account, published in "The Horticulturist," of the vineyard of William Wolfskill, containing fifty-five acres, and ninety thousand vines in bearing, yielding seven hundred thousand pounds of grapes annually, and producing fifty thousand gallons of wine. In "The United-States Agricultural Report" for 1862, the estimated number of vines in California in 1861 is placed at 10,592,688, of which Los Angeles County had 2,570,000, and Sonoma 1,701,661. Subsequent to this time, the number has vastly increased. Mr. Speaker Colfax reports, that, during his travels in this State in the summer of 1865, he found one vineyard which alone had upwards of a million of vines. With such rapid increase, the mind staggers in making estimates for the future.

CHAPTER II.

BOTANY AND HYBRIDIZATION OF THE GRAPE.

THE old Latin noun *vitis*, meaning "vine," derived from the verb *vieo*, "to bind with twigs," was adopted by Tounefort, and accepted by Linnæus, as the botanic name for the grape. Dr. Whittaker expresses the opinion that it is derived from the noun *vis*, signifying "strength." The grape belongs to the natural order Vitaceæ, and to the class Pentandria and order Monogynia of Linnæus. In the European species, the flowers are generally perfect; but in our native kinds the flowers are frequently imperfect, the stamens and pistils being separated in different flowers. In common language, the grape is divided into two classes, — the European and the American. These two classes are decidedly distinct; and yet there are varieties of each family which have so few of these distinctions, and approach so nearly to the characteristics of the other family, that it is sometimes difficult to determine to which class they belong. The European class, Vitis vinifera, is but a single species, from which have sprung all the different kinds which have been or now are cultivated in Europe, — probably exceeding two thousand varieties. While these varieties have their own individual habits, more or less distinct, yet they give good evidence of belonging to the one species *vinefera*. Which one of these varieties was the parent of all the rest, it is now impossible to determine. Doubtless the number of varieties will go on increasing, the number of seedlings which are likely to be brought forward exceeding the number which will be rejected and lost.

Of American grapes, Professor Gray enumerates four distinct species, as follows: 1. V. Labrusca; 2. V. æstivalis; 3. V. cordifolia; 4. V. vulpina.

1. "Leaves woolly beneath; when lobed, having obtuse or rounded sinuses.

"*Vitis Labrusca*, L. (Northern Fox Grape.) Branchlets and young leaves very woolly; leaves continuing rusty and woolly beneath; fertile panicles compact; berries large (one-half to three-fourths inch in diameter); moist thickets common; June; berries ripe in September, dark-purple or amber-color, with a tough, musky pulp. Improved by cultivation. It has given rise to the Isabella Grape, &c.

"*Vitis æstivalis*, Michx. (summer grape.) Young leaves downy, with loose, cobwebby hairs beneath, smoothish when old, green above; fertile; panicles compound, long, and slender; berries small (one-third or one-fourth inch in diameter), black, with a bloom; thickets common; climbing high; May, June; berries pleasant; ripe in October." The Delaware is thought by some to be an improved variety of this species.

2 "Leaves smooth, or nearly so, and green on both sides; commonly pubescent on the veins beneath; either incisely lobed or undivided.

"*V. cordifolia*, Michx. (winter or frost grape.) Leaves thin, not shining, heart-shaped, acuminate, sharply and coarsely toothed, often obscurely, three-lobed; panicles compound, large, and loose; berries small (one-fourth inch broad), blue or black, with a bloom; very acerb, ripening after frost; Var. Riparia, with the leaves broader, and somewhat incisely toothed and cut-lobed. Thickets and river-banks; common; May, June. Flowers very sweet-scented." The Clinton is an example of this species.

"*V. vulpina*, L. (Muscadine or Southern Fox Grape.)

Leaves shining both sides, small, rounded, with a heart-shaped base, very coarsely toothed, with broad and bluntish teeth, seldom lobed; panicles small, densely flowered; berries large (one-half to three-fourths inch in diameter), musky, purplish, without a bloom; ripe early in autumn. River-banks, Maryland to Kentucky, and southward; May. Branchlets minutely warty; fruit with a thick and tough skin. A variety yields the Scuppernong Grape, &c."

Attempts have been made to subdivide into more species; but it may well be doubted if it can be done with any distinctness. Though we find many distinct varieties, which, by careful observation, we can readily class under one or another of these four species, yet there are many others which are so indistinct, that it is extremely difficult to say to which they belong. This difficulty will go on increasing, and will soon amount to an impossibility, as the different species are hybridized, and the seedlings, partaking of the blood of each parent, shall mingle the characteristics of each. At the present time, the great practical classification is the one first mentioned; viz., European and American. Even these will be likely to be thrown into confusion if success shall attend the many efforts now being made to cross the two classes. It has been doubted by some whether there are any instances of native and foreign hybridization. Certainly there is no inherent impossibility in thus crossing the two species, they being closely allied in their nature and characteristics; so closely, indeed, that it is as difficult even for experts to determine to which class some varieties belong as it is in the case of the different native species which have been mentioned. For example, it is still in dispute whether the Rebecca and the Delaware are pure foreign or pure native varieties, or whether they have a mixture of the blood of each. If, then, there is such similarity in the two classes, it certainly seems entirely reasonable to suppose they may be intermingled. It would seem very easy to determine this problem by actual test; but the experiment is more delicate than might at first be supposed. In order that this subject of hybridization may be more distinctly understood, the following description of the inflorescence of the grape is quoted from Gray's "Manual of Botany:"—

"Calyx very short, usually with a nearly entire border, or none at all, filled with a fleshy disk which bears the petals and stamens; flowers in a compound thyrsus; pedicels mostly umbellate-clustered; petals five, cohering at the top; and so the corolla usually falls off without expanding."

This compound thyrsus, or cluster of flowers, greatly facilitates the natural impregnation of the pistil, which, of course, must be prevented where a cross is intended. Another and greater difficulty arises from the cohesion of the petals at the top. Fig. 1 illustrates a single flower from a cluster; the corolla being raised by the stamens, the petals remaining united until they fall. It is frequently the case that this little cap remains over the stamens, holding them over the pistil, and letting in sufficient air to mature the pollen for its work of impregnation; so that the work is done before the flower is expanded. In many cases, it would be difficult, if not impossible, to determine whether this impregnation had actually taken place or not; and hence the uncertainty in determining whether seedlings are natural, or are artificial hybrids. The only practical and satisfactory test is in the character of the offspring. It is but reasonable to expect that many attempts at crossing will prove to be failures; but it is also as reasonable to hope for success in some cases. Indeed, it would seem to be indisputable that success has already been attained in some instances. In answer to some inquiries, I have received a letter from Mr. Edward S. Rogers, who is widely known as having made careful experiments in hybridizing. From this letter I make an extract:—

Fig. 1.

"I have often noticed that the anthers have shed their pollen before the corolla, or cap, comes off: this is not always the case. But, to make sure work, it should always be removed, although some judgment must be used as to the right time of doing it. My usual practice has been to choose those clusters that are the farthest advanced, and cut away all but four or five of the flower-buds, and, when the buds are nearly ready to open, to remove the corolla, or cap, and apply the pollen of the kind we have chosen for the male parent, covering the cluster at the same time with a small bag, and also enclosing a cluster of the male parent in full bloom; and usually I retouch the pistil the next day, as it may not have been in the state to receive the pollen at first. I have not the least doubt now as to the certainty of raising new grapes by this process."

Mr. Rogers has raised his numerous "first-class seed lings" from hybridized seed of the Mammoth Fox. One proof that they are true crosses is in the fact, that the Mammoth has an imperfect flower, while the seedlings have perfect flowers, like their male parent. His "second-class seedlings" are from seed of the first class, again hybridized with foreign kinds. Some of these certainly show marked foreign characteristics; too much so, in the opinion of Mr.

Rogers. Mr. Allen's White Hybrid is another example where hybridization seems to be evident.

On the other hand, many seedlings which are heralded as hybrids, can, in truth, neither lay claim to any foreign blood or native merit. In the "Horticulturist," vol. i. p. 343, a writer says, "I have a large number of seedling grape-vines, hybrids between the different foreign kinds and the Isabella and Catawba, which promise well, and will be in bearing next year." If they had been genuine hybrids, they would not have remained unknown to the world for twenty years.

In performing this experiment of hybridizing, we must adopt the rule to combine marked and contrasting excellences; as, *e.g.*, vigor with earliness, or good quality with productiveness. A Black Hamburg and an early Creveling would be a good example; also the early and excellent Delaware with the large and vigorous but late Union Village. But the Union Village with the Isabella would not be a good example, because they have a similarity of characteristics, and are both late.

The object is to bring together different excellences. Having determined the varieties beforehand, if there should be a difference in the time of inflorescence, the later kind may be hastened by the protection of glass, or the pollen of the earlier kind may be preserved in a closely corked phial until the later kind is ready for impregnation. It is said that pollen may be kept for a month, and sent thousands of miles, without injuring its vitality. There may also be a choice which of the kinds to constitute the female parent, resulting from the imperfect organization of some kinds; e.g., the foreign Damascus and the native Taylor, which have deformed stamens, and an insufficient supply of pollen. A careful observer will readily be guided in his practice. I cannot think it is material to the character of the seedling which variety is the mother. In the analogous case of animal life, we find equally marked paternal and maternal traits in the offspring. The choice being made, before inflorescence, with a long and slender pair of scissors remove the larger part of the flower-buds from the bunch that is to be impregnated, in order that there may be ample room to operate upon the remaining flowers. This rule will vary with different varieties, the operator being easily guided by his judgment. Watch the period of inflorescence with utmost care; and when the corolla is seen to lift, and part from the calyx, then with the scissors carefully remove the cap. Generally the cap will fall before you can get to it; but, in order to make certain work, every moment is precious. The flower is shown in fig. 2.

Fig. 2.

The anthers of the five stamens are to be immediately removed. The stamens will then appear as in fig. 3. The air being dry, procure your bunch which is to fructify, the pollen of which should be dry, like dust. With a fine camel's-hair pencil apply this pollen to the stigma of the pistil. This work should be repeated after an interval of a few hours, and again on the two following days, in order to make sure of impregnation. As the different flowers on the bunch will not open at the same time, it will be necessary to watch and operate upon it for several days. During this time, it will be essential to protect the bunch by a gauze bag to prevent bees and other insects from carrying pollen from other flowers, and spoiling your work. After all this skill, care, and patience, there are liabilities either that the stamen was impregnated before you got to your work, or that an atom of the pollen fell upon the stigma when you were removing the anthers, or, in an unguarded moment, was afterwards deposited by a mischief-making insect. You have no means of determining the fact but by the slow process of ripening the seed, and, by years of after-

Fig. 3.

watching, arriving at an opinion whether or not you have obtained a true cross. Such a cross of well-selected varieties would be almost certain to be a high prize, and would well repay years of patient care. Until such methods shall have developed the capacity for improvement of our native species, we cannot expect to obtain the very highest results. But by continued crossing and recrossing, combining and refining, there would seem to be no limit to this process of improvement. The field is wide, inviting, and rewarding. It is to be hoped, and it can scarcely be doubted, that many will enter it.

CHAPTER III.

PROPAGATION OF THE GRAPE.

THERE are four methods of propagating the grape; viz., by seed, by cuttings, by layers, and by grafts. We will examine them in the above order.

BY SEED.

This is the natural method, but desirable only for the purpose of obtaining new kinds. The grape is so easily multiplied by cuttings, that seedlings are never raised for stocks, as is the case with apples and pears. When stocks are on hand, they may be used for the purpose of grafting new varieties upon them; but it cannot be regarded as economical to raise them for this purpose. Many experiments are, however, now going forward with the hope of obtaining improved kinds. As has been stated in the previous chapter, a judiciously obtained hybrid, or cross between two varieties of excellence, is almost certain to give a seedling of good qualities. There is indeed a probability, that, by combining known excellences, the product may be a decided improvement upon either of the parents. It is also reasonable to expect, that when the seed of the best berries of the best varieties is selected, even without hybridization, many of the seedlings will show points of excellence. It is in this way, or, worse than this, by mere chance seedlings, that most of our present kinds have been obtained. And it would be strange, if, by a careful selection of seed, we should not arrive at much better results. This seems to be so reasonable, that it has induced many within a few years to plant seeds very extensively. In one instance within my knowledge, a gentleman has thirty thousand seedlings at the present time which he will test by fruiting. Smaller experiments in the same direction are being tried by many in all parts of the land; and it is a course to be recommended to all who have the time and interest to watch results. For, if a really good seed is selected, it is not probable that the product will be much inferior; and, if it should so prove, I believe the process of grafting will be made so certain, that it may readily be used as a stock for a better kind. The chance that some lucky seed may win the prize, — how amply it would compensate for multiplied failures!

As it is a long experiment to test seedlings, it is extreme folly to use any but the very best seed. Select thoroughly ripe and the largest berries of the best varieties. Separate the seed from the pulp, and mix with double the amount of sand, and set away for spring use. Freezing the seed is not important to a speedy germination of the seed. The only things to be guarded against are mice, heat, and dryness. As early as is possible in the spring, make a bed of light soil with a liberal quantity of thoroughly decomposed horse-manure, or other equally light and enriching material, well incorporated to the depth of two feet. Sow the seeds in drills one foot apart, and one inch apart in the drill; cover to the depth of half an inch. To one accustomed to the management of cold frames, sashes will be of great advantage, giving the young plants a little protection and warmth, thus securing an early and vigorous start. Judgment must be used in watering, giving air, and partially shading the tender plant from the fiercest rays of the sun. As the season advances, the sashes may be removed, but not until the weather is warm. Let not this change be too sudden, or the result will be that the tender growth will be destroyed by raw winds, or will fall a prey to mildew. Dust flour of sulphur over the plants at mid-day as a preventive; also continue a partial shade during the heat of the day. A lattice of lathes is the best shade. This may be dispensed with as soon as the plants obtain vigor and substance. When the vines begin to run, support each plant with a slight stake two feet long above ground. If these directions are followed, the vines will attain an average growth of three feet the first season. In the fall, the plants are to be dug, and the weakest rejected. The rest are to be completely buried in a dry soil, and sheltered from rain by boards or shutters. As they are hereafter to be treated precisely like vines from cuttings for vineyard planting, it is unnecessary to give further directions in this place. It is sufficient to say, that it is neither true economy, nor a fair test, to endeavor to fruit the vines in crowded beds. Let them go into the usual vineyard rows when one year old. If they prove to be valuable, they will want all the space; but, if worthless, the stocks are in the right position to receive grafts. Of course, it is not understood that the wide spaces for high trellises are recommended. For extensive experiments, a distance of three feet by four is sufficient. Generally, these seedlings do not produce fruit as early as cuttings: not until the fourth season will they give a fair indication of their quality.

The method of propagation by cuttings may be subdivided as follows, — by single eyes, by green wood, and by cuttings in the open air.

PROPAGATION BY SINGLE EYES.

This is the method most extensively in use, and in most instances possessing manifest advantages. It is a near approach to the natural method by seed, there being but little of the old wood to separate the young roots from the new growth. The different parts of the plant are homogeneous, with the slight exception of about an inch of wood. Vines started in this way require artificial treatment under glass: but, as the amount of wood which is used is so small, the space required is correspondingly small; consequently, the expense of thus starting them is not large. But a great advantage is thereby obtained, by securing an early and vigorous start, and a season of growth extended one or two months, resulting in large and well-ripened vines in the fall. Thus we have answered the all-important conditions of perfectly healthy plants, which is a sufficient reason why this method of propagating should continue to have the preference. It is also an important consideration that every known kind is readily increased in this way, and with great rapidity, inasmuch as every sound eye will make a plant. It has been objected, that, by taking a portion of the old wood of the parent plant, any tendency to disease in the parent will be communicated to the offspring. It is undoubtedly true that weak eyes and poorly-ripened wood will produce feeble plants, and that such are undesirable, and should be rejected. The desire to increase the new varieties as rapidly as possible has induced propagators to use every eye that could be made to grow; which is a sufficient reason for the weak and spindling growth which is so often seen. But when a plump, well-ripened eye is used, theory and practice both confirm the opinion, that, under good management, perfectly healthy vines are produced. As this method of propagation is now, and in all probability will continue to be, the most practised and the best, a full description of the management will be given.

At the time of fall-pruning of the vineyard, the wood for cuttings should be tied in bundles, marked distinctly, and stored away in a cold cellar. During the leisure months of January and February, the work of making up the cuttings may be done. A vineyard pruning-knife, as represented in fig. 4, is much the best instrument for making the cuttings. The wood is cut with almost the rapidity of strips of paper cut with a pair of scissors. A dexterous cutter will retain the branch in his left hand, and with two strokes of the knife the cutting is made, and falls into a pan, while the refuse wood falls on one side. One man will make from three to four thousand cuttings per day.

Fig. 4.

The most convenient size for the knife is one, the length of which is nine inches. The little bar seen on the handle is intended to play between the first and second fingers, and will be found to be a great assistance in controlling the knife. See that the blade of the knife is keen, in order that the cut may be clean, and free from any bruising or tearing. Each cutting will require two strokes of the knife,—the first about a third of an inch above the eye, and sloping parallel with the eye; and the

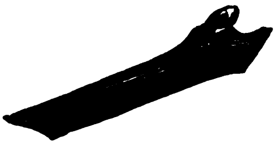

Fig. 5.

second cut about an inch and a half below the eye, and at right angles to the slope of the bud. The appearance of the cutting is seen in fig. 5. It has been recommended by some to cut out the under side of the cutting, in order to give a

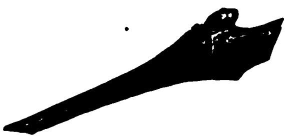

Fig. 6.

larger surface for the emission of roots; the cutting, when finished, presenting the appearance as in fig. 6. The objections to this method are, first, that it is unnecessary, roots being formed with the greatest freedom at the end of the cutting, as in fig. 5, and also throwing out from under the bark; second, when so much surface of the cutting is exposed for the absorption of moisture, as in fig. 6, it is much more liable to become rotten.

Fig. 7.

Still another form has been recommended, as seen in fig. 7. The advantage claimed for this form is that the wood above the eye helps to keep the eye from drying, whereas there is the least possible amount of wood between the eye and future roots; so that the growth of the young plant will be more nearly homogeneous, and the nearest approach to a seedling. Roots are also known to form more readily, the nearer we approach to an eye; the deposit of cambium being greater near the eye than in other parts of the plant. The theory is correct; but it is found in practice that the eyes are much more liable to be displaced, and to suffer from changes in heat and moisture, as the greater part of the cutting necessarily lies nearer the surface. In my opinion, the form in fig. 5 cannot be improved.

These cuttings, being made in winter, may be put away in boxes of moderately dry loam, the loam being well mixed among the cuttings. Place the boxes in a cold cellar, and let them rest until March or April. If the right degree of heat (from thirty-five to forty-five degrees) and of moisture (very slight, but not too dry) are maintained, the process of callousing and preparation will go on slowly, but naturally and surely, and the time in the propagating-house will be diminished one-half. For the ready and certain development of roots, it will now be necessary that they be put in a condition to receive a gentle and steady bottom-heat. There are two methods of obtaining this,—first by hot-beds; and secondly by fire-heat, generally in connection with water-pipes or tanks.

HOT-BEDS.

These are a simple and long-established method. Yet, when we take into account the cost and considerable waste of material of which the bed is composed, the labor of making, the care and time in watching, and, in addition, the considerable risk as to results, this cannot be considered an economical way for extensive propagation. When a propagating-house would only be used for this single purpose, or when only a moderate quantity of vines is wanted, the hot-bed will be a good substitute for the more perfect plan of tanks.

In order to secure a good bed, select a sheltered position, the sub-soil of which is well drained; dig a pit of the length and width of the frame, and to a depth of eighteen inches, the surface-soil being thrown out as a bank for the sides of the bed. Fresh, well-moistened stable-manure should be drawn to the side of the frame, and allowed to lie in a heap until the heat is well up, which generally requires four or five days. Turn the heap from end to end, thoroughly incorporating the coarse and the fine, the hot and the cold, the wet and the dry, and allowing the excess of heat and moisture to pass off. On the following day, commence at one end of the pit, and build up the bed in tiers of about a foot in width, shaking out all clods in the manure, and spanking the bed very firmly together with the back of the fork during the process of building. The bed should be well compacted, of uniform density; and hence it should never receive the impression of a foot. If the manure is free from straw or other litter, a saving of manure is effected by using from one-third to one-half the bulk of oak or other firm leaves. To make the bed sufficiently permanent, it should have a depth of three feet; the surface-earth which was thrown out being drawn up at the sides to a level with the surface of the bed. Cover the surface of the bed with fine, light soil, to the depth of four inches, and then apply the frame, and bank it with leaves or other material which will best protect the bed. After the application of the sashes, another week will be consumed in drawing up the heat, and allowing the excess of moisture to pass off. In the latitude of Boston, if work upon the manure is commenced about the middle of March, the beds will be found to be in good condition for receiving the cuttings by April 1; which is quite early enough for eyes prepared in the previous winter, as before described.

These should now be taken from the boxes in the cellar, the light soil being so dry as readily to pass through a coarse sieve. Owing to the liability to an excess of moisture, and in order that they may readily be changed if necessary, it is best to plant the cuttings in six-inch pots. These are filled with pure, sharp, clean sand, and the cuttings inserted at an angle of forty-five degrees. The top of the eye should be just visible on the surface of the sand after pressing down and watering. Planted at equal distances, a pot six inches in diameter — measuring from inside to inside at the top — will hold from twenty to thirty cuttings, varying according to the size of the wood. When prepared in the cellar, the pots are brought out, and plunged in the bed to a level with the rim. Admit air freely in mild weather, keeping the earth warm, but the air ten to twenty degrees lower, in order to induce root-action at once. The most desirable heat for the pots is from seventy to eighty degrees. If the sun's rays are very fierce, give a partial shade as well as ventilation, and prevent the atmosphere from rising above a temperature of eighty degrees. It would be better to keep it twenty degrees lower, if possible. Secure a good foundation of roots, and "make haste slowly." If the cuttings have been well managed, they will be well rooted, and the shoots well started, within a month from the time of potting them. As they are to be managed precisely like vines coming from a propagating-house, we will now go back to a description of this method.

THE PROPAGATING-HOUSE.

As has been said, this is by far the most economical and best method, and is the one in use by all extensive cultivators. In commercial gardens, the house is in constant use throughout a considerable portion of the year, one crop of cuttings succeeding to another. Hence the expense of a crop of thousands, occupying but a small space, and less than a month of time, is comparatively trifling. Under strict conditions, the experiment of striking can scarcely be called such, being reduced almost to a certainty. Mischances will happen; but, if they can be avoided, well-selected grape-eyes are sure to root. The following rules are given for the construction of a house: Grade to a level a piece of land ten feet wide, and running north and south a distance sufficient for the length of the house. Next plant durable posts on each side of the lot, running north and south; the posts being about four feet apart in the lines, and the lines being nine feet from centre to centre of the post. The posts are to be cut to a level of one foot eight inches above the ground surface. The walk in the centre of the house is then to be cut down two feet nine inches below the surface, and is to be two and a half feet wide when boarded or cemented. The next work in the order of construction is the building of a water-tank for the purpose of generating bottom-heat, and also heating the house. Wooden tanks have been often recommended, and they are now generally in use; but they have always been found to be more or less troublesome, and by no means a perfect success in any case: they are apt to swell and shrink with the changes in temperature. Wood being porous, they give off more or less moisture, if they do not do worse, and come to a positive leak. If the top of the tank is covered with wood, it is a poor conductor, and does not sufficiently heat the propagating-bed, unless the water is raised to a high temperature, when too much steam is generated. If the wooden tank is covered with slate, it is difficult to join the two materials with cement, so as to endure the extremes of winter and summer, and keep the work impervious to steam. It is not denied that wooden tanks have done some good service, but they are imperfect; and, as there is a better material and a cheaper, they should never be used. Tanks have been made by a thick coat of cement upon the level surface of the ground, the sides being of brick. This simple method has been recently brought more prominently into notice by Mr. E. H. Hooker, of Rochester, N.Y. An objection to these tanks has been made, that, in the changes of temperature of the earth, the bottom of the tank will crack and leak; but this is disputed, and it seems reasonable, that provided the preparation of the foundation is thorough, and the cement is properly applied, the work may be made tight and durable. An equally cheap, and I think a better tank was first constructed and used by Mr. Asa Cummings, of Reading, Mass. This appears, thus far, to be perfect in all respects. It is simply a slate tank, top and bottom (ordinary roofing slate), with sides of brick. In comparison with iron water-pipes, the slate tank seems to be as dry, and impervious to steam, gives off the heat with equal facility, gives a better horizontal surface for bottom-heat, and, chiefest of all, is far more economical. The construction is extremely simple, and it can be done by any one used to the trowel. For the propagating-house, procure slate twelve by eighteen inches in size, the length of the slate being the width of the tank. After the walk is dug, make the surface on each side perfectly level and solid. Then place rows of brick on each bank, at right angles to the walk, for a foundation; the length of the rows being eighteen inches, the width of the tank, and the rows being a foot apart; so that each joint of slate shall have the support of brick underneath. Lay the slate upon the brick piers, and cement the joints with utmost care, using the best New-Jersey cement, mixed with an equal quantity of pure sand. Fig. 8 shows the appearance of the work at this stage. The outer lines indicate the sides of the house; the lines in the centre indicate the walk; and the checked belt the course of slate, constituting the bottom of the tank.

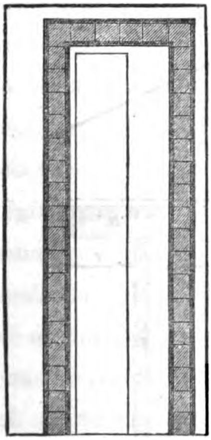

Fig. 8.

As the under surface is exposed to the air, except the small part which rests upon the brick at the joints, heat is given off at the bottom of the tank as well as at the top; which is a great advantage over Mr. Hooker's plan. For the sides of the tank, lay a single brick edgewise. This will give a depth of three inches for the water, which is quite sufficient. Bed the brick carefully in cement, and also cover the inside face. The top course of slate should be laid and cemented with as much care as the bottom, in order to prevent any escape of steam.

The further construction of the house will be obvious upon examination of fig. 9, which is a view of the north

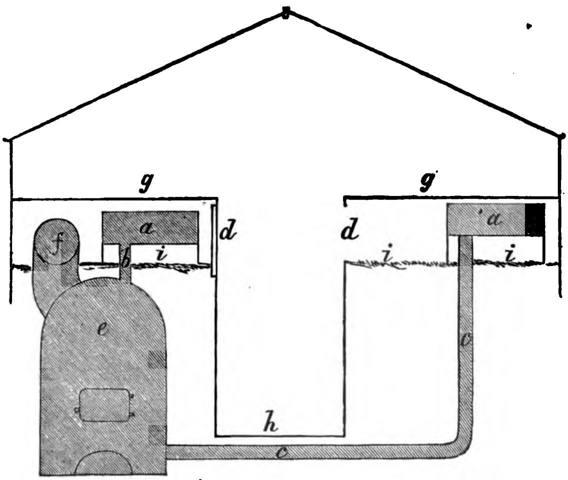

Fig. 9.

end; fig. 8 being a ground-plan of the south end. The posts being set for the sides, nine feet from the centre of one side to the other, allowing three inches on each side for the radius of the post, the house will be eight feet six inches wide in the clear, inside. The rafters will be four feet ten inches in length, having a perpendicular rise of two feet two inches. As this house is to be permanent, it is cheaper and warmer to have a fixed roof with a few trap sashes for ventilation at the top. It will be noticed that the amount of space not wanted for growth is reduced to a minimum, — simply a walk, and room for the head. In such a snug house, there is no lofty space on which to expend heat. Of more importance still, the conditions of success are under such easy control, and the cuttings are so near to the glass, that there will be no need whatever of bell-glasses, or a second set of sashes. The house is close, genial, and humid enough for all ordinary propagation. This is a great gain, saving in material and in labor, and keeping the cuttings in clear sight, so that their exact condition may always be obvious. The letters *a*, *a*, indicate the tank resting upon brick piers; *i*, *i*, being the ground-line. The water flows in at the pipe, *b*, and, flowing completely round the house, enters the boiler through the return-pipe, *c*. The flue, *f*, runs the length of the house, and back of the tank. The tables, *g*, *g*, are composed of slate for the sake of durability, and also because this material will secure a better bottom-heat than boards, which are poor conductors of heat. These tables are three feet wide, three inches above the tank, and a foot below the lower edge of glass. This gives room for a bed of sand three to four inches deep, and sufficient working and growing space. On each side of the walk, *h*, are sliding shutters, *d*, *d*, one of which is represented as open, to let the heat pass from the tank into the house. This will be found necessary in cold weather, but only to a moderate extent. The object is to "keep the feet warm and the head cool." A glance will show how perfectly this paramount condition is secured. The boiler, *e*, may be of the smallest size, and kept exclusively for this house, which should work independently of all others. I have not thought it necessary to give all the reasons determining the above construction, nor the many modifications and other forms which are now in use. This would require too large a space in a treatise for general use. Suffice it to say, that after years of trial, and many disappointments, I have come to the conclusion that the above simple and cheap plan is nearly perfect. It only requires care, and the observance of a few, the simplest rules, to propagate almost any known plant.

For large establishments, should more space be desired than a distance of sixty feet would secure, it will be better, as a general rule, to begin a parallel house on the ridge and furrow principle. Succession-houses are a necessity in commercial gardens; and the conviction is now general, that ridge and furrow houses are most economical. By this term is meant a succession of parallel houses, joined to each other by wide plank-gutters sufficiently strong to bear a heavy weight of snow, and also to form a passage by which it may be thrown out. From houses sixty feet in length, the difficulty of removing snow does not prove to be serious; at least not on the seacoast, where the fall is less than in the interior. The advantages of this system are manifold and manifest,—such as diminished cost of construction; diminished exposure of sides to the cold, the low stature of the houses making them better for the plants, and less difficult to heat; also compactness, and economy of space, thereby saving thousands of unnecessary steps in moving plants and working the houses. For the strict purpose of grape-culture, it is the opinion of some that such houses are desirable as reception-houses for the young plants when rooted, and ready to be potted off, or planted in borders under glass. These houses may be constructed of movable sashes, which can be used to advantage later in the season, in the vineyard, as we shall see hereafter. With this, or a similar end in view, *i.e.* a double use of the sashes, I would recommend, as a general rule, a uniform size of sashes,—three feet wide and six feet long. This will give inside borders, or tables, four feet wide on each side of the walk; a width not difficult to manage. Fig. 10

illustrates a succession of such houses, the propagating-house being the smallest, the other two or more being

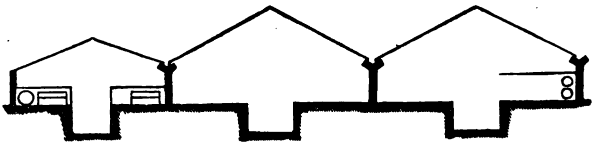

Fig. 10.

well adapted for growing young vines in the borders during the summer. These houses may also be used to advantage in winter for flowering plants, early strawberries, vegetables, or any forcing purpose, by introducing heating apparatus, hot-water pipes, slate tanks, or, least desirable of either, a simple flue under the walk. Iron pipes, being but four inches in diameter, might be supported near the posts, under the gutters, as indicated in fig. 10, in the house on the right-hand side. It should be here stated, that, when rapid forcing is desired, I have found that lean-to houses, facing southerly, and taking the full force of the winter sun, are better for this purpose. Yet, even in winter, the north and south ridge and furrow houses are best for steady, moderate growth. The morning and evening sun strikes the glass more directly, while the mid-day sun is by no means so fierce. From this digression, we return to the cuttings.

EYES FOR THE PROPAGATING-HOUSE.

These having been prepared in January or February, and kept in boxes, mixed with light, dry, sandy loam, by the 20th of March or 1st of April they will be found to be somewhat calloused, and on the point of throwing out roots. As the propagating-bed should now be cleared of bedding-out and other winter cuttings, it is free for the grapes. For economy of space, use no boxes or pots, but insert the eyes in the bed of sand, which is three to four inches in depth upon the slate table. The eyes should slant at an angle of about forty-five degrees, and be inserted to such depth, that the eye shall be barely visible after the sand is watered and settled. The eyes should be put in an inch apart in the line, and the lines two inches apart. Slender-growing kinds, or small wood, may be put in thicker. Indeed, all kinds may be started considerably thicker; but they will require more care to prevent damping, and also an earlier and more careful removal. At this rate of planting, one foot of the width of the table will take two hundred and sixteen cuttings; and a house sixty feet long will take 26,352 on the two sides and one end.

After planting, give a good watering, in order that the sand may be thoroughly settled. After this, avoid extremes of moisture or dryness. Maintain a steady bottom-heat of about seventy degrees, never allowing a variation of more than ten degrees either above or below this point. Keep the temperature of the house below sixty degrees at night, not allowing it to rise above seventy degrees in the daytime if this can be done. A uniform observance of these simple conditions will command certain success. The tables will become an unbroken sheet of green. The length of time they are to remain in the beds will depend somewhat upon the after-treatment. It is the custom of some propagators to pot all the cuttings, and place them upon tables in succession-houses, giving them heat, and securing an early start. Stronger vines can be grown in this way, as they can be established in pots in the genial atmosphere of a house with more vigor than in any other way. A gain of weeks, or even months, of time in the spring, may also be made by shifting into larger pots, if desired, in the case of new and choice varieties; but this plan involves too much labor, expense, and space of glass, to be practised on a large scale. Should it be decided to pot the cuttings, they will be in condition as soon as it is found that the roots are well started, which will be within three, or at most four weeks from the time they were put in the bed. Light, floury pasture-loam, with an addition of one-sixth of sand, and a double quantity of thoroughly decomposed stable-manure, will make a good compost. The young plants will not require the richer addition of bone-dust at this stage. Pots the inside diameter of which at the top is three inches will be sufficiently large for the first potting. When the vines are well established, the pots being well filled with roots, with a top-growth of from six inches to a foot, take out the temporary tables of the succession-houses, which are made of boards and are easily removed, and plant the vines in the prepared border below. This border is two feet below the gutter, which will secure sufficient head-room for the vines for at least a growth of six weeks. The house being kept warm and humid, the vines will soon become established, and will make rapid growth. At mid-day, when the air is dry, dust flowers of sulphur over the plants to prevent the possibility of an attack of mildew. An ounce for prevention is better than pounds for cure. The borders are farther from the glass than is desirable for so small plants; but by careful management, and encouraging the warmth of the sun upon the borders, no serious difficulty will attend the establish-ment of the young vines. They are now in plain sight, easy of access to water, to shower, and stake, and, when once established, ought to be a sure crop. Stake the vines as soon as they need support, and tie each one with bass-string, which is the cheapest material, and least likely to cut the tender shoot. As soon as the vines reach the glass, the sashes may be raised a foot or more at the gutters, thus obtaining sufficient head-room. Still later in the season, the sashes may be entirely removed, giving the vines all the air and sunlight in order to harden and ripen them.

Owing to the cost of potting the cuttings when taken from the propagating-bed, it is to be avoided if possible. If the young plants are allowed to remain in the bed four, five, or six weeks, gradually diminishing the heat until they are somewhat hardened, the roots being firm and vigorous, they may be transferred from the bed directly to the house-borders with a good degree of success. Every precaution should be taken to insure against failure. The house should have been previously kept close, so that the borders may be well warmed by the sun; shade should be at hand when necessary; a growing heat should be kept up. The difficulty will be over in a few days, and a great saving will be effected, provided complete success attend the effort to establish the plants. A careful gardener would prefer to run the risk rather than go through the labor and expense of potting.

But a more certain and perhaps cheaper and better method is to prepare frames to receive the plants directly from the propagating-bed. They are best prepared as follows: Throw out the surface-soil to the depth of a foot, the soil being placed on each side to bank the frame: six-feet sashes being used, this will be the width of the pit. Fill the pit to the depth of nine inches or a foot with fresh manure for a slight bottom-heat. Half a foot of manure is sufficient, if the ground is warm, and the season advanced. As the depth is slight, the manure may be thrown in without turning. Then cover with a compost of two-thirds light, floury, pasture-loam, and one-third of a spent hot-bed at least a year old. Add charcoal-dust *ad libitum;* also bone-dust and wood-ashes to a moderate degree, if at hand. This covering should be at least five inches thick over the manure. The front plank of the frame should be a foot wide, and the back eighteen inches. Bank up the sides, and let the sashes remain close upon the frame for a few days in order that the soil may be well warmed. When the temperature of the bed is found to be above sixty degrees, the cuttings may be taken from the propagating-bed, and carefully planted in the frames, shading as the work progresses. As it is a wretched want of economy to produce vines of inferior quality, care should be taken to give room for growth. A distance of six inches each way is quite near enough; and probably true economy would require an increase of this distance to nine inches between the rows, and six inches in the row. At the former distance, a sash would cover seventy-two vines, and only forty-eight vines at the latter distance. An allowance should be made for strong or feeble-growing kinds.

With the warmth secured by the bottom-heat, and owing to the closeness of the frame, the cuttings are readily established, and will soon begin to grow. They require careful attention in watering, and giving air. Remember the sulphur, and *prevent* the approach of mildew. When the vines approach the glass, they must be staked, and another plank added on each side of the frame. I have lost thousands of vines by removing the sashes at this stage, before the vines had acquired sufficient constitution to endure so great an exposure. As the weather becomes genial, the vines may gradually become accustomed to the winds and the full blaze of the sun. Make free use of sulphur "about these days." Sulphur will *pre-*

vent mildew; but it is by no means a certain *cure*. Remove the sashes first, allowing the planks to remain for a time as a protection. In the fall, the vines will require all the air and sun in order to mature as much of the cane as is possible. There is no difficulty in obtaining canes of free-growing kinds as large as the usual size of lead-pencils, with at least three feet of well-ripened wood, in a single season. I have myself grown Allen's Hybrid, from an eye started in March, thirty-six feet in one season by actual measurement. Such excessive growth, however, is not desirable. A few plump, well-hardened eyes, with a good foundation of healthy roots, is all-sufficient.

In November, the vines should be dug; and, if any of the wood of new kinds is wanted, it should be taken at this time. Heel the vines in, in beds five feet wide, the roots lying at an angle of forty-five degrees, the rows across the bed being as close as possible without having the roots come in contact. When the vines are all in, cover the tops of the vines with earth taken a foot from the sides of the bed. The bed will thus be raised above the adjoining surface; and a trench dug completely around it will carry off the surface-water. Cover the bed with boards or shutters to prevent the winter rains from penetrating. It is a delight to find how fresh these vines will come forth from their sleep in the spring. Let them rest for the present.

SOFT-WOOD CUTTINGS.

This is a method of recent introduction; at least, I find no mention made of it until within a few years. It has, however, been extensively adopted, especially in the multiplication of the new varieties, which can be propagated much more rapidly in this way than by waiting for the maturity of the wood. The method has been abused, and the country has suffered largely by the sale of immature vines which have not sufficient vitality to endure the first winter. This method certainly is not objectionable intrinsically. Indeed, it is, theoretically, the best way, next after the natural way by seed. If roots can be started directly from a young growing shoot, with no intervening old wood, the whole plant is homogeneous: it is a very near approach to a seedling. Now, the great evil has been that these cuttings have been rooted during the summer months, and have not had time to mature before frosts.

My opinion is, that provided they are started early in the season, and are well managed, they will make strong and healthy plants. To secure this end, let the stock-vines be potted in December in a rich soil, and started very gradually. About the middle of February, the first crop of cuttings will be ready. These are taken off precisely like the soft cuttings of the rose or verbena. The appearance of the cutting when prepared is seen in fig. 11, the lower end being cut just below an eye. This is not essential, as roots are developed at any part of the stem. A plant can be obtained from every eye, if carefully managed; though it is certain that roots form with more readiness just under an eye. The parent vine should never be denuded of foliage. By being judiciously cut back, it will break again, and, without sustaining injury, will give several more cuttings before April 1. After this time they should not be used, unless grown in pots, and matured in the fall by artificial heat.

Fig. 11.

These cuttings are put in the propagating-bed, directly over the boiler, the warmest part, in a temperature of eighty to ninety degrees. In order to secure this, and also closeness, bell-glasses, or a sash, should be used. Guard against excessive moisture, maintain the required heat, and the cuttings are as sure to root as verbenas, requiring from two to four weeks' time. Coming from such a heat, of course, they will be soft and tender. They should be potted, and plunged in a cooler part of the propagating-bed. Thus established, they will acquire substance, and grow with vigor. They may then be treated in the same way as heretofore described for hard-wood cuttings.

This mode is so liable to abuse, and is so unnecessary and disadvantageous, except where the amount of ripe wood of new varieties is limited, that its adoption is undesirable, except under the conditions named. As an instance of the rapidity with which vines may be propagated in this way, I mention the fact, that, when the Rebecca Grape was first introduced, I received twelve small vines in the spring of 1857; and in twelve months from that time I had over three thousand plants which would average a larger size than the original vines. I should add, that one of the original vines never started; so that the stock was only eleven to commence with.

CUTTINGS IN THE OPEN AIR.

This is the ancient method of propagation; the cuttings being called *malleolus*, on account of their resemblance to a mallet. Precisely this form is continued in use to the present day, and in France its use is quite general. Fig. 12 is a representation of this form. The head of the mallet, *a*, is a piece of the old cane, the wood being at least two years old. The shoot, *b*, is the growth of the previous season. It is not true that roots are more easily developed from the old wood than from the new. It is also obvious that but a very limited number of cuttings can be obtained from a single vine, and none at all except by cutting back the fruiting cane. It is true, however, that some varieties will root more readily in this way than by simple cuttings. The reason is probably twofold: 1st, The old wood being hard, the young wood is preserved in a more

Fig. 12.

uniform state, never absorbing so much moisture as to rot, and, on the other hand, not becoming too dry; 2dly, There is an unusual amount of cambium at the junction of the old and new wood; and here also there are always to be found several buds, either developed or dormant. Hence this is a peculiarly favorable point from which to develop young roots. Some kinds which are difficult to root in the open air, the Delaware for example, are propagated quite successfully by cuttings in this form. Miller, in his "Gardener's Dictionary," gives the following directions for a primitive method: "Having an iron bar of an inch or more in diameter, a little pointed at the end, they therewith make a hole directly down, about three feet and a half deep; then being provided with an instrument they call a *crucciala*, having a handle of wood like that of a large auger, and the body of iron four feet long and more than half an inch in diameter, at the end of which there is a nick something like a half-moon, they, after twisting the end of the cutting, put it therein, and force it down the bottom of the hole, where they then leave it, and afterward fill up the vacancy with fine sifted earth or sand; observing to tread the earth close to the plants, which otherwise (unless it be stiff land) is often inclinable to be loose and dry, especially if rain does not soon follow their planting: and it is incredible how many vines three persons can in this manner plant in one day; viz., upwards of two thousand."

The two foregoing modes are brought into juxtaposition in order to show how little and how much progress has been made. The mallet-cutting was used by the Romans, and is still largely used. The *rationale* of Miller's method is simply this: That a large cane being inserted so deeply in the ground is almost certain not to suffer from drought, and it has substance enough to sustain it until roots are formed. It is obvious that such a trunk of old wood is very objectionable.

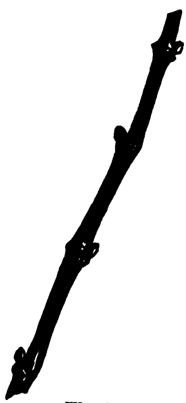

Fig. 13.

The most common form for open-air cuttings is seen in fig. 13, using the wood grown the previous season. Most vineyardists use from three to five eyes, the cutting being a foot or more in length. It is thought that this length is some guard against injury from drought; but I think it far better to use a shorter cutting, and guard against injuries by other methods. With the long cutting, the roots are formed at each eye, and are so scattered as to make an undesirable vine. It is true, the lower roots may be cut away, as indicated in fig. 14, at the line *a*, thus securing a compact and very satisfactory vine; but in doing this we sacrifice at least two-thirds of the roots, the lower roots being generally found to be strongest.

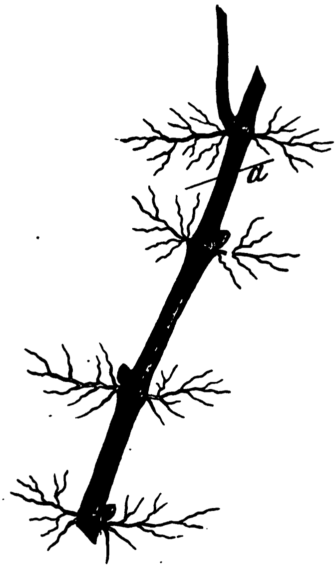

Fig. 14.

As the best method for the open air, I would recommend that the cuttings be made in the fall or early winter, of an average length of seven inches, and having at least two buds. Some varieties are much more short-jointed than others, in which case there will be three or more buds on this length. This is an entirely immaterial point; but, as a general rule, there will be but two eyes. With the shears (fig. 4) cut at right angles to the slope of the lower bud, and a quarter of an inch below the base of the bud. Be careful that the cut is clean, and made without bruising the bark. The upper cut should be at least an inch above the upper eye. These cuttings should be tied in small bundles, and buried in dry soil, or kept in boxes of moderately dry loam in a cold cellar. A cutting-bed should be made in the fall, if convenient, in order that any enriching material may be thoroughly decomposed and incorporated. It should be composed two-thirds of light garden loam, and one-third of decomposed stable manure or spent hot-bed soil. Sand should be added if the soil is too compact; also a slight addition of coal-ashes, charcoal, bone-dust, or super-phosphate of lime, will be found advantageous. This compost should be at least a foot in depth, and the sub-soil should also be a free loam, at least six inches deeper; so that capillary attraction may be free in case of dry weather. Great care should be taken to avoid all decaying vegetable matter, even partially decomposed manure. Hence it will be best if the bed is made up in the fall, and forked over in early spring. The bed may be six feet wide. When the ground has become somewhat warm, and heavy frosts have past, from the middle of April to the first of May, the cuttings may be brought out; and, if properly kept, they will be found to be impatient for a start. Indeed, it will be necessary to guard against too rapid development of the buds by keeping them as cool as possible, and rather dry. If the buds show signs of breaking, planting must not be delayed. With a spade cut the first line across the bed to the depth of six inches; place the cuttings in the line, in a slanting position, as seen in fig. 15, four inches apart in the line. This is rather thick; but some of the cuttings will probably fail. The lower eye, it will be seen, is behind the cutting, and the lower cut is in a position to be pressed firmly to the earth. Partially fill the trench, and press the cuttings quite firmly with a long-handled mallet prepared for the purpose. Then fill up the line to a level, the upper eye being just visible on the surface. Cut a parallel line twelve inches from the first for such varieties as the Delaware, or fifteen to eighteen inches for grosser kinds, and proceed as before. Should the cuttings be in perfect condition, they will soon make root, though they sometimes remain stationary until June in cold and wet seasons. It is true economy to give the bed every requisite, — a partial shade if the weather is very dry and

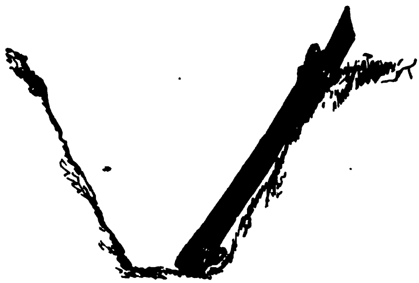

Fig. 15.

burning; and also continued waterings, should they seem to be necessary. Each vine should receive a small stake; for which purpose I have found the annual cuttings of a buckthorn hedge, pruned in March, are admirably adapted. Under favorable circumstances, the plants will make from three to six feet of growth. The cost of producing vines is less in this way than in any other, as it requires no glass, and there is no transplanting, and but little space is required. For older and free-growing kinds, where there is a full supply of wood, it is undoubtedly an advantageous method; but it is by no means as certain as the method by artificial heat, and the vines are seldom as well rooted at the end of the season. The roots of single eyes being also developed near the surface, they are decidedly preferable for planting.

Other modes of planting have been suggested, — such, for example, as is seen in fig. 16, — with the intent to keep the scion entirely buried, and so fresh and moist as to make the process of rooting more certain; but it is doubtful if the theoretical advantage is realized, and there are objections which outweigh any supposed gain.

Fig. 16.

Provided the soil is light, porous, and dry, and the bed is well protected from frost by a good covering of leaves, there will be an advantage in planting the cuttings in the fall. During winter, the cutting will be gradually preparing for the early development of roots in the spring. Special care will be requisite that the cuttings are not loosened or displaced by the frost, or destroyed by mice. Under these conditions, there are decided advantages in fall-planting.

CHAPTER IV.

LAYERING AND GRAFTING.

VERY strong vines may speedily be obtained, with much certainty and little trouble, by layering. To obtain strong vines in a single season, it is only necessary to bring a shoot, the growth of the previous season, to the ground early in April; and having made a slight incision below an eye, as seen in fig. 17, peg the shoot firmly down at the cut, and cover to the depth of four inches. The ground should be mellow and rich, and prepared soil should be placed at the point of layering if

Fig. 17.

necessary. Only a single eye should be allowed to grow beyond the point of layering; but this will be so strong as to require a firm support. When extra strength is not so much the object sought, but layering is relied upon for obtaining a considerable number of plants, the parent "stools," as the rooted trunks are termed, should be devoted to this sole purpose, and not be allowed to fruit. From two to four new shoots may be grown each year, from four to eight feet in length. These are succession-canes, which are to take the place of the canes which are layered this season. About the 1st of April, the canes of last season are uncovered from their winter bed, and a slight incision is made below each eye, as seen in fig. 17, not commencing nearer than a foot and a half from the stool. Now dig trenches radiating from the stool, sufficiently long for each cane to lie its length; the trenches being four inches deep. Peg down the canes, sprinkle a slight quantity of prepared compost around them to a level with the eyes, and partly fill the trench with light moss. This will preserve the cane in a humid state, and will not prevent the eyes from seeking the light. Judgment must be exercised as to the amount of moss to be used, and the time when the young shoots are sufficiently strong and hardened to bear the removal of the moss and a substitution of soil. By this method, a well-rooted vine can be obtained from every eye on the cane; yet they will be stronger, and will ripen better, if not allowed to be nearer than nine inches on each cane. The distance of the eyes on the cane will govern this. Give a strong support to the young plants, and allow a single shoot for each plant to grow as long as it will. At the end of the season, the young canes will be from four to eight feet, or even ten feet, long; and an abundance of roots will be found along the entire length of the old cane, as seen in fig. 18.

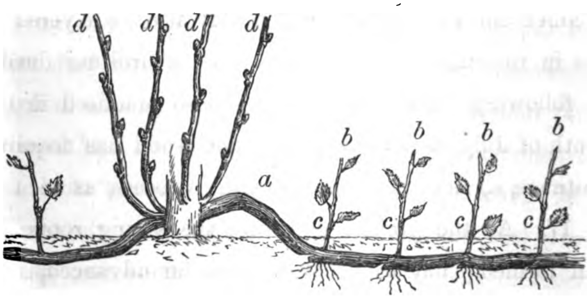

Fig. 18.

It will be found that roots have formed freely at the notches in the arm *a*, and also at the base of each of canes *b*, *b*; the last being of later growth. The arm is now to be separated into a number of distinct vines at the lines *c*, *c*, *c*; leaving the new canes *d*, *d*, *d*, *d*, for the same process the following season.

An interesting experiment may be tried in producing fruit in pots by plunging the pot up to the rim, it being first filled with a rich compost. Then bring down a strong fruiting-cane, cutting a notch just below an eye, as seen in fig. 17; insert the cane four inches deep into the pot at this cut; fasten it firmly with a strong peg, and support the fruiting-end of the cane in a perpendicular position with a strong stake. Several pounds of grapes may be ripened in this way; and, by severing the new vine from the parent stock in September, it becomes a beautiful specimen for exhibition. Vines may also be layered in pots in this manner for the purpose of fruiting during the following winter. Layering is also practised in the month of July, as soon as the young wood has acquired substance, so as to bear the tonguing process, as seen in fig. 17. As the ground is warm, the young roots are soon formed; but the season is so far advanced, that the layers seldom equal spring layers in strength. Yet it is a rapid method, and requires little care, except mulching and staking.

GRAFTING.

This art is very ancient, being mentioned by Columella as long in use. Other ancient authors give detailed directions on the subject. However easily the vine may be propagated by the methods previously described, there are instances when grafting would be extremely advantageous. A vineyard may be composed of inferior varieties. It would be a great gain if choice kinds could be substituted by grafting, — a gain of at least three years in time. It would much reduce the cost of experimenting with seedling grapes if those which prove inferior could at once be used as stocks for grafting. In this way also, the wood of new kinds can be more rapidly increased than in any other manner. In "The Country Gentleman," Mr. E. A. King states the actual measurement of the growth of a Delaware, three months after grafting in a three-years'-old stock, to be sixty-nine feet. Of course, this included lateral growth. The method usually recommended by authors is cleft or wedge grafting, — sawing off the vine two inches below the surface. The time recommended is different, — some giving the preference to March, just before the sap begins to flow; others waiting until the buds have started, and danger from bleeding has passed. While these methods are carefully described and recommended, it is still a fact, that comparatively few are successful in grafting, and but few attempt it. Certainly it is not as easy an operation as in the case of the apple or the pear. First of all, it is the almost invariable recommendation to go below ground. A serious and universal difficulty arises from the excessive bleeding of the vine wherever a cut is made in the spring. When the whole top is taken off, the flow is so free as to drown and rot, or poison the vine in some instances. Some persons do, however, have very tolerable success by commencing quite early, before the flow of sap has become free. The following directions, given by Chaptal, and practised very successfully in France, will apply equally well to this country: "Having selected a healthy stock, it is, just when the sap is beginning to flow, taken off with a clean cut an inch or two below the ground. The upper portion of the stock, which must be perfectly free from knots, is split evenly down the centre, and pared quite smooth within, to a sufficient size for the reception of the scion. The latter is pruned to three eyes in length, having the lower part cut in the form of a wedge, commencing about an inch below the lowest eye, and gradually tapering to the bottom. It is then inserted as far as the lowest bud into the cleft of the stock: the second bud is level with the surface of the ground, which is drawn close around it; and the uppermost is quite above the soil. Great care is necessary in adjusting the scion, that its bark may touch that of the stock in every possible point. The whole is then bound round with a pliable osier, which retains the scion in its proper place. The best season for grafting the vine is just when the warmth of spring sets the sap in motion; and it should be performed when the sky is cloudy, with the wind blowing from the south-east or south-west. Whenever a northerly wind or a great drought prevails, it is better to delay the operation: a burning sun, or cold wind, would arrest the course of the sap by drying up the vessels at the point of union. Neither is it advisable to graft in rainy weather, because the water will trickle down into the incision, and prevent the union between the scion and the stock. The best time for taking off the grafts is in a dry day toward the end of autumn, when the sap is still. They should be cut off with a portion of the old wood adhering, which will assist in preserving them until wanted for use. They should be plunged two or three inches deep in damp sand, and kept in a cool cellar, where neither heat nor frost can penetrate. Twenty-four hours previously to being used, they should be taken up, and that part which had before been in sand should be laid in water."

These directions are excellent, and only very slight variations seem to be desirable. In making the split in the stock, it may be necessary to smooth some rough threads; but it would be unwise to cut or pare "to a sufficient size for the reception of the scion." The split will open with a wedge quite sufficiently for the reception, and it is very desirable that the stock should bind firmly. In case the scion is large, and the stock very stiff, a thin paring may be taken from the split, and also the scion may be shouldered, as seen in fig. 20. I think the scion is unnecessarily long as recommended by Chaptal, two eyes being quite sufficient. Instead of commencing the cut for the wedge an inch beneath the lower eye, it is better to begin the slant very near the base, and on each side of the eye; so that, when the scion is in its place, the lower eye will be just outside the cleft of the stock. The advantage of this form consists in securing the thicker deposit of cambium, which is found at the base of an

Fig. 19.

eye, and applying it at the point of juncture with the stock. The union will be more sure and more perfect than in so long a cleft, and so long an insertion, as is described by Chaptal. And yet we can by no means indorse his strong statement, that "the vine is thus grafted with so much facility, and the union between scion and stock is so perfect, that no plant appears more adapted for this mode of propagation." Undoubtedly there is more truth in this opinion, as applied to sunny France, than to our country and our varieties of the vine. Possibly the vine is not as liable to excessive bleeding from a spring cut in France as with us. They have at least a longer and more favorable season in early spring in which to perform the operation. Whatever may be the reason, it is certainly true, that the result of grafting by the above method has not proved as uniformly successful as could be desired; yet it is oftentimes so desirable to change varieties, that grafting is resorted to, even though but partial success is expected. To avoid the evil of bleeding, Prof. Lindley recommends keeping the scion in a dormant state until the stock has so far developed its shoots and leaves as to be beyond the danger of bleeding. He then recommends the ordinary mode of cleft-grafting the branches, using clay around the scion. He terms this delay the great secret of success. In the humid climate of England, this plan may succeed; but, under our hot and drying sun, the scion will generally perish, unless kept cool by being almost entirely under ground. Now, the recommendation to wait until the vine is under a full flow of sap, and then at a blow to remove every vestige of foliage, and substitute a dormant scion in its place, is doing violence to every principle in the theory of horticulture. Such a sudden check to the sap must inevitably result in great injury to the stock. A much more judicious method would be to remove a considerable proportion of the shoots of the parent stock, and, after drawing away the soil at the root, to apply the scion in some one of the various forms of whip-grafting. But it is always difficult to apply the scion exactly, and bind it sufficiently firm so near the surface; and it is not probable that the plan will be adopted to any considerable extent.

As has been intimated, the great difficulty in grafting the grape lies in the abundant flow of sap from every spring cut. In "The Horticulturist," vol. i. p. 515, Mr. Robert Nelson communicates his practice of autumn grafting of the roots of various trees and shrubs, which he adopted with great success in the fall of 1836. The roots being protected by covering with earth and leaves, the process of uniting progresses to some degree throughout the winter. As the vine has no tendency to bleed when cut in the fall, it is obvious that it is a specially fit subject for this method. Indeed, so completely is the difficulty avoided, that the language of Chaptal, in respect to success, does not seem to be too strong when applied to this country. Mr. Fuller recommends this method in his book upon the Grape, and gives clear directions; by carefully following which, success is almost certain.

In October or November (later if the weather permits), the vine is cut away just below the surface, and the scion inserted as described by Chaptal, with the exceptions that the scion should not have more than two eyes (even one being sufficient), and the stock should be tied with bass-string, for the sake of more firmness, and because it will decay of itself at the proper time, or can easily be removed. This being done, the earth is drawn around the stock, leaving the upper eye of the scion just above the surface. Now cover the scion with a common flower-pot, a small box, or even a triangle of shingles, if the others are not at hand. After this, a covering of leaves from four to six inches deep, made firm by a little earth over all, will effectually exclude the frost. The pot is the cheapest covering and most perfect, and is also a better guard against mice. Leaves are better than earth, hay, or straw; although they, as well as hay and straw, are an inviting nest for mice. The advantages of this method are as follows: First, the work is done at a comparatively leisure season of the year, when there is time to select the best days; secondly, the cut of the stock being made in the fall, the pores have time to close before the flow of sap in the spring, and very little if any bleeding ensues; thirdly, the frost being excluded, a slight assimilation of the stock and scion is going on throughout the winter. In the spring, they are in the precise condition to make the start together. The object of the pot as a covering is to prevent any thing from coming in contact with the scion to disturb it during the winter, or when uncovered in the spring. I once omitted this covering, but substituted a considerable mound of earth. As a result, some scions escaped injury, and grew with great vigor; while others, being caught at the top by the frost, were drawn completely out of the stocks, and so perished. But a sufficient covering is a complete guard against this danger. The scions are not to be uncovered until the severe frosts are past, which, in the vicinity of Boston, is about April 1. This should be done with care, that no displacement may occur; the pots being allowed to remain at hand for replacing, in case of unfavorable changes in the weather. Provided no accident has occurred, and the work has been well done, the scion will start with the vigor of a natural shoot, and make about an equal growth the first season. A cane may be obtained the first season, which will be abundantly able to bear a good crop the following summer. Judging from present experience, I see no reason why this mode of grafting should not come into general use, and prove invaluable to the vineyardist.

Of the various forms of whip-grafting, it is scarcely necessary to speak, inasmuch as the operation is attended by very indifferent success in most cases. Should any one wish to try experiments in this direction, it will be necessary to bear in mind two imperative conditions: First, to bind the scion with great firmness; and, secondly, to keep it moist with grafting-clay, and a wrapping of wet moss over all.

In "The Gardener's Monthly," vol. ii. p. 347, is a description of a mode practised with success by Mr. Cornelius, which we copy, not merely as it is interesting in itself, but also because it illustrates many other modifications in grafting:—

"After the first four or five leaves are formed, and the sap is flowing, you choose the place on the vine where you intend to graft. At that point, wrap tightly a twine several times around the vine. This will, in a measure, prevent the return-sap.

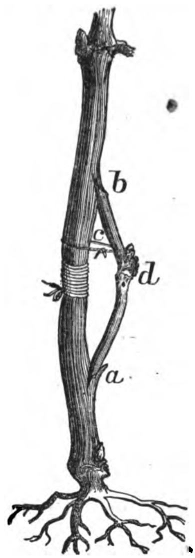

Fig. 20.

"Below the ligature make a sloping cut down, as shown at *a;* also a similar reversed one above the ligature, as at *b*, about one inch in length. In selecting a scion, prefer one that has naturally a bend. Cut it so that it shall be wedge-shape at both ends, and a little longer than the distance between the cuts in the vine at *a* and *b*. Insert the scion, taking care to have the barks in direct contact, securing it with a string, *c*, bound round both scion and vine sufficiently tight to force the scion-ends into their places. If the work is done well, no tie will be required at *a* and *b;* but the joints must be covered with grafting-wax. In a short time, the bud at *d* will commence its growth; after which you can by degrees remove all the growing shoots not belonging to the scion; and, in the course of the summer, you may cut off the wood above *b*, and in the fall remove all above *a* on the stock, and *c* on the scion."

This method, however successful, has many disadvantages, and will require too much careful watching to come into general use.

It will be observed that grafting-wax is not recommended. Most kinds of composition are indeed positively injurious, seeming to enter and poison the porous wood. Below the surface, the moist earth is all-sufficient as a covering; but in extreme cases, where grafting above ground is desirable, the air may be excluded by a judicious use of wax.

It has been the practice of some to whip-graft single eyes upon short pieces of roots, precisely in the manner of root-grafting the apple. This may be done with success, and new varieties may be propagated with stronger growth the first season than from single eyes; yet the gain is so inconsiderable, and the eyes root with so much freedom, that this practice is not specially desirable.

Still another form of grafting, "by approach," or inarching, is in frequent use in glass houses, and may also be successfully applied in the vineyard. It consists in bringing a potted vine alongside of a stock at any time during the growing season, — the month of May being best.

With a sharp knife cut a strip from two to three inches long from the stock-cane, and also a strip of corresponding length from the scion-cane. The aim should be to bring as large a surface of the alburnum of the stock and scion in contact as is possible. Apply the two canes so that the strips shall fit, and lace them firmly together with bass-matting. Surround the work with moss, which should be kept moist for several weeks. It will be necessary to relieve the canes whenever the tying binds too firmly. In the fall, the union will be sufficiently complete to allow the separation from the pot-plant. Though this is a safe mode, it is troublesome, and will not be much in use in the vineyard. Under the constant watching, and in the humid atmosphere of a house, it does admirably well.

CHAPTER V.

SOIL AND SITUATION.

WHEN we consider the exorbitant price of some of the vineyard-lands in favorite localities (some spots on the Rhine being appraised at eight to ten thousand dollars per acre), we might infer that it is only in these localities that we can expect good results. Price is indeed the great index of the comparative value of an article. Applying this index to grape-lands, we shall find a vast preference given to one situation over another. Probably the Rhine vineyards are valued at a higher rate for the mere purpose of cultivation than any other land on the globe. Quite different in character, yet held at the enormous prices of a thousand to five thousand dollars per acre, are the wine-districts of Bordeaux and of Burgundy. In our own country, the same partiality is manifested, to some degree, for favorite localities. For example, some lands bordering upon Lake Erie are held at from two to three hundred dollars per acre and upwards, which is a great increase over ordinary farming lands.

A brief description of the peculiarities of the most famous European districts will be interesting and suggestive. The world-renowned vineyards of the Rhine district are planted on both sides of the river, some of the most famous having even a due-north aspect. They are described as having a good deal of clay mixed with the loose stony soil. When a vineyard becomes exhausted after a culture of about thirty years on these steep slopes, it is renewed by adding several inches of clay as well as manure. The clay is necessary to give strength to the otherwise gravelly and loose stony soil. The Steinberg lands are a bluish clay, the substratum being gravelly. Most of the Rhine soil, the famous Johannisberg for example, is a very red clay, with gravel freely intermixed. In the Burgundy district, the finest wines are produced from vineyards upon the *Côte d'Or* (Golden Hills). This range stretches from Chalons to Dijon, a distance of eighty miles, in a north-east and south-west course. The soil is described as red and gravelly, containing a good deal of limestone. At the top (an elevation of two to three hundred feet) there is but little soil, the red rock projecting in many places. The vineyards commence nearly at the top, where the soil is reddest, and where the richest wines are produced from the small black Pineau Grape. The middle range of the hills is planted with the Black Gamai, larger and more prolific, but yielding an inferior wine. Third-class vineyards are planted down to the foot, and extending into the plain, producing abundantly, but giving only ordinary wine. The hills on both sides of the River Marne are planted; but the sides looking due south are classed differently from those looking north. The south slopes include such distinguished vineyards as Hautvilliers, Disy, and Aix; while the equally famous Epernay, Moussy, and Vinay are on the opposite bank, looking north. The Mountain of Rheims, though in the north of France, is planted on its northern as much as on its southern slope; the soil being a limestone and chalk formation, with a thin covering of vegetable matter. Among the Pyrenees, the vineyards are extended half-way up the highest mountains. In a comparison of French and Hungarian wines, M. de Szemere writes as follows: "In Hungary the old system prevails, under which the quality is the principal object in view, and under which a favorable exposure is the all-important consideration; and the poor, light, stony, granitic land, from whence alone the choicest and the most highly-flavored wines can be obtained, is preferred to a rich, manured soil which insures an abundant, but, in quality, far inferior return. Nothing is grander or more beautiful than our mountains, crowned either with shady woods, or with vines of exuberant vegetation. Where you see a mountain, there you will find our vineyards. The superb Badacsong Mountains form a high semicircle around the majestic Lake of Balaton, covering a surface of a hundred and twenty-five English square miles. The arid mountains of Ménes or Vilàgos overlook proudly the rich plains of Bànat, the holy Canaan of Hungary. The mountain called Tokay rises in another large plain like a lofty pyramid. It has the form of Vesuvius, and, indeed, its existing but silent crater: its volcanic formation shows evidently that it was once a fire-spreading mountain. The cultivation of such a soil is very difficult and expensive, the produce obtained but little; but then the latent fire of this volcanic mountain is what we call Tokay wine."

The above examples confirm the truth of Virgil's oft-quoted statement, "Bacchus amat colles." Yet we find marked exceptions to this rule in various parts of Italy, France, and other countries. Falernia, whose wines were so celebrated in classic song, was a fertile plain. The Medoc district, near Bordeaux, is a gently undulating plain, extending from the River Gironde on the east to the Atlantic on the west, with frequent lagoons indenting the shores on either side. This peninsula contains some of the finest vineyards in the world, such as Lafitte, Château-Margaux, Branc-Mouton, &c. The soil is a coarse, sandy clay, strongly impregnated with oxide of iron. The vineyards of Languedoc, of Tonnere, and on the banks of the Rhone, are of this level or slightly undulating character. Although a chemical analysis of a soil is a very uncertain guide, independent of other conditions, yet the following table of the soil of the celebrated plain of Château-Margaux will be of interest:—

Oxide of Iron	3.341
Alumina	1.590
Magnesia	0.263
Soluble Silicates	0.380
Phosphoric Acid	0.147
Potash	1.291
Carbonate of Lime	0.891
Organic matter	6.670
Insoluble residuum	85.427
	100.000

It cannot be doubted, that, with a favoring climate and soil, an excellent wine can be obtained from plain lands. We know, that, under French manipulations, these wines become famous; yet it is equally certain that the very highest wines can be obtained only where the growth and produce have been quite limited, and the fruit has attained the most concentrated flavor from an abundant amount of light, air, and heat.

There is no apparent reason why the rule which is observed in Europe should not hold good in this country. Certain conclusions may be drawn from a study and comparison of European methods. We may conclude that the production of grapes for the table and for wine are two distinct purposes. For the table, we require fair, large, and luscious fruit, full of juice, bunches of good size and form, an ornamental as well as a useful fruit. These conditions require a generous growth, which will give a large supply of watery matter at the expense of the high saccharine and vinous quality which is so much prized by connoisseurs. A good home drink can undoubtedly be made even from the gleanings of our plain vineyards; but if there is any aim to produce wines which will bear the test of comparison with those of the Rhine, of Burgundy, or Tokay, we must learn to account quantity as of least importance, while quality is the *sine quâ non.* Again: it will be noticed that the hillsides flanking a river are universally esteemed. The deeper these valleys, the farther north the culture of the vine may be successfully extended. This is the secret of success in the Rhine Valley, the grape being planted even upon the northern slopes of this high latitude of fifty-one degrees. In these valleys the air becomes heated during the summer much more so than in the open plain. In addition, a moderate humidity is preserved by the mist arising from the flowing river. It will be noticed that the Rhine lands are described as having a large proportion of clay. It should be borne in mind that this is freely intermixed with calcareous and silicious gravel, while the sharp pitch of the hill will insure quick drainage and a warm soil. As a rule, we observe that preference is given to a loose, warm soil; limestone and silex being both considered as desirable elements. On the plains, more sand is required than on the hills: a heavy clay or loam, at all inclined to dampness, is unfavorable. Sufficient clay to give strength to a dry, gravelly hillside, or a sandy plain, would be a valuable addition. Just that degree of richness should be sought that will insure health and a fair degree of vigor, in order to the full development and early maturity of the fruit; at the same time guarding against such fat lands as will produce rank and immature growth. Some varieties of the grape (*e.g.* the Rebecca) require more strength in the soil, more clay, than others; but this should never so abound as to be called heavy land.

In respect to the aspect of hill-slopes, the testimony of the majority both in this country and in Europe is decidedly in favor of a southern exposure. An eastern exposure is good, as having the benefit of the early sun; a south-east aspect being still better, as receiving the warmth for a longer time. A western slope is shaded from the morning sun, an hour of which is reckoned by gardeners to be worth two hours of the evening sun. After the cool moisture of night, all plants long for the warm rays of early day. A northern slope is oftentimes so situated as to receive the sun's rays from rising to setting. Such aspects may be allowable in many cases, especially for early kinds, and in portions of the country where the fruit has abundant time to mature; yet it must be for other reasons, and not because the slope is desirable, that this aspect is chosen. An exposure to sweeping winds is objectionable, causing much more rapid evaporation from the expansive foliage, and thereby exhausting the life of the vine in hot, dry weather. The contrast between such arid exposure and the comparatively moist and confined heat of river hillsides is very perceptible on the vine. It is found also that vines greatly exposed are more liable to mildew than in positions where a more uniform humidity is preserved and the changes are less violent. It is well known, that, in many parts of the country, the grape does not ripen as well as in former years. In Massachusetts, the Isabella, for example, used to be a certain fruit, but has now become almost a certain failure in ordinary localities. Our State was formerly covered with forests, — Nature's vast system of sponges, — which absorbed the rains, and gradually gave them off in the humid atmosphere, and in gently flowing streams, for months afterwards: but now the greater portion of the country is laid bare to the fierce rays of our clear sun; the natural mulching of leaves is lost; our rains rush in torrents down our hillsides, and speedily make for the ocean whence they came. By this we do not imply that our climate can, with any propriety, be called arid; yet it is true that there is much less *uniform* humidity of the atmosphere during the summer than in former years. An able presentation of this subject will be found in the volume of Hon. G. P. Marsh, entitled "Man and Nature," to which the reader is referred.

The drainage of our meadows and bogs will have an influence in the same direction; so that, by the slow but constant effort of man, silent yet vast changes are effected in the entire system of Nature. This diminution of the even humidity of the air during summer, and the increase of strong sweeping winds with more sudden and violent changes, we cannot doubt, is prejudicial to the grape. We must resort to means to counteract this evil; and, as has been said, we must avoid arid positions exposed to strong currents of wind; seeking protected situations having, if possible, an evaporating surface of water near at hand. Not that more moisture is needed, but that the modifying influence of the lake or ocean may give more uniformity to the humidity and the temperature. Hence the shores of Lake Erie, the Hudson, the Rhine, the Rhone, and the Bordeaux peninsula between the Gironde River and the Atlantic, are all highly prized. It is within the power of man greatly to modify the character of a situation by the judicious planting of belts of evergreens, by a wise addition of elements and a proper culture of the soil, and by encouraging the shade of the vineyard itself wherever circumstances indicate its necessity.

The mechanical texture of the soil is perhaps of more consequence than its chemical analysis. It should be loose and friable; limestone and silicious sand being always esteemed desirable elements. Limestone soils are found to absorb more of the sun's heat during the day, and to part with this heat much more slowly at night, than is the case with vegetable soils. The same is true also of silicious soils; so that they may with propriety be termed warm soils. In conclusion, we may add that the vine will exist in almost any variety of soil; that it luxuriates in rich, fat lands, the growth of wood being excessive, and the fruit large, well developed, but lacking in quality; and that in lighter and dryer soils the growth and fruit are less, but the quality is superior, and the plant is much less liable to disease. A common and rough, yet in general a correct test, is found in the question, whether a soil is favorable for the growth of Indian corn.

PREPARATION OF THE SOIL.

Many soils well situated, and naturally adapted to the grape, are yet wet and springy. It is of great importance that the subsoil as well as the surface should be thoroughly drained. It must be determined, before planting, whether this work is necessary. The distances for the drains will vary from twenty to forty feet apart, according to the nature of the soil. It is desirable to place the tile from three to four feet deep, in order that they may be out of reach of the roots. We are next to consider the nature of the soil, the purpose for which the grapes are cultivated, and the particular kinds to be planted. If the soil is a light, silicious sand, some clay may be added with other enriching material. A strong gravelly soil will require a compost of two-thirds vegetable mould with one-third of stable manure which has been mixed for some time previous.

Fifteen cords of this compost to the acre is little enough dressing for most New-England soils. Indeed, for the purpose of obtaining table fruit, and for such varieties as the Delaware, this quantity may be doubled; but, for such strong and long-jointed kinds as the Concord, a less amount than that first named will generally be found sufficient. The compost is to be spread evenly over the whole surface. To this compost we may add, with profit to most soils, at the rate of two barrels of unslacked lime for every acre. Wood-ashes are always in order for the grape: yet the sole object for the first two years is to produce wood only; and for this the natural strength of the soil, aided by the compost manure, should be fully equal. The bulk of ashes, bones, lime, sulphur, phosphates, or other special manures, should be reserved for top-dressing in the third year and thereafter. We are now ready for the work of loosening the soil and incorporating the compost. Trenching is recommended by some, working the entire surface with the spade to a depth of two feet at least. Some authors recommend that the subsoil should be brought to the top, and the surface should go to the bottom; others would preserve them in their relative position, simply loosening the earth; others still advise that the two soils should be well mixed. Different soils require a modification of every general rule; yet the latter course seems to be most reasonable, and has the approval of most practical cultivators. But this hand-work, though most thorough and perfect, seems to me to be too laborious and expensive for any extensive application. In most soils suited for a vineyard, the plough can be made to go to the depth of twenty inches or two feet, and the work is done sufficiently well for practical purposes. The first furrow being opened as deep as is possible with a strong team, let the subsoil plough follow in the furrow, not only loosening the subsoil to the required depth, but also mixing the surface soil to an extent, as I think, sufficient for all practical purposes. On the hillside, the side-hill plough will throw the surface furrow so far down the hill as to give full space to work the subsoil. This work of ploughing should be done in the fall. If, however, the compost is not in readiness in the fall, it may be spread in the spring, and worked in by a second surface-ploughing.

In case the situation is a hillside, the question of terracing will arise. Undoubtedly this may be advantageous in some cases. Narrow terraces, supported by a stone wall, or even a grass sod, will prevent wash, and give the vine a warm and protected exposure; but this extra expense will not be warranted except the situation is very steep, so that the wash will prove excessive. A partial terracing may be done without great expense, provided a sufficient quantity of stones, from one to two feet in diameter, is at hand. A single course of such stones running in parallels along the face of the hill, and just behind each row of vines, will be a great help in preventing wash. On many hillsides, it would not prove tedious, or very expensive, to throw narrow terraces when the greater part of the work can be done with the plough, the bank and other finishing work being left for the shovel. In such a case, the top surface of the terrace should slope slightly towards the hill, in order that rains may not run down the bank, and wash. Where a more expensive system of terracing is adopted, it will be rather for ornament than for profit; and this may be left to the landscape-gardener.

VINE-BORDERS.

We have thus far spoken only of vineyard-lands. Many persons will wish for instructions for borders for a few vines exclusively for table-fruit. In such cases, the borders may be made deeper and richer. We have instances where the vine is an exceedingly gross feeder. The Hampton-Court Vine lives upon the sewerage of the palace. We read of artificial borders, three to four feet deep, one-third of which is rich stable-manure, with a large supply of bones, lime, &c. The result is a prodigious crop of grapes. We are now speaking of foreign varieties, under glass, which receive constant and peculiar care. Let it be remembered also that such excessive growth is only of second quality for the table, and would be utterly worthless for wine. There is a limit to the richness of a border; though the American people will incline to err on the side of extra growth, to the sacrifice of quality. In such rich borders, another difficulty occurs: the vine is inclined to make wood rather than fruit. This is much more true of some varieties, *e.g.* the Concord, than of others. The Delaware, and such other kinds as are short-jointed, prolific, and of moderate growth, will allow, and even require, a rich soil. If, then, the purpose is to give special advantages to one or more vines for table-fruit, as the first step, see that the sub-soil is well drained. Then add a sufficient quantity of friable pasture sod to increase the depth of surface-loam to eighteen inches: to this add six inches of stable-manure, and about a bushel of bone-dust, to a square rod of border. If the soil is inclined to be heavy and retentive, add pure sand; or, if sand is in excess, add a moderate quantity of clay, and perhaps well-decomposed vegetable soil. But peat and meadow-muck are not desirable additions to such a soil as may be called a good garden or pasture loam. To such a loam, six inches of manure will be quite a sufficient supply of vegetable matter. In such rich borders, special care is necessary that they do not become too heavy, and retentive of moisture.

An addition of lime will be beneficial in correcting this tendency, and will also be of service, both as food for the plant, and as assisting in the decomposition of organic matter and in destroying insects. Potash, in some form, is essential to the grape; yet this may better be supplied as a surface-dressing during the after-growth, when, as we shall see, it is most needed in producing fruit.

The border must be trenched, mixing all the materials, simply loosening the sub-soil, and letting it remain at the bottom. If, however, the character of the sub-soil should be judged suitable to have a good mechanical effect upon the surface-soil, or if it contain any elements which are desirable on the surface, it should be brought up, and mixed to a greater or less extent. The border will be two feet deep when finished, deep enough and rich enough for the feeblest variety; too much so for rampant kinds.

Some authors recommend the grossest and richest materials for the border, such as slaughter-house offal, whole carcasses of horses and cattle, and the like. This is with the object of giving permanence to the border, it being supposed that these remain a store of fertilizing wealth for many years; the large bones becoming fit for use as the fleshy matter is exhausted. Provided such gross material is buried to such a depth that the young roots do not come in contact with it in its putrid state, it may do no present injury; but it will ultimately draw the roots to such a depth from air and warmth as to prove objectionable.

Such use of material is not only a waste, but a positive injury. The use of whole bones is a decided benefit, yet a most expensive mode of applying nourishment. Some kinds of bones will remain in the ground for half a century with but little change. It is manifest that it would be poor economy to furnish so expensive and valuable food by such a slow process. It is true that vine-roots will intwine themselves around and through fresh bones, and greedily take up whatever is obtainable; yet the great bulk is forbidden food until crumbled by time. It is said that vine-borders should be supplied with permanent material which should last as long as the vines themselves. It is indeed of the utmost importance that the composition of the soil should be such that it shall never become sodden, or suffer from drought. Being originally composed of suitable earths, and a moderate supply of organic matter, it will be easy to add manures on the surface, from year to year, as the land may require. Unquestionably the most economical mode of applying manure is to reduce it, as nearly as possible, to a condition for immediate use as food for the plant. Stable-manure should be well composted and decomposed. Bones should be broken into fine pieces, or, better still, ground to powder. Nothing is lost by this process, and a great gain is obvious, both in time, and in other respects which it is not necessary to enumerate. If, then, we can answer four requests, — viz., thorough drainage, a friable soil, a generous dressing of composted manure, and loosening to a depth varying from eighteen to thirty inches, — we shall be ready to take the next step of planting.

CHAPTER VI.

PLANTING.

WHAT kind of vines are best? With care, vines three or four years old may be moved, and will produce fruit the following season. Indeed, they may show fruit the same season; which should be removed at once, in order that the vine may expend all its energies in becoming established. A gain in time may be made by taking large vines. The gain is, however, more apparent than real. At the end of five years, a young vine will probably have borne more fruit than one which was three or four years old when transplanted. Layers have not had the preference, especially layers of new growth, for the reason that the young roots are very fibrous, as a general rule, not running off like strong cords. Such a plant might be called finely rooted by one unaccustomed to judge. But this is a great mistake; for these tender fibres are so delicate, as almost inevitably to perish during the process of transplanting, and thence they become worse than useless: they are nothing less than decaying matter attached to the plant. Such fine fibres should be cleaned from the roots, leaving only those which have considerable substance. If the layer shall still have a sufficiency of roots, there is no reason why it should not become a perfect vine. Cuttings from the open border seldom become sufficiently strong in a single season to be desirable for the vineyard or trellis. Frequently, also, they have a double or a triple set of roots; and it becomes desirable to remove the lower set. The second size of cuttings from eyes under glass is also too small for vineyard planting. Extra No. 1 vines, one year from the eye, with strong, healthy, cord-like roots, and a few plump and ripe eyes on the cane,—I consider such young, vigorous, and healthy stock to be as good as larger vines. They will not bear exposure and neglect as well as vines of larger size; but skilful cultivators will select such stock in preference to any other. The yearlings of second quality will require another season of nursing. They may go into rich beds much like open-air cutting-beds, as previously described.

In a bed five feet wide, there may be four rows of vines, running the length of the bed. The roots of the two outside rows should be turned outwards, the two inside rows occupying the inner portion of the bed. As the vines may be planted within six inches of each other in the rows, a large number will occupy but a moderate space of ground. They will require very similar treatment to the cutting-beds of the previous season, allowing but a single eye to grow near the ground. If a sufficient quantity of stakes are not at hand, it may be as well and cheaper to plant a strong stake at each end of each row, and intervening stakes at a distance of every ten feet in the row; then draw a trellis of strong twine for each row (the lines being wound around each stake in its row), the first line being six inches from the ground, and the lines above being six inches apart. The upper lines should not be put on until growth requires it. Remember the ounce of prevention, — frequent dustings of sulphur. Keep the vines carefully tied to the lines as they grow, allowing but a single cane for each, and removing all the laterals. The growth may be so rank as to. require checking of the main cane in August in order to its ripening. The great majority of these will be extra large vines, with at least six feet

8

of ripe wood,—in all respects as good as could be desired.

Fall and spring planting have each their advocates. It is claimed, and I think with truth, that a vine planted in early October, if in a warm and dry soil, will, in some degree, establish itself in its new locality in the fall, so as to start more vigorously in the spring than if newly planted. Under favorable circumstances, fall-planted vines certainly make more growth the ensuing season than if planted in the spring. On the other hand, there is risk that fall vines may be injured by the winter. There may also be an advantage in leaving a field unplanted, in order to give it another ploughing and loosening after the winter freezing. Certainly there is some extra labor in protecting and uncovering fall-planted vines. These reasons are to be weighed. I should advise fall-planting as preferable, when the ground is in readiness, and the soil is light and dry, and if it is a more leisure time for the planter to do the work in the fall than in the spring.

In planting, the following rules are to be observed: Examine the roots, cutting away any fine threads that will be likely to dry and perish; shorten any of the long cords of roots extending beyond two or three feet, according to the size of the vine; and see that all bruised ends are removed by a smooth cut. If many vines are to be thus prepared, do the work in some moist and shaded place, and take them to the field in a mat or box, with moss around the roots. The holes should be already dug, being large enough for the roots to radiate from the centre without bending. The holes should be about six inches deep, the centre being very slightly crowning, so that the base of the vine shall be from four to five inches below the surface when the work is finished. The vine should be placed exactly in the place where the cane is to be brought up. Some advise the plan of placing the vine a distance from the trellis, and then laying down the cane towards the trellis, and burying all but the end of the cane upon which an eye is left remaining. This eye is to furnish a new cane, while the old cane under ground is making an extra supply of new roots. It is claimed that a greatly increased amount of roots can thus be obtained in a single season; but such a vine is an ill-arranged and incongruous affair. Make haste slowly; preserve the symmetry of the vine; keep the roots as near as possible to the stem, and radiating around it: these are safe rules to follow. In a good soil, there need be no fear but the roots will do all that may be desirable.

Never plant, under any consideration, just after or during a rain, when the soil is wet and heavy. It is best to have the soil pretty dry, so that, during the process of planting, the soil may be pressed to the roots with the foot without danger of hardening it. If the work is done in the fall, it will be necessary, just before the ground freezes, to bend the cane to the earth, and cover it slightly with a few spadefuls of soil. Then throw a slight covering of litter around each vine, if it can be conveniently obtained. This will keep the frost from penetrating too severely, and will favor a slight root-action during the winter. Uncover the cane in the spring before the buds become too much started. On a warm southern slope, they will start earlier when covered than when exposed. Judgment must therefore be exercised not to allow the buds to become too forward, and, on the other hand, not to expose them to severe freezing. As the buds start, rub off all but the three strongest which are near the base. When these are sufficiently grown to take the first tie, select the most promising shoot, and secure it to the stake, or trellis. This work must not be delayed, else the young shoots are very liable to become broken by the wind, or to be bent and misshapen. At this time, the other two shoots (which were only a reserve against accidents) are to be removed. The cane itself can be cut away just above the growing shoot, now that danger from bleeding has passed. We shall thus have but a single, strong shoot starting from the very surface of the ground. Allow it to grow as far as it will, keeping it tied in an upright position. Many lateral shoots will start from the axils of most of the lower leaves. Do not rub these laterals entirely out, but check them with the thumb and finger just above the first leaf on the lateral. The object in preserving one joint of the lateral is to protect the eye in the axil at the base, which would be exposed, and liable itself to start, if the lateral should be entirely removed. If the vine is vigorous, it will attain a height of eight feet; when it may be stopped, and the laterals allowed to grow, pinching the strongest so as to preserve the proportions of the vine. In the fall, the cane is to be shortened to two feet, and again covered with earth. Before proceeding farther, the method of training must be decided upon.

CHAPTER VII.

MODES OF TRAINING.

NATURE is our guide. With an intelligent observation of the habits of plants, we can scarcely go astray in their culture; and yet how greatly do we modify the circumstances, retaining the conditions which are of essential importance, and rejecting incidents which have no intrinsic connection with the plant! We find the grape running wild over our stone walls, oftentimes bearing considerable fruit in this trailing position. More commonly we find it climbing to the tops of forest-trees, its naked trunk being oftentimes twenty, forty, or even sixty feet in length. Reaching the top, its branches spread out horizontally; and on its pendent laterals we shall find a profusion of fruit. Seldom do we find much fruit while the vine maintains an upright position. In such a position, the upright flow of sap is strong, and the break of the bud is for wood-growth rather than for fruit. We infer that the position of a vine upon a wall is some check to its growth, that it will develop fruit-buds to some degree, but that a tangled and crowded mass of growth is not conducive to fruitfulness. We also infer that the elongated trunk of the vine in the forests is for the simple purpose of climbing to the light; that its length is of no account, provided light and a spreading support are obtained at the top; and that a horizontal position is a healthful check to growth, and a condition of fruitfulness. Now, supposing we could cut away the whole naked trunk, and drop the vine on a trellis, in the form of the top of the tree, to within four feet of the ground: would the essential conditions of healthy development be changed? Let us see. We know that sap will course through a long, hard, and dry-looking trunk, and show vigor at the extremity; but we cannot for a moment believe there is any gain (rather a loss) by such long passage. We know the vine likes air and light; yet there is a limit to these: exposure to high winds must be avoided. The leaves and branches will be much less liable to be torn, and evaporation from the leaves during parching winds will be much reduced, if the vines are near the ground. Is the state of the atmosphere twenty or forty feet from the surface more suited to the vine than nearer the ground? Both theory and facts are against such a supposition. A more uniform temperature and humidity are preserved near the surface than in the upper air. The temperature will average higher, and changes will be less sudden. It is the testimony of French vineyardists, that grapes trained close to the ground will ripen considerably earlier than when carried into the air. The main lesson of the natural vine, then, is the horizontal and the pendent position of the fruiting-branches. The natural vine has no kind hand to check exuberant growth; but it adopts this principle of a reversal of the position of the branches to accomplish this end. Let us now examine the various modes of training which recognize this principle.

In the vinery, under glass, we train the cane at an angle of from thirty to forty-five degrees with the surface; the lateral branches being tied out on each side, approaching to a horizontal position. In the common form of an arbor, the overarching top will give a horizontal growth, and the branches may be allowed to hang pendulous. Such vines are difficult to manage at the top, and the growth is liable to become tangled and excessive. Various other plans have been suggested for the purpose of checking the flow of sap and developing fruit. The bow-system has been in use in Ohio to a considerable extent, having been introduced by Germans accustomed to the practice in Europe. It consists in training two canes, — one of which is of the previous season's growth, and which is the present fruiting-cane; the other being the growth of this season, and designed to replace the other cane, which is cut away as soon as the fruit is matured. Figure 21 illustrates the

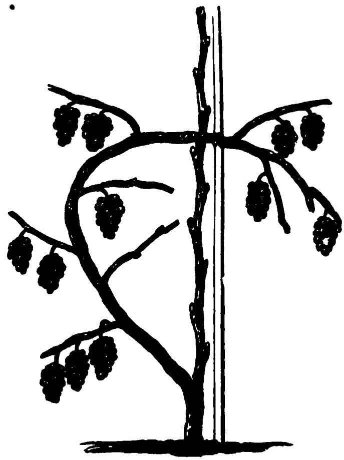

Fig. 21.

mode. The bow is often varied in form, being sometimes bent to a complete hoop. Of course, the flow of sap will be checked by this process. Among other objections, the one which I should regard as final is the annual expenditure of so much energy in producing new canes. It would be possible to train vines in the form of a tree, as seen in fig. 22. The annual growth is to be cut back to within one plump eye of the trunk each fall. The branches will arch by their own weight and the weight

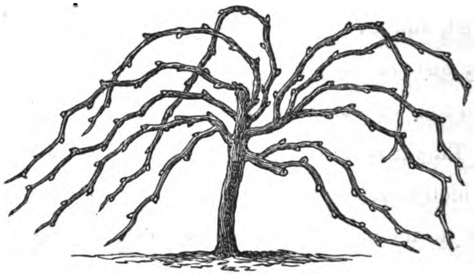

Fig. 22.

of fruit. A large hoop, supported by stakes, may give support and symmetry to the vine. The objections to this plan are, that the growth and the fruit would be too compact near the trunk: it would also be found troublesome to give suitable support to such a form.

But in California, where the amount of wood-growth is limited on account of the dry climate, this is the form adopted; the vine being stiff, and able to support itself. A form which endeavors, to some extent, to diminish the strong flow of sap, is a simple coil, or cork-screw, of the vine around a post. The fruit-branches are allowed to grow, and hang down of their own weight. The coil, or twisting, has an undoubted tendency to check the flow of sap; yet its effect is by no means sufficient: the growth of leaf and branches will be too strong at the top; the lower eyes will become weak; and the quantity of fruit will diminish, especially at the base. The more the vine is coiled, and even bowed, the less this evil will be felt. It may also be remedied by bringing up a renewal-cane once in four or six years, whenever the old cane becomes bare. This involves some waste of energy; and the necessity which requires it indicates an imperfect system. Yet it is by no means a bad method; indeed, it has some advantages over any other, and seems peculiarly suited to some varieties. Its simplicity commends it, and the very little amount of labor required in tying is another advantage. There is, however, considerable risk in allowing the branches to hang unsupported. When they are young and tender, they are liable to part from the vine by their own weight, or by the force of a strong wind. This objection, of course, will apply to every system where there is no support for the branches. The distance apart will depend upon the height of the posts, and may exactly correspond. For instance, if the posts are six feet high, the vines may be planted six by six; or, if trained to eight-feet posts, increase the distance to eight feet each way. If the vines are carried above eight feet, the rule will require modification, as the distances will not then increase as rapidly as the height. As each vine will require a post, the cost will generally be about the same as a trellis, with fewer posts, and wire for the spaces. If two-inch poles are used, the first cost will be less; but these will last only a few years. Many good cultivators are adopting this cork-screw system, if it may be so termed, as a very easy, simple, and economical way, having the advantage of making each vine independent, and accessible on all sides, and securing a good circulation of light and air. But there are objections to it, as we have seen; and it is believed that other systems are superior.

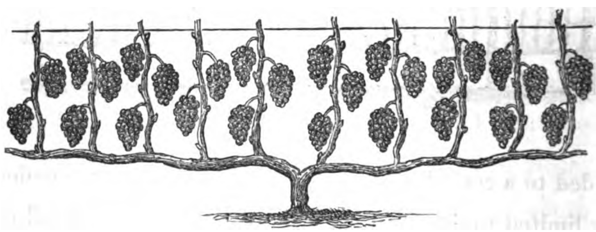

Fig. 23.

A method adopted in France more than a century ago, in the village of Thomery, and since that time brought into extensive use, more especially for the culture of table-fruit, has been brought into special notice in this country within a few years. It consists in the training of two horizontal arms in opposite directions upon a wall or trellis, with fruiting branches tied perpendicularly, in the manner seen in fig. 23. By this position, the distribution of sap is equalized; there being no marked difference between the growth of branches near the trunk and those at the extremities of the arms. The arms may be ex-

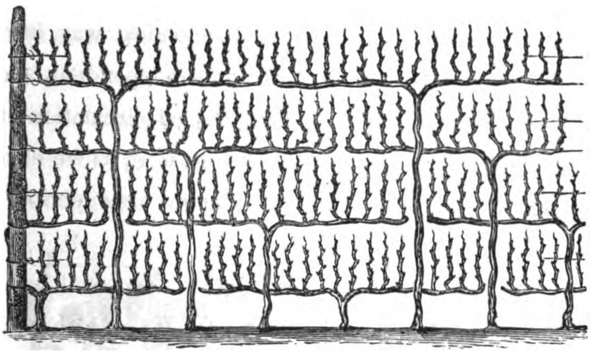

Fig. 24.

tended to a considerable distance, though they are generally limited to four feet for vineyard-culture. Fig. 23 indicates that the arms are kept near the ground, which is regarded as a decided advantage. However, it is often desirable to cover a high, upright wall, or trellis. The Thomery system admits of an easy modification to accomplish this end. By an examination of fig. 24, it will be seen that there are four tiers of arms, which will require a height of about twenty feet from the ground. It will be observed that the principle on which the system is based remains intact. The branches are in such position, and may be arranged with such regularity, as to be easily and firmly tied; so that the whole appearance of the vine will be neat and symmetrical in the extreme. It may be asked why it would not be as well to have a single main upright trunk, half-way from the ends of the wall or arbor, and the four tiers of arms stretching horizontally from one trunk. It would be a serious objection to this plan, that the upper tier of arms would receive too large a proportion of the strength of the vine, while the lower arms would experience a corresponding lack, and would ultimately become barren. It is the excellence of the Thomery plan, that it reduces all the fruiting-eyes of an individual vine to an exact level. Though there are four tiers represented in fig. 24, yet all the eyes of each single vine will be seen to be on a level; and consequently there will be an impartial distribution of the sap. This complication, however, though simple, is by no means desirable, except for the purpose of covering buildings or high walls. It is far better in the vineyard to have but a single course of arms, planting the rows sufficiently near together to economize all the land. The objections to a high trellis, and a double or a triple course of arms, are, first, that, in rough vineyard-culture, there is more or less danger that the growth of the different arms will not be kept separate in actual practice, occasioning some confusion, and unequal distribution of foliage; secondly, the lower tiers and the ground will be too much sheltered and shaded by the upper tiers, causing a dampness, and a lack of circulation of air near the ground; thirdly, the upper tiers will be exposed to strong currents of wind, which are very injurious; and, in addition, the expense of building high trellises, and managing the vines upon them, is much greater than in the low system.

By a study of fig. 24, any one of ordinary judgment will be able to follow the form that is given, or make such simple modifications as are desirable for covering the sides of barns, or the roofs of sheds, arbors, &c. To the novice in grape-culture it may be well to mention, what will more fully appear in the chapter on Pruning, that all the upright fruit-bearing wood is annually cut back to one new eye, leaving but the trunk and the two arms at the close of the season. Is this system correct in theory? and what is the practical testimony in regard to it? It is the misfortune of horticultural science that many of its questions cannot be answered with mathematical certainty: so much time is required in making observations, so many disturbing causes enter into our calculations, and it is so easy to misinterpret, that it is not strange there are very conflicting opinions. Yet to how much more certainty might we attain by a careful study and comparison of Nature's laws! At present, we can only give qualified opinions in regard to the Thomery system. Its arms are near the ground, which we judge to be favorable: they are in a horizontal position, which, we know, checks the strong flow of sap, and induces fruitfulness. Its fruit-branches are tied in an upright position, and evenly spread, so as to receive a full supply of light and air in all their parts. The practical cultivator will complain of the amount of labor involved in the repeated tying of every shoot. In large vineyards, and with the present high cost of labor, this is, indeed, a serious item. The theorist will also question whether this bolt-upright position of the branches is favorable. Nature indicates that they should arch over, or even be pendent, with the weight of fruit. While the position of the arms tends to an equal distribution of sap, yet it will be found that the upright shoots nearest the trunk are generally the strongest; and, if one is left directly over the trunk, it will be like a perpendicular cane, and will require frequent checking. This upright position of the branches unquestionably counteracts, to some extent, the horizontal influence of the arms: it induces growth at the extremities of the branches, and tends to enfeeble the dormant fruiting-eyes of the succeeding season. This is the theoretical tendency. To what degree this will result in evil has not yet been proved in this country. It is a well-established fact, that the best table-grapes are thus grown in France, and that they have been thus grown with admirable success in this country; and it is manifest that the plan combines many advantages. Yet these facts by no means establish as true that it has no practical or theoretical defects. It should be borne in mind that the climate of France is dryer than our own, and the tendency to wood-growth is consequently less than with us; so that the upright position of the laterals may be much less objectionable in France than in our Atlantic States. Theoretically it will be a rule, that countries which have the least amount of rain fall during the growing season will suffer least from the counteracting effect of the upright branches. In such dry climates, there is little danger of excessive wood-growth. I question the principle of two arms, as being less simple and less manageable, especially in cold latitudes, where it is desirable to lay down the vines and cover them in the winter. It is true, a vine with the two arms can be bent backwards to the ground, so that the trunk and the arms can be covered; yet it is not an easy process, and will require more of a bank of earth to effectually cover the trunk than can well be spared from the roots. The principle of the system may be entirely preserved with a single arm, as is represented in fig. 25. It may be sug-

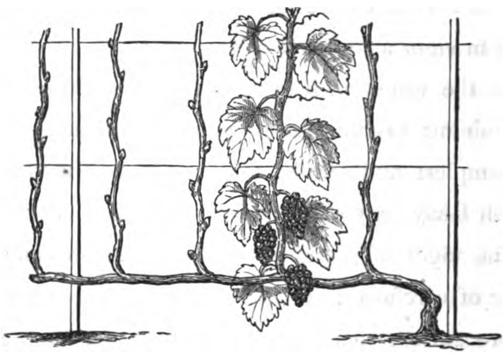

Fig. 25.

gested, that, if but one arm is used, it would be necessary to have it about equal in length to the combined length of the two arms; and that, consequently, the extreme end of the single arm would suffer, inasmuch as the upright shoots are strongest near the base. It is true, that, if an upright shoot starts at the bend of the arm, it will receive more than its proportion of vigor; but, when the sap is turned into the horizontal arm, its tendency is to seek the extreme end. This force is diminished by the suction of the successive upright shoots; yet it is sufficiently strong at the end of a cane of the ordinary length of six or eight feet. This one-arm system, or single, horizontal cane-system, I have tried for two seasons in my own vineyard, and with gratifying results. Upon arms six feet in length, I have not noticed any appreciable difference in vigor at the end of the cane.

As the canes all lead in one direction, the whole work of training, pruning, and winter-covering, is reduced to its simplest and easiest form. The two main objections which I have experienced have been, first and especially, in the vigor of the upright shoots; and, secondly, in the labor of carefully tying each shoot. It is evident, as was before stated, that the upright position of the bearing wood tends directly to overcome the influence of the horizontal arm. In the case of the wild vine, not only the arms run horizontally in the tops of trees, but also the branches arch over, or are pendent, with the weight of fruit. In the Thomery plan, it is evident that Nature's pattern is not followed. What will be the result, if, instead of a partial use of Nature's hints, we apply the principle entirely?

There is no form in present use to which there are not practical and theoretical objections. To obviate some of these difficulties, I have conceived a modified form of training, which I call the horizontal-branch system. It will meet with criticism, and it may prove to be valueless. I am aware of facts and theories which seem to be opposed to it. These I shall endeavor to state fairly, so that no one may be misled by a theory, but rather may await the test of actual trial. I suggest the following mode: Posts for a trellis are to be set in the rows twelve feet apart, and sawed to a level, three feet above ground. To the top of each post, and at right angles with the row, nail a strip of wood one foot in length. Draw a wire from post to post, fastening it by staples two inches from the top of the posts. The ends of the strips at the top of the posts should project an equal distance of six inches on each side of the wire. Now draw two more wires, which are to be secured by staples to each end of the strips. Thus we shall have a horizontal trellis of three wires, the middle wire being from two to three inches lower than the two outer wires. A single arm, or horizontal cane, is to be tied to the middle wire. The side wires, being but six inches from the cane, and a little above it, will give early support to the soft fruit-bearing shoots. The majority of these may be simply placed in position upon the outer wires, where their own weight will keep them. Some stray shoots will require tying. As the fruit matures, the weight will gradually bend down the branches, checking the tendency to growth at the extremities, and securing all the forces of the vine for the fruit. Fig. 26 represents a vine grown after this manner.

Fig. 26.

So far as I am aware, this mode of training is novel: it has not had the test of trial. The main advantage which it claims is the economizing of the forces of the vine to the utmost extent possible for the production and maturity of fruit. It is a near approach to the position of a vine in a tree-top. The two outside wires are a little raised for the purpose of encouraging growth in the shoots during the early stage of development; this growth, however, becoming gradually restrained as the branches take a horizontal position. Incidental advantages of this form may also be suggested, — such as a more uniform and moderate shade of the soil than by upright trellis; also securing the benefit of more radiation of heat, and uniform and moderate humidity from the soil; and, again, securing an abundance of light and air, without exposing the vine to sifting winds as a perpendicular trellis does. Thus far, the plan seems to have manifest and very decided advantages, and to answer all the requisites. There yet remains one important consideration. Will such a broad exposure of the vine to the sun, the rain, and the dews, be beneficial, or otherwise? Upon this point we have the very definitely expressed opinion of Prof. Lindley, given in his "Theory of Horticulture," p. 269; which opinion is certainly entitled to very great consideration. We quote as follows: "That training a tree over the face of a wall will protect the blossoms from cold must be apparent when we consider the severe effect of excessive evaporation upon the tender parts. A merely low temperature will produce comparatively little injury in a still air, because the more essential parts of the flower are very much guarded by the bracts, calyx, and petals which overlie them; and, moreover, because radiation will be intercepted by the branches themselves, placed one above the other; so that none but the uppermost branches which radiate into space will feel its full effects: but, when a cold wind is constantly passing through the branches and among the flowers, the perspiration — against which no sufficient guard is provided by Nature — becomes so rapid as to increase the amount of cold considerably, besides abstracting more aqueous matter than a plant can safely part with. It being one of the great objects of training trees to prevent this, it is inconceivable how any one should have recommended such devices as those mentioned in 'The Horticultural Transactions,' vol. ii., Appendix, p. 8, of training trees upon a horizontal plane; the only effect of which would be to expose a tree as much as possible to the effect of that radiation which it is the very purpose of traing to guard against."

This is sufficiently explicit; indeed, too much so to be taken without consideration. Consider the natural growth of trees. All flat-topped trees have precisely this horizontal plane: so, indeed, the vast majority of vegetable growth inclines more or less to this plane contour. Such perpendicular growth as the Lombardy Poplar or the Irish Juniper is exceptional, and not the general habit of vegetation. Can it be that Nature has made a mistake? that the habits of plants are not best adapted to their necessities? Prof. Lindley very justly alludes to the effect of "cold winds constantly passing through the branches;" but we must bear in mind that currents of cold air are almost entirely in a horizontal direction. Of course, then, the perpendicular trellis will receive the full force of the wind, like a spread sail; while the horizontal cuts the wind like a knife, presenting far less surface for resistance than any other form. In this consists a very decided advantage for the horizontal plane; but it is true that the wind will strike the outer foliage with full force as it passes over the trellis. This same foliage is again exposed alternately to the fierce heat of a direct sun, and the cold air and heavy dews of night. Such fluctuations are not favorable. It is noticeable that the outer and more exposed foliage of the grape is, in general, most liable to mildew. Whether this fact, as applied to the horizontal trellis, will prove a serious objection, can only be determined by actual trial. While horizontal training of fruit-trees has been suggested, and a partial and modified form is almost universally adopted for the grape under glass, yet as a complete system, and for open culture, I am not aware that the form given above has ever been tried; but I think it is so plainly suggested by the natural habit of vegetation, and that it secures so many theoretical and practical advantages, that it is worthy of the most careful trial. If the vines can be guarded from mildew, I shall have no question of the excellence of the mode. I am aware, that, in the opinion of many, the dews of night are the great prolific cause of mildew, and that partial roofs are recommended for upright trellises for the sole purpose of keeping off the dew; but I am inclined to think that the cold night air is the true cause of disease. I believe, also, that the vines near the ground will feel the night currents less than when elevated. Possibly the radiating heat of the earth may, to some extent, be preserved by the spreading branches. I trust also, that, by this plan, the moisture will prove to be more uniform and less excessive, as the shade of the vines is more even and less dense in spots. The plan is so contrary to prevailing theories, and, I grant also, to some experiences (which perhaps are exceptional), that I would not advise its extensive adoption without previous trials on a moderate scale; yet I have so much confidence, that, if there are objections, there are also counteracting or mitigating circumstances, that I shall not hesitate to transform a considerable portion of a present vineyard to this method of training, for trial.

Though this principle of horizontal training, as has been said, has not heretofore been completely carried out and applied in this form, yet we often see a modified form, and with good results.

The allusion by Professor Lindley to the suggestions in "The Horticultural Transactions" has reference to a mode of training fruit-trees described by M. Noisette of France, and introduced in England by George H. Nochden, LL.D. It consists in the simple training of fruit-branches upon a horizontal trellis; one form, for example, being circular, like a centre-table, the tree-trunk being the centre pillar of the table. The supposed advantage of this form is so well stated by Mr. Nochden, that I give it in his own words: —

"The essential point is to lay the branches in a horizontal position; for, by training them in this way, the current of sap is forced to assume a direction in which it cannot move with the same quickness as it would in its natural channel, which is from the root straight upwards: and the diversion favors the process of forming fruit, by inducing, as has been elsewhere intimated, a slower motion of the sap, and thus affording time for the secretion and deposition of the particles."

M. Noisette designed his mode especially for the peach, the apricot, and other fruit-trees; but it must be obvious that these stiff and naturally upright fruiting-trees are by no means such natural subjects for this mode as the flexible and pendulous grape. Very naturally, therefore, they have often been trained over the tops of arbors, generally without system, and with an entire neglect of summer-pinching. As another instance, a vine running over the roof of a house, if properly cared for, will give excellent results. The plane is inclined, yet is so flat as to spread out the foliage to the full effects of sun and wind and rain. Vines running over rocks have a broad and full exposure of the whole surface; and grapes are ripened in the cold latitude of Maine in this way better than in any other. Of course, the rocks are favorable; but we must conclude that the position is, at least, not unfavorable. Other similar instances might be mentioned, and they certainly go a great way in strengthening the belief that the horizontal is the true position for developing fruit.

In concluding this chapter on Training, it may be said, in review, that the spiral or cork-screw system has strong advocates, and answers very well, though open to objections. The Thomery plan, with two horizontal arms and upright shoots, is better in some respects, and on other accounts not so good, having more numerous and earnest advocates. A modification of the Thomery, the single arm, is better in some respects, and equally good in all.

And, finally, the horizontal system seems to be based upon the laws of Nature, approaching very nearly to a perfect theoretical form for an equal development of fruit and foliage; and setting aside the effects of mildew, which time and trial alone can determine, in other respects it seems to be the most promising of all.

CHAPTER VIII.

DISTANCES AND TRELLISES.

THE mode of proceeding will vary essentially, to accord with the different kinds of training. If it is decided to adopt the spiral coil, the plan involves large and high posts; and these must therefore be planted deep in the ground. It will be necessary to do such deep digging before the vine is planted. In order to do the work systematically, so that the posts may range in every direction, the distances should be determined, and the land laid out in squares. For this mode, I think, as an average rule, the Jewish sacred number seven may be applied. The posts may stand seven feet apart each way, and seven feet out of ground. Perhaps the height is stretched a foot for the sake of uniformity; and it would undoubtedly be better to reduce the height for short-jointed kinds, such as the Delaware. At the distance of seven feet apart each way, it would require eight hundred and eighty-eight vines to plant an acre. The simplest way to lay out a lot with exactness is to divide a line into the distances determined for planting the vines, and fasten a bit of string at each point on the line. Apply the line on one side of the lot, and drive stakes at each string; then apply one end of the line at either of the end-stakes, draw it at a right angle with the row of stakes, and again drive stakes at each string. This gives two sides of a square; and in the same way the third and fourth sides may be formed, and the exact spot for every stake may readily be indicated by the strings on the line. On level ground, or a smooth slope, the posts will range diagonally as well as at right angles: they should also be sawed to a uniform height for the sake of neatness of appearance. For the spiral mode there is no trellis,—no other support than the post, with a few nails driven partly in at suitable intervals on which to hang loops for supporting the vine.

For the trellis system, I am inclined to think six feet apart each way will be found to be a sufficient distance, as an average rule. Such strong and rank growers as Union Village, or Rogers No. 15, may need more width between the rows if in a rich soil. On the other hand, the Delaware, in ordinary soils, will not require so much space between the rows. There is also no arbitrary necessity for planting at a distance of six feet in the rows: the two arms of the Thomery may be more or less than three feet each, and the single arm may be extended to eight or even twelve feet or more. With liberty for variation, it is yet probable that a distance of six feet each way will be found the safest rule for general adoption. This will give twelve hundred and ten vines to the acre. As the vines are to be trained to temporary stakes during the first and second season after planting, it will not be necessary to prepare the trellis until the spring of the third season. The height of a perpendicular trellis should be made to vary according to the variety of grape to be cultivated. As has been previously stated, it is not probable that we can adopt such severe checking with our American varieties as is done in Europe. A celebrated French cultivator, M. Malot, has a trellis at Montreuil; the arms upon it being only fifteen inches one above another. He therefore allows the fruiting-branches of such varieties as the Chasselas de Fontainebleau to grow but fifteen inches. This is less than the usual length in France, which varies from seventeen to twenty inches. In this country, the shoots are seldom less than two feet long, and more frequently extend to two and a half, and even three feet. The Delaware may easily be kept within a limit of two feet; while the long-jointed Concord must have, as a least allowance, thirty inches. Hence the height of trellises will vary. A form of trellis is recommended by Fuller in his treatise upon the grape, which is less in accordance with practical good sense than most of the suggestions in his book. It consists of the usual upright posts, with two horizontal bars, one at the top, and one within a foot of the

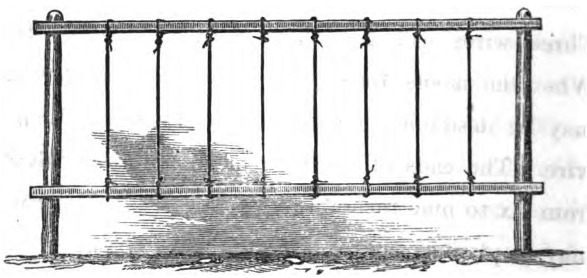

Fig. 27.

ground. Wires are passed from bar to bar at such intervals as the shoots are expected to appear. This is seen at a glance in fig. 27. It must be obvious that the amount of wire will be considerable, and that there will be a good deal of waste in winding so many short pieces round the bars. A perfectly practicable and much more economical way is to draw the wires horizontally from post to post. The first wire is the support for the arm, and should be a foot from the ground at least. Even at this distance, it is sometimes the case that the lower bunches of fruit are spattered with earth during heavy showers. The next wire should not be more than eight inches above the first, in order that the young shoots may obtain an early support. The next wire may be from twelve to sixteen inches above the second, and from twenty to twenty-four inches above the first. The top wire will therefore be from thirty-two to thirty-six inches from the ground. Three wires will generally be found quite sufficient. When the shoots are extended to three feet, however, it may be desirable, in windy positions, to have a fourth wire. The ends of the shoots may, with safety, extend from six to nine inches beyond the last tie. The posts may be planted twelve feet apart; and, being but about three feet above the surface, of course the strain will be slight. Yet it is best to put a brace to the inside of the two end-posts of each row, as this secures against all sagging. Galvanized wire has been recommended as being more durable. It is much the most expensive, and is no more permanent than common annealed wire can be made to be by a trifling expense in painting. I have found number-thirteen wire to be quite strong enough; this number yielding about forty-five feet to the pound, and costing six cents per pound in Boston in 1862. An ordinary pair of nippers and a hammer are all the tools necessary for putting up the wires. With the nippers, cut pieces from the wire two inches in length, first bending the pieces at the centres. These pieces are for staples, which will answer every purpose, and can readily be formed and sharpened with a hammer in a rainy day at much less cost than they can be bought. The wire, being fastened to the post at one end of the row, is stretched to the post at the other end, and with the nippers drawn tightly around it, and made fast. It will be an easy matter to slacken the wire at the fall-pruning in order to avoid the strain of contraction during cold weather. The strand being made fast to the posts at both ends, it only remains to secure it to each of the intervening posts by driving the staples. As soon as the trellis is finished, the wires should be painted with common paraffine varnish, which costs from sixty cents to a dollar per gallon, and which quantity would be sufficient for an extensive vineyard. A stiff swab of woollen cloth will make the best brush. It can be drawn with long strokes, covering the wire very rapidly. This varnish, when applied every second year in a single coat, proves a perfect protection against rust.

In regard to the horizontal form of trellis, while I have great confidence in the theory, and hope and believe it will have practical merit, yet it is to be remembered that it has not stood the test of trial. Some defect or objection may be found. Many are fond of experiment, however, and are willing to venture a moderate risk as the price of progress. In a previous chapter, the height of a horizontal trellis was suggested as three feet. This was with a view of letting the branches arch down over the outside wires. It is also high enough to give space for the hoe. Possibly it may be found, upon trial, that it will be advantageous to bring the trellis six or more inches nearer the ground. This will undoubtedly hasten the maturity, and otherwise benefit the fruit, provided there are no practical difficulties in the way of cultivation. The construction of this trellis is very simple. The posts being sawed to the desired height of two and a half or three feet, the centre wire may pass directly over the tops: a cross-piece, from twelve to sixteen inches in length, is then nailed to the top of each post, at right angles to the wire. The two outer wires can then be secured at each end of the strips, equally distant from the centre wire, and about two inches above it; this being nearly the thickness of the strip. Thus the shoots will have a slight upward inclination at first, and will have support by a tie at the wires, six or eight inches from the cane. The weight of fruit will rest upon the wires; while the weight of growth beyond the outer wires, a length of sixteen to twenty inches, will incline downwards. Possibly strong-growing kinds might find advantage in another outer wire, which could easily be added. When the rows are six, or even five feet apart, this form will not prevent the use of the horse-hoe in the spring, and until growth is advanced.

The question occurs, At what points of the compass is it most desirable to run the trellis rows? The north and south line has many advocates, and so also has the east and west, both sides giving weighty reasons for their preference. For the north and south line, it is said, that, during some part of the day, the sun shines on all sides of the trellis,—the east side in the forenoon, and the west side in the afternoon; while at mid-day it warms the soil on both sides. The advocates of the east and west line claim that the sun will send its beams aslant between the trellises at its very first appearance in the morning, and its last rays at night; that during the cold and dewy morning hours, when light and warmth are much more important than at a later hour of the day, one row does not shade another, but the first beams stream in to give light and some degree of warmth, and to dispel the mists. There is reason in both views; and, while I incline to give preference to the east and west line, I do not regard the direction as in itself essential: it will be often varied by circumstances. For instance, on sloping ground, it is undesirable to run the rows up and down the hill, both on account of the greater labor in working up and down hill, and also because of the greater liability to wash. In the case of the horizontal trellises, it will be seen that it is still less material which way they run, as the foliage is spread out to the utmost to catch the sunshine in every position. For walls, it must be apparent that the nearest approach to a due east and west line will give the greatest amount of sunlight and heat. A wall looking south-easterly, or even easterly, will do very well; but a west wall is much less desirable. On a wall looking due north, the sun would strike but a brief hour, morning and night; and it would be useless to plant grapes in such a position.

Many kinds of grapes will not endure the full force of our clear sun when trained against a wall or a building looking due south. The leaves of the Rebecca, for example, will become scorched and crisp in such a position. Indeed, there is no variety, however rough its foliage, that will not suffer from the burning heat, when in close contact with the south side of a wall or building. It is best to keep the foliage a few inches from the wall.

TRAINING FOR FAMILY USE.

There are multitudes who have no interest in vineyard culture, and yet who wish for a few vines in the garden, or to run over buildings, for the purpose of obtaining fruit for their own table. For such cases, distinct and definite directions are often wanted. It is frequently the case that a garden is surrounded by a picket or a close board-fence. Every face of this fence which does not look more directly to the north than north-east or north-west may have a row of vines planted in front of it. If the face looking south is protected, and has the full force of a glaring sun, the vines should be trained at least a foot from the fence. If the fence is but four feet high, there will be room for only one course of arms; and the single horizontal arm, pruned on the short-spur system, is best for this position. But, supposing the fence to be six feet high, there will then be space sufficient for two "cordons," or tiers, of fruit. It is perfectly practicable to supply both these tiers by the single-arm system, as represented in fig. 28; the arms being

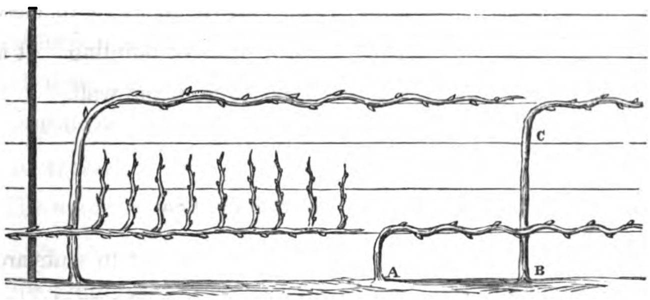

Fig. 28.

all led in one direction, which will enable us the more readily to lay them down for winter covering. Aside from this advantage, the Thomery plan of two arms, as represented in fig. 24, p. 125, is a good method. Adopting the single-arm system, the vines may be planted in a row one foot in front of the fence, and four feet apart in the row. The first and probably the second season after planting will be required to make the strong fruiting canes, and establish the vines, as directed for the vineyard. It will be necessary to grow the cane B, fig. 28, two and a half feet longer than the cane A, in order to provide for the extra length of the upright trunk at C. The vines being planted four feet apart, the arms will, of course, be eight feet long; the lower arm being a foot from the ground, and the upper arm being three feet and a half from the ground.

This will allow a space of two and a half feet for the upright fruit-branches upon each arm, which will cover the fence to the top. The eyes upon the trunks have all been rubbed off; and upon the arms they will be so close together, that, in most instances, the upper eyes alone will be sufficient to give sixteen upright branches for each arm of eight feet in length. The method of pruning will be found described on p. 173. The upright branches will also require frequent stopping during the growing season, as directed on p. 170.

When single vines are to be planted in vacant spots in a garden, they may be trained around a post, according to the spiral method, as described on p. 128. Frequently there is an opportunity to train a vine upon the branches of a feeble tree. By keeping watch of the growth, controlling the form, and allowing the fruit-branches to radiate from the trunk and hang pendent with their own weight of fruit, they are often found to do admirably well. This is Nature's system of horizontal fruit-branches.

There can, however, be no virtue in the old trunk of a tree, which is not likely to be symmetrical in form, is high in air and inaccessible, and is also liable to fail at any time. It would seem that the principle might be preserved in better form by the horizontal trellis, as previously described.

ARBORS.

The usual modes of training upon arbors is very imperfect; an upright cane being allowed to furnish shoots for the side, and also arching over the top for the same purpose. The flow of sap being towards the top, of course the growth on the top will be excessive and succulent; and in its high position, being exposed to drafts, it is very liable to suffer from mildew. The shoots on the side of the arbor, not receiving a due proportion of the strength of the vine, are almost sure to be weak in growth, producing little fruit. It would be much better to plant a larger number of vines, and train them on the Thomery plan, so that the bearing-shoots on each individual vine shall all be on a level, and no one of the shoots be allowed to grow higher than the rest on the same vine. This reduces them all to a perfect equality. By this means we shall never be troubled with long naked canes on the sides, with here and there a weak and barren shoot.

HIGH TRELLISES.

The same rule will apply to all high trellises. When the number of cordons, or fruiting-arms, exceeds two, it is generally best to adopt the double-arm plan, as is represented in fig. 24, p. 125. When vines are trained on the sides of buildings, instead of supporting them with leather loops nailed to the building, as is frequently done, it is far better for the building and for the vine to erect a trellis standing out from six inches to a foot from the building. This is generally constructed of wood, with upright posts, and light, horizontal cross-bars. A neater and less expensive way is to nail brackets, or arms, from six inches to a foot in length, to the side of the building, at suitable intervals, for the support of the horizontal wires, which are to be fastened to the ends of the arms. By keeping the vine at this distance from the building, there is opportunity for the air to circulate behind the foliage, and thus prevent dampness and decay.

Should the system of horizontal branch-training be applied to the side of a building, the grape-arm may be secured horizontally to the building. In front of each arm, and about on a level, two wires are to be stretched;

the first wire being eight inches from the building, and the second one sixteen inches. The fruiting-shoots will be led from the building, and tied down to the wires. Though the branches will project from eight to sixteen inches beyond the outer wire, yet in this position, with the weight downwards, they will be much less liable to injury than if the same distance were exposed on the top of an open perpendicular trellis. The appearance of a vine so trained to the side of a building would be like a series of shelves; the fruit hanging in beautiful exposure underneath each shelf. As I am not aware that grapes have been grown in this form, I cannot advise from experience as to the distance between the shelves. Of course, this will depend materially upon the length to which the branches are allowed to grow. As a general rule, I should judge that a distance of at least three feet would be required to clear the overhanging shade; and, in some cases, it would be desirable to increase the distance to four feet. The arms on the side of a building being elevated and more exposed to cold currents of air, it will be best to have a wide projection of cornice, or of the eaves, above the upper arm, extending as far out as the length of the branches, both for the sake of protection, and also to prevent the fall of too much rain upon the foliage. Of this form I can say the same as of the single horizontal trellis, it is worthy of careful trial.

It is unnecessary to speak of the many cheap and temporary devices for the support of the vine,—such as the nailing of laths and poles to stakes, and other plans which may have obtained in Europe. These are all temporary and imperfect. What is worth doing at all is worth doing well. The plans which I have recommended are not expensive, are easily put up by any one, are neat, do not shade, and are permanent. We shall see vast changes and improvements in grape-culture in this country, resulting simply from systematic modes of training.

CHAPTER IX.

SUBSEQUENT MANAGEMENT AND PRUNING.

IN order to a distinct understanding of the different parts of the vine, it may be well briefly to describe them, though their character may appear very obvious from their names. The upright part of the cane, A, in fig. 29, is generally termed the trunk, especially when there are two or more side-canes. The horizontal part of the cane, B, is called an arm, or cordon. From the arm, or cordon, is the new

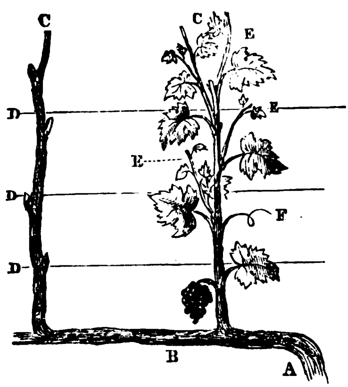

Fig. 29.

growth C, C, the upright shoot in the Thomery plan, termed the fruit-branch; the fruit being two or more leaves from the arm. At every joint of the branch is a strong leaf, at the axil of which eyes are formed, which, if allowed to remain, will develop into fruit-branches next year. By the side of these embryo fruit-eyes, sub-shoots, E, E, often start into growth, which are termed laterals.

When they are broken off at the top, or *checked* as it is technically termed, other shoots will start at the axil of the leaves of the laterals; these being termed sub-laterals. On the opposite side of the branch to the fruiting-eye, leaf, and lateral, is a tortuous fibre of the branch, as seen at F, called a tendril, preserving its vitality but a single season, and designed by Nature for the purpose of clinging to some support until the branch shall have attained a permanent position. The fruit-cluster is but a modified tendril. It is frequently observable that the cluster is inclined to return to its normal condition of tendril, and also that the tendril becomes a fruit-cluster. Now, as we give artificial support to the branches, the use of the tendril seems to be entirely superseded, except as we transform a desirable number into fruit-clusters. In illustrating the short-spur mode of pruning, let us take our vine at the end of the first season after planting. If vigorous, it will have attained a length of cane of about six or eight feet of ripe wood, which is cut back to within two feet of the ground, before winter-covering, as directed in a previous chapter. The vine is neither old enough, nor the cane strong enough, to bear any quantity of fruit the following season. It is often the case that a very little fruit is allowed to grow, rather to gratify curiosity and test new kinds. In such a case, the vine is cut back to within eighteen inches or two feet of the ground, and the fruit-bearing eyes are allowed to remain, while the top eye is encouraged to form the cane. This, however, is a pernicious practice.

SECOND YEAR OF THE VINEYARD.

The vines are to be uncovered after the severe frosts are passed, and before the earth has become so warm as to swell the buds. Let the cane remain lying on the ground; and, when the buds have barely changed to shoots, rub out all the top-shoots, leaving but three strong shoots near the ground. In a few days, the strongest of this trio may be selected, and tied to the stake, rubbing off the other two shoots, and cutting away the vine above the remaining shoot. This is a precise repetition of the process of the previous year, and all the growth of the previous year is apparently lost. This loss is only in appearance. It will be delightful to watch the vigorous growth of the new cane during the second season. As this cane is destined to become the permanent arm for the branches of future years, it is essential that its growth should be strong and uniform, with a development of eyes about six inches apart. It is very probable that the shoot may have a single bunch or two near the ground. If it is a new kind, and is desired as a specimen, it may remain; yet it is better to give the future arm every possible advantage. As the growth pushes with vigor, the laterals will develop themselves. By no means allow them to be rubbed off, since they not only guard the eye in the axil of the leaf, but are also to serve the purpose of developing the growth of the vine as soon as the main cane is checked. During the first season after planting, the sole object is to encourage a healthy growth of wood, and consequently a corresponding increase of roots. During the second year, the same object is to be kept in view; and, in addition, it is now time to develop fruiting-eyes. The upright position of the cane is preserved until it attains a height of eight feet, when the leading shoot is to be pinched off. This will cause all the laterals to start with vigor. As it is not desirable to allow the vine to bear fruit near the ground, the laterals within two and a half feet of the ground may be entirely rubbed out. Those above should be allowed to make uniform growth, pinching off the tips of the strongest, from time to time, if they are inclined to outstrip the rest. In such a case, sub-laterals will develop, and the proportions of the vine will be preserved. The laterals will spread out sideways, and are to be allowed to arch over by their own weight, in order gradually to check growth, ripen the wood, and develop the fruiting-eyes at the axils. Should the growth be excessive, it will be well to keep it in constant check by pinching during the latter part of summer, in order to bring the wood to full maturity. The height of the cane is given at eight feet; but this will vary according to the plan of training and the length of arm desired. This length is designed to apply where the vines are planted six feet apart in the row. For a wall or high trellis, the canes for the lowest tier should be allowed to grow from two to three feet longer than the designed length of arm. The next tier of canes should be six feet longer, and a third tier should be nine feet longer, than the designed length of arm. This extra length is the length of the upright trunk, which is not designed for fruit, and therefore may be stripped of laterals in order to develop growth above. It may not be possible to grow the upper tiers to a sufficient length to furnish the entire length of arm the second season after planting; but these can, of course, be easily extended the following season.

It will be apparent that this method is designed to form but one arm, which, as has been before stated, I regard as the simplest and best form for the vineyard. If the vines are not to be covered in winter, or if the two-arm Thomery system is preferred, then, instead of rubbing off the upper shoots in the spring, we are to seek for two eyes about eighteen inches from the ground, which are to be developed to form the two arms. All other eyes are rubbed off, and these two are inclined a little from each other, and treated precisely as has been directed for one cane, except that the arms are not usually allowed to grow so long by two or three feet as a single cane. During this second season, the treatment is the same, whether we design to adopt in the future the spiral, the horizontal arms with upright branches, or the complete horizontal mode of training. It is true, that, when the arm is brought down to a horizontal position, the fruiting-eyes will not all point upwards; but they can be turned into position without much difficulty. For the horizontal mode, it will be found that we meet the exact form of growth; the eyes on each side of the cane pointing towards the side wires. Some varieties are longer jointed than others, and consequently the eyes on the arms will be farther apart on some kinds than on others. This seems to be a wise design of Nature, to give more space to the coarse-growing kinds. The fruit and foliage of the Delaware being small, its fruit-spurs should be nearly twice as frequent as the coarse Concord or Hartford. Soon after the frost has killed all the foliage, let the vines be pruned. It is better to do this early, in order to harden the wood as much as possible before covering. The vine is to be pruned to a single cane; the laterals being cut half an inch from the cane, and the cane left for its entire length. Just before the ground freezes, stretch the cane upon the ground, and cover with two inches of earth, as in the previous winter. Up to this time, the soil, if properly enriched and prepared, will have been amply sufficient to give the necessary wood-growth. At this period, either late in the fall of the second, or early in the spring of the third season, it is desirable to supply special stimulants for fruit-bearing. It will be remembered, that, in the preparation of open vineyard lands, ashes, bones, and lime were not recommended to be used to any considerable extent. This was not because the importance of these fertilizers was underrated or forgotten. Indeed, they may be called the specifics for the grape; but they are most economically held as a reserve-force, and can easily be applied as a top-dressing, the virtues of which will soon penetrate into the soil. In the chapter upon Manures, special directions will be found for the application of these fertilizers.

THIRD YEAR OF THE VINEYARD.

This is the year of results. The vines, if well managed, will bear a two-thirds crop; the fruit being equal in size, and perhaps superior, to any which will come after. It is the first-fruits of a virgin soil, and of most vigorous new wood. We must be the more cautious not to overstrain, and must so feed and prune and check as to make our vine a permanent institution. Uncover the vines early in the spring, as directed for the previous year. The spiral cane may be allowed to lie on the ground until the eyes are pushing strongly. Its horizontal position will encourage the eyes to break from the base to the top. When these have fairly started, but before growth, the cane is to be coiled to the post. The Thomery and the horizontal arm may be secured to their positions at once. The fruiting-eyes (and every eye should be such) will develop into shoots having from two to five bunches of fruit, the bunches being opposite the first five leaves. If a shoot has developed its fourth leaf without showing fruit, it will be barren. For the first year of fruiting, two bunches will generally be quite sufficient, as the bunches are likely to be large. I give a very decided preference to wires running parallel with the cane for the upright trellis, as will be seen in the chapter upon this subject. The first wire being but six inches from the canes, the young shoots can be secured by tying with bass-string, at a time when this tender, succulent growth is very liable to be injured by strong winds. Let the tie be very loose, to allow for future growth. For the upright training, one more wire, a foot above the second, will be sufficient. As soon as the branch has passed one leaf beyond the top wire, each branch is to receive a second tie, and the head of the shoot is to be pinched out. This is apparently contrary to Nature, — to check the young shoot at a time when it is most rapidly furnishing new leaves, — the lungs of the plant. Prof. Lindley, in his

"Theory of Horticulture," has stated the reasons for this step with great distinctness:—

"But although the general rule is to allow as many leaves to remain on a tree as can be kept in health, yet there are circumstances which justify their removal, and indeed render it necessary. For example, when a tender tree is trained to a wall, a great object with the gardener is to secure ripe wood; for, unless he does this, the frost of the succeeding winter may destroy the branches, or the buds may be so imperfectly formed as to produce feeble shoots the ensuing season. To attain this object, those leaves must be removed which prevent the sun from striking upon the branches to be ripened; the effect of this being to stop the rapid growth of the branches, and to consolidate their tissue, in consequence partly of the excessive perspiration, and partly of the rapid digestion of the sap which is thus induced: for the rate of digestion and perspiration in a healthy plant is in proportion to the quantity of light and heat to which it is exposed. Hence the removal of those shoots, which in summer overshadow that wood of the peach-tree which is intended to be preserved another year, is useful. There can be no doubt, however, that as few shoots as possible should be thus removed. Another case in which the removal of leaves is justifiable occurs in the vine. In this plant, the fruit is borne near the base of the lateral shoots, which will, if unchecked, go on lengthening, and producing leaves to a considerable distance. Now, all the food of such a lateral shoot is obtained from the main branch, which, however, is only capable of furnishing a certain quantity. If the lateral shoot is allowed to grow unchecked, it will consume its portion of food in the production of many leaves and some grapes; and the more there are of the former, the less will be the weight of the latter. But if the shoot is stopped, after having formed two leaves, all that quantity of food which would have been consumed in the production of other leaves is applied to the increase of size in the grapes and the two leaves that are left; while, on the other hand, the general crop of leaves on the vine will be amply sufficient to prepare those secretions which are to give flavor, color, and sweetness to the grapes. This will perhaps be better explained by the annexed diagram:—

"Let the line *a g* represent a lateral vine-branch, bearing fruit at *B*, and leaves at *c*, *d*, *e*, *f*. Suppose six ounces of sap are destined to support this lat-

teral *a g* during the summer: it is evident, that, if equally distributed, each leaf and branch will receive one ounce of sap as its proportion. But if *e*, *f*, *g*, are removed, it is obvious that the three which remain will have two ounces each, or double the supply.

"Why, then, it may be asked, not remove *c* and *d* also? Because, in that case, *B*, the bunch of fruit, would have the whole six ounces of sap to itself. The reason why this should not be done is this: If all the leaves on the lateral be removed, there will be no force left upon it wherewith to attract from the main branch the food that belongs to it; for the power which the parts of the plants possess of attracting fluid is in proportion to the amount of their perspiration. Now, leaves perspire copiously, but the grapes themselves scarcely at all; whence their gradual conversion, from a substance of the texture of a leaf, into a mass of pulp. In the instance of vine-pruning, the great object is to leave on the laterals just as much force as may be required to secure for the bunches the food that is intended for them, and at the same time to deprive the laterals of the means of expending that food uselessly in the production of leaves instead of fruit."

The closing sentence may be taken as the rule for all checking of the growth of the grape. In all climates where there is considerable humidity, if the branches have an upward support, there is a strong tendency to excessive growth, to the almost total failure of fruit. But in the dry climate of California and of Spain there is no such excessive growth, and consequently the grape is allowed to grow with no checking. In Northern France, and in our Northern States, the practice has been to check constantly throughout the season. This is absolutely necessary where the shoots have an upright position. Even when checked, the rush of sap is strongly upwards; and laterals and sub-laterals are continually being developed.

Nature accomplishes the desired end in another way: she reverses the position of the branches. When the fruit weighs down the branches, the flow of sap becomes so slow, that there is very little inclination to growth, and the fruit obtains a full amount of nourishment. Can we not imitate Nature, and so diminish this necessity of checking growth? We will proceed, however, with the checking upon the upright trellis; and the same directions will, to some extent, apply to the horizontal trellis, though the necessity will be far less. The first checking will occur before the clusters are in blossom. It will be well to remove the superfluous clusters at once, in order to preserve all the strength of the vine. At Thomery, the checking is very severe; the branches being allowed to grow but eighteen inches, and the laterals being either rubbed out or stopped at one leaf. Such severe checking has never been practised in this country, that I am aware of; and it is believed that the rampant nature of most of our varieties, and our clear, hot atmosphere, would not allow of so small a quantity of foliage. The general practice is to stop the branch two or three leaves beyond the last bunch, and, as the terminal lateral and a succeeding sub-lateral are developed, to increase the length by a single joint at each checking; thus growing a final length of two and a half to three feet. The force of the ascending sap will be such, that several of the laterals towards the end of the shoot will break. As the eye at the axil is of no consequence, these laterals may be either entirely rubbed out, or stopped at one leaf; the rule varying with different kinds of grapes, according to the amount of foliage.

So long as we keep to this upright position, this practice of constant checking is our only means of keeping the vine within due bounds; yet it is a very imperfect remedy, as any one who has had experience can testify.

Fig. 30 illustrates the effect, the representation being exaggerated in order to be more clearly seen. The laterals are seen to be stronger at the top of the shoot than near the base: the foliage is also larger. This is the natural consequence of the strong upward flow of sap. The evil is felt not merely in diminishing the supply of

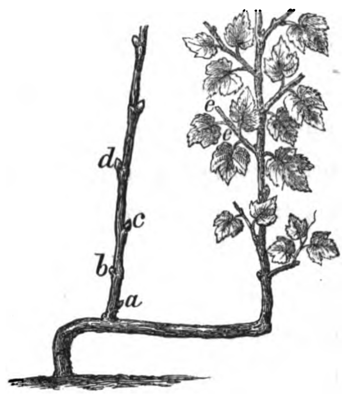

Fig. 30.

secretions for the clusters at the base, but the fruiting-eyes *a* or *b*, or even *c*, are by no means developed as prominently as *d* and those above. This last evil has been so severely felt as to suggest the long-spur alternate system of pruning. It is to obviate these evils that the system of horizontal training of the branches as well as of the arms is suggested. It is obviously reasonable to expect that the buds *a* and *b*, in fig. 31, will develop more strongly as brought to the light and air by the arching and horizontal position of the branch, at the same time that the sap is retarded and elaborated for the benefit of the fruit and lower buds. Even with the advantage of this position, there will still be a necessity of checking, but to a much less extent, and to a more

Fig. 31.

effectual purpose, than with upright branches. By this mode, the short-spur system of pruning becomes very easy and practicable.

As soon as the fruit is gathered, and the foliage killed, the vines are to be fall-pruned. On all horizontal branches, the bud *a* (fig. 31) will be a plump, fruit-bearing eye: the branch may therefore be cut just above the bud *a*. It is extremely desirable that the same bud *a* (fig. 30) may be the fruiting-eye for upright shoots; but, in case it is too weak, the cut is made above the eye *b*. As all subsequent years are a repetition of this third year, with the single change in fall-pruning, we conclude this chapter with a description of the different modes of fall-pruning.

SHORT-SPUR SYSTEM.

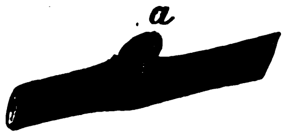

Fig. 32.

Fig 32 represents a section of the horizontal arm in the spring of the third season; the eye *a* being plump, and strong for fruit. Fig. 33 represents the shoot *a* after it is cut back in the fall following. The eye *d* is well developed, especially if it is borne upon a horizontal shoot, or if the shoot above was kept well checked during the previous season; and this is to be the eye for fruit the following season. The eyes *b* and *c* at the base are generally too small to be trusted for fruit, and are to be removed if they start. Fig. 34 rep-

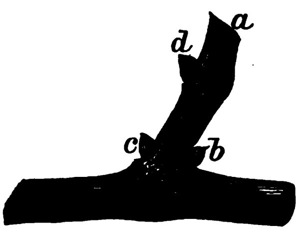

Fig. 33.

Fig. 34.

resents the spur at the succeeding fall-pruning. The eye *b* is to bear the fruit the following year, and the small eyes *a* must be rubbed off if they start. Thus it will be seen we are annually increasing the length of the spur about an inch each year. This, though an objection, is not a serious evil; and it can often be remedied by taking some strong plump eye near the base, which frequently develops sufficiently to give a good fruiting-shoot. Or, if the spur becomes long and ungainly in a course of six or more years, it may be remedied by adopting the double-spur system for a single season.

THE ANNUAL RENEWAL SYSTEM.

It is known, to all who understand the habits of the vine, that its fruiting-shoots are the growth of buds formed the previous season. It is true that dormant eyes from old wood do sometimes break, and bear fruit; but this is exceptional, and the fruit is inferior. Hence the necessity of preserving newly formed wood on which to rely for a succeeding crop. This necessity of new wood suggested the alternate system of Speechly, which is very similar to the renewal system of Clement Hoar. Fig. 35 represents the plan. While the cane *a*, the growth of last season, is bearing fruit, the spur *b* is allowed to grow, and form the cane of the succeding year. The cane *a* is cut away in the fall, and forms a new spur for the succeeding year. Thus they alternate from year to year, keeping up an endless succession of new wood. The Ohio bow-system adopts this renewal-principle. But such an annual growth of new wood is objectionable. The new shoot is a constant drain from the fruiting-cane. Magnificent specimens of fruit have been produced by this method upon the luxuriant young wood; but it must

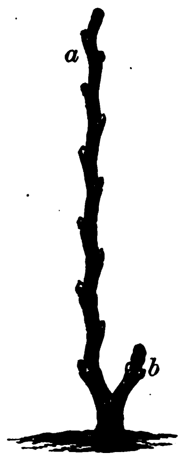

Fig. 35.

be a waste of energy to grow so much wood only to be thrown away the succeeding year. Certainly it would be better if more of the sap which went to form this growth could be diverted into fruit. We cannot, therefore, regard the system in any of its various forms as specially desirable; and there will be no need to make further explanations. It should be stated, however, that it is frequently desirable to renew a cane after it has become old and blind by fruiting a series of years. In such a case, we bring up a new shoot from the base of the vine; but this is entirely different from the annual renewal. The short-spur system is the one now almost universally adopted, as best adapted to practical purposes, and economizing to the utmost the strength of the vine.

THE ALTERNATE-SPUR SYSTEM.

This is also called the long-spur and the double-spur system, and is based upon the same principle as the annual renewal of the cane, but is applied to the fruit-branches. It is illustrated in fig. 36. By a comparison with fig. 33, it will be seen that the branch *a*, in fig. 36, is the developed bud *d* in fig. 33, which has borne fruit: the bud *b* has also developed to the *shoot b* in fig. 36; while the bud *c*, in fig. 33, has been rubbed off. The branch *a* is now to be cut away at the dotted line, leaving the shoot *b*, which grew to the same length as *a*, but which is now represented as it appears after pruning, to take the place and perform precisely the same part as the removed shoot. The bud *d* will, in general, be stronger than *c*, and is

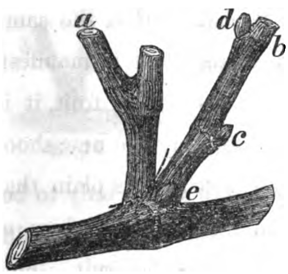

Fig. 36.

therefore chosen for the fruiting-shoot; while a bud *e* forms a new shoot, springing from the base, or near it, which is to be the spur for the succeeding year. Thus the process is repeated from year to year, with but a slight increase in the size of the spur. It is also an advantage that strong fruit-buds can always be selected; the bud *d*, in fig. 36, being generally stronger than *c*, and always stronger, and showing larger fruit-clusters, than the bud *e*. The principle is the same as in the alternate-cane or annual-renewal system, and a corresponding advantage is claimed for it; and it is obvious that the same objection lies against this as against that. It is manifest, that while the branch *a*, in fig. 36, is bearing fruit, it is a serious tax upon the vine to be forming the new shoot *b* in preparation for the following year. It is plain that the shoot *b* will draw much nourishment away from *a*, which clearly ought to be economized for the fruit. This unnecessary expenditure of strength is so great, for the twofold object of avoiding the increasingly long spurs, or knobs, and of securing large and plump fruiting-eyes, that, though the ends are desirable, we cannot afford to purchase them at such expense.

Careful and close summer pinching is a great help in developing the buds at the base of the shoots: horizontal training is also a great help. There is, therefore, no practical difficulty in obtaining good eyes within a reasonable distance from the base by the single, short-spur system. But, should the spur increase in the course of a few years, a new shoot from one of the dormant eyes at the base of the spur may be trained up for one season. The old spur may then be cut away, and the wound covered with shellac dissolved in alcohol to a creamy thickness; and the young shoot will then form a new spur as good as the first. Upon old canes, it will be well to renew one or two spurs on each vine each year, rather than do the whole work of renewal upon a vine in a single year.

CHAPTER X.

METHODS OF HASTENING MATURITY.

IT is well known that the same variety of grape will ripen at different times in different localities, and under varying circumstances. A protected southern slope, or an angle of buildings looking southerly, with a loose, warm soil adjoining, will make a difference of two, three, or possibly of four weeks in the time of ripening, over ordinary localities. It is the experience of French cultivators, that vines trained near the ground mature their fruit from one to two weeks earlier than when carried higher up. It will be found, that, under the spiral system, the grapes nearest the ground ripen first: yet, in this case, the difference is not so marked as we might expect, since the ascending sap rushes past the lower clusters, and they do not receive a proportionate share of the strength of the vine; which is, of course, a hinderance to their process of maturing. Aside from the many other advantages resulting from keeping vines near to the ground, there can be no question that this one of hastening the maturity of the fruit is a very important consideration.

In the early part of the eighteenth century, a very curious method of treating fruit, especially the vine, was discovered and practised in France, the object of which was not only to hasten the maturity, but also to develop the size, of the fruit. In the year 1745, the French Agricultural Society awarded the premium to M. Buchatt of Mentz for the successful practice of this method. It consisted in the entire removal of a ring of bark from a fruiting-branch just below a cluster of fruit, as seen in fig. 37. Though the experiments were always successful, we do not hear that the plan was known to any extent in England until the early part of the present century. In

Fig. 37.

the year 1808, Mr. John Williams of Pitmaston communicated the plan, with full directions, to the London Horticultural Society, as published in the first volume of its "Transactions," p. 107. He states that he performed the work in June and July, "leaving the naked alburnum completely exposed above an inch in width. . . . The following autumn, the fruit growing on these trees came to great perfection, having ripened from a fortnight to three weeks earlier than usual; but in the succeeding spring the branches did not shoot with their accustomed vigor, and I found that I had injured them by exposing the alburnum unnecessarily." The next season, he performed the operation a month later in the season, and diminished the width of the ring, and, he states, with the best results. The philosophy of the method is very clear, as will appear upon examination of a section of a branch thus operated upon, as represented in fig. 38. The removal of the bark has not interrupted the flow of sap upwards through the porous wood. It has, however, absolutely arrested all descending and elaborated sap, which,

Fig. 38.

as is well known, passes down between the wood and the bark. The consequence is, the part of the branch above the ring, receiving a full share of sap, elaborates it, and reserves it all for itself. Fig. 38 shows the branch larger above the cut than below. The result upon the fruit is to increase its size, in some cases more than fifty per cent, and to hasten the time of ripening from one to three weeks. Not only the cluster just above the ring, but also all the clusters above, and the whole upper portion of the branch, will be affected. The bunch nearest the ring will, however, receive the most benefit, as we should naturally expect. While these desirable points are attained (and it is admitted by all that the appearance of the fruit is very superior), yet there are few who do not admit that the quality of the fruit has deteriorated. A few English cultivators are even bold enough to claim that the quality has improved. It is not probable that most persons would detect the difference; yet I think a critical taste would always give preference to the natural growth. Certain it is that the French regard the ringing process as injurious for wines. The time for performing this operation, by the French, is just after the fruit has set, which is as soon as the branch has acquired strength and substance; thus securing the virtue of the descending sap for the entire season. They act upon the belief, that, the earlier the work is done, the more manifest will be the results. But there is a limit. If the ring is made too soon, the branch is very liable to break or be seriously affected by the premature exposure of its tender wood. In our dry climate, and for our varieties, I should recommend delay until the young grapes begin to stone. This is a stage in their growth when they especially need additional stimulus. Where the experiment is tried only to a limited extent, an ordinary knife will do the work sufficiently well; but, if the operation is to be performed to a considerable extent, it would be an economy of time to procure a French tool expressly adapted to the work. This is simply a pair of nippers, with two knives at the jaw, at a suitable distance for the length of bark to be taken out. When the jaw is closed over a branch, a single turn of the instrument completes the two circular cuts. If the knife is used, the work must be done with boldness, cutting quite down to the wood. The length of bark to be taken out should be at least half an inch: some recommend the length to be an inch. The least distance that will effectually check the descending sap is manifestly best. Mr. Thomas Weaver, a successful English grape-grower, in communicating his practice to "The Cottage Gardener," adds as follows: "By thus practising ringing, I have produced, for the last twelve or fourteen years, grapes out of doors, that have puzzled many a tyro, and others too. Our indefatigable editors have both watched my progress in vine-culture for years. My grapes have many a time puzzled the late Mr. Elphinstone, when he was gardener to the late Speaker of the House of Commons, now Lord Eversley, although I used to compete against him with both in-door and outdoor grapes." This quotation is made to show that the practice has been carried on for years with the best success. The question will now be asked, if this practice is to be recommended. It is undoubtedly better suited for the alternate long-spur mode of training than for the short-spur. The branch that has been ringed is to be cut away in the fall at any rate. The new shoot will not be materially affected by the process. When this alternate system is practised, and when there is a desire for early grapes of extra size, it is perfectly practicable and advisable to ring a portion of the branches. Still, it requires but the reflection of a moment to perceive that the practice is against Nature's law, and that a too extensive application of the principle would be fatal even to the life of the vine. It is an established law, that a plant requires the support of the elaborated and descending sap, to some degree, for the trunk, and even for the roots. If this support is arrested above, the lower parts will suffer. The more complete the arrest of the descending sap, the more injury results to the trunk and roots. As a general rule, when a tree is girdled at the trunk, it will die; but a branch may be girdled without serious injury to the entire system.

For the short-spur system of pruning, it is plain that the ringing practice would be very injurious. The eyes upon which we rely for fruit the following season must be below the ring. Consequently they are deprived of the downward flow of elaborated sap, which is absolutely necessary to their perfect development. It would be very foolish to rely upon eyes below the ring, and on the same branch, for fruiting the following season. If every other eye on an arm of the single-spur system should be fruited and ringed, and should be allowed to re-establish on the succeeding year, without fruiting, the result might be satisfactory. But it cannot be questioned that this practice interrupts the natural flow and distribution of sap, and that its tendency is decidedly injurious. It may be practised to a certain extent, and for certain purposes; but it cannot be recommended as a desirable mode for general cultivation. What we gain in one direction we lose more than proportionately in another. We must therefore regard this curious, interesting, and valuable method as applicable only to a limited degree, and for the specific purpose of obtaining a few early bunches of extra size.

In the more difficult climate of England, a practice has obtained to some extent of enclosing clusters of fruit under bell-glasses, or an entire fruit-branch under a small glass frame secured against a wall. Fruit may be obtained from two to four weeks earlier in this way. But there is too much trouble and expense attending this, and the results are too limited, to warrant the use of such glasses to any extent. Cheap glass houses are a better substitute; and there can be no doubt that these are very desirable, and can be used with profit in skilful hands. This is an interesting and prolific subject, and is destined to become increasingly interesting to the public. The limits of this treatise forbid any extended suggestions in regard to the construction and management of fruiting-frames, or glass sheds or houses. In a subsequent chapter upon the treatment of vines under glass, some further hints are given upon this subject; but its full development would require an entire volume. A single method for the use of sashes has occurred to me, and I am inclined to think it has sufficient merit to be carried into extensive practice. It is mainly applicable to the horizontal-branch system of training. Supposing we have a lot of sashes from hot beds and houses which are generally released from use by the 1st of June: now, if our horizontal trellis is two and a half feet from the ground, by running two wooden strips horizontally, the length of the rows, a foot above the vines, — the bars being three feet apart (which is the ordinary width of sashes), and resting upon small posts, which are three and a half feet out of ground, — it will be seen that we have a very simple and cheap frame upon which sashes could rest, directly over our vines. It will be easy to secure these sashes to the frame by side-hooks, to prevent them from being lifted by a gale. Sashes three feet in width would cover the principal part of the foliage of a horizontal trellis. If the sashes were applied to the frame early in the spring, the vines underneath would start much earlier than when uncovered: they would also be protected to a great degree from late spring frosts. There would therefore be a gain of some weeks in growth. The inconvenience in disbudding, tying, and checking under the sash, would be but trifling. Throughout the season, it will be found that the glass covering is a material aid in developing and maturing the fruit. I am inclined to think that the foreign kinds, at least many of them, can be cultivated with great success by this simple method. As our sashes are mostly in use in April, and perhaps in May, if we delay to apply them to the frame until June, we shall still find them of great service: they materially hasten the maturity of the fruit, drawing the heat of the sun, and confining the radiating heat and moisture of the earth; they are a great protection against mildew and other evils during summer; and they are also a guard against autumn frosts. If our rows are six feet apart, then our sashes will cover just half the surface of the ground; but, if the rows should be only five feet apart, we should still have walks between the rows, of two feet in width, after the sashes are applied, which will be sufficient for ventilation, and for convenience in working. It will undoubtedly be best to have the north side of the sash a little the highest, both for the purpose of taking the sun's rays more directly, and also in order to shed the rain. When the sashes run east and west, they will not be constructed properly to shed rain; but, if well painted, the slight lodgement of water will be no serious detriment. The pouring of water from the edge of the sash will be a greater evil, and, in some positions, will cause considerable washing of the soil. A mulch of litter along the edge where the water drops will generally prevent this evil from being serious. In the fall, the sashes can be removed for winter and spring use on houses or frames.

This plan is not suggested as a perfect glass structure, but only as a cheap and a double use of glass at a season when it is not wanted for other purposes. I cannot speak from experience of the practical working of this form; but I do not now see any reason to doubt its merit. Such a roof of glass over at least one-half the surface of the vineyard, with space sufficient for ventilation, so arranged as to check rather than encourage draughts of air, — such a roof must, to a considerable degree, secure the warmth and humidity and geniality of the glass grapery. I have a good deal of confidence in my preparations to use my idle sashes the coming summer in this way; and with the same confidence I suggest it to the judgment of others for trial.

I may here say, that, in my thoughts, the horizontal-branch system of training, and the use of movable sashes, grew out of each other. One thing is certain, that a much more general use of glass in some cheap form, requiring little care, will be adopted for the early ripening of grapes. Graperies are admirable for their specific purpose; but they are expensive, and involve a gardener, and the constant labor of opening and closing. More simple and less expensive forms, with permanent ventilation, are found sufficient to mature Black Hamburgs of the darkest hue and highest flavor. The use of brick or stone walls has been somewhat extensive in England. The vines or other fruit-trees are trained close to the surface, which is supposed to absorb and radiate the heat of the sun. The theory is undoubtedly correct, and the practical results are satisfactory, especially since the walls serve a double purpose of sheltering from winds. Some experiments have been made in coloring the walls black, in order that the sun's heat may be more perfectly absorbed, and the heat be gradually imparted to the vines. In the third volume of "The Horticultural Transactions," p. 330, is a communication from Henry Dawes, relating his experience with colored walls, which is worthy of being transcribed: —

"Two years ago, I covered a portion of my wall with thick black paint. The vine was divided into two equal parts: one-half was trained on the painted, and the other on the plain wall. The season was so unfavorable last year, that scarcely any out-door grapes came to perfection;

but those in the blackened part of the wall were much finer than those on the plain part. This year the success of my experiment has been complete. The weight of fine grapes gathered from the blackened part of the wall was twenty pounds and ten ounces; while the plain part yielded only seven pounds and one ounce, being little more than one-third of the other. The fruit on the blackened part of the wall was also much finer, the bunches were larger and better ripened, than on the other half: the wood of the vine was likewise stronger, and more covered with leaves, on the blackened part. It is a generally known fact, that a black, unpolished surface absorbs more rapidly than other colors the sun's rays, and thereby becomes sooner heated. It is equally well known, that surfaces which absorb heat more quickly part with it more easily when the source of heat is withdrawn, and cool quicker. In the summer-time, when the days are long, the wall will be more intensely heated under the blackened surface; and, the night (or time of cooling) being short, it may not have returned to the temperature of the air before it is again subjected to an increase of heat. If the time of cooling were long enough, that part of the wall under the blackened surface might become actually cooler than the part not blackened, and thus the extremes of heat and cold be greater than when the wall was left with its usual surface. In the summer-time, however, the wall is not only more intensely heated, but probably retains a great portion of the heat during the night."

Another writer upon the same subject, Mr. Charles Harrison, writes as follows: —

"The dark color absorbing the rays of the sun, the wall acquires at least ten degrees more of heat than the walls not colored as directed; thus affording great assistance in maturing the buds upon fruit-bearing shoots, so that the fruit may be productive. In cold and wet seasons, without such aid, I should not have been able to obtain ripe buds upon fruit-trees under my care. This I have had ample proof of by the unfruitfulness of those trees which are against walls not colored, at the same time that trees against colored walls were abundantly fruitful. The wall being colored is also a preventive of insects harboring in it, and also tends to keep it dry."

The importance of coloring walls will be more especially felt in England, where the sun's rays are never so clear and powerful as in this country. Yet the subject is one of interest; and there are many situations where its application may possibly be advantageous even in this country. It is often noticeable, that, where vines ramble over the surface of dark-colored rocks, they ripen much better than elsewhere. Walls are too expensive if erected expressly for this purpose. Close board-fences will answer nearly the same purpose. These may be painted with coal-tar, which is very cheap, and very quickly applied. While it is true that the wall will soon become covered to a considerable extent with foliage, yet it is also true that the sun's rays will always penetrate to more or less of the black surface, and cause a decided change of temperature. The practical value of the plan should have a cautious test of actual trial. In this connection it should be stated, that vines upon close board-fences have been found in many cases to suffer from mildew. This has been attributed by some to a want of circulation of air, and by others to the extreme heat of mid-day and the great change at night.

It is prudent and it is wise to expend freely and largely, with well-informed judgment, in the production of fruit of superior excellence. He who, at a proportionate cost, can excel in the quality of his fruit, or the time of ripening it, will obtain an altogether disproportionate price for his fruit, and is the only producer who can show a large margin of profit. High culture, the best modes, — these must be the watch-words of the horticulturist.

CHAPTER XI.

MANURES.

IN the preparation of the soil for planting, it was recommended that a compost, consisting of one-third stable-manure and two-thirds peat, or vegetable matter well decomposed, should be applied. The quantity will vary with the character of the soil and the variety of grape,—from twelve to thirty cords to the acre. The land should be rich enough to insure a strong growth, without additions, for the two first seasons. The mechanical condition of the soil is quite as important a consideration as its fertility. Any element that is wanting to make it loose, friable, light, and warm, yet retentive, and moderately rich in organic matter, should be added. The soil will, ordinarily, contain a sufficient supply of alkaline matter for the first and second season. When it is borne in mind, however, how greatly these enter into the composition of the vine, it will be evident that they must not lack in these materials. Various analyses of the ashes of the grape vary in results; but we may state, in round numbers, the more important items.

According to the tables of the French chemist Crasso, the ashes of the wood of small Burgundy vines contain of potassa, 45 per cent; lime, and phosphate of lime, 35; phosphoric acid, 7; magnesia, 5; soda, 4; sulphuric acid, 2; with traces of silicic acid, chlorine, &c., to make up the 100 parts. In the fruit, the proportion of potassa is very considerably increased, rising as high as 60 per cent in some experiments; while the phosphoric and sulphuric acids are also considerably increased; and, on the other hand, lime falls away, in the fruit, to about 4 per cent.

Dr. Emmons, of Albany, N.Y., who has made valuable analyses of the inorganic parts of various kinds of fruit-trees, gives the following result from the ashes of the common wild grape:—

	Wood.	Bark.
Potash	20.84	1.77
Soda	2.06	0.27
Clorine	0.02	0.40
Sulphuric Acid	0.23	trace.
Phosphate of Lime	15.40	5.04
Phosphate of Per-oxide of Iron	1.20	5.04
Carbonic Acid	34.83	32.22
Lime	17.33	39.32
Magnesia	4.40	0.80
Silex	2.80	14.00
Soluble Silica	0.00	0.30
Coal, and Organic Matter	2.20	1.70
	100.21	100.86

It will be noticed that the percentage of carbonic acid given by Dr. Emmons is quite large, while the percentage of potash is correspondingly small. The difference between the hard, firm growth of Burgundy wood and the more succulent wild vine will account for the variation to some extent. In all other analyses which I have seen, the amount of sulphuric acid has been considerably larger, varying from 1.5 to 2 per cent. In the fruit, all chemists agree that this amount is considerably increased. Mr. A. J. Downing, in "The Horticulturist," vol. iii. p. 526, states, "that, while the analysis of the ashes of the foreign grape shows only about 2 per cent of sulphuric acid, the analysis of the must-pulp, or juice of the ripe grape, shows more than 13 per cent of sulphuric acid, — a most extraordinary increase, and, we believe, a larger percentage than is found in any other fruit." This is a larger percentage in the fruit than is given by most chemists.

These analyses are a clear indication that potash, lime, and bone are three prominent and necessary fertilizers. These may all be applied in large quantities, with less danger of over-stimulating than in the use of stable-manure or vegetable matter. Coal-ashes have but very slight traces of potassa, and have but little value for the vineyard, except as they may contain sulphate of lime (in which case they will serve an important purpose, as will be seen hereafter), and also for the mechanical purpose of making the soil more porous. Wood-ashes, on the contrary, contain a large amount of potash, and also phosphate of lime, and magnesia. The ashes of oak-wood contain 38 per cent of potassa, and about an equal amount of the carbonates and phosphates of lime and magnesia. As before stated, the ashes of the vine have a still larger percentage of potassa. These elements are therefore valuable, as entering directly into the composition of the vine, and also because the potash promotes the dissolution of vegetable matter in the soil. We may apply leached ashes in almost unlimited quantities. Unleached ashes (if they can be obtained) are much more valuable. A hundred bushels might be applied to the acre without injury, and without causing an excessive growth of foliage, as is the case when stable-manure is heavily applied. Probably an annual dressing of fifty bushels of unleached ashes would be found quite sufficient for most lands. If ashes are not to be obtained, we can obtain the elements in crude potash, in ground bones, and in lime. Common ashes will usually yield five and a half pounds of potash to the bushel. As a portion of the potash does not leach, we may say that fifty bushels is equivalent to three hundred pounds of potash, or about two hundred pounds of soda-ash. If we dissolve this amount of potash, and pour it upon fifty bushels of peat (triple this amount would be better), we shall then have obtained a very considerable part of the virtue of the fifty bushels of wood-ashes. For the supply of the phosphates, and the carbonate of lime, and magnesia, we will resort to bone-dust, or ground bones. This is the safest and most universally esteemed fertilizer. There is not a single particle in the composition of bones which is not of essential service in contributing food to the vine. This will be seen by examining an analysis of the fresh bones of an ox, prepared by M. Berzelius. He found 100 parts of these bones consisted of—

Cartilage	33.30
Phosphate of Lime	55.35
Fluate of Lime	3.00
Carbonate of Lime	3.85
Phosphate of Magnesia	2.05
Soda, with a little common Salt	2.45
	100.00

These are precisely what is wanted as food; and hence the testimony as to the value of this fertilizer is uniform and decided, as we might expect. In the purchase of this article, there is always considerable shrinkage from the above analysis, resulting from the usual processes in reducing the bone to powder. It is, however, most economical to purchase it in this form, in order to secure immediate results. For ordinary field-crops, English cultivators use, as the only fertilizer, from fifteen to forty, and even eighty, bushels per acre. In regard to the annual amount for a dressing to the vineyard, no definite rule can be given, as the various soils have different necessities. We may bear in mind, however, that any reasonable amount of bone-dust is a safe fertilizer, and that, where table-grapes, in large quantity and of superior size, are the desideratum, it will be prudent to borrow money in order to procure a good supply of the dust. He is a shrewd usurer who regards manure as the best security on which to loan money to the agriculturist. As we have found such a large percentage of lime in the ashes of the vine, we should naturally conclude that this substance also should be liberally supplied. This is indeed true, and we notice that the grape always thrives in a limestone soil. The action of lime is twofold: it enters directly into the combination of almost all classes of plants, and is therefore valuable as food; and it also serves another important purpose, in its chemical effect upon the organic matter contained in the soil. If we use bones in considerable quantity, as before directed, we shall have nearly the amount of phosphate and carbonate of lime (about 60 per cent of the bone) that will be needed by the vine as a direct food. But there are many soils that would receive natural benefit by the chemical action of lime upon them. Heavy soils inclining to clay are rendered much more friable and porous to receive the gases of the atmosphere. There is also a considerable quantity of vegetable and animal matter, worms, and animalculæ, in the soil, upon which the lime has a direct effect, reducing them to food for the vine.

In England, lime is applied in vast quantities upon some of the low, heavy lands; in some instances, the amount reaching a thousand bushels to the acre: but, upon ordinary uplands, fifty bushels are considered a large dressing. As most vineyard-soils are inclined to be dry, and as we advise to a considerable supply of lime through bones, an annual dressing of five or ten, or, in the case of heavy soils, of fifteen bushels, will probably be found quite sufficient. The best way to apply this will be by mixing it with three times its bulk of peat.

It will be seen by the analyses previously given, that, while sulphur is found in small quantity in the wood, it enters largely into the composition of the fruit. We should consequently infer that a top-dressing of sulphur would be of service as soon as the vines come to bearing, not merely for the purpose of preventing mildew, as we shall see hereafter, but also as direct food for the plant. It is well known that in volcanic soils, where there is considerable impregnation of sulphur, the vines do extraordinarily well, and the product in fruit and wine is of a superior character. As there is a deficiency of this element in most soils, it would seem essential to provide a sufficient quantity. May it not prove that the increase of rot and mildew within the past twenty years is owing, in a very considerable degree, to an exhaustion of this element in the soil, which causes an enfeebled and diseased state in the berries, and invites the attack of fungi? It is an invariable rule, that plants which abound in certain earthy salts never flourish in soils in which these salts are wanting; but, upon application of the deficient elements, the result is as invariable, that the plants recover their vigor. It is for the purpose of supplying a deficiency of sulphur, that gypsum (sulphate of lime), or plaster of Paris, is recommended. Gypsum is composed, according to the analysis of Chaptal, of

Sulphuric acid	32	to	43	parts.
Lime	30	"	33	"
Water	38	"	24	"

This article has long been known as a fertilizer; and upon some soils, and for some crops, there is no other artificial manure so decided in its effects. The results of its application have been unequal, however; for the simple reason that some soils have a sufficiency of sulphate of lime for some crops, and hence an addition would be useless. Johnson, in his "Farmer's Encyclopædia," states that an ordinary crop of clover and sainfoin grasses usually contains from one and a half to two hundred-weight of sulphate of lime to an acre. This is the amount (two hundred-weight) of gypsum to an acre which he recommends to be applied annually for such crops. The amount of sulphate of lime needed for an acre of grape-fruit must much exceed two hundred-weight per annum, if the statement of Mr. Downing, that the fruit yields thirteen per cent of sulphuric acid, is not altogether wrong. Lime, we know, exists in the wood in a much larger proportion. It would seem reasonable to conclude that an application of at least two hundred-weight per annum of sulphate of lime in some form would be not merely desirable, but necessary.

According to Johnson, coal-ashes contain about ten per cent of sulphate of lime. This undoubtedly refers to ashes of the English coal, and is probably a larger percentage than is contained in our anthracite coal-ashes. At this rate, ten per cent of fifty bushels of coal-ashes would be equal to five bushels of gypsum, which would be a suitable dressing for an acre. Wherever coal-ashes are on hand, they should be tried, not because they contain any considerable amount of potash, but more especially because of the sulphate of lime which they may contain.

Upon this subject of furnishing the specific food for the vine, recognizing the desirableness of a change of diet at different periods of growth, and formation of wood and of fruit, an interesting communication was made to the French Academy of Sciences by M. Perzoz, and is quoted in "The Horticulturist," vol. iii. p. 525, as follows:—

"The new process which I propose for cultivating the vine, inasmuch as it enables us to make use of half the land for growing nutritive plants, may, at first sight, appear to differ completely from the plans now adopted in vineyards. Such, however, is not the case; and, as those who have studied the various methods adopted in different countries will see, several of the recommendations here made have already been followed in practice. I acknowledge this the more readily, as it enables me to appeal, as a proof of their usefulness, to results attained by a long experience. In one respect, my plan differs from every other; for I propose that all the vine-stocks in a certain space of ground should be brought together in a trench, where by one chemical action the wood, and by another the fruit, may be induced to form. This I propose, in consequence of having by direct experiment satisfied myself, that, of the manures which are fit for the culture of the vine, some seem exclusively for the increase of cells,—i.e., of wood; that others cause the development of the flower-bud (fruit or grape); and that the actions of these substances, instead of both going on at the same time, ought to be successive. By the application of these principles, the growth of the wood can be stopped at pleasure; while, by the ordinary methods, the same effects can only be produced by artificial and empirical means.

"When it is wished that wood should be developed, the vines (roots) must be placed in a trench, and covered with three or four inches of earth with which have been mixed, for every square yard of the surface of the trench, eight pounds of pulverized bone, four pounds of pieces of skin, leather, horns, tanners' refuse, &c., and one and a half pounds of gypsum.

"When the wood is sufficiently forward, which will be in a year or two, according to circumstances, the roots must be supplied with salts of potash in order that the fruit may be produced. For this purpose, it is necessary to spread over the trench, at a distance of three or four inches from the buried wood (roots), five and a half pounds of a mixture formed of silicate of potash, and two and a half pounds of double-phosphate of potash and lime. The trench is then to be filled up, and the roots have as much potash as they want for a long time. To prevent, however, the exhaustion of the potash, it is as well to spread every year, at the foot of the stools, a certain quantity of the *marc* ('cheese,' or refuse of the wine-press) of grapes. This *marc*, containing 2.5 per cent of carbonate of potash, will restore annually a large proportion of the potash which may have disappeared from the trench.

"Hitherto, the success of a vintage depended, *cæteris paribus*, in a great measure upon the influence of the atmosphere. Thus, suppose a vine-stock required ten parts of potash to be enabled to bear fruit: if the action of the heat and rain on the stones and earth, in a state of decomposition, could only furnish five, the vintage would be bad.

"This danger will be avoided by the above system of culture, in which the vine must always have suitable food. But it is not to be forgotten, that, although I promise those grape-growers who follow my plan an abundance of produce, I can by no means insure the quality of that produce; for quality must always depend on the temperature."

It is unnecessary to specify all the different kinds of fertilizing matters that might be used to advantage in the vineyard. We are safe in concluding that soap-suds, containing potassa and greasy matter, or old leather or horn-shavings, any thing that approaches the nature of ashes or bones, will be valuable. Watering with liquid manure is recommended by some; and this is a great stimulant to the vine at the time of stoning and swelling-off of the fruit: but it must be done judiciously, that the wash be not so strong as to injure the roots. Care also should be taken that the soil does not become wet and sodden. We have instances where the vine feeds near the sink-spout and around the cesspool. The roots of the great Hampton-Court Vine are said to feed upon London sewerage. Yet these roots will be found not to have passed a certain limit. Roots cannot remain in a healthy condition in ground that is continually saturated with moisture.

It may not be out of place in this connection to consider the fertilizing effect of rain. It is well ascertained that rain contains a considerable quantity of nitrogen, ammonia, chlorine, lime, and magnesia. An analysis of a cubic metre of water by M. Barral is given in Lindley's "Theory of Horticulture," upon which he bases the following estimate:—

"The average depth of rain which falls in the neighborhood of London is well ascertained to be about twenty-four inches per annum. This is at the rate of 87.120 cubic feet or 2.466 metres of rain-water per acre; and this, according to the proportions per cubic metre in the preceding table (M. Barral's), would afford annually of

"Nitrogen	45½	pounds.
Nitric Acid	103	"
Ammonia	19½	"
Chlorine	12½	"
Lime	35	"
Magnesia	11	"
Amount total per acre	227	"

"Of these substances, the three first are of the utmost importance, on account of their entering so largely into the indispensable constituents of the food by which vegetable life is sustained. The quantity of ammonia thus ascertained to exist is about what is expected in two hundred-weight of Peruvian guano; and bountiful Nature gives us, moreover, nearly one hundred and fifty pounds of nitrogenous matter equally suited to the nutrition of our crops."

True as it may be that there is vast benefit from rain in addition to the humidity which it yields, and that an increased supply promotes luxuriant vegetation, yet there is a limit to the requirements, and also to the capacity, of the grape. Indeed, we do not find results to harmonize with the theory which might be deduced from a consideration of the foregoing table. By a comparison of the following tables, taken from "The United-States Agricultural Report" for 1862, p. 594, it will be seen that the most favored grape-districts have the least amount of rain-fall, especially during the growing season of summer:—

INCHES OF RAIN.

CALIFORNIA.	Spring.	Summer.	Autumn.	Winter.	Total.
Sacramento	3.3	0.1	3.0	6.9	13.5
San Francisco	4.6	0.7	3.7	8.8	17.8
Los Angeles	2.5	0.1	1.6	5.5	9.7
NEW MEXICO.					
El Paso	0.6	6.6	4.9	0.3	12.4
Alberquerque	0.6	5.6	1.2	1.0	8.4
AMER. ATLANTIC CLIMATES.					
Cincinnati	11.9	14.2	10.0	11.3	47.5
Cleveland	9.1	11.6	9.8	6.9	27.4
Ann Arbor	7.3	11.2	7.0	3.1	28.6
Pittsburg	9.5	12.3	7.6	7.4	36.8
St. Louis	12.7	14.6	8.7	7.0	42.5
Nashville	14.1	14.0	12.3	12.4	52.8
EUROPEAN CLIMATES.					
Turin, Piedmont	8.2	9.0	11.5	7.8	36.5
Valley of the Rhone	10.2	9.5	10.4	4.3	34.4
Vevay, Switzerland	7.9	10.8	11.1	3.9	33.8

	Spring.	Summer.	Autumn.	Winter.	Total.
Manheim, Rhine	6.3	8.0	7.4	5.3	27.0
Bordeaux, West France	7.3	7.4	10.3	9.0	34.0
Dijon, East France	7.1	7.5	9.3	7.3	31.2
Chalons, North-east France	5.4	6.2	6.1	5.6	23.3
St. Michael's, Azores	6.6	3.6	9.5	11.7	31.4

It will be observed that the most noted grape-growing countries have the least amount of rain-fall, especially during summer. The average of the Atlantic States during summer is about thirteen inches; and of the vine-growing countries of Europe, less than eight inches: while the Los Angeles vineyards receive but the almost incredibly small amount of 0.1 of an inch. In an article in "The United-States Agricultural Report" for 1863, by I. S. Lippincott, p. 206, he expresses the opinion, that, in climates where the summer fall of rain exceeds fourteen inches, the grape cannot be profitably grown, on account of the liability to rot and mildew. He adds, "The region over which the fall of nine to ten inches of summer rain extends includes all the localities where the cultivation of the vine has, in the northern section of our country, been attended with the largest share of success." It appears by the able researches of L. Blodget, as published in his work upon "The Climatology of the United States," that on the coast of New England, the valley of

Lake Champlain, the shores of the Great Lakes as far west as Superior, Pennsylvania west of the Susquehanna, and, passing south, through the mountain district of Virginia, the average fall of rain during the summer is about ten inches. The lower region of the Hudson has about eleven inches, while Southern New Jersey and Eastern Pennsylvania average about twelve inches.

In comparing these statistics of Blodget, as applied to the last district, Mr. Lippincott remarks, "This is not generally a favored region for the vine, having an average fall of two inches more than the district of less rains, though more promising than where fourteen inches prevail. . . . And such must ever be the experience of those who in this district continue to cultivate the Catawba and Isabella, and other varieties subject to injury from excess of moisture. It is only in the region of lesser rain-falls, and within the zones adapted to their needs as respects summer heat, and length of season, that we can reasonably hope to find a greater or general exemption from influences so unfavorable."

These views are so conflicting, that the expression by an eminent pomologist in regard to grape culture, "We are at sea without a rudder," sometimes seems to be true. In this case, I apprehend we can reconcile the apparent differences more easily than in many other instances. That the rain has great fertilizing power is beyond question. With the vine, it promotes excessive vegetation; and also, by an excess of humidity at times, with sudden and extreme changes to heat and dryness, causes rot and mildew. The growth of vine is far greater with us than at Los Angeles, where the grape is so stubbed that it supports itself without a stake, and there is no necessity for summer checking. Yet the salubrity of the Pacific air, and the uniformity of climate, make it a favored spot both for European and American grapes. While there is force in the views of Mr. Lippincott, it is a matter of doubt whether such arbitrary rules can be given in regard to the culture of the grape. A location may be subject to an average rain-fall of fourteen inches during the summer; and yet it may be so high and dry, and the land so porous, that no serious results may follow. Irrigation has been suggested as a method of fertilizing the vineyard; but it must be evident, from a consideration of the foregoing statistics, that this can never be recommended for the Atlantic States. Doubtless it might be practised to advantage in California.

It is a question of importance, at what season of the year to apply a top-dressing. After the young fruit is set, it is a great assistance to the vine if some extra supply of food can be given in the stoning and "swelling-off" of the berries. It is like a friendly lift over a hard place. The vine has then partially ceased its efforts to make wood, and the fertilizing matter seems to be specially appropriated for the fruit. I think a little bone-dust, or a slight sprinkling of guano, in June, will have twice the effect upon the fruit that the same amount would have if applied in November. On the other hand, ashes, which serve the double purpose of developing the soil and building up the vine, should be applied a considerable time before the results are expected. Certainly it is not true economy to enrich land while the roots are inactive. We think it injurious to water a pot-plant with liquid manure when it is at rest. Moreover, there is waste in top-dressing a vineyard in the fall; a portion of the manure being volatile, and passing off in the air, while some of the solvent portion will pass off by filtration. Yet the amount of loss in either case is not so great as many suppose. The ground is generally frozen, and oftentimes covered with snow. These conditions not only prevent much loss, but also any perceptible effect of the manure upon the roots. The fall application brings the manure into excellent condition for the use of the plant the following season. When ashes and bones are composted with peat (which is by far the best method), or when stable-manure is used, if the dressing is applied in the fall, it serves also as a protection for the roots against winter frosts. Ashes, or peaty composts, should always be mixed into the soil with the horse-hoe. Some have advocated the application of stable-manure in the spring, that it may serve the purpose of a mulching during the summer. On most soils, this would be a positive and serious injury. In the dry climate and soil of California, this mulch would prove a great benefit. Also upon very light, dry, and sandy soils, in the Atlantic States, it might be safe to use a mulch. But when we consider the superabundance of rain, and the danger from mildew and rot, we cannot be too careful in keeping our soil warm and dry. The sun should exert its full power to warm the roots as well as the branches. This is the rule. If some one suggests an ugly case of a vine whose roots run out of sight, around a building or under a pavement, and yet yields the best results, we can only sav it is an exceptional case. As a general rule, avoid mulching; apply all heavy manures in the fall, in order that they may become thoroughly decomposed and incorporated; and let the soil be kept light, and free from weeds, exposed as much as possible to the sun and air.

CHAPTER XII.

DISEASES.

IT is to be expected that we shall find great diversity of experience in respect to the diseases of the vine in different climates. In the Atlantic States of America we have two evils, so universal, and so much more serious than all others combined, that they deserve special consideration. Every one who has had any experience with grapes will understand that I refer to mildew and rot. Mildew has been the bane of the husbandman from the earliest ages. God repeatedly warned the Israelites that blasting and mildew should be sent as a penalty for disobedience. By the prophet Amos (iv. 9) he reminds them, "I have smitten you with blasting and mildew: when your gardens, and your vineyards, and your fig-trees, and your olive-trees, increased, the palmer-worm destroyed them." And again (Hag. ii. 17): "I smote you with blasting, and with mildew, and with hail, in all the labors of your hands." Theophrastus, in his "History of Plants," written three hundred and twenty years before Christ, treats very distinctly of mildew, and mentions the plants most subject to its attack. He states that the crops on high-lying lands were seldom attacked by this disease, but that the hollows surrounded by hills, where winds could not get at the crops, were frequently infected. This disease is often alluded to by subsequent ancient writers, and is generally connected with the dog-star and with foggy weather. The Romans even regarded the mist as a cloud of mildew; and they recommended fumigations with "stinking, pungent smokes," at such times as the mists should appear in the air. The credit of discovering the true nature of mildew belongs to Felice Fontana, who published a work, entitled "Osservatione sopra la Ruggine del Geano," at Lucca, in the year 1767, in which he declares it to be a fungus. Since this time, observations with the microscope have been made by botanists; and it is determined that there are distinct species of fungus infesting different plants. These minute parasitic plants, or fungi, seem to have a perfect vegetable organization. Their roots fasten upon the leaf or stalk of a plant; while their stems grow and bud, and mature seed, during their brief life, with as much system as the California giant Sequoia of three thousand years' growth.

A correct knowledge of the nature of this parasite will of course afford great assistance in checking its ravages.

Prof. B. Silliman, jun., in an article upon Mildew in "The Horticulturist," vol. xviii. p. 305, remarks, "But little study has been given by botanists to the investigation of mildew. In fact, Dr. George Engleman is the only botanist whose papers I have seen upon this subject. In 'The Transactions' of the Academy of Science of St Louis, vol. ii. 1863, Dr. Engleman, the president, describes two species of fungi destructive to vineyards (p. 165). I add an abstract of Dr. Engleman's short note on this subject, for the information of your readers. Dr. Engleman describes first a species of Botrytis, probably the B. viticola of Berkley. It makes its appearance in the latter part of June on the lower, downy surface of the leaves. . . . About the same time, the mildew appears on the pedicles, and often also on the young berries, when they are about the size of peas, or smaller. Dr. Engleman never saw it on full-grown berries. Those attacked on their surface or on their pedicles soon fall off: but the most material damage is done by the mildew infesting the leaves; whereupon the greater part of the berries will gradually turn yellowish-brown at their base, shrivel from that point, assume a club shape, and at last dry up entirely, usually remaining adherent to the withered racemes. This is the *brown rot*, so well known to all cultivators to their dismay. The second kind of rot, the *black rot*, is brought on by a very different fungus, which Dr. Engleman thinks is undescribed by botanists. It evidently belongs near Ehrenberg's genus Nœmaspora, and ought to bear the name Ampelicida. It makes its appearance only on nearly full-grown berries, exhibiting in the first stage a discolored spot on the side, but never at the base, of the berry, about two lines in diameter, with a dark spot in the centre. This spot soon becomes light brown, and remains so; while the surrounding part of the berry gets darker, and exhibits a rough or (under the magnifier) pustulous surface: gradually now the berry shrivels up, and becomes black. The individual fungi are little spherical bodies (0.07–0.10 line in diameter), formed under the surface in great numbers, which, growing, elevate, and at last burst, the epidermis; then open at their apex by a small, jagged hole and, shrivelling with the berry, eject a more or less curled or twisted thread, which, moistened, becomes gelatinous, and shows the innumerable oval sporules (0.004–0.005 line long), each embedded in its coat of mucilage."

The first species of fungus, which Dr. Engleman calls Botrytis, is very similar to, if not identical with, the European Oidium Tuckeri. Another species (Erysiphe) is more frequently seen upon the European varieties of grapes, though it is sometimes found upon our native kinds, indicating that it may at a future day become a source of evil. It is entirely distinct, developing upon the upper surface of the leaf in the form of a white powder, which spreads like a web, enveloping leaf and fruit. This may be peeled off with ease, leaving the foliage uninjured, as the roots of the fungus do not appear to penetrate the leaf to any extent. Hence it may not be called a parasite, but rather an epiphyte, in its habit of growth. But it is a serious check to the vine, and will entirely prevent the ripening of the fruit. This last species is of rare occurrence upon our native grapes, but may be observed upon the European varieties of gooseberry.

I believe it is well ascertained that all those species of parasitic fungus which infest the grape, and which we call mildew, vegetate most rapidly in a moist atmosphere.

Indeed, a somewhat moist state of the air is necessary to their continued life. Hence we find that those climates which are subject to rain and fogs are also most subject to mildew. On the other hand, the dry climate of California, for example, is almost a complete safeguard. It is also true, that this excess of moisture, with heavy dews, and sudden changes from heat to cold, tend to make the grape-foliage feeble or unhealthy, possibly rupturing the pores of the leaves, and destroying the cuticle, which is a guard against the lodgement of floating seeds of fungi. In muggy weather, the foliage is soft and succulent, which is also an assistance in the vegetation of fungus-seeds. It is well known with what anxiety the English farmers watch their wheat-crop during its rapid growth, and time of ripening, lest the mildew, or rust as it is called (*Puccinia graminis*), should have the favoring influences of their dull weather. M. Duhamel states that mildew is caused by such an atmosphere. Though this may not be strictly true, it is universally observed that such weather greatly favors its development. We are to consider mildew as a living plant, dependent, like all other vegetable life, upon its conditions of growth. Possibly we may be able to prevent its seed from taking root, or we may produce such a state of the atmosphere that it cannot grow, or we may cause a violent death by poisoning. I think it wise to keep it constantly in mind that this is a plant, and let our efforts be distinctly directed to one or other of these three ends. In this way we shall arrive at intelligent results, and be spared a multiplicity of foolish theories. For example, in "The Horticulturist," vol. xix. p. 143, Mr. J. Stagman "fully elucidates the subject" of mildew and grape-rot, and concludes that the first is produced by a negative state of electricity, and the rot by a positive state. If the nature of the disease is kept distinctly in view, we shall not be in danger of bewilderment by incorrect statements and crude opinions. Let us take the three possible ways of counteracting the disease, in the order in which they are before written.

1st, Preventing the seeds of fungi from taking root. Can we guard against the *attacks* of mildew? It is universally observed that feeble and sickly growth is much more liable to the attack than firm and healthy foliage. Middle-aged vines are more free than either young or old vines: this is the universal law. A good constitution can make a more successful defence against disease. Any thing, therefore, that contributes to the health of the vine, is so far a help. In "The Horticulturist," vol. i. p. 148, is an article signed by "Chemico," which suggests that the fungi causing blight, or mildew, is caused by a surplus of carbonic-acid gas, which gas would not exist as such were there a sufficient supply of potash in the soil. "We may now easily account for facts mentioned by your correspondent, that old vines are much more liable to mildew than young. They have exhausted the potash from the soil; and, when their leaves absorb carbonic acid, the plant has no potash with which to form a healthy salt by union with it, and the diseased plant invites the fungi. A humid summer is favorable for the generation of carbonic acid, and hence the reason why 'T' found his young vines attacked during such a season. 'T' is correct when he says, 'Soap-suds are always beneficial, and can be used freely.' The reason is, soap-suds contain potash." To this Mr. A. J. Downing adds, "There is some point in these notions regarding mildew. Young and healthy plants are seldom attacked by mildew, while old and feeble ones are very liable to it. Our own observation has led us to believe that wood-ashes are one of the most beneficial fertilizers for the grape, giving it the appearance of extraordinary luxuriance and health. The great productiveness and longevity of the vineyards abroad, which are formed upon a soil composed mainly of the spent ashes of volcanoes, and the acknowledged superiority of the grapes and wine yielded by such soils, are manifest proofs of the value of ashes. . . . Let every one troubled with the mildew, especially in grapes, make a fair trial of it, and report for the benefit of others. There are certainly soils where this plant thrives wonderfully well, and no mildew appears; and others, where, with all ordinary care, it can seldom be prevented. If the application of potash in the form of wood-ashes will insure the cultivator against mildew in grapes alone, it is a discovery of no ordinary utility." The form of expression which is used by "Chemico," that "mildew is caused by a surplus of carbonic-acid gas," is unfortunate. But there is plausibility in the theory, that a superabundance of carbonic-acid gas in wet weather may act upon leaves having an insufficient supply of potassa, and thus cause a diseased state which invites fungi. At any rate, we know that potash will give that vigor which will enable the vine the better to resist mildew.

Sudden changes from heat to cold, and from wet to dry, are conditions which universally develop mildew; but these are not conditions which specially favor the growth of the fungus plant. We must therefore conclude that these sudden fluctuations have so disarranged the delicate tissues of the leaves, and perhaps ruptured the pores, that, so to speak, the ground is broken up, and prepared for the fungus-seed to take root. Strong currents of wind, and exposure to clear sun by day and cold dews at night, have each a tendency to disorganize the delicate leaf-tissue. Possibly it may be, that, when active respiration is going on from the leaves during dry weather, this respiration is suddenly checked when damp weather comes on, and the leaves may become gorged with sap, which cannot pass off by evaporation; and, as a consequence, the tissue becomes disorganized.

Mr. J. N. Jones, of Charleston, S.C., communicates to "The Gardener's Monthly" (vol. ii. p. 363) the result of his observations upon mildew, under the microscope, which confirm this view. He says, "I had always considered mildew as a disease of plants, or at least as a cause of disease, regarding it as a parasitic fungus, feeding upon the sap, obstructing the respiration, and destroying the vegetable tissue. I observed, however, that *before* the fungus made its appearance, and before any trace of it could be observed under a high magnifying power, the foliage in parts, and sometimes entire leaves, put on a peculiar glazed appearance, evidently caused by the exudation of some gummy or viscid matter oozing out of the stomata, gradually spreading over the surface, and drying in the form of a thin pellucid pellicle, scarcely distinguishable by the naked eye. Upon or under this pellicle, after some days, the vegetation of the fungus was distinctly observable in the form of fine threads, ramifying in all directions exactly as mushroom-spawn runs through a 'brick.' A low magnifying power of two or three hundred shows the object beautifully in the form of most delicate lace-work. Fine particles of dust frequently adhere so thickly on the viscid surface as to interfere with a good view of the object. In a few hours, under favorable conditions, little globular bodies may be observed, forming all over the net-work of fibres. These burst through the thin layer of extravasated sap, 'coming up' very much like a fine crop of mushrooms. On twirling an affected leaf in a tumbler of warm water, the gummy matter dissolved, and carried with it the fungi, root and branch. The conclusions deduced from these facts seem to be that mildew is not a parasite in the proper sense of the word, but rather a scavenger, decomposing and changing into another form the excrementitious matter, or whatever it may be, thrown off by the leaves. Mildew cannot exist upon a healthy vegetable surface;

but, wherever decomposition is going on, there mildew will be found in some form or other.

"The unhealthy exudation, from the surface of a leaf, of this viscid matter, which dries, and no doubt decomposes, on exposure to the atmosphere, forms a proper food for the mildew. The stomata, or pores of the leaf, being stopped up, it is impossible that healthy respiration can be resumed until the surface is perfectly cleansed. The cause which produced the overflow of sap (if I may so term it) may have been transient; but, as long as the pores remain closed, it is impossible for the plant to grow healthily. The tissue of the leaf or fruit becomes unhealthy under such circumstances, merely from suffocation, as it were. The application of lime or sulphur may cause the destruction of the fungus by acting upon and purifying the viscid sap. Possibly, however, the plentiful use of warm or even hot water, where it can be used, might be quite as efficacious."

I have quoted the communication of Mr. Jones nearly entire, because it gives an interesting, and, I think, a correct view of the superinducing cause of mildew. Facts will, however, compel us to differ from him in regarding mildew as merely a "scavenger," &c. Were it of such nature, we might regard mildew as a remedy for the previous evil. But it is clear that this is not the case. This viscid appearance is sometimes noticed upon the leaves; but, under favoring weather, the mildew is not developed, and the vines do not suffer materially. On the other hand, the strictly parasitic growth of the mildew noticeably and speedily sucks out the life of the leaf. Again: when we apply dry suphur as a remedy, manifestly it is not to take off the viscid matter, but simply to destroy the life of the parasite. When this last result is accomplished, the vine recovers its health, though the viscid matter remains.

All our views and theories in regard to mildew must bend to facts. It is of the utmost importance that we have the experience and observations of scientific men, in order that, by a comparison of cases under a variety of circumstances, we may be able to build a true philosophy of the evil. With the hope of contributing to this end, I make free quotations. In "The Horticulturist," vol. xviii. p. 304, Prof. B. Silliman, jun., mentions the case of a Catawba vine twenty years old, covering an open space in front of his piazza, twenty-one feet long and twelve feet high, above which is a cornice projecting rather over a foot beyond the wires on which the vine is trained. "The exposure is west by north; and, although it is late in the morning before the sun rests upon it, this vine has very uniformly ripened its fruit, and has never (on the portion described) been affected with mildew to any noticeable extent. Three years ago, I carried some strong shoots of this vine over the cornice, with a view to transfer the chief growth of the plant to a new trellis which I constructed, reaching from the edge of the piazza-roof to the top of the main house, at an angle of forty-five degrees, above a tin roof. Here, I thought, was an exposure so much more favorable than the old one, that the fruit would be much more fully and more early ripened; and, as the strength of this old plant seemed equal to it, I proposed to remove all the old branches on the lower trellis, and supply their place by new plants, while the new trellis above should be covered by strong new shoots trained in horizontal cordons. To my surprise, I find my plans do not meet the approbation of the old Catawba; in fact, he quite resents this proposed change. All the branches which I have brought up over the roof are badly mildewed. At this time (Sept. 14), but few leaves on the vertical surface of the old trellis, under the cornice, show a trace of mildew; while above the roof the exact reverse is true. Few of the berries fell off with brown rot (of which more anon) from the vertical surface, while over the roof this trouble was much more general. In short, to view the vine at a distance, the part above the roof seems as if it were scorched by fire, while that below the cornice is as green as it was in June. The fruit on the portion fully exposed to the sun is likely to fail, in good part, from the loss of foliage; while, on the protected part, there will be a good crop ripe in October. The plain inference from this and many similar cases within my observation is, that the vine must have some protection from nocturnal radiation."

Mr. C. A. Riehl, of Boonville, Mo., writes to "The Gardener's Monthly," vol. ii. p. 362, giving facts which are so much to the point, that we again quote: "I have for many years been of the opinion that two things were essentially necessary for the healthy growth of the grape; namely, natural or artificial protection from dew, and thorough drainage. The reasons for entertaining this belief are these: Some ten years ago, my father tried some experiments on three vines of the Isabella planted on the east side of the house. At first they were trained close to the wall, where they would be protected from dew by the projection of the roof; and, while grown thus, they bore regular and fine crops of grapes. But subsequently they were permitted to run on some framework, so as to make a kind of arbor in front of the house, and where the dew would fall on the leaves; after which the grapes invariably rotted both on the arbor, and under the roof, and on the wall: and I have observed the same thing in other localities; thus showing that it is not the fault of the soil or climate, aside from the dew." Mr. Riehl gives his opinion, that vines do better in the tops of trees, because their foliage is protected from dews by the foliage of the trees. He also states, that, upon thoroughly drained lands, there is always less rot or mildew than where the ground tends to heaviness; and that in dry seasons, when there is little dew, the vines are wholly exempt from disease.

We have already seen that the amount of rain which falls in the Atlantic States is in excess of the wants of the grape. Those States which have the least amount are best for the vine, and suffer least from mildew and black rot. By the tables taken from "The United-States Agricultural Report" for 1862, it appears that at St. Louis, Mo., there is the greatest amount of summer rain-fall, averaging 14.6 inches; while the total average for the year reaches the large amount of 42.5 inches. As might be expected, this region suffers extremely from mildew and black rot. On the other hand, there is a small tract, commencing at Rochester, in New York, and extending west along the shore of Lake Erie, and including its islands, where the rain-fall does not average over nine inches during the summer months; which is less than in any other part of the Northern United States east of the Mississippi. On Kelly's Island, in the western part of Lake Erie, there is not only this favoring circumstance of a light rain-fall, but also a remarkable freedom from dews and fogs during the summer. After the water of the lake becomes warm, the night temperature of the island is kept up; and the consequence is, that very little dew falls. Fogs are also very seldom experienced. It is to this that the cultivators on the island attribute their uniform success in ripening their grapes, and their almost entire freedom from mildew and rot. The water of the lake preserves a uniformity of temperature, and prevents the extremes of heat and cold. This alone is a most important advantage, and a great safeguard against mildew. It is a question, whether dew is in itself promotive of mildew, or whether we should not, with more propriety, say that the conditions which produce dew tend also to develop mildew. This distinction is important; and I confess that upon it my hope for the unprotected hori zontal trellis to some extent depends. That such a trellis is exposed in the greatest degree to the effects of dew is obvious. Copings and projecting cornices have, in numberless instances, proved a safeguard against mildew. A single, wide board has been run along the top of perpendicular trellises for the purpose of keeping off the dew; and it has been thought to effect good results. Whether such results are not rather the effect of protection from cold, and a partial arrest of warm air radiating from the earth, may be a question. In the cases of Prof. Silliman and Mr. Riehl, — and such cases might be multiplied, — it is important to determine whether the evil result of bringing vines out from a projecting coping is caused by the new exposure to strong currents of air, and the extremes of heat by day and cold by night, rather than by the effect of dew. It is a question which must be determined by facts alone. I have hope that a vine trained horizontally, near the ground, will of itself arrest radiation to some extent; that it will, to some extent, find a benefit in its proximity to the earth, the temperature of which is so much above the cold night-air. We know this benefit is very appreciable where vines run over rocks, which become heated during the day, and give off their heat during the night. It must be kept in mind that the leaves spoken of by Prof. Silliman were high in air, and exposed to cold draughts, and that a low-trained vine relies upon its favoring circumstances. Of course, we would wish to avoid the dew, because a cold dry air is less injurious to vegetation than a cold damp air. But, if we may hope to retain a higher temperature underneath the vine, we may also trust that the dew upon the upper surface will not in itself be a serious injury. Actual trial can alone determine this. While it is true that an exposure to strong draughts of air is an injury to the foliage, which tends to mildew, it is equally true that foliage growing in a close or a shady place is almost a certain prey to mildew. Hence it is that close fences are regarded by some as undesirable. A certain amount of circulation is necessary to keep the air sweet and dry, and to produce a firm instead of a succulent growth. We may sum up our views, under the head of preventing the seeds of fungi from taking root, as follows: So long as we can keep the foliage of the vine in perfect health, we are safe against attacks. Whatever tends to promote firm growth, especially the use of ashes, is beneficial. A light and warm soil is least affected. Copings which guard from the cold night-air are also a benefit. Any thing done in either of these three directions, which promotes the health of the vine, and prevents that debility of foliage, and exudation of viscid matter, upon which the fungus may fasten, is done wisely. Upon the second point, namely, a state of the atmosphere in which mildew will cease to grow, we shall have little to say. That mildew delights in a warm and muggy air is beyond doubt. It is equally clear, that, though the vines have become debilitated, and in condition to receive, and have actually received, the seeds, yet, if the weather becomes warm, dry, and clear, the fungus will perish. It cannot grow in a clear, dry air. However important this fact may be, it is one over which we have very little control. In a glass house, we can control the atmosphere; and I have no doubt that by this means alone we could check the growth and spreading of the fungus. In the open air, we must be content with the slight modification of the temperature, and the material diminution of the humidity of the air, which result from a warm, well-drained soil.

The third and last remedy consists in destroying the life of the fungus by poison. In England, it is found that caustic lime, and also common salt, are destructive to the Puccinia graminis, the species of mildew which attacks grain. In Johnson's "Essay upon Salt," 3d ed. p. 52, is an account of the application of salt, by Rev. Edmund Cartwright, upon a field of wheat which was badly mildewed.

A brine was made in the proportion of one pound of salt to one gallon of water, which was sprinkled broadcast. The result was, that the mildew was completely subdued. Mr. Cartwright adds, "I believe it to be *instant death to fungus*. This, however, is certain,—in less than forty-eight hours, the straw nearly recovers its original color and brightness. The certainty and celerity of its operation I account for thus: The mildew, it is well ascertained, is a parasitical plant of the fungus tribe, the principal constituent of which tribe is water: when salt is therefore applied to them, the aqueous particles are immediately absorbed, and their vitality destroyed. The action of salt upon mushrooms, as in making mushroom-catsup, confirms this theory."

This applies to mildew upon wheat; but it would be reasonable to suppose that its nature was so similar to grape mildew (*Oidium Tuckeri* of Europe), that it would have equal effect upon the latter also. I have never heard of any experiments in this direction in this country as applied to the grape. It is certainly worthy of trial. But the most powerful specific is sulphur, which has long been known and applied,—long before the nature of the disease was understood. The testimony in its favor is unanimous and very decided. If it can be made to pervade a house or a vineyard, it not only will prevent development, but it will absolutely arrest and kill the fungus when growing. It will be found far easier, however, to prevent than to cure. Various modes of applying the sulphur have been tried. In one of the "Gardener's Magazines" a suggestion was made (to which I have not been able to turn), that sulphur, if worked into the soil in moderate quantity, would prove a sure *preventive.* I know of no case where this has been tried. The sulphur would prove valuable as a fertilizer; and possibly a very small amount of gas would pervade the air of the vineyard. So far as the sulphuric acid, which the vine imbibes, tends to promote vigor, and prevent the enfeebled condition and viscid secretion of the leaves, it should be applied like ashes, to give constitution and tone, which will enable the vine itself to resist the disease. With this design in view, it is well to make trial of sulphur as a dressing; but, when we have the direct "intent to kill," we must make more direct application.

In forcing-houses or graperies that have hot-water pipes or flues, it is a very simple and effectual plan to dust the flowers of sulphur upon the pipes or flue. The fumes of sulphur pervade every part of the house; and, in such an atmosphere, the fungus cannot live. Care must be taken that the sulphur is not put upon very hot bricks, so that it will approach burning, else the sulphurous acid gas will prove destructive to the foliage of the vine as well as to the fungus. Another mode of applying it is to dust the dry flowers through the foliage in the middle of a clear, dry day. The sulphur is much more efficacious and pervading when the foliage and the air are free from moisture. For the vineyard, this is the easiest and most rapid mode of application, requiring, however, a larger amount of sulphur. I have never found any evil resulting from too free use; and I therefore recommend frequent and liberal dustings wherever there is a liability to the disease. Several machines have been devised for the purpose of dusting the sulphur evenly underneath and through the foliage,—such as the bellows principle to blow the dust; also a tin cylinder, two feet in length, and about three inches in diameter, perforated with minute holes at one end and on the sides, and having a round woollen ball to play inside as a valve. This cylinder is attached to a handle two feet or more in length. When the cylinder is partly filled with sulphur, and is thrust back and forth under the vines, the ball acts as a plunger to drive out clouds of sulphur. Though I have never used such a machine, I think it can be made very efficient. My own practice has been to use an open tin pan, with a common feather duster. The work is more rapid, there is no liability to clog, and the quantity of sulphur is more liberally supplied. Still I am not prepared to say it is better than the mode of applying by a cylinder. The main point is to secure an even distribution in a dry time. To make sure work, this application should be made before any signs of mildew appear, and repeated three or four times during the season. The first application should be soon after the leaves appear; a second, about the time of blossoming; and one or more repetitions, when the grapes are of the size of peas, with frequent repetitions if there are indications of the disease after this time. In "The Horticulturist" for June, 1864, p. 170, "Horticola" gives a letter from Neubert, a celebrated vine-grower at Leipzic, Saxony. In addition to the ordinary application of sulphur during the growing season, Mr. Neubert also recommends the following: "Treatment of the vines *before* the leaves appear: Syringe them thoroughly, also the walls, posts, stakes, trellises, &c., with the following mixture: Take eight and a half ounces of common salt, four ounces of saltpetre, thirty-six ounces of water, and add ten drops of oleum anthos and ten drops of oleum lavendulæ to the solution, shaking it well; take one part of the solution, and from a hundred to a hundred and twenty parts of water. Immediately before using, it must be vigorously shaken, on account of the oils, which, of course, easily separate from it." In view of this syringing and the use of sulphur during the growing season, Mr. Neubert, alluding to his past years of sleepless anxiety, struggling with the disease, adds, "Now, however, I am confident that all the cares arising from that disease are at an end." The ingredients of the wash are antiseptic; yet when we consider the homœopathic quantity, the time of application, also that rosemary and lavender are volatile, we do not understand how so practical and skilful a cultivator as Mr. Neubert can attach so much value to it. It is wise to test the wash, varying its strength and the time of its application.

We account for the efficiency of sulphur from the known effect of sulphurous acid gas upon vegetable and animal life. This gas, as we have stated, is very destructive to vegetation. It extinguishes flame and animal life. When diluted with a large proportion of atmospheric air, it is still so acrid as to produce a sense of suffocation and violent coughing. Every one has experienced the suffocating odor of friction-matches. Sulphur is insoluble in water, and volatilizes slowly, combining with oxygen, forming sulphurous acid in the proportion of one part sulphur and two parts oxygen. Now, when we use dry sulphur, it is converted into a gas so slowly, that the grape-foliage receives no perceptible injury. But the parasitic fungus is far more sensitive, and perishes upon the least perception of this gas.

And yet, though we express the opinion that the sulphur acts as a direct poison upon the fungus, and that its chief merit consists in this, still it may be well to consider how far the enfeebled state of the foliage, and of the berries also, in the case of black rot, is caused by a lack of sulphur in the plant, arising from a lack in the soil. If this were true, possibly the slight amount of sulphurous gas given off, instead of being an injury, may be, to some extent, directly inhaled by the leaves in sufficient quantity to give them tone, and enable them better to withstand the attacks of mildew. Careful observation may enable us better to understand the principle upon which sulphur acts.

It will be obvious, that though this mode of using sulphur is easy and safe, yet we get but a small percentage of the virtue of the sulphur at the time of application. This involves a loss of material to some extent; but, on the other hand, there is an advantage in having a prolonged effect from the gas. For dull weather, and when immediate effect is desired, another more speedy and more powerful remedy is to dissolve the sulphur, and apply it in solution. This mode was recommended by Prince, in his "Treatise on the Grape," published in 1830. His mode is to take a pint and a half of sulphur, and a lump of unslacked lime as big as the fist, and dissolve the two together by pouring a pail of boiling water upon them in a barrel. This is to be diluted by adding two barrels of water, at which strength it is to be applied to the vines. A pint and a half of sulphur will therefore make about sixty gallons of the wash. This is too weak, and the quantity of lime is also too small to dissolve all the sulphur. In the twelfth volume of "Hovey's Magazine" is a recipe for a solution, recommending one peck of lime, and half a pound of sulphur, to be slacked with boiling water in a tight barrel. After slacking, three gallons of water are to be added; and, when settled, the clear liquor is to be poured off. To every gallon of this mixture add forty-eight gallons of water. This will give about a hundred and forty-four gallons of liquor for half a pound of sulphur. In this case, the amount of sulphur is far too small for so much lime and so great a dilution. The heat which is evolved by slackening a peck of lime with boiling water will dissolve ten times the half-pound of sulphur. Though the caustic lime-water is undoubtedly destructive of the fungus, yet its effect is limited to actual contact with the disease. Our main reliance is upon the sulphurous gas. I have made a solution of the following proportions, without perceiving the slightest injury to the foliage of the vines from its application: To a peck of lime add five pounds of sulphur; slack with hot water, in order that the heat of the lime may be as great as possible, and the solution of the sulphur more perfect. This may now be diluted with two barrels of water, which is in the proportion of twelve gallons of liquor for every pound of sulphur. I have indeed used it stronger than this without ill effects. Considerable strength will be obtained by drawing off a second, and even a third, run from the lime-mortar. This liquid is to be applied to the foliage with a syringe or hand garden-engine. It is quick in action, and is therefore more desirable than dry sulphur when the disease is under headway. It may also be used in dull weather. A vineyardist will therefore do wisely to provide this remedy in case of necessity, relying upon the dry flour mainly for prevention, and in dry weather. With a faithful use of these remedies, it is believed that mildew cannot make headway.

In regard to the black-rot fungus, it is more doubtful if sulphur is a specific remedy. The fungi are formed under the surface of the berries, making it difficult to reach them. I apprehend that sulphur would be an important *preventive* to the development of the fungus. The universal testimony is, that heavy soils are certain to be most troubled with rot; also that the disease is much more prevalent in wet seasons than in dry. In California, the disease is unknown except in low clay soils. This is the most serious of all evils in Southern Ohio, where the soil is strong, and the rain-fall is excessive. So serious has the evil become within a few years, that some extensive vineyards around Cincinnati are being abandoned for the more favored locality of Kelly's Island and the surrounding region. In the vast extent, where the summer rain does not average above ten inches, we may hope, that in warm and well-drained soils, with a free use of ashes and sulphur and other tried remedies, we may have a good degree of exemption from this evil. In this connection, I would again suggest the use of gypsum, or plaster of Paris, as containing the essential elements, sulphur and lime, which enter so largely into the structure of healthy vines. Experiments with this sulphate of lime have been made for the purpose of testing its effects upon the black rot;

and many cases have been reported where it had a very perceptible influence. The late A. J. Downing was accustomed to recommend it as a specific. A great many cases might be cited where the rot has disappeared, and there has been entire exemption after the use of plaster. Certainly it must be of great service wherever there is a deficiency of sulphur in the soil; and it would be wise to try its effect upon every vineyard.

CHAPTER XIII.

INSECTS INJURIOUS TO THE VINE.

WE cannot, of course, expect to give a complete list of insects which prey upon the vine, to a greater or less degree, in the different parts of the country. It will be enough if those which are liable in any case to become seriously destructive are enumerated. In making up the list, great reliance has been placed upon Prof. Harris's most able and interesting treatise upon insects, which, though limited to New England in its researches, will probably be found to embrace all insects that are to any extent troublesome in other parts of the country. Long as the list is, and seriously troublesome as some of them are, yet they have not hitherto been as much so as the diseases mentioned in the preceding chapter. Some species increase with great rapidity, and we cannot be too much on our guard against them. Reports will materially differ in different localities; some places being entirely exempt from insects that are very destructive in other sections. Every section, however, is liable to attack; and it is wise to know the enemy, and guard against invasion. It is evident, that as the cultivation of fruit extends, and as the number of birds diminishes, the increase of injurious insects is a natural result. It will be absolutely essential that human skill shall be made effectual against this increase. Already we know, of substances destructive to most insects, and there is no reason for discouragement in a single instance.

THE ROSE-CHAFER.

(Melolontha subspinosa of Fabricius.)

The prevalence of this insect on the rose, and its annual appearance coinciding with the blossoming of that flower, have gained for it the name of Rose-bug. Harris describes the beetle as "measuring seven-twentieths of an inch in length, with a slender body, tapering before and behind, entirely covered with very short and close ashen down; the thorax is long and narrow, angularly widened in the middle of each side, which suggested the name Subspinosa, or somewhat spined; the legs are slender, and of a pale-red color; the joints of the feet are tipped with black, and are very long, which caused Latreille to call the genus Macro dactylus, i.e. long-toe or long-foot. This insect comes from the ground in swarms, in some sections about the second week in June, and especially chooses the grape, taking also the cherry, apple, plum, garden-vegetables, and indeed almost every green thing; feeding indiscriminately upon leaves, flowers, and fruit. Dr. Harris states that they have prodigiously increased in number during the last forty years; though I think the contrary is true for the last ten years, since his opinion was written. In the early formation of Dr. Underhill's celebrated vineyard at Croton Point, N.Y., the rose-chafer was very numerous and destructive; and would have ruined the vines, had not the doctor taken vigorous measures to destroy them. This can easily be done by shaking them into a pan of water, and killing them when collected in sufficient quantity. If taken soon after their appearance from the ground, being then quite feeble, they do not attempt to fly, but drop helplessly at the least shake of the branch. John Lowell, Esq., states in the "Massachusetts Agricultural Repository," vol. ix. p. 145, that, in 1823, the rose-bug appeared upon a solitary apple tree "in such vast numbers as could not be described. . . . Destruction by hand was out of the question." He shook them down upon sheets, and burned them. "Eighty-six of these spoilers were known to infest a single rose-bud, and were crushed by one grasp of the hand." Owing to this ease of its destruction, we can with certainty protect ourselves against the ravages of the bug. According to Dr. Harris, the male bug becomes exhausted in from thirty to forty days, and perishes; while the females enter the earth, lay their eggs, re-appear, linger for a few days, and die also. The number of eggs deposited by each bug is about thirty, at a depth of one to four inches below the surface. They are globular, whitish, about one-thirtieth of an inch in diameter, and are hatched in twenty days after they are laid. The young larvæ are of a yellowish-white color, with six short legs; and attain a full size in autumn, when they are three-quarters of an inch long. In October, they descend below the frost, and pass the winter in a torpid state. In the spring, they approach towards the surface; and each grub forms an oval cell by frequently turning around so as to compress the earth, and make it hard and smooth. In the month of May, the grub is transformed into a yellowish-white pupa, with short stump-like wings, and legs folded upon its breast, all enclosed by a thin film. In June, the filmy skin is rent, and the beetle digs to the surface. As before stated, they can be more easily destroyed soon after they appear. The rose-bug is very fond of the blossoms of the ailantus, being attracted by their sickening odor. Fortunately, the ailantus-blossoms are of some service, as they are deadly poison to the bug; and this may account for their gradual diminution since the ailantus has been cultivated.

THE FLEA-BEETLE (*Haltica Chalybea*).

This insect is found upon the grape-vine in all parts of the United States, both upon wild and cultivated vines. Generally it is not numerous enough to be very destructive; though there are cases mentioned, such as Mr. Howell's, in "The Horticulturist," vol. v. p. 52. Mr. David Thomas also, in the twenty-sixth volume of Silliman's "Journal of Science," speaks of them as appearing in unusually great numbers in the vicinity of New Haven, Conn., and doing unexampled injury, in the spring of 1831. "Some vines were entirely despoiled of their fruit-buds, so as to be rendered for that season barren." Dr.

Harris describes the color of the beetle as varying in shades of blue. "The most common tint of the upper side is a glossy, deep greenish-blue; the under side is dark green; and the antennæ and feet are dull black. It measures rather more than three-twentieths of an inch in length. The beetles emerge from the ground about the last of April, and continue to appear during the month of May. Soon after their first appearance, they pair, and probably lay their eggs on the leaves of the vine. A second brood of the beetles is found on the grape-vines towards the end of July." The larvæ are small chestnut-colored and blue worms, about one-quarter of an inch in length, which feed upon, and are very destructive to, the foliage of the vine, until they descend into the ground, and undergo their transformations.

The beetle appears so early in the season, that, in order to find food, he is compelled to resort to boring the grape-bud. This is the most serious injury which the beetle effects; and it can be prevented by washing the canes, especially the eyes, with a mixture of whitewash and sulphur. After the vine is in leaf, and if seriously infested, probably the beetle may be driven away by a dusting of air-slacked lime. Tobacco-water will subsequently destroy the larvæ, and it will probably have the same effect upon the beetle. At present, this beetle is not a serious pest.

THE SPOTTED PELINDOTA (*P. punctata*).

This is an oblong, oval-shaped beetle, about an inch in length, appearing during the months of July and August, in some sections in great abundance. The wings are of a dull brownish color, with three black dots on each; the body and the legs are of a deep bronze-green. Owing to the size of this beetle, and the fact that it subsists only upon the foliage of the vine, its increase would prove very injurious. At present, they are easily kept under by hand-picking, and destroying them with the foot.

ANOMALA VARIANS.

This is a broad, oval-shaped beetle, described by Dr. Harris as very variable in color; the males being sometimes entirely black, and sometimes the head and thorax greenish-black, margined with tile-red; the wing-covers being clay yellow, irregularly furrowed, and punctured in the furrow; the legs are pale red, brown, or black. It measures about seven-twentieths of an inch in length; the females being slightly larger than the males. This beetle has been found in many gardens in Cambridge, Mass.; and has proved very injurious to the vine. Should it increase, it may prove as difficult to check as the vine-chafer of Europe (*Anomala vitis*), which it much resembles. The beetle appears in the months of June and July, and feeds upon the leaves, completely devouring them. It should be destroyed by collecting in a pan of water, as directed for the rose-bug; this bug being also a melolantha, and of about the same size as the subspinosa.

THRIP, OR VINE-HOPPER (*Tettigonia vitis.*)

The thrip is distinct from the European vine-fretter. It is about one-tenth of an inch in length, of a straw-color, with two red lines upon the head, and a scarlet band across its middle and at the base of the wing-covers: the tips of the wing-covers are blackish, with red lines between the band and the tips. Upon its first appearance in June, it is small, and, being in the larva state, is not provided with wings. Coming from the egg previously deposited upon the leaf, it remains quietly sucking its nourishment, unless disturbed; when it is very shy, and leaps with great agility. During its growth, it frequently changes its skin; and great numbers of these cast-off skins are frequently found upon the leaf. In August, the insects become mature, and, with their flying and leaping powers combined, become exceedingly active, and exhaustive to the vine. In the autumn, they hide themselves under leaves, and come forth in the spring to lay their eggs, and die. They live by suction of the juices from the under side of the leaf, and even from the fruit. They have been much more destructive to the European varieties of grapes than to our native; so much so, that some writers have asserted that they were to be found only in grape-houses. This opinion is quite erroneous; for though the thrip, or vine-fretter, is almost universal in all graperies, and would prove a serious evil if not held in check, yet it by no means confines itself to graperies. I have seen its evil effects in multitudes of vineyards. Attaching themselves to the under surface of the leaves, they greedily suck the life of the leaf, producing the yellowish, spotted appearance which is seen upon the upper surface. I have seen them increase so much, especially in dry summers, as to exhaust almost every appearance of green upon the vine; and to fly away at my approach, in such numbers as to make it quite disagreeable to walk through the swarm. In the grapery, they can be killed by fumigating with tobacco, which is a specific for all plant-lice. They are tenacious of life, however; and it will generally require two or three smokings to effectually clear a house. In the open air, tobacco-water and a suds of whale-oil soap are the remedies which can most easily be applied. A strong decoction of tobacco, syringed upon the foliage, is usually effectual in driving them away, though it does not kill them. Whale-oil soap would also probably prove efficacious if used in June, when the thrip first appears in its larva state. If allowed to mature, neither tobacco nor soap will prove effectual in the open air. Fessenden, in "The American Gardener," suggests movable tents, to be placed over the trellis, so that tobacco-smoke can be applied. This might be done during the early stage of the insect; but, when it has acquired wings, it would find no inconvenience whatever in shifting its quarters as the tent advanced. The movement of the tent would prove too slow for these saltatory larvæ. They dance to quicker music.

Dr. Grider, President of the East-Pennsylvania Fruit-growers' Society, recommends carrying lighted torches under the vines at night. He says the thrip, being attracted by the light, flies into the fire, and is killed.

It is a statement easily tested, and if true, of which I am somewhat doubtful, would prove an easy way of destroying them. To my surprise, I have found the Clinton, firm in its foliage as it is, to be more affected than any other kind in my vineyard. I have never had occasion to protect other kinds from thrip in the open air, while this inferior fruit has suffered severely.

I have never known the wingless species of aphis, or green fly, seriously to infest the grape in the open air; and it seldom troubles the vine under glass. Should it be found, it will be at the ends of the soft, new growth, which, in the open air, may easily be cleared by either dipping or syringing them with whale-oil soap or tobacco-water. For aphis on the cherry and apple, I have used the soap-suds with the best success. But it is fortunate that this green fly does not show a preference for the vine.

VINE-SCALE (*Coccus vitis*).

This is a species of bark-louse, having the appearance of a small scale. This is the protecting cover of a minute insect, which subsists by sucking the juices from the bark. It is readily destroyed by washing it in a strong solution of caustic potash. Also, as a preventive, when the vines are taken up in the spring, the canes should be cleaned, and all the crevices thoroughly washed with a solution of one pound of potash to two gallons of water. A brine made of one quart of salt and two gallons of water is also effectual.

Other species of bark-lice are found to some extent. The *Coccus Adonidum*, or mealy bug, is a bark-louse, covered with a downy, white scale, which is frequently seen in graperies, especially where other plants are kept. It draws from the sap of the vine, lodging in the axil of the leaves and in crevices, or in the bunches of fruit; and proves very injurious, disgusting, and difficult to reach.

The same application of potash as in the previous case, if thorough, will be found effectual. . . . Still another species of lice is mentioned by Dr. Harris, as follows: —

"Many years ago, when on a visit from home, I observed, on a fine native grape-vine that was trained against the side of a house, great numbers of reddish-brown bark-lice, of a globular form, and about half as large as a small pea, arranged in lines on the stems. An opportunity for further examination of this species did not occur till the summer of 1839, when I was led to the discovery of a few of these lice on my Isabella grape-vines by seeing the ants ascending and descending the stems. Upon careful search, I discovered the lice, which were nearly of the color of the bark of the vine, partly embedded in a little crevice of the bark, and arranged one behind another in a line. They drew great quantities of sap, as was apparent by their exudations, by which the ants were attracted. Further observations were arrested by a fire, which consumed the house, and the vines that were trained to it."

Wherever there is danger of any of these or other forms of bark-lice, the solution of potash will be found an effectual remedy. It may be freely applied, without regard to the drippings, as that which falls to the ground will not be lost.

GALLS.

The leaves of the vine are sometimes seen to have excrescences, which appear in the month of August. This is undoubtedly caused by the sting of some insect, or gall-fly, depositing a poison, and making a puncture for the lodgement of its young. The effect upon the vine is very slight; but, lest the evil should increase, it would be well to collect and destroy the leaves so punctured, before the eggs are hatched.

RED SPIDER (*Acarus tellarius*).

This minute insect delights in a dry atmosphere, and is destroyed by continued humidity: consequently we seldom find it troublesome in the open air, except in very dry seasons. It almost invariably makes its appearance in the greenhouse or grapery that has been kept hot and dry, and soon disappears when these conditions fail. In dry seasons, we sometimes see the effect of the insect in small, light spots, and the generally sickly, dry, and yellow color of the leaves. The insect is so minute as to be scarcely discernible to the naked eye; but attaching itself generally to the under surface, as the softer part of the leaf, it spins a fine film as a protection, and subsists by suction upon the leaf. When in sufficient quantity, it is as exhausting to the plant as the thrip. But there is no excuse for this ever happening. In addition to humidity, sulphur is a sovereign remedy. In the grapery, it may be sprinkled upon the flues, or dusted upon the foliage; and, in the open air, it should be used precisely as directed for mildew.

CATERPILLARS.

There are several kinds of caterpillar which feed upon the vine, some of them being exceedingly voracious. They are not so numerous as to be troublesome in most sections; and are easily destroyed by hand-picking, as their work becomes apparent. In some cases, it will be necessary to pick entire leaves, or else dip the leaves in strong whale-oil suds. Though these gourmands will require looking after, yet it is not probable that they will ever multiply so as to cause serious trouble. I condense and arrange the following descriptions from the work of Dr. Harris. Linnæus gave the generic name of Sphinges to a group of moths, from the fancied resemblance which their caterpillars bore to the Egyptian Sphinx. These caterpillars are often found supporting themselves by their hind-legs, with the fore-part of their body elevated, with Sphinx-like fixedness, for hours. The Sphinx genus is subdivided; and one group is known as *S. philampelus*, from the fact that the larvæ or caterpillars feed upon the vine. The caterpillars which produce the moth *S. satellitia* are pale-green or brown, with six cream-colored, broad oval spots on their sides.

Another caterpillar of about the same size and habit, producing the Sphinx-moth *Achemon*, is more commonly found upon the vine. It is about three inches in length, and the six cream-colored spots on each side are found as in the preceding species; but they are long and narrow. They have the power of withdrawing the segments of the body within each other (of which there are six besides the head), giving them a blunt appearance. When of full size, they are very voracious, coming to their maturity in August. They then enter the earth, and appear the following June as a winged moth, four or five inches from tip to tip of wing, of a light olive, with patches of dark olive color.

In "The Gardener's Monthly," vol. iv. p. 151, a "new enemy of the grape-vine" is figured and described by Jacob Stauffer, which, he says, was found cutting off entire bunches of native grapes in Lancaster County, Penn., in the month of July, 1861. Mr. Stauffer says this caterpillar belongs to the genus Papilio, which produces a tribe of day-flying, swallow-tailed butterflies. It is styled "a dangerous species, undescribed before. It certainly is a fearful-looking monster." The representation is like the Achemon Sphinx caterpillar, with the segments of its body drawn in.

Another Sphinx caterpillar (*Chœrocampa*, or *Hog Caterpillar*), smaller and more numerous, though solitary in its habits, like the preceding, is much more destructive. Eating the leaves as it descends the stem, it also nips off the half-grown grapes in great quantities, and allows them to fall to the ground. It receives its name from the resemblance of the fore-part of the body to the head and snout of a hog. Its color is pale green, sometimes brown, with orange-colored spots on the back, six or seven darker lines on each side, and a horn at the hinder extremity. It descends to the ground in August, and forms a partial cocoon under the leaves; and the small winged moth appears in the following July.

Besides the Sphinx caterpillars, there are other species which feed upon the vine. The common *Blue Caterpillar*, which produces the delicately colored and very beautiful small moth *Eudryas grata* (beautiful wood-nymph), is often found, solitary but in considerable numbers, feeding upon the vine-leaves. When fully grown, it measures an inch and a quarter, stretching to an inch and a half, in length; its color being blue with deep orange bands, dotted with black across the middle of each ring. They first appear about the middle of July, and, when not feeding, may be found on the under side of the leaves, until they disappear, and go into the chrysalis state three or four inches deep in the ground, and re-appear in the beautiful moth-form in the latter part of June following. Hand-picking, or syringing with tobacco-water, is a remedy, whenever they are so numerous as to be troublesome. Among a group of caterpillars called *Glaucopidians* is one which produces the moth *Procris Americana*, representing the *Procris vitis* of Europe. This caterpillar is above half an inch in length when fully grown, is of a yellow color, with a transverse row of black, velvety tufts on each ring, and a few conspicuous hairs on each extremity. It is hatched from eggs, twenty or more in number, laid on the lower side of the leaves early in July. These caterpillars are gregarious, collecting side by side, and eating every particle of the leaf except the ribs. They have sixteen short feet, are rather sluggish in their motions, and, when touched, curl their bodies sidewise, and fall to the ground, or hang by a silken thread. They continue for about a month, disappearing in the latter part of August, and, in some sheltered spot, enclose themselves in a thin, tough, oblong-oval cocoon, and soon are transformed into shining brown chrysalides, producing the moth in the latter part of June following. It is evident, that, when numerous, these caterpillars are very destructive; but they are easily detected, and can be soon gathered. Still another and more frequent and destructive insect, mistaken by Fuller for the preceding, is called

False Caterpillar.—This caterpillar is the offspring of a jet-black saw-fly named *Selandria vitis*, which rises from the ground at irregular intervals in the spring and early summer, and lays its eggs on the under surface of the terminal leaves of the vine. In July, these caterpillars may be seen in swarms of various ages and of all sizes; those which are fully grown being about five-eighths of an inch in length. The head, and tip of the tail, are black; the body being light green, with two transverse rows of minute black points across each ring, the lower side of the body being yellowish. They are somewhat slender and tapering behind, thickest before the middle, and have twenty-two legs. Each swarm consists of twelve or more worms, feeding in rank with surprising regularity. Commencing at the edge of a leaf, a platoon in exact line, they retreat in perfect order, eating every particle of the leaf except the ribs, doing their work with a thoroughness, and a regard for straight lines and mutual rights, that would be beautiful to see, were it not so destructive to the vine. At their last moulting, they become nearly yellow; when they descend, and form oval cells in the earth. Passing through their chrysalis state in a fortnight, they come out, take wing, and lay their eggs for a second brood. The second brood remain in cocoons in the ground through the winter. Increasing more rapidly than the Procris Caterpillar, they have consequently been very destructive in some cases.

Air-slacked lime is fatal to them, either dusted upon the foliage, or upon the ground to receive those that fall. Whale-oil soap, one pound to seven gallons of water, is also effectual.

Leaf-rollers. — There are some kinds of caterpillar that curl up the edge of leaves into rolls, thus securing to themselves food and habitation by the same process. They generally appear early in May, soon after the leaves appear; and mature, and pass through their chrysalis, in the folds of the leaf. The only way to destroy them is to pluck the leaves; and, as the vine is not subject to this attack, the process will not be found tedious.

Sun-scald. — This is a mere development of mildew. The vitality of the leaf being destroyed by the fungus when the sun acts upon it, it becomes dry and crisp. The reason why so many have mistaken this for a distinct disease is because its full effect is not seen until after active mildew may have disappeared; and its result is therefore attributed to another cause. Of course, the remedy lies back in the treatment of mildew.

Birds.—The truth must be told, that some birds, especially the robins, are exceedingly destructive in some sections. However disagreeable the fact may be, our plump, domestic, and motherly robin is one of the least serviceable of insect-devouring birds, and, as a natural consequence, does more damage to our fruits than all others put together. In the vicinity of Boston, robins have become so numerous as to be an almost unendurable nuisance to the fruit-grower. Commencing with the strawberry, they turn from all insect food, for which they never show a special fondness, except for the harmless fish-worm, and follow up all our choicest fruits; selecting the best kinds, the largest specimens, and the ripest side, of strawberries, cherries, raspberries, grapes, peaches, and even pears; extending through almost the entire list of fruits. They are the more provoking, because, instead of contenting themselves with a meal upon a single bunch of grapes, for example, they are most dainty tasters, and will spoil half a dozen bunches in making a single breakfast. To find a premium-bunch just spoiled by a few pecks at the finest berries is no slight trial of patience. In my own vineyard, I have found it absolutely necessary, in order to have any salable fruit, to keep a boy constantly at work with a watchman's rattle, and also with a gun, "contrary to the statute in such case made and provided." Of course, this will be called cruel and barbarous; and it will be asked with an outgush of generous emotion, "Why not raise grapes enough for ourselves and the birds also?" Yes; but when the robin spoils tenfold what he can eat, and, in his greed, lays claim to all, however extensive the vineyard, I for one am inclined to resort to the argument of powder and shot.

In concluding this subject of diseases and injurious insects, we must admit that the list looks long and formidable, and that "eternal vigilance" is the price which we must pay for the grape. In the Atlantic States, it is no spontaneous growth, as in California, where they treat the vine much as we treat a crop of corn, with no training, no checking, no mildew, and no complaint of insects. And yet we are not to be discouraged: we shall find, that, by systematic effort, our difficulties can not only be overcome, but will prove less than we anticipated. Many of the insects, for example, are not likely to trouble us in the least; and there is not one of them which cannot be kept in check, the thrip being perhaps the most difficult. Notwithstanding all these difficulties, we do not complain, or despair that this noble fruit will strike the beam, even with the still more serious evils of rot and mildew thrown into the opposite scale.

CHAPTER XIV.

VARIOUS ITEMS.

THINNING THE FRUIT.

MOST of our American varieties of the grape do not set their bunches as closely upon the cluster as do the foreign kinds. This is owing in some cases to the flowers being imperfect, and in other cases to the length of the pedicles, and the long spaces in which they are arranged upon the peduncle. As a general rule, it is not, therefore, necessary to thin our bunches. This is fortunate; for it would otherwise involve a great amount of labor in the vineyard. Some varieties are quite too loose in their bunches, the Scuppernong for example, having but very few berries set separately upon a long peduncle. On the other hand, a few kinds, such as the Diana, Herbemont, and Delaware, will develop their berries to a larger size if the bunches are somewhat thinned. For the purpose of raising a few bunches of superior quality, this is a very desirable practice. This work should be done soon after the clusters have gone out of blossom and have taken their first swelling. From one-quarter to one-half of the berries may be cut out, selecting those which stand inside of the contour of the cluster, and leaving those which remain evenly arranged at the extremities of the peduncle. The work is done with a pair of long, slender-pointed scissors made expressly for this work. An expert hand will go over the grapes quite rapidly; and it is often desirable, when the season has been favorable for the setting of fruit, to go over many of our varieties, thinning out some bunches, and removing defective clusters and the surplus quantity.

THINNING THE FOLIAGE.

It has been the practice of some, as the fruit approached maturity, to remove some of the dense shade, and allow the sun to warm and ripen the fruit. When the wood has been allowed to grow throughout the summer without checking, the foliage is undoubtedly in excess, and the fruit is not inclined to ripen; neither does it receive its suitable share of nourishment in this damp shade. But the mischief has been done, and it is folly to expect that a removal of the leaves in so sudden and violent a manner will remedy the evil. It is better, even thus late, to check the wood-growth, rather than have that strength of the vine which should go towards maturing the fruit diverted in this direction, though this is work which should have been done months before. The removal of developed leaves will prove rather an injury than a benefit, as the plant has become accustomed to and dependent upon these lungs for the elaboration of the sap. The fruit of the grape also is unlike many other fruits: it is dependent upon the foliage for its maturity. We can never cut the grape in an unripe state, and ripen it in the house, as we do apples, pears, and other fruit. Even if the bunch remains on the vine, and the leaves are stripped, the chemical action of maturing is arrested, and the bunch changes color without ripening. In cases of excessive growth and foliage in August, there may be a partial remedy in an entire stoppage of all growth, and in a moderate removal of the superfluous foliage; but it is an unnatural and imperfect remedy, and the indolent cultivator must expect to pay the penalty for his neglect.

GATHERING THE FRUIT.

The time for this work will vary, to meet the purposes for which the fruit is raised. If raised for wine or for table-use, the fruit should be thoroughly ripened. Probably upon this "dead" ripeness, as it is commonly termed, depends the high quality of the Tokay and many other celebrated European brands. The vinous quality of the fruit is greatly increased by remaining on the vines a considerable time after the fruit is called ripe. On the other hand, if the fruit is to be sent to a distant market, or if it is designed to be packed away for winter use, it should be cut as soon as it can be said to be fairly ripe. In all cases, this work should be done when the fruit is perfectly dry; and every imperfect berry should be cut out with the scissors. Generally, there is a slight inequality in the time of ripening in the different bunches, which makes it desirable to go over a vineyard twice, making two cuttings. From vineyards in the vicinity of cities, the fruit is sent to market in baskets; but the larger part of the grapes which come from a distance are packed in paper boxes which hold from four to eight pounds. The box is packed perfectly full, so that the grapes cannot shake about, with no paper or cotton protection between the bunches. In this manner, great quantities are sent to the Atlantic cities from a distance of six to eight hundred miles interior; and they generally arrive in good order. Some kinds, of course, are unsuited for such transit. In my own experience, a temporary advantage has resulted to those living near a market from this fact. The Hartford Prolific is the earliest market-grape; but, as it is liable to drop if carried to a distance, those who cultivate it in the vicinity of cities enter the market without any competition from the interior. The result has been, up to this time, that, when the average wholesale price of grapes has not exceeded fifteen dollars per hundred pounds, the Hartford, which is an inferior fruit, has sold for twenty dollars. As earlier and better kinds are introduced, this condition will cease.

AMOUNT PER ACRE.

Very extravagant impressions are received by many as regards the profit of grape-growing and the annual product per acre. I have under my eye a recent estimate made in "The New-York Tribune," in which it is shown that it is an easy matter to produce ten tons of grapes per acre, which, at fifteen cents per pound, would amount to three thousand dollars. The estimate is based upon the supposition, that the vines are planted four feet apart each way, giving two thousand seven hundred and twenty-two vines per acre, which, at an average of seven and a half pounds of fruit for each vine, would yield twenty thousand four hundred and fifteen pounds. It cannot be disputed that vines may be trained to stakes at that distance, and that they may produce even more than seven and a half pounds in some cases; but it may well be doubted whether any acre ever did yield this amount. Estimates based upon a few vines or a few rods of ground are entirely fallacious. We must rely mainly upon actual results, although we may hope to increase these results by improved modes of culture. In the established vineyards of Cincinnati, the opinion of Mr. Buchanan and Mr. Longworth was, that an average yield of wine per acre was about two hundred and fifty gallons, requiring about seventy bushels of grapes. I have no means of estimating the equivalent in pounds of fruit. This is called a fair average, "for eight or ten years, with but little rot." Mr. Longworth, in a report to the Cincinnati Horticultural Society in 1846, mentions some much larger results. He says, "The best crop for the extent of ground this season was at the vineyard of Mr. Rentz, about four miles from town. Two acres yielded thirteen hundred gallons. This is as large a yield as I have known, taking two acres together. To select particular spots, I have raised at the rate of fourteen hundred and seventy gallons to the acre." Such enormous productiveness must have been at a great sacrifice of quality. Probably the grapes were very watery; so that a bushel would produce considerably more than three and a half gallons of juice. At that rate, the "particular spots" mentioned by Mr. Longworth would have produced at the rate of four hundred and twenty bushels per acre. Of course, this must be regarded as quite exceptional. In the vineyards on Kelly's Island, it is said that the average annual product is not less than six thousand pounds per acre. No doubt, there are many instances where this amount is very much exceeded; but, taking the country at large, this is decidedly above the average. Judging from my own experience, I think there is great liability to overestimate. I should say, that, with the exception of some specially favored spots, it would not be prudent to estimate the average annual yield above four thousand pounds per acre of good marketable grapes. Of course, there will be some shrinkage, and many inferior bunches, which a prudent man will not reckon upon. Even this net amount of two tons per acre, if it could be depended upon, would yield a very large profit at the present prices for grapes. Certainly there is great encouragement to plant the grape extensively as a market-fruit.

PRESERVING THE GRAPE.

The great bulk of this fruit is consumed during the autumn months. It is a wise economy that fruits should be more abundant during the summer and fall, as the most suitable food at that season. Yet who would not regard the refreshing and invigorating grape in winter as something more than a luxury, — a real and needed good? No fruit can be taken with such impunity; no other is so little inclined to clog. You may eat the Diana at night, and a pleasant taste is created, and lingers in the mouth the next morning. It is indeed important that the use of this fruit should be extended through as many months as is possible. There is room for much improvement in this direction, and also abundant promise of success.

We must first determine by trial which varieties are best adapted to being kept into winter. I know of no extensive experiments, and am unable to give a perfect list. It is certainly useless to attempt to keep the Concord or the Hartford or Creveling. Delaware, Isabella, and Catawba all keep well; the Union Village keeps better still; the new Dana Grape has been exhibited in January in unusually good preservation. But the Diana probably exceeds all others in its keeping qualities. Its thick, tough skin preserves it from decay, and enables it to retain its high quality. There is no difficulty in keeping this kind until March, with moderate care. By some of the methods enumerated, it is to be hoped that the same will be true also of many other equally good and less difficult varieties. As before stated, grapes intended to be kept into winter should be cut before they are very ripe. This should be done when they are perfectly dry; and every decaying or imperfect berry should be scrupulously removed. A cool and dry atmosphere is absolutely essential to really successful preservation. At a low temperature, moisture is less promotive of decay than at a higher. But it is far better to secure both a dry air, and also a temperature just above the freezing-point. A thoroughly drained and cool cellar is the easiest approach to this, and yet it will prove considerably warmer than could be desired. Either this, or a cool room on the north side of the house, must be the substitute for a more perfect place, when the amount of fruit is small. But I have thought an improved and very simple method might be contrived for pre-

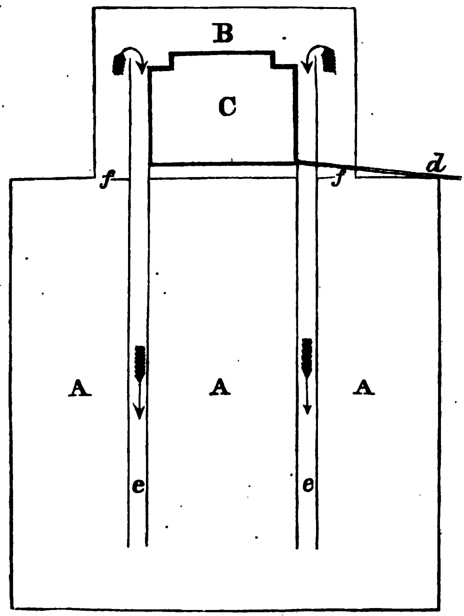

Fig. 39.

serving the temperature at a low range. This can easily be done by introducing ice in the various forms of our common refrigerators. But the objection is, that, while the temperature is reduced, there is necessarily a great amount of moisture constantly accumulating. To avoid this, I would plan a fruit-room, or a refrigerator, as follows: In the fig. (39), the lower square, A, A, A, represents the fruit-apartment. The square, B, is the second story of a refrigerator; or, on a large scale, it may be a room over the cellar or other fruit-room. In this square is the ice-chest, C, which must be made of some close metal, a good conductor of cold, and not porous. Iron chests painted thoroughly inside and out will answer every purpose. From one corner of this chest, a small pipe, *d*, conducts the water of the melted ice entirely away from the house. Another gutter may run around the bottom of the chest to collect and carry off any moisture which may be condensed from the air upon the cold surface of the chest. The principle on which such a refrigerator, or fruit-room, would act, is very simple, and must be understood at a glance. The cold air radiating from the iron chest reduces the temperature of the square, B. This cold air, being heaviest, immediately descends through the wooden pipes, *e*, *e*, to the bottom of the fruit-room; while the warmer air rises through the apertures, *f*, *f*, to be cooled, and descend in turn. Possibly it will be found desirable in practice to provide one or two air valves at the top of the square, B, in order to let currents in and out, and thus make the circulation of the cold current more rapid. This can quickly be determined by trial. I do not know that this form has been used; but I regard it as having decided advantages over other forms in use. While the temperature is under easy control, it will be seen that there is no liability to moisture from the melting ice. This has heretofore proved the great bane of all fruit-rooms; and it is with some satisfaction and confidence that I give this plan, in the hope that this evil may thereby be avoided. In any case, there will be more or less of moisture; to avoid which, the plan of Dubreuil, which is most successfully in use in France, is very simple, inexpensive, and altogether the best. I copy the directions as translated in "The Horticulturist," vol. xviii. p. 85:—

"Until now, the only means used to get rid of the dampness which arises from the fruit in the fruitery has been to ventilate the fruitery during ten days before closing up the house. This plan has serious objections. In the first place, it causes the temperature of the room to become the same as that of the open air, which often injures the fruit. It also introduces air less charged with carbonic acid, which is quite as objectionable: besides, it is exposed to the light, which hastens its maturity. Moreover, this method can only be used in dry weather, and when the temperature is above the freezing-point. Now, as this is seldom the case in winter-time, the fruit is consequently subjected to the dampness of the fruitery.

"To overcome this difficulty, we recommend to use chloride of calcium, which must not be confounded with chloride of lime (*chaux*). This comparatively cheap article absorbs nearly double its weight of moisture, and becomes deliquescent after being exposed a short time to the damp air.

"In order to make use of the chloride of calcium, make a wooden box, lined with lead, twenty inches square and four inches deep, which must be raised about sixteen inches from the floor, on a small stand, inclined a little at one side: in the middle of the inclined side place a spout. This apparatus being placed in the fruitery, put in it about three inches deep of chloride of calcium, very dry and porous. As it melts, the liquid runs out through the spout into a stone jar underneath it. If all the chloride of calcium is melted before all the fruit is taken out, you must renew it. About forty pounds are sufficient to keep a fruitery dry, used at three different times.

"The liquid which is obtained by this plan should be carefully kept in stone jars, and tightly covered until the next fruit-season. Then, when the fruitery is again filled, pour the liquid into an iron pot, and evaporate it. It is then again fit for use the next year."

This plan has been tried with entire success in an extensive fruit-room at Cleveland, O., using the cheap and abundant waste bitterns from salt-works. It is stated that fifty gallons of water have thus been absorbed from six thousand bushels of apples every week.

By using this chloride of calcium in the manner proposed, and in a fruit-room constructed on the principle before described, the exact conditions of preservation may easily be obtained, and grapes may be kept in great perfection for many months.

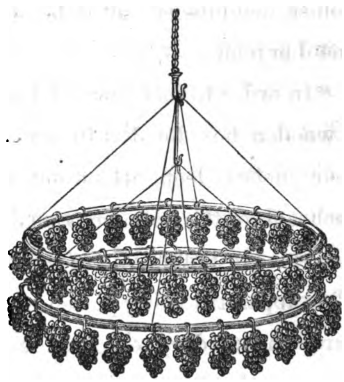

Fig. 40.

It has been recommended to suspend the clusters in an inverted position, as may be seen in fig. 40, in order that the berries may fall apart, and have a free circulation of air, as preventive of decay. In ordinary dry-rooms, the bunches will be liable to shrivel too much by this method; but in our cold, close fruit-room, they will keep very well in this way. More space is required by this plan than is desirable to give; and, as boxes answer every purpose, they will be best when there is a considerable quantity of fruit. Shallow wooden boxes sufficiently deep to contain but a single layer of grapes are best. A layer of glazed cotton-wadding or of paper, or of cork-dust or wheat-bran or rice-chaff, may be placed in the bottom of the box. I incline to think that clean and perfectly dry sand would be better still. This might be sifted in after the fruit is placed away in the room. But it is not essential to use either one of these materials. The fruit as it is cut in the vineyard should be at once packed closely, so that there shall be but one handling. Every appearance of imperfection or decay should be cut away.

The boxes should then be placed in a cool, dry room for a day or two, with the covers off, to allow all perspiration and moisture to pass off. Then shut down the covers, and set the boxes away in the fruit-room until wanted for use. It may be necessary to examine the fruit occasionally, and remove any signs of decay. It is best, however, to keep the grapes as close, and as little exposed to the air, as possible. Indeed, it is an excellent plan to pack the fruit in glazed earthen jars, with sufficient wheat-bran, or perfectly dry sand or grain, between each bunch to keep them separate; and, when the pot is full, to seal it hermetically. Grapes are sent from the Crimea to St. Petersburg, packed in sealed pots, with kiln-dried grain between the bunches; and they are said to keep perfectly throughout the year. Another most successful method has been adopted by M. Rose Charmeux of Thomery, in France, by which he has been enabled to exhibit fresh grapes in spring and early summer. He cuts a portion of a branch having two or more bunches of fruit attached. The lower end of the branch he places in a small bottle of water, to which is added a little charcoal for the purpose of keeping the water sweet. The bottles arranged in the rack, as seen in fig. 41, will convey an idea of the plan better than any description. Though M. Charmeux does not direct it, it would be an undoubted advantage to seal the upper cut of the branch with a shellac solution, or with wax, and also to close the mouth

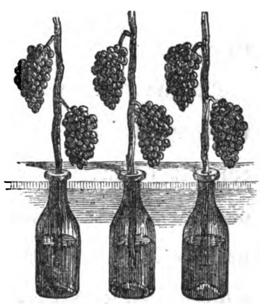

Fig. 41.

of the bottle, in order to prevent evaporation. These racks are to be kept in the cool fruit-room, as described for boxes. M. Charmeux preserves his Chasselas and Black Hamburgs (cut the previous fall) until the end of April, with the "grapes as plump, and the stems as green, as when taken from the vine." With such strong assurances, and the great inducements to bring fruit into the market at a season when it will command large prices, it is to be hoped we shall see more enterprise in this art of preserving fruit.

WINE-MAKING.

In some parts of the country, this has already become an immense business,—an art by itself. In giving a few simple directions for the home manufacture of an innocent and health-giving beverage, it is not expected that they will be any guide to the professed vintner; neither can it be inferred that we thereby commit ourselves upon the question of the expediency of wine-selling. The rules may be taken as they are intended,—for home use. When the grapes are "dead ripe," strip the berries from the stems, rejecting any which are unripe or decayed. The fruit should be perfectly dry when gathered. It is now to be mashed in a mill or churn, or in any convenient way by which the skin and pulp may be completely broken without breaking the seeds. This should be done as speedily as possible after gathering, and before any decay can set in. In order to make a white wine, the first run of the juice is taken: the second run from the press will be of a deeper color; and the third pressing of the skins still deeper, and of an inferior quality. For the manufacture of deep colored clarets in France, the juice and the husks are allowed to ferment together in immense vats; the husks being frequently pressed down as they rise to the surface. It may not increase the relish for this drink to state, that in order to keep the temperature up to about sixty degrees, and also to facilitate the mashing and mixing of the husks, many of the workmen are accustomed to strip, and enter for the work.

In making a sparkling wine, the must is never casked, but is bottled directly from the vat; so that all fermentation is in the bottle. Before bottling, the must is allowed to settle in vats, the fibrous matter either rising or settling at the bottom. This must is then drawn off, or racked as it is termed, into another vat; and this process is repeated several times until the wine is clear. It is then strained into bottles, which are corked and wired, and laid upon their sides in a cool cellar, to remain until the following autumn. There is usually considerable loss, during the summer, from the bursting of bottles. In September, a gentle inclination of the bottle, bottom upwards, twice a day, will facilitate the settlement of sediment towards the neck and cork. Later in the fall, the bottles must be opened with extreme care, and the sediment let out. The bottles must then be refilled, and again corked, wired, and sealed. It will be seen that it is a much more troublesome and risky process to make sparkling than still wines; and it is not wise to undertake this for family use. Neither is it, in general, desirable to make different grades of wine, but rather to secure a good average from one thorough pressing. The skins, pulp, and juice are emptied into the press as soon as they are mashed; and the "cheese" is pressed dry, requiring to be partially turned in order to obtain all the juice. The must is immediately put into casks, and placed in the cellar; the most desirable temperature being about fifty degrees. The larger the casks, the slower but more perfect will be the fermentation. The cask should be of oak, or some perfectly clean wood that will not give flavor to the wine; and should be filled to within two or three inches of the top, and the bung put in loosely. A better way to allow for fermentation, and yet keep the wine from the air, is to fill full and bung tightly, but insert a siphon through the bung (the outer end of the siphon being introduced into a pail of water); thus allowing the gas to pass off through the water, without the admission of air into the cask. The first is a violent fermentation, during which all the fibrous matter settles to the bottom of the cask, and is called "lees." Most writers advise that the wine should be racked soon after this (in December or January), the lees emptied out, the cask thoroughly cleansed, and the wine returned; the cask being filled full, and bunged tight. Such early racking avoids the danger of too rapid fermentation, which is liable to pass into the acetous form, to the ruin of the wine. A second fermentation will take place, during which the wine again becomes turbid; and gelatinous matter works clear, and settles to the bottom. A small quantity of isinglass, or an ounce of fish-glue, dissolved in a pint of alcohol for a barrel of forty gallons, is sometimes used for the purpose of facilitating this settling of the sediment and clearing the wine. It may be desirable to rack again in March, as is the opinion of most authorities. Buchanan, however, from his own extensive experience, advises otherwise. He says, "The fewer rackings it receives, and the less it is exposed to the air, the sweeter and better it will keep; retaining the fine aroma and flavor of the grape, and acquiring but little acidity." Through the summer, the cask is to be kept tightly bunged, drawing a little from it in case of such fermentation as to endanger the bursting of the cask. But fermentation will be much less active as the wine becomes clear, and the lees are separated. In the fall, the wine may be bottled; though it will improve by remaining in the cask another season. The bottles are to be placed on their sides, in a cool cellar; and will improve by being kept two or three years. If a good quality of fruit is used, and care is taken that the fermentation is not too rapid (which may be checked by an early and a second racking), there will be no necessity for adding sugar or alcohol, or resorting to any other mode of "doctoring." But a vast amount of liquor (I will not call it wine) is annually made from imperfect fruit of an inferior quality, to which a considerable quantity of sugar must be added to increase its alcoholic properties, and prevent its change to vinegar. In my opinion, such a change would be "a consummation devoutly to be wished." And yet it is true, that in our

Northern latitude, where growth has been excessive, and maturity imperfect, the juice of most of our grapes will require an addition of sugar-water to prevent souring. So necessary is this, that I believe it is regarded as absolutely essential by the prudent housewife, in making a few bottles for family use and for culinary purposes. The rule, as laid down by Dr. Ludwig Gall of Germany, "for making very good middling wines (third quality) from unripe grapes, and an excellent wine from the pressed skins, or husks," is to add from thirty to fifty pounds of refined sugar, dissolved in an equal number of quarts of water, to every hundred quarts of must. The poorer the grapes, the greater the quantity of sugar-water to be added. The sirup is to be poured in when very hot, as soon as the must comes from the press.

Very full and lengthy extracts from Dr. Gall's "Guide" are given in the volume, for 1860, of "The United-States Agricultural Report," pp. 323–358, designed as a guide in the extensive manufacture of "improved" wine. But no one should be deceived into the supposition that such a manufacture is a pure wine, or can be called a temperance drink. Only the very best fruit, thoroughly ripened, or ripened even to drying, as in California, the Rhine, and Tokay, will yield a juice which requires no sugar, and will mellow and refine to a beverage worthy to be called wine.

CHAPTER XV.

CULTURE UNDER GLASS.

GLASS HOUSES are in use for two purposes: first, as a protection for varieties which are otherwise too delicate to ripen well in our climate; and, secondly, for the purpose of ripening fruit out of the natural season. For the first purpose, a very slight protection is all that is essential. The Black Hamburg, and many other of the more vigorous European varieties, are found to ripen perfectly under a roof of glass; the back of the house being left entirely open throughout the season. Indeed, they have ripened well under single sashes left open on all sides. So simple is the requirement, that every householder may have foreign grapes growing under a temporary roof of sashes, with none of the care of ventilation;

his main efforts being directed in training, and in guarding against mildew. But there are advantages in having close houses, in order to obtain entire control of the atmosphere, even for the summer crop.

THE COLD GRAPERY.

Contrary to the direction of Mr. Allen, for the position of the grapery I should advise a double or span roof, the ridge running as nearly as possible to the north and south. Thus the sun will have its utmost effect during the morning and evening, while its fiercest rays will be mitigated by striking obliquely upon the glass at mid-day. The pitch of the roof may vary from thirty to forty-five degrees; the latter pitch, however, giving a more upright position to the vines than is desirable. Fixed roofs are cheaper, and also much lighter and neater, than sashes with framework, and are therefore much to be preferred, unless the sashes can be put to double use during the winter, when the vines are at rest. The curvilinear style is perhaps more graceful than the straight-line roof; but one has no very material advantage over the other. For the sake of a pleasing picture, houses are often represented with a high elevation; but this form is in every respect disadvantageous in practice. It is better to have the sides of the house quite low; and, as we have heretofore seen, the nearest approach to the horizontal position is the most favorable for an even development of fruit. So strongly was this advantage felt, that Alexander Seaton, Esq., adopted the plan of training his canes horizontally, lengthwise of the house, instead of leading them up the rafters; and for many years he claimed very successful results in comparison with the best English

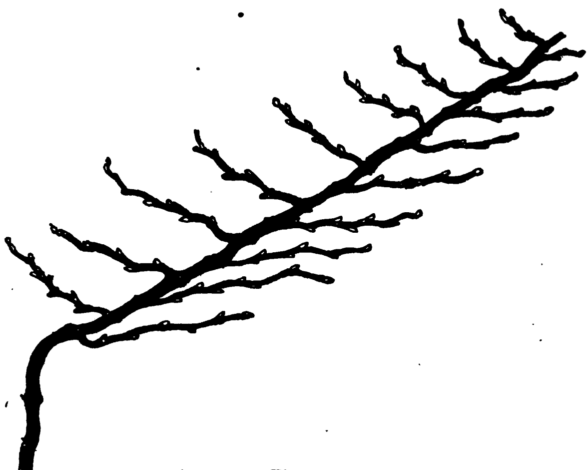

Fig. 42.

competitors. But the almost uniform and entirely successful mode of training is to lead the cane up under the roof, at the same angle with it, and suspended about a foot from the glass. The form of the cane and of the side-branches is represented in fig. 42. It will be seen, that, with the exception of the elevation of the cane to correspond with the pitch of the roof, the form is a very near approach to the horizontal system previously suggested. The branches are spread to receive the utmost effect of the sun's light and heat. However this form may prove to be adapted for open-air culture, there is no question of its excellence for the grapery. Ample ventilation is necessary; and, in houses exceeding fifty feet in length, it is best, in addition to the top-sashes and end-doors, to have side-passages for the air to enter. It is better to make large provision for the outlet of the hot air at the top, depending upon the side ventilators as little as possible for the admission of a cold current at the bottom. For top-ventilation, the simplest form is to hinge sashes about three feet in length to the ridge-pole, allowing them to shut down upon the roof like a trap-door. An iron rod a half-inch in diameter, running the length of the house just under the lower lids of the ventilators, will be of sufficient strength to raise them all at once. Pieces of window-cord about six feet in length are attached to this rod at suitable distances, which, passing through a pulley screwed to the roof, descend to the lower end of the pushers, which are attached to the lower side of the shutters. The cords being tight, when the rod is drawn, the lower end of the pusher will be drawn up towards the pulley, and thus the sash will be pushed up.

At the end of the house, a strong rope is fastened to the iron rod, which, passing over a wheel, descends to a windlass or a simple lever, which may be made sufficiently powerful to raise all the sashes at a single stroke. Any ingenious mechanic can so arrange the pushers as to prevent the sashes from being blown open or raised too far by the wind. The ventilator may be made of indefinite length, extending even to the entire length of the house, by having a number of pushers attached at suitable distances, so that the ventilator may be raised evenly in all parts. This simple contrivance will save a vast amount of labor involved by the old methods. A water-tank and a force-pump, with rubber-hose, are the only requisite appurtenances to a cold grapery. The tank is formed by digging a hole in the ground, and lining its face with two coats of common New-Jersey cement, either arching the top with brick, or covering with plank. For a house fifty feet long and twenty feet wide, a cistern ten feet in diameter each way will prove sufficient. The house should have gutters, as well to keep the borders dry as to fill the cistern.

THE FORCING-GRAPERY.

For this a "lean-to" house is best, having a single roof pitching as nearly as possible due south. In order to advance growth as rapidly as possible during the winter, the house will require the direct rays of the mid-day sun. For early forcing, I would also advise that the borders be made entirely inside of the house. It is against all reason to expect good results from forcing the tops while the roots are stagnant in the cold ground. Protection of the open border with leaves or manure, or by shutters, which also shed the rain, have given measurable success; and yet we can expect that vigor and early maturity which is desirable, only by keeping the roots warm, and as active as the tops. The north side of the house will be a convenient place to erect a store-room for fuel, potting-materials, &c., giving a space also to the furnace. The simple brick furnace and flue will do the work at a great saving in the first cost, but with much larger consumption of fuel than a water-boiler. With the use of a simple flue, I should always combine the Polmaise system. This consists in leading a covered air-drain from the coldest corner of the house down under the furnace, and bringing it up into an air-space which surrounds the furnace, and which opens into the house. The air, becoming heated in the chamber around the furnace, rises, and produces a draught of air in the drain at the cold end, causing a vacuum, which the warm air flows to fill; thus creating a continued current, which tends to equalize the temperature of different parts of the house.

There is no doubt of the efficacy of this plan; and for narrow houses of moderate elevation it works very well indeed, and is a valuable auxiliary to the simple furnace and flue. Yet there is no disputing its inferiority to the hot-water apparatus. My preference is for the upright boiler of Weathered & Cherevoy, over many others which I have seen and tried. Iron pipes four inches in diameter are in general use for circulating the water. The slate-tank, as described for the propagating-house, would give a much greater radiating surface for the same cost, and, upon actual trial, works admirably. Steam-pipes have been used to a limited extent; but by these the fluctuations and the liabilities are increased, without securing any decided advantages. A slight pressure upon the boiler may allow a saving in the extent of piping, and be unobjectionable.

THE RETARDING-HOUSE.

This should be so situated, that the vines may be kept dormant as late as possible in the spring, and come forward very moderately throughout the season. Probably a "lean-to" roof, sloping west, is as good a position as can be obtained. A north aspect would not secure sufficient sunlight. A simple flue is sufficient to keep out the frost; and this is all that is desirable after the fruit has ripened, in November. In such a house, grapes may be kept with a good degree of freshness until February; yet it involves much care, labor, and cost: and it is to be hoped that the methods of preserving grapes in the fruit-room will, to some extent, remove the necessity of the retarding-house.

BORDERS.

The cost of the houses, and the permanence of the vines, make it desirable that the borders should be as perfect and as enduring as possible. Tile, or covered drains, should be laid, three and a half feet deep, running the length of the border, near the eaves, on each side of the house; and another course of drain should be placed fifteen feet farther out from the house. If this work is well done, it will be wholly unnecessary to pave the bottom of the border with loose stones, as is recommended by some. The directions previously given for a border will here apply, though the depth for the grapery is generally increased to three feet. If the soil on the spot is not very objectionable, it may remain; its character being modified by sand, or other material which it may seem to need. In addition, most soils will require about a foot of friable pasture-loam, and nine solid inches of stable-manure, with three bushels of bone-chips, to every square rod of the border. Then commence at one end, and trench, and thoroughly mix, to the depth of three and a half feet, so that the border may be fully three feet deep when settled. It is important that the material used shall be of such a character that it will not become sodden. Any of the fertilizers recommended for the vineyard may be added to the border at its formation, or as a top-dressing from year to year. For the cold grapery, it is best to have the principal part of the border outside, to receive the summer rains and the warmth of the sun, and also to avoid the walking which is necessary inside of the house in checking, thinning, and otherwise caring for the vines. For early forcing, however, the roots should be kept warm; and this is most economically done by keeping them within the house, and covering the border where it is necessary to walk. When the fruit is not to be ripened until May, or afterwards, the roots may extend into an outside border which is well protected from frost, as before described. It is best that the houses rest upon stone or cedar posts, so that the vines may be planted inside, and the roots may have free space to ramble. The breadth of the border will, of course, depend upon the length of the cane. If trained to the rafter, it is a fair rule to have two or three feet of border inside the house, and a width equal to the length of rafter outside the house, except for very early forcing. It is not necessary that this whole width should be made at once. The border may be extended during the second and third years if more convenient. These borders will require moderate annual top-dressings of ashes, plaster, bone-dust, or stable-manure, when the vines are in bearing; those elements being supplied of which the border seems most deficient. Keep it light by frequent forkings.

THE FIRST YEAR.

The planting and training is as directed for the open-air culture. The distance of planting is from three to four feet apart, the latter being best for strong kinds. Owing to the richness of the border and the more favorable atmosphere under control in the house, the growth will be far superior. A single cane should be allowed to grow from twenty to thirty feet in length; after which it should be stopped, and side-shoots may be allowed a moderate and uniform development. In the growing part of the season, the air should be kept moist and warm; giving air in the morning as soon as the thermometer rises to eighty degrees, and closing up early, and showering, so as to create a warm humidity, which will be retained through the night. Frequent but moderate sprinklings of the floor, and showering of the foliage, when the sun is not too strong, will cause luxuriant growth. If any danger of mildew is apprehended, sulphur should be dusted through the foliage during the heat of a dry day. Keep the temperature as nearly up to ninety degrees as is convenient. By the 1st of September, water should be withheld, and the growth allowed to harden and ripen.

The canes should be from three-fourths of an inch to an inch in diameter; and, if allowed to bear from three to five pounds the following season, they should be cut back to within six feet of the ground in November, and then laid down and covered for the winter.

THE SECOND YEAR.

In case we take a little fruit for trial, this year will be a type of all succeeding years. We suppose our cane to be six feet in length. All the eyes below the level of the eaves should be rubbed out. Also, as a general rule, rub out every alternate eye on the remainder of the cane, leaving the eyes from eight to ten inches apart, according to the vigor and size of foliage of the variety. The branches will then alternate on each side of the cane, and be from sixteen to twenty inches apart on either side; the latter distance being near enough for such strong kinds as the Syrian. At the end of the cane an eye is preserved, to extend to the top of the house. The same system of sprinkling and showering is pursued as in the previous year, withholding the water during inflorescence. The fruit-branches are carefully tied to side wires, and continually checked, as directed for the vineyard. We even carry summer-pinching to a greater extreme in the house than in open-air culture and upon our native varieties. The vines being but four feet apart at most, the whole length of the branch must be less than two feet. The usual rule is to pinch the shoot, at first, three leaves above the bunch, leaving one leaf to each lateral; as it develops, rubbing out the laterals below the fruit, but not the one opposite the bunch. At the end of the branch, the sub-laterals may develop a single leaf at each course of pinching. This work should be done regularly, so as never to require the removal of full-grown leaves. During inflorescence, the house should be kept dry, with a free admission of air for Muscat varieties, which set their fruit imperfectly. Nearly all foreign varieties set their fruit so compactly as to require thinning. This work is done with long-pointed scissors, commencing as soon as the berries are large enough to see that they are impregnated. It is often the case that two-thirds of the berries will require to be cut out, selecting those which are within and are likely to crowd. In the fall, water is withheld, for the sake of the fruit as well as of the wood. The vine may now remain the full length of the rafter, and be allowed to bear three-fourths of a crop the following season. One bunch for each branch is quite sufficient;

the size increasing as the number of bunches diminishes. Should such varieties as the Frontignan shrivel the berries at the tips of the bunches, it indicates an inequality between the temperature at the roots and in the house; the border being too cold or wet. Over-cropping, or too rapid forcing, will also cause this.

The vines are pruned in November for the cold grapery, or in August or September for early forcing. I give a decided preference for the short-spur system; finding by experience, that, by this approach to horizontal training of the branches, there is no practical difficulty in producing good fruiting-eyes near the cane for a succession of years. Should the spurs become long, the cane may be renewed after six or ten years. In forcing, endeavor to secure the same conditions as in summer growth. Start the vines gradually, taking four to six weeks to break the buds, keeping them humid, and in a horizontal position, until the eyes are all pushing: then raise the canes, and increase the heat to fifty-five, sixty, and seventy degrees at night; at which last temperature the fruit will mature. During the day, the heat may increase to ninety or even a hundred degrees, with a proper degree of humidity to guard against the red spider. By observing the laws of natural growth, the work of forcing, or early ripening, is simple, and the crop certain.

POT-CULTURE.

In our clear and hot climate, and in view of the extra amount and the higher cost of labor with us, pot-culture does not seem to be so desirable as in England. Yet the work can be done with perfect success; and, for some purposes, the method is most desirable. For very early forcing, vines in pots can be managed with the greatest ease. So also, for retarding, they may be kept in a cold cellar or ice-room until July, and then be brought forward as desired. For summer-fruiting, there is no advantage in the use of pots; and as the labor of watering, and keeping in perfect condition, is so greatly increased, it is far better to plant in the border. For forcing, the following course may be pursued: About the 1st of April, select a healthy, one-year old vine, or a vigorous young plant started from an eye in February previous, and shift into a seven-inch pot. The soil should consist of about two parts of well-rotted pasture-sod, and one part of thoroughly decomposed horse-manure. Fine bone-chips may be mixed with the compost, and a handful of crocks used for drainage. Kept in a warm, close house, and showered frequently, the vines will grow with surprising rapidity. In order to give strength to the cane, it may be desirable to check the leading shoot if it is growing too rapidly. The leading lateral-eye will then break, giving a more stocky cane and stronger foliage. In June, it will be necessary to shift into the fruiting-pot. This is called the twelve-inch size, and has four or more large holes at the bottom, through which the roots are hereafter to run. The same compost is used as for the previous shifting, it being rammed into the pot very firmly with a dibble. In consequence of this firm packing, there is much less liability to fluctuation in the moisture of the soil. When the canes have attained six feet in length, they should be stopped, and the laterals allowed to develop evenly to a length of two or three leaves. In September, give a plenty of air, withhold water, and harden the wood as thoroughly as possible. By observing these simple conditions, there is no difficulty in obtaining strong fruiting-canes the first season. About the 1st of October the laterals may be cut away, and the vines kept dry for a month or more. Up to this time, the space occupied will have been only about one-third of that which is required for fruiting-vines. In November, the vines are to be placed in the forcing-house, if it is desired to ripen the fruit by the 1st of April. The house should have an inside border of moderate depth, on which the pots stand; the drainage-crocks having been displaced, so as to allow the roots to come through into the border. Each vine will require a space of about three feet square, and will ripen, on an average, six pounds to a vine. A house fourteen feet wide would accommodate four rows of pots, and leave space sufficient for a walk in the middle. The treatment is obvious, and similar to that of forcing vines in the border. Under careful management, the crop will equal in weight a border-crop; and it can generally be brought to earlier maturity. In April, when the fruit is ripe, the roots which penetrate the border are severed, and the pot is carried to the exhibition, or the fruit is sold. The house is cleared for a summer crop or for other use. These same pot-vines may be kept in a dry, cool, airy position during the summer, and given an earlier start in the following autumn. Before again placing them in the forcing-house, they should be drawn out of the pots, and the roots pruned, especially the tap-roots; so that new roots may readily form, and descend into the borders, which have been renovated for that purpose. By a careful and systematic method of pot-culture, houses may thus be put to a double, or a winter and summer use, with the best and most economical results. Yet this culture requires constant and long-continued care; and it should not be undertaken except with a determination to grant every requisite, and allow no neglect.

DISEASES.

We have given an extended view of this subject in treating of open-air culture; and the rules there given will, in general, apply with equal force in the grapery. In the latter case we have such control of conditions, that it is comparatively easy to banish all diseases.

We can avoid sudden changes of temperature, or cold bottom-draughts, or dampness, which are the causes or conditions of mildew. We can also apply the remedies more effectually: we can pervade the house with a smell of sulphur (*never burning it*), and thus defy mildew and red-spider; we can fumigate with tobacco-smoke, which is a sovereign remedy against most other insects. Where there is a liability to the attack of the mealy-bug, or scale, it is best to make a wash, of the thickness of cream, of the following ingredients: Half a pound of whale-oil soap, four pounds of sulphur, and one ounce of nux vomica. Mix this with boiling water in which half a pound of tobacco has been steeped, and then wash every part of the cane at the season just prior to starting its growth. A solution of one pound of potash in two gallons of water is also effectual in killing the insects and destroying the eggs. So complete is our control of all the essential conditions, that we may safely say, that the grape-crop, under glass, is the most certain of all fruit-crops. If the crop has been injured by diseases, it is a certain proof of culpable neglect: if there is a partial or total failure of the crop, it arises from circumstances which might easily have been prevented. Considering the certainty and the ease with which the grape may be thus grown, and the very important fact that it retains its high quality under glass, in striking contrast, for example, with the peach, we may conclude that no other fruit is so well suited for glass-culture as the grape.

CHAPTER XVI.

DESCRIPTION OF VARIETIES.

IT would be worse than useless to give a list of all the varieties that have appeared. A large number of them, if tried, would prove to be merely duplicates of known kinds, or so closely resembling them, that the difference is not noticeable. Many others have been consigned to oblivion as unworthy of culture. Of the fifteen hundred varieties collected in the Garden of the Luxembourg, only about three hundred are regarded as distinct, and less than fifty can be called really desirable. Of these, it would be best to make a still larger reduction, selecting the best five or ten, or at most twenty; always placing the Black Hamburg in the fore-front for general culture. It is therefore wise to retain only such kinds as have known excellence, and give marked prominence to the best. This is becoming an easy task in respect to exotic grapes, as opinions are settling down upon a solid basis; though, within a few years, there have been an unusual number of seedlings brought to notice in England, which give promise of becoming really valuable varieties, — such as the Bowood Muscat, the Muscat Hamburg, Lady Downes, the Golden Hamburg, and some others. But, with native kinds, experiment is rife: seedlings and hybrids are multiplying to a surprising degree; and the list will continue to extend until some one or more shall stand as prominent for general excellence among our natives as the Black Hamburg does among exotics. I shall endeavor to name only such as have known excellence, or are now prominently before the public.

EXOTIC KINDS.

Aleppo. — Belongs to the Chasselas family; the berries being round and thin-skinned, curiously striped from light to pink and black; sweet, but of second quality. Knight's variegated Chasselas is probably the same.

August Muscat. — Probably the earliest grape, having ripened its fruit in three months under high forcing. The vine is weak in growth; the berries are small, oval, black, with a slight Muscat flavor, but of third quality.

Barbarossa. — Bunches of largest size, often weighing six pounds, heavily shouldered, compact; berry large, roundish-oval, black, with a thick bloom; skin membranous; flesh greenish-white, juicy, and of fair quality. Is rather shy in fruiting, and requires heat, but is a valuable late kind.

Black Alicante. — Bunches large; berries large, oval, black; sets well, and keeps late.

Black Corinth. — A small, round, black grape of third quality, — the Zante currant of commerce.

Black Cluster. — A hardy and very early kind, with small and very compact bunches; berries small, oval, black, with a thin skin, often bursting from the pressure of the berries; flavor brisk, rather acid until over-ripe; productive, and does well upon open walls.

Black July. — Very similar to the preceding, being perhaps a little earlier, and the berries more round; berries equally small, and quality the same. I think it distinct; though, in the opinion of some, it is considered identical with Black Cluster.

Burgundy. — This is surnamed Miller's, on account of the downy or mealy appearance of its leaves; which is almost the only marked characteristic which distinguishes it from the Black Cluster. It does pretty well in the open air, but is too small for culture under glass.

Black Prince. — An excellent kind, with large and long bunches, generally shouldered; berries of good size, oval, black; juicy and sprightly, with rather a thick skin. Cambridge Botanic Garden is identical with this.

Bidwell's Seedling. — Resembles Black Prince in bunch and berries; berries medium, round, bluish-black, with a fine bloom; skin thin; flesh tender, very juicy, and rather too acid for the taste of most.

Bishop. — A large, slightly oval, black grape of peculiar flavor, firm, coarse, keeps well. It seems to be identical with *Portien Noir.*

Bowker. — A seedling from a Malaga raisin raised by Joel Bowker of Salem, Mass., resembling the Lisbon Grape, but is superior. The bunch is large, closely set, with large, oval, white berries of second quality. It is very productive, and equal in appearance to the White Hamburg.

Canadian Chief. — Probably an American seedling of the Chasselas, somewhat resembling Royal Muscadine in the shape of the cluster.

Chasselas de Fontainebleau (White Chasselas, or Sweet-water). — This is the famous and the most common French table-grape. Though it can claim no excellence in high flavor, yet its simple, melting juiciness, combined with its excellent habits of growth, render it one of the most valuable varieties. It grows well, is very productive, is one of the most hardy and least liable to disease, and is quite early; bunches of good size, long, generally shouldered; berries round, of medium size, of a pale-amber color, very juicy and sweet.

Chasselas de Bar sur Aube. — This resembles, but is not identical with, the preceding. Its bunches are longer, and it is less inclined to shoulder. In other respects, it is so similar that it is classed by many as a synonyme of Chasselas de Fontainebleau.

Chasselas, Golden. — Earlier than any other Chasselas: its berries also are much larger, with large clusters of a beautiful golden-amber color. But it has the serious fault of setting badly, many of the berries remaining very small and seedless. In a house, under control during inflorescence, it may be desirable, though always somewhat uncertain.

Chasselas Musque (Joslyn's St. Albans). — One of the highest flavored of grapes, having a remarkably concentrated, sweet, Muscat-taste. This is all which can be said in its favor. The bunches are under medium size, tapering; berries round, pale-amber, with a thin skin, which is unusually liable to crack and to shrivel. A variety for the amateur alone.

Chasselas, Red.—This is easily distinguished by the fact that the berries are tinged with red as soon as formed: the young wood is also bright red. The bunches and berries are larger than the following.

Chasselas, Rose.—A beautiful and good variety, resembling Chasselas de Fontainebleau, except in color, which is bright rose. The bunches and berries are scarcely equal in size; but its beauty and flavor will recommend it to every collection.

Chavoush.—This variety is said to have been recently obtained from Bithynia in Asia Minor, the fruit of which has received a first-class certificate in England. Bunch medium, shouldered, tapering; berries large, long, oval, white or light amber, very showy; skin thin; rich, high-flavored, juicy.

Damascus.—Bunches large; berries of immense size, oval, black, full of juice, brisk, sprightly, rather too acid for most tastes. It requires heat to set well, and is then very showy.

De Candolle.—A large, round, purple grape, sweet, and of good quality; clusters large and showy; requires high temperature to ripen.

Decon's Superb.—Bunches of good size, and handsome; berries of a frosted-amber color, and of good size, of second quality, and ripening unevenly. Sahibee is supposed to be identical with this.

Dutch Sweet-water.—Bunches well shouldered, and of medium size; berries large, amber, transparent, oval; skin thin; a good early white grape of the Chasselas class.

Duchess of Buccleugh.—A new grape, said to be a cross between Chasselas Musque and a Muscat, and of the highest flavor; bunches large and long, tapering, slightly shouldered; is early, bears well, and does not crack.

Esperione.—Clusters very large, heavily shouldered; berries small, black, with a fine bloom; sprightly subacid; of second quality.

Foster's Seedling.—Exhibited in England in 1865, and described as having large bunches; berries medium, of a pale-amber color; flesh juicy, luscious, and refreshing, equalling the flavor of Lady Downes, and, like it, hanging without shrivelling.

Frontignan, Black (Black Constantia).—Bunches long, tapering, slightly shouldered, below medium size; berries medium, black, sweet, with a fine Muscat-flavor; is liable to "shank," and does not color well.

Frontignan, Blue (Purple Constantia).—Similar to the previous kind, but having less Muscat-flavor, and coloring to a blue-black.

Frontignan, Grizzly.—One of the best of this class; bunches above medium, long, tapering, slightly shouldered; berries large, round, of a grizzly-gray color changing to dull red, of a high musk-flavor, quality best; early and excellent.

Frontignan, White.—Bunches large, or above medium, shouldered, long; berries large, round, white, sweet, with a rich musk-flavor; an excellent kind.

Gros Coulard.—A large, early, white variety of the Chasselas type.

Hamburg, Black.—This variety is universally esteemed, in all situations, as the very best for general culture. It is so hardy, prolific, constant, of good fair quality, and unobjectionable to all tastes, that it should take the lead in all collections. The bunches are large and shouldered; the berries large, round or slightly oval, perfectly black when well grown, pleasant, sub-acid, juicy.

Hamburg, Champion.—Like the Black, but said to have larger berries.

Hamburg, Golden.—A fine, new, white grape; bunches large and shouldered; berries large, oval, pale-yellow; skin thin; flesh tender, rich, vinous; very free and showy, ripening with, and a fine contrast to, the Black Hamburg.

Hamburg, Mill-Hill.—Much like Wilmot's, and perhaps identical.

Hamburg, Pope's Black.—This is said to be similar to but earlier than the old Black.

Hamburg, Victoria.—Resembles Black Hamburg; the bunches being somewhat larger and more tapering; the berries very similar. As it is so difficult to distinguish them, there is much confusion in the two kinds.

Hamburg, White.—This is the Portugal Grape of commerce sent to all parts of the world, packed in kegs, or jars filled with saw-dust. The clusters are large and well-shouldered; berries large, oval, white; flesh crisp and sweet, coarse, and of third quality; ripens late, and keeps well.

Hamburg, Wilmot's.—Short compact bunches; berries very large, round, black, with a peculiarly dented or hammered appearance; a fine grape, but a little coarser than Black Hamburg.

Hamburg, Wilmot's, No. 16.—Scarcely distinguishable from the Black Hamburg.

Ingraham's Hardy Prolific. — A new grape, which has obtained a first-class certificate from the English Royal Horticultural Society. Bunches a foot in length, with black oval berries, vinous, with slight Muscat-flavor.

Lady Downes. — This variety receives uniform praise as the best late-keeping grape. It somewhat resembles the St. Peter's; the bunches and berries being large, and the quality being excellent. The fruit will remain plump and firm upon the vine, if the frost is kept out, until new growth commences.

Lombardy, Black. — Same as West's St. Peter's.

Lombardy, Red. — Same as Queen of Nice.

Macready's Early. — Bunches of medium size, compact; berries white, transparent, oval, pointed; skin thin, very juicy and melting; a pleasant little grape.

Malvasia. — An early white grape; bunches below medium, slightly shouldered, tapering; berries small, oval, sweet. Burchard's Amber Cluster seems to be identical.

Marchioness of Hastings. — A new grape, now attracting much attention at the English exhibitions; of a greenish-white color, the bunches being very large, weighing five pounds.

Morocco. — Clusters large, shouldered; berries very large, reddish-black, oblong-oval; sets badly, and is not of first quality.

Muscat of Alexandria. — A type of all the Muscats; a late variety, requiring heat, or a current of dry air, during inflorescence, in order to set well. Bunches large and loose; berries large, oval, light, changing to amber-color when perfectly ripe; flesh firm, juicy, high-flavored, and excellent. All the Muscats prefer a high temperature.

Muscat, Austrian. — Similar in appearance and flavor, but inferior, to Grizzly Frontignan; bunches medium, very compact; berries oval, tawny-red; keeps well, but sometimes cracks.

Muscat, Bowood. — An excellent new kind, shorter-jointed than Muscat of Alexandria; having all its good qualities, and also the advantage of setting its fruit freely in a cold house. A. Cramb, in "The Gardener's Chronicle" for 1860, p. 1021, asserts that it is the same as Passe Muscat; yet we cannot doubt that it is a seedling.

Muscat, Cannon Hall. — A stronger variety than Muscat of Alexandria, both in growth, and size of fruit. The berries are of the very largest size, oval and white: it sets very poorly, and needs heat, or even artificial impregnation; but it will give an ample return for special care.

Muscat Hamburg. — A strong, free variety, which sets well, and does not require more heat than the Hamburgs. Fruit large, oval, black, with a high Muscat-flavor. Sir Joseph Paxton affirms that it is identical with Black Muscat; but it is probably a seedling, and is valuable.

Muscat, Portuguese.—Similar to Muscat of Alexandria, but of higher musk-flavor, and said to set its fruit better.

Muscat, Prince's Black.—This is a new seedling, very similar in description to the foregoing, which received a first-class certificate at the London Exhibition of 1865.

Muscat, Tottenham Park.—Sets well, and is similar to but has less musk than the preceding.

Muscat Troveren.—A new white oval grape, large as a Black Hamburg, with a Frontignan-flavor, which received a first-class certificate at the English exhibitions of 1865.

Palestine.—Bunches often two or more feet in length, much branched or shouldered; berries very small, oval, amber, very sweet. It is quite distinct, but only desirable for the amateur.

Pitmaston White Cluster.—Cluster of medium size, compact; berries round, large, white, sweet, early; a good variety of the Chasselas class.

Portien Noir.—Bunches large and fine; berries large, slightly oval, black, peculiar in flavor; late. It is identical with Bishop.

Prince Albert. — Bunches large and well-shouldered; berries large, oval, black; flesh firm, rather coarse; growth very vigorous, too much so to be productive except in a poor soil; ripens late, and keeps well. May prove to be Barbarossa.

Queen of Nice (Reine de Nice, Regnier de Nice of Prince, Red Lombardy, and Flame-colored Tokay). — This variety is known under all these names, but is so distinct as to be unmistakable. Bunches long, heavy at the top, and tapering to a point; berries large, oval, peculiarly tapering and pointed; tinged or considerably colored red; flesh firm, of third quality; keeps well.

Raisin de Calabre. — A large, round, pure white transparent grape of musk-flavor, sweet and firm, which keeps well.

Red Traminer. — A celebrated table and wine grape of the Rhine. Cluster small and compact; berries small, roundish, rose-color; quality sprightly sub-acid, pleasant, and excellent. The Delaware so much resembles the description of this variety, that many have affirmed it to be a seedling from it; while others have even gone so far as to assert its identity with the Traminer. Undoubtedly the last is a mistaken opinion.

Royal Muscadine (White Nice or Xeres). — This belongs to the Chasselas class, but is remarkable for its large, loose, heavily-shouldered bunches, more resembling the Syrian, and often weighing six pounds: indeed, it has been grown to weigh nineteen pounds. Berries round, amber, sweet, and of fair quality.

Royal Vineyard. — Bunch large, tapering; berry large, oval; deep, clear amber; skin thin; flesh sweet, luscious, aromatic. New, and said to resemble the Golden Hamburg.

Syrian. — Bunches of the largest size, heavily shouldered; berries very large, oval, white, sweet, but coarse: if allowed to remain a long time, until fully ripe, the quality is good. This is the variety produced in England which weighed nineteen and a half pounds, and it is probably identical with or similar to the Eshcol Grape of the Hebrew spies. Duretto and Akbar Khan are very similar.

Tokay, Charlesworth. — Resembles the Muscat of Alexandria in shape and quality, but is said to be more vigorous, to set freely, and to keep longer.

Tokay, White. — Bunches compact, medium, long; berries medium, oval, sweet; liable to shrivel.

Trebbiana. — This is one of the largest Exhibition grapes; the bunches frequently weighing eight pounds.

It resembles the Syrian, but is distinct, and of better quality; berries large, white, oval, firm, and keep well.

Trentham Black.—Bunches large; berries large, purple-black; skin thin, earlier than Black Hamburg, and better than Black Prince, which it resembles.

Verdelho.—The table and wine grape of Madeira, of the best quality. Bunches small, loose; berries small, oval, greenish-white or amber; sweet and good; ripens late.

West's St. Peter's.—A noble variety, with large, long bunches, well shouldered, often weighing two or three pounds; berries large, oval, very black, covered with a fine bloom; quality excellent, sprightly sub-acid; late, and keeps well.

White Corinth.—A small, white, seedless grape, in compact clusters, of sweet and pleasant flavor.

White Gascoigne.—Bunches large, compact, shouldered; berries large and oval; quality good.

White Nice.—Is identical with Royal Muscadine.

White Riessling.—A famous Rhenish-wine grape, very productive, with small, compact bunches, and small white berries of a pleasant flavor.

Zinfindal (Zinfardel of Prince).—Bunches generally almost equally divided into two long shoulders, making a large cluster; berries medium, round, very black, covered with a thick bloom; sprightly acid, becoming good when fully ripe.

A SELECT LIST OF EXOTIC VARIETIES.

As it is specially undesirable to grow inferior kinds under glass, it is well to limit the list as much as is consistent with a sufficient variety in quality. The following list of best kinds for a cold grapery will give every variety in color and quality as well as size. The figures indicate the relative value and the number of each which I would recommend in a collection of fifty vines. When the collection is small, or for market-purposes, select only the highest numbers.

10 Black Hamburg.
4 Bowood Muscat.
2 Black Prince.
1 Black Frontignan.
3 Chasselas Fontainebleau.
1 Chasselas Musque.
3 Golden Hamburg.
2 Grizzly Frontignan.
1 Lady Downes.
1 Marchioness of Hastings.
2 Muscat Hamburg.
1 Red Chasselas.
1 Reine de Nice.
2 Syrian.
1 Trebbiana.
2 Trentham Black.
5 West's St. Peter's.
1 White Gascoigne.
3 White Frontignan.
2 White Nice.
1 Wilmot's Hamburg.
1 Zinfindal.

In addition to these, the Muscat of Alexandria is a most valuable kind if it can have a warmer position. The Cannon Hall Muscat requires even more heat; and indeed all the Muscats are better if they can have fire-heat at critical times. Some of the newer grapes are not included in the above list, because not sufficiently proved. For a retarding-house, the most suitable are Lady Downes, Barbarossa, Trebbiana, and West's St. Peter's; to which may be added Black Hamburg, Reine de Nice, White Lisbon, Muscat of Alexandria, and Syrian. A wise cultivator, who seeks a profitable return, will confine himself to a very few standard kinds; while the amateur will take pleasure in "proving all things, and holding fast that which is good."

NATIVE VARIETIES.

The list has become extended to such a degree, that it is now undesirable to give even the names, much less a description, of the great majority which will soon fall into oblivion. It is a great public injury to introduce and disseminate an inferior variety; and it should be the object of every pomologist to give such fruit a silent burial in an early grave. We must learn also to hold introducers as answerable, to some extent, for the correctness of their descriptions, and the quality of their seedlings. If three-fourths of the kinds now before the public could be destroyed, it would be greatly to the public advantage. It is in view of this fact that the following list is limited to such kinds as require special notice, either from their intrinsic merit, or their present prominence in the market. It should be borne in mind that to many tastes the strong, wild, fox, or musk flavor of our native kinds is not disagreeable; and they are therefore surprised to find some favorite and rugged native, like the Dracut Amber, for example, classed as worthless, because put in comparison with varieties of superior excellence with which they are unacquainted. *De gustibus non est disputandum:* we must expect and allow a diversity of opinion. Yet we may have a certain standard of excellence upon which there will be an agreement of opinion. It is desirable to have bunches and berries of good size; an abundance of juice, with as little pulp as possible; a sprightly mingling of sugar and acid; small seeds, and a thin but firm skin. Freedom from foxiness, or any strong and wild flavor, is an essential merit with those whose tastes have been cultivated. It must be admitted, however, that no grape combines all excellences. The Diana, for example, in quality, has much merit; yet it also has a thick skin, considerable pulp, and a very peculiar musk-flavor, which is disagreeable to some, but of which others are very fond. There is so much variety, that all may be pleased.

A SELECT LIST OF THE MOST PROMINENT NATIVE KINDS.

Adirondac. — This grape is presumed to be a seedling from the Isabella, which it resembles in many respects. The original vine, as is supposed, is on the estate of J. G. Wetherbee, Port Henry, N.Y., on the western shore of Lake Champlain. In this favorable locality, it has been free from mildew, ripened early, and been excellent in quality. In other localities, there has been some complaint of its tendency to mildew; but it is to be hoped, that, as the vines become established, they will acquire more vigor, and power of endurance. If so, it will prove a valuable acquisition on account of its earliness and good quality. Bunches large, compact, shouldered; berries large, round, dark, with a slight bloom; skin thin; flesh melting to the centre, sweet, excellent, juicy, but not high-flavored.

Allen's Hybrid. — A cross between the Chasselas and

Isabella, raised by J. F. Allen of Salem, Mass. I regard this variety as giving clear evidence of hybridization; the appearance of the wood and of the foliage, as also of the fruit, being unmistakably foreign; while its vigor in open culture, its adaptedness to our climate, together with a slight trace of native flavor in the fruit, are proofs of its mixed origin. The foliage in the vineyard is remarkably fine, seeming to be as subject to the attacks of mildew as the Isabella, but having a marked power of enduring and resisting the evil effects of the disease. In this respect, it is essentially different from any foreign kind. The vine is not as hardy as most native kinds, but is safe under a slight covering of earth. Though a little tender, and rather late, it is the best grape of its color yet introduced. Bunches large, long, compact, shouldered; berries medium, round, pale amber; skin thin; flesh melting to the centre, very sweet and juicy, with more character than the Chasselas, and superior to it. Ripens with the Concord, but is better if allowed to hang ten days later.

Catawba.—Mr. John Adlum, of Georgetown, D.C., procured this grape from the garden of Mrs. Schell, in Maryland, about the year 1820. He considered it very similar to a grape growing wild in Maryland, and called by him the Red Muncy. Since Mr. Adlum first introduced it, the Catawba has been the favorite variety in all sections where it will ripen thoroughly. It is too late for the New-England climate; and, within a few years, it has been so subject to the rot, that other varieties are being substituted for it, even in vineyards where the Catawba has formerly held undisputed precedence. Its high vinous and musk flavor has given character to its wines. Bunches above medium, moderately compact, shouldered; berries large, round, deep red, with lilac bloom; skin thick; flesh juicy, with some pulp, rich, spirited, vinous; ripens early in October, around Boston, in favorable positions.

Clinton.—In the year 1821, Hon. Hugh White, then in the junior class in Hamilton College, N.Y., planted a seedling vine in the grounds of Prof. Noyes, on College Hill, which still remains, and is the original Clinton,—a very hardy, healthy, and productive grape, of the first class. Bunches and berries small, black, with blue bloom; brisk, juicy, quite acid, but improves by keeping until February.

Concord.—Raised by E. W. Bull, of Concord, Mass. A retrograde from the Isabella or Catawba in the quality of the fruit, yet so superior in its habits, that it is generally regarded as one of the most valuable kinds. In hardness, vigor of growth, productiveness, and fine appearance of its fruit, it is unsurpassed. In the opinion of most cultivators, it is the most profitable market variety. The leaves are very thick and leathery, and comparatively free from mildew: the fruit is, however, subject to mildew and black rot, which seem to increase in some localities, and may prove serious evils. Bunches large, long, heavy, compact, shouldered, and of noble appearance; berrries large, round, black, with a beautiful blue bloom; skin thin; flesh sweet, with a pulp, and acid at the centre, somewhat foxy; ripens about the 20th of September.

Creveling (Catawissa, or Bloom).—Discovered growing wild on the banks of the Catawissa River, in Pennsylvania. It is now much esteemed on account of its hardiness, earliness, productiveness, and the somewhat peculiar excellence of the fruit. The wood is long-jointed, and of a reddish color, easily distinguishable. Bunches medium, long, and loose; berries large, oval, dark-red, or black; skin thin; flesh melting, sweet, juicy, with a peculiar plum-like flavor, not high or vinous, but decidedly superior to Concord, or even a well-ripened Isabella;

ripens with the Delaware, and is a valuable early black grape.

Delaware. — Mr. Paul H. Provost, of Kingswood, N.J., emigrated from Switzerland, and brought with him many varieties of foreign grapes, which he cultivated in his garden. The Delaware is supposed to have originated with him. From New Jersey it was carried to Delaware, O., by Joseph Heath; and hence its name. Considering the circumstances of its origin, and the character of the vine and fruit, there is strong reason to believe it is a seedling from the Red Traminer. But this in no way detracts from its value: it is now so well tested, that its reputation will stand entirely upon its intrinsic merit. Its growth is slender, very short-jointed, in some localities somewhat subject to mildew, acquiring more vigor with age, and is hardy and very productive. Its fruit is small and light; but what it lacks in size it makes up in the number of bunches, standing among grapes very much as the Seckel does among pears. In quality, and as a wine-grape, it deserves unqualified praise. Bunch below medium, long, generally lightly shouldered, very compact; berries small, round, beautifully rose-colored; skin thin; flesh juicy, with some pulp, very sweet, but with a slightly vinous flavor; seeds large; quality unsurpassed; ripens Sept. 15 in the vicinity of Boston.

Diana.—A seedling from the Catawba, raised by Mrs. Diana Crehore, of Milton, Mass. With many decidedly bad points, it still has a high musk (not foxy) flavor, which marks it as excellent in quality. It is an uncertain grape, sometimes doing very well, and again being shy in setting its fruit, or very unequal in the time of ripening its berries on the same bunch. A warm, dry, and rather poor soil is found to secure the best results, securing well-ripened wood and an abundance of fruit. Bunches medium, very compact, seldom shouldered; berries above medium, round, pale-red; skin remarkably thick; flesh tender, with some pulp, very sweet, juicy, with a rich musk-flavor, which is offensive to some, and to others very delicious. Ripens about with the Concord, and keeps well throughout the winter.

Hartford Prolific.—Introduced by Mr. Steel, of Hartford, Conn. Its merits consist in being very early, of large size, and wonderfully prolific. Notwithstanding its tendency to drop its berries when fully ripe, and the fact that it is rather below the Concord in quality, it is yet a profitable market-fruit. Bunches large, compact, shouldered; berries large, round, black; skin firm, moderately thick; flesh sweet, juicy, with considerable foxiness and pulp; ripens ten days before the Delaware, and is, therefore, valuable for the market.

Iona.—A very promising seedling, raised by C. W. Grant, of Iona Island; undoubtedly springing from the Catawba, which it much resembles. The quality of the fruit is excellent, partaking of the high vinous character of its parent; while the character of the vine is healthy, vigorous, and not subject to mildew. In the Northern States, the test of its value will be in the time of its ripening. Bunches large, shouldered, and rather loose, so far as my observation extends; berries large, round, light-red, with dark-red veins; skin thin; flesh melting to the centre; full of juice, brisk, vinous, and excellent; probably ripens about with the Concord.

Israella.—Another seedling from Dr. Grant, somewhat resembling the Isabella, but valuable on account of its earliness, claiming to be ripe with the Hartford. If this should prove true, and if it is not subject to mildew, as it is of decidedly better quality than the Hartford, and does not drop its berries, it will be of great value. Bunches large, compact, shouldered; berries large, black, slightly oval like the Isabella; skin thin; flesh melting to the centre, sweet, and free from foxiness; ripens early in September.

Isabella. — An old variety, introduced at the North by Mrs. Isabella Gibbs, of Brooklyn, L.I., from whom it has received its name. In ordinary localities, especially in New England, it is liable to mildew, and does not ripen its fruit. In favorable localities, especially on the shores of large bodies of water and in a warm position, it still does admirably well. There is a vine on the shore of Lake Winnipiseogee, in New Hampshire, which annually ripens several hundred pounds of noble-looking fruit with great certainty, and in season for the fruit exhibitions about the middle of September; but this is exceptional. In most positions, the vine mildews, and the fruit will not ripen; and hence this noble variety is, to a great extent, being displaced by new kinds. Bunches large, long, shouldered; berries large, black, with a thin bloom, oval; when well-ripened, the flesh is melting, juicy, sprightly, and good; ripens in Boston, Sept. 25.

Lydia. — A seedling raised by Mr. Charles Carpenter, of Kelly's Island, O., and promising well in quality and earliness. Bunches above medium; berries large, oval, greenish-white, with a tinge of rose in the sun; flesh sweet and excellent; ripens with the Delaware.

Maxatawny. — Originated at Eagleville, Penn., and is a healthy, hardy, and vigorous variety of excellent quality, but is too late for Northern culture. Bunches medium, compact, without shoulder; berries medium, oval, greenish-white; flesh tender, sweet, and delicious, without pulp; ripens Oct. 1.

Mead's Seedling. — By John Mead, of Lowell, Mass., from the Catawba, which it resembles. Bunch above medium; berry of the size of the Catawba, darker, with a fine blue bloom; flesh juicy and very sweet, and better than the Catawba. It was found in the summer of 1847, and taken to Illinois in 1850, where it is received with favor.

Miles. — A recent variety from Pennsylvania, said to be the earliest of grapes, ripening before Canby's August. Vine vigorous, healthy, and hardy; fruit of medium size, black, oval; flesh sweet and rather buttery, but of fair quality.

Rebecca. — A chance seedling, found in the garden of E. M. Peake, Hudson, N.Y. It is subject to mildew when young, and its foliage also suffers from the burning rays of the sun. Yet it becomes more vigorous with age, and its excellent quality makes it desirable for garden culture. It is a little tender, and requires covering. Bunches medium, compact; berries above medium, oval, pale, yellowish-green; flesh tender, sweet, with a slight native aroma, which gives character, with little pulp; ripens with the Concord.

Rogers's Hybrids.—It is a public misfortune that this large family of seedlings has been disseminated without names, and before they were tested. A great majority of the number, though an improvement upon the parent Mammoth, are yet below the standard of table-grapes. They all claim to be hybrids; the Black Hamburg and other foreign kinds being the male parents, and the wild Mammoth being the female. Mr. E. S. Rogers of Salem, Mass., is deserving of much credit for his skill and enterprise in hybridizing; and it is hoped and believed, that, from his numerous seedlings, some will prove to be of permanent value.

No. 1 indicates its foreign blood, in foliage, and character of the fruit: its leaves suffer somewhat from the effects of our clear sun, and also from mildew; yet it is a grape of fine appearance and good quality, and meets with favor at the South, where it is more certain of ripening. Bunches large, shouldered; berries large, very oval, amber, with a reddish tinge; skin very thin; flesh tender, juicy, somewhat stringy, of good quality; ripens with the Isabella.

No. 2.—One of the largest, both in bunch and berry; dark purple, slightly oval; flavor sprightly and vinous; is later than the Isabella.

No. 3.—One of the most desirable of this class, on account of its earliness, which is nearly with the Delaware. Bunches of medium size; berries above medium, oval, dark red; flesh tender, sweet, with flavor resembling the Diana.

No. 4.—A very large, black grape, resembling the Union Village. It is of vigorous growth, hardy, and productive; of good quality, noble appearance, and promises to be a good market-grape. Bunches large, compact; berries very large, round, black, with thick bloom; flesh melting, very juicy, sprightly acid, but becoming sweeter when fully ripe; later than the Concord.

No. 5 and No. 9 resemble No. 3, but are not equal to it.

No. 15 is regarded by Mr. Rogers as his best. It is remarkably vigorous, productive, and hardy; and will pass as a good, sweet grape, where the taste is not critical. Bunches of fair size, rather loose, shouldered; berries oval, large, dark red; flesh juicy, with some pulp and foxiness, and somewhat stringy; leaves a rough taste upon the palate; ripens as early or earlier than the Concord.

No. 19 and No. 33 resemble No. 4; but, I am inclined to think, are less desirable.

No. 41 is a large, black grape, of the character of No. 4; perhaps earlier and sweeter.

The higher numbers of these seedlings are a second generation from the lower numbers impregnated with foreign kinds; and, in general, they seem to have too much of the foreign element for our climate. Trial alone will determine which of these have a permanent value.

In regard to these, Mr. J. F. C. Hyde, an able pomologist, and Chairman of the Massachusetts Horticultural Society, in his report for 1865, remarks, —

"We are happy to say, that, from all we have seen of the various numbers during the past year, we are very much better pleased with them than ever before, and truly believe that some of them are destined to become highly popular and valuable varieties, especially for the market. We have given our judgment of these grapes as they appeared this year, but may, from the experience of another year, change it as much as we have changed it the past year; for it is very certain that none can safely judge of a grape until the vine gets age, and the fruit has been grown in different localities and under varying circumstances. So far as relates to quality merely, we do not yet regard any of these grapes as equal to Delaware, Allen's Hybrid, Iona, and others."

Union Village.—A seedling from the Isabella, raised by the Shakers at Union Village, O. It resembles its parent in growth, though more rampant, and with larger foliage; does not ripen its wood thoroughly, and requires winter-covering. Notwithstanding these objections, and its lateness, it will be retained on account of its noble appearance. Bunches very large, compact, shouldered; berries of largest size, round, black, with bloom; flesh very juicy, with little pulp, spirited, and rather too acid, until fully ripe in the early part of October, when it is full of juice, and its quality is good.

RECENT KINDS, PROMISING WELL, BUT NOT SUFFICIENTLY TESTED.

Barnes.—Mr. Parker Barnes has, for two years past, exhibited a grape which appears to be nearly as early as the Hartford, and quite superior to it in quality. Bunches about five inches in length, shouldered; berries medium, oval, black, sweet, and good; ripe Sept. 5; worthy of trial as an early grape.

Bogue's Eureka.—"The Attica Atlas" (N.Y.) describes this as stronger, earlier, and better than the Isabella, which it resembles.

Clover-street Black.—Originated by Jacob Moore of Rochester, N.Y., and said to be a cross between Diana and Black Hamburg. Bunch large and well shouldered; berries large, black, with a fine bloom; flesh tender, with little pulp, sweet, spirited, and excellent; was fully ripe when exhibited Sept. 20. Promises well.

Dana.—A seedling by Francis Dana of Roxbury, Mass., which is described by Mr. Hyde, Chairman of the Fruit Committee of the Massachusetts Horticultural Society, as follows: "Bunch of medium size, shouldered, compact, with a peculiar red stem; the berries of rather large size, nearly round, red, with a rich, heavy bloom, so that, when fully ripe, they appear almost black; as free from pulp as the Delaware; not so sweet, but more spirited and vinous, and yet not an acid grape." This grape is now under trial.

Diana Hamburg.—Another hybrid by Mr. Moore, of Rochester, N.Y., and thus described in "Hovey's Magazine:" "Clusters very large, six to eight inches in length, usually longer in proportion to breadth than the Hamburg, regularly shouldered, compact; berries roundish, larger than the Concord, dark crimson, with a rich purple bloom, mingled with a fiery lustre in the sunlight; flesh perfectly tender, breaking to the centre, and letting out the seeds like a foreign grape; of sugary sweetness, in flavor remarkably like the Hamburg, but more aromatic and lively, fully equalling that excellent variety. Hardy, and very productive; fruit ripens after the Concord, and a week or ten days earlier than the Diana." When exhibited, Sept. 20, it was not fully ripe, but appeared very promising.

Howell. — Of this new grape, Mr. Meehan says, in his "Monthly," that it was "perfectly ripe Sept. 4, with bunches and berries of medium size, of a jet-black color; with a thick skin, and too firm pulp, but superior to Concord, and much better than many that have been 'let out' with a loud explosion."

Lincoln County. — Raised by W. H. Read, of Canada West, who states that the clusters are larger than the Union Village, and the berries equal in size, while its time of ripening is with the Concord.

Martha. — A seedling from the Concord, raised by S. Miller, Calmdale, Penn. The vine is vigorous, hardy, and healthy; bunches medium, loose, shouldered; berries large, round, pale yellow; flesh sweet, juicy, with some pulp and foxiness, but of good quality. This description is given by George Husmann, who is a careful judge.

Nonantum.—Another seedling by Mr. Francis Dana, and described by Mr. Hyde as "a black grape; bunch rather small as it appeared this year, shouldered; berries of good size, oval, similar in shape and appearance to the Isabella; entirely free from pulp, being quite remarkable in this respect; good flavor; promising. Some prefer it to the Dana. Time of ripening about the same as the Dana." This also is under trial.

Pollock.—A grape raised by Mr. Pollock, of Tremont, N.Y., has been mentioned as promising. Bunches are said to be as large as the Concord, very compact; berries large, dark purple or black; flesh without pulp, very vinous, and not too sweet.

Yeddo.—A new species from Japan, and classed in England as *Vitis glaucescens.* It was sent to this country by Dr. Hall, and has been introduced through Parsons & Co., of Flushing, N.Y. In England, the quality of the fruit is highly spoken of. The bunches are of medium size; the berries brown, with a thin skin, and "flavor all that can be desired." Not yet proved, but will probably be rather late. The vines appear to be much inclined to mildew.

SYNONYMES, AND VARIETIES OF LESS VALUE, OR DESIGNED FOR SPECIAL LOCALITIES.

Alexander. — Large, black, tough pulp, with some foxiness; rather late.

Aiken. — Same as Isabella.

Albino, or *Albiness.* — A worthless large white grape.

Allair. — A worthless red grape.

Alvey. — A Southern grape, but hardy at the North, ripening in the latter part of September. Berries small, vinous, without pulp.

American Hamburg. — A large black and poor fox grape.

Amber Catawba. — Said to resemble, but is earlier and more musky than, its parent.

Anna. — Introduced by Dr. Grant. Bunches and berries large, white, rich Catawba-flavor, with a tough pulp; vine not healthy, and fruit too late for any latitude north of Washington.

Arkansas. — Is Isabella.

Baldwin Le Noir. — Like the Alvey; rich in grape-sugar for wine.

Baxter. — A very large-clustered frost-grape, with berries of the size and quality of Clinton.

Bland. — Mr. Van Buren recommends this strongly for the South, as resembling and more desirable than the Catawba.

Black King. — A hardy and vigorous early grape, of medium size; sweet, but foxy.

Bloom. — Resembles the Union Village.

Blood's Black. — An early sweet, black, foxy grape.

Blood's White. — A worthless fox-grape.

Blue Favorite. — A frost-grape, not equal to Clinton.

Brackett's Winchester. — Very similar to Union Village.

Brincklé. — A seedling from the European.

Canada Chief. — Like the Chasselas; not suited to our climate.

Cassady. — A white grape of medium size, of good flavor, juicy, with little pulp. Vine vigorous, hardy; ripens Oct. 1.

Canby's August. — Is York Madeira.

Camden. — Is a wild fox-grape.

Chippewa. — Is a small, black, and sour grape.

Child's Superb.—Foreign, and unsuitable for open culture.

Clara.—A seedling from the foreign, originated in Philadelphia. Bunch and berries medium, round, greenish-white; flesh tender, juicy, sweet, and delicious; ripens last of September.

Christy's Isabella.—Same as Isabella.

Charlotte.—A seedling from the Catawba, by Edmund Ward, Kelly's Island. Bunches medium, not shouldered, compact; berries medium, roundish, pale red; flesh tender, sweet, vinous, with slight musky aroma; ripens with the Delaware.

Cloantha.—Resembles, but is more foxy than, the Isabella.

Coriell.—Resembles the Isabella, but is said to be larger and better; ripening Oct. 1.

Cuyahoga.—Introduced by Mr. Wemple, of Cuyahoga County, O. A greenish-white grape, of medium size, compact, round, sweet, and juicy; does not ripen well at the North.

Cynthiana.—Is pulpy and inferior.

Devereux.—Is Le Noir.

Diller.—Pulpy, and inferior to the Isabella.

Dracut Amber.—An early, productive, foxy grape.

Early Amber.— Similar to the last; berries drop.

Early Hudson.— Berries round, black, of medium size, often seedless; of third quality.

Elizabeth.— Originated on the farm of James Hart, near Rochester, N.Y. Resembles the Isabella in size and form, but of a greenish-white color, and thought to be of better flavor by the editor of "The Rural New-Yorker."

El Paso.— Foreign varieties, or Mexican and California seedlings from the foreign, are sent out indiscriminately under this name.

Elsinburg.— Originated in a town of this name in New Jersey. Bunches large, long, loose, shouldered; berries small, black, with a blue bloom; skin thin; flesh melting, sweet, sprightly, and vinous. Ripens Oct. 1.

Emily.— Two kinds have been sent out under this name; one a foreign seedling, and the other a worthless frost-grape, having remarkably fine foliage.

Fancher.— Found by Mr. F. B. Fancher, of Lansingburg, N.Y., where it succeeds well, and is equal to the Catawba, if not superior. The Catawba will not ripen so far North.

Framingham.— Resembles, but is scarcely as desirable as, the Hartford.

Franklin.—A dark-colored, free-growing wine-grape, like the Clinton.

Garrigues.—Similar to, and perhaps identical with, the Isabella.

Golden Clinton.—Like the Clinton, except in color, which is yellowish-white.

Graham.—A good purple grape, of medium size, juicy, and with tender pulp; is rather late.

Harris.—A Southern grape, of medium size, round, black, sweet, juicy, with some pulp. Vigorous and productive.

Haskel.—Is Concord.

Herbemont.—A Southern variety of the *Vitis æstivalis*, which mildews, and is quite too late, at the North. Farther South, it is a vigorous, coarse vine, very prolific, and excellent; bunches very large, sometimes weighing two pounds, compact, shouldered; berries round, small, purple, with a blue bloom; flesh juicy, vinous, sprightly, and free from pulp.

Hyde's Eliza.—Raised by Wilkes Hyde, Catskill, N.Y. A smaller and somewhat earlier grape than the Isabella, which it resembles.

Labé.—From Lebanon, Penn. Bunches medium, compact, not shouldered; berries large, deep black; flavor brisk, with a peculiar pleasant sweetness. Of promise.

Le Noir.—One of the earliest and best of the Southern varieties, resembling and ripening two weeks before the Herbemont; has less compact bunches, and is about equal in quality. In some favored garden-spots at the North, it may mature.

Lincoln.—Is much like the preceding, but is distinct in foliage.

Long.—Resembles the Le Noir, but is not equal to it.

Logan.—Bunches medium, compact; berries above medium, oval, black; flesh juicy, but of second quality; ripens with the Concord.

Louisa.—A seedling from the Isabella, raised by Samuel Miller, of Calmdale, Penn. It is much like its parent, but is said to be more healthy, and ten days earlier.

Manhattan.—A strong, foxy grape; sweet, with tough pulp.

Marion.—Of the frost class; bunches above medium, very compact; berries medium, black, with a fine bloom; very sharp, with pulp, but becomes eatable in the winter.

Mary Ann.—An early, black, foxy grape.

Massachusetts White.—Introduced by B. M. Watson, of Plymouth, but proves to be a worthless wild grape.

Maguire. — Is like the Hartford, but more foxy.

Merceron's Seedling. — Reported as "a decided improvement on the Catawba, and two weeks earlier."

Merritt's Seedling. — Is of foreign habit, and undesirable for our climate.

Mottled. — From the Catawba, by Charles Carpenter, of Kelly's Island. Said to be earlier and less disposed to rot than its parent. It is of brisk, sprightly flavor, and otherwise resembles the Catawba, but is mottled with darker purplish-red shades.

Newport. — Is a seedling from and is like the Herbemont.

North America. — Is early, sweet, foxy, with pulp; of third quality.

Norton's Virginia. — Introduced by Dr. Norton, of Richmond, about the year 1825. It is esteemed as a wine-grape at the South and West, being healthy, productive, and spirited. Bunches long, loose; berries small, round, black, harsh, and sour, but becoming sufficiently sweet at the South for wine.

Ohio Cigar-box. — Is much like Herbemont.

Ontario. — Is the Union Village.

Oporto. — Introduced by E. W. Sylvester, of Lyons, N.Y. A black, harsh, and very acid grape; too poor for wine.

Pauline.—A Southern grape, of excellent quality, resembling Le Noir, but with larger and lighter-colored berries.

Perkins.—The true variety from Massachusetts is of the general appearance of the Diana, but larger, earlier, much more foxy, with a hard pulp, and drops badly. Ranks with the Northern Muscadine.

Powell.—Is the same as Bland.

Provost White and Sage.—Are like common wild grapes.

Raabe.—A cross between Elsinburg and Bland. Bunch and berry small, compact, dark red, very sweet and good.

Scuppernong.—Of this Southern family, belonging to the species *Vitis vulpina*, there are several varieties, as the white, the blue, &c., having similar characteristics, but differing in the color of the fruit. Clusters are small, loose, with but few scattered berries, which are large, bronzed, white, blue, or black, with thick skin; very sweet, with fine musky aroma; makes an excellent wine. Suitable only for the South.

St. Catherine.—A good native kind, with large and fine-looking bunches and berries, which do not drop. Flesh sweet, foxy, with considerable pulp.

St. Geneviève.—Is probably the same as Herbemont.

Taylor's Bullitt.—Introduced by Judge Taylor, of Jericho, Ky. Of rapid growth; bunches and berries of medium size; nearly white; not productive, and not equal to other white grapes.

Northern Muscadine.—A dark amber, foxy grape, from the Shakers; is large, early, sweet, with a hard pulp; drops badly; of third quality. Ranks with the Dracut Amber, or Early Amber.

To Kalon.—Introduced from New York, and known also in Massachusetts as the Carter & Wyman. It is a large, blue-black grape, with a fine bloom; skin thin; flesh tender, rich, juicy, with little pulp; mildews, and is not productive.

Underhill's Seedling.—Similar in color to the Catawba, but having a tough pulp and foxy flavor; ripens earlier.

Venango.—A Southern wine-grape, of the size of the Catawba, and of brownish-lilac color.

Wilmington.—A very showy oval white grape, from

Delaware, but requiring a long Southern season to become of good quality.

York Madeira.—A small black grape from Pennsylvania, somewhat resembling the Clinton. Of second quality, but makes a good wine.