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OPEN AIR GRAPE CULTURE:

A PRACTICAL TREATISE

ON THE

GARDEN AND VINEYARD CULTURE

OF

THE VINE.

By JOHN PHIN.

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PREFACE.

THE following work has been undertaken, not so much in the hope of adding anything new to what is already known of the culture of the vine, as with a view to collect the scattered information which exists on the subject in periodicals and kindred works as well as amongst practical men, and to throw it into such a shape as may prove useful to the amateur and the vine-dresser.

This being our object, we have endeavored to modify and adapt the practice and principles of others to our own climate and wants, and to simplify and explain the processes of the professional gardener so that he who reads may practice. To this end we have in general avoided theoretical discussions, and have depended chiefly upon the practice of ourselves and others for the directions here laid down. For although we know that well established principles are the only sure foundation of all right practice, this is not the place for discussing the theoretical grounds upon which these principles rest. A practical work should deal with facts and be a guide to action.

As the garden culture of the vine, at least in the northern States, differs from that in the vineyard only in the more thorough preparation of the ground and the larger size of the plants, we have not formally divided the work into sections corresponding to these two classes, as the principles which govern both are precisely alike.

Where, however, some peculiar details of management apply to either we have inserted them in the section to which they properly belong—as under the subject of VINE BORDERS and

CARE OF OLD VINES. A full account of the Ohio vineyards is given.

In the execution of our work, we believe that where we have had occasion to make use of the labors of others, due credit has always been given; and we have also added a list of those books which we have most freely consulted, so that those who desire to make the culture of the grape a specialty may be directed to original sources of information.

That the culture of the grape will ere long attain a position of which its present condition affords little idea, we have no doubt. Not only is it one of the most delicious and easily raised fruits, but it also gives quick returns, so that he who plants a vine has not to wait for the better portion of his lifetime ere he eats the fruit of it; in three or four years it will yield an ample vintage.

CONTENTS.

THE MANUFACTURE OF WINE.

BIBLIOGRAPHY OF GRAPE CULTURE.

The subjoined list contains all the principal works which have been consulted in the preparation of the following treatise. Having made the study of the subject a specialty, we have been at considerable pains to collect all the works relating to vine culture of which we could find any account, and although there are several important omissions in the list given below, yet it is believed that their place is tolerably well supplied by those of which titles are given. As our attention has been chiefly directed to open air culture, we have intentionally omitted some excellent English works. The French, however, possess some valuable treatises which we regret having been unable to obtain, and a still greater source of regret has been that we have been unable to use the many fine works possessed by the Germans.

It was suggested that this list be prefaced with a short article on the bibliography of grape culture, or at least that the peculiar features of the works mentioned be indicated. But we found ourselves incompetent to the former, and the latter would have occupied a space disproportionate to its importance in a practical treatise. It is hoped, however, that the list given will not prove useless to those who desire to extend their inquiries beyond the narrow limits of the present work, and from the assistance which we ourselves have frequently derived from similar catalogues, we feel confident that this hope is not ill founded. It may be added, in conclusion, that many works have been consulted and used of which no mention is made, simply from the remoteness of their general bearing upon the subject. Thus the figure of the oïdium is taken from Pouillet's "Traité de

Physique," and is, we believe, the only thing in all the three volumes of that work which at all relates to vine culture.

Having no desire to preface our work with a mere catalogue of our private library (as we have seen done more than once), no work has been mentioned which it will not repay the reader to consult. On the general subject of the "Theory of Horticulture," Lindley's work has been our guide and our standard, and for our chemical facts and principles we have relied upon the work of Gmelin, published by the Cavendish Society of London, in twelve volumes, as we have always found it most full and reliable.

But in selecting a course of reading with a view to advance his knowledge of grape culture, the student must bear in mind that so varied, complex and intimately connected are all the operations of nature, that the facts which have a bearing upon any portion of them, are to be found in books which professedly treat of the most diverse subjects. Chemistry and mechanics are alike important; the principles which govern the relations of heat, light, and electricity, exert a more or less important influence on all vegetation, and he who would be fully master of the subject, must aim at an extent of knowledge only to be found in the widest range of scientific reading and experiment.

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OPEN AIR GRAPE CULTURE.

CHAPTER I.

NATURAL AND CIVIL HISTORY OF THE VINE.

PROFANE history reaches not back to the time when man first planted a vineyard and made wine, and when we leave the sacred records, its first culture is shrouded in allegories, myths and fables.

The native country of the vine cannot be well ascertained. It occurs wild in Greece, Italy and even in the south of France. In Mingrelia, Georgia and the regions between Caucasus and Ararat and Taurus, it flourishes in extreme vigor and great abundance. And that it is indigenous to America, also, there can be no doubt, the apocryphal stories about its introduction by Sir W. Raleigh to the contrary notwithstanding.

Records of its culture are found in most of the poems and sculptures of antiquity. The shield of

Achilles represented a vine-gathering, and Herodotus and Theophrastus speak of the culture of the vine in Egypt; and on the very oldest Greek tombs are found pictures representing the vine harvest. Pliny enters fully into the natural history of the vine, and describes a variety with berries shaped like the finger,* while the second book of Virgil's Georgics forms no mean treatise on practical viticulture.

The generic name of the vine (*vitis*) is derived, according to some authors, from the Latin *vincire* to bind; according to others it comes from *viere*, to bend, alluding to the flexibility of its branches. Both these

* Most of the authors who have noticed this variety, suppose it to have been lost, but we have received from John Kolber, Esq., of New York, slips of a vine imported by him from Hungary, the fruit of which is described as being an inch and a half long and half an inch in diameter—a form which might easily be described by an imaginative writer as resembling a finger. In fact the native name is *Kecske, csocs* or *Goats teats*—an idea similar to that of the old philosopher, though not quite so elegant. We find also in several catalogues grapes called finger-grapes—synonyms of which are Cornichon Blanc, Cucumber Grape, Bec d'Oiseau (Bird's beak), Teta de Vacca (Cow's teats), Doigts Donzelle, etc., etc. Mr. Kolber has made earnest and praiseworthy efforts to introduce the hardier varieties of the vine from the hills of Hungary, and we are happy to learn that thus far, the results are exceedingly promising. It will take several years, however, to decide whether or not any foreign variety can be grown with success in this country, as most imported plants do well for a few years.

Latin words, however, are derived from a Greek word signifying to bind. Dr. Whittaker, in a work published in 1638, entitled, "The Tree of Human Life, or the Blood of the Grape," expresses his opinion that the name *vinum* is derived *a vi* from its strength, or, perhaps *quasi divinum*, because it is a species of the tree of life in Paradise.

The species of the genus vitis are numerous, though botanists are not agreed as to the distinctive differences, especially as between the European and American sorts. In France, Chaptal, when Minister of the Interior, caused 1,400 different varieties of the vine to be collected in the garden of the Luxembourg, and under his direction M. Champagny described as distinct 550 different kinds. Four American species have been usually numbered (some authors describe eight), though the varieties, more or less distinctly marked, probably exceed 300. To the number of the latter, however, there is no limit, as every seed *may* produce a new variety.

The vine lives to a great age and attains a great size. Pliny mentions a vine which had lived for 600 years, and in Italy, vineyards have continued in bearing for 300 years, while in some parts of that country, a vineyard of 100 years is still accounted young.

Its size, whether we regard the European or Ame-

rican varieties, is often very great. Speechly describes and figures a vine trained against a row of houses in Northallerton, Yorkshire, which covered a space of one hundred and thirty seven square yards, and had a stem three feet eleven inches in circumference at a short distance from the ground. No work on the grape vine would be complete without a mention of the great Hampton Court vine, from which George the Third once directed his gardener to cut one hundred dozen bunches of grapes, if so many were on the vine, and present them to the players of Drury-lane Theatre, who had greatly pleased him. The gardener not only cut off this number, but sent word to the king that he could cut off as many more without entirely stripping the vine. This vine was planted in 1769 and has a stem fourteen inches in girth, one branch extending nearly 200 feet.

In America, too, very large vines are to be found. The following is clipped from the "Alta Californian:"

"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 he spoke 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 7000

bunches, and the estimated yield was 18,000 pounds of fruit. Can this be beaten? The only thing that surprised me in the relation of my friend was that any person in Santa Barbara should have displayed the energy necessary to build the trellis for this noble vine."

In the "Horticulturist" for October, 1858, a vine growing near Burlington, New Jersey, is described as follows: "In May last it was measured with the following result: Two feet from the ground it measured 6 feet, 2½ inches in girth; four feet high it is about 6 inches less; it there divides into two branches, the largest of which is 3 feet, 3 inches in girth, and the smallest is 3 inches. The largest of the trees which the vine covers is 10 feet in circumference at two feet from the ground. The vine is very much decayed, but still puts forth leaves and young shoots. It has never borne a grape in the memory of a lady now 98 years old and who has lived her long life within sight, or nearly so, of this gigantic production, and to whom it was a wonder in her youth. The largest tree is a black oak, the others are black, or sour gum. On pacing the circumference covered by the branches, it was found to exceed 100 feet.

"This vine grows near a springy soil, or upland, its roots, no doubt, penetrating to the water. May not this teach us a lesson, to give the rootlets, wherever

it is possible, access to a spring, or running water? It may be a question, too, whether we do not cut our vines too much. I have observed frequently in England that a whole house was devoted to a single vine, generally of the Black Hamburgh, and I think they uniformly bore the finest grapes. To carry a single vine over a large grapery would, of course, require years of judicious trimming and management."

The bunches and berries also have been known to attain a very great size. In the south of France instances are known of bunches attaining a weight of eight or ten pounds; travellers in Syria mention bunches weighing 17 lbs.; and we all remember the enormous clusters which the Jewish spies brought back from the promised land. Even at the present day the grapes of Damascus frequently weigh 25 pounds to the bunch.

With all the vigor and fruitfulness evinced by such instances it is no wonder that the culture of the vine should prove profitable and certain. At the meeting of the Fruit Growers' Society for western New York, held in the city of Rochester in 1859, S. H. Ainsworth made some statements as to the actual products of several vineyards, showing that from $1000 to $1500 had been realized from an acre of Isabella grapes. Mr. Rush, of East Bloomfield, had 100 vines on one-third of an acre, from which he

picked 4000 lbs., which he sold for $500, or at the rate of 12½ cts. per pound. None reported a less profit than $500 per acre.

From the very first settlement of America the vine attracted the attention of the colonists, and efforts were made both to introduce the finer European varieties and to cultivate the native sorts. Even as early as 1564, wine was made from the native grape in Florida, though, of course, in small quantity.

The earliest attempt to establish a vineyard in the British North-American colonies was by the "London Company" in Virginia prior to 1620. By the year 1630, the prospects were sufficiently favorable to warrant the importation of several French *vignerons*, who, it was alleged, ruined them by bad management. Wine was also made in Virginia in 1647, and in 1651 premiums were offered for its production. On the authority of Beverley, who wrote prior to 1722, there were vineyards in that colony which produced 750 gallons a year.

In 1664, Col. Richard Nicolls, the first English governor of New York, granted to Paul Richards of the city of New York the privilege of making and selling wine free of all duty or impost, Richards having been the first to enter upon the culture of the vine on a large scale. It was also enacted that every person who should during the succeeding thirty

years set out a vineyard should pay to Richards five shillings for every acre of vines so set out. We have been unable, however, to find any account of his success or failure, and the probability is, that after a short time the enterprise was abandoned. A gentleman in Hoboken, also, had a fine vineyard which after a little time fell into decay.

Beauchamp Plantagenet, in his "Description of the Province of New Albion," published in London in 1648, states that the English settlers in Uvedale (now Delaware) had vines running on mulberry and sassafras trees, and that there were four kinds of grapes. "The first is the Tholouse Muscat, sweet scented; the second, the great fox and thick grape, after five moneths reaped, being boyled, and salted, and well-fined is a strong red Xeres; the third, a light claret; the fourth, a white grape, creeps on the land maketh a pure, gold-colored wine. Tennis Pale, the Frenchmen, of these four made eight sorts of excellent wine; and of the Muscat, acute boyled, that the second draught will fox (intoxicate) a reasonable pate four moneths old; and here may be gathered and made two hundred tun in the vintage moneth, and replanted will mend."

In 1683, William Penn attempted to establish a vineyard near Philadelphia, but without success. The same result attended the efforts of Andrew Doré

in 1685, but after some years, Mr. Tasker, of Maryland, and Mr. Antil, of Shrewsbury, N.J., seem to have succeeded to a certain extent. Mr. Antil wrote an excellent article on the culture of the grape and the manufacture of wine, which may be found in the first volume of the "Transactions of the American Philosophical Society," published in 1771. In this article, Mr. Antil describes only foreign varieties, from which it is to be inferred that he cultivated them chiefly, if not solely.

In 1769, the French settlers in Illinois made one hundred and ten hogsheads of strong wine from native grapes.

In 1793, Peter Legaux, a French gentleman, obtained of the legislature of Pennsylvania the incorporation of a company for cultivating the vine. They purchased a farm at Spring-mill, Montgomery county, thirteen miles from Philadelphia, on the Schuylkill. For one year only were prospects favorable; divisions and dissensions arose; the stockholders sold out in disgust, and the vineyard went to ruin.

At Harmony, near Pittsburg, a vineyard of ten acres was planted and cultivated by Frederick Rapp and his associates from Germany. They afterward removed to another Harmony in Indiana, on the east bank of the Wabash, where they continued the cultivation of wine and silk for many years.

A Swiss colony settled about 1790 in Jessamin county, Kentucky, and raised a fund of ten thousand dollars for the express purpose of forming a vineyard. Their first attempts failed, they having cultivated the foreign vine. In 1801, they removed to a spot which they called Vevay, in Switzerland County, Indiana, on the Ohio River, forty-five miles below Cincinnati. Here they planted native vines and met with some success. But, after forty years' experience, they consider our climate and soil inferior to those of Switzerland, as they claim that they can there make a gallon of wine from ten pounds of grapes while here twelve pounds are required. Their vineyards have now, we believe, nearly disappeared.

But the great turning point of vine culture in America was when the Catawba grape was introduced by Major Adlum, of Georgetown, D. C., who considered that in so doing he conferred a greater benefit upon the American nation than he would have done by paying off the national debt.

We could have wished to give an accurate view of the present state of the vine culture of this country, but the best works which we have been able to consult are very imperfect in this respect, and we believe that we have examined all the more important ones. Want of time has prevented us from instituting a special correspondence on this subject. We can

therefore only say that it never at any period presented a more flourishing aspect than it does at the present day.

Of the future prospects of grape culture, of its extent, and of its influences, it would be difficult to speak. But we feel assured that, whether in the form of wine or of fruit, the produce of the vine cannot fail to do much good in this country—not the least of its benefits being that it will afford those with small capital an easy and pleasant mode of securing a competency.

Another point in this aspect of grape culture, and one in which we have strong confidence and ardent hope, is the employment which it promises to afford to women. We are none of those who would desire to see woman rendered independent of man, for we well know to what a miserable condition man would come if rendered independent of woman, and it is a poor rule that will not work both ways.

But we cannot shut our eyes to the fact that there are vast multitudes of women whose labor receives no adequate remuneration—who make shirts at the rate of five cents apiece, and then often get cheated out of their pay. Now, if some of our large-hearted, as well as large-worded, philanthropists would procure a few acres of land in some proper locality, and after having it well trenched or subsoil ploughed,

would let it out in half, or even quarter acre lots to industrious women with a view to their establishing vineyard plots, we think that after the first two years such an allotment of half an acre ought to yield its tenant from $250 to $400 per year, from which, after paying a good round rent, they might retain more than they can now make at any other employment within their reach. And let it not be said that the culture of the soil is unsuited to the sphere of woman. We rather think that Eve was more of a gardener than shirt-maker before she "brought sin into the world and all our woe;" and those who think gardening unsuited to woman are referred to Loudon's remarks in the "Gardener's Magazine," where he recommends it to his fair countrywomen instead of the ball-room and the dance.

We shall not stultify ourselves with referring to Indian and European savages, who make the women do all the hard work, even though women are there found equal to the roughest agricultural labor. But in vine culture, after the first great effort has been made to get the soil suitably prepared, there is really little hard work to be done. Even hoeing does not require more strength than washing and scrubbing; and pruning, trimming, and gathering the fruit are not above the strength of our weakest females; and we promise them that if they undertake it they will soon

acquire the necessary health and strength. All that we can say is that we hope ere long to see the experiment tried, and nothing would afford us greater pleasure than to give a lecture on vine culture, with experimental illustrations, to such a society of women, and tell them all we know about raising good grapes; and we think we can point to others who are not only competent but willing to assist in the good work —thus rendering the objection that "women don't know how" of no avail. But even if no such experiment should be tried, we feel confident that the thousands of acres which will be devoted to vine culture during the next few years will not be cultivated without affording abundant work for women

CHAPTER II.

SOIL, SITUATION AND ASPECT.

Soil.—The vine will grow in almost any situation, and reach a large size and exhibit luxurious vegetation under conditions apparently the most unfavorable; but if healthy vines and fine fruit be desired, it is necessary to choose a soil where the roots can ramble freely, find plenty of nutriment and be safe from stagnant water and its accompanying cold, sour subsoil. One of the largest vines in the country grows in a swamp in New Jersey, and a vine has been known to grow vigorously from a cleft in an old wall twenty feet from the ground. But these are by no means examples to be imitated in practice where we have the power of selecting the site of our garden or vineyard, though they afford encouragement to the amateur who is compelled to make use of an inferior location.

The opinion of good grape culturists is that any soil which will grow *good* Indian corn is suitable for grapes. Others describe a soil adapted to the culture of the vine as one which will grow good winter

wheat without the plants being thrown out of the ground in winter.

Downing recommends a "strong loamy or gravelly soil—limestone soils being usually the best." And in another place he gives it as his opinion that "all that can be said of a soil for grape culture is that it be light, rich and dry." G. W. Johnson thinks a light, sandy loam the best. And Buchannan, who may be safely taken as the representative of the Cincinnati vine growers, recommends a dry, calcareous loam with a porous subsoil. At the recent meeting of the Fruit Growers' Society of western New York, Dr. Farley stated that his best grapes had been raised on a clay soil, and that in this matter his opinion in regard to the soil best adapted to the culture of grapes had undergone some change.

It will thus be perceived that the opinions of our best horticulturists vary a little, but we believe that this variation is mere adaptation to the different modes of growth and training adopted by the various cultivators. The purpose for which the grapes are raised —that is whether for wine or for the table—ought also to have a material influence in directing our choice of a soil.

When the object is to manufacture wine, the vines require to be kept within moderate bounds; all rankness of vegetation must be carefully avoided, and con-

sequently the soil must be light, rich, porous and dry, and if calcareous so much the better.

On the other hand, where high saccharine qualities are not so much desired as abundance of grapes of agreeable flavor, the vines will succeed better and produce more certain crops if allowed a greater extent of growth, and in this case they will bear a heavier and richer soil—in some cases (as in growing Isabella and Diana grapes for the table) even preferring a clay soil well drained and cultivated and highly manured.

That this view is correct may be easily proved by referring to well-known examples both in Europe and in this country. Thus in the Arriege in France a rich wine like Tokay, is obtained from mountain sides covered with large stones as if the cultivators had left all to nature. In Italy and Sicily the best wines are grown amongst the rubbish of volcanoes. "Good rich soils," says Redding, "never produce even tolerable wines."

On the other hand the rich Chasselas de Fontainebleau table grapes are produced by vines planted in cold and heavy soil, well manured. And he who desires to find *rich soil* should examine the vine borders of the English hot-house grape-growers. Allen, one of our most successful grape-growers recommends a border of the richest kind. So does Chorlton, and

such we believe to be the practice of all our successful cultivators of the grape under glass. The celebrated vine at Hampton Court revels in the luxury of an old sewer, and instances have come under our own observation where the proximity of a vine to a cesspool caused the production of large quantities of most excellent grapes. In France, the application of night-soil and sewerage to the vineyards has in all cases injured the quality of the wine. That such would have been the case, however, if the French vignerons had acted upon correct principles in the application of these powerful stimulants, we are scarcely prepared to believe. And we have no doubt but that by judicious management and a careful observance of the laws of nature one of the greatest achievements in vine culture may yet be effected, viz, the union of vigorous vegetation and stimulating manures with the production of good wine. But so far as present experience extends the soil for a vineyard must be light and not *too highly manured*—and in all cases whether the object of culture be wine or table grapes the subsoil must be warm and loose. Cold borders are very prejudicial to the roots of the vine, and are supposed to be an efficient cause of the *shanking* of the grapes. It would appear from an inspection of the subjoined tables that this desired warmth might be secured to the surface soil at least

by plentiful addition of lime and any black mold or charcoal.

Maximum Temperatures of the various Earths Exposed to the Sun. By Schubler.

KINDS OF EARTH.	Maximum Temperature of the superior layer, the mean temperature of the ambient air being 77 degrees F.	
	Moist Earth.	Dry Earth.
	Degrees.	Degrees.
Silicious sand, yellowish grey, ...	99.05	112.55
Calcareous sand, whitish grey, ...	99.10	112.10
Argillaceous earth, yellowish grey,	99.28	112.32
Calcareous earth, white, ...	96.13	109.40
Mold, blackish grey, ...	103.55	117.27
Garden earth, blackish grey, ...	99.50	113.45

Table of Retention of Heat. By Becquerel.

KIND OF EARTH.	Capacity for heat, that of Calcareous sand being 100.	Time required by 18 feet cube of earth to cool from 144.5 to 70.2, the temperature of the surrounding air being 61°.2.
		Hours.
Calcareous sand, ...	100	3.30
Silicious sand, ...	95.6	3.27
Argillaceous earth, ...	68.4	2.24
Calcareous earth, ...	61.8	2.10
Mold, ...	49	1.43

From these tables it will be seen that black mold receives or absorbs heat most rapidly, but parts with it in the shortest space of time also, and that for

receiving and retaining heat, dark colored, calcareous earth is by far the most efficient. Good silicious sand comes next in order, and hence we conceive that a soil composed chiefly of calcareous and silicious sand, with a sufficient amount of charcoal or mold to give it a dark color, would prove one of the best for grapes.

Such are the general points deserving of consideration. Those desirous of studying more minutely the influence of the chemical constitution of the soil upon vines growing therein will find an interesting and valuable résumé of the subject in M. Ladrey's "Chimie appliqué à la Viticulture," whose general remarks on this point are so much in unison with our own experience and observation that we are tempted to translate them.

"If now we examine the series of different soils devoted to the culture of the vine in France and in other countries, we shall find this plant cultivated in soils the most diverse, not only as regards their natures (nature evidently alluding to physical constitution—*Trans.*)—but also their chemical composition. All soils appear suited to the culture of the vine, and there are none, unless those absolutely barren, in which this plant may not grow and develop itself. Thus the vine requires but little fertility in the soil, it covers a great space of land which would be

unsuited to any other culture, and in order to give an idea of this, we may cite the ancient regulations of Provence which prohibited the planting of the vine until inquiry had been made as to the sterility of the soil, and the permission of the intendant of the province had been obtained.

But if the vine can grow in all soils it behaves very differently in each of them. In strong, argillaceous, rich soils, it will acquire a great vigor of vegetation, the wood is largely developed, the product is abundant; on the contrary, in soils poor, light and dry, the vine is less robust, more delicate; it requires a culture well contrived as to even the most minute details, and the product is much less in quantity.

"In general, if in any locality the vegetation of the vine be more rich as the soil is more fertile, we observe by the side of this result that the nature and quality of the product is consequently in an inverse ratio. In heavy land the vine is well developed and furnishes abundant return; in a light soil it gives less and the product is of higher quality."

Situation.—The situation of a vineyard should be elevated, but not too high, otherwise the vines will not only be exposed to high winds and their concomitant evils, but will also be subjected to a lower temperature. On this latter point, but little is known—at

least not enough to enable us in all cases to reconcile the anomalies which occur. Enough is known, however, to cause us to avoid the tops of hills and the bottoms of valleys, and it may be worth our while to consider a few of the principles which regulate temperature in these situations. During the night, the cold air, being heavy, settles down into the valleys and hollows, thus producing in such locations a temperature several degrees lower than is found on the sides of the adjacent hills. And no influence is then at work to disturb this state of things, for the earth itself is becoming rapidly cooled by radiation; and if a small quantity of the air should become warmed by contact with it, it immediately ascends, and cool air takes its place.

At daybreak, however, an agency is introduced which reverses this condition of things. Then the dense air in the valleys concentrates and absorbs the heat of the sun's rays and increases their effect upon the soil, which in turn imparts heat to the stratum of air lying next it. This lower stratum of air being warmed and consequently rendered much lighter than the colder portion above it, it ascends, but as it rises it also expands still more, which in some measure compensates for the heat which it received from the earth. The same process keeps going on until night comes, when the lower stratum of air being no longer

warmed it no longer ascends, and the colder and heavier air again accumulates in the valleys. Thus it will be seen, that during the night the air in the valleys is colder than that in other places, while the reverse is the case during the day. The stillness of the air in valleys and sheltered situations also contributes to this result in a remarkable degree.

Now it is obvious, that if for any fruit tree, the air in the valleys should be sufficiently cold to kill the buds, no orchard could succeed. And if, on the other hand, sufficient light and heat to ripen the fuit could not be found on the hill-tops, such situations also would be unavailable.

Nor is the mere existence of such extremes of temperature the worst evil. The destructive influence of a hot sun upon frozen vegetation is well known, and in low valleys, the circumstances are such as to give the greatest effect to this adverse influence. For not only are the plants chilled by the extra cold night-air, they are also completely protected from the rays of the sun, until it has attained a greater power than it usually exerts at its first appearance upon plants in more exposed situations. And then, owing to the dense atmosphere through which they pass, the rays strike suddenly with concentrated energy so as to thaw the buds with a rapidity completely destructive to their vitality. In such situations also, the soil

is usually very deep and rich, producing a vigorous though succulent growth which is unable to withstand the influences above detailed. All experience bears out the practical value of these principles. Thus, in Italy, where the country is undulating and very much broken, all good wines are grown on the hill-sides. Hence Virgil tells us

> . . . . . "denique apertos
> Bacchus amat colles,"*

and modern experience bears out the ancient saw, though it does not follow, however, that plains will not produce good wine-making grapes, provided they be of sufficient extent to obviate the evils just described. The fine wines of the Gironde in France, and Châtaux Margaux, Lafitte and Latour, are grown on the plains.

Aspect—Exposure.—The aspect which is best adapted to the growth of grapes will, of course, depend upon influences, some of which at least, are liable to vary, as the keenest and most destructive winds may come from different quarters in different places—a very slight geographical change sometimes making

* The force of this saying is lost by adopting Mr. Redding's translation "Bacchus loves the hills." Davidson gives the whole, "Bacchus loves the open hills"—which is better. But the true meaning "Bacchus loves the open little hills" coincides perfectly with experience and with the principles above set forth.

an important difference in this respect, owing to peculiar topographical features. Thus a range of hills or a belt of woods, may so deflect the prevailing winds, as to completely change the condition of two localities situated within even a very short distance of each other.

In general, it will be found necessary to secure protection on the west, north and northeast. This may be afforded either by natural local features, as by a range of hills, or it may be derived from artificial sources, as woods or fences. No defence is better than a good belt of Norway spruce, and if they form a crescent in which the vineyard is embowered, but little danger need be apprehended from violent winds. Even high fences, which may be single, double or triple, afford ample protection in ordinary cases, and as trees, even of the fastest growing kind, take a considerable time before they give sufficient protection, many will prefer the fence. We are therefore tempted to extract from the "Horticulturist" for August, 1847, Downing's description of the method by which Frederic Tudor, Esq., has converted the naked promontory of Nahant into a luxuriant garden.

"To appreciate the difficulties with which this gentleman had to contend, or as we might more properly say, which stimulated all his efforts, we must recall to mind that, frequently, in high winds,

the salt spray drives over the whole of Nahant; that until Mr. Tudor began his improvements, not even a bush grew naturally on the whole of its area; and that the east winds which blew from the Atlantic in the spring are sufficient to render all gardening possibilities in the usual way nearly as chimerical as cultivating the volcanoes of the moon. Mr. Tudor's residence there, now, is a curious and striking illustration of the triumph of art over nature.

"Of course, even the idea of a place worthy of the name of a garden in this bald, sea girt cape, was out of the question, unless some mode of overcoming the violence of the gales and the bad effect of the salt spray could be devised. The plan Mr. Tudor has adopted is, we believe, original with him, and is at once extremely simple and perfectly effective.

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"It consists merely of two, or at most three parallel rows of high open fences, made of rough slats or palings, nailed in the common vertical manner, about three inches wide, and a space of a couple of inches left between them. These paling fences are about 16 feet high, and usually form a double row (on the most exposed side, a triple row) round the whole garden. The distance between that on the outer boundary and the next interior one is about four feet. The garden is also intersected here and there by tall

trellis fences of the same kind, all of which help to increase the shelter, while some of those in the interior serve as frames for training trees upon.

"The effect of this double or triple barrier of high paling is marvellous; although like a common paling, apparently open and permitting the wind a free passage, yet in practice it is found entirely to rob the gales of their violence and their saltness. To use Mr. Tudor's words, 'it completely sifts the air.' After great storms, when the outer barrier will be found covered with a coating of salt, the foliage in the garden is entirely uninjured. It acts, in short, like a rustic veil, that admits just so much of the air, and in such a manner as most to promote the growth of the trees, while it breaks and wards off all the deleterious influences of a genuine ocean breeze, so pernicious to tender leaves and shoots.'

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"It is worthy of record, among the results of Mr. Tudor's culture, that two years after the principal plantation of his fruit trees was made, he carried off the second prize for pears at the annual exhibition of the Massachusetts Horticultural Society, among dozens of zealous competitors, and with the fruit most carefully grown in that vicinity."

Of the necessity for shelter under circumstances far less desperate than those at Nahant, no good horti-

culturist has any doubt. Even the oak-tree has been proved by a well directed series of experiments, to be benefited by shelter in the comparatively mild climate of England. For the rationale of the evil effects of wind on plants in general, we must refer the reader to Lindley's "Theory and Practice of Horticulture." The following cases are detailed by Hoare:

"Many instances might be circumstantially detailed of the injurious effects of wind upon established vines during their summer's growth; two, however, of recent occurrence will perhaps suffice.

"On the eleventh of June, 1833, a strong wind sprang up early in the morning from the west, and increased in force till noon, when it blew quite a gale and continued to do so throughout the day. It slackened a little during the night, and gradually decreased in violence the next day, dying entirely away in the evening.

"The effects of this wind on a vine of the White Muscadine sort, trained on a wall having a western aspect, were carefully observed. It had on a full crop of fruit and a good supply of fine young bearing shoots, and was altogether in a most thriving condition. Such, however, were the injurious effects of the wind in dissipating all the accumulated secretions of the foliage, and then closing, almost hermetically, its pores, and thereby totally deranging the vital

functions of the plant, that although in the height of the growing season, not the slightest appearance of renewed vegetation could be discerned in any part of its leaves, shoots or fruit, until the third day of July, or twenty-two days afterward. It never produced another inch of good bearing wood throughout the remainder of the season, but lingered in a very weak and sickly condition; and the fruit which had been previously estimated at ninety pounds' weight, did not exceed fifty-five pounds when gathered, and that of a very inferior description in point of flavor and size of berry. Its leaves, also, having been thus crippled, were shed prematurely a month before their natural time, and hence the deficiency in the flavor and size of the grapes.

"The other instance, which happened shortly afterward, is still more decisive. On the 30th of August following, about eight o'clock in the evening, a strong wind began to blow from the southwest, accompanied with heavy rain. At nine it blew violently, and continued to do so until noon the next day. It then slackened, and then veering to the northwest, died away some time during the following night.

"The full force of this wind fell on a remarkably fine black Hamburg vine, trained on a wall having a southwestern aspect, and its effects were therefore proportionately destructive. Many of the principal

branches were torn so completely from their fastenings that their extremities swept the ground. The bunches of fruit were knocked about, and portions of them, as well as single berries, lay scattered on the ground in every direction. On the fruit, however, that survived the wreck, the effects of the wind were remarkable. It must be stated that the wall on which the vine is trained, is ten feet high, and is so situated that to the height of about three feet from the ground the wind had but little power over it, its force being broken by an outer wall standing at a little distance off in front of it. On the lower part of the wall so protected, the grapes not having been much injured, began to change their color and ripen about the twentieth of September, and on the twelfth of October every berry was perfectly matured, while all those that remained on the vine above three feet from the ground, were, on the first of November, as green and hard as on the thirtieth of August, when the high wind occurred. Shortly afterward these began to change their color, and ultimately ripened tolerably well by the first week in December. Thus, solely through the effects of a strong wind, there were to be seen at the same time, on the same branches of this vine, and within nine inches of each other, bunches of grapes, the lowermost of which were perfectly ripe, while the uppermost were quite

green and hard, and not within seven weeks of reaching the same state of maturity.

"These facts, which might be multiplied indefinitely, sufficiently show the injurious effects of strong winds, and the necessity of protecting vines as much as possible from their destructive consequences."

But although there can be no doubt as to the evil effects of wind storms, it must be borne in mind that ventilation, and even motion, are essential to the health and growth of the vine. Experiments made by Andrew Knight, show that young trees tied to stakes so as to prevent all motion, do not increase in size as much as those left to the free action of wind. Hence, perhaps, one reason why wire is to be preferred to wood for the cross slats of trellises. In the northern States, however, we in general have wind enough for all useful purposes. But in view of these facts, we would rest content with shelter outside of the vineyard, and unless in very exposed situations we would not deem it advisable to place either trees or fences amongst the vines.

But while we can guard against wind and storms by belts of woods or high fences, there are other influences which we cannot thus alter. Chiefly among these is the exposure of the sun's rays.

Exposure is, in general, derived from one or both of two causes. First, the inclination of the ground,

and, secondly, its openness and freedom from overshadowing influences. A wall is a good illustration of the latter—the north side having a northern exposure, and causing fruit planted against it to ripen at a much later period than that planted on the south side, which has a southern exposure. The little raised mounds or flower-beds, to be found in every garden, exhibit the influence exerted by the inclination of the earth—the vegetation on the south side being usually some days earlier than that on the north.

For vineyards, the best exposure is undoubtedly a southern one, slightly inclined toward the east, or at least fully protected from the west, and also from the early morning rays. "It has often been observed that woods or thick trees, buildings, high, broad fences, or steep hills, on the east side of peach orchards, protect the crop. Hence the erroneous opinion, that it is the east winds which do the damage. It is the sunshine upon the frozen buds which destroys them; hence a clouded sky, after a clear frosty night, by preventing sudden thawing, sometimes saves a crop. Covering trees of rare kinds with mats, to shade them from the morning sun, after an intensely frosty night, might sometimes be highly beneficial." (Thomas.)

In this connection, it may be proper to consider

the best direction for the trellises on which the vines are trained. We have often seen a north and south direction advised under the idea that the vines thus receive the sun's rays for a longer time. But the evils attached to this plan are great and insurmountable. In the first place, the vines receive the full force of the early morning sun which, striking the young leaves while still cold, and it may be partially frozen, is productive of the most injurious effects. Then as the day progresses toward noon, the vines are so shaded as not to receive the amount of heat, which they would gladly enjoy at that time, while toward evening again their excitability is greatly increased and is kept up until the last moment, instead of the exciting influence being quietly withdrawn as it ought to be.

But if we give our trellis a direction from east to west, instead of from north to south, the vines will expose but a small surface to the first rays of the sun which will thus warm them gradually, until it attains its meridian splendor, when it will exert its full power and then gradually decline until evening, when everything will gradually cool down. Sudden changes are thus avoided, and the full power of the sun is secured in the ripening of the grapes.

Intimately connected with the foregoing subjects, are the laws which regulate the influence of tempe-

rature upon vegetation. These are stated by M. De Candolle, as follows:

1. All other things being equal, the power of each plant and of each part of a plant, to resist extremes of temperature is in the inverse ratio of the quantity of water they contain.

2. The power of plants to resist extremes of temperature is directly in proportion to the viscidity of their fluids.

3. The power of plants to resist cold is in the inverse ratio of the rapidity with which their fluids circulate.

4. The liability to freeze, of the fluids contained in plants, is greater in proportion to the size of the cells.

5. The power of plants to resist extremes of temperature is in a direct proportion to the quantity of confined air which the structure of their organs give them the means of retaining in the more delicate parts.

6. The power of plants to resist extremes of temperature is in direct proportion to the capability which the roots possess of absorbing sap less exposed to the external influence of the atmosphere and the sun.

From this it will be obvious that all rank growth and succulent vegetation should be avoided where the desired object is to obtain hardy vines.

CHAPTER III.

PREPARATION OF THE SOIL AND FORMATION OF VINE BORDERS.

Having selected a proper site for a vineyard, the next step will be to prepare the soil for the reception of the young vines. It is rarely if ever that ground can be found in a condition fit to plant a vineyard without thorough and extensive improvements, and unless it be in proper order our hopes of success will end in failure and disappointment.

In our remarks on soil it was stated that one absolute necessity is a *dry* subsoil. No other good qualities can compensate for the want of this, and in most cases it is only to be obtained by thorough *draining.*

The first great evil obviated by thorough draining is the existence of stagnant water beneath the surface. It is a saying amongst vine-dressers that "the vine cannot bear wet feet." And nothing can be more true. If the roots be exposed to stagnant water they will become diseased and die off, thus giving rise to weak and ill-ripened though sometimes succu lent growth, and hence causing the vine to suffer from

the attacks of disease and insects. The grapes, too, will not ripen well, but will remain sour and ill-flavored.

M. Gasparin gives the following observations with regard to the influence which a dry or a moist soil exerts upon the grape: "Other things being equal, we obtain grapes which contain much sugar and little acid from vines grown in a dry soil; more free acid in a moist soil, and much acid, albumen and mucilage with little sugar in a soil which is absolutely wet."

Another advantage consists in the fact that well-drained land always possesses a higher temperature than that which is wet. This difference amounts to 10° to 12° Fah. and is accounted for by the rapid absorption of heat by the water as it becomes converted into vapor. During this process, too, it is probable that the nascent vapor robs the earth of a portion of the ammonia and gases which it would have separated from the water and retained if it had acted as a filter and the water had passed off by the drains. But however this may be, its effect on temperature is such that Johnson regards thorough draining as equal to a change of climate.

But not only does draining enable the soil to filter all the water which descends upon it, retaining its ammonia, gases and even salts; it is probable that by

these means the excrementitious matters discharged by plants, as well as other noxious bodies are washed out of the subsoil or decomposed by contact with the air which penetrates along with the water. In the case of oxide of iron it is probable that a very beneficial effect results from its conversion from the protoxide to the peroxide by means of this influence.

But a change in the chemical constitution and action of the soil is not the only effect of this operation; a no less marked alteration is produced in its mechanical character—heavy lands being rendered light, porous and permeable to the roots of tender plants.

It is unnecessary here to give minute directions for performing such a well-known operation, so we shall merely refer our readers to some of the numerous treatises on that subject. An excellent article on the theory and practice of draining will be found in the "Rural Annual" for 1859 published at the office of the "Genesee Farmer," Rochester, N. Y.

We may state, however, that in laying drains for a vineyard, it should be borne in mind that after the vines are planted it will be almost impossible to get at the drains in case of accident, without serious detriment to the plants. It will, therefore, be well to construct them in the most substantial manner and also to arrange them so that they will not lie imme-

diately under any of the rows of vines. If they are *between* the rows it will not be so difficult to get at them as if they lay directly beneath the plants.

The next great requisite in a soil for the culture of the vine is depth. Ordinary soils of from eight to ten inches are by no means deep enough. Twenty inches is the least depth to be relied upon, and, if very favorable results are desired, it should be made three feet. The subsoil to this depth should be thoroughly loosened, and, unless its quality is very inferior, it may be well to mix it with the surface soil—adding at the same time a good supply of manure or compost. We are aware that some horticulturists object to bringing up the subsoil, but we incline to the belief that if it is of such a character as to produce much injury, the site is unfit for a vineyard. When the subsoil is light (except it be pure sand) no harm can result. If it be pure sand, however, it had better remain where it is unless a sufficiency of clay can be found to mix with it. If, on the other hand, it be so clayey as to hermetically seal up the vine borders, we should prefer to let it remain under. But, if possible, a site should be selected where a good depth of tolerable soil may be obtained either naturally or by proper effort.

The advantages incident to depth in ordinary cases consist in the roots being placed alike beyond the

extreme heat of summer and the severe cold of winter. Consequently they do not suffer from drought, and are able at once to enter upon their duties in the spring.

For table grapes, we doubt whether the soil can be too deep or rich—not meaning by the latter term, however, saturated with *undecomposed* organic matter. But observation leads us to doubt the propriety of carrying these features to an extreme in the case of closely-trimmed vines cultivated for wine. It is true that the Western authors (Remelin, Buchannan, etc.—some of them Europeans) advocate this depth and richness. But, if our memory does not deceive us, some of Mr. Longworth's tenants who have not pursued the most thorough system of cultivation have occasionally escaped evils to which their more *skillful* and hard-working brethren have been exposed. And perhaps a solution of this mystery may be found above, notwithstanding Mr. Longworth naïvely tells us that he cannot believe that nature ever favors the indolent. Our own experience in this particular department is not sufficient to warrant us in pronouncing a decided opinion on the subject; but the principles of physiology would lead us to believe that if the roots of vines are planted in a deep and rich soil the branches must be allowed corresponding elbow room. If we desire to keep a vigorous

plant down we must starve and curtail its roots as well as use the pruning-knife on its branches.

There are two methods of deepening a soil, viz: by the subsoil plough and by trenching with the spade. Both these operations are too well known to require a minute description, though in regard to the latter there are so many and such contradictory directions given in books that we may be pardoned a few remarks in relation thereto.

In order properly to trench a piece of ground the directions given by Loudon are as explicit and judicious as possible. "Trenching is a mode of pulverizing and mixing the soil, or of pulverizing and changing its surface to a greater depth than can be done by the spade alone. For trenching with a view to pulverizing and changing the surface, a trench is formed like the furrow in digging, but two or more times wider and deeper; the plot or piece to be trenched is next marked off with the line into parallel strips of this width; and beginning at one of these, the operator digs or picks the surface stratum, and throws it in the bottom of the trench. Having completed with the shovel the removal of the surface stratum, a second, third or fourth, according to the depth of the soil and other circumstances, is removed in the same way; and thus, when the operation is completed, the position of the different strata is

exactly the reverse of what they were before. In trenching with a view to mixture and pulverization, all that is necessary is to open, at one corner of the plot, a trench or excavation of the desired depth, 3 or 4 feet broad, and 6 or 8 feet long. Then proceed to fill the excavation from one end by working out a similar one. In this way proceed across the piece to be trenched, and then return, and so on in parallel courses to the end of the plot, observing that the face or position of the moved soil in the trench must always be that of a slope, in order that whatever is thrown there may be mixed and not deposited in regular layers as in the other case. To effect this most completely, the operator should always stand in the bottom of the trench, and first picking down and mixing the materials, from the solid side, should next take them up with the shovel, and throw them on the slope or face of the moved soil, keeping a distinct space of two or three feet between them. For want of attention to this, in trenching new soils for gardens and plantations, it may be truly said that half the benefit derivable from the operation is lost."

A more expeditious method of mixing the soil, and one which varies but slightly from the ordinary system, consists in cutting down the bank in successive sections so as to produce theoretically a series of layers of soil and subsoil, but in reality a most inti-

mate mixture of the two. This is best accomplished by opening a very wide trench—say from four to six feet wide. Then throw the top spit off a bank of the same width into the bottom of the trench so as to insure the burial of all insects, seeds, and weeds; cut a width of from six to fifteen inches of the remaining portion of the bank completely down to the bottom, and spread the soil so obtained in a thin layer over the spit formerly thrown in. Then cut down another six to fifteen inches in the same manner, proceeding thus until the whole bank has been cut down and used to fill up the trench. It will now be found that, with the exception of the extreme top spit which is placed at the bottom for very good reasons, the whole soil is sufficiently mixed for all practical purposes.

Another mode of trenching—called bastard trenching—is thus described by a writer in the "Gardener's Chronicle:" "Open a trench two feet and a half, or a yard wide, one full spit and the shovelling deep, and wheel the soil from it to where it is intended to finish the piece; then put in the dung and dig it in with the bottom spit in the trench; then fill up this trench with the top spit, etc., of the second, treating it in like manner, and so on. The advantages of this plan of working the soil are, the good soil is retained at the top—an important consideration where the soil is poor or bad; the bottom soil is enriched and

loosened for the penetration and nourishment of the roots, and allowing them to descend deeper, they are not so liable to suffer from drought in summer; strong soil is rendered capable of absorbing more moisture, and yet remains drier at the surface by the water passing down more rapidly to the subsoil, and it insures a more thorough shifting of the soil."

A method which we have sometimes adopted, and which we think a saving of labor under some circumstances, is as follows:

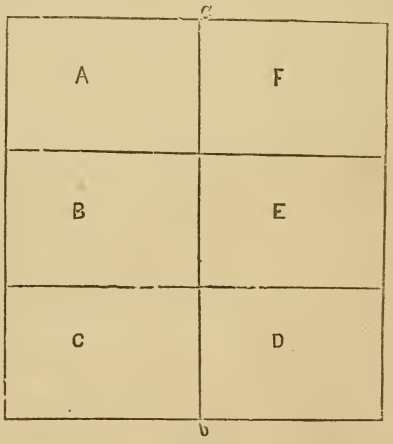

Fig. 1.

Let fig. 1. represent the plot of ground to be trenched. Divide it into two equal parts by the line *a b*, and instead of wheeling the soil out of A F to the rear of the plot, simply throw that from A out in front.

There can, of course, be no more difficulty in finding room for it there than there would be in obtaining a place for it in the rear. Then dig down the bank B, and with it fill the trench A. B is now a trench which may be filled from C; C may be filled from D; D from E; E from F; and the filling of F with the soil which was at first thrown out of A, will make all even. The wheeling of the soil, which is no inconsiderable item, is thus saved. It is evident, however, that this plan is adapted only to small, or at least narrow plots.

All the foregoing operations prove most beneficial when performed in the fall. At that time the soil should not be finely pulverized, but left in as rough a state as possible so as to expose it thoroughly to the action of the winter's frost and snow. It should be also well mixed with a good dressing of well decomposed stable manure, and any of those matters mentioned in Chapter XI.

By these means, the ground will be thoroughly enriched by spring, and will not consist of earth mixed with fermenting masses of manure, than which nothing can be more injurious to young plants. In the following spring the land should be raked or harrowed, so as to obtain a level surface of finely pulverized soil, and if it should be lightly forked over it would be none the worse for it.

Terraces.—From our directions for the selection of a vineyard site, it will be seen that we prefer a gentle slope to the south or southeast. If this slope does not exceed an angle of eight degrees, or a rise of one foot in seven, it will be unnecessary to adopt any peculiar system of arrangement. For a rise of one in four it will be necessary merely to make very slight terraces, the borders being made eight feet wide and half the descent being taken up by the slope given to them, will leave but twelve inches of a terrace, which may be easily secured by a row of sods, boards or stones, or even the earth beaten hard and kept carefully dressed up. But when the inclination of the ground much exceeds this amount, it becomes necessary to form regular terraces which is best done as follows:

Find out the actual slope or inclination of the ground, which is easily done by taking an eight-foot

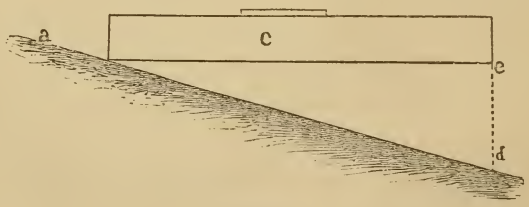

Fig. 2.

board, and after laying one edge on the ground and levelling the board, find the length of the perpendi-

cular which touches the surface beneath the other end. Thus *a d*, fig. 2, being the surface of the hill, and c the eight feet board with the level resting upon it, *e d*, will be the rise in eight feet and *e d*, less the slope given to the border will be the height of each step or terrace. Having found this, the next step is to cut a perpendicular face half the height of the proposed terrace at the foot of the hill and against it to build a wall as high as may be required. This is best formed of dry stone, though the bank is sometimes left with a good deal of slope, and sodded, the sods being pinned to the face of the bank with stakes until the roots have penetrated sufficiently to hold. The sods for this purpose should not be cut square, but diamond form, so that the face of the bank would present the appearance shown in fig. 3. But sods are

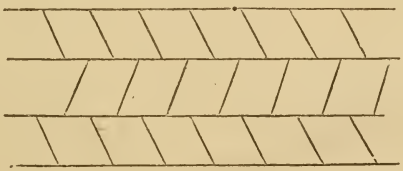

Fig. 3.

objectionable from the fact that they not only keep the air moist in the vicinity of the vines, but also abstract a good deal of nutriment from the soil, and unless kept neatly mown present a very bad appear-

ance. In default of good stone we think that sun-dried brick would make a very good wall. The earth of which they are made should be mixed with straw, well worked and made into blocks.

It is probable that in well-drained terraces such walls would last well if protected with a coping of boards or straw secured with good clay in the manner shown in fig. 4, so as to shed the rain.

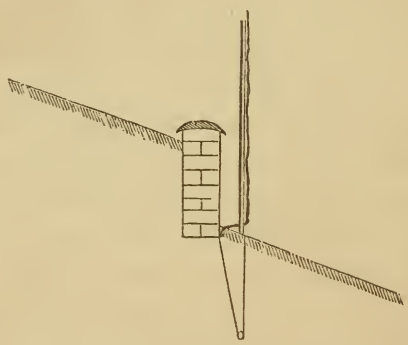

Figure 4.

Having built this wall, the next step is to fill up behind it, and level off a border of suitable width—say 6 or 8 feet. To do this it will be necessary to cut down a perpendicular face the same height as before, when another wall must be built, and the same process repeated.

A writer in the third volume of the "Gardener's Magazine" proposes to train the vines on trellises

lying on the surface of the slopes as shown in figure 5. Trained in this manner, grapes are said to have

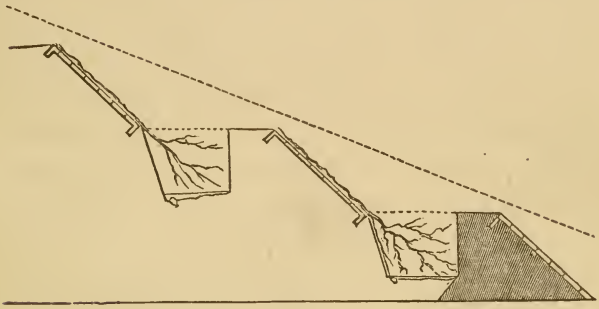

Figure 5.

ripened well in England. We would prefer the vertical trellis, however, and give the illustration, more to show what has been proposed than as an example to be followed. So many times have we seen it proposed to incline trellises and train vines horizontally, that we cannot refrain from quoting Lindley's remarks upon this point.

"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 but little comparative 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. To prevent this being one of the great objects of training trees, it is inconceivable how any one should have recommended such devices as those mentioned in the 'Horticultural Transactions,' 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 training to guard against."

All terraces should be well drained, and the drains are best arranged by having a series of cross drains parallel to the terrace, as seen in section fig. 4 and 5, and emptying into a main drain which descends the hill. These drains should be placed as in the figures, taking care to leave the ground under the wall solid and undisturbed. In forming terraces for vine culture it is necessary to exercise care and judgment, so as not to bury the good soil and leave the poor soil for the vines to grow in.

VINE BORDERS.—The formation of vine borders in gardens is a subject upon which the student will find no lack of information, almost every successful gardener attributing the superiority of his grapes to some peculiarity in the construction of his borders, and innumerable have been the paper conflicts waged between the advocates of carrion, asphalte, ventilated borders, etc., etc., and their opponents. The "carrion" controversy has probably caused the shedding of more ink than any of the others, the ultraists on both sides being probably in the wrong. But, after all, we regard the construction of proper vine borders as no very difficult affair, and shall first give our own views in the matter and afterward quote those of other authors.

Of course in borders, as in other cases, it is necessary that the bottom be as dry as possible. This being provided for, if the soil is a light mellow garden mold, we would rest content with trenching it thoroughly, and adding liberal supplies of litter, well decomposed manure, woollen rags, and especially bones;* and if in the bottom of each trench a good

* In the ordinary course of agriculture, where "quick returns," if not "small profits" are an important element of success, bones when used as manure cannot be too thoroughly pulverized. Indeed, it is often profitable to reduce them to the most active form—that of a solution—by means of acids. But for reasons to be hereafter stated one

layer of brickbats, lime rubbish, and oyster shells be laid, it will prove an advantage. A border prepared in this simple manner will give good satisfaction under any circumstances.

If the soil be heavy we would also make liberal additions of sandy loam or saw-dust.

But if the location of the border is such that it cannot be well drained, we would remove all the soil to the depth of 18 inches over the entire extent of the border and fill up at least 12 inches of the space with stones, brickbats, etc. Over this we would spread a thin layer of straw or brush, and after building a wall round the border 18 to 30 inches high, we would fill in with a rich soil resembling in composition, that described above. The earth on the outside might be banked up to the wall, and either sodded, or merely beaten solid.

In all such cases, it is evident that from the narrow limits to which we are in general confined, the soil ought to be of the richest kind; and as it is nearly impossible to renew it after the vines are once started, this richness should be derived from materials calcu-

great advantage to be derived from the use of bones in vine borders is the length of time during which they continue to act, and, therefore, the largest and most solid should be selected and used without being crushed or broken. This is no argument, however, against the *additional* use of bone dust.

land to give more than a mere temporary impetus to the plants. The nature and action of manures will form the subject of a future chapter, but we may here state that bones, hair, woollen rags, leather clippings and similar matters are by far the most suitable. For the purpose of giving porosity to the soil, as well as furnishing nutriment to the plants, nothing will be found to equal chopped straw. Chaff, or sawdust comes next in order, and from experiments which we have made on the subject, we do not think the value of the latter is half appreciated. To dead animals, either whole or divided, we have never found any objection, provided they were not placed in direct contact with the roots of the plant. No danger is to be apprehended of the vine seeking them to its own detriment. But this more properly pertains to the subject of manures. We will now give the manner in which the most celebrated grape growers construct their borders.

Miller (1759) recommends good mellow soil without any addition.

Speechly (1790) states in his work: "As the vines in the hot-house at Welbeck have been remarkably fruitful and vigorous, I shall beg leave to recommend the same kind of compost mold which I make use of there, viz. one-fourth part of garden mold, (a strong loam); one-fourth of the sward or turf from

a pasture where the soil is a sandy loam; one-fourth of the sweepings and scrapings of pavements and hard roads; one-eighth of rotten cow and stable yard dung mixed; and one-eighth of vegetable mold from reduced and decayed oak leaves. These are the several and respective proportions. The sward should be laid in a heap till the grass roots are in a state of decay, and then turned over and broken with a spade; let it then be put to the other materials, and the whole worked together, till the separate parts become well and uniformly mixed and incorporated.

As the vegetable mold from decayed leaves cannot always be obtained, by reason that the leaves require two years before they become sufficiently putrid and reduced, it therefore may sometimes be necessary to substitute some other ingredient in lieu of this part of the compost; wherefore it may not be inexpedient to point out the proper succedanea.

Rotten wood reduced to a fine mold, such as is often found under fagot stacks; the scraping of the ground in old woods, where the trees grow thick together; mold out of hollow trees, and sawdust reduced to a fine mold, provided it be not from wood of a resinous kind, are in part of a similar nature with vegetable mold from decayed leaves, but are neither so rich nor so powerful, because the vegetable mold receives a power by its fermentation.

Abercrombie directs the top slip of sandy loam from an upland pasture, one-third part; unexhausted brown loam from a garden, one-fourth part; scrapings of roads free from clay, one-sixth part; vegetable mold or old tan, or rotten stable dung, one-eighth part; shell marl, or mild lime, one-twelfth part. His borders he recommends to be from three to five feet in depth, and where practicable, not less than four feet wide within the house, and not less than ten feet wide without.

The vine borders at Wishaw House, Lanarkshire, in a cold and wet locality, are thus formed: Breadth, 12 feet, depth of soil 18 inches, under which is laid a foot of hard clinkers, by way of drainage. The soil used is that natural to the garden, which had for years been under pasture, and is a remarkably strong, rich brick-clayey loam, with no other preparation than the addition of a moderate supply of stable manure. In this soil the best grapes ever produced in Scotland have been grown for the last three years.

A writer in the "Gardener's Chronicle" (1843, page 825) prepares his borders thus: The soil most suitable for a vine border is the surface spit from a field of an old fertile loam pasture; this should be collected some time before it is required, mixed with a good proportion of cow dung, and the whole turned over at intervals, three or four times, and exposed to the

action of the weather. In preparing the border, the old earth should be cleared away from the whole space, to the depth of about two and a half feet, and a main drain cut parallel with the length of the border, at its extreme outer edge.

This should be at least two feet lower than the bottom of the border, whether laid with concrete, chalk or bricks, and the bottom of the border should have a gentle inclination from the back to the drain. To render this drainage more effectual, cut small drains, placing drain tiles at their bottoms, at convenient distances, to run in a slanting direction from the back of the border into the main drain, the latter being six inches below them. A few turfs should be laid over the tile drains with the grassy side down; the fresh soil may then be filled in, taking care to keep the roughest part near the bottom.

Three cubic yards of compost are enough for each vine; this will admit of the border being ten feet wide, or with forty-eight cubic feet, you may form it only six feet wide in the first instance, and add six feet more as the vines extend.

Roberts, the great advocate for carrion, gives the following description of his border: "The compost and manures I most recommend, and which I made use of, are two parts the parings of a piece of old pasture land, a strong loam laid up one year (or till

the sward is half decomposed), in the form of a potato hod, close covered in with soil, and never turned; one part, the turf with four inches of the soil, of a looser texture laid up for the same period, and not turned, as before; an eighth part scrapings of the highways formed from limestone, or other hard material; and the other eighth part, half decomposed horse or cow dung. I am not an advocate for turning over and mixing the materials promiscuously together; as, by often turning, the compost becomes too solid, losing a great portion of its fertilizing property by such repeated intermixture; and unless it be of a very sandy, loose texture, the border will, in a few years, become impervious both to water and to atmospheric air, which are of incalculable benefit to the growth of the vine. I would recommend the autumn, if the weather be dry, to prepare to fill in your border.

"A month previous to filling your border, provide a quantity of carrion, cattle dying by accident, disease, etc., which I am sorry to say, has, of late years, been too common an occurrence. If you have collected it some time before hand, have it cut into small pieces and laid up in soil till the time of using. It emits a very nauseous effluvia, but this must be borne, for this is the *pabulum* to produce the nectar of Bacchus. When all is ready, and the weather favorable, proceed at one end of your border, wheeling in

and mixing the materials in proportion as they stand to each other in my previous directions, on no account breaking the materials in mixing, but turn them in as rough as possible, adding one good sized horse or cow carcass to every ten or twelve square yards, using caution, and not bringing it to the surface of the border within one foot as its assistance is not wanted the first year. What I have here recommended is my practice adopted at this place, the result of which, I dare presume to say, has surprised all, both gentlemen and practical gardeners, who have witnessed it."

Fiske Allen, one of the best American culturists of the vine under glass, constructs his borders thus:

"If the soil is very poor, or unsuitable for the purpose, so as to require to be removed entirely, then a compost prepared thus is recommended; one-half to be the top soil of an old pasture, one-quarter to be bone, or some other strong manure; one-eighth oyster shells, or lime and brick rubbish; one-eighth rotten manure; these articles thrown together in a heap, and so to remain until decomposed and amalgamated, when they should be placed in the border and thrown loosely together. My borders having the most slaughter-house manure, or whole bones of animals in their composition still continue, as they ever have done, to produce the best fruit and the largest crops.

"It is unnecessary to attempt to give rules for every kind of soil. One must use his own judgment, and make his border to consist, as near as can be, of the above ingredients. He must bear in mind that, if his soil is a stiff clayey loam, he must add freely of such materials as will lighten and give permeability to it. If the soil is light, sandy or gravelly, with the manure should be added a proportion of clay or clayey loam. The rich alluvion soil, abounding in our western and southwestern States, will not require any of these strong manures. If anything is requisite to improve them, it must be shells, charcoal, leaves, small stones, or gravel—such materials as will loosen the soil."

But that the reader may not be discouraged by these extravagant demands we quote the following from Hoare:

"But if vines could not be planted with any prospect of success in any other situations than in borders set apart for that purpose, but a very small quantity of grapes could be grown, compared with what the country is capable of producing. Innumerable instances occur throughout the country, and especially in towns and their suburban districts, in which walls, cottages, houses, and various descriptions of brick and stone erections present very favorable aspects for the training of vines, but which neverthe-

less are so situated locally, as to possess little or no soil at all on the surface adjoining their sites; the ground being either paved with bricks or stone, or perhaps trodden so hard, as to be apparently incapable of yielding sustenance to any vegetable production.

"In all such cases, however, if the ground adjoining the site of the wall or building be opened to the extent of eighteen inches square, and as many deep, it will be sufficient to admit the roots of a young vine, which must be pruned to suit that space. If a wider and deeper space can be made, it will of course be better; but if not, that will do. After the sides and bottom have been loosened as much as possible, the vine may be planted and the hole filled up with two-thirds of rich loamy earth, and one-third of road scrapings, previously mixed well together, and if necessary the surface covering, whether of stone, brick, or otherwise, may be restored again to its former state, provided a space about six inches square be left open for the stem to swell in during its future growth. Vines planted in such situations, will in general do well, although their growth will not be so rapid as when planted under more favorable circumstances.

"In all cases where vines are planted against any description of buildings, their roots push as soon as possible under the foundations, being attracted thither by the warm air which is there generated; and

such situations being also dry, from the excavations which have been made, offer to the roots the same protection from excessive moisture, as the substratum of a well-prepared border. The same may be observed of vines planted against walls, the foundations of which possess similar advantages, although in a more limited degree. Hence the fact may be inferred that vines planted in such situations, without any previous preparation of the soil, will frequently grow as luxuriantly, and produce as fine grapes as those planted in rich and well-prepared borders.

"Indeed, it is hardly possible to plant a vine in any situation in which it will not thrive, provided its roots can by any means push themselves into a dry place, and the aspect be such as to afford to its branches a sufficient portion of the sun's rays to elaborate the juices of the plant.

"The truth is, that the roots of the vine possess an extraordinary power of adapting themselves to any situation in which they may be planted, provided it be a dry one.

"They will ramble in every direction in search of food, and extract nourishment from sources apparently the most barren. In short, they are the best caterers that can possibly be imagined, for they will grow, and even thrive luxuriantly, where almost every description of plant or tree would inevitably starve."

CHAPTER IV.

PLANTING.

Proper Age of Vines for Planting.—Where young vines have been raised from cuttings, in the open ground, two years old probably is the best age to select for planting out. Plants one year from the cutting have rarely made sufficient roots to bear transplanting well, and at a greater age than two years the roots are so long that they generally receive much mutilation in taking up—thus losing their most fibrous and valuable part, viz., that at the extremities. Of course older vines, carefully taken up and as carefully planted, will come into bearing in shorter time than younger plants, and thus give more satisfactory results where expense is no objection. But where a large number of vines are to be set out, two-year old plants, as above stated, or one-year old plants raised from eyes in the spring, and grown all summer in the open air, have decided advantages on the score both of economy and ease of planting. Indeed, we should prefer plain cuttings, planted two to each stake, to one-year old vines raised from cut-

tings in the open ground. Plants raised from eyes in pots, early in spring, and transferred in summer to their final location, do very well.

Proper Season for Planting.—The proper season for planting depends much upon local circumstances —soil and climate being chiefly to be considered. In a few instances, were the soil is light and the climate mild, it may do to risk fall planting, but under all ordinary circumstances we should advise this operation to be deferred till pretty late in the spring, and this advice is founded upon the uniformly favorable results which have attended this plan in our own experience, as opposed to frequent want of success at other times. Plants set out even early in the fall rarely outstrip those planted in the following spring, and when autumn planting is delayed much beyond the fall of the leaf, the plants frequently fail if the winters are severe.

The reason of this probably depends upon the fact that the roots of all plants when vegetation is active, are enabled to resist adverse influences which would prove fatal to them when dormant. Thus the vine when growing will revel in a degree of moisture which would destroy it, or at least prove very injurious during the winter months. Now the roots of all trees are more or less injured by transplanting, and

incipient decay is apt to supervene unless the vitality of the plant is sufficient to withstand it. If this should occur when the plant is dormant, there is no influence at work to resist the evil. But if such injuries should be inflicted in spring, when vegetation is just commencing, they are quickly and readily repaired.

With care vines may be transplanted even when their leaves are well developed; but under such circumstances the vine, from its great evaporative powers, makes a heavy draft upon the roots and is rather impatient of removal after vegetation has made some progress. We have had the best success, however, when the plant was set out so late in the spring that the buds were starting, but just before they were fully burst. About this time the soil is getting gradually warmer, and although it does not reach a sufficiently high temperature to induce the formation of roots in cuttings before June or July, still it is warm enough to allow of the healthy action of the roots in a growing plant.

In the above cases the vines were set out immediately after being dug up. Where it is necessary to transport them any distance, it would undoubtedly be better to take them up earlier, before the sap begins to move. They need not be planted for some time, but may be merely *heeled in*, as it is called,

that is, placed in a shallow trench and well covered with dry soil. A covering of straw or leaves in addition will do no harm if the mice do not make it a harbor.

Distance Apart.—The distance apart at which vines should be planted will, of course, depend not only upon the variety, but upon the object for which they are set out. In Europe they are placed at all distances from 30 inches to 30 feet. In the Ohio vineyards, where they are usually fastened to stakes, the plants are placed about four or five feet apart; but in the northern States, where vines are trained upon trellises, we should prefer to set them out in rows 6 feet apart, and the vines standing 7 or 8 feet apart in the rows. This distance enables us to keep the vines close enough and short enough for all practical purposes, while it does not require more time to cover the trellis than is absolutely necessary to bring the vine into proper order for bearing. The rows are also sufficiently far apart to allow of horse labor being used—a considerable saving being thus effected.

The number of vines required to plant an acre will be seen from the following table, which has often been published, but which it may be well to insert here.

		PLANTS TO THE ACRE.			PLANTS TO THE ACRE.
3 × 3	requires	4,840	8 × 7	requires	788
4 × 3	"	3,630	8 × 8	"	680
4 × 4	"	2,722	9 × 7	"	691
5 × 4	"	2,178	9 × 8	"	605
5 × 5	"	1,742	9 × 9	"	537
6 × 5	"	1,452	10 × 7	"	622
6 × 6	"	1,210	10 × 8	"	544
7 × 6	"	1,023	10 × 9	"	484
7 × 7	"	888	10 × 10	"	435

Marking off the Ground.—Where vines are set out at from 4 to 6 feet apart and trained to stakes, the following directions, taken from the "American Philosophical Transactions," and frequently quoted (generally without credit), are as good as any:

"Your squares being laid out, and having concluded how far your vines shall stand every way from one another, in which every man is to please himself, you stretch a line of proper length, and stitch small pieces of red, blue, green, or any other colored cloth, at such distance from each other as you mean to plant the vines. I will suppose 8 feet, because upon the most mature deliberation, I think that the best distance for vines to stand in this country, as I shall afterward show more fully. The line being ready, stretch it along the head or upper part

of your square, so that a rag appears at each corner, drive down a stake at every rag. This done, move your line down to the lower side of the square, which is opposite to the first, and stretch your line along that, having a rag at each corner, and drive down a stake at every rag. Then turn your line the other way up and down, and fasten your line to the upper and lower outside stakes, so that a rag be at each stake, and drive down a stake at every rag, and so on from stake to stake, till the whole be completed. If you have been careful not to disturb or move the line, when you drove down the stakes, and have driven them all on the same side of the line, your square will be uniform, and the stakes near the ground will range exactly every way."

Where the vines are trained to trellises, it is not essential that they should be straight both ways as when tied to stakes, it being necessary that the trellises be parallel and equi-distant only.

To make them so, a very good plan is as follows: Prepare a rod, fig. 6, a few inches more than twenty feet long, and having a small hole (*a*) bored through one end, then bore a similar hole (*c*) twelve feet from the first; one (*b*), 16 feet from the first; and one (*d*) 20 feet from the first. Having decided upon the direction of the first row and divided it into spaces corresponding to the distance the plants are to

stand from each other, drive in stakes A A at each end, and measuring off 16 feet, drive in other two, B B. The heads of these should be made level with

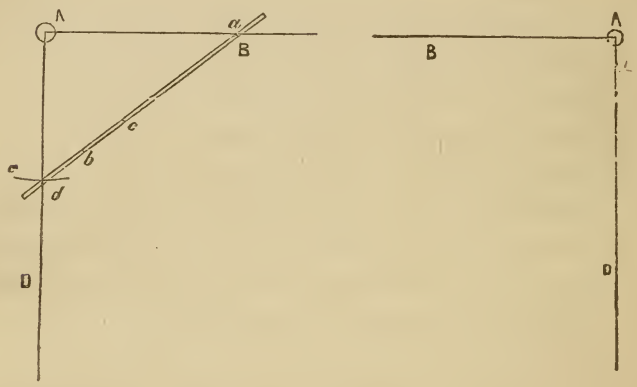

Fig. 6.

the surface of the ground, and headless nails should then be driven into them—the two nails (A and B) at each end being exactly 16 feet apart. Now place the rod on one of the outside stakes, so that the nail will pass through the first hole (*a*) and drive a peg into the hole in the rod 12 feet from the end. With this peg mark a curve (*e*), and then placing the end (*a*) of the rod on the stake B, mark another curve (*d*) crossing the first by means of a pin passing through the hole (*d*). A line (A D), drawn from A through the crossing of these curves will be perfectly square with the

first row. Divide the lines (A D) into spaces equal to the width of the rows, and the lines joining the corresponding divisions will be the proper lines of the trellises.

As many stakes or poles, 6 or 8 feet long, should be provided as there are vines, and these should be set at the points where the vines are to be placed before the holes are dug. These stakes will serve during the first two years and will save the tear and wear of trellises as well as the interest on the investment, besides relieving some of the hurry incident to the work of the first spring, which is always more pressing than that of any succeeding one.

Digging the Holes.—In digging the holes it will be well to take up the stakes one at a time, and after digging the hole to replace the stake, driving it slightly into the soil at the bottom. By so doing the centres of the holes, or at least the points where the stems of the vines should come, will be easily kept, whereas if all the stakes were removed before digging the holes, it would be troublesome to get them exactly right again. The insertion of the stake, before planting the vine, not only aids us in this, but prevents the possibility of injuring the roots by driving a sharp stake through them, a thing which is often done. The holes should be dug from 12 to 24

inches deep and about 3 feet in diameter, or as wide as the distance to which the roots extend.

Taking up the Plants.—When plants are purchased, this operation is generally left to the nurseryman who not unfrequently commits it to men who care very little *how* it is done so that they get the plants out of the ground. But when we reflect that a small amount of care in taking up a plant will often cause a difference of a year or more in its subsequent growth, it will be evident that the labor, time and consequent interest on capital which will be ultimately saved by devoting a little attention to this matter will more than pay for the few extra minutes required.

In taking up a vine, or any plant, it is well to remember that the most efficient portion of the roots is that which lies at the extreme ends—those minute fibres or spongioles which have been aptly termed the mouths of the plant. In old vines, where the roots extend to a great distance, these fibres are generally left in the soil, and the plant presents but a few smooth, fibreless, cord-like roots from which spongioles must be emitted ere the plant can derive any nourishment from them.

But in young plants the roots have not yet extended so far as to prevent their being easily taken up

without any great loss, and here we have one reason why we prefer young plants to old ones. A consideration of this fact will also lead us to follow out each root to its termination and so secure all the fibres possible. Where the plants have been started in sandy, friable soil this is not a laborious task, but where the soil is clayey and plastic, it is often a work of considerable difficulty.

In any case, however, the purchaser should see that the roots are taken up as completely and entirely as possible, and it will also be well to prune all that are bruised, broken, or diseased—taking such injured parts off with a clean cut. As these injuries can never be so well seen, or so well remedied as when the plant is newly taken up, this is the best time to attend to them; and this forms another reason why the purchaser should, if possible, give this matter his personal supervision. They should then be dipped in puddle made of good garden soil, stirred up with water; clay is frequently used for this purpose, and so is cow dung, but very injudiciously. The former is too tough and hard and prevents the formation of young roots, while the latter (as it is commonly used) is caustic and destructive to the tender fibres. We have tried all three substances and are confident that nothing will be found equal to good common soil.

If the nursery in which the plants have been raised

is on the same premises as the vineyard, the vines may be either rolled up in coarse sacking, or, a few being taken up at a time, they may be plunged in a pail or tub filled with puddle. But if they are to be sent to a distance, they should be packed in damp (not moist) moss (sphagnum) or good clean straw, and either made into light bundles or firmly packed in boxes.

The vines having been carefully taken up and the holes properly prepared to receive them, the next step is to set them out, and in doing this the following points require special attention:

1. That the roots be disposed in their new location as nearly as possible in the same position that they occupied before their removal.

2. That some fine, friable, mellow mold be placed in immediate contact with the roots.

3. That no fresh manure or decomposing organic matter be allowed to come in direct contact with the plant under any circumstances whatever.

4. That the soil be firmly packed about the roots, no air spaces being left. In doing this, however, do not tread down the plant with your whole weight, as you will thus be very apt to tear off some of the roots, but work the soil in with your hand or a pointed stick.

In general it will be well to insert the plants a little deeper in the soil than they were previously,

as, owing to the mutilation which of necessity takes place, a greater draught is made upon the roots for moisture than they can support when thus shortened, if they are placed near the surface. But this point requires the exercise of discretion, and a good substitute for deeper planting will be thorough mulching.

As roots always spring from a bud or joint, and rarely from the internode or portion between the buds, the mode of propagation by which the plant has been produced will exert considerable influence upon the *modus operandi* of setting it out.

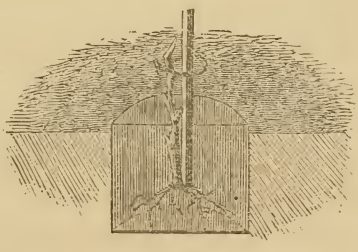

Fig. 7.

In fig. 7 is shown the proper disposition of the roots of a young plant raised from a seed or from a single eye. In this case the roots all proceed from within a short distance of each other and from the base of the stem. In setting out such a plant, the better plan is to throw a shovelful or two of fine

mold on the bottom of the hole, so as to form a conical heap, the top of which should be just at a suitable height to support the base of the stem in its proper position. Then, having placed the plant on the top of this little mound, spread out all the roots equally and naturally over its side and fill in with pulverized soil, being careful to pack the soil firmly around the roots, yet still leaving it mellow and porous.

The soil ought to be raised some inches above the surrounding ground, the amount depending upon the size and depth of the hole dug. All filling-in is apt to sink, and unless this is done, the plant may be found after a few weeks to be too low. Some, however, prefer to have the plant set in a hollow, claiming that a basin is thus formed which catches and retains the rain. We would rather rely upon good mulching for obtaining the requisite amount of moisture, but if this is dispensed with, and recourse had to the former plan, we should prefer to have the hollow or basin in the form of a ring around the edge of the hole, leaving the stem surrounded with a little mound which will shed the rain. The stem is thus kept dry, and the moisture is guided just where it is wanted, viz.: to the extremity of the roots. Figure 8 gives a sectional view of the soil so arranged.

When vines have been raised from cuttings con

Fig. 8.

sisting of several eyes or joints, there will in general be several layers of roots—the plants having the appearance shown in Fig. 9.

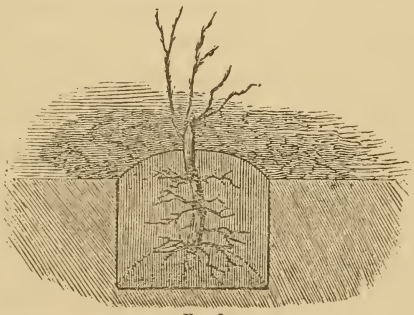

Fig. 9.

In this case it will be necessary to proceed as directed for plants from eyes in so far as the lower layer of roots is concerned—the upper layers being held up while this is done. After the first layer has been properly covered, the next layer is laid on the surface of the soil which covers the lower layer, and after being properly disposed are covered in turn,

which process is repeated until all the roots are imbedded in the soil.

Plants raised from layers in general demand a treatment peculiar to themselves. If they have been produced as in Fig. 44, page 176, they will, of course, be set out in the main as shown in Fig. 7. But if they have been raised in the open ground, and the roots have been produced from several joints or buds, it will be found that while the roots are not disposed in regularly-ascending layers, yet that some are lower than others—the whole, however, in general lying in one plane which is greatly inclined to the surface of the earth. For such plants it will in general be best to dig a trench or oblong hole, and instead of raising a heap in the centre to lay the soil in the bottom, so as to form a regularly inclined bed. The plant being placed on this bed of fine soil, the roots are all arranged over it at once and covered in without further trouble.

In all these cases it will, of course, be necessary that the stem of the plant be placed sufficiently near to the stake which has been inserted in the hole to allow of its being tied thereto without much bending or wrenching, and if the weather be dry it will be necessary to give the plants a good watering at the time they are set out.

When plants are received in pots—having been

grown therein from eyes or grafts—it is always best after taking them out to remove a considerable portion of the soil, and spread out the roots. This is necessary from the fact that the roots of plants grown in pots form a series of spirals round the outside of the ball (between the earth and the pot), and if set out in the ground just as they are taken from the pot, it requires a long time before the roots change this habit and acquire a proper direction and healthy condition. The plants should be well watered before being taken from the pots, and they should be set in fine, loose soil, being exposed to the air as little as possible. After planting, it will, of course, be well to be liberal with water, and liquid manure used in a very diluted state will prove highly beneficial *after the first week.*

Plants for setting out are usually obtained in pots in June, July, or the beginning of August, and as it frequently happens that at that time the earth and air are so dry as to endanger the life of a young vine, if treated as just directed, we have sometimes found it advisable after receiving them from the nursery to set out the pots (without removing the plants) in the open ground, plunging them about two inches below the surface of the soil, and leaving them there until a few rainy days occur, when the pots are taken up and the plants removed and properly set out.

CHAPTER V.

CARE OF THE VINES DURING THE FIRST, SECOND AND THIRD YEARS.

The roots of the vine having been properly cared for, the branches may now be pruned. Unless where very large and well-rooted vines have been planted expressly for immediate bearing, all the secondary shoots should be cut away and the main stem shortened to an extent depending upon its character.

As usually received from the nursery, one or two year old plants, if raised from cuttings, consist of a short stem two to six inches long, one or two shoots and a large quantity of spray or small twigs, consisting of the laterals of last year. If raised from eyes, there will in general be but one shoot, with perhaps a few laterals. Under any, circumstances the plants ought to be cut back at planting to two good eyes, and as soon as they have made a few leaves, cut off the upper one as close as possible to the one left, taking care, however, not to injure the base of the remaining shoot, which ought to be kept tied up to the stake

as fast as it shows symptoms of leaning over.* The

Fig. 10.

base of the shoot which is retained (that is, the point

* It is recommended by some respectable authorities, to allow the young plants to remain untied during the first year, urging as a reason that more vigorous stems will thus be obtained. But, although the experiments of Knight have proved the advantage of bending and motion to most young trees, yet the vine naturally seeks support from surrounding objects, and will in most cases, receive more injury from dirt, and abrasion by being blown about and rubbing upon the ground than will balance the good derived from the motion imparted.

But as we may observe that the vine is adapted to cling, not to the thick and stout bodies of trees, but to slender branches, it is obvious that nature provides fully for sustaining the plant beyond the reach of injury, without interfering with the action of the wind in producing motion. Hence, in the construction of trellises and the choice of stakes, it will be well to select flexible material, always provided it is strong enough to avoid all danger of being blown down; stout rods or poles are therefore to be preferred to sawed lumber, and we may add they are also cheaper. From the above facts we may also gather the reason why wires are to be preferred to wooden slats in the construction of trellises.

at which it springs from the old wood) should be as low down as possible—if even with the surface of the ground, so much the better.

A plant such as we have described, is shown in Fig. 10 as it is usually received from the nursery. The same plant properly pruned is shown in Fig. 11.

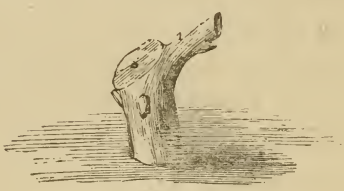

Fig. 11.

Many are afraid to cut back so severely, but it is the only true method.

The object of leaving two eyes at first, is merely to guard against accidents. If we could be insured against them, the upper one would be better away. Little else can be done during the first year than to keep the ground mellow, loose about the plants and free from weeds. The vine must also be tied up during the season, and if a little liquid manure could be applied to them while growing, it would prove of great benefit. In applying this stimulant, it is necessary to use it in a very diluted state, and if possible, just before or during wet weather. When applied during very dry weather remove the surface soil to a depth

of three or four inches, and give at least a pailful to each plant, working the soil as little as possible, lest it be converted into puddle. Such an application will last for ten days during even very dry weather, and will do more good than frequent sprinkling.

Mulching.—But if abundance of grassy weeds, litter, stable manure, or similar matters can be obtained, the best plan is to mulch the plants deeply for at least three feet every way from the stem. Of this process, A. J. Downing says: "Covering the soil in summer is, in this country, one of the most valuable aids to good cultivation ever put in practice. The best mode of doing this is, by what is technically called *mulching*. This consists in spreading over the surface of the ground, so far as the roots of the tree or plant extend beneath it, a layer of tan bark, saw dust, barn yard litter, straw, salt hay, sea weed, or the like, of sufficient thickness to maintain, as nearly as possible, a uniform state of temperature and moisture for the roots. From an experience of some years, we do not hesitate to say that mulching the surface of the ground over newly-planted trees, is not only far better than any after-watering, but that, if the layer is thick enough to keep the surface cool, it renders water wholly unnecessary. In the case of bearing fruit-trees, especially the more delicate kinds, as dwarf pears, apricots, etc., mulching not only precludes the

necessity of stirring the soil, by preventing weeds from growing, but it conduces so much more to the health of the tree, and the size and excellence of the fruit than any other practice in horticulture, that the more intelligent growers in the United States now consider it indispensable in this climate."

In addition to these lucid directions, we would only say that before applying mulch of any kind to a young vine it will always be advisable to raise the soil around the stem to the depth to which it is intended to lay the mulch, so as to prevent any of the latter from coming in contact with the plant, as in this case it might be productive of evil.

The annexed figure, 12, where the mulch is seen on the surface of the soil, will illustrate our meaning.

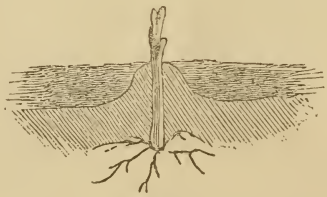

Fig. 12.

LATERALS* are small shoots which spring from the axils of the leaves (the point which they join the

* To these the French have given the name *stipulaires*, and it seems to us that *stipularies* would be quite as good a term as laterals, and more correct.

shoot). As these laterals absorb much of the nutriment which would otherwise go to the increase of the stem, they should be carefully pinched out after they have made one or two leaves. If removed before they have made some growth, the bud at their base is very apt to *push*, as it is called (that is, to grow), which should be avoided, if possible.

Fig. 13 shows a young shoot of the current year with a lateral (B) springing from the base of the leaf L. This lateral should be pinched off at the cross line.

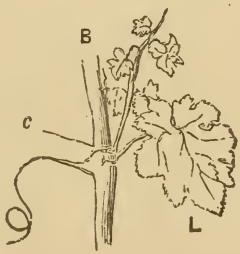

Fig. 13.

If removed entirely or too soon the bud (C) will be apt to push, and destroy our prospects for next season.

Winter Protection of young Vines.—At the close of the season, the vines may either be bent down and covered with earth in the manner usually adopted for covering raspberries, or they may be left upright, and tied to the stakes, a mound of earth

being raised up around each such mound, being at least 18 inches high. The soil of which it is made should be taken from the centre of the rows, as, if we take it from about the plants, we only cover the stem to expose the roots.

Where the vines are left tied to the stakes, we prefer to leaving them unpruned. True, most of the wood gets killed, but this is of little moment since it is to be nearly all cut away at the spring pruning.

Management during the Second Year.—As soon as the severe frosts of winter and early spring have passed away, uncover the young vines, and if not already pruned, cut them to a good bud within 9 to 14 inches of the ground. They should be shaded for a few days from the sun and cold, which may be very well done by sticking a shingle before each, though two shingles placed so as to form an angle in which the vine may stand, will be better. We have now arrived at a point where it will be necessary to decide upon the peculiar system to be adopted in the training of our vines. Instead, however, of describing all the different modes of pruning and training in this place, we shall give only that which we consider best adapted to the native American varieties and leave the consideration of the others to the chapter on general pruning and training.

If the plants have made but a weakly, stunted growth, it will be necessary to allow them another year before proceeding to grow shoots for permanent arms or branches. In this case but one shoot should be trained up, which may be treated precisely as directed for the first year. But if a cane of from 6 to 12 feet has been produced, we may safely proceed to train up two canes which will serve for the future arms of our vine. To do this, after cutting down the first year's shoot as directed, remove all the buds except the three uppermost, and as soon as these are beyond danger of accident, rub off one if three

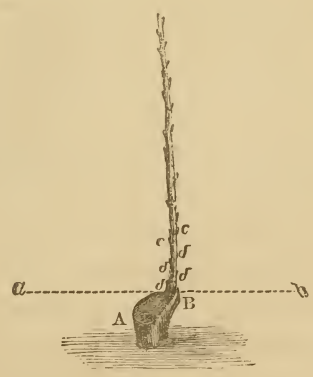

Fig. 14.

should still remain. The two shoots which are left must be carefully trained up, the laterals being

pinched out and any fruit blossoms which may appear being removed.

The operations of the second year will be readily understood from the inspection of Fig. 14, which shows the young vine as it should appear at the close of the first season. Here *a* is the wood of the old cutting, with *b*, the shoot which was cut back and from which the young cane *c d* grew. As this old wood is hard and cross-grained and *cannot* be renewed, it will be well to add top dressing, sufficient to cover it up to the line *a b*. The buds, *c c*, are those which produce next year's shoots; and the buds at *d d* must be carefully removed.

The ground should be kept clean and mellow during the season, and by the first or middle of September the further growth of the canes should be stopped by pinching off the ends—the wood being much more thoroughly ripened when this is done.

It will be necessary, or at least advisable, to lay the vines down this season also and protect, not only the old stem, but at least four feet of the young shoots. The stakes may be removed, and during the fall or early spring the trellises may be erected, for which full directions are given in Chapter IX.

MANAGEMENT DURING THE THIRD SEASON.—The tre-

lises having been constructed in such a manner, that the lowest slat or wire may be just below the base of the second year's shoots, that is from 9 to 14 inches above the surface of the ground, these two shoots should be firmly, though not tightly, tied, in a horizontal position as shown in Fig. 15, and all buds

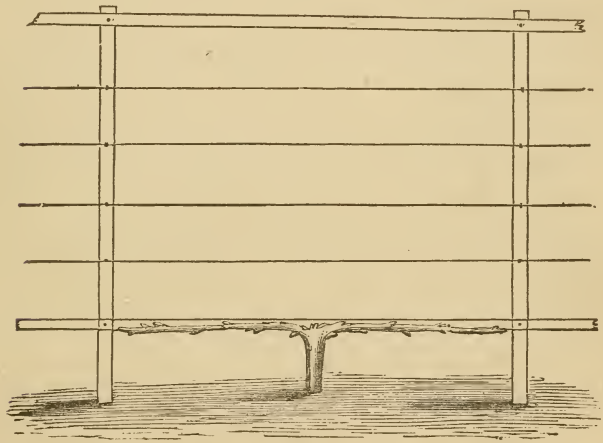

Fig. 15.

should be rubbed out except three on each arm (or shoot) thus leaving six on each vine. Each of these buds should produce a shoot which, if the ground has been in good condition and the plants healthy and properly set out, would reach from 12 to 25 feet unless stopped, and as it is upon every second one of these that we depend for our next year's supply of fruit, they deserve and will require great care and

attention in order that they may finally be of equal strength and well ripened. Every second shoot should be stopped when it has made a growth of about two feet, and if any of the others should so far outstrip their compeers as to reach the top of the trellis much before them, they should be stopped also, though except in the case of excessive growth all the shoots had best be allowed to grow on until the first of September, when they may all be stopped at once, unless it be deemed best to allow the weakest a few days' longer growth, in which case it is surprising how soon they will overtake their companions.

Stopping, or pinching, consists in breaking off the end of a shoot, and its immediate effect is to arrest the further growth of the cane, or at least its further lineal development, for the time being. But although no more leaves are immediately formed, those already in existence perform their usual functions and the whole energies of the plant are directed to the ripening of the wood already produced. After a time, one of the buds near the extremity of the shoot will probably break and become the leader, when it should be stopped in turn, this process being repeated as often as any symptoms of vigorous growth are exhibited. The result of all this checking is to lessen the ultimate amount of wood produced and to improve its quality both as to ripeness and density.

Stopping furnishes us with an effectual means of

equalizing the growth of our young canes—a most important point, not only as regards the neatness of their appearance, but the regularity with which the fruit buds will break next season and the strength with which they will shoot. But as the latter points depends not only upon the *size* of the canes, but their *maturity*, it is necessary that an equal growth be kept up during the whole season. This is easily accomplished as the stopping may fortunately be performed at any time.

The same directions as to the removal of laterals and the clearing of the ground should be observed during this as during former years. Greater care is, however, required in the treatment of laterals when raising fruit-bearing canes, as if by too close pinching we should cause the buds which are found at the base of the leaves and upon which we depend for our next year's fruit to push, our prospects would be materially injured. A good rule will be, never to pinch out the laterals, and stop the main cane at the same time; and if the vines show a very vigorous growth of wood, to allow the laterals to make two leaves before stopping them. If the vines are weakly, we may stop the laterals as soon as they appear, as in this case, the main shoot makes sufficient draft upon the roots, to keep all other growth in abeyance.

CHAPTER VI.

MANAGEMENT OF FRUITING VINES.

At the close of the third season we ought to have a vine such as is shown in Fig. 16, consisting of a stout, strait, clean stem, 9 to 14 inches high, from the

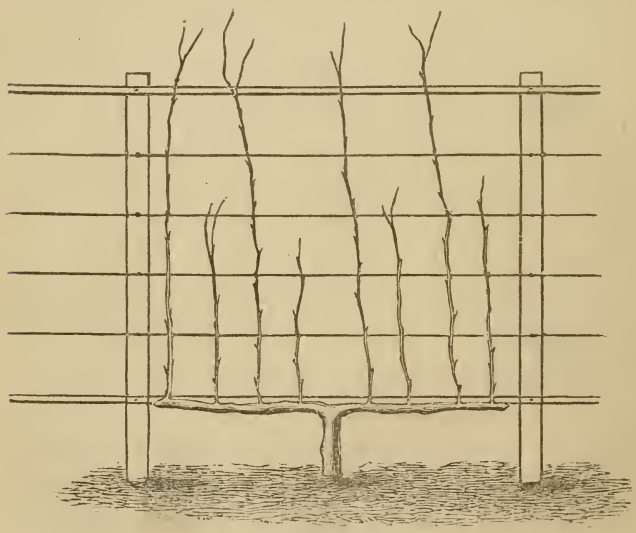

Fig. 16.

top, or head of which springs two horizontal arms, each bearing two well ripened canes, 8 to 10 feet long,

and two smaller shoots of from two to five feet. The two canes ought next season to produce 3 to 5 lbs. of fruit each, and their proper care during the winter is worthy of our best efforts.

WINTER PROTECTION OF THE FRUITING CANES.—As the vines have now assumed their permanent form and size (unless it should be deemed advisable after the lapse of a few years to remove each alternate vine and so double the extent of trellis allotted to the remainder), it becomes important to settle upon a systematic course of procedure in order to facilitate our operations, and this remark applies to their protection during winter as well as to every other process connected with them. Of the advantage, we had almost said necessity, for winter protection there can be no doubt. Some extensive cultivators, at a late meeting of the Western N. Y. Fruit Growers Society stated, that they would have made $100 per day for the time spent in covering their vines if they had done so in the fall of 1858.

One gentleman asserted that he had lost thousands of dollars by neglecting it—and there is probably no point in the whole range of grape growing upon which cultivators are so thoroughly agreed as this. The mere laying down the vines on the ground, covering them with snow, laying boards or brush upon or

against them have all been found materially to increase the next year's product and to improve its quality. But these are clumsy expedients, incapable of systematic application and unfit for adoption on a large scale.

Where vines are trained to trellises in the manner which we have just described, it has been asserted by many that it is impossible to lay down the horizontal arms so as to cover them, owing to the rigidity of the old wood, and in order to avoid this it has been proposed to leave the head of the vine so low down that the arms shall lie on the surface and be always covered with earth. To this method there are many objections. The berries are soiled with every rain, clean culture is rendered more difficult, and the surface roots thrown out by the arms cause a succulent growth during moist weather, which suffers during the succeeding drought. But if the vines are bent down every year, little difficulty need be apprehended on this score, and if the following plan be adopted, vines may be bent sufficiently, even when they have become old and rigid.

The method which we have proposed, is to place the trellis 8 to 12 inches in advance of the vine, the stem being brought forward beneath the first slat or rail, and tied up as usual. The accompanying figure (17) explains this better than words can express it, and

Fig. 17.

it will be readily seen that very little bending is required, and even that is so distributed over the

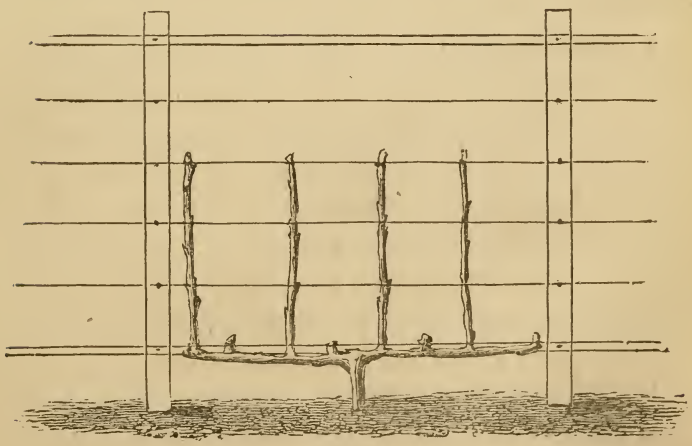

Fig. 18.

whole stem that no injury can result. No practical objections that we are aware of exist to this method.

Before bending down the stem, the vine should be pruned. This consists in cutting off the long shoots to a length of four feet (the first season), and the alternate short ones to the *lowest good* bud. The vine so pruned is shown in Fig. 18. Then the stem, having been bent down, it will be easy to fold the flexible young canes so as to lie compactly together, as shown in Fig. 19, when they may be

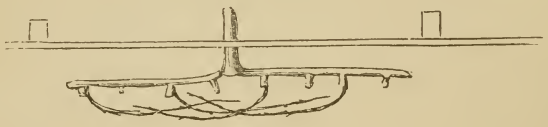

Fig. 19.

covered with earth. The soil for this purpose must be light and sandy, and should be so disposed that water will not penetrate to the vines. If light soil cannot be had, the vines may be pegged down and covered with the branches of evergreens, though it is improbable that these could be obtained in sufficient quantity to protect a large vineyard. Leaves or straw would answer, though they might harbor mice, which would soon destroy the vines.

The vines should be left covered as long as possible, but must be exposed before the buds begin to push in the spring. No particular day of the month can

be given, the date varying with the locality and the season. The best mode of determining the point is to uncover some of the vines as soon as the cold weather has passed away. If they are swollen and ready to push, it is time to tie the vine to the trellis. If they seem still dormant, leave them a little longer. The later the vines can be made to push the better, as they not only escape late frosts, but their excitability seems to be so accumulated and intensified by such retardation that their after growth is much more vigorous than it would otherwise have been.

After the vines have been properly tied to the trellis, and the ground raked, or hoed level (all work on it being avoided when it is wet, however), nothing should be done until the buds have burst so as at least to show their vitality and strength. Then go over the vines and rub off all buds which show themselves on the upright stem and horizontal arms and disbud the canes so as to leave six good buds, and no more, on each. By doing this at this early period, the strength of the vine is thrown into the buds which remain, and they consequently push with increased vigor. The lowest good bud on the short spurs must also be left, all the others being removed.

As soon as the blossoms show themselves, and before they have expanded, it will be necessary again to go over the vines and stop or pinch all the shoots

which show fruit, at the same time removing all the blossoms except two or three clusters on each shoot. This will not only serve to keep the vine within bounds, but it will cause the fruit to set much better than it would do if this course were not pursued. In a former section, we alluded to stopping with a view to the ripening of the wood and the training of the vine, and the directions there given apply equally to our action as regards the shoots from the short spurs —they being designed to furnish the bearing canes for next year, to replace those which are now fruiting, and which will be entirely cut away at the next winter pruning. But other reasons also induce us to stop the fruit-bearing shoots, and as the whole subject of stopping, and its detrimental substitute, summer pruning, is one of vital importance to the grape vine, we cannot do better than preface our remarks by quoting the physiological laws upon which it is based, from Lindley's "Theory and Practice of Horticulture."

"Nature has given plants leaves, not merely to decorate *them* or to shade *us*, but as a part of a wondrous system of life quite as perfect as that of the animal kingdom. It would be of no use for a plant to suck food out of the earth by its roots, unless there was some place provided in which such food, consisting principally of water and mucilage, could be digested and so converted into the matter which

maintains the health of the individual. The stem cannot do this: firstly, because it is a mere channel through which fluids pass; and, secondly, because many plants have no visible stem, as in the instance of the primrose; and yet in all such cases the plant feeds and must digest its food. It is to the leaves that this important office is assigned, and to enable them to execute it God has formed them with wisdom no less infinite than has been displayed in the creation of man. The leaves have veins through which their fluids pass and cells in which they are held while digesting, myriads of little caverns through whose sides respiration is maintained, a skin to guard them from the air, and pores for carrying off perspiration. A leaf is, in fact, both stomach and lungs; and to destroy it is to do the same injury to a plant as would be effected in an animal by the destruction of the parts to which those names are given. Of this we may be certain, that neither taste, perfume, color, size, nor any other property, can be given to a plant except through the assistance of the leaves; and that the more numerous these are, the larger and the more luxuriant, so, within certain limits, will be all that a plant is capable of forming. Strip the leaves off a tree, and no more wood will appear until the leaves are restored; feed its roots in the hope of thus compensating for the loss of its leaves, and the stem will be filled indeed with

watery matter; but the latter will collect in the interior until it forces its way through the bark, and runs down in putrid streams, as happens to the mulberry-tree when it is incessantly stripped for silkworms, and as occurs to trees whose leaves are continually destroyed by a noxious atmosphere. Strip the ripening grapes of their green garments, and no color or sweetness will be collected in their berries. Rob the potato of its foliage and you will seek in vain for nourishment in its tubers; and so of all things else. On the other hand, leave the mulberry, the vine and the potato uninjured, to the genial influence of the sun and the air, and the dews of heaven, and wood is formed in the one case, sugar and color in the other—and flour, the staff of life, in the last, and these products will all be in exact proportion to the health and abundance of the foliage. . . . . .

"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 the 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 is 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 lateral *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.

g
f
e
d
c
B
a

"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 are 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 con-

version 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."

In applying the above to the culture of the grape in this country, however, we are inclined to believe that the direct access of the sun to the wood or fruit is not necessary to their perfect ripening. And our readers must also observe that, although in the illustration at the close of the paragraph, Dr. Lindley alludes to the "removal" of the leaves, yet from the remarks immediately preceding it, we gather that he is no advocate for "summer pruning," but for "stopping." By summer pruning we mean the removal of large quantities of leaves and shoots—a practice which is quite common throughout the country. Often and often have we seen loads of such matter cut away under the pretence of "letting in the sun and air to the grapes." Now if these summer pruners would only observe that all the finest bunches grow and ripen under the *shade* of the leaves, they would cease their senseless efforts and rest content with merely breaking off the ends of the shoots.

That grapes will not ripen well, and that vines will not be healthy under a dense mass of matted foliage, we freely admit. But this is not an evil to be remedied by the knife. In this case, most emphatically, prevention is better that cure.

When we reflect that the amount of organizable matter which can be furnished by any vine is limited, and also that all rank and succulent growth is prejudicial to the production of fruit, we can readily appreciate the advantage of directing the sap to the production of fruit, rather than wood and leaves. But we must also remember that every ounce of organizable matter which is embodied in leaves or stem, is so much capital invested, and is no more to be thrown away than the stock of the moneyed capitalist, which only brings in two per cent., even though his neighbor, on a different investment, receives ten.

The leaves are the laboratories in which the sap is prepared for the nourishment, not only of the fruit, but of the wood, and the more of them we have the better, provided we do not invest too large an amount of our available capital in their production, just as some of our farmers invest all their capital in land, and leave themselves nothing with which to work it.

Another evil attendant upon summer pruning, is the sudden and violent check which it gives to the

plants. The roots being excited into vigorous action by the enormous draft made upon them, find themselves suddenly without a channel through which their unelaborated product can find vent; the balance of product and supply is upset and the fruit is filled with crude, ill-digested sap, thus causing it to be unripe and ill-flavored. But by early stopping the shoots, and thus preventing the further production of leaves and wood, we render summer pruning, that is, the removal of superabundant leaves and wood, unnecessary; no sudden check is given to the vines, the sap is fully elaborated as fast as it is supplied, and the fruit receiving an extra supply of properly prepared sap (which would otherwise have gone to the production of wood and leaves) is enlarged in size and improved in flavor.

That the leaves are the great agents in the elaboration of sap, was fully proved by the experiments of Hales, who forced orange flower-water into the vessels of a vine, with a view to impart its flavor to the fruit. The experiment was unsuccessful as to its ostensible object, but not as to its concomitant results; for he traced the flavor through the stem and branches to the leaves, but no further; there it was decomposed, and doubtless returned to the wood and fruit in the form of sap.

In a few weeks, or perhaps days, after being

stopped, the last bud on all these shoots, will, no doubt, burst and form a leader, which will grow nearly as vigorously as if the terminal bud had not been removed. It will, therefore, be necessary to go over all these vines again as soon as the fruit is set, and repeat the same operation. At this time, also, the fruit should be thinned, which, for vineyard culture, consists in the removal of all weak, ill-formed bunches, some even recommending the removal of the lower part of all the bunches.

When, however, extra fine bunches are desired, we prefer the plan usually adopted in hot-house culture, which consists in removing at least one half the berries from every bunch—the largest and finest being, of course, left. This operation is best performed when the grapes are the size of peas, but by many it will be deemed too minute and laborious an operation for vineyard practice.

While doing this, it will also be proper to remove or extirpate *all* shoots which either have not fruit, or are not wanted for next year's canes.

During the growing season it will be necessary to look over the vines, at intervals of two or three weeks, stopping the fruiting shoots, removing suckers, and pinching out laterals at the second eye. The ground should also be kept loose and mellow, and all the operations of the vineyard be carried on, with as

little trampling on the borders as possible. Indeed, if the expense be not an objection, we would lay down boards or planks, supported by suitable stakes or posts, and forming a walk along the front of each trellis, so as to allow all the work of the vineyard being performed without a foot being set upon the soil.

CHAPTER VII.

SUBSEQUENT MANAGEMENT OF THE VINES.

THE future management of the vines will consist in training up, each year, a shoot from the intermediate spurs, and cutting out entirely the cane which has borne the fruit. The cane which was trained up last year, will this year produce a crop, while, from the spur left in cutting out the former cane, is trained up a shoot for the following year, and so on *ad infinitum*.

As the peculiar pruning necessary is a subject of vital importance to success in grape culture, we will give a consecutive condensed description of it, illustrated by proper figures.

Fig. 20.

Fig. 20 shows a section of the horizontal arms, at the end of the third season. A is the cane which has

been trained to the top of the trellis. B the shoot which was stopped when two to four feet long. Just before laying down the vine for winter protection, A is cut to about a length of 4 feet, and B is cut away at the cross-line, or just above the first good bud.

As the force with which the buds push, depends a good deal upon their number relatively to the size of the vine, it is absolutely necessary to cut off A to 4 feet or less, and rub out several of the buds which appear on it. If, in addition to this, all other buds except one from each of the spurs, B, be removed, we could scarcely fail to train up a good cane from B, even though none but latent buds were left.

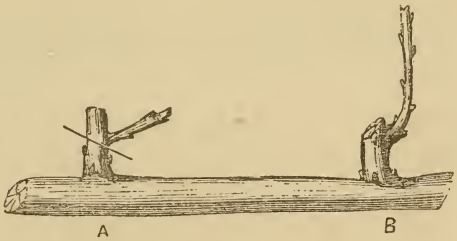

Fig. 21.

Next season the figure is reversed. Here B is the young shoot of last year, while A, which carries the six shoots upon which the fruit grew, is cut off at the cross-line. B is shortened this year to 5 or 6 feet, and disbudded as before—one or two more buds being left on, as the vine is growing stronger.

At the base of A, below the cross-line, will appear intermediate little buds—some of them quite prominent. The best of them must be taken, and no fear need be entertained of getting a good cane from it, *if all the unnecessary buds are promptly extirpated.*

If, however, we allow shoots to grow all over the vine we will probably fail to get any cane at all.

The following season, the shoot proceeding from A

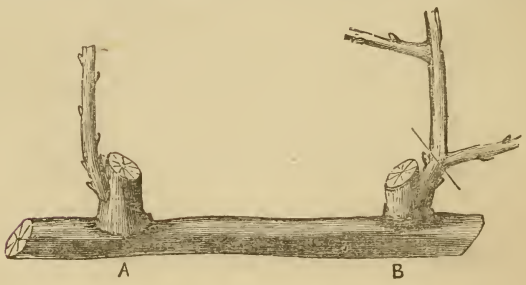

Fig. 22.

is fruited, and B is cut off at the cross-line. This stage of its progress is shown in Fig. 22.

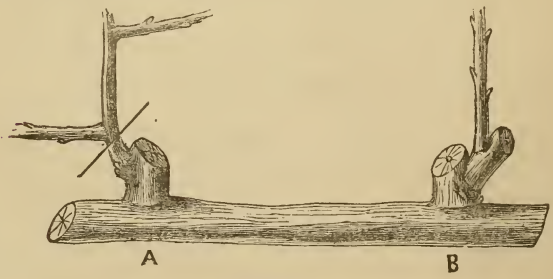

Fig. 23.

In Fig. 23 is shown the vine at the end of the sixth season. By this time, the spurs will have become hard, and if allowed to remain much longer, it will be necessary to renew the whole vine, as is done in the Thomery system (see Appendix). It will, therefore, be well to allow a bud to push from the base of B, if one should show itself, as there most likely

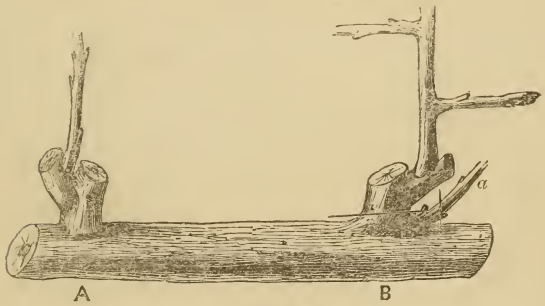

Fig. 24.

will. In this case, Fig. 24 will represent B as it will appear at the close of the season, when the entire spur must be cut off with a fine saw, at the cross line, and the wound carefully pared smooth and coated with a solution of shellac in alcohol.*

* "Take a quart of alcohol and dissolve it in as much gum shellac as will make a liquid of the consistence of paint. Apply this to the wound with a common painter's brush; always paring the wound smoothly first with a knife. The liquid becomes perfectly hard, adheres closely, excludes the air perfectly, and is affected by no changes of weather; while at the same time its thinness offers no

The shoot *a* is cut off at the line, as shown, or just above the lowest good bud. Next season, B will appear as shown in Fig. 20, and the same routine as that first described much be again gone over.

If we should be unable to obtain the shoot *a* at the time it is wanted (which, however, will not happen once in twenty times), we must leave the old spur and obtain a shoot from the base of last year's fruiting cane.

After a number of years (say six to ten), it may be found advisable to extend the vines. This may be done either by removing every second one, or by raising the trellis.

In the latter case it will be best, in order to secure an equal distribution of the sap, to lay down two courses of horizontal arms and allow the vertical, or bearing canes, to extend only half-way up the trellis.

The proper arrangement for this, is shown in Fig. 25, where it will be seen that the horizontal arms of every second vine are extended both ways, so as to cover double their usual space. The stem of the centre vine is carried up to the middle of the trellis and arms from it laid down, of the same length as the

resistance to the lip of the new bark that gradually closes over the wound. If the composition is kept in a well-corked bottle, sufficiently wide mouthed to admit the brush, it will always be ready for use and suited to the want of the moment."—*Downing.*

lower ones. The fruiting canes are produced and treated in the manner just described.

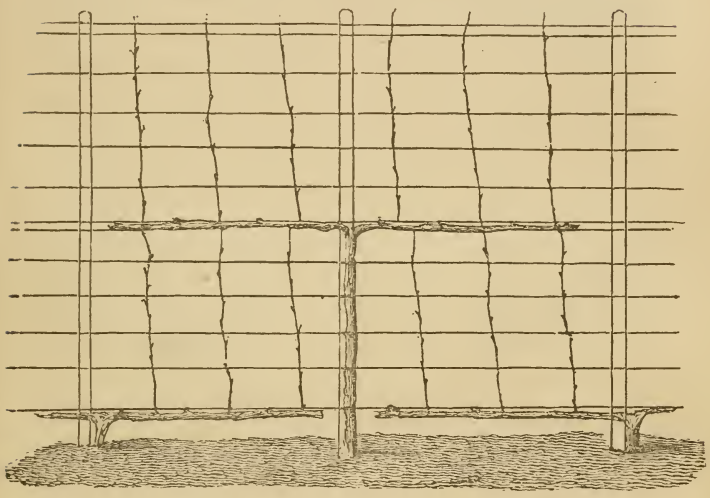

Fig. 25.

In order to effect the change, the lower arms may be extended by laying down the outer fruit canes of last year and pruning their junction with the old wood so as to leave a continuous rod. To produce the upper arms, however, it will, we think, be found best to cut the vines down to the ground and train up new stems, arms and verticals. The loss of time incurred will be more than repaid by the increased vigor and health of the vine.

That the general system of culture here laid down

is the best for all ordinary purposes, we are firmly convinced. The extent allowed to the vine during its first few years, is amply sufficient for the production of an abundant crop, while at the same time the vine is so far kept within bounds, that every bud is pushed with vigor. And this will be found to be one of the most important points connected with the proper training of the vine. For when the balance between the vital forces of the plant and the extent to which it is allowed to extend, is greatly disturbed, as exemplified in the opposite extremes of stake training and total neglect, nothing but debility on the one hand, and the inordinate production of wood to the exclusion of fruit on the other, can result.

CHAPTER VIII.

GENERAL THEORY AND PRACTICE OF PRUNING AS APPLIED TO THE GRAPE VINE.

In the preceding chapters we have given minute directions for that particular system of pruning and training, which we believe to be best adapted to our native grapes. It is now our purpose to detail those general principles which apply to *all* modes of pruning and training, and to describe a few of those peculiar systems which have been founded upon them.

I. The first principle upon which all correct pruning, whether of the vine or any other tree, must be based, is that the sap always tends to the extremities of the branches.

From this, it follows that unless the balance between the roots and branches of the vine be carefully and accurately adjusted, all the lower portion of the old wood will become devoid of spurs or bearing shoots, and unless the portion of the wall or trellis over which it is trained is otherwise occupied, the space will be left practically vacant.

Experience has also shown that there is no practi

cal limit to this law—that is, that the distance to which the sap *may be* propelled exceeds any limits to which it is ever necessary to carry it.

"If the shoots of the vine are trained along a considerable extent of wall, the branches spread out much wider, and the berries attain a larger size. This property of the vine, although known to experienced gardeners, is not taken advantage of as it ought to be. A vine might be trained horizontally under the coping of a wall to a great distance, and by inverting the bearing shoots, the spaces between the other fruit-trees and the top of the wall could readily be filled up, and if different vines were inarched to the horizontal branch, the south wall of a large garden might be furnished with a variety of sorts from the stem and root of a single plant, the roots of which would not encumber the border in which the other fruit-trees are growing. I have an experiment of this kind now in progress in my garden. Within a few years past, I have gradually trained bearing branches of a small black cluster grape, to the distance of near fifty feet from the root, and I find the bunches every year grow larger, and ripen earlier as the shoots continue to advance.

"According to Mr. Knight's theory of the circulation of the sap, the ascending sap must necessarily become enriched by the nutritious particles it meets

with in its progress through the vessels of the alburnum; the wood at the top of the tall trees, therefore, becomes short-jointed and full of blossom buds, and the fruit there situated attains its greatest perfection. Hence, we find pine and fir-trees loaded with the finest cones on the top boughs, the largest acorns grow on the terminal branches of the oak, and the finest mast on the high boughs of the beech and chestnut; so, likewise, apples, pears, cherries, etc., are always best flavored from the top of the tree But I suppose there are certain limits, beyond which the sap would be so loaded with nutriment, that it could not freely circulate."

The sap being determined so powerfully to the extremities of the branches, the most unremitting attention is required upon the part of the vine dresser, so that the bearing shoots may be equally distributed along the entire plant and an equal amount of nutriment directed to each.

But if through negligent management the bearing shoots or spurs are allowed to die out on the lower part of the vine, it will be difficult, if not impossible, to replace them.

By judicious pruning, the entire head of the vine may be so reduced that there will be abundant nutriment for all the buds, and by promptly and carefully stopping the more vigorous shoots, the sap may be

so directed to the weaker ones that no difficulty of this kind need occur.

II. In this connection, we may consider a rule—which is laid down as a *principle*, however, by most arboricultural authorities—the buds are developed with greater vigor upon a branch which is cut short, than upon one which is left long.

This is true, but must be accepted with limitations. If there be two shoots springing from the same stem, one being pruned short and the other long, the buds on the long branch will be developed with the greatest vigor. If, however, the shoots be upon *different stems*, the buds upon that which is pruned most closely will push most strongly.

This we might anticipate, from the fact that there is more root power (if we may use the expression) to a given number of buds. But experiment would lead us to believe that if the lower buds are removed so that the same number of eyes are left on both, the longest would have the advantage—at least at first.

But as sap moves with greater difficulty through old than through young wood, the shortest shoot soon overtakes its companion and outstrips it. This principle is well exemplified in the rampant growth of those suckers which spring from old vines near the ground. They will frequently grow twenty or thirty feet in a season, while the strongest shoots at the

extremities of the old branches do not exceed from five to eight.

Upon these principles is founded the rule which directs us to cut back plants which have made a weak growth, or have become old, gnarled and hard, so that they may throw up strong, vigorous shoots.

III. The sap supplied by the roots must be elaborated by the leaves, before it is fitted for the formation of wood or fruit, and the development of the roots is in direct proportion to the increase of leaves.

From this, it follows: 1st. That it is injurious to remove the leaves from the plant, with a view to ripen the fruit by the admission of sun and air (this point has been fully discussed, page 110, *et seq*).

2. That during the first two years' growth of the plants, the production of leaves should be encouraged as much as possible, so as to aid in the development of roots. Hence the plants should be carefully tied up, so as to preserve the leaves clean, active and uninjured, and abundant light and air should be furnished, so that they may be able to perform their part with efficiency. This being the case, it may be asked why we advise the stopping of the laterals which certainly form leaves, and hence must increase the growth of the roots. Two reasons may be given for the practice either of which are ample. The first is that it is not the leaves, *per se*, which do good, but their action on

the sap, to effect which, they must be supplied with air and light. Now, if the leaves on the laterals are allowed to grow, they crowd the foliage at the base of the plant, so that many of the leaves are partially shaded, while if these laterals are prevented from growing, the sap which would be absorbed by them goes to the elongation and enlargement of the main stem, by which the leaves are disposed over a greater surface and consequently maintain a more vigorous action. And, as during the first two years at least, the production of canes well ripened in their whole length, is no object, seeing that they are all to be cut away at the winter pruning, the vines should not be stopped, but should be allowed to grow to the end of the season. For as the roots require a certain degree of warmth to enable them to grow, and as the earth is in the best condition as regards temperature, just at the close of the growing season, it is best to maintain a vigorous action in the roots at that time—a time when they can make the most of it.

The second reason is, that the sap, as before stated, flows most vigorously through stout, free-growing shoots. Now, by removing the laterals, we increase the vigor of the main stem as well as its size, and hence not only obtain an enlarged, but a more suitable channel for the sap to flow in. The consequence is, that a well trained shoot will far exceed the

aggregate of the same shoot and its laterals, if it be neglected during its growth.

IV. The more the sap is impeded in its course, the less vigorous will be the shoots produced, but the greater the tendency to bear fruit. This is exemplified in the pear-tree, where the branches are bent in order to produce fruit buds, and also in the common practice of bending the canes of the vine into bows and spirals, so that the buds may burst equally and produce fruit.

V. Whatever tends to diminish the vigor of the shoots and to force the sap into the fruit, enlarges the size and improves the flavor of the latter.

Upon this law depends the practice of summer pruning, which has been fully discussed in a previous chapter. And as it is necessary not only to diminish the vigor of the shoots, but to force the sap thereby saved into the fruit, the object of destroying all fruitless shoots (in bearing vines) is obvious, as well as the necessity of attending to the health of the roots.

Such are the general principles which should regulate the proper pruning of all trees; though they have been expressed chiefly with reference to the vine. In pruning with a view to the production of fruit, however, it is necessary to know the peculiar fruit-bearing habit of the plant under consideration. Thus upon the peach, fruit is always borne upon the

last year's shoots; the pear bears its fruit upon spurs which have been formed during the previous year, upon old wood, and the fruit of the vine is always borne upon shoots of the current year, these shoots proceeding from either last year's shoots, or wood, which is much older. The last assertion is one which conflicts with the statements of most of our pomologists, and therefore it is incumbent upon us to give some evidence of its truth. Thus, Barry says:

"It must be observed, that the grape vine produces its fruit on shoots of the current year produced from eyes on the previous year's wood."

Du Breuil is more positive, and states that shoots which accidentally spring from old wood *never* produce grapes. His words are: "Dans la vigne, les grappes sont attachées sur des bourgeons naissant sur les sarments formés pendant l'été précédent. Les bourgeons développés accidentellement sur le vieux bois ne portent jamais des grappes."

We were rather surprised at this assertion, as it appeared to contradict our own observation. But lest it might be that the shoots which we had in view, had been produced by the remains of last year's rubbed out buds, we carefully watched a piece of old wood during one season, so as to assure ourselves that no buds had sprung from it between certain marked points. Next season the head of this old

vine was pruned so severely as to cause several shoots to issue from the previously barren wood. Two of these bore fruit.

In performing this experiment, we kept carefully in view the difficulties attendant upon bringing it to a successful result, and although we succeeded in getting fruit from only two out of nine shoots, still, this was sufficient to establish the point. In performing it, care will be necessary to prune with sufficient severity to force the buds out of the barren wood, and yet to leave sufficient head to draw up the sap and prevent the too vigorous growth of the shoots after they are formed; otherwise the blossoms may change to tendrils. This experiment does not suggest any newer or better mode of pruning the vine, but it throws new light upon the laws which govern the formation of fruit buds, and exemplifies the fact that they are formed where the vital forces of the vine are so balanced that there is sufficient vigor and material to form fruit, and yet not so much rampant growth as to rob the blossoms of their necessary nutriment and convert them into tendrils.

That they are so convertible, every cultivator is aware, for it often happens that the hopes of the unskillful vine-dresser are disappointed—his fine show of blossom buds, turning out nothing but tendrils.

We believe the converse of this was first shown by Knight, from whose papers we make the following extract: "Every bunch of grapes commences its formation as a tendril, and it is always within the power of every cultivator to occasion it to remain a tendril. The blossoms are all additions, the formation of which is always dependent upon other agents; and if any considerable part of the leaves be taken off the branch prematurely, or if the vine be not subjected to the influence of the requisite degree of heat and light, the tendrils will permanently retain their primary form and office; and it is very frequently observable, when much of the foliage of fruit-trees has been destroyed, by insects, or when the previous season has been cold and wet, that blossoms are not formed at all, or are feeble and imperfect, and consequently abortive. . . . .

"The tendrils of the vine, in its internal organization, is apparently similar to the young succulent shoot and leaf stalk of the same plant, it is abundantly provided with vessels, or passages for the sap, and it is alike capable of feeding a succulent shoot or a leaf when grafted upon it. It appears, therefore, not improbable, that a considerable quantity of the moving fluid of the plant passes through its tendrils; and that there is a close connection between its vascular structure and its motions."

The various systems of vine pruning which have been founded upon these general principles, may be classified according to the part of the vine from which the fruit buds are produced. Thus, if we suppose A

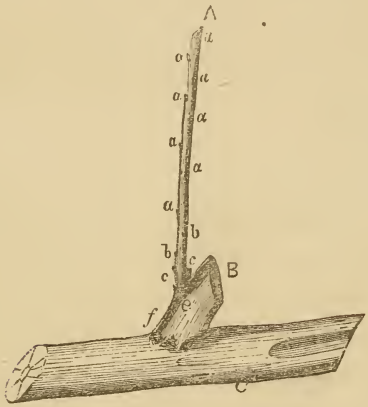

Fig. 26.

to be a shoot of last year; B a spur two years old, and C a branch three years old, then we may by judicious pruning obtain fruit, first from the plump buds *a a* on the young cane A; secondly from the buds *b c* near its base; thirdly from the buds *e* which will be found at its junction with the spur B; and fourthly from buds situated at *f*, that is at the junction of the spur B with the branch C. In the latter case, however, if the spur B is old and has borne several shoots like A it will require some skill and very favorable

circumstances to procure fruit from the buds at *f*. But if B be always kept short, and no shoots be allowed except from its base, no difficulty of this kind will arise. Following this arrangement, then, we have:

I. The long-rod renewal system.

II. The long-spur system.

III. The short, or secondary-spur system.

IV. The close-cut, or primary spur system.

This system of classification we believe to be the only true one, although we are not aware that it has been adopted by any preceding author. Each of these four systems is not only distinct, but it may be adapted to almost any system of training, while none of them can be well combined in the same vine, unless the power of the roots is greatly in excess over the extent of the branches. Suppose, for example, on a vine with a well balanced head, a few long rods are left. No buds will start from the base of the spurs. But if all parts are treated alike, the eyes will break equally and in general will be all fruitful. The facility with which this principle may be explained and enforced is greatly increased by a clear and systematic classification, such as we have given above, and most authors have been aware of the importance of such a classification; but if the reader will compare the attempts of Loudon, who depends in his

classification, not only upon the system of pruning, but of training; of McIntosh, whose three systems are "the spur," "the long-rod," and "the irregular" forms; of McPhail, who has the "fruit-tree method;" "the spurring-in system" and "the long-rod sytem;" of Von Babo, who has "head pruning," "limb pruning," "frame pruning," and several sub-varieties named after the localities in which they have been adopted; and most of our American authors, who have simply the renewal and spur methods, with that given above, we think he cannot but give his preference to the latter. And as all systems of pruning with which we have ever met may be easily referred to one or the other of our four classes, we will describe them in detail and give a few illustrations of each, as derived from the practice of our best growers.

I. The long rod or renewal system is generally attributed to Clement Hoare, who adopted it in his "Practical treatise on the Cultivation of the Vine," and as he has not seen fit to give the credit of it to prior authors, most of his readers have awarded it to him. But it is substantially the "new method" of Switzer; the alternate system of Speechly, and the "new and experimentally proved superior method" of Kecht. It is certainly very old, though it is still commonly called the "new method."

The system which we have adopted as the best for

vineyards and gardens in the northern States *where our native vines are cultivated* is substantially the system explained by Hoare. The system pursued in Ohio and in many European vineyards, is also a modification of the long-rod system, but as we propose to give a full account of Ohio vine culture amongst our examples of American vineyard practice, we need not dwell upon it here.

The following are a few of the most elegible modifications which have been proposed:

Mr. John Mearns, in the Horticultural Transactions, (vol. iv.) describes a system which is not only well adapted to the hot-house culture of the vine, but is one of the best with which we are acquainted where it is desired to fruit quickly, a great variety of grape vines in a small place. This method is as follows:

"My method of managing vines is in some respects different from any other with which I am acquainted; by it I have never failed, for the last eleven years, to obtain invariably the same luxuriant crops, although I have never allowed above one-third of the bunches which showed themselves to remain on the vine; and each succeeding crop has been as uniform as if the branches had been placed, artificially, over the whole roof. I have no doubt but, under the same treatment, the vines will continue to be equally productive for any length of time. The shoots are so vigor-

ous that their girth is, generally, at the end of the season, from an inch and a half to an inch and three quarters. The branches, in their most luxuriant growth, never appear in any confusion, even to those who are but little skilled in the cultivation of grapes, and the method is so simple, that it may be described with the assistance of figures, so as to be perfectly comprehended by any person in the least acquainted with the nature of the vine. I have never deviated from it since I planted the vines in the spring of 1806.

"My vines were planted two feet and a half apart, and being watered to settle the earth round their balls, I headed them down to within a foot of the soil, as here represented.

Fig. 27.

"I only allowed one shoot to proceed from each plant the first year; rubbing off all the others before they had completely burst into leaf, the uppermost being the one I retained. In the course of the summer I watered them with soft pond water, as I found they wanted it, and frequently with drainings from the farm-yard, and with soap suds, when I could procure any.

"During the first summer, the vines made quite as

much progress as I could have expected, and their different degrees of vigor were nearly in proportion to the state of the roots when planted. When the leaves had fallen in the end of the year, I cut them down to the second or third eye, when they had this appearance. (Fig. 28.)

Fig. 28.

"In the beginning of the succeeding February, I excited them gradually into action by a little fire heat, and when the buds were ready to burst I rubbed all off but the two finest on each plant; the strongest of these I intended to furnish bearing wood for the lower half of the roof for the following year. The most feeble of the two was cut down to the second or third eye, at the end of the season, and at the same time the strongest shoot was reduced to eight feet, being the length of the lower half of the rafter.

Whilst they were growing during the second summer, I kept the shoots regularly trained upward, divesting them of tendrils and laterals. I only allowed the strongest of the two leading shoots to run about three, four or five joints beyond the middle of the

roof (where I intended to cut them at their winter pruning), according to the vigor of the different shoots; and then I pinched off their tops, in order to strengthen the eyes for the ensuing season. The weaker shoots I only suffered to run about three four, or five feet, according to their strength, and I then pinched off their tops, never allowing them to push above two or three eyes from the same place, during the remainder of the season, without pinching them back; and then retaining only a single eye, unless I found it necessary, in consequence of the vigor of the

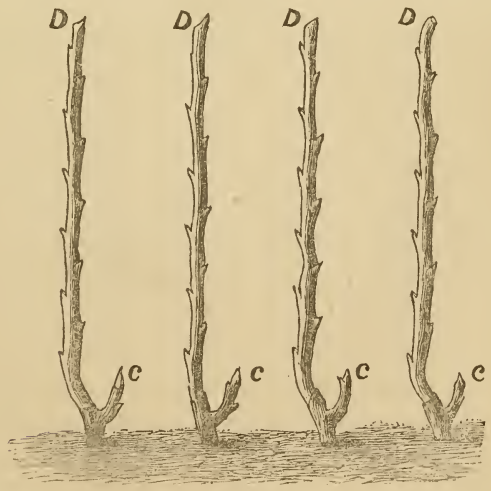

Fig. 29.

vine. I kept the laterals stopped back also to the first leaf. At the fall of the leaf, I cut the leading shoots

at the middle of the rafter, and the lower one at the the eye, as is here represented. (Fig. 28.)

"The preceding sketch represents four separate vine-plants, at the end of the second season after they had been planted, when the strongest shoot had been headed down to the middle of the rafter D, and the weakest shoot to C.

In the third season, I carefully preserved the uppermost shoot from the end of my bearing branch at D, as a leader to furnish the upper part of the rafter with bearing wood for the next year; and I also trained upward the leading shoot from the bottom spur C, which I intended should become the bearing branch for the lower half of the roof in the following season. I was careful that none of the tops of these leaders should meet with accident, till they had reached their destination for the season—that was about three or four joints beyond where they were intended to be cut down, to the winter pruning. All the buds on the bottom spur C, were rubbed off, except the leading one. As I bore in mind the necessity of a bottom spur to produce a succession shoot from the bottom in the following year, which was necessary to the regularity of the system I contemplated, I selected one of the most convenient buds for my purpose, from the bottom of the old stems, all of which were now putting out several buds; but I

suffered none except the selected one, to remain long after it had made its appearance. The management of the young shoots of the year was, in this and the following seasons, the same as I have before detailed.

"In the autumn of this, the third season, the lower half of the house was furnished with a crop of ripe grapes upon the wood of the preceding year, and parallel to it on each vine grew a young shoot, intended to bear the lower crop the next year; whilst the upper half of the house had single shoots trained from the end of the bearing wood, which shoots were also to bear a crop the next year; and besides these, a third shoot on each vine had been trained from the bottom bud, which I had not removed, and which were about four feet in length, having been treated as the weaker shoots in the second year's management, which I have described, and to which they were similar. When this half crop was gathered and the leaves had dropped, I cut off the top leaders level with the uppermost wire of the house to which they were tied, and the lower leaders level with the middle of the roof (the top and bottom leaders, or bearing wood for the next season, being each eight feet long), and the bottom or weak shoot, above described, was cut down to the second or third eye, as the lower shoot had been cut in the preceding winter. All the spurs of the lower

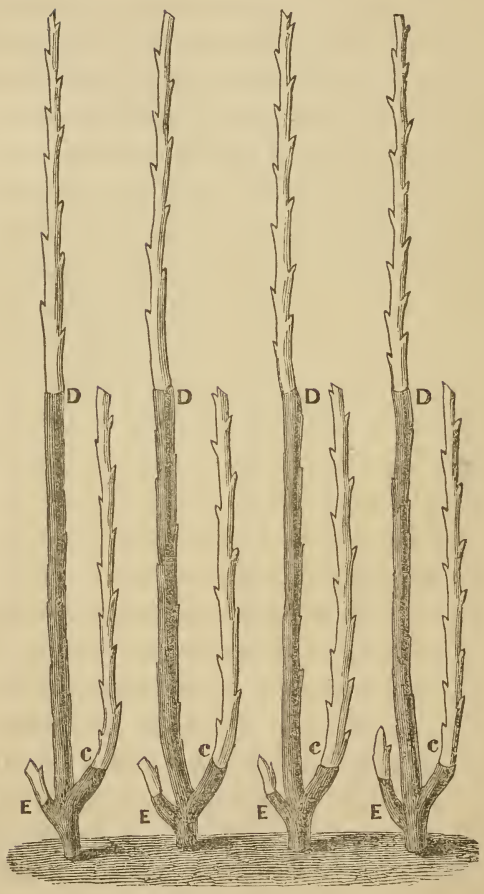

Fig. 30.

part of the shoot, which had now reached the top of the house and had borne the crop of grapes, were cut clean out. The following was the appearance of the same four vines, after they had been pruned in the third winter, when they were in a state to produce their full crop in the following season. (Fig. 30.)

In the fourth summer a full crop was produced both in the upper and lower half of the house; the longer shoot D bore its bunches on the upper half of its length, and it was not suffered to extend itself by a leading shoot; the shorter shoot C bore its bunches on its whole length, and extended itself by a leading shoot to the top of the house; the spur E was suffered to become a shoot, extending a few joints beyond half the length of the rafter, and from the bottom of the old wood a weaker shoot, as before, was trained, to become the foundation of the lower shoot of the next season. In the pruning season, D, which had become the longest branch in the previous winter, was entirely cut away from the bottom; the shorter branch C, which had now become the longest, was stripped of its spurs on its lower half of the old wood, and its upper half was left for bearing; the extended spur E, became the lower bearing branch, and the weak shoot F (Fig. 31.) at the bottom, was reduced to a spur, to furnish the lower wood for the next year.

The following figure represents the plants after

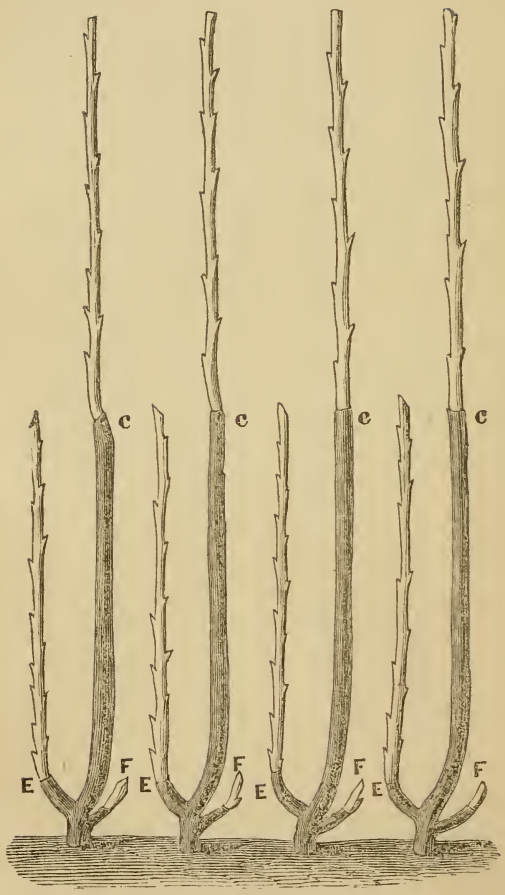

Fig. 81.

being pruned the fourth season, the sides being reversed.

With this alternation of pruning, the system has been continued to the present time, and may continue as long as it shall be desirable to have the house in bearing.

During the last four years, I have stopped the bearing branches at the bunch, instead of the next joint above it, which is the usual practice; for I found that the fruit did equally well and it divested the branch of an incumbrance, while it allowed a much larger portion of light to come into the house, together with a more free circulation of air among the fruit and young wood.

I blind all the eyes on each fruit spur as soon as they push, except the uppermost, which I retain to draw up the sap to nourish the fruit. I never suffer them to push above a joint or two, before I pinch them back, always cautiously retaining an eye. By constant stopping, the eyes soon increase to a large cluster, when I frequently find it expedient to pinch out a great part of them with my finger nails, unless I see danger of its exciting my next year's fruiting eyes to burst prematurely. I am particularly cautious that nothing shall happen to injure the leaf that accompanies the bunch, for if that is lost, the fruit, of course, will come to nothing.

During the summer I inspect the vines regularly every morning; seeing that the ends of my leaders

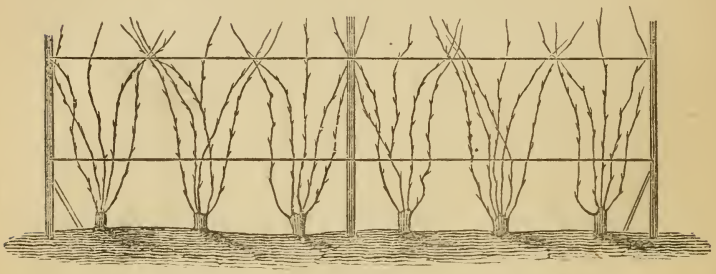

Fig. 32.

are in their proper places, and not obstructed; picking off tendrils and stopping the laterals above the

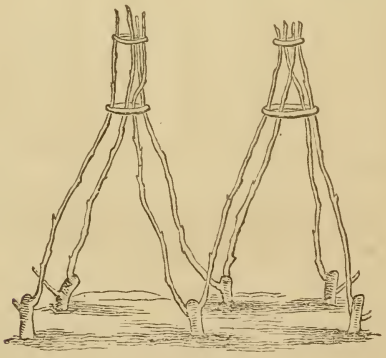

Fig. 33

first leaf, on my next year's bearing wood, tying down fruit spurs carefully, and stopping any shoot that may have sprung from the ends of them; as

well as other shoots that may come out from the pre viously stopped laterals.

Fig. 32 shows a simple method of training wines to a trellis formed of light stakes or a couple of

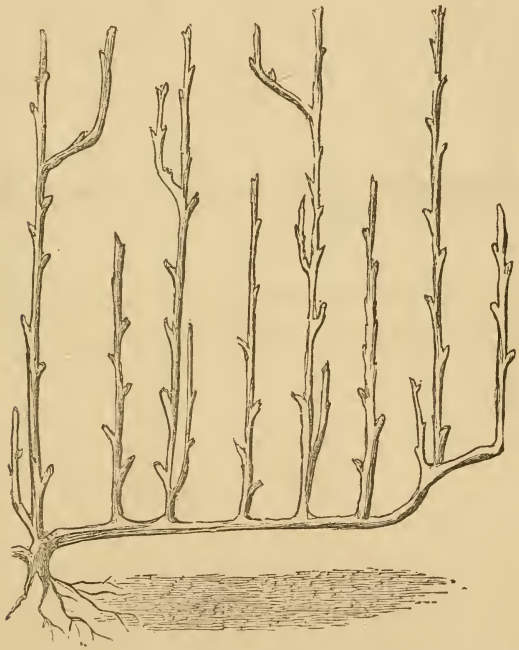

Fig. 34.

wires. If trained on the plan shown in Fig 33 neither stakes nor trellises will be required.

II. The long-spur system is that upon which old vines are trained, and consists in cutting the young

wood the previous year, back to three or four eyes, all weak shoots and dead wood being removed.

Sir J. Paxton, in the "Gardener's Chronicle" for 1842, gives the following directions for pruning vines on the spur system. The cut there given (Fig. 34) has been often reproduced, but in general it has been so reduced that the character of the shoots is not clearly seen:

"It represents a portion of the vine when pruned in autumn, on the spur system, with short rods of five or six eyes each, left at convenient intervals on the oldest branches throughout the vine. The perpendicular main shoots should not be less than two feet apart, and when pruning them no useless eyes should be left, that is, no eye should be allowed to remain but where a shoot is desired in the following season. By attending to this, the vine will not have to develop (as is usually the case), an immense quantity of superfluous branches; and although the operation may appear a tedious one at the time of pruning, an immense saving of labor and time may be effected at a busier period in the spring, and the quantity of fruit may be easier regulated in proportion to the strength of the vine. If this is attended to, nothing will be required in the summer but securing the young fruit-bearing shoots to the wall, and shortening them to one joint above the bunch

as soon as the fruit is set, excepting the leading shoots, which should not be stopped until the lower part is ripened; otherwise the main eyes for the next season may be induced to grow prematurely. In autumn the young wood from the spurs is shortened back to one, or at most, to two eyes, and the terminal shoots in proportion to their strength; but for the strongest wood, from eight to twelve eyes will be found as many as will break well.

"When commencing to train a young vine in this manner, the side branches should not be brought to the horizontal position at first, but lowered gradually as the number of suitable branches for upright stems are obtained; by this means they acquire strength faster than if trained horizontally at first."

It is obvious that this system is nearly the same as the long rod, or renewal system—the difference being that instead of taking several of the upper buds on each young cane, we use only one and have a great many canes or spurs.

The only real advantage to be derived from it (so far as we are able to judge), and that upon which its distinctive features is founded, is that the buds from which the next year's crop is to be obtained are always well ripened. We would, therefore, prefer it to the first system, where the vines are tender, or the climate unfavorable, and deem it of sufficient impor-

tance to give in detail a method of treating the spurs during a series of years.

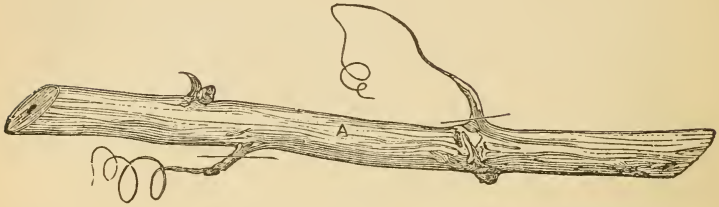

Fig. 35.

Fig. 35 (A) shows a portion of a young cane which may either form part of the vertical branches on a trellis, or the single stem of a young vine. The first season of fruiting, the tendrils should be cut off and the buds thinned to from six to ten inches apart, depending upon the vigor of the variety; and so that they will be alternately on different sides of the cane, thus leaving the buds on each side from 12 to 20

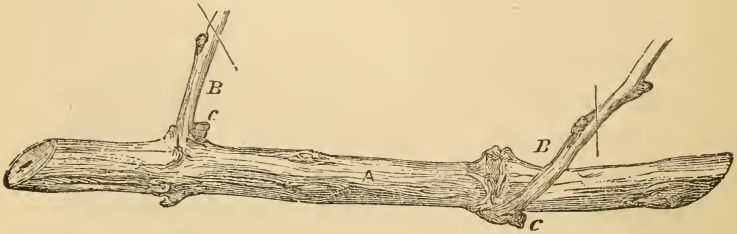

Fig. 36.

inches apart. Not more than four or five buds should be left on a cane during the first season.

At the close of the first season, after the leaves have fallen, the cane will present the appearance shown in Fig. 36. Here A is the main cane; B is the shoot produced by the buds on Fig. 35; and C is a bud at the base of this shoot. Prune the shoot B to one plump bud, as shown in the figure and allow the bud C to push and form a shoot; stopping it, however, as soon as it has made a few leaves.

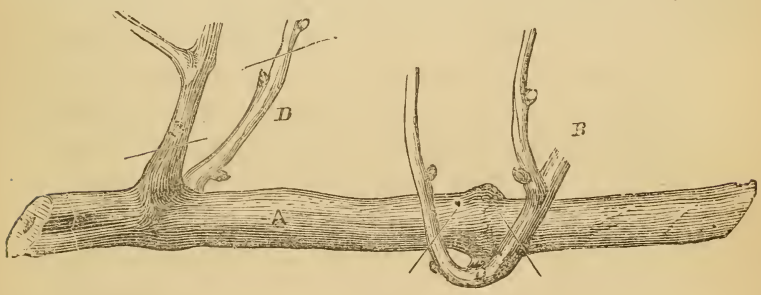

Fig. 37.

Next season we will have the shoot D, (Fig. 37) with several nice, plump buds, and the old spur B, with its shoot which bore fruit last year. Cut D back to one or two eyes, and cut B away entirely. The buds on D will push and bear fruit, and a bud will, no doubt, push from the base to form the spur for next year.

Fig. 38 shows the next winter pruning. From this description, it is obvious that we must, each year, have eyes to produce, not only fruit, but a

young cane, which will form the spur for next year. If we depend for this spur upon last year's fruiting

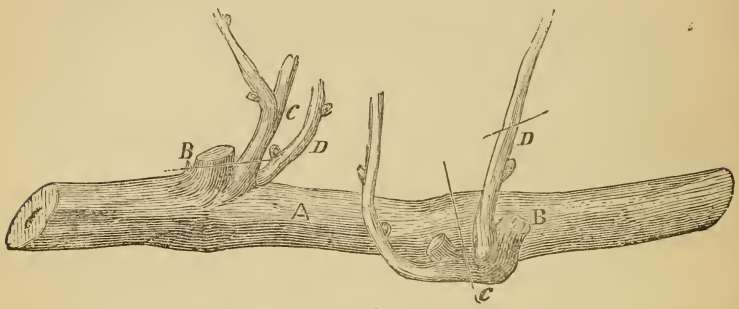

Fig. 38.

shoots, our spur will soon become so long, and our vine so encumbered with old wood as to be quite unmanageable, unless we adopt the system to be next described:

III. Here we depend for our fruit upon buds proceeding from the base of last year's fruiting shoot, this fruiting shoot being borne upon a spur attached to the main branch. This is the system of pruning adopted at Thomery, and as no good description of it is be found in any American publication with which we are acquainted, we give the very full and lucid account by M. Dubreuil—a translation of which may be found at the close of the volume.

IV. In the short-spur, or Thomery system, the fruit-bearing shoot proceeds from a spur on the main

branch, which although short, is still a spur. Theory, however, would lead us to suppose that it might just as well proceed from the juuction of last year's fruit-bearing shoot with the main branch.

CHAPTER IX.

WALLS AND TRELLISES—THEIR INFLUENCE AND CONSTRUCTION.

Although the influence of the various forms of walls, trellises and stakes upon the growth and maturity of the vine depends somewhat upon the system of pruning and training pursued in connection with them, still, it cannot be doubted but that their forms and the materials of which they are made also exert an influence which is by no means to be disregarded.

In this country, walls devoted to the culture of the vine have not been used to a sufficient extent, to afford reliable data as to the benefit to be derived from them. Many single vines, however, are trained on the ends of houses and along board fences, and from a careful examination of several such examples, we are inclined to believe that in exposed situations the erection of cheap walls would pay well, even in vineyards.

When vines are judiciously trained in front of brick walls and *at a few inches' distance* from them, the grapes uniformly ripen sooner than those on

exposed trellises. The wood also is more perfectly matured, and this, during a succession of years, exerts a considerable and favorable influence on the vine.

The effect of walls doubtless depends upon two causes, one being the higher temperature produced by the radiation from the surface of the solid wall, and the other being the protection from wind and storms which such a structure affords.

That the latter point is one of material importance, we are well satisfied, for however essential ventilation may be to the healthy growth of the vine, all violent winds and cold blasts are to be studiously avoided.

A striking instance of this is to be seen in the garden of a gentleman of this city. Several vines are there trained along the east side of a high board fence, and although the same judicious and systematic care is given to all parts of the vines, yet the finest fruit is uniformly found a foot or two below the top of the fence. Now when we remember that on all open trellises the finest grapes are found at the *top*, since all trees produce the best fruit at the *extremities* of the branches, we must attribute no mean effect to the protection afforded by the fence, since the boards of which it is composed can scarcely be supposed to retain and radiate much heat, and its height (about eight feet) is not sufficient to include the limit to which vines may be judiciously carried.

"The actual temperature to which a tree trained upon a wall facing the sun is exposed is much higher than that of the surrounding air, not only because it receives a larger amount of the direct solar rays, but because of the heat received by the surrounding earth, reflected from it and absorbed by the wall itself. Under such circumstances the secretions of the plant are more fully elaborated than in a more shady and colder situation, and by aid of the greater heat and dryness in front of a south wall, the period of maturity is much advanced. In this way we succeed in procuring a Mediterranean or Persian summer in these northern latitudes.

"When the excellence of fruit depends upon its sweetness, the quality is exceedingly improved by such an exposure to the sun; for it is found that the quantity of sugar elaborated in a fruit is obtained by an alteration of the gummy, mucilaginous, and gelatinous matters previously formed in it, and the quantity of those matters will be in proportion to the amount of light to which the tree, if healthy, has been exposed. Hence the greater sweetness of plums, pears, etc., raised on walls from those grown on standards. It has been already stated that an increase of heat has been sought for on walls by blackening them, and we are assured in the 'Horticultural Transactions' (III. 330) that, in the cultiva-

tion of the grape, this has been attended with the best effects. But, unless when trees are young, the wall ought to be covered with foliage during the summer, and the blackened surface would scarcely a and in the spring the expansion of the flowers would be hastened by it, which is no advantage in cold, late springs, because of the greater liability of early flowers to perish from cold. That a blackened surface does produce a beneficial effect upon trees trained over it is, however, probable, although not by hastening the maturation of the fruit; it is by raising the temperature of the wall in autumn, when the leaves are falling, and the darkened surface becomes uncovered, that the advantages are perceived by a better completion of the process of growth, the result of which is the ripening the wood. This is indeed the view taken of it by Mr. Harrison, who found the practice necessary, in order to obtain crops of pears in late seasons at Wortley, in Yorkshire (see 'Hort. Trans.' III. 330 and VI. 453.) It hardly need be added that the effect of blackening will be in proportion to the thinness of the training and vice versa." —*Lindley.*

The articles referred to by Lindley, being short and practical, it may be well to transcribe them. Henry Dawes writes thus to Sir Joseph Banks: "I take the liberty of communicating to you my remarks

on a garden wall, on which I have been making experiments at Slough. It faces the south, and against it, about the middle, a young grape vine is trained. Two years ago I covered a portion of the 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 20 lbs. 10 oz., while the plain part yielded only 7 lbs. 1 oz., 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 ripened better 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.

"Horticulturists will decide which of these two causes is efficient in producing the effect I have stated, or whether both may not coöperate; it is not for me to presume to do so, though I should be inclined to think, that in this climate, the intensity had more influence than the uniformity."

Chas. Harrison, gardener at Wortley Hall, Yorkshire, gives the following directions for blackening walls:

"When the leaves have fallen in the autumn, I take the earliest opportunity to loosen the tree from the wall and to prune them; the wall is then colored with coal-tar, mixing with every gallon of the tar one pint of linseed oil, in order to prevent it having a shining surface when dry. It is more necessary to

make this addition in the hotter parts of the kingdom than it is here, but even here it is essential in hot summers, for when the sun shines strongly on the wall with a shining black surface it has appeared to me to scorch those shoots which touch the wall; but this does not happen when the color is rendered opaque by the mixture of the oil as recommended. If the wall has not been previously colored, I give it a second coat as soon as the first is dry. In laying on the color care is taken that the liquid is not sprinkled upon the trees, for it would close up the pores of the wood and consequently do injury.

"After the wall is colored I allow the trees to remain loose from the wall until the coal tar has set (unless strong winds prevail, in which case I secure the main limbs and branches to the wall), in order that the shoots may not be damaged by coming in contact with it before it is dry. When the wall has become moderately dry, I nail the trees to it. A wall of sound bricks will not require recoloring more than once in ten years. Coal tar being very cheap, a wall of considerable extent may be colored for a trifling sum. Any dark-colored paint will answer the same purpose, but it is far more expensive, and requires renewal more frequently.

"The dark color, absorbing the rays of the sun, the wall acquires at least ten degrees of heat more than

the walls not colored, as directed; thus affording great assistance in maturing the buds upon fruit-bearing shoots, so that the trees 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 growth of young trees is much promoted by the coloring and they are sooner brought to a supply of fruitful buds."

In all cases in which vines are trained in front of walls or fences, it is important that a space of from six to twelve inches be left between the wall and the trellis to which they are fastened. If trained directly to the wall, the vine will not only be subject to mildew, but ventilation will be materially interrupted. The bunches also, are liable to injury when lying against the surface of the wall.

Walls may, of course, be constructed of any material, brick, stone or concrete. Brick is probably the most suitable material, though, as plain walls can be rapidly and cheaply built of concrete, it is probable that it might pay to erect them on an extensive scale

in some parts of the country. In the celebrated Thomery vineyards, the walls are built of clay with a cap of thatch. It is probable that walls built of well made sun-burnt bricks would last a long time and answer a good purpose if properly protected by a cap or eave of board or straw.

But, for all practical purposes, our reliance for vineyard training, in the present state of our experience, must be upon properly arranged trellises. We will, therefore, give what we consider the best mode of constructing them.

If the vines have been planted two years previously at distances of eight feet in the rows and the rows six feet apart, the first step to the erection of the trellises is to set up a post between each vine and slightly in advance of the rows, so as to facilitate bending the vines for winter protection.* These posts may be of such size and material as the vine dresser may procure. Cedar, chestnut, locust or oak make the best, and a good size is four inches deep (across the rows) and three inches thick. They should stand from seven to nine feet out of the ground and be sunk not less than two and a half feet—if three feet, all the better. The two posts at the ends of the rows must be placed so that they cannot be drawn inward. Various devices for effecting this are shown in Figs. 39 and 40.

* See page 107.

One consisting simply of a piece of plank nailed across the post so as to afford a broad surface to lie against the earth. The other is secured by a brace,

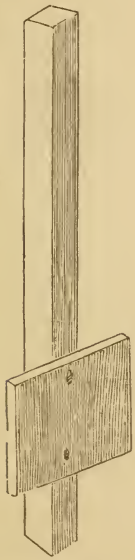

Fig. 39.

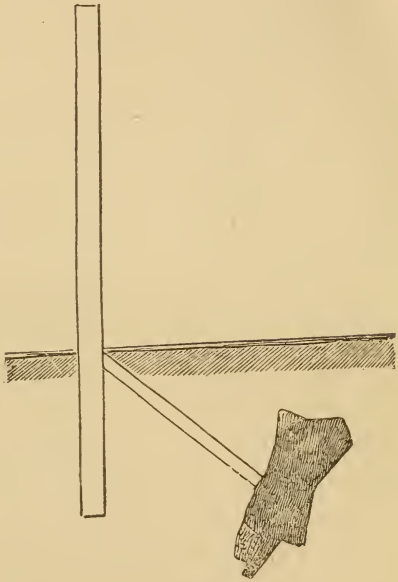

Fig. 40.

which rests against a large stone sunk below the surface.

The posts having been set in a straight line and reduced to a proper height, the next step will be to nail two strips of wood, one along the top and the other at from 9 to 14 inches from the ground, or just at such a height that the head of the vine-stems

(from which the horizontal arms spring) may reach its upper edge when laid against it. If the trellis is over seven and a half feet high, it will be well to nail a third slat, equidistant between the two, though it is not absolutely necessary. The next step is to divide the spaces between the slats into equal parts of about 15 inches each. Thus if the trellis be seven and a half feet high, and two slats (the lower one ten inches from the ground) we would divide into five spaces of 16 inches each. If nine feet high with three slats (the lower one twelve inches from the ground) we would divide each of the two spaces into three divisions of 16 inches each. Then take No. 12–16 annealed iron wire, twist a good loop on the end, and having slipped it over a stout nail driven into the end post, draw the wire along the posts, attaching it to each with a small staple well driven in until the last is reached, when the wire may be twisted round a nail or pin and the loose end secured by a staple.

Various devices have been proposed for drawing the wire tight and adjusting it for contraction and elongation according to the temperature, as is done in the construction of fences. But we are satisfied that there is no necessity for this, as the wire can be drawn over a stretch of eight feet tight enough for all practical purposes, while it will always be loose enough to allow of any contraction that can take

place. The truth is, that the wires do not require to be so very tight; even if they do have a little motion from the wind, it is not productive of any injury.

Our method of putting up the wire is as follows: We first provide a pair of strong wooden pincers such as those shown in Fig. 41, the handles of which are at least 30 inches long, and having a piece of stout sole leather tacked over the jaws.

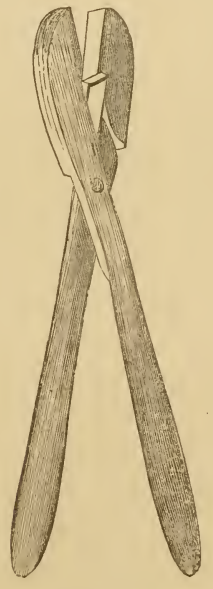

Fig. 41.

Then having secured one end of the vine to the first post and uncoiled the roll, laying it on the ground,

in front of the posts to which it is to be fastened we grasp it between the leather jaws of the pincers and step slowly back, straining it as much as possible until we are past the second post, when an assistant fastens it firmly with a small staple and we are again ready to step back to the next. By means of this contrivance, the wire can be laid on as tightly and smoothly as possible, for all the kinks are taken out by passing it through the leather jaws of the pincers, which should be well greased. It is necessary to go into the field provided with several sets of leathers, as they soon wear out, but are easily renewed. They should be at least three inches broad, so as to straighten out the wire thoroughly.

That wire is better than wooden slats there can be no doubt. It is less in the way, the vines cling to it more readily and the appearance is vastly superior. A pound of No. 12 wire will stretch across three posts (24 ft.) so that a trellis 8 feet high with two wooden slats and five wires, each 14 inches apart, will require 1⅔lbs., which, at eight cents per lb., will cost about 13 or 14 cents. As the cost of the wire is considerable, some cultivators do with less. Dr. Underhill's trellises are seven feet high with only three wires, and we believe no slats. But we prefer the arrangement just described, as we can thus tie in each shoot conveniently and regularly, and the wires at 14 inches

are none too close to have a bearing shoot on each. When wire cannot be conveniently had, the following is a good mode of putting up a rough trellis.

Set the posts as usual, and provide a number of slender split poles (hoop poles) and also a sufficient number of wire staples made of strong wire (No. 6 or 8 hard). Then secure the poles or slats to the posts by means of the staples, the ends of the poles being made to lap over each other so that two may be fastened by one staple. The accompanying figure (42) will explain this better than words can describe.

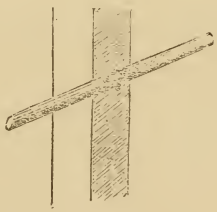

Fig. 42.

If the staples are a *little* less than the poles, the latter will be held very firmly. Nails will not answer, as they are apt to split the poles, and we are inclined to think that, for ordinary slats, staples would be better than nails on this very account. If made square and light, they need not be unsightly, and the cost is not very great.

No directions need be given for the construction of

arbors, or those ornamental trellises usually erected in gardens, as their form and arrangement will vary with the taste of the possessor.

A very neat, simple and efficient support for a single vine trained on the spur system is shown in Fig. 43.

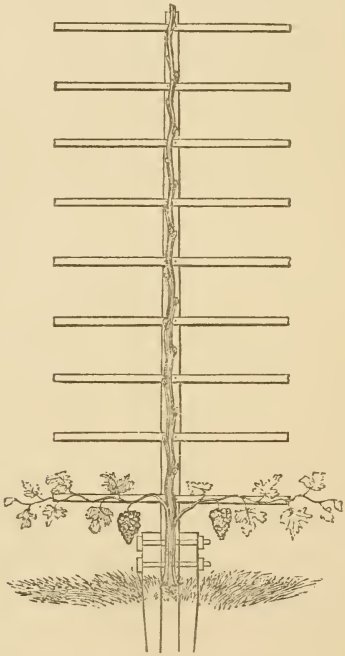

Fig. 43.

It might be constructed so as to be removable when the vine is laid down for the winter. It has even been proposed to have a hinge at the foot of the trel-

lis and lay down trellis and all. But this would be very injudicious.

Stakes are frequently used in vineyards, and also in gardens, but do not present any feature which is not more immediately connected with the subject of training, than with that of the present chapter.

The materials of which trellises, etc., should be made, will as often be governed by local circumstances as by any other consideration. As before stated, cedar, chestnut, locust and oak, are to be preferred for posts, and any tough, light and straight-grained wood for slats. The posts may be charred, where they enter the earth, though we should prefer to soak them for an hour or so in boiling coal tar. This may be readily done in a large pot, or caldron, set up in the field over a temporary furnace. It will of course be wise to give the whole structure a couple of good coats of paint, especially the wire.

The height to which trellises may be carried, depends upon two circumstances—the extent of their shadow and the influence of high training upon the vines. The latter point has been sufficiently discussed, under the head of pruning and training, and we find that at a distance of six feet no ordinary trellis will, in latitudes suited to the culture of the grape, shade its neighbor during the growing season. At other times, shade is not at all injurious. We had

prepared extensive tables, giving the distance to which shadows will be thrown by trellises of various heights, at different seasons of the year, and in different latitudes; but omit them for the above reasons.

The only limit which we would set to the height of a trellis, would be our ability to prune the vines and gather the fruit, with the aid of a light stool. Ladders are too unwieldy and involve too much labor, except for a few vines.

CHAPTER X.

PROPAGATION OF THE VINE.

Young vine plants may be raised from seeds, eyes, or cuttings, or by layering or grafting, all which modes are in common practice, though some are only adapted to peculiar circumstances and objects. We shall give a few practical directions for each.

Layering.—This is the mode in which large, thrifty vines may be most rapidly obtained; but it is by no means adapted to general use, where large quantities are required.

To procure a young vine by layering, we take a cane of the preceding year, having a well advanced shoot; and about the middle of June, or first of July, cut it half through, as shown in Fig. 45. It is then bent down and pegged into a hole, about three or four inches deep. It should be well watered, and the application of a little mulch, consisting of long litter, new-mown grass, weeds, or any similar matter, will prove of much service. Roots will soon push, and at the proper time for transplanting, it will have formed a *fine* healthy plant. Larger and stronger

vines, which will in some cases bear the succeeding season, may be obtained by layering older and stronger shoots; but the most healthy and, we believe, the most vigorous, plants will be produced by following the directions just given.

Instead of one plant, several may be obtained from

Fig. 44.

the same layer, if it be simply buried its whole length, as in Fig. 44. Roots will start from each joint, and consequently each joint will form a plant. But where a single plant is wanted, the method shown in Fig. 45 will give the finest results.

If very fine plants are wanted, in a short time, the best method is to sink a six-inch (or larger) pot in the ground and layer the shoot in it. This is best done by first making a hole in the ground, sufficiently large to receive the pot; then by running the loop

end of a doubled cord through the hole in the bottom of the pot, and passing a stick through the loop

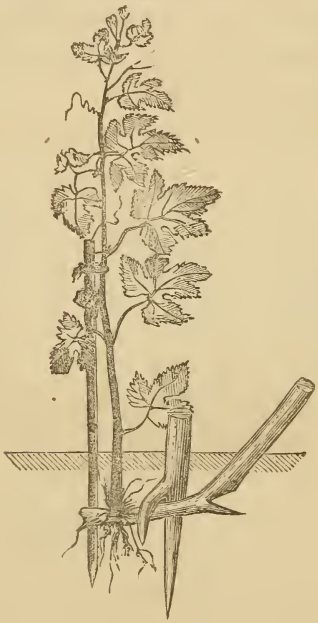

Fig. 45.

or double, it will be easy to tie the shoot in any desired position. The whole process will be readily understood from an inspection of Fig. 46; and we much prefer this plan to pegging down the shoot, or laying on bricks or weights, as pegs are rather uncertain when used in pots, and bricks take up too much room to the prejudice of the roots.

The young plant should be detached from the parent vine in about five or six weeks after layering, and may then be set out in its proper location. As this will be about the latter part of July, or the first of September, the vine will have plenty of time to become well established, and make good roots before winter sets in; and it will form a strong plant, capable of throwing up two permanent canes or producing a specimen bunch of fruit, during the succeeding season—provided, of course, that the variety propagated is of a vigorous and prolific character. An Isabella vine, layered in this manner in an eight-inch pot, threw up, next season, two canes, one twelve and the other sixteen feet. Another, treated in the same way, bore sixteen bunches of fine fruit.

In several instances, we have used common four-inch semi-tubular tile, instead of flowerpots, and with excellent results. They have the advantage of cheapness; but, in other respects, the flower-pot is to be preferred. In some cases, the shoot is drawn through the hole in the bottom of the pot; but although we have tried this in one or two instances, we have not found it either convenient or satisfactory.

A bearing shoot, layered in a good sized pot, or in a common water-pail, may be made to produce a well-rooted plant, which will perfectly ripen several bunches of fruit the same season, even after being

removed from the parent plant. This forms a very elegant and ornamental object; but, except as a matter of curiosity, such a process is worthless. In rare instances, perhaps, specimen bunches might be grown

Fig. 46.

out of doors, and perfected in the house, thus avoiding numerous evils to which the finer varieties of the vine are subject in this climate. In all cases, it is essential that the layer be kept moist and warm. As

the earth does not seem to be warm enough to induce the formation of roots, before June, it has occurred to us that very early and strong plants might be produced by inserting the pot (Fig. 46) in a slight hot-bed. A few barrow loads of manure would answer every purpose; and by producing roots thus early, strong specimen plants might be procured more easily than by any other method.

It may be well here to state that wood of any age from the oldest gnarled stems to the succulent growth of the current year will root if properly treated. We have always found, however, that the best and healthiest roots always spring from the junction of the old wood with the current year's growth.

It is recommended upon good authority (with which we in general coincide) to separate the plants from the old vine at least by the end of September, unless previously removed. In the case of some varieties, however (Diana, *e. g.*) this will not always answer, as roots are produced with such difficulty that *two* years are often required to make *good* plants

Cuttings.—Where large quantities of young plants of the common varieties are required, this is one of the cheapest and easiest methods of procuring them. Where wood is plenty, each cutting may consist of several buds or joints, as in Fig. 47. In ordinary cases,

however, a length of three buds is sufficient, and we have grown very good plants from cuttings of only one joint in length—that is, having two buds. Indeed, the latter make by far the nicest and cleanest plants, and though not quite so strong at first as those from a greater number of eyes, yet we question if in the long run they would not prove quite their equals.

Fig. 47.

Fig. 48.

Cuttings to be good should be of thrifty, well ripened, close jointed wood—long reedy canes and spindling twigs being alike to be avoided. The best cuttings are those which have the base of the shoot attached, and this may be either as in Fig. 47, where the cutting has been cut away close to the old wood; or it may be a *mallet cutting*, as it is called, where a small section of the two-year-old wood is left, as in Fig. 48.

The proper time for procuring cuttings is at the

regular fall or spring pruning. The cuttings may then be preserved in a cool cellar, either buried in moderately dry sand or simply laid on the floor and covered with straw or leaves. Excessive dryness or dampness are equally to be avoided, and the temperature should be low though never sufficient to freeze the fluids in the cutting. In this state they should be kept until the middle or end of April, as nothing is gained by setting them out at an earlier period. Indeed, we have found those which had been well preserved during the winter and set out in May do quite as well if not better than any others. In some experiments we used the previous year's wood, cut from the vines when the young shoots had grown two inches, and yet in this case they grew finely and made strong plants. But of course this is not an example to be imitated except where it is desired to procure scions of some particular variety, and the opportunity for so doing occurs only at the period indicated. Such cuttings should be set out as soon after being cut off as possible, and if the weather be dry and warm, shading, watching and watering will all be necessary.

In planting cuttings it is best to choose a plot of rather sandy soil (heavy soil will not do); trench it deeply, mixing it with manure *thoroughly rotten and converted into a black mold.* (Any decomposition going on in the soil will ruin the cuttings.) Then

plant the cuttings in rows twelve to eighteen inches apart and six to eight inches apart in the rows. They may be planted either in holes made by a dibble or laid in trenches made by the spade—the earth from the next trench being used to fill up the trench in which the cuttings are placed. Some authors direct us to place them perpendicularly, but we have always obtained the best results when they were placed as shown in Fig 49. In placing them, always be careful

Fig. 49.

to have the end bud which is out of the soil uppermost, and be careful that the end be cut with a slant, the same as that in the figure, so that it will not throw the rain *on* to the bud as in that case it may cause it to rot. In long cuttings the upper bud should be left about three inches above the surface of the soil, so that it may not be covered by the coat of mulch, which it is well to apply. Short cuttings must be inserted more deeply, but in all cases the bud should be uncovered unless in very late planting. We are aware that many advise the bud to be covered, but our own experience has been uniformly against it.

Neither should several buds be left above the surface, as they can do no good and require constant watching, as it is important for reasons to be hereafter detailed that only one shoot should be allowed to grow. With cuttings of four or more buds, a very good rule is to place the second bud even with the surface of the ground. In this case the cutting should be turned one-fourth round from its position in Fig. 49 so that the two upper buds may lie one on each side.

Another mode of planting cuttings is to make a hole with a dibble, and after inserting the cutting about two-thirds its length, bend it over and peg it down, as shown in Fig. 50.

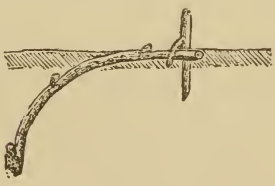

Fig. 50.

Fig. 51.

Fig 51 shows a method of inserting cuttings which we have practised with success. As it is well known that a cutting will grow, no matter which end is stuck in the ground, a scion is taken containing at least three buds, and after bending it into a semicircular

form, both ends are inserted in the ground, leaving the middle bud above the surface. As soon as this bud begins to grow, it will be supplied with nutriment from both ends and will make rapid progress. The plants produced by this method are very strong and if designed to remain where they are first set out they give very certain and satisfactory results. But they do not transplant well.

The following plan described in Miller's "Gardener's Dictionary" is one which we have tried with success: "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 Nich 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., upward of two thousand."

In our own practice we simply make a deep hole, insert the cutting, fill up with *dry* sand and give a liberal supply of water. By inserting the cutting as deeply as here advised it is placed beyond reach of drought, though the lower portion rarely throws out roots unless the soil be very favorable.

Eyes.—Where the aid of a hot bed or propagating house can be obtained, eyes afford an easy and rapid mode of multiplying vines. They are usually cut about two inches long, containing only one bud, and are started in February or March in pots or boxes filled with a mixture of sand, leaf-mold, and soil. The buds are either buried half an inch deep or placed even with the surface of the earth, according

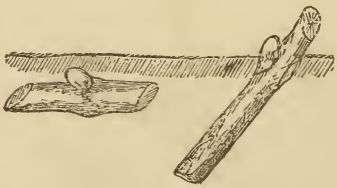

Fig. 52. Fig. 53.

to the ideas of the operator, and generally form strong plants, which may be set out in the open ground in June or July. Figs. 52 and 53 illustrate the position

of the cutting in relation to the soil. This method of propagating requires skill and great care and is seldom employed except by professional men.

GRAFTING is seldom employed in the case of those common varieties which are easily raised from cuttings or eyes. Diana and Delaware are, however, sometimes raised by this method, and to the amateur it is one of the most important processes, as by this means a new and rare variety can be fruited some years before a young plant would come into bearing. Loudon gives the following directions for performing the operation:

"Cleft grafting the vine is shown in Fig. 54, in which *a* is a bud on the scion, and *b*, on the stock,

Fig. 54.

both in the most favorable position for success. The graft is tied and clayed in the usual manner, excepting that only a small hole is left in the clay opposite

the eye of the scion, for its development. In grafting the vine in this manner when the bud (*b*) on the stock is developed, it is allowed to grow for ten or fourteen days, after which it is cut off, leaving only one bud and one leaf near its base to draw up sap to the scion till it be fairly united to the stock. The time of grafting is when the stock is about to break into leaf, or when it has made shoots with four or five leaves. By this time the sap has begun to flow freely, so that there is no danger of the stock suffering from bleeding; though, if vines are in good health and the wood thoroughly ripened, all the bleeding that takes place does little injury."

Root-grafting the vine is also frequently practised. For this purpose, saddle-grafting is most suitable, the scion being properly secured to the stock with waxed cloth or paper.

Lindley, in the "Gardener's Chronicle," states that the great secret of success in grafting the vine is to keep the scion dormant until the stock has so far developed its leaves and shoots as to be beyond the reach of danger from bleeding. His directions are as follows:

"Shorten the branch or shoot at the winter pruning, to the most eligible place for inserting the graft. The graft should be kept in sufficiently moist soil till the time of performing the operation, and for a week

previous in the same temperature as that in which the vines to be operated upon are growing. When such portions of the latter as are shortened for receiving the grafts have made a bit of shoot, graft as you would other fruit-trees, taking care, however, to preserve the shoot at the top in claying, and till the buds on the scions have pushed, then shorten it back. Inarching may be performed at any time after the vines have started, so far as not to bleed."

Speechly, however, names the middle of March as the best time for grafting the vine in the open air; and his directions are so lucid that we offer no apology for quoting them:

"In general, vines should be grafted about three weeks before they begin to break into bud.

"Upon small stocks, not more than one inch in diameter, cleft grafting will be found the most proper; but upon larger stocks, whip grafting is to be preferred.

"In both methods, much care should be taken in fitting the scion and stock together, and the operation should be performed with great exactness.

"When the stock and scion are well fitted the graft should be fastened with the strands of bass matting, and should then be covered with clay in the usual way.

"Vines do not harmonize with so much freedom as

commoner fruit; for though the scion will sometimes begin to push in a few weeks, yet it will frequently remain in a dormant state for two or three months; and during this period it will be necessary to strip the stock of all the shoots it may produce, as soon as they appear; and, in order to preserve the scion in a vegetative state, it will be necessary to keep the clay moderately moist, which may easily be effected by wrapping it round with moistened moss, and keeping the moss constantly sprinkled with water.

"When the scion has made shoots five or six inches long, the clay and bandage should be carefully taken off; and the clay may be removed without injuring the graft, when it is in a moist state.

"Vines will frequently prove successful by both the above-mentioned methods, but still the most eligible way of all, seems to me, to be that of grafting by approach. Indeed, I have seldom known any plants miscarry, that have been grafted in this way. Now in this case, it is necessary to have the plant, intended to be propagated, growing in a pot. Strong plants that have been two or three years in pots are to be preferred, but plants from the nursery may be potted and grafted in the same season, if brought into a hot-house or vinery; for the great warmth of either will generally cause plants, brought out of the open air, to push with vigor, and to form new roots, which will

support the plant, and greatly facilitate its forming a union with the stock.

"I have constantly had fine grapes, and the grafts have made good wood, the first season, by every method of grafting, but particularly by the last. In which it is obvious that the graft has a double support, viz.: from the stock, as well as from the plant in the pot.

"In this method it will be necessary to let the clay and bandage remain two or three months after the graft has formed a union; for if taken off at an earlier period, the grafted part of the plant will be very liable to spring from the stock.

"The pot should be plentifully supplied with water till the month of August, when the graft should be separated from the plant in the pot. Two or three inches of wood below the bottom of the graft may be left, but should be taken clean off at the next winter's pruning."

Grafting is a common practice in the vineyards of France. Chaptal's directions are as follows:

"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 surface of 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, of 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 beneath 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

Fig. 55.

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 southeast or southwest. Whenever a northerly wind or 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 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 the sand should be laid in water."

He, moreover, states 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."

We have never met with an example of budding

as practised on the grapevine. The following process, which is described as budding in the "Gardener's Chronicle" for 1844, is in reality a species of grafting:

"Bud about the first week in March, or as soon as the sap begins to rise. Cut an eye about three inches in length, having attached as much wood as you can get with it; at each end of the eye cut off about a quarter of an inch of the upper bark, making the ends quite thin. Next measure off the exact length of the bud on the bark of the vine intended to be budded, and make a niche slanting upward at the upper part; and another slanting downward at the bottom. Then take the piece neatly out, so that the bud may fit nicely in, and by making the niche, as stated above, each end of the bud is covered by the bark of the shoot. Bind the bud firmly round with matting, and clay it, taking care, however, that the clay does not cover the eye of the bud. Then tie it round with moss, and keep it constantly damp, and as the sap rises in the vine the bud begins to swell. When the vine commences to push out young shoots, take the top ones off, in order to throw a little more sap into the bud, and as you perceive it getting stronger take off more young shoots, and so continue until you have taken off all the young shoots. Budding can only be performed where the long-rod system is practised, as in that case you have the power of con-

fining the sap to the bud, which will grow vigorously. As soon as you perceive this, cut the vine down to the bud. Budding has the advantage over grafting of not leaving an unsightly appearance where the bud was inserted. A bud likewise grows more luxuriantly. Allow the matting to remain until about the month of September."

Mr. Knight was accustomed on some occasions to employ two distinct ligatures to hold the bud of his peach-trees in its place. One was placed above the bud inserted, and upon the transverse section through the bark; the other, which had no further office than that of securing the bud, was employed in the usual way. As soon as the bud had attached itself, the ligature last applied was taken off; but the other was suffered to remain. The passage of the sap upward was in consequence much obstructed, and buds inserted in June began to vegetate strongly in July: when these had afforded shoots about four inches long the remaining ligature was taken off to permit the excess of sap to pass on; and the young shoots were nailed to the wall. Being there properly exposed to light, their wood ripened well, and afforded blossoms in the succeeding spring.

Might not the principles here indicated be applied with advantage to the foregoing method of budding (grafting?) the vine?

A method which partakes partly of grafting and partly of inarching is shown in the annexed figure. Fig 56. Here the graft is covered with soil which

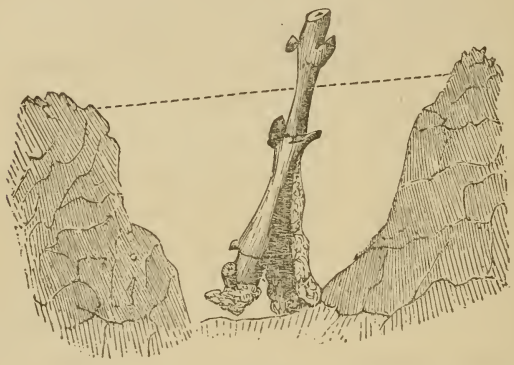

Fig. 56.

supports it in the same manner as a cutting, while at the same time it receives nutriment from the stock.

Seed Hybridization.—Young vines are never raised from seed, except for the production of new varieties; but, as this subject is deservedly attracting very general attention at present, a few practical hints thereon may prove acceptable.

Ever since Bacon observed that "The compounding and mixture of plants is not found out, which, nevertheless, if it be possible, is more at command than that of living creatures, wherefore it were one

of the most noble experiments touching plants to find this out; for so you may have a great variety of plants and flowers yet unknown. Grafting doth it not; that mendeth the fruit, or doubleth the flower, but it hath not the power to make a new kind," it has been the constant endeavor of good gardeners to improve the qualities of domestic plants by judicious mixtures of varieties.

Bradley, we believe, was the first who undertook to produce hybrid plants; but since his day, it has been attempted by almost every celebrated horticulturist.

The limits of hybridization amongst plants have never been thoroughly ascertained, although it is a subject of deep importance. For in the animal kingdom we know that while cross breeding (or intermixture of varieties) has been productive of the best results, hybridization, or muling has been successful in but very few instances, at least so far as practical good is concerned. Now whether the different species of the vine, as *vitis vinifera*, *vitis labrusca*, *vitis cordifolia*, etc. are so far removed from each other as to produce mules by their intermixture, or whether they are varieties and will freely cross-breed, has not yet been fully determined.

To examine this subject, however, with sufficient fullness to be useful would far exceed our limits.

Neither can we enter upon a discussion of the claims of the rival theory of Van Mons. We shall therefore rest content with a few practical directions.

Speechly, who was probably the first to attempt the improvement of vines by cross-breeding, directs us to bring the flowering branches of the two kinds of vines into close proximity—they being, of course, in the same stage of maturity.

No very superior varieties followed his attempts, however; and this is not to be wondered at, as it is probable that branches might be entwined a thousand times without effecting the result aimed at; for no means are taken to bring the pollen of the different flowers into contact with the stigma of the others, and although we have no reasons to doubt the possibility of super-fœtation, (seeing it is well-known to occur in the higher animals) yet no means are here taken to produce even this.

J. Fiske Allen, one of our most successful grape growers and the originator of some new and excellent varieties, gives the following directions upon this point.

"The applying the pollen, or farina of one variety to the pistil, or stigma of another, is the surer method of proceeding to obtain new sorts in the shortest time; and this is called hybridizing.

To do this properly, the bunch should be thinned

of three-quarters of the buds; the lower part should be cut away entirely (immediately before inflorescence), the strongest buds always being left.

Observe them closely, and as soon as the flowers open, with sharp scissors clip the *anthers*, being careful not to injure the pistil; with a soft brush, apply the pollen from the kind to be used in impregnation; or the whole bunch which is to furnish the pollen may be cut from the vine and gently rubbed or applied to the bunch, by frequently striking them together on every side. This should be repeated several days, until it is evident that the fruit is all impregnated; a fresh bunch with the pollen in a suitable condition, must be had at each operation.

"The pollen must be dry and in a falling condition, to be fit for the purpose. If your vines are so situated that a branch to be acted upon can be brought into contact with the branch of another kind, and the bunches interlaced, this will be a good method of proceeding—cutting away the males part of the blossom from the kind that is to ripen the seed for the new kinds."

Fig. 57.

Fig. 58.

Fig. 59.

"Fig. 57 is a magnified representation of the bud

of the grape. Figs. 58 and 59 show the blossom. The change from the bud to the blossom is usually rapid, and takes place about thirty to forty days after the shoot appears in the spring which bears the fruit. This bud, which forms the blossom, consists of a covering, or cap, and the embryo berry with five anthers, which, when the time for inflorescence has come, is raised, or lifted, by the anthers, and the wind blows this cap free.

"The third is the blossom or embryo grape, with the anthers clipped and deprived of their farina; on the top of the embryo is the pistil; upon this is to be placed the farina, or pollen of the male plant; when this is done, impregnation takes place, and the embryo rapidly swells off. If the operation has not been effectual, the berry will remain as it is. When the grape has attained one-third or one-half its size, it remains stationary two or three weeks, and at this, time it is perfecting the seed. When this is done, the fruit begins growing again; thus it appears the seed will vegetate, even if the fruit does not ripen sufficiently to be eatable."

Loudon's directions for saving and sowing seed are as follows: "Grapes for seed should be permitted to remain on the plant till the fruit is perfectly mature, and the seeds are of a very dark brown color. They should be separated from the pulp, and preserved till

February or the beginning of March. They should then be sown in pots filled with light fresh mold, and plunged in a moderately warm hot-bed; they will come up in from four to six weeks, and when the plants are about six inches high, they should be transplanted singly, into forty-eights, and afterward into pots of a larger size. Water gently, as circumstances require, allow abundance of light and air, and carefully avoid injuring any of the leaves. Cut down the plants every autumn to two good buds, and suffer only one of these to extend itself in the following spring. Shift into larger pots as occasion requires, till they have produced fruit. This, under good management, will take place in the fourth or fifth year, when the approved sorts should be selected, and the rest destroyed, or used as stocks on which to graft or inarch good sorts."

CHAPTER XI.

MANURE.

Manure* may be defined to be anything added to the soil to increase its fertility, whether by mechanical or chemical action. Substances serving the first purpose have been alluded to under the head of soils. The latter will now occupy our attention.

In a former chapter sufficient practical directions were given for the preparatory enrichment of the soil and for the annual top-dressing of the borders; it will now be our object to consider in detail the character of the nutriment required by the vine; the sources whence it may be derived; the various modes of its application; and its effects upon the plant.

It is a well-established fact, that unless the soil in which any plant is placed contains all the elements necessary to the formation of such plant, no healthy growth can ensue. Hence our first step must be to inquire into the chemical constitution of the grape-vine, or at least of its ashes, those elements which

* QUERY.—To what extent was Jethro Tull's idea of horse-hoeing, as a substitute for manure, anticipated by those who first used the word *manure* (*manœuvrer*—to work with the hand), before it was employed to express the addition of matter to the soil, with a view to increase its fertility? One old English author speaks of the Commonwealth of England as being "gouerned, administered, and manured by three sorts of persons," etc.

are dissipated during combustion being abundantly supplied from the atmosphere.

The following are a few of the most reliable analyses which have been published:

Dr. Emmons found the wood of *Vitis Labrusca* (Isabella?) to contain: Water, 40.26; dry matter, 59.74; ash, .98.

Full-sized leaves of Catawba, picked June 2d: Water, 72.388; dry matter, 27.612; ash, 2.138. Per centage of ash calculated on dry matter, 7.746.

Leaves of Catawba grape picked June 2d. Analysis of ash:

Carbonic acid	3.050	Potassa	13.394
Silicic acid	29.650	Soda	9.698
Sulphuric acid	2.062	Chlorine	0.741
Phosphates	32.950	Organic acid	2.250
Lime	4.391		
Magnesia	1.740		96.926

An analysis of wood and bark of wild vine gave

	Wood.	Bark.
Potassa	20.84	1.77
Soda	2.06	9.27
Chlorine	0.02	0.40
Sulphuric acid	0.23	trace
Phosphate of lime	15.40	5.04
Phosphate of peroxide of iron	1.20	5.04
Carbonic acid	54.83	32.22
Lime	17.33	39.32
Magnesia	4.40	0.80
Silex	2.80	14.00
Soluble silica	0.00	30.00
Coal and organic matter	2.20	1.70
	100.21	100.86

The following tabulated analyses by Crasso & Walz explain themselves:

ANALYSES OF ASH OF GRAPE VINE.

COMPONENT PARTS.	CRASSO.									WALZ.		
	Unripe Blue Grapes—Ash of Juice.	Ripe Blue Grapes—Ash of Juice.	Ripe Blue Grapes—Ash of Juice.	Ripe Green Grapes—Ash of Juice.	Blue Grapes—Ash of Skin.	Green Grapes—Ash of Skin.	Blue Grapes—Ash of Seed.	Green Grapes—Ash of Seed.	Small Burgundy Vines—Ash of Wood.	Cleven Vines, with leaves.	Reisling Vines, with leaves.	Drollingen Vines, with leaves.
Potassa	66.33	65.04	71.85	62.74	41.65	46.89	27.87	29.45	44.15	7.04	6.31	11.96
Soda	0.33	0 42	1.20	2.66	2.13	1.62	.....	.....	3.45	9.20	7 13	3.41
Lime	5.20	3.37	3.39	5.11	20.31	21.73	32.18	35.57	36.04	21.72	24.54	31 07
Magnesia	3.27	4.74	3.97	3.95	6.02	4.45	8.53	8.59	4.77	6.81	4.76	9.22
Sesquioxide of Iron	0.73	0.43	0.09	0.40	2.11	1.97	0.45	0.65	0.54	.....	.....	.....
Proto-sesquiox. of Manganese	0.82	0.75	0.10	0.30	0.76	0.51	0.35	0.45	0.11	0.03	0.13	0.17
Sulphuric Acid	.....	5.54	3.65	4.89	3.48	3.88	2.40	2 61	1.82	1.27	1.36	1.13
Hydrochloric Acid	5.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chlorine	0.70	1.03	0.47	0.70	0.49	0.71	0.27	0.35	0.85	.....	.....	.....
Silicic Acid	1.99	2.10	1.19	2.18	3.46	2.57	0.95	1.27	1.22	3.54	3.41	3.25
Phosphoric Acid	15.38	16.59	14.07	17.04	19.57	15.66	27.00	21.05	7.05	.....	.....	.....
Phosphate of Alumina	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.15	0.91	1.00
Phosphate of Sesquiox. of Iron	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.21	2 38	2.47
Phosphate of Lime	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.17	19.63	9.25
Chloride of Sodium	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.27	1.73	1.65
Charcoal, Sand, CO^2 and Loss	.....	.....	.....	.....	.....	.....	.....	.....	.....	34.56	27.68	25.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of Ash	0.259	0.340	0.409	0.290	3.745	4.321	2.776	2.837	3.692	6.19	7.74	6.00

Such being the normal constituents of the vine and of its fruit, and the latter being, in almost all cases, removed from the soil in which it was produced, it is obvious that a process of exhaustion must be constantly carried on, which, if not counteracted, must, in a short time, perceptibly reduce the crop.

The means by which the matter thus removed from the soil is restored, are of three kinds: First, the action of the plants themselves, or of man upon the subsoil; secondly, rain; and thirdly, by the direct addition of the requisite elements, through the agency of man and animals.

Although the soil has, to a certain extent, the power of separating salts and gases from the water which passes through it, the drainage water still retains a certain proportion of valuable matter,* and consequently the subsoil also becomes saturated to a greater or less extent with these same elements. Hence one of the effects of trenching is not only to bring up unexhausted soil to the surface, but to return those matters which had previously been washed out of the upper soil by the rains. The plants themselves occasionally bring up some of this matter, sending

A series of valuable analyses and experiments upon this point appeared lately in the transactions of the Highland (Scottish) Agricultural Society, which the reader who desires to pursue this subject would do well to consult.

down roots deep into the subsoil if it is open and porous.

Rain is another important source not only of ammonia and gases, but of mineral matter. We quote the following from Lindley's "Theory of Horticulture:"

"The researches of chemists have shown that all rain water contains ammonia, a compound of hydrogen and nitrogen, and thus the source of the nitrogen absorbed by plants was explained. But it has also been shown, especially by M. Barral, that other substances upon which plants feed are contained in rain water to a much greater amount than was suspected. This observer was led, during six months of 1851, to examine minutely the water collected in the rain gauges of the Observatory of Paris. His mode of investigation is declared by Messrs. Dumas, Boussingault, Gasparin, Régnault, and Arago, names foremost in French science, to be free from all objection, and to bear the most counter trials to which they could expose it. M. Barral states, that although the quantities of the following substances varied in different months, yet the monthly average from July to December, inclusive, was as follows:

"SUBSTANCES IN A CUBIC METRE OF RAIN WATER.

	GRAMMES.	GRAINS.
Nitrogen, ...	8.36 =	129.
Nitric Acid, ...	19.09 =	294.

	GRAMMES.		GRAINS.
Ammonia, ...	3.61	=	55.7
Chlorine, ...	2.27	=	35.
Lime, ...	9.48	=	100.
Magnesia, ...	2.12	=	32.7

"He did not ascertain whether all these substances are contained in rain water collected at a distance from towns. But Dr. Bence Jones found at least nitric acid in rain water collected in London, at Kingston in Surrey, at Melbury in Dorsetshire, and far from any town at Clonakelty, in Ireland. If we assume that M. Barral's averages represent what occurs on an English acre, the quantity of such substances deposited on that extent of ground may be safely estimated as follows:

"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 cubic metres of rain water per acre; and this, according to the proportions per cubic metre in the preceding table, would afford annually of—

Nitrogen, ...	45½ lbs.
Nitric acid, ...	103 "
Ammonia, ...	19½ "
Chlorine, ...	12½ "
Lime, ...	25 "
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."

But although nature is thus liberal in supplying the necessary wants of her children, man desires returns rather more extensive than is merely necessary for the good of the plant. He therefore adds directly to the soil those matters which contain proper nutriment for the vine. In doing this, however, it is not necessary to follow very accurately any recipe founded upon the analysis of the vine, provided we obtain sufficient of those elements which are most wanted. If we only spread a liberal table, the vine will select its own food.

Of all applications to the soil, none deserve more confidence than well rotted barnyard manure; from time immemorial it has been the staple reliance of the gardener and farmer and few are the instances in which its judicious application has been known to fail.

That it may do good and not harm, however, *when*

mixed with the soil in which plants are growing, it is necessary it be thoroughly rotten. However much may have been written about the waste incurred by allowing manure to decompose, it is a well know fact that thoroughly decomposed manure is beneficial to most plants, while decomposing or fermenting manure is frequently prejudicial. This probably arises from the fact that all bodies while undergoing decomposition exert a catalytic action on any organized matter in contact with them. Thus decomposing manure directly tends to produce rot in the roots or other parts of plants with which it comes in contact.

The proper time for the application of manure to a vine border has been a subject of much discussion. Our plan is to apply it as a top-dressing in the fall and fork it in in the spring. It thus serves to keep the border warm and the soluble portions are washed down amongst the roots of the vine by the winter snow and rain, thus reaching it in a most effectual manner. To assist this process, the border should be loosened with a fork before the manure is laid on.

Of all the substances entering into the composition of a manure heap none have a better influence upon vines than bones. In the formation of a border they are of essential utility, affording for a long period a constant source of nutriment. The avidity with which the roots of the vine seek such a depot of food

may be easily seen by placing a large porous bone amongst the roots of a vine. In a few months it will be literally covered with rootlets which have sought it out and find their nutriment in its recesses.

Leather, hair, horns, hoofs, woollen rags and other animal offal possess a similar action to bones. They all possess the valuable property of lying undecomposed in the soil for long periods, yet yield readily to the disintegrating action of plant roots. Hence, while they afford abundant and valuable nourishment to the vine, it is not surfeited by them as this nutriment must be wanted and sought before it will be given up.

Ashes of wood, whether fresh or leached are a powerful manure for the vine, and probably contain all that it requires. Leached ashes may be applied as a top dressing in almost any quantity with excellent effect, but a more cautious use must be made of fresh wood ashes, they being much more powerful and caustic. Coal ashes have hitherto been deemed utterly worthless, and are usually thrown into the street. To some soils, however, particularly those which are too heavy, they are a very useful addition, and as they are a powerful absorbent, there is no doubt that if mixed with night soil, or some similar matter, they would prove an excellent article—more lasting, and consequently better than night soil by

itself. They should never be thrown away, however, as they contain lime, iron and minute, though appreciable quantities of alkalies, soda usually predominating. It is also quite possible that they contain minute traces of phosphates, though in no analysis with which I have met is it mentioned. Where the coal has been burned at a high temperature the alkali is in general reduced, and the metal volatilized.

The dung and urine of animals forms a powerful manure. The solid excrements of all these are best mixed with some absorbent, as plaster, charcoal, burnt clay, etc.; or thoroughly decomposed in contact with vegetable matter, as straw, leaves, etc. The liquid and soluble portion may be used as liquid manure, or may be poured over the fermenting dung heap.

The dung of birds, as hens, pigeons, etc., and also guano, form a very convenient and most excellent top dressing for vine borders, but are better when applied as liquid manure during the growing season.

An excellent manure may be made as follows: Sink a hole in any convenient part of the premises and fill up with saw-dust. On this pour all the urine that can be obtained from time to time, and keep closely covered with a broad cover.

When sufficient has been added, or when the smell becomes offensive, remove the cover and place a pile

of charcoal, burnt clay, coal ashes, or other absorbent on top of it, and allow it to lie for a few weeks. At the end of that time, a mass of matter will have been produced almost equal to guano.

Road scrapings form a good top dressing for most soils. Hoare considers them unrivalled for the grape vine, and such was the opinion of Speechly, who tells us: "The dust, or dirt, from roads, consists principally of the following particulars: first, the soil of the vicinity; secondly, the dung and urine of horses and other animals; and thirdly, the materials of the road itself when pulverized. Various other matters may be brought by winds, and by other means, but the foregoing may be deemed the principal. The first of the above articles is brought to roads by the wheels of carriages, and the legs of horses and other animals; the last is the worst part of the materials, as the dust and scrapings of roads, made and mended with soft stone that grinds fast away, is much inferior in its vegetating quality to that which is collected from hard roads. On the whole, however, this ingredient of compost from the roads is unquestionably in general of a fertile nature, which may be attributed in part to the dung, urine, and other rich materials, of which it is composed, and in part to a kind of magnetic power, impressed upon it by friction and its perpetual pulverization.

"The nature of this road earth ought to be duly considered, when used in the vine compost, and its proportion adjusted according to its quality. In a sandy country it will naturally abound with particles of sand, and long and continued rains will, of course, wash away *its* best parts. High winds, too, in dry weather, will as certainly deprive it of its lightest and finest parts, especially when roads lie on eminences, or enjoy an open exposure. Those materials from roads are therefore preferable, which are produced from an inclosed track in a low situation Pavements, however, and hard roads, produce the best sulture of all. The compost is much better when collected in a moderate dry state, than when it is either very wet or dusty. If scraped off the road in a wet and soft state, when it is become dry it will be hard and cloddy, and will require time to bring it to a proper condition.

"When thus circumstanced, the best way of recovering it is to give it frequent turnings in hard, frosty weather."

Dead animals may be used in a vine border if placed sufficiently far from the roots to allow of their being decomposed, before the roots reach them, as previously remarked.

Any *decaying* matter in a border is very detrimental.

Charcoal is one of the best additions to any soil. It should be well burnt, however, and free from all smell of creosote, as this substance is rather prejudicial to the roots of the grape vine, although it seems to agree with some plants; (chiefly alliaceous, for which soot is a specific). On this account, when used for drainage in pots, it should be reburnt.

I am informed by one successful grape culturist that unless this precaution of reburning is taken with most charcoal, it is rather prejudicial to the roots of young vines in pots than otherwise. I have found, however, that if well sprinkled (it need not be saturated) with putrid urine and allowed to lie for some time, it loses its injurious qualities and retains abundant nourishment, which is gradually given off to the roots of the plants as they require it. When used as a compost for enriching a vine border it had always better be saturated with night soil or urine. Even brick rubbish, if so treated, becomes of great value.

Most of these solid matters are best added to the soil in the original formation of the border. This is especially the case with the prunings of the vine, than which nothing can be more valuable. If added when the border is first formed, it will not only furnish nutriment for the vine, but will tend to keep the soil open and porous. For our established vines, therefore, it will be best to depend upon liquid manure

and autumn top dressing of stable manure, and all solid matters may go to the formation of new vineyards, of which we suppose there will in general be an annual addition. But where no new borders are being formed, it would be well to open trenches between the rows of vines, in which such matters might be buried. If this were done immediately after the vintage, the roots would recover the same season from any wounds they might receive, and the ultimate gain would greatly overbalance any temporary injury. In doing this, it will of course be best to enrich but a small extent of border each year and do it thoroughly, so that it may afford a supply during many succeeding seasons.

Liquid Manure.—Of all the forms in which manure can be applied, the liquid manure is the most convenient and the most effective. No garden or vineyard should be without a tank of this article, as its judicious application will often enable us to mature a fine crop under very unfavorable circumstances, its great advantage consisting in the immediate results obtained; though this very quality, renders it a dangerous article in the hands of those who do not thoroughly understand its proper application. To prepare and preserve liquid manure, two tanks with good covers should be made in some convenient spot. In small gardens, barrels, such as are used for

hydraulic cement, will answer—larger establishments, of course, requiring something more capacious. They should be filled with chamber and kitchen slops and soap suds, the latter being generally added warm. On the large scale, when horse, cow, and other manure can be obtained, it may be mixed with water and added to the contents of the barrels. Hen manure is one of the most valuable additions. *Two* barrels should be used, so as constantly to have some of the manure *thoroughly* decomposed.

After standing for a week or ten days, it will be fit for use, and may either be applied to the surface of the border, or what is far better, introduced by means of subterranean drains or channels. These may consist simply of long wooden boxes, bored full of small holes and sunk about twelve inches beneath the surface, or of common horse shoe tiles placed in a similar position. Under any circumstances, it must have a tube at one end rising up to the surface, through which the liquid may be poured and which may be closed on the approach of winter so as to exclude frost. In very small gardens, it may prove sufficient to sink one or two flower pots in the border. These, being filled with the liquid manure, it will soak down amongst the roots without the possibility of loss by evaporation from the surface of the ground. The pots should, of course, ordinarily be kept covered

Liquid manure is such a powerful agent, that there is only one season of the year at which it can be applied; that is from the time the first leaves are well developed until the fruit is fully formed. During this period a *very weak* solution may be applied in *large quantities* once or twice a week. The culturist, however, must remember that the solution must be *weak*—say one pailful of the contents of the barrels to six or ten pails of water, according to the strength of the original liquid.

To prepare extemporaneous liquid manure ready for application to the borders or drains, dissolve two or three ounces of guano in a gallon of rain water, and allow to stand some time, stirring occasionally.

The principles which govern the application of this useful and powerful agent, are so clearly set forth by Dr. Lindley, in the last edition of his "Theory of Horticulture," that we cannot do better than quote from him.

"In order that the full effects of liquid manure should be felt without injury, it is indispensable: 1, that it should be weak, and frequently applied; 2, that it should be perfectly clear; 3, that it should be administered when plants are in full growth. If strong, it is apt to produce great injury, because of the facility with which it is absorbed, beyond the decomposing and assimilating power of plants. If

turbid, it carries with it in suspension a large quantity of fine sedimentary matter, which fills up the interstices of the soil, or, deposited upon the roots themselves, greatly impedes their power of absorption. If applied when plants are torpid, it either acts as in the case of being over strong, or it actually corrodes the tissues.

"Let the manure be extremely weak; it owes its value to matter that may be applied with considerable latitude; for they are not absolute poisons, like arsenic and corrosive sublimate, but only become dangerous when in a state of concentration. Gas water illustrates this; pour it over the plant in the caustic state in which it comes from the gas-works, and it takes off every leaf, if nothing worse ensues. Mix it with half water—still it burns; double the quantity once more—it may still burn, or discolor foliage somewhat. But add a tumbler of gas water to a bucketful of pure water, no injury whatever ensues; add two tumblers full, and still the effect is salubrious, not injurious. Hence it appears to be immaterial whether the proportion is the hundredth or two hundredth of the fertilizing material.

"Manuring is, in fact, a rude operation in which considerable latitude is allowable. The danger of error lies on the side of strength, not of weakness.

"To use liquid manure very weak and very often is, in fact, to imitate nature, than whom we cannot take a safer guide. This is shown by the carbonate of ammonia, carried to plants in rain, which is not understood to contain, under ordinary circumstances, more than one grain of ammonia in 1 lb. of water; so that in order to form a liquid manure of the strength of rain water, 1 lb. carbonate of ammonia would have to be diluted with about 7,000 lbs. weight of water, or more than three tons. Complaints which have been made of guano water and the like are unquestionably referable to their having been used too strong.

"It must be borne in mind: 1, That liquid manure is an agent ready for immediate use, its main value depending upon that quality; 2, that its effect is to produce exuberant growth; and 3, that it will continue to do so as long as the temperature and light required for its action are sufficient.

"These three propositions, rightly understood, point to the true principles of applying it; and if they are kept in view, no mistakes can well be made.

"With fruit, the period of application should be when the fruit, not the flowers, is beginning to swell. Nothing is gained by influencing the size or color of the flower of a fruit tree; what we want is to increase the size or the abundance of the fruit. If liquid manure is applied to a plant when the flowers are

growing, the vigor which it communicates to them must also be communicated to the leaves; but when leaves are growing unusually fast, there is sometimes a danger that they may rob the branches of the sap required for the nutrition of the fruit; and if that happens, the latter falls off. There, then, is a source of danger which must not be lost sight of. No doubt the proper time for using liquid manure is when the fruit is beginning to swell, and has acquired, by its own green surface, a power of suction capable of opposing that of the leaves.

"At that time liquid manure may be applied freely, and continued from time to time as long as the fruit is growing. But at the first sign of ripening, or even earlier, it should be wholly withheld."

The action of manure is even now very far from being thoroughly understood. When modern chemistry was first applied to agriculture, it was supposed that the great object of manure was merely to afford food for plants. But it was afterward found that other conditions were of equal importance, and that the advantage of many manures arose from their mechanical influence upon the soil. At Lois Weedon in England, excellent crops of wheat have been raised by thorough cultivation, without the application of manure, and the same principle was advocated by Jethro Tull in 1731, whose famous system of horse

hoeing husbandry consisted simply in deep ploughing and thorough pulverization of the soil.

But while the mechanical condition of the soil exerts a most important influence on the growth of plants, there can be no doubt that unless all those elements of which a plant is composed, exist in the soil, or are derivable from other sources, healthy vegetation is impossible. Tull's farm finally failed to yield fair crops, notwithstanding large expenditures, on the mechanical part of the process, and the same result is said, to have attended the rigorous application of his principles elsewhere.

If the action of manures in general, is but imperfectly understood, still less does its influence upon the vine and its products, seem to have been reduced to known laws. In France the use of manure has been productive of evils so great as to induce the company of wine merchants, and vineyard proprietors, to condemn the use of azotized manures entirely.

On the other hand, the vine-dressers of Thomery, who produce the beautiful Chasselas de Fontainebleau grapes, use rich manures in liberal quantities. In general, it will be found in this, as in other cases, that a middle course is best. If the border has been purposely prepared in the first place, a vigorous growth will have been secured, while it was necessary that the vine should produce abundant wood, and

when, after four or five years, the fruit is applied to the manufacture of wine, all rankness of growth will have disappeared. If, in after years, the vine should show symptoms of debility, it will be easy to supply it with nourishment, by means of liquid manure; and if ample means are provided for keeping the roots very dry during the ripening process, so that we can regulate the period over which the effects of such application shall extend, we are inclined to believe that no evil results will follow.

M. Ladrey suggests that but one portion of the vineyard be manured at one time, and that the wine from the part so treated be kept separate from the rest, until the evil influence of the manure has disappeared. It is obvious, however, that if we could avoid entirely any loss, of even a part of the vineyard, it would be desirable.

In this, however, as in all other matters, we must keep steadily in view the fact, that all rank vegetation exerts an injurious influence, not only upon the fruit product of the current year, but on the wood upon which our next year's crop depends.

In his "Nouveau système de la culture de la vigne," Persoz attempts to avoid the evils incident to the ordinary mode of the application of manure, by adding to the soil those matters which tend to produce wood, and those which favor the production of fruit,

each at the appropriate time. His formulæ are as follows.

Six pounds bone dust; three pounds leather clippings and other animal refuse; (blood, horns, hoofs, etc.) and one pound gypsum, making in all ten pounds to be added to each square yard of border. This is done in the spring before the buds have pushed.

As soon as the young shoots are well advanced, he manures each square yard with eight pounds silicate of potassa, and two pounds of the double phosphate of potassa and lime. Silicate of potassa he procures by fusing fifteen parts of quartz sand with ten of potassa and two of charcoal.

The double phosphate of potassa and lime is prepared, by adding 18 lbs. of sulphuric acid to 24 lbs. of calcined and pulverized bones. This, after being well stirred, is diluted with water, allowed to stand for three days, treated with hot water and filtered. Carbonate of potassa is then added, until the liquid is slightly alkaline, and it is then evaporated in a cast iron vessel, roasted at a red heat, mixed with the silicate, and the whole reduced to powder.

A vine manured by Persoz with 0.5 kilogr. of silicate of potassa, 1.5 of phosphate of lime and potassa, and an equal weight of dried blood and goose dung, put forth in one year a shoot 11 metres in length, and yielded on nine shoots twenty-five bunches of grapes,

while a similar vine, which was not manured, produced a shoot only 4.6 metres long, with only four or six blossoms, which faded away before their full development.—LIEBIG AND KOPP: *Annual Report.*

CHAPTER XII.

DISEASES AND INSECTS.

We confess we have had very little experience in the matter of diseases and insects affecting the grape vine. Our native varieties are so vigorous and hardy that disease rarely affects them, and during the growing season they push with such rapidity, that the loss of a few leaves destroyed by insects is scarcely felt.

But we are aware that it is not always so, and we shall therefore give as full an account as we can obtain of the formidable pests to which the grape grower is exposed.

When growing in the open air in a suitable soil, and with a good exposure, the only two diseases to which the grape vine is liable, are mildew and the rot. The former appears in whitish spots on the surface of the leaves and wood, and when examined with a simple lens of 25 inch focus, shows a net-work of fungus with its sporules.

For this, as well as for the red spider, no remedy has been found equal to sulphur, the use of which for this purpose has been known from time immemorial.

To apply it, use may be made either of a common dredger fixed to the end of a pole, or of a pair of bellows with a contrivance for admitting a small quantity of sulphur into the stream of air. Or it may be mixed with water and the foliage syringed therewith. But the most efficient method is that proposed by Dr. Price, who was the first to suggest pentasulphide of calcium for this purpose.

This compound is prepared by boiling 30 parts by weight of caustic lime with 80 parts by weight of flowers of sulphur, suspended in a sufficient quantity of water; heat is applied until the solution has acquired a dark red color and the excess of sulphur ceases to dissolve. The clear solution is drawn off, and after being diluted with 20 times its bulk of water, may be applied to the vines by means of a sponge, brush or syringe.

Where flowers of sulphur is used, it should have a few drops of ammonia added before it is applied to the foliage, as the sulphurous acid with which it is saturated (derived from its combustion during distillation) is always injurious to leaves and young shoots.

The rot has rarely troubled our northern vineyards, though it is the great bane of vine culture in Ohio. We are inclined to believe that if vines are planted in soil, dry or well drained and not too rich, and be

allowed to extend themselves moderately, but little need be apprehended from the rot.

Dr. Asa Fitch has found upward of thirty different insects which prey upon the grape vine, but with the exception of the red spider, and occasionally the rose-bug, they do not injure the vine materially.

The red spider (*acarus tellarius*) of which we give a cut (Fig. 60), we have found, not only under glass,

Fig. 60.

but on vines in the open air. It is a small, reddish-colored insect which it requires a sharp eye to detect. For this, as for mildew, sulphur is a specific, and we are always safe in giving our vines a good dusting of this substance, so as to *prevent* any injury which might arise from either source.

The rose-bug has never troubled us much. It nearly destroyed Dr. Underhill's vineyards at one time, however, and we therefore give his account of the matter in his own words.

"Several years since, when my vineyards were

smaller than at present, I found the rose-bug a formidable enemy. They appeared on the vines when they were in blossom, or just as the blossoms were falling off and the young grapes forming, and devoured them with the greatest avidity. This feast continued from eight to twelve days, or, until the cherries on the trees in the vicinity began to ripen, when they with one accord flew to them, for a change of diet, I presume, or from some other cause. I was quite familiar with the habits of the caterpillar, and had been in the practice of clearing them from my orchards in the spring, before they had destroyed scarcely a leaf. This I did not consider a great or difficult matter, for they were enveloped in a web early in the morning, and one man in a few days was able to clear many hundred trees, by twisting them off, web and all, with a basket, and carefully placing them under his foot. The rose-bug, however, did not, like the caterpillar, make its appearance in clusters or webs, but in small numbers at first, and scattered through the vineyards, increasing rapidly every day. Though taken from the vines on the trellis every morning, they continued to multiply till the eighth or twelfth day, when they suddenly left for the cherry-trees, as before stated. I was at a loss at first to know where they came from, till at length I discovered the ground perfo

rated with numerous holes, through which they made their way to the surface.

"I observed, when they first appeared on the vines, they were so feeble as to be unable to fly even for a few yards. Having surmounted all other difficulties, I was determined not to be defeated in the vineyard cultivation of the grape by this insect, and consequently resorted to the following means for their destruction. I directed my men to take each a cup, with a little water in it, and go through the vineyards every morning, removing every bug from the vines; and this was done quite rapidly by passing the cup under the leaf, and merely touching it, when the bugs instantly dropped, and were received in the cup containing the water. When the cup was full, they were soon destroyed by pressing the foot upon them on a hard surface. After all of them had been taken off, on the following morning there were ten on the vines where we had found but one; and the succeeding morning, after having been removed as before, there were one hundred where there were but ten, and so on. I was not discouraged, however, and directed my men to persevere in the work of destruction, and we should thus perhaps prevent the formation of another progeny for the next season, for it is very easily shown that they do not migrate to any great distance; and by thus

destroying the present race, I am convinced that we insure ourselves from their further depredations to any injurious extent. When a person of some energy has cleared them from his vineyard or garden, he is pretty certain to enjoy the benefit of his labor another season as well as the present, though he may have a few from his less resolute neighbor. Pursuing the course I have mentioned, I very soon lessened the rose-bugs so much that they gave me very little trouble.

"I also tried ploughing my vineyards just before winter set in, so as to expose to the weather the insect in the larva state, which will certainly destroy all the young tribe that have not descended below the reach of the plough. For two years past the number has been so small, that I have omitted this process for their destruction."

CHAPTER XIII.

METHOD OF HASTENING THE MATURITY OF THE GRAPE.

Several methods have been proposed for causing grapes to ripen at an earlier period of the season than usual, or in localities where they would not otherwise ripen at all. The most successful, and, on the large scale, economical, mode of effecting this is undoubtedly by means of glass houses, either with or without fire heat. A description of these is beyond the limits assigned to this work, though we may, perhaps, be allowed briefly to describe two devices of this nature, by which a few bunches may be matured at small expense and with very little trouble.

"More than twenty years ago, a market gardener at Bath published a plan of ripening grapes under common hand-glasses. He planted the vines in a soil composed in great part of lime rubbish; placed a glass over each plant, taking out half a pane in its summit through which the leading shoot of the vine protruded itself, and grew in the open air. The bunch or bunches of grapes remained within the hand-glass, and enjoyed the advantages of protection

from cold winds, dews, and rains during the night, and of a high degree of confined solar heat during the day."—LOUDON.

Mr. Maund, editor of the "Botanic Garden," employs the following method of obtaining a few bunches: "Although my experiment is not yet completed, I cannot omit mentioning to you its success. Grapes grown on open walls in the midland counties are rarely well-ripened; therefore, I provided a small glazed frame—a sort of narrow hand-glass—of the shape shown in the annexed outline, to fix against the wall, and inclosed in it one branch of the vine with its fruit and foliage. The open part, which rests against the wall, is 13 inches wide, and may be of any length required to take in the fruit. The sides are formed of single panes of glass, seven inches wide, and meet on a bar which may represent the ridge of a roof, the ends inclosed by triangular boards, and having a notch to admit the branch. This was fixed on the branch a month before the vine came into flower. The consequence was, the protected branches flowered a week earlier than the exposed. The frame was not fitted closely to the wall, but in some places may have been a quarter of an inch from it. The lateral branches being shortened before it

Fig 61.

was fixed, it did not require removal, even for pruning, because I adopt the long-rod mode of training, which is peculiarly adapted to my partial protection system.

"The temperature within the frame is always higher than that without, sometimes at mid-day even from 20 to 30 degrees. By this simple protection, I find grapes may be ripened from three weeks to a month earlier than when wholly exposed, and this saving of time will, I believe, not only secure their ripening well every year in the midland counties, but, also, that such advantage will be available in the north of England, where grapes never ripen on the open walls. I should have told you that the cold nights of spring have caused almost all the young fruit to fall off during the flowering season, excepting where it was protected.

"To hasten the maturity of grapes grown in the open air, means may be taken to throw them early into a state of rest. On the 20th of September prune the vine as you would in the month of December, taking off all the leaves and grapes, ripe or unripe, and shortening all the branches to one, two or three eyes at most. The following spring it will push its buds a few days before any of the neighboring vines pruned in winter. Train it as carefully all the summer as though you were certain it would ripen its

crop of fruit. Pursue the same system annually, pruning the tree always between the 20th and 30th of September, and in the course of seven years you will be rewarded for your patience and expense with half a ripe crop in most summers, and a whole ripe crop in warm summers."—LOUDON.

The following method of hastening the maturity of grapes on open walls, was communicated to the Horticultural Society of London, by Mr. Thos. Fleetwood: "Before the vines are out of flower, he brings each bunch into a perpendicular position by a thread attached to its extremity, and fastened to a nail in the wall, carefully confining the young branch with the bunch thereon, as close to the wall as possible. The period of blossoming is preferred for this operation, because the bunch at that time takes a proper position, without injury.

By this practice the bunches are kept so steady that the berries are not bruised by the action of the wind, and being fixed close to the wall, they receive such additional heat, that they ripen a month earlier than when left to hang in the usual way."

But of all the plans which have been proposed, perhaps the simplest and most efficient is ringing, girdling or breaking. It has been employed for many years in France, although it is there conceded, that it injures the quality of the wine produced. For

table purposes, however, the grapes seem to be improved both in size and appearance.

Fig. 62.

The French method is shown in Fig. 62. Here the annular incision is made just below the fruit bunch at the time of flowering. A pair of pincers with a double pair of semicircular jaws, makes both the upper and lower incision at once, when the bark is easily removed by the finger nail.

The following are the details of an English practitioner:

"The vines are generally cultivated upon the *Hoare* system, or, as it is called, the *long rod system;* but they are not so cultivated in every case, for sometimes an old bearer is spurred back to one or two buds, to carry its crop another year. My vines are very strong, and the rods or branches stand at

least three feet, or even three feet six inches, distant from each other, when winter pruned. This allows just sufficient room for the fruit-bearing laterals and a young rod to come up between every two bearers. This young rod, of course, to be the bearer of lateral the following year:

"Thus no vines cultivated on any other system are so capable of being rung, without the disadvantage of killing or losing the future useful part of the tree, because on Hoare's long-rod system, the whole of the previous years, bearers will have to be cut entirely away.

"The very right time to perform the ringing is just after the berries are all set, or have attained the the size of No. 2 shot, or small peas. In ringing, cut, with a sharp knife, clean round the branch between two joints. Or, if you are going to ring the laterals carrying the fruit, leave either two or three buds and leaves beyond the main stem, and make the ring just in the middle, between the third and fourth leaves, or joints. As I said before, make two cuts clean through the bark, quite down into the wood, one inch apart, and remove the bark clean away, all round the branch or lateral. By this means, if you are in the habit of spur pruning, the hinder buds are left all right, to spur back the following year. If you prune upon the long-rod system, you may ring the rod just

wherever you please— the whole branch, if you like— as the rung part will have to be cut away entirely after the fruit is gathered.

"The ringing is performed just the same on an old whole branch as in that of the young lateral carrying one or two bunches. I have repeatedly rung old branches, that have been carrying from twenty to thirty bunches of grapes, with the same good effect; only it has been such branches that I have intended to cut away entirely the following autumn: of course, thinning out the berries of the bunches, and the bunches too, if excellence be aimed at, is of the utmost importance. The process of thinning this cannot be too early attended to. I always begin as soon as the fruit is fairly set, and continue to remove all inferior berries, and, with a good pair of scissors and clean fingers, using my eyes to see what I am about, so as not to injure the berries by handling and mauling them.

"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 indoor and outdoor grapes, at our Hampshire horticultural show in November.

"As a matter of course, I had read of ringing fruit trees, etc., but it never struck me to put the same into practice until about fourteen years ago, when my attention was called to it in an amateur friend's garden, Mr. Frampton, glass and paint merchant of this city. I happened to walk in and look at some vines to which he was paying great attention at that time. This was in the month of September, and here I first saw the ringing process of the vine. Seeing a few bunches of the *Black Hamburg* so large in the berry, and all ripe, I began to inquire into the particulars, when Mr. Frampton kindly showed me where the branches were rung, and that the ringing was the cause of their being so very large and so early. I then wanted to know whence Mr. Frampton obtained his information, when he showed it to me in the 'Penny Cyclopædia,' from the pen of Professor Henslow."—*Thos. Weaver, Gardener to the Warden of Winchester College.*

[It is quite true that we have watched for some years, with great interest, the experiment upon ringing vines carried on by Mr. Weaver, and we can authenticate his statement of the mode of ringing and its

results. It must not be done in that petty timid manner hinted at by a contemporary. There must be a ring of bark perfectly removed; the cuts being made boldly down to the very young wood, or alburnum, and every particle of bark, inner and outer, must be removed between the cuts. (See Fig. 63.)

Fig. 63.

This drawing represents, faithfully, the ring part of a rod at the close of autumn, and shows how the removal of the band of bark checked the return of the sap, and how, in consequence, the rod above the

removed band increased in size beyond that portion of the rod below the band.

The effect upon the berries was, in every instance, to advance their early ripening a fortnight, and to about double the size and weight of the berries, when compared with those grown on unrung branches of the same vine. Nor was the color and bloom of the berries diminished; indeed, so excellent were they, that we have seen them exhibited deservedly by the side of grapes grown under glass, and they were sold in November, at Winchester, for half-a-crown a pound.

Ringing the branches of fruit-trees, to render them fruitful, was practised in France, and recommended there in print, about a century and a half since. There are various letters upon the subject in the early volumes of the "Horticultural Society's Transactions," and in one of them (vol. 1, page 107), published in 1808, Mr. Williams, of Pitmaston, gives full directions for ringing the grape vine. He tells the result, in these words: "I invariably found that the fruit not only ripened earlier, but that the berries were considerably larger than usual, and more highly flavored."—*Editor of the Cottage Gardener.*]

CHAPTER XIV.

CARE OF OLD VINES.

There are scattered through the country numerous old vines of large growth and great age, which have been trained upon trellises, through trees, against the sides of houses and on arbors, without much skill or attention. These well deserve good culture, and the owners would gladly bestow it if they knew how. For their benefit, a few hints in this direction may not be out of place.

Such vines have in general either been left entirely to themselves, or trained wholly on the long-spur system, no new wood except these spurs being kept from last year's growth to supply the wants of next year, and the strength has thus been thrown to the ends of the stems, leaving them barren for a great distance from their base.

Vines in this condition, if of good origin, may, by judicious management, be speedily made to bear large crops of excellent fruit, as their roots are large and powerful, and fully competent to supply nutriment to a large crop of grapes.

If the stems are tolerably well supplied with bearing spurs, it may be advisable to take good care of such of these as we can find, and where there is a barren spot, to train a young shoot over it from the nearest bearing spur. Upon this young shoot spurs may soon be made, which will bear admirably.

But, in almost all cases, the better plan will be to gradually renew the whole vine, as strong, vigorous shoots, when once laid in for main branches and well supplied with bearing spurs or canes, will last for a long time and give satisfactory results with far less labor than is required by an old and straggling vine.

This change had better be effected gradually, a portion of the old wood being retained until the young shoots come into bearing, so that we need not be entirely deprived of fruit during its progress.

Commence, then, at the spring or winter pruning, and remove all the wood that can be well spared, keeping only a few of the best main branches, and cutting the spurs on these very close, leaving not more than one eye to each.

This severe pruning will cause the vine to throw up numerous strong shoots, or suckers, from near the roots. Two or three of the best of these must be selected and trained to stakes, away from the trellis or arbor, so as to give them all the light and air possible; the laterals which start from these must be

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pinched at the third leaf, and they should be stopped about the middle or end of September. All other shoots from the base of the vine, as well as all useless or barren shoots on other parts, must be carefully removed as fast as they appear, so as to throw as much as possible into the canes we had selected.

Next season, these canes must be disbudded and laid in as follows: Having removed all laterals and tendrils and tied them firmly to the trellis, as shown in Fig. 64, commence at the first good bud from the

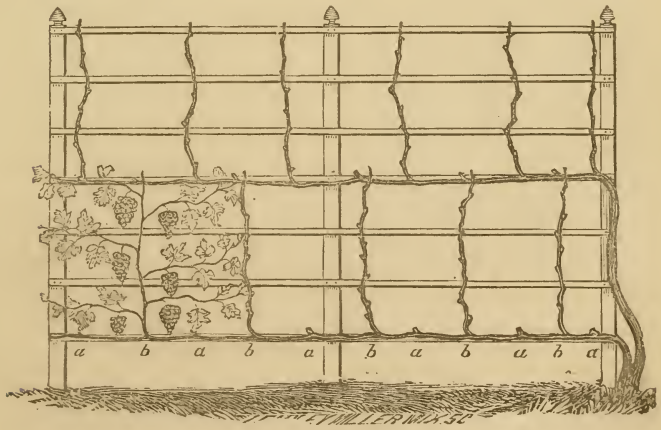

Fig. 64.

base, which leave, and then remove all the buds for a space of from 14 to 20 inches. Between 14 and 20 inches we will certainly find a good bud on the

upper side of the cane (as it is tied to the trellis), which must be kept, and all the buds on the next equal space, removed in the same manner. So proceed until you have laid in ten or a dozen buds on each cane, when it should be cut off. We will now have two or more horizontal arms, each of which will throw up from 5 to 6 vertical canes of a strength sufficient to bear fruit next year, and the same number of short shoots which will form spurs for next year's bearing canes. But in order to make sure of this, we must prune the old vine very severely, indeed, and if we could make up our minds to do without fruit for one year and cut it *all* away, we would be gainers by it in the end. But in any case, all fruit must be removed from our new wood, as the stems will have enough to do to cover the trellis without bearing a crop of grapes.

Next year, the canes *b*, *b*, *b*, *b*, *b*, will bear a full crop of fruit, and shoots must be trained up from the spurs, *a*, *a*, *a*, *a*, *a*, *a*, to take their place at the winter pruning. The whole management will now be the same as that previously described for vineyards.

If it be preferred to train up the vine on the spur system, the buds at *a*, *a*, *a*, *a*, *a*, *a*, should be removed when the cane is disbudded the first season, and after having borne once on the long-rod system, the canes *b*, *b*, *b*, *b*, *b*, will be well provided with shoots by cutting

back on which good spurs may be formed. These spurs should be distributed along the canes at a distance of 14 to 20 inches on each side, and may be managed individually, as described in Chap. VII.

The height to which spur-bearing canes may be carried is, perhaps, without limit, if they are properly treated and the vines have sufficient root power. But in practice, we do not think that it will be well to have them longer than 6 to 8 feet. They are thus kept within bounds, and any one which may become barren is more easily renewed than if they are of greater length.

Where the vines are managed on the long-rod system, we would never have the canes over 6 feet long, and if only 4½ to 5 feet, so much the better.

Thus, if we desired to cover a wall or trellis fifteen feet high, we would have two tiers of arms carrying spur-bearing canes each 7 feet long, or three tiers carrying long-rod or renewal canes.

Before proceeding to renew an old vine, it may be well to manure it thoroughly, either by a good top dressing in the fall, liquid manure during the growing season, or by digging a trench about six feet from the roots and filling it with good compost, bones, etc.

An excellent plan for feeding an old vine is to make a basin about six inches deep round its roots, with boards, against the outside of which sufficient

heavy soil has been placed to make it water-tight. Then, during the growing season, let this basin be filled with soap-suds every washing day—mixing them with chamber slops, etc. During the winter, it should be filled with leaves and prunings, over which a little earth may be thrown to keep the wind from blowing them about, and preventing an unsightly appearance. If the roots of the vine are so near the house as to be unsightly when treated in this manner, the basin might easily be provided with a light board cover neatly painted. It might be requisite to form it in two parts, having notches through which the stem of the vine can pass.

That a good manuring will often cause a vine which has been previously unfruitful to bear abundant crops, is well known. We have now in mind an instance of a vine which after remaining barren for many years suddenly became quite fruitful from chickens making a roost of the trellis on which it grew.

CHAPTER XV.

TO PRESERVE GRAPES.

Although He who "has made everything beautiful in his season," no doubt designed grapes to be used while fresh, yet, though we cannot preserve the exquisite flavor of newly-gathered grapes, we may, nevertheless, prolong their season, if not in its full excellence yet with sufficient attraction to make it worth while.

With proper care, grapes may be kept until Christmas, and at that time will command a price which would not be paid for fresh fruit during the height of the grape season.

As yet, the preserving of the fruit seems to be but little understood, and although we have kept grapes until January in a very palatable state, and we have tasted others which have been tolerably preserved until March, we must acknowledge that none of these attempts quite came up to our desires, however much others might have praised the result. The truth is, that grapes in March will never be very severely criticised under any circumstances: They are too much of a rarity for that.

Although the foreign grapes which are imported, packed in sawdust, are said to be gathered before they are fully ripe, we believe that this plan is not suited to our native varieties. They should always be fully ripe before they are gathered, and this should be done on a clear, dry day before they have been touched with frost. The bunches should be carefully examined, none but the first-rate ones selected, and they must be scrupulously freed from all dirt, such as leaves, spiders' webs, insects, etc. All decayed or unripe berries must be removed with a pair of sharp scissors (merely pulling them off will not do); and they should be exposed to the air (but not the sun) for a few hours before being packed away. In one case where, after the grapes were gathered, the weather became damp before they were put up, we know them to have been placed in a *moderately* warm oven for rather more than five minutes, and the result was very good.

The following are a few of the methods which have been recommended:

1st. Procure some fine, dry sawdust (avoiding that from resinous or scented wood), and pack the grapes in a box or barrel, in layers, being careful to have sufficient between the bunches to prevent their touching. Bran is sometimes substituted for sawdust.

2d. Wrap each bunch in fine, clean dry paper, and put away in layers in boxes.

3d. Take a good box and place a layer of cotton batting on the bottom; on this place a layer of grapes, then a layer of batting and so on, until the box is full, wrapping each cluster in thin paper. Some omit the paper.

4th. Seal up the ends of the stems with wax, and suspend them in a cool, dry and dark room, looking them over occasionally and removing unsound berries and bunches.

The French suspend their bunches by the lower ends to a little hook (see Appendix). Some cultivators, however, cut away the fruit-bearing branches and preserve the grapes attached to them.

It has been advised to immerse the stems of the bunches in wine, before the fruit is used; but as they are always dried up and incapable of transmitting fluid, we have found it better to immerse the whole bunch in cold water for half an hour or so. This restores the plumpness of the berries and removes some of the foxy flavor which is apt to tinge our native grapes when long kept.

THE OHIO SYSTEM OF VINEYARD CULTURE.

This is merely a modification of the French and German methods, having been generally introduced by vine-dressers from those countries. It is, we believe, now generally giving place to the trellis system of culture, which seems to be better adapted to the habit of our native vines. Vines and even vineyards may be found around Cincinnati, which are trained differently from the method here described, but nevertheless, the following is what is known as the *Ohio system.*

The ground having been properly prepared, the vineyard is set out either with cuttings or rooted plants, generally the former. In setting out cuttings, holes about two feet deep are made with a stilt or dibble, shod with iron, and after inserting two cuttings in each, the holes are filled in with sand which is washed into immediate contact with the cuttings by means of water. During the first season, the vines are allowed to grow at random, the ground, however, being kept clean and mellow.

In the spring of the second season the vines are pruned, which is done by removing all the wood made by the young cutting, and also all the roots which spring from the cutting, within several inches of the surface. Fig. 1 shows the young plant. The soil being removed, the roots *e*, *e*, *e* are cut off close to the

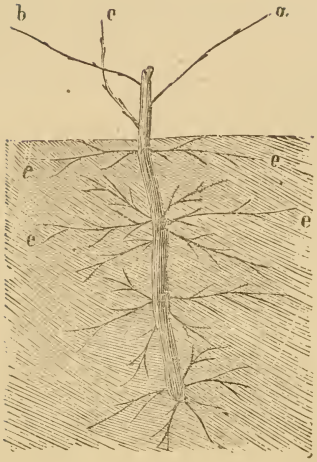

Fig. 65.

stem, the shoots *a b* are cut clean out, and *c* is cut down to one eye, which should be as near the old wood as possible, and if on it, so much the better. During the second year the vines are treated nearly the same as the cuttings were during the first year, and the spring pruning is also the same.

During the third summer, three or four shoots are trained up and carefully tied to stakes; laterals are pinched out and the shoots stopped in September.

During the fourth year, the vines are allowed to bear on the spurs produced by cutting back the shoots of the previous season to six or eight inches. These spurs of course throw up fruit-bearing canes, which during the fifth season are tied to stakes in bows, so as produce a crop of grapes, and at the winter pruning the bows are cut away, their place being filled next season by a fresh cane trained up for the purpose during the preceding summer.

The following figures will illustrate this fully: Fig. 66 shows the vine in the fall of the fourth year; H is the head of the

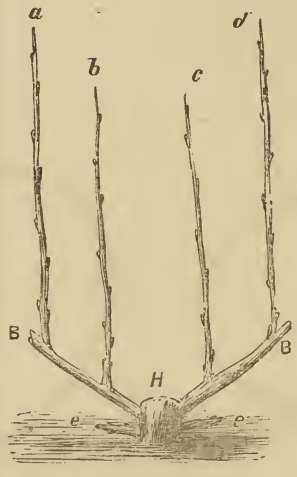

Fig. 66.

vine, B the arms or thighs, as they are sometimes called; and *a*, *b*, *c*, *d* are the canes which bore fruit last year; *b* and *c* are cut off to one good bud, and *a* and *d*, after being shortened, are formed into bows and tied to stakes, so that the vine in the spring of the fifth year presents the appearance shown in Fig. 67. The bow will now yield a liberal crop of grapes, and a few bunches will be obtained from the shoots springing from the spurs *b* and *c*, though they must not be allowed to bear much, as it is desired that they should grow strong and vigorous so as to form the bows for next year. If the vines are strong, they may be allowed to bear more, and other spurs are sometimes allowed to grow from the arms where the vines will bear it.

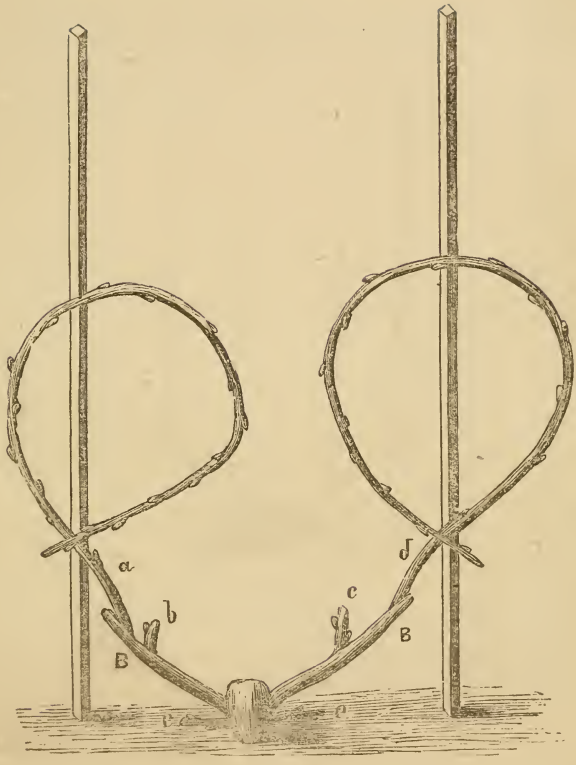

Fig. 67.

The arms themselves are renewed every few years, so as to get rid of all the old gnarled spurs, by training new shoots from the spurs *e e*.

THE MANUFACTURE OF WINE.

It is still a disputed question whether or not it is possible for good wine to be manufactured in the United States. Daniel Webster, whose high intellectuality did not detract from his fondness for the pleasures of the table, declared that we could never hope to make good wine on this continent, and that it would always pay us better to raise corn, cotton, etc., for export, and buy our wines and silks. On the other hand, the following letters from President Jefferson to Mr. Adlum would seem to establish the fact that, even at an early day, wine had been made in this country of more than ordinary quality:

EXTRACTS OF LETTERS FROM MR. JEFFERSON, LATE PRESIDENT OF THE UNITED STATES.

Dated October 7th, 1809.

"While I lived in Washington, a member of Congress from your State (I do not recollect which) presented me with two bottles of wine made by you, one of which, of Madeira color, he said was entirely factitious; the other, a dark red wine, made from a wild or native grape, called in Maryland a Fox grape, but very different from what is called by that name in Virginia. *This was a very fine wine, and so exactly resembling the red Burgundy of Chamberlin (one of the best crops) that on a fair comparison with that, of which I had very good on the*

same table, imported by myself from the place where made, the company could not distinguish the one from the other. I think it would be well to push the culture of that grape, without losing our time and efforts in search of foreign vines, which it will take centuries to adapt to our soil and climate."

Dated April 20th, 1819.

"The quality of the bottle you sent me before satisfies me that we have at length found one native grape inured to all the accidents of our climate, which will give us a wine worthy the best vineyards of France. When you did me the favor of sending me the former bottle, I placed it on the table with some of the *best Burgundy of Chamberlin, which I had imported myself from the maker of it*, and desiring the company to point out which was the *American bottle*, it was acknowledged they could perceive no difference."

Dated April 11, 1823.

"I received successively two bottles of wine you were so kind as to send me; the first, called Tokay, *is truly a fine wine*, of high flavor, and as you assure me there was not a drop of brandy or other spirit added to it, I may say it is a wine of a good body of its own. The second bottle, a red wine, I tried when I had good judges at the table; we agreed it was a wine *one might always drink with satisfaction*, but of no peculiar excellence. Speaking of brandy being added to the wine, he says it is never done but by the exporting merchants, and then only for the English and American markets, where, by a vitiated taste, the intoxicating quality of wine, more than its flavor, is required by the palate."

Now Mr. Jefferson and his friends were no doubt accustomed to drink good wines, and we think their opinions valuable, although at the same time it must be confessed that they were not very extraordinary

judges, or they would have detected a *difference* between the French and American wines. The question of *superiority* may sometimes be disputed even by good judges, that of identity never.

Good wine has also been made in the south of England, as the following extract from Barry's work on wines will show, and as it contains some practical notes on wine-making, we give it entire:

"The vineyard of Painshill is situated on the south side of a gentle hill; the soil a gravelly sand; it is planted entirely with the two sorts of Burgundy grapes: the Auvernat, which is the most delicate, but the tenderest; and the Miller grape, commonly called the black cluster, which is more hardy. The first year I attempted to make red wine in the usual way, by treading the grapes, then letting them ferment in a vat till the hulls and impurities formed a thick crust at the top, the boiling ceased, and the clear wine was drawn off from the bottom.

"This essay did not answer; the wine was so very harsh and austere, that I despaired of ever making red wine fit to drink. But through that hardness I perceived a flavor something like some small French white wines, which made me hope I should succeed better with white wine. That experiment succeeded far beyond my most sanguine expectations; for the very first year I made white wine, it nearly resembled the flavor of champagne, and in two or three years more, as the vines grew stronger, to my great amazement, my wine had a better flavor than the best champagne I ever tasted. The first running was as clear as spirits, the second running was *œil de perdrix*, and both of them sparkled and creamed in the glass like champagne. It would be endless to mention how many good judges of wine were deceived by my wine, and thought it superior to any champagne they ever drank; even the Duke de Mirepoix preferred it to any other wine. But such is the prejudice of most people against anything of English growth, I generally found it most prudent not to declare where it grew till after they had

passed their verdict on it. The surest proof I can give of its excellence is that I have sold it to wine merchants for fifty guineas a hogshead; and one wine merchant, to whom I sold five hundred pounds' worth at one time, assured me he sold some of the best of it from 7s. 6d. to 10s. 6d. per bottle.

"After many years' experience, the best method I found of making and managing it was this: I let the grapes hang till they got all the maturity the season would give them. Then they were carefully cut off with scissors and brought home to the vine barn in small quantities, to prevent their heating or pressing one another; then they were all picked off the stalks, and all the moldy or green ones were discarded before they were put upon the press, where they were all pressed in a few hours after they were gathered; much would run from them before the press squeezed them, from their own weight one upon another. This running was as clear as water and sweet as syrup, and all this of the first pressing, and part of the second, continued white. The other pressings grew reddish, and were not mixed with the best. As fast as the wine ran from the press into a large receiver, it was put into hogsheads and closely bunged up. In a few hours one could hear the fermentation commence, which would soon burst the casks if not guarded against by hooping them strongly with iron and securing them in strong wooden frames and the heads with wedges. In the height of the fermentation I have frequently seen the wine oozing through the pores of the staves.

"These hogsheads were left all the depth of winter in the cool barn to reap the benefits of the frosts. When the fermentation was over, which was easily discovered by the cessation of noise and oozing—but, to be more certain, by pegging the cask—when it would be quite clear, then it was racked off into clean hogsheads and carried to the vaults, before any warmth of weather could raise a second fermentation. In March the hogsheads were examined. If they were not quite fine, they were fined down with common fish glue, in the usual manner; those that were fine of themselves were not fined down, and all were bottled about the end of March, and in about six weeks

more would be in perfect order for drinking, and would be in their prime for above one year; but the second year the flavor and sweetness would abate and would gradually decline, till at last it lost all flavor and sweetness, and some that I kept sixteen years became so like old hock that it might pass for such to one who was not a perfect connoisseur. The only art I ever used to it was putting three pounds of white sugar-candy to some of the hogsheads, when the wine was first tunned from the press, in order to conform to a rage that prevailed to drink none but very sweet champagne.

"I am convinced that much good wine might be made in many parts of the south of England. Many parts are south of Painshill, many soils may be yet fitter for it, and many situations must be so, for mine was much exposed to southwest winds (the worst of all for vines) and the declivity was rather too steep. Yet with these disadvantages it succeeded many years. Indeed, the uncertainty of our climate is against it, and many fine crops have been spoiled by May frosts and wet summers. But one good year balances many disappointments.

"Captain St. Pierre, who has established a great colony of vignerons in South Carolina, and carried there three years ago above three hundred vignerons from different parts of Europe, was with me several days before his departure, was charmed with my vineyard, and he had cultivated vineyards many years in France. He was very happy at my giving him all the cuttings of my vineyard, as he found it very difficult getting the right sort, and though his plantations are about the latitude of 33°, he has not the least doubt of having excellent wine there, which, if he has, must be of infinite service to this country."

Still more recently Mr. Longworth has succeeded in the manufacture of fine champagne wines, which we believe are valued as high as any, except the very finest brands of foreign wines.

Wine is the fermented juice of the grape, and *pure wine* should contain nothing else. When sugar and

spices are added, and exist in the fluid as such, the product is no longer *wine*, but *liqueur* or cordial. Some have, however, extended this principle so far as to assert that any addition to the juice of the grape, either before or after its fermentation, robs it of its claim to the name of wine; but to this we cannot subscribe. If we by any process could produce a fluid identical in its chemical and physical properties with the juice of the grape, we could no doubt make good and real wine therefrom. And if so, then surely the addition of any ingredient which may be required to bring the juice up to the quality and composition of a good wine-making must, cannot have any but a good effect, and must produce a real wine.

Now the juice of the grape varies in composition from several causes. The variety of grape, the climate in which it is produced, the character of the soil in which it grows, the nature of the manure with which it has been nourished, the mode in which it has been pruned, its exposure to sun and air, and many other influences, all modify the character of the must, and consequently of the wine produced therefrom. In almost every locality we are confined to a few varieties of grapes, and as the climatic conditions are also in a great measure beyond our control, we must depend upon judicious pruning, manuring and cultivation for the production of the best grapes for the manufacture of wine. In former chapters we have detailed the peculiarities of vine-dressing as adapted to the producing of wine-making grapes;

but we may be excused for briefly recapitulating them.

Must for wine requires to be highly saccharine, and although the wines manufactured from American grapes have not yet shown much inorganic matter (potash salts) in their composition, yet the best wines in Europe are made from grapes containing an extra quantity of these matters. In order, therefore, to the production of a good wine, it will be requisite to produce grapes not only thoroughly ripened by A HOT SUN ACTING ON THE LEAVES, but they should also contain the juices and inorganic salts in large amount.

With a view to this, it will be necessary in the fall, and shortly after the vintage, to lightly fork in a dressing of bone-dust, guano or hen manure; and on the fall of the leaf, and before any frosts set in, the border should be covered with the fallen leaves raked together and mixed with stable litter or cleanings. This will protect the roots from the severity of our winters, and enable them to sustain the draft made in spring by the branches at an earlier date than they otherwise would.

In the spring, after the weather has become settled, the border should be very lightly forked over and the long litter removed; the rest may be mixed with the surface soil.

The vine having been properly pruned, must be allowed to *break its buds*, as it is termed, and push out the young stems until those which promise best can be clearly distinguished.

As soon as the leaves are formed, liquid manure may be applied if the number of vines cultivated will permit of it, and this application of liquid manure may be continued until after the middle of July. It should then cease for the season. Meanwhile, as soon as the young shoots are well formed, all the weakly ones should be rubbed off, carrying the pruning recommended in former pages to even a greater degree of severity than there noted.

By these means the grapes will be obtained ripe much earlier and of a higher (not stronger) flavor. The importance of having the grapes ripe early will be appreciated when we consider that, other things being equal, the heat and dryness of the season in which they ripen will be the measure of the perfection of the grapes, at least in this latitude. Now, in 1858, the mean temperature of August was 69° Fahrenheit, while the mean temperature of September was only 61°, and as the amount of rain which fell in each month was equal, the grapes which were ripe by the beginning and middle of September were much richer in saccharine and other wine-making elements than those which were produced in the cool and damp atmosphere of September and October.

From the foregoing observations it will be evident that in preparing must for wine we must pay particular attention to the quality of the grapes and the circumstances under which they were raised. Thus, in Cincinnati, no sugar is added to the juice of the Catawba; it is fermented just as it comes from the press. But in more northern climes, not only does

the juice of the Isabella and Clinton require sugar, but that of the Catawba stands in need of it, in order to make, not a sweet but a full-bodied wine, which will bear keeping.

In the manufacture of wine from the grape, the first process is to carefully pick over all the grapes, rejecting those which are unripe, rotten, mildewed, or imperfect in any other way. The rejection of the stems will depend upon the character of the wine desired. If retained, they impart a roughness to the wine, which some admire; and it is claimed by some, that the tannin of the stems helps to preserve the wine. The grapes are then to be mashed, which is easily done with the hands if in small quantity. In the large way it is performed by passing the grapes between rollers armed with pins. On a smaller scale, a beetle or stamper, armed with pins, may be used; and where but a few are prepared (as for domestic purposes) the hands alone can perform the work. A gentleman of this city has devised a very useful and efficient machine, in which, by passing the grapes between rollers covered with india-rubber, the juice is expressed and separated from the husks without bruising the stems or seeds.

If prepared in the ordinary way, the must may be allowed to ferment either before or after the juice has been separated from the seeds and husks. Fermenting the husks and seeds gives a roughness and harshness to the wine as well as a higher color. For the finest wines the juice only is fermented.

This is effected by simply allowing the juice to

stand in casks filled three-fourths full. Fermentation speedily sets in; the saccharine matter becomes converted into carbonic acid, which escapes, and alcohol, which remains in combination with the fluid, and gives it the character of wine. At first the fermentation is very violent, but after a time it moderates, when the casks should be filled up, lightly bunged, and kept during winter in a temperately cool apartment. In spring it should be carefully drawn off, either by means of a syphon or through a hole bored into the cask some distance above the bottom, so as to avoid disturbing the lees. After this, fermentation should be avoided as much as possible, which is best effected by a low temperature and the exclusion of oxygen. It is generally considered best, we believe, to leave the wine at least one season in the cask into which it has been drawn off. In some cases it is kept for years in the "wood," as it is termed.

Wine can of course be made of any kind of grape, though in and around Cincinnati the Catawba is altogether preferred. Tolerable wine has been made of the Isabella, and in the hands of Dr. Underhill it has proved of superior excellence for this purpose. But for all northern localities we think the Clinton promises to be the wine grape. When carefully pruned and *thinned*, so as to get fair bunches instead of the load of little sour trash usually seen, the Clinton grape is peculiarly rich in saccharine and saline matter. Of its wine-making qualities Nicholas Longworth speaks as follows in a letter to "The Horticulturist:"

"I believe I advised you that the must and wine of the Clinton grape differed from any I have ever seen. The must weighs very heavy, indicating a large quantity of saccharine matter; the wine, fully fermented, acid and weighing but little, and indicating but little spirit. Of the grapes you sent last spring I made two kinds of wine. One part I pressed as soon as worked, and put at the rate of seventeen ounces of sugar to the gallon of must; the other I worked and left to ferment in the skins before pressing, and put no sugar. The first is a beautiful dark red, which I have never seen equalled, and very clear. It has no sweetness and is rather dry, but of fine flavor. The other is clear, very dark red, and more acid, but of fine flavor. I deem that in our warmer latitude the must will have more sugar, and will make a valuable red wine, an article we have not at present.

"I am very desirous of giving the grape a further trial, and shall esteem it a favor if you will engage and send me from two to five bushels of grapes, and let them be as ripe as possible. I shall also be pleased to get from two to five thousand cuttings. I will next spring graft a dozen roots with this grape, and the next season guarantee to have grapes enough to test how they will suit our climate, as I have had grafts grow the first season from ten to thirty feet, and often bear some fruit the same season."

The following letter, received from a lady whose wine we can testify to be of very superior excellence, contains directions slightly different from those in ordinary use, and in some respects perhaps superior. We give it in her own words, which it may be but justice to say, were not originally intended for publication:

"After the grapes are gathered, pick carefully from the clusters all the good ones. Wash these, being careful not to mash the seeds (we had a little machine for this purpose that turned

with a crank). Have ready a perfectly sweet cask, that has a hole, about an inch in diameter, bored in one side near the bottom; fit into this hole a stick from six to eight inches long, with a hole bored from end to end of sufficient size to let the juice flow freely through it. Stop this hole tightly with a plug; as the grapes are mashed, pour the juice, skins, pulp and all, into the cask. When all are in, cover closely with four or five thicknesses of woollen blankets; let it remain in this condition until fermentation has advanced sufficiently to cause the grapes or must (as I believe wine-makers call it) to rise to the top and begin to crack open, the cracks being filled with little yeasty-like bubbles, which will be probably in from four to eight or ten days, according to the temperature of the weather. Now have ready a perfectly clean barrel, purified with sulphur; put into a pail ten or twelve pounds of sugar, take out the little plug, and let the juice on the sugar. As you fill the pail, stir the sugar occasionally from the bottom, so as to dissolve enough of it to make the juice sufficiently sweet. If the sugar should all dissolve before the juice is all drawn out, of course put in more. When the barrel is full, put the bung in lightly, so as to give it a chance to ferment. The little cups you speak of were used more as an experiment than a necessity; when those were used, the bung was fitted in tight and a small hole made in the bung, and a tin tube inserted in it, rising from the bung, the long end being in the bung, and the short end in a little tin cup filled, and kept full of water, care being taken to keep the barrel always full; but, as I said before, this was not necessary. After the juice had been barrelled, as above described, let it stand till some clear, cold day in February. Then draw off the juice and put it in another barrel, care being taken to have it perfectly clean and well fumigated as the first was; save a pailful, and when all has been drawn off, stir into this pailful the whites of ten or twelve eggs, beaten to a froth, as you would for cake. When well stirred, pour this in the barrel with the rest. After being well incorporated with that in the barrel, bung it up tightly, and for two years 'touch not, taste not, handle not,' and as much longer as you can resist the tempta-

tion, as it improves from 25 to 50 per cent. in quality every year it is suffered to stand. The barrels should be kept in a dark cellar.

"The above contains all the most important particulars of the doctor's process of making wine, to the best of my recollection. It will answer very well where one only desires to make a little for his own use; but would hardly answer on a large scale.

"Fumigating the barrels with a sulphur match destroys any musty or unpleasant smell which the barrel may have, and is done by melting flowers of sulphur or roll brimstone in an iron vessel on the stove; making a swab by rolling a rag around the end of an iron rod, saturate the rag with the melted sulphur as you roll it around; stick the other end of the rod into a good-sized potatoe, and set fire to the rag or swab; hang it in the barrel at the bung-hole, the potatoe will prevent it dropping down in the barrel."