

SOUTH AUSTRALIA.

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# DIRECTIONS FOR PLANTING THE VINE,

BEING PART I. OF THE

*South Australian Vinegrower's Manual:*

A PRACTICAL GUIDE TO THE ART OF VITICULTURE IN  
SOUTH AUSTRALIA.

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*Prepared under Instructions from the Government of South Australia, and with  
the Co-operation of Practical Vinegrowers of the Province.*

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## PREFACE.

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IN the preparation of this work very valuable assistance has been given by several of the leading practical vigneronns of South Australia, who, in the most public spirited manner, have shown the greatest readiness to admit intending growers of the vine to the benefits of their long, and often dearly bought, experience in viticulture. In the course of a number of interviews with some of these gentlemen the author has been able to note many practical hints which are in entire accord with the teaching of the leading experts in grape culture in Europe and America; while on the other hand there are not a few matters in which the local experience of the South Australian grower has led him to adopt methods which, to a certain extent, are peculiar to this colony, or, at any rate, to the Australian continent. In regard to the majority of practical points many of the local growers are in complete agreement, and it has therefore been unnecessary to quote individual authorities in connection with these; and in dealing with the points upon which much diversity of opinion has been disclosed care is taken to set out the different methods in detail, and to give some, at least, of the reasons which have been urged in favor of one method as advocated in preference to another. As a general rule it has been found that any serious difference in practice is to be explained to a large extent by the difference of soil and climate under which different vigneronns are accustomed to work, so that while there are wide discrepancies of practice, there are at the same time rules which cover almost the whole of the various sound methods which have been introduced and successfully brought into vogue. The practices which have been profitably put into operation in one locality of the colony may be very different from those which might safely be recommended for another locality, and for this reason it has been necessary to carefully collate the opinions of

individual winegrowers in the various districts of South Australia; yet, so far as has been found possible, the account of the operations necessary for the successful cultivation of the vine has been made continuous, and anything like repetition on the points upon which all are agreed has been avoided. In addition, the author has made extensive use of the best available authorities, not only Australian, but also European and American, and has to express his obligations to the writers of the following:—

- "Wine-growing in Australia," by A. C. Kelly, M.D.
- "The Culture of the Vine in New South Wales," by James Busby.
- "The Handbook of Viticulture for Victoria," by F. de Castella.
- "Journal of the Victorian Board of Viticulture."
- "Reports on Vine-growing Districts," by R. Bragato (Victoria).
- "The Vine: When, What, Where and How, to Plant (three papers)," by Thomas Hardy, written for the South Australian Royal Agricultural and Horticultural Society and the Agricultural Bureau in 1882, 1887, and 1891.
- "Soils, Situations, and Suitable Varieties" special paper, by Thomas Hardy and J. G. Kelly.
- The Garden and Field (passim).*
- Daily and weekly South Australian newspapers (*passim*).
- "Manual of the Vine," by C. W. Grant.
- "The Grape Culturist," by Andrew Fuller (New York).
- "Open Air Grape Culture," by John Phin.
- "The Vine Dresser's Manual," by Charles Reemelin.
- "American Grape-growing and Wine-making," by G. Husmann (California).
- "Grape Culture, Wines, and Wine-making," by A. Haraszthy (California).
- "Grape Culture and Wine-making in California," by T. H. Hyatt (California).
- "Vine Manual of the Journal of Horticulture."
- "Culture de la Vigne et Vinification," par le Dr. Jules Guyot.
- "Etude des Vignobles de France," par le Dr. Jules Guyot.
- "Le Vin," par A. de Vermette-Lamotte.
- "Cours Complet de Viticulture," par G. Foex.
- "Ampelographie Universelle," par le Comte Odart.
- "Manuel du Vigneron," par le Comte Odart.
- "Vignes du Medoc," par A. D'Armailhac.
- Annales de l'Ecole Nationale d'Agriculture de Montpellier.
- "Les Maladies de la Vigne," par Pierre Viala.

Among the most valuable sources of information which have been utilised relative to the local developments of the various methods of viticulture are the following:—

Reports of, and evidence given before—

Select Committee on Vegetable Products (1887), consisting of the Hons. J. H. Angas, Alexander Hay, James Martin, J. Rankine, and R. A. Tarlton, Dr. Cockburn, Jenkin Coles, R. Homburg, F. Krichauff, and E. Ward.

Select Committee on Bonuses for Agricultural, Dairying, Fruit, and Wine Industries (1890), consisting of Messrs. Butler, Cock, Gillen, J. R. Kelly, McDonald, Hon. J. L. Parsons, and Mr. Castine.

Barossa Water Commission (1889), consisting of the Hons. A. Catt, A. Hay, J. V. O'Loughlin, J. Warren, and Messrs. R. Homburg, A. McDonald, L. Grayson, and J. H. Bagster.

Among the South Australian experts and gentlemen connected with the viticultural and wine-making industries whose views upon various points have been made available, either through their published communications and their evidence given before Parliamentary Commissions and Committees, or in the course of personal interviews and correspondence with the author, are the following:—

- Sir Samuel Davenport, K.C.M.G., of Beaumont.
- Mr. T. Hardy, of Bankside.
- Mr. B. Seppelt, of Seppeltsfield.
- Mr. J. G. Kelly, of McLaren Vale.
- Messrs. S. & W. Sage, of Angaston.
- Messrs. S. Smith & Sons, of Angaston.
- Mr. W. Jacob, of Moorooroo.
- Mr. Joseph Gillard, jun., of Magill.
- Mr. E. Mazure, of Magill.
- Mr. J. C. Gelly, of Tanunda.
- Mr. E. Salter, of Angaston.
- Messrs. Chaffey Bros., Limited, of Renmark.
- Messrs. G. F. Cleland & Co., of Adelaide.
- Messrs. Snow & Co., of Adelaide.
- Messrs. H. J. Scott & Co., of Adelaide.
- Messrs. P. B. Burgoyne, & Co., of London, Melbourne, and Adelaide.
- The Secretary of the Central Agricultural Bureau (Mr. A. Molineux, F.L.S.).

## INTRODUCTION.

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THE publication of this handbook has been undertaken in compliance with the decision of the South Australian House of Assembly to give effect to the reports of the Select Committees on Vegetable Products and on Bonuses for Agricultural, Dairying, Fruit, and Wine Industries, especially the portions containing recommendations for the further extension of viticulture in South Australia. The primary object of the publication, therefore, is to facilitate the spread of a knowledge of the broad general principles upon which the cultivation of the vine may be undertaken in South Australia, rather than to attempt any exhaustive treatment of the subject of viticulture and oenotechny as branches of systematic study. It is universally regarded as being extremely desirable that such industries as fruit-growing, viticulture, and the raising of dairy produce should receive more attention from agriculturists in South Australia in the future than they have in the past, not necessarily as providing occupations to which holders of land may devote their whole time and energies, but as subsidiary branches of agricultural work which hold out good promise of profits as the result of intelligent effort. Already the cultivation of the grape on a small scale has been attended with so great a measure of success that there are in the present year (1892) more than a thousand viticulturists in the Province.

The high standard of excellence attained by South Australian grapes and wine has given rise to so healthy a demand for these products beyond the limits of the Province that ample evidence may be adduced to prove that there is room for an indefinite expansion of the industry. Those who have specialised in the intricate and delicate operations of wine-making, or "vinification," as the French vigneron term the process, are in the majority of instances finding that this branch of the general work of wine

production demands more and more of their attention, and that they must in future look to growers beyond the limits of their own immediate properties for their annual supply of grapes at vintage time. The expansion of the industries of wine-growing and wine-making is mutually advantageous to the viticulturist and to the oenotechnist, and hence the spread of information upon all subjects connected with the production of grapes and the making of wine has been wisely facilitated, not only by the Legislature, but also by the Agricultural Bureau and the Vinegrowers' Association, as well as by individual viticulturists of long and proved experience. The market for the products of the vine is practically unlimited, and it is universally recognised that Australia can never make the most of its undoubtedly pre-eminent natural advantages until the supply of grapes in each of the centres of the wine-industry has become sufficiently large to warrant a winemaker in enlarging his operations to a scale of magnitude commensurate with those of the great wine-producing countries of the world. For this reason it is felt that the more wine-making and storage there is in each locality, the better it will be for all concerned.

The planting of a small vineyard is by no means a formidable or even a difficult undertaking; but in very many cases the agriculturist finds it is not at all an easy task to collect for himself such precise information and such plain instructions as may give him a clear idea of the work before him, the advantages or disadvantages of his land for certain kinds of grapes, and the prospects of securing any addition to his income by his operations. The questions—"What shall I plant?" "Where shall I plant it?" and "How shall I plant and tend it?" are susceptible in the majority of cases of very simple answers, and those who have taken in hand the dissemination of information on the subject have usually found but little difficulty in placing their questioners upon the right road to success. Following upon the lines laid down by these pioneers, it has been the aim of the writer to gather from local growers and winemakers certain clear and concise rules, which for all practical purposes may embody the best available teaching on the subject. The inquiry kept in view throughout, and brought also under the notice of some of the local experts,

has been—"How would you advise an agriculturist who possesses no special knowledge whatever upon the subject to proceed if he intends to add to his existing occupations that of a grower of grapes on a small scale?" Wide variations in practice have of course been brought to light by the application of this query, and it has been one of the writer's principal difficulties to mark out for the small grower the middle course which seemed at one and the same time to represent the best practice and to suit the particular purposes he has in view. The methods which are best adapted to attain the objects of the professional viticulturist who has a large area under vines, and who devotes his whole time and a large amount of capital to the development of the business, may not be exactly those which will be found suitable for the smaller grower who only aims at putting a limited area under vines, and whose appliances must necessarily be of a more simple character than those of the large vigneron. Keeping this fact steadily in view, it has been found advisable to make the first part of the book consist of a plain and simple statement of operations with the object of bringing into bearing a patch of five or ten acres.

Our supposed vinegrower is, as has been indicated, entirely unversed in the whole matter of viticulture, so that many facts require to be insisted upon which to the moderately initiated may appear mere truisms, and which to an expert would perhaps seem to be so plain as to require no reference. Taking five or ten acres as the unit of area to be treated of expressly, it will easily be seen that by doubling that amount, or trebling it, and repeating the operations described in the instructions, anyone can provide for practically any total area which it may be within his means to cultivate. A word of reminder is, however, needed in regard to this point. To a farmer accustomed to the growth of wheat and other cereals the habit of dealing with large areas has, in Australia and America more particularly, become like a second nature. To such, therefore, the advice is due not to attempt to cover too large an area of ground with vines. Even with fairly wide planting ten acres of fully matured vines in South Australia represents a capital of from £200 to £400, according to the care taken, the kind of grapes, and the proximity to the market. The aim should be not so much to place

a very large area of ground under vines in the first instance as to select with care and judgment the best varieties for future operations, having in view the particular nature of the soil to be worked and the special advantages or disadvantages which it may present in the matters of situation and climate. The primary object of these pages, in regard to this part of the subject, is not to supply full information to the intending vigneron who has his choice of localities and who has made up his mind to cultivate certain favorite varieties of vines; but rather to point out to the agriculturist who already has acquired his land, for better or for worse, what varieties and what modes of cultivation will best suit his individual case and what market it will be best for him to aim at supplying. The question is not "What land shall I secure for certain vines?" but, "What vines shall I obtain for certain land?" and hence it has been thought advisable to give primarily an account of the various kinds of soils and situations upon which the vine thrives, affixing to each kind the names of the particular varieties which will grow specially well on that variety of soil and situation.

A more detailed list of varieties, or "*cepages*," as the French call them, will be given in the third part of the book, but for the immediate purposes of the practical intending planter the first mode of presenting the information will, perhaps, be the more serviceable. It will be understood that the intention in this list is to indicate preferences and not the absolute condemnation of any one variety as unadapted to any stated locality or kind of soil. The vine will thrive and yield profitable results in so great a variety of soils and situations in South Australia that it would be hopeless to attempt an exhaustive classification of the districts available for viticulture; still the broad classification will be valuable as affording general information to be supplemented as experience may suggest by local experiment and inquiry.

The case in favor of vine-growing as a profitable industry in South Australia has been very tersely and plainly set forth by a writer in the *South Australian Garden and Field*, who said (July, 1889):—"It is very strange that men should need so frequently to be advised, and without effect, to consider matters by which they alone will benefit; but it is more strange that other people can be

so earnest in advising where they have nothing to gain by so doing. Vines will probably grow upon any acre in South Australia where wheat will grow. The crop for vines is certain. Grapes will be saleable at good prices every season, either for eating whilst fresh or made into raisins or currants, or for wine-making. There will certainly, and soon, be large purchasers of grapes, and good prices will prevail. The vine is easily cultivated, and begins to bear at four years after planting. Its crop comes in after all other crops are gathered, and before ploughing and seeding commence. The pruning is done after seeding is over, and the cultivation of the vines fills up time that would otherwise be lost. It costs £4 5s. at the outside to plant an acre with vines, even when labor has to be employed." The same journal remarked in another place:—"Very little of the farming land in this colony is so poor that it will not produce its two tons of grapes to the acre. These sell for from £8 to £6 per ton; but if the price were only £4 per ton, the grape would pay better than wheat."

The point here mentioned in regard to the profitable utilisation of spare time that cannot well be put to any other use is worthy the serious attention of every farmer whose land is at all suitable for the growth of the grape, and is situated not too far away from a practicable market. When £4 5s. is mentioned as the cost of planting it should be noted that the agriculturist who puts his own labor or that of members of his family into the work need go to very little cash outlay indeed beyond the small sum of 5s. for, say, 500 or 600 vine cuttings with which to plant an acre of land. The cuttings for ten acres, then, will cost the very moderate amount of £2 10s., and beyond this sum the farmer can practically save almost every other source of outlay. His unutilised labor is, by means of vine culture, being put into a sort of savings bank, which, at the end of four years or five years, yields him high interest in the shape of returns for his produce at the rate of from say £10 to £50 or £60 per acre. He is, moreover, providing for the future of his children or those dependent upon him, and making sure, so far as in him lies, that they shall not be driven away from home and friends owing to lack of land. Vines give so large a return in proportion to the area of land required that, for all

practical purposes, the vineyard acreage of this Province may be considered for many generations as unlimited in extent. Vine culture helps to bring people together, so that they are enabled to secure for themselves and children the same advantages which a city offers, but without the great disadvantages that are often associated with city life.

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THE

*South Australian Vinegrower's Manual.*

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*PART I.*

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## DIRECTIONS FOR PLANTING THE VINE.



## DIRECTIONS FOR PLANTING THE VINE.

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### CHAPTER I.

#### SOIL AND SITUATION.

**First Direction.**—Examine the soil of your land and take into consideration also its situation in order to ascertain its suitability for vine-growing, and the particular varieties of grapes which may most profitably be grown upon it.

There are very few localities in South Australia in which the vine cannot profitably be grown. When experts who have gained a great deal of experience in the cultivation of the plant in the colony are asked to state upon what kinds of soil the vine may be made to thrive and give good crops, they almost unanimously reply that there are really so few positions in which vine-growing is impracticable in South Australia that it would be far easier to enumerate the few places in which the vine will not grow than the very large number of soils and situations upon which it will thrive well and prove a source of handsome profit to the grower.

The one great fact which the farmer accustomed to the growing of cereals, and the market gardener accustomed to the growing of vegetables, must endeavour to bear in memory, if he thinks of going in for viticulture, is that the vine often loves a quality of soil which for any other purpose would be considered poor. If a soil is specially good for potatoes, for instance, no experienced vigneron would think of putting in vines upon it. A rich nitrogenous soil which gives splendid crops under wheat and other cereals would be practically no better for vines than one of apparently much poorer quality; and one in which phosphoric acid was present in comparative abundance and which would grow turnips to perfection would probably yield wine with a very objectionable taste, and the vines would be subject to attacks of oidium and other diseases. The vinegrowers of the Rhine provinces have a very simple expedient, which is said to be efficacious, for finding out in an easy and inexpensive way whether their land is suitable for the production of a good quality of wine grapes. An

average specimen of the soil is put into an earthenware vessel, and boiling water is poured upon it and allowed to stand till it cools and for two or three days afterwards. If at the end of that time the water from it, on being tasted, gives a decidedly mouldy or salt taste the soil is not considered to be of the best quality for vine-growing. The mouldy taste is in general due to decayed vegetable matter, and the presence of an excessive quantity of this is hurtful to the vine. The objectionableness of any large proportion of salt will be readily understood.

It must not be supposed that the nitrogen, which contributes so largely to the success of wheat-growing, is an unimportant element in vine-growing land. Both nitrogen and phosphorus are essential to the formation of the wood of the vine, but the proportion of these elements which the plant takes out of the ground in vine-growing is much less than in most of the other occupations of the agriculturist, and, so far as the fruit is concerned, the only element to which much importance is to be attached beyond those which are obtainable in practically unlimited quantities from the air and from almost any soil is potash. The need for this will be readily understood from the fact that what is popularly known as "cream of tartar" is really tartrate of potash, and is a product which is deposited naturally during the fermentation of the wine and the distillation of alcohol from grape sugar. The two constituents, lime and potash, usually go together in soils which are specially suitable for vine-growing, and hence it is generally said that the presence of a little limestone diffused through the soil, or of a limestone formation as the subsoil, is a good indication for the growing of the future vineyard. Ironstone is also a good sign if in moderate quantities, as the presence of iron helps to give color to red wine besides being an important help to the growth of healthy plants. Land may be too light and sandy for wheat, in fact it may have been worked out so far as wheat is concerned, but if it has a good red clay, indicating the presence of iron at a depth of not more than 12 in. or so from the surface, the necessary conditions for both body and color are present, and the resulting wine will be of fair quantity and excellent quality.

Having noted these points it is well again to insist upon the fact that poor and light soils are not at all necessarily unsuited for vine-growing; in fact the preference as a general rule goes quite the other way, and poor, and particularly sandy, soils yield as fine a quality of wine as can be grown anywhere. Stony or even gravelly soils with clay subsoils are also often suitable. It is a common saying in some of the wine-growing districts of America, as well as of Australia, when anyone is asked to state what sort of land is

suitable for vine-growing, "Land that is not suitable for anything else." The statement is an extreme one, but a reference to it may perhaps serve to call the attention of the agriculturist to the necessity for getting away from his ordinary rules for judging of rich and poor, heavy and light, in the matter of soils if he wants to be successful in vine-growing. The matter of dryness must, however, be carefully attended to. The most essential conditions for successful wine-growing have been admirably summed up in the words "dryness of air and soil." This refers more especially to the seasons of the late summer and the autumn. The absence of dampness in the atmosphere during the summer and autumn, when the grape is ripening, and when it has to be gathered, and perhaps dried as well in the form of the raisin, may be taken as the main reason which places the climate of South Australia in the foremost rank in Australasia so far as vine-growing is concerned. An even constancy of temperature, such as is maintained on most of the plateaus of South America and some parts of South Africa is not at all suited to maturing the fruit of the vine in such a state as to produce the best quality of wines. The same, indeed, may be said of a large proportion of the northern and middle regions of the Australian continent, the tropical and sub-tropical positions of which place them in a very disadvantageous situation in comparison with a colony like South Australia, which has a moderate winter rainfall, a warm summer, and a dry autumn.

In regard to the soil, the rule is the same as for the atmosphere; that is to say, that the soil which will not remain damp after having been well wet is the best for the grape. If, therefore, anyone should inquire about a soil of a loamy nature whether it is likely to be good or bad for the growth of the vine, the answer will depend to a very large extent upon the permeability of the land. A rich and heavy loam that retains moisture persistently is not to be on any account preferred for wine-making purposes, and though it may with tolerable success be put under vines for the making of raisins, yet even for that purpose it is usually found much better to choose a looser and more dry and open kind of soil. The best raisins grown at Malaga, in Spain, are from a light sandy loam. However, if any farmer who has a heavy description of soil all over the area of his land should intend to put some of it under vines, he will find, supposing that it is not too wet, that he can raise good table grapes on it, and will probably succeed also in the making of raisins. For this latter purpose, however, it is essential that a very early summer season should be enjoyed, otherwise the grape will not ripen soon enough to leave time for drying thoroughly in the sun. It is also to be observed that the richer the soil is in any locality the

slower will be the ripening of the grape. This is a matter which will be more fully explained when the growing of grapes for raisins comes to be referred to. The general characteristic of grapes grown on a heavy soil is a lack of saccharine or sugary matter. Grapes without much sugar may be grown either upon very heavy or upon very light soil, the result being due in the former case to the heaviness of the crops, and in the second to the lack of the constituents. Land need not necessarily be unsuitable for the wine vines simply because it is black in color and looks heavy. A mellow rich black gravelly or sandy loam will grow excellent grapes. The presence of sand and gravel helps to give at the same time sufficient permeability and enough of retentive power. A sandy soil produces a grape which does not give so strong and heady a wine as grapes grown on most other soils. This is sometimes a great advantage in a climate like that of South Australia, where the heat is great during the ripening season, and the tendency is usually for the saccharine matter to become concentrated during the process of the formation of the fruit in its last stages.

Some of the best wines of a light claret and hock type have been grown upon soil which to all appearance is merely sand about a foot deep overlying a stratum of clay. As a rule, it is well to choose the part of one's land for wine-growing which shows the loosest nature. The presence of soft rock in a crumbling state is a benefit rather than an objection, and schistose subsoils or loose slaty ones are found very suitable indeed. A bottom of hard and impermeable sandstone is, however, not at all desirable, although if the rock be "clefty," and can allow the water to run off freely underneath, the rock is really an advantage.

When we come to consider the various descriptions of loam we find that a dry calcareous loam, preferably of a yellow or brown color with a porous subsoil, not too retentive of moisture, will give the vine an excellent chance. Loams which are of a blue or a white color are not at all so good. Clayey soils may not or may be good, according as they may be too retentive of moisture or sufficiently permeable to admit of drainage downwards. Sometimes the outcropping portions of a clayey subsoil in the midst of gravelly or sandy districts give first-class results, especially if the clay is well broken up. Red clay, as a rule, is found to be the best, but dense, heavy, clay soils are difficult to maintain in a loose, friable condition and are expensive to work.

A limestone formation underneath, if not too solid and not too near the surface, affords a splendid formation for vine-growing; but if the soil be very shallow on limestone the vines are shy at growing and at bearing, and the wines produced are apt to be

acid in taste. Where the four elements are combined—that is to say, in places which have a light loam mixed with sand and either a clay or a limestone subsoil, but usually both of these present in fair quantity—the conditions for vine-growing so far as soil is concerned could not be improved upon; and if there be also a fair proportion of iron in the soil, the vigneron will in most cases find that his grapes will grow to perfection.

On granitic soil it will usually be found that the vine will flourish at a considerable elevation, especially if it should have an aspect towards the north or the east so as to receive as much warmth as possible. It is believed that in the future some of our best wines of a claret and hock type, will come from such elevated land up to as high perhaps as 1,500ft. Vines on the western slopes overlooking the sea sometimes suffer through the scattering of the pollen at the flowering season, but even this objection on elevated and exposed situations can be overcome by planting hardy varieties, such as the Mataro. Early efforts should, however, be made to provide a breakwind of evergreen trees.

In short, it is possible to obtain good results with the vine on almost any soil that does not bake and crack in the summer and get wet and boggy in the winter. The whole matter was summed up by Dr. Guyot many years ago in a manner which even at the present day can scarcely be improved upon. He said:—"Limestone, sandy, clayey, magnesian, primitive, transition, secondary, tertiary, and volcanic soil all suit the vine, provided that they are not impregnated with water and do not occupy low situations where the mists fall and continue." In such positions as those referred to, there is continual danger from frosts even in Australia; and recently one vinegrower who planted in a low-lying situation in South Australia had to report that he had planted six years in succession and had his vines cut by frosts each year, so that he was obliged to relinquish vine-growing as a hopeless case. In this instance by bad luck one of the exceptional places where the vine should never be tried in South Australia had been selected, and the result might have been foreseen had more knowledge been available at the start.

Leaving the more general considerations of soil and climate and coming to the matter which more particularly concerns the holder of land in South Australia, the question which first arises is, What particular varieties of the grape vine are most suited by natural and economic facts for particular districts of the province? More knowledge and a wider range of experience will have to be gained before a fairly accurate estimate can be given of the capabilities of all the leading districts of South Australia in regard to wine-

growing, because, although the industry has grown by rapid strides of recent years, yet it is certain that the places in which the grape vine has been fairly well tested in the past form but a small fraction of the total number of localities which will be tried in the future. Whatever is said on this point must therefore be held to be not conclusive, but only an indication of the best light that is at present obtainable on the subject.

With a view to getting the best data available some leading viticulturists have been consulted, and while some have supplied the advice which is particularly applicable to their own particular localities others have given a wider range to their inquiries, and have indicated in a general way what vines they consider it would be most advisable to plant in the different districts, even including those in which very little vine-growing has yet been tried, the estimates in these cases of course being based upon the experience gained on similar soils and under somewhat similar conditions in other parts of the colony.

For purposes of viticulture the grades of land in South Australia may provisionally be divided into ten different divisions, beginning with the warmest, going on to the coolest, and ending with those in which peculiar modes of culture, such as the adoption of irrigation, can be applied. The references to the wine-making and other qualities of particular vines are only incidental in this place, as the subject will be treated of more fully later on.

1. WARM PLAINS, ESPECIALLY EAST OF RANGES LIKE THOSE OF MOUNT LOFTY, MOUNT TERRIBLE, AND THE FLINDERS RANGES; SANDY SOIL WITH RED CLAY AND SOFT LIME FORMATION IN SUBSOIL; ALSO ALLUVIAL FLATS, AS IN THE LOWER VALLEY OF THE TORRENS.—All kinds of table grapes do well in these conditions, also most of the wine grapes, both the red and the white, except the early ones, such as the Pinot Noir, which ripens too early in these particular localities for wine. All the Spanish kinds of white grapes, such as the Doradillo, Pedro Ximenes, Albillio, and the Rousillon vines, the Mataro, Carignan, and Grenache, and besides these the Shiraz, Carbenet (or Cabernet), Malbec, Dolcetto, with Red and White Madeira, Verdelho, Sercial, the Frontignacs, Muscats, and the Zante and Corinth currant grapes all thrive in great perfection. Sultana should be tried in all directions to find out where it will bear well and constantly.

2. THE PENINSULA.—About Maitland, where the soil is of a good depth and the subsoil a red clay with lime, it will

grow all the above kinds. On the thinner soils with little or no clay and near the limestone the hardier kinds, such as Doradillo, Mataro, and Grenache, and the Muscat Gordo Blanco, are more suitable. The Carbenet, Shiraz, and Malbec are apt to dry up before coming to proper maturity and produce an acid wine. The Zante currant does well near the coast in such situations as the country near Stansbury.

3. WARM SLOPES AMONG THE HILLS AT A LOW ELEVATION; SANDY SOILS WITH GOOD CLAY SUBSOIL AND WITH IRONSTONE AND LIME PRESENT.—All the kinds recommended in the first division do well and ripen perfectly in all aspects. They give, in fact, the best results either for light or for heavy wines according as the grapes are ripened.

4. ALLUVIAL FLATS SITUATED IN POSITIONS WHERE THE SUMMER IS WARM AND THE AUTUMN DRY.—The soil should be warm and dry also to get best results from the following six varieties, namely—Carbenet, Shiraz, Malbec, the Muscats, and the Zante and Corinth currants. These all bear well under such conditions and give large yields.

5. MOIST FLATS WITH WATER NEAR THE SURFACE.—For these it is necessary to make quite a different selection of varieties, as the principal use to which grapes grown upon such soil can be applied is for distillation; therefore any heavy bearer such as the Doradillo or Aramon will be found to be the most suitable and profitable.

6. HIGH ELEVATION AND DRY DEEP SOIL WITH LIMESTONE OR CLAY SUBSOIL. COOL HIGH SLOPES OF HILLS EITHER TO LANDWARD OR SEAWARD. SOIL EITHER LOAMY OR SANDY; SUBSOIL EITHER SCHISTOSE OR ROCKY, BUT SOIL ALWAYS DRY RATHER THAN DAMP.—Shiraz, Carbenet, Malbec, and Pinot Noir for red wine; and Pinot Blanc, Madeira, and other early ripening grapes for white wine. These all give wine of high character, light in alcohol, and of quick maturity. Mataro where it will ripen well will give a light clean wine, but not of high character. In similar positions to those indicated under this heading, if the soil be very shallow, it cannot safely be recommended for the growing of the vine.

7. COOL HIGH SLOPES OF FAIRLY DEEP SOIL AND SUBSOIL OF SCHIST OR OF DECOMPOSED GRANITE.—Land of this class would be most suitable for white wines from the Riesling grape mixed with a good proportion of a

neutral early ripening grape, such as the Sweetwater or the White Hermitage, to blend with it. Chassellas is also a good variety for this division, and is plentifully grown in Victoria; but in this colony there are only a very few vines. Cool high slopes of hills with quartz and gravelly subsoils have also given high character white wines from the same as the above; and the wine proves to be of good keeping quality.

8. SOUTH-EASTERN COUNTRY ABOUT NARACOOTE AND PENOLA. LIMESTONE LAND WITH A CLIMATE MOIST AND TEMPERATE. WATER NEAR THE SURFACE.—This description of land has not been much tried for wine, but will certainly give good wine for champagne if the Pinot Noir, Pinot Blanc, Shiraz, and other early ripening grapes are grown; also fine light wines, both white and red, from the Riesling and others recommended in division 6.

9. IRRIGATED LANDS ON THE MURRAY, AS AT RENMARK AND OTHER PLACES.—If not over-irrigated or put under water too late in the season, these lands will probably give a fair quality of light wines from almost any wine grapes we have, if the crop is gathered when fully ripe and before the fruit begins to shrivel. For sending to distant markets as opposed to retaining for local use sweet wines, both red and white, will be found in this division the most profitable; and the kinds of vines mentioned in division 1 will be the most suitable to grow, especially the Shiraz, Grenache, and Dolcetto, for red wine of a Port type, and the Spanish and Madeira vines and the Frontignacs for white sweet wines, and strong dry wines of a Sherry and Madeira type.

10. IRRIGATED AND OTHER SUITABLE LANDS WEST OF FLINDERS RANGE, FROM PORT BROUGHTON TO PORT AUGUSTA.—On this description of land the Muscat, Gordo Blanco, and the Sultana may be grown with profit for raisins, and the Zante and Corinth currant vines will also be profitable, as likewise the *early* kinds of table grapes for sending to the various cities, both in South Australia and in the neighboring colonies, which cannot grow early grapes to such advantage as South Australia. As compared with the vicinity of Adelaide it has been observed that west of the Flinders Range, between Port Broughton and Port Augusta, the grapes ripen a month earlier, and this gives a specific advantage which should not be lost sight of.

A word or two will be necessary with regard to the estimate which has been given of the capacity of some of the more elevated lands of South Australia for wine-growing. In the earlier days of the colony, as is well known, some of the efforts which were made to produce wine of a high type in such situations met with but indifferent success. The few vineyards that were planted in these early times about Mount Barker never had a chance of producing what they might have done with the management which greater experience and a wider market have rendered possible in the present day, and what little good wines were produced were not in those days appreciated. As a consequence nearly the whole of the vineyards referred to were abandoned, and they are sometimes erroneously quoted as a proof that the production of high-class wines in elevated situations in South Australia is impossible. This is a great mistake. In fact it appears to be fully proved that, at a high elevation and with suitable aspects and soils, wines of great delicacy can be grown, and it is to these localities that we may look in the future to produce wines that will have perhaps a world-wide reputation.

With regard to specific localities, the advice of a vinegrower of wide experience to an intending grower on a comparatively small scale may be quoted. His remarks may be taken to have special reference to all the country round about Angaston, Tanunda, Greenock, &c., or at least to so much of it as is of the prevailing quality and formation, namely, a light sandy loam, with clay and limestone subsoils and a certain proportion of iron. He says:—

“For red wine plant Shiraz, Carbenet, Malbec, and Hermitage. You may plant one-quarter or one-third your area with Mataro, but it would, on the whole, be better to put in Grenache, because that vine is just as good a bearer and it gives a better quality of wine. For white wines Riesling makes a beautiful quality, and White Frontignac and Muscat Gordo Blanco may also be recommended. I would like to caution all vinegrowers not to plant much of any white variety, seeing that until the taste changes very much both here and in the old country there is very little market for white wine. Above all things avoid the Albillio, or the so-called “Sherry” grape, which has been too much planted already. For currants the Zante can be recommended, but the soil should not be too dry nor too shallow. A shallow soil on a limestone subsoil will never suit for Zante currants. It would be a good thing if more people went in for this currant. The berries are ready for drying about one month before it is time to start wine-making, and I have known of 2½ tons of dried currants being taken off three or four acres of land; that means over 7 tons of the undried fruit” With regard to

the Albillio or Sherry grape it is only fair to add that although relatively to Shiraz and some other varieties it has recently fallen in the estimation of some winemakers, yet others still adhere to the opinion that it makes a sound wine of good keeping qualities and very suitable for export.

Another grower in the same locality says that everyone should aim at planting more Shiraz, Carbenet, and Malbec, as these varieties are rising in price.

At Magill and along the foothills bordering on the Adelaide Plains the advice given was—

“Plant Shiraz and Carbenet for quality and Mataro for quantity, if you mean to grow for red wine-making. If for white wine put in Riesling. Verdelho should be avoided, as it is too subject to oidium; for white wines also Tokay, Pedro Ximenes, White Madeira, and White Frontignac are good, but White Madeira needs a good deal of care. Carignan is good, but is an uncertain bearer, and puzzles the grower a good deal. If there be any doubt put in Mataro, as it will grow on almost any soil whether damp or dry. Grenache gives a good wine, but needs a special soil. Doradillo is first-class for table grapes, but not for wine. Do not plant white grapes in the present state of the market. If you have the vines of such grapes it is better to graft them.” The settlers at the Murray Irrigation Colonies plant Gordo Blanco for raisin-making purposes, Zante for currants, and Shiraz, Carbenet, Carignan, and Malbec for red wine grapes, these being the varieties introduced into the colonies by the Company.

In concluding this part of the subject it will be well to quote from Dr. Guyot on the mistake which was almost as common in France in his days as it has been more recently in South Australia, namely, the putting in of too many kinds of vines. He said:—“In order to constitute either a small or a large vineyard there is no need ever to cultivate more than three varieties of vines of which indeed two most frequently are merely accessories and only one constitutes the foundation. No wine, from the most common up to the most celebrated, should result from a greater number of varieties, and none has ever acquired a reputation if it resulted from six, eight, or ten varieties.”—*Etude des Vignobles de France*,” vol. 3, p. 613.

## CHAPTER II. VINE CUTTINGS.

**Second Direction.**—Procure good cuttings of the varieties desired, and bury them in bundles so as to preserve them from drying until a favorable time arrives for planting.

In order to understand the necessity for this operation it should be noted that the proper time for the taking of the cuttings from the parent plant is in the autumn when the leaves have fallen. They should be taken from the fully matured past season's wood, and it is of importance that no other kind of cutting should be used. It would be a fatal mistake to suppose that any sort of waste clippings from the vine would serve as a propagating cutting. The need for taking the cutting from the fully matured past season's wood was at one time so strongly insisted upon in France, that it was customary for purchasers of cuttings to insist upon getting what they called “Crosettes; that is to say, cuttings with each a small piece of the previous season's wood adhering to it, say, about lin. or 2in. in length. Owing to this custom—merely intended as a precaution against fraud or mistake—an impression arose that the pieces of old wood planted along with the cutting assisted the young plant to put forth its roots. Even when the practice of planting the piece of wood was abandoned owing to its distinctly injurious effects, some vigneronns still adhered to the practice of planting a small piece of bark from the former season's wood. This practice, however, was shown by Dr. Jules Guyot to be quite unnecessary. It draws attention, nevertheless, to one not unimportant fact, namely, that cuttings which have a bud right at their base have a better chance of thriving than those which terminate in a barren piece of shoot. The point adjoining the old bark would generally have more than one such bud, and therefore, other things being equal, it was best to plant a cutting which had its extremity at the base of the shoot. This is not very material to the purpose. The main point to be observed is that cuttings as a rule should terminate in a good healthy bud, and if a supply of cuttings after being purchased or procured from a vineyard should be found to include many not conforming to this rule it will be well to trim them with a view to getting a bud as near to the end of each cutting as possible. Another rule to be observed in the selection of cuttings is, that those which have short internodes or spaces between the buds are, as a rule, better than those having long ones. It is also prudent to observe that the cuttings when received are in a



really green condition; that is to say, that if cut at any part of their length with a bright steel knife, they will leave a damp mark on the knife. Unless they do so, either at first, or, at an rate, after being soaked in water, as hereafter described, it is of no use planting them out, as they are not fit for growing. After these points have been attended to, it is necessary, in most cases, that the cuttings should be kept for some weeks, or even two or three months, until a favorable opportunity arrives for planting. It is not to be supposed that the early winter is at all the most favorable time for putting out cuttings. Some, indeed, have advised planting out as early as July; but the majority of authorities in South Australia are agreed that August is, on the whole, the most favorable month; and, in very many instances, it has been found that September has been not at all too late. Of course a good deal depends on the particular nature of the season. If the ground should remain in a moist and kindly condition till the middle or end of September, that month will be found the best. The real effort of the cutting to work out for itself an independent existence does not come about until the early spring; and, if it should be planted out much before that time, it has to take its chance of meeting one of those unseasonable dry spells, which occur in Australia even in the middle of what is generally the wet season; and a prolonged spell of this sort—parching up all the tissues of the cutting as it stands in its dry, absorbent bed of soil or sand—will simply put an end to its chances.

From this consideration, common sense will at once suggest the rule for keeping cuttings. Let them be kept till well past the middle of the winter, but not until the chances of a few weeks of fairly moist soil have gone past. For this purpose they should, as indicated in the second direction, be buried in bundles. About three or four dozen will be found a convenient number to tie together with loose hempen stuff from rope, or with any other kind of material which will not cut the outside sticks of the bundle. Dig a trench as wide as the cuttings are long, that is to say, from 15in. to 20in. in width, with a little to spare, and lay the bundles in, side by side; 6in. or 8in. will be quite sufficient depth. Then cover the whole up with loose soil—not dry, but yet not too wet. If the cuttings during their time of hibernation should be allowed to lie in water they will speedily become mouldy, and the buds will begin to rot, and become quite useless. On the other hand, if the ground be allowed to become quite parched, the sap will dry out, and there will be a difficulty in getting them into a suitable condition for planting. In order to hit the happy medium, a good plan is to mix together one part of well wet soil with four or five parts of thoroughly dry, and to use this for covering up,

as well as for the bed upon which the bundles rest. The horizontal position is almost always adopted for burying cuttings, or “stratification,” as it is called in France.

In the principal vineyards of California, on the other hand, it is customary to set the bundles upright, on slightly moist soil, in some cool and shady spot, and let them remain till the time for planting out. In either case the design is obvious. The cutting must be kept, as far as possible, in natural conditions of moisture and protection from the injurious effects of the air. There are many cases on record of intending vinegrowers in Australia neglecting this precaution altogether. Cuttings have been allowed to knock about in odd corners of sheds, and have been taken long distances in carts exposed to the direct rays of the sun, or left lying about at railway stations in the same predicament. They have been allowed, throughout a dry winter, to get thoroughly dried up and shrivelled; or they have been planted out, and exposed to three or four warm spells, when the earth was as hungry for moisture as they were themselves. Then, when the spring and summer came round, and the result showed itself in miserable failure, the viticulturist has expressed his surprise that vine-growing in Australia should prove to be so difficult. Let anyone take really good care of his cuttings, and not expose them to unnatural conditions; let him plant them with judgment, and cultivate with fair diligence; then, if his percentage of success should be a bad one, it will be due to unusually bad luck. There are some seasons in Australia when the most careful and skilful vigneron must make many failures, but they are exceedingly few and far between.

The inexperienced vinegrower will naturally desire to have some rule by which to know whether, in the matter of constitutional immunity from disease, his cuttings are of a favorable character for producing healthy vines. As a general rule, any brown or black marks spreading persistently over both the outer and the inner bark of a cutting, indicate that the vine from which it was taken was suffering badly from oidium or anthracnose, otherwise known as black spot. Cuttings with this sort of defect very plainly marked on them would produce vines not necessarily suffering from the same disease as the parent vine, but still more liable to be affected by it, and they ought therefore to be rejected. Of course it is not always that in any particular district quite clean cuttings can be procured and occasionally it may be found that the perfect freshness of locally-secured cuttings may make up for slight defects in this way. The general principle to be followed is to obtain the cuttings as fresh and as healthy as is practicable, and to keep them in this condition until the time for planting. The worst mistake of

all, however, in the selection of cuttings is that of choosing barren suckers in mistake for good fruit-producing shoots. The shoots which grew off the old stem are also ineligible, seeing that these, as will be more fully explained later on, are incapable of bearing fruit, and may therefore not improbably produce absolutely worthless vines. Any barren shoot is liable to grow into a barren vine. Not only is this the case, but it is generally found, more especially in regard to the Shiraz variety, that indifferent or poor vines giving but little fruit are prone to propagate poor or sterile vines from their cuttings. The careful vigneron, who has full opportunities for picking and choosing among his vines for cuttings to plant out, will always take note of the particular plants which have given the best yield, and will take his cuttings preferably from them.

One or two others matters will require attention before the subject of the best kind of cutting is left alone. As regards the length required to make a safe cutting for planting out or even for nursery purposes, it is well to remember that rules laid down for other countries are not necessarily the best for application to South Australia. The object to be secured in putting a cutting into the ground is to make certain that it shall be in contact with fairly moist soil all through the spring time, or at least for as great a length of time during September, October, and November as possible. Now, anyone who is acquainted with the peculiarities of the South Australian climate knows well enough that no mere shallow depth of 4in. or 5in. would fulfil these conditions. There is no doubt that the varying conditions of different districts even within South Australia may give good grounds for a variation in practice in regard to this particular. But in almost every part of the colony it will be found advisable in most instances, to put the cuttings at least 12in. into the ground, so that, at any rate, the lowest bud may lie in contact with fairly moist and mellow soil. This means that a cutting of 15in. is none too long in almost any part of the colony. None should be shorter than about 10in., and it may be found advantageous in specially permeable soils to go far as 18in. or even 20in. Sandy soils are of course not in this sense at all the most difficult to deal with, for it is a well-known fact that sand possesses a wonderful faculty for retaining moisture even in the hottest weather and at a very moderate depth. This is indeed one of the reasons why many vineyards with exceedingly sandy soil have proved so eminently successful.

The deepest planting will usually be found necessary in the case of a deep dry friable loam either on the flats, or on some slope where the moisture drains off very fast, and there is but little sand, to retain a trace of moisture a little below the surface when the

top soil is parched. Highly experienced vigneron accustomed to dealing with vineyards in the moister countries of Europe have, through neglecting to take this into consideration in regulating the length of their cuttings, actually made as many as 50 to 70 per cent. of failures and that, too, in seasons not at all the driest experienced in this climate. It is well to choose a time when the sky is overclouded for removing the cuttings from their pits and planting them for growing. This, however, is not a really essential point. It is more important to remove only those that are actually required for immediate planting and to have the cuttings placed in water for a few hours in order that the buds may begin to swell. Very cold water should not be used for this purpose, and if a moderate summer warmth be given to the water the swelling will take place all the better and the more quickly.

Having now given the chief points to be noted in connection with keeping and preparing the ordinary form of cutting it will be well to say a few words about a kind of cutting which has been warmly advocated by various authorities, but which as a general rule is not to be advocated in the dry climate of South Australia, unless under exceptional circumstances, as shall be explained. This is the "single eye cutting"—a kind which is reduced in size to absolutely the shortest length which is capable of producing a new vine, that is to say a piece containing only a single eye or bud. In this mode of propagation it is advisable to secure good stout eyes from well grown cuttings. The pieces should not be longer than 1½in., and they require to be planted very much in the same way as seed. To all intents and purposes in fact a single-eye cutting is to be looked upon as a kind of seed, not botanically of course, but for practical objects.

The single eye is planted under 1in. or 2in. of soil, which should be well pressed down on top of it. One curious part of the operation is that the eye will grow best if laid in sideway or upside down instead of in the normal manner. It sends out its roots below exactly like a seed, and as it has the advantage of starting these from a central point, just as the natural seed does, it certainly produces an exacter imitation of the natural mode of vine propagation than does the long cutting with its large root and its horizontal lateral branches at the sides. It is recommended by one writer that those who intended forming vineyards on a very small scale should plant some eyes in pots or tins at, say, 1in. or 2in. apart. A kerosine tin cut into two lengthwise gives a small nursery which will take from fifty to a hundred eyes and if it be pierced with holes at the bottom for drainage and well watered it will soon contain a large number of closely packed but healthy roots. A dozen of such tins



will give enough of roots for a surprisingly large area of vines. Those who have a taste for this sort of mixture of the ornamental and the practical may take an interest in cultivation from eyes. But as a mode of practical propagation on a moderately large scale it does not offer unexceptional advantages; in planting by this method it is always advisable to put a good coating of mulch around the place where the single-eye cutting has been set. A peculiar thing about the growth of such a cutting is that, after once making a start, it will turn in the soil and sent its shoot upwards while its roots go downwards.

The intending viticulturist before purchasing his cuttings will wish to know how many will be required for the satisfactory planting of a given area of land. In order to decide this point fully it will be necessary for him to go at some length into the vexed question of close or wide spacing in the vineyard and this matter will be treated of later on. In the meantime, however, it will be of some use to give a statement of the number of cuttings which will be required for the planting of one acre of ground at various fixed intervals. It will be understood that in this statement no allowance is made for paths or passages, which must be made according to discretion but which do not very materially alter the totals in any case, nor for the headlands at the sides, which are left for convenience in turning the plough. The square formation in spacing is the only kind here taken into consideration, as the object is to convey a general idea only of the number of cuttings required and more particular details will be given later on.

DISTANCE APART.	VINES PER ACRE.
4ft. ....	2,722
5ft. ....	1,742
6ft. ....	1,210
7ft. ....	889
8ft. ....	680
9ft. ....	537
10ft. ....	435
11ft. ....	360
12ft. ....	302

As a general rule it will be found, for reasons to be given afterwards, that from 500 to 1,000 cuttings will be necessary for the satisfactory planting of an acre of vines. The prices of these will vary greatly according to the kind required and other conditions which cannot easily be foreseen; but it may be useful to know that during the autumn and winter seasons of the year 1891 and 1892 the more common varieties were available at from 8s. to 10s. per 1,000 cuttings. They may be procured at almost any time after the fall of the leaves, and so long as they are kept fresh by the

seller and by the buyer until the time for planting out arrives there need be no fear that the length of time that elapses between cutting and planting will prove detrimental. It will be seen from what has been said that the bare cost of the cuttings for the planting of ten acres with any of the more common varieties of vines will vary from £2 to £5 if the rates be reckoned as stated on the ruling prices of 1891 and 1892.

An ingenious mode is sometimes practised in Europe for assisting cuttings of varieties which strike with difficulty to make roots when they are planted out into the vineyard or in the nursery. It may also be adopted in some cases where the cuttings received for planting have undergone rather inconsiderate usage, and there is reason to believe that, owing to their being dried up and shrivelled, many of them may not take if put out in their first condition. The bundles of cuttings are placed in trenches, at the bottom of which has been laid 3in. or 4in. of stable manure, well wetted and pressed down. The cuttings must be suspended above this layer of manure by means of string, upside down, but not touching the manure, and the feet should then be covered over with a layer of moss, 4in. or 5in. thick. With a little string, and a few sticks of wattle or of bamboo, a number of bundles can easily be suspended over one trench in this way; and in the course of a few days there will be noticeable a number of white excrescences shooting up from the upturned ends of the cuttings, which, in point of fact, have been forced into a kind of upward growth, owing to the heat and moisture evolved by the manure.

A simpler method still is to set the cuttings in tied bundles of, say, fifty each, into a stream of running water or a river or dam until they have developed shoots from the top buds, about an inch in length. They must, of course, be set upright in the water, and the top bud or two should be above the surface—the vertical position being adopted in this case. The top buds, with their shoots, may be cut off prior to planting out, which should be done immediately they have developed, and the white excrescences are to be seen on the feet of the cuttings. After their immersion it is recommended by Professor Bragato that the whole of the cuttings should be placed in a bath of cow manure, clay, and water prior to planting out.

### CHAPTER III. THE NURSERY.

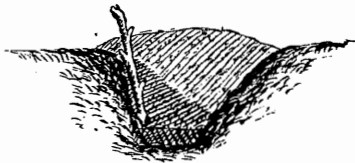
**Third Direction.**—Make a nursery or bed from which to transplant rooted vines to the vineyard when they have attained the proper age.

There are two widely different practices, both of which are well supported, in connection with the method of planting a vineyard. The one is to rear the young vines in a nursery, or to buy those which have been so reared, and to plant them out into the vineyard after they have become well rooted. The other is to plant out the cuttings directly into the soil in which it is intended that they are to grow. Without going into the reasons for and against each of these practices, it is sufficient at the present point to say emphatically that, no matter which of the two modes of planting may ultimately be adopted by the vigneron, it is of very great importance that every intending cultivator of the grape vine should understand the work of the nursery. The mode of propagation almost universally adopted is, as we have seen, that of employing cuttings in the first instance. Whether they are rooted vines or simple cuttings that are intended to go out into the vineyard, the fact always remains that both in the nursery and in the vineyard itself the vine is grown almost solely from cuttings.

These should be placed about 3in. apart, in long rows, which should be at a distance of about 2ft. from one another. The object is to utilise the space as thoroughly as possible, by getting the young vines closely together in the rows, and yet to leave plenty of room for the spade and hoe work by putting the rows a sufficient distance apart. The spade is to be used for opening up the trench in which the cuttings are to be planted; and the work can easily be so arranged that the operation of filling one trench, after the cuttings have been well set in, is the same as that of opening up the next trench, and so on. In other words, the soil taken out from the second trench is used for filling up the first.

With regard to the depth of trenching, it should be noted that the arguments for insisting upon a considerable length of cutting and a great depth in the soil do not apply with quite so much force in nursery planting as in that of the vineyard, if planted with cuttings directly. Yet it is, nevertheless, a great mistake to adopt short cuttings. The object of placing the cutting in the nursery in the first place at all is mainly to secure greater attention in regard to correcting any deficiency in the rainfall, and thus

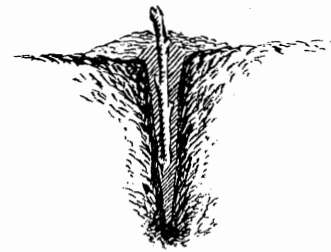
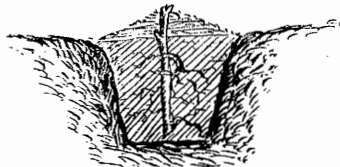
Plate 1.



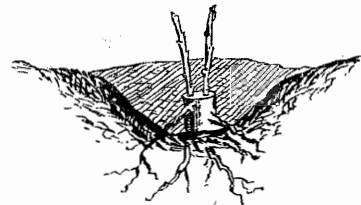
Cutting in nursery.

Cutting planted out  
(by spade).

Planting-bar or "dibble."

Cutting planted out  
(by dibble.)

Planting rooted vine.



Grafting.

securing the presence of a mild moist soil for the tender roots of the young vine in the first year or two years of its existence. But if these roots do not start from a sufficient depth to enable them after being planted out to attain to a moisture-keeping stratum of the soil, they will quickly fail and the plant will die. The mistake has often been made of overwatering the young vine when it is in the nursery so as to induce a feeble and flabby constitution, and it is not surprising that plants of this description should succumb when planted out into the drier soil of the vineyard where the struggle for existence is so much more severe.

With all the care that may be exercised, however, in the matter of not giving the young vine too much water so as to let it have a hardy constitution, it is yet necessary that when planted out it should have sufficient depth to guard it against the parching effects of a drought with a hot surface soil, and no better way of ensuring depth can be secured than to have a good length of cutting. On this account it is well to dig the trenches about 18in. or 20in. deep. When this depth has been opened out the lower soil may in many cases be unfavorable to the growth of the cutting and it is therefore desirable that a little open soil should be thrown in to the depth of about the width of a man's hand. This will give a congenial bed in which the lower roots can expand themselves. After this has been done the cuttings can be placed in the trench resting against the steeper slope of the opening. (See sketch on Plate 1.) Against the cuttings when placed in this position, a few inches of earth should be thrown in and pressed with the foot firmly so that there is no chance of any open spaces remaining in which water might accumulate or too great a facility might be allowed for the access of air. If this be not attended to the probability is that the roots will suffer through mildew or will actually rot away.

On the top of the pressed soil the loose earth taken from the adjacent trench may be thrown, but it should be left as free and open as possible. Nothing like hardening the ground down or packing it in from the surface should be attempted, seeing that the looser the soil the more generous it will be and the more moderately it will assist in retaining the moisture. One other point may here be mentioned in regard to the packing of the soil. It is not well to place the cutting against the side of the trench which has been stiffened up by the pressure of the spade, because on this side the young roots will have more difficulty in penetrating through the layer of compressed soil than they would if placed on the opposite side. Cut the trench out neatly and put in the cuttings on the opposite side to the first digging position, and it will then be found

that the soil can be thrown in from the next trench without any difficulty. By reference to the sketch which is given on Plate 1, it will be noticed that an inclination is given to the cutting as it rests in the trench. This position is adopted not merely for convenience, but also to give the cutting an aspect towards the sun which may be of use to it in the early months of spring when every day is of paramount importance to it, and the earlier it can obtain the needed warmth and sunshine to start it into growth before the fierce heat of the summer comes on the better it will be. There need be no fear that the resulting position of the adult vine will be a crooked or slanting one, because the vine always rights itself in that respect unless forced to do otherwise by outside circumstances.

There is a practice which is often adopted on the Continent, especially in Hungary and in some parts of France, of putting in long cuttings as much as 3ft. or 4ft. in length, letting 2ft. or 3ft. lie horizontal and bending up the cutting at the end so that only a short portion protrudes from the ground. This mode of planting is not to be recommended in this climate as it entails the employment of extra labor and requires a special knack in the bending of the cutting. Besides this it gives no added security against the parching of the cutting in early spring.

In the placing of the cutting in the soil the general rule is to allow only two of the buds to remain above ground. Strictly speaking there is, from the point of view of absolute necessity, no need for more than one; and if no danger were to be apprehended to the delicate shoot resulting from the early development of the bud no doubt the usual mode adopted would be to leave only one bud visible. But it is obvious that the breaking off of one bud may occur from many different mishaps, even a puff of wind being sometimes sufficient, and therefore it is usually advisable to leave two buds out of the ground. It must not be supposed, however, that anything is gained by leaving above the ground any larger portion of cutting than is required to give security against this risk. The portion of the cutting which is between the lower and the upper bud is apt to exhibit signs of weakness in the after-life of the plant and to give a less satisfactory stem than the shoot resulting from the lower bud, which usually lies down against the surface of the ground, and it is customary, as we shall see when we come to consider the art of pruning, for the vigneron to remove this upper shoot by preference unless he should see by distinct evidence that owing to some other reason the upper shoot has, after all, proved the better in actual development.

As regards the situation of the nursery, one of the main points to be observed is that the necessity of artificial watering is the prime

reason for having a nursery at all, and, other things being equal, it will always be found best to have the nursery in some spot where it can be either be irrigated by flooding the land or where it can easily be supplied with water from some not too-distant source of supply. This necessity for watering the nursery, need not give rise to the idea that a very plentiful supply of water is absolutely essential to the early cultivation of the vine. It is, as we shall see later on, quite possible to rear the young vine in large numbers when planted out and relying upon nothing more than the natural rainfall, if the conditions be favorable. It is also, as has been said, a great mistake to accustom the young plant to too much water so as to give it a feeble constitution before being planted out, and even in the nursery care should be taken to merely supplement the natural rainfall, giving, say, one watering after the cutting starts to grow and two or three afterwards during the season. It should not be forgotten that the vine, young or old, hates anything in the shape of mud or caked earth that has been soaked and deluged at one time and then left to bake hard and fast at another time. In some seasons it will be found that very little watering by hand is needed and even if greater labor and a larger amount of water is required it must be remembered that the whole area to be operated upon amounts to that of a small kitchen garden. Supposing that ten acres are to be put under vines and that 500 vines are needed for every acre, then it will be sufficient to lay out as has been described a nursery consisting of ten rows of about 42yds. long. It is advocated by some authorities that in the rows the cuttings should be placed about 4in. apart, but even with this interval of spacing it will not be necessary to lay out a greater length than 56yds. or 60yds. at the most, while the width for the ten rows will be about 10yds. in all if the trenches are dug 2ft. apart and have a width of about 12in. From this it is easy to see that artificial watering for a nursery for ten acres of vines cannot be looked upon as a formidable undertaking in any sense of the word. If it should be more convenient to adopt the square shape for the nursery than an elongated one the measurement will be from 20yds. to 25yds. for each side.

The principal points to be observed in laying out and planting the nursery will now be apparent. As an additional precaution to ensure the greatest possible chances of complete success, and especially where the soil is very poor, the lower layer of soil which is put into the trench and afterwards compressed by the foot may be enriched by the addition of a little manure in liquid form; but this is seldom found necessary, and is not so often practised in the nursery as it is in the operation of planting out directly into the

because exactly the same connection so far as regards the time of bearing and the depths of planting can be traced in Australia as in France. In fact, for Australia, it can only be said that the truth here expressed is based upon a fact generally, though not numerically, correct. But the lesson which it conveys is that the vine-grower in his efforts to get down to a permanently moist substratum of soil should not overdo it. At the Murray irrigation colonies, where the prevailing soil is a deep red, light, and sandy loam, with a good red clay subsoil, it is customary to use cuttings 18in. in length.

The actual lower subsoil itself is, in the great majority of places, really injurious to the vine, and the roots of this plant are not at all to be thought of in connection with those of trees or even hardy shrubs. The experience gained at the irrigation colonies in the matter of levelling should be of some use in this connection, for it has been found that where, owing to the levelling operations necessitating the removal of a considerable depth of soil, the underlying subsoil has been exposed and the whole area covered with vines the plants have thriven invariably best in those places which retained their natural coating of upper soil, the vines on the exposed parts presenting a much feebler appearance and showing a larger percentage of failures; thus, while the quality of the subsoil has a good deal to do with the success of vine-growing, it is not to be supposed that this is because the roots of the vine ought to be in the midst of the subsoil, for exactly the reverse is the case.

Lastly it may be urged that the vinegrower should never fail to recognise that whether in the bed or in the vineyard the life of the young vine is a continuous one, and that on this account he should endeavor to imitate in his nursery, so far as is consistent with success in rearing his plants, the same conditions as exist in his vineyard. A sudden change from a nursery with very rich soil into a vineyard with particularly poor soil might be fatal and *vice versa*. It should also be noted that the diligent cultivation of the soil of the nursery is a prime necessity, as the soil about the roots of the young plants must be kept free and loose.

## CHAPTER IV.

### PREPARING THE LAND.

**Fourth Direction.**—Plough the land and reduce it to a fairly fine state of sub-division so as to prepare it for planting operations.

In the first place it is very necessary that the land should be cleared of timber and well grubbed. It is of no use attempting to grow vines close up to the roots of a growing gum tree or even in land which is largely occupied at a depth of a few inches by the roots of dead trees. In cases where this has been tried it has been found that while the vines at a good distance from the trees or roots were thriving those in their immediate proximity had a very miserable time of it and were next to worthless. The comparatively large value of a small area of land well-planted with vines, should induce the farmer accustomed to wheat-growing to pay far more attention to the preliminary preparation of his land than he would think of doing if he were merely intending to lay in a crop of cereals, and any extra trouble that he may take will probably be repaid many times over on the future.

After the grubbing has been carried out it is necessary that the land should be well ploughed and harrowed. The depth to which it is actually imperative to cultivate a vineyard is a point upon which, in the course of the past generation, a strange transformation of opinion has taken place, especially among those who came from continental wine-growing centres and took up their residences in Australia or who went abroad to America and started vine-growing on the virgin soil of that great continent. The practice among the vignerons of Europe was to trench the land by means of the spade to a depth of 2ft., 3ft., or even 4ft., throwing up the sub-subsoil, and often manuring heavily even at considerable depths from the surface.

The earlier emigrants to America from Germany and France carried with them a prejudice in favor of the hereditary customs of their forefathers, and were accustomed to dig their New World vineyards to a very great depth. A vigneron named Bull was perhaps the first to call attention, in the early half of this century, to the mistake which this custom involved. "If the ground is trenched and made rich," he wrote, "the roots are coaxed down into the lower and colder stratum of the soil and the wood and buds are not properly ripened, the former being immature and spongy and, as a natural consequence, the latter being weak and

imperfect so that next year's crop is enfeebled and will ripen later." Writing from the same point of view in 1867, Dr. Kelly advocated the same reform of practice in South Australia when he said, "With a small garden or vineyard plough of any of our modern makers and a steady horse, a good ploughman will do in two operations as good work as is effected by all the various and repeated labors expended on the ground in France."

There is no doubt that a shallow depth of 8 in. or 9 in., or even of 6 in., is quite sufficient penetration of the soil in the case of most of the land in South Australia. Whether the same mode of cultivation would answer in France on those vineyards which have borne large crops of grapes, generation after generation from time immemorial, may well be left open to question. But it is to be noted that notwithstanding the comparative cheapness of labor in France, and the consequent relative advantage of the use of the spade, it has been found that French vigneronns have adopted the plough as a means of cultivation in very many instances, the great obstacle in most cases being simply that the vines have long ago been planted too closely to admit of that mode of turning up the soil. But Dr. Guyot in his "*Etudes des Vignobles de France*" mentions the ingenious device of one grower who was so determined to use the plough, notwithstanding the closeness of his vines that he made a special kind of harness, having only one trace applicable to one horse and passing between the animal's hind legs. In South Australia in the earlier days of vine-growing Dr. Kelly advocated the adoption of a device according to which the draft iron of the plough was placed all on one side, so as not to interfere with the vines or stakes. The iron was shifted from side to side according as the ploughing was away from or towards the vines.

If, however, plenty of width is left between the rows there is no absolute necessity for the adoption of any peculiar form of plough for the vineyard. The great object in the first instance, should be to get the land as well pulverised as practicable without the expenditure of a prohibitive amount of labor. One Californian writer has gone so far as to say that the ground to be ready for planting should be "as fine as bolted flour." This of course is the language of exaggeration; but it serves to call attention in a forcible manner to the fact that the state of sub-division which is advisable in the case of the vineyard is very much more complete than in the case of land devoted only to the cultivation of cereals. For this reason it has been advised by good Australian authorities that the land should be ploughed and gone over with the scarifier first in one direction and then in the other, that is to say, cross-wise. This gives four workings and is usually sufficient to effect

a good reduction of the soil. Some advocate that two ploughs should be employed in the first instance, the one following in the furrow of the other and turning up the land to as great a depth as can conveniently be done. Afterwards the scarifier can be used, and finally the land can be rolled out flat. The following advice may facilitate operations and save some trouble:—"Before the land is ridged up for planting a round with the plough should be made throwing the furrows apart so that when the ridge is started all the ground will have been moved by the plough. If this is not done it will be difficult to take the last furrow if the ground is at all hard."

In ordinary land it is not as a rule advisable that the subsoil should be actually brought to the surface; but in places where there is a tendency to dampness and coldness or too great stiffness of the soil, it is a good thing before planting to go down so deep as to at least loosen the ground for the lower roots of the vine to penetrate into. If this be not done there will be some danger of the black rot at the roots in later years—a disease which is mainly attributable in most cases to the soil being rich and damp and having insufficient air and drainage. For the purposes of the average agriculturist in South Australia this is not the most important point, excepting perhaps in some parts of the South-East. The fine reduction of the soil is the practice which needs to be recommended as strongly as possible. Many instances have been observed in which one man might get large crops of a fine-flavored wine grape off his vineyard, while another, with exactly the same kind of situation and the same quality of soil, would get a miserable return, the difference being mainly due to the fact that one had kept his land well pulverised and turned well over and free from weeds, so that it was constantly mellow, and kept the moisture needful for the growth of the fruit crop at the proper time, while the other had neglected to attend to these points.

It has been observed of the habits of the vine that it gains more of the moisture from the air by the process of condensation than the majority of other plants with which the agriculturist has to deal, and this is to some extent an explanation of the fact, already alluded to, that the roots of the vine are really better supplied with moisture in a sandy soil than in some other kinds of land which at first sight seem to be more retentive of water, the reason being that sand acts first as a good condenser of the moisture from the atmosphere, and secondly as a good distributor of that moisture owing to the power of capillary attraction; as may be easily seen by dropping some water on sand and noticing how very quickly it distributes itself as compared with

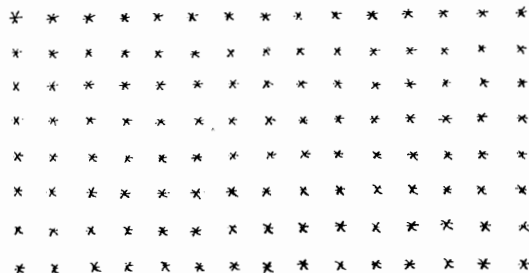


what would have been the case with hard caked soil. The same fact to a more limited degree applies to most of the soils in which the vine grows best. If they are in a state of fine sub-division they retain the slight moisture which the vine requires for a much longer period than they would if merely broken up into crude lumps.

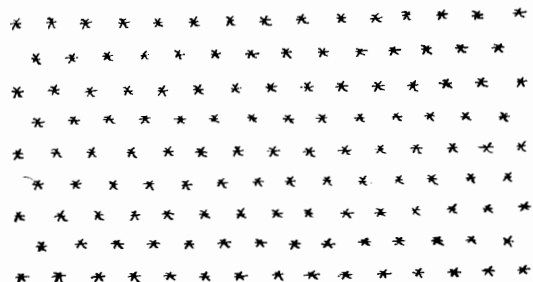
Finally, it may be noted in this place that, for the convenience of ploughing, the vigneron should leave around his planted area, on every side, headlands of 20ft. wide so that the plough may have plenty of room to turn freely. It is sometimes a good thing to make a turn with the plough around the land in order to mark off the width of the headlands and at the same time to secure a good grip when the plough takes the ground at the starting of each furrow. The general contour of the ground should always be taken into consideration when planning the mode of ploughing and laying out a vineyard. If the position be such as to receive a good deal of so-ke water from neighboring hills, there will usually be some natural depressions in which the channels for drainage may conveniently be situated, and in some cases it will be found that owing to the continual scour of the water there has been comparatively little soil left on such places of the same quality as in the other parts of the land. Nothing is lost, therefore, in devoting such portions of the land solely to the purpose of drainage, and confining the vines to the other parts where there is a greater depth of good soil.

Again, in regard to the upper limits of any vineyard which is situated on a slope, there is no real economy in removing all the timber right to the very summit of a hill or rise and trying to cultivate for vines the whole of the land including the crown of the hill. It should be remembered that the continual process of ploughing and scarifying has the effect of giving the loose earth of the surface a general downhill tendency, and that, therefore, there is much need for leaving a good supply of soil at the top which may be drawn upon from time to time by the taking in of an extra furrow, and thus preventing anything like denudation of the soil. The presence of a little timber in a hill above the vineyard acts in another way as a preservative, as it helps to prevent the formation of watercourses which might sweep away some of the soil and expose the roots of the vines.

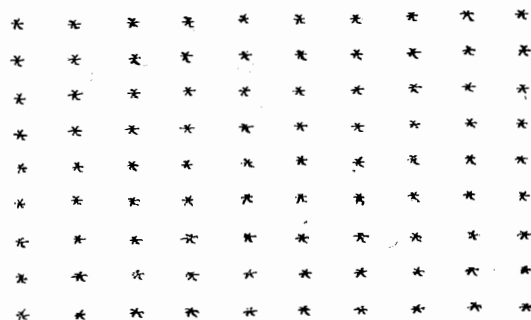
Plate 2.



Square formation.



Quincunx or septuple formation.



Rectangular formation.

## CHAPTER V.

## SPACING THE VINES.

**Fifth Direction.**—Determine the length of the space which the vines are to have between one another, and lay out the vineyard in regular lines, marking along each line the spot at which each individual vine is to grow, and adhering strictly to perfect regularity in the lines as seen from all directions.

We will suppose that the land has been well ploughed and harrowed, and that everything has been made ready for the actual planting out of the vines. It is well that the preparation of the land should be done in good time, so that advantage may be taken of any very favorable turn of the season which may present itself, seeing that in the rather variable climate of South Australia it is impossible to tell from one season to another the exact period of the year which may prove to be the best for planting.

After this preparation of the soil has been completed, it is necessary that the land should be marked out by lines crossing from side to side, so as to determine the positions in which the vines or cuttings are to be planted. The first thing is to lay out lines at equal intervals from side to side, and any good ploughman, with a fairly straight eyesight, will do this satisfactorily if one or two precautions be adopted. On the two opposite sides of the vineyard the ends of the lines are to be marked by means of stakes of bamboo or of wattle made fairly conspicuous by any means. With a light plough the man then runs his line from one stake to the other. In keeping the straight line his work is greatly facilitated by an assistant going out beyond the stake for which he is aiming, and keeping such a position as to be always in line with the two stakes forming the ends of the furrow; then the ploughman only needs to keep the stake covering the assistant all the time, and he cannot go out of the straight line.

When the area includes several slopes the lining of the ground may require more than one operation of this sort, as common sense may suggest. The holes for the vines are then made at equal intervals along the furrows, as will be described under the heading of the next direction. For comparatively small areas, such as five, ten, or even twenty acres, it is often sufficient to use a piece of string or cord, with pieces of white tape tied to it at the proper intervals, as a means of indicating the future positions of the vines.



Stakes are put into the ground at the ends of the lines just as before, and the string is stretched from one side to another, and kept tight while an assistant goes along and marks out the positions of the intervals. There are three favorite formations in which the vineyard may be planted, namely, the square, the quincunx (or septuple), and the rectangular.

The square formation is that which has already been explained in the working directions. It means, of course, that every side of the vineyard is divided off into an unvarying length of interval, and that the ground is lined from side to side, the vines being planted at the places where the lines cross one another. If the string system be adopted it is well to verify the work by having conspicuous stakes, made visible, say, by attaching to each a small piece of white paper, set in at each place where a vine is intended to be planted; then, after the work is done, it can be corrected by taking a sight across the vineyard from side to side along each line in turn. If the plough be used for the lining it may often be found sufficient to return in the same line, watching for any irregularities and correcting them as the plough proceeds.

The quincunx system of spacing is so called because it aims at setting out the ground in a series of figures resembling the five in a pack of playing cards; this can easily be observed by reference to the figure showing the nature of the formation. It has also been called the septuple formation, owing to the fact that, taking any one vine as the centre, one may count six others at equal distances from it, thus making the unit of the whole arrangement seven rather than five. The formation is much used in connection with the laying out of fruit trees as well as vines, and has been introduced at the Mildura and Renmark irrigation colonies with much success. (See Plate 2).

In order to secure the markings needed for the figure, the line of string, as before, may be taken, and marks made at each piece of tape when the string is stretched across, not from every one of the stakes at the ends of the lines, but from alternate stakes. After this it is only necessary to place in the vineyard one mark opposite each space, thus filling in the places which correspond to the middle mark in the five of cards. The same piece of string as was used before will serve to assist in this marking, but of course it needs to be shifted half a space to the side when applying it to the stakes at the lateral extremities. The work may be corrected as before by sighting also along each line. It is to be observed, however, that, for a reason to be explained later on, the sides should not be marked with the same interval as the top and bottom, but with about seven-eighths of that interval. The reason why this forma-

tion has been recommended is that it allows of three entirely different roads for the plough through the vineyard, so that more thorough cultivation is possible, and also that the admission of sun and air is more perfect than under the square system. So strongly are some local vigneronns convinced of the advantages of the formation that they have decided to use it in most of their future plantings.

In large vineyards, however, there is no doubt that the favor with which the third system has been viewed is well deserved—that is to say, the rectangular. Under this system the area is marked out, not in squares as under the square principle, but in rectangles. In other words, the top and bottom of the field have a different space for unit of measurement from the sides. Thus the top and bottom may be marked off into spaces of 12ft. each, while the sides have only spaces of 7ft. The advantage claimed for this mode of arrangement is that it gives for each vine fully as large an area in which to spread its roots as if a square formation of 9ft. x 9ft. had been adopted, and yet it admits of a dray being taken in among the vines at the times of vintage and pruning, and on other occasions. It partly depends upon whether operations are conducted on a sufficiently large scale to make the length of the row great enough to require a dray to remove the produce or pruning refuse of two rows, whether this formation will be found the most advisable. One other consideration, however, may be noted, namely, the necessity of supporting some of the longer-pruned vines by means of trellises, very similar to wire fences, run along from side to side or from end to end.

It stands to reason that, if the 12ft. x 7ft. formation is adopted, a shorter length of trellis will be required, if each line of trellis is 12ft. apart, than would be needed if the square formation were in vogue and the lines of trellis were only at a distance of 9ft. from one another. The theoretical advantages of both of these two irregular formations, as they are sometimes called, are undoubtedly very great. But yet the vast majority of vineyards are put in, and will probably continue to be put in, on the simple square principle, which has been found to answer all requirements fairly well. The horses take kindly to it in ploughing, and the fact that it is just as easy to plough lengthwise as it is crosswise makes it more certain that, in the future working of the vineyard, both directions will be fully attended to. When trellising has to be adopted, of course the argument about the facility of ploughing both ways cannot fairly be urged in favor of the square system.

Into the very vexed question of close or wide planting, it is not necessary to enter fully. Suffice it to say on the general question

that new methods of cultivation have introduced new notions on the subject of spacing, and that European ideas of planting vines, even as close to one another as 30 in., have been completely abandoned in Australia. Scarcely any authority in Australia now advocates a closer plantation than 6 ft. x 6 ft., and by taking the average of the advice given by forty or fifty experienced vignerons, the weight of evidence seems to be in favor of something like 8 ft.

It is to be noted, however, that in higher localities where there is an abundance of rainfall, it is usual for the vigneron to plant closer than down on the plains or on the lower slopes. This is done not only for the reason that he does not need to fear that his vines will have to fight one another for a scanty supply of water in the soil, but also because a closer formation tends to enable the vines to afford better protection to one another against the storms of wind, rain, and hail, which sometimes play havoc with the flowering at a critical time and prevent the setting of the fruit. Another consideration which in some localities must be held to tell in favor of the choice of a closer formation than would be advisable in many places is that in vineyards which are very liable to spring frosts it is very desirable that the vines should afford shelter to one another from the direct rays of the sun which coming immediately after a severe frost are, as will be noted later on, the real cause of the disastrous "nip," which sometimes causes such a heavy loss in the fruit crop.

As regards the prevention of vines suffering from drought during a hot summer authorities differ as to the advantages of a closer or wider formation, some asserting that by giving a larger area to each plant the grower ensures that each shall have its due quota of moisture, while others say that it is not at all a bad thing that the roots of adjacent vines should come into contact with one another, because this gives them a tendency to strike deeper in search of moisture than they would otherwise do, and it is upon the lower stratum of moisture that the vine relies for its support during a hot spell in summer. Other considerations again are the lightness or darkness of the color of the soil, but many growers are apt to labor under a wrong impression in regard to this point. It is supposed by some that in a light-colored soil the vine suffers more from the direct rays of the sun than in a dark-colored one owing to the reflected rays which are thrown upon the fruit and leaf. But it should be remembered that the safety of the root in the case of a plant like the vine is the most vital consideration of all, and that a dark-colored soil absorbs much more of the heat from the sun's rays than a light one; in fact that what-

ever heat it does not reflect it actually absorbs. There is danger of the roots of a vine being injured by the sun beating upon a dark soil just as there is danger of a man wearing a dark-colored hat getting sunstroke, the reason being that dark colors always absorb more of the heat rays than light colors. For this reason it has been strongly urged that vinegrowers who have a dark chocolate or other heat-absorbent soil should endeavour to plant close enough to make the shadows of the summer vines cover a very large proportion of the total area of roots.

The matter of convenience in ploughing is of course a very important one, and in this connection it may be noted that for a double-furrow plough to work freely it is necessary that the interval between the rows should be at least 7 ft. If a formation of 8 ft. square is given, then the vigneron has the additional advantage of being able to plough four different ways, as the space left in the oblique directions both ways in the square formation is wide enough to admit a light plough.

A few other hints deserve slight mention. For instance, it is desirable when ploughing out the land for a vineyard to run the furrows, if on the side of the hill or slope, neither too level nor too steep, but just at a moderate enough inclination to carry off the water and avoid the formation of stagnant pools and yet not with enough slope to make rapid torrents which in time of heavy rain may expose the roots of the vines. Sometimes it is necessary that wet patches should be drained, and in this case a well-paved drain of stone should be made at every interval of a few yards in order to carry off the heavy volume of water. As a rule, however, the land which is suitable for vine-growing in South Australia will be found to contain very few wet or sour patches, and thus the expedient of draining will not require much attention excepting, perhaps, in the South-East. A warning may be here given to the intending viticulturist not to abandon the square style in favor of the rectangular in order to provide for trellising, unless he has made certain that his vines will not do well without such adventitious aids. There are very few indeed that really cannot do without the trellis, and some vinegrowers go so far as to say that, unless for vines of the currant-making tribe, it is quite needless to have trellises at all. The vine, they say, should be trained to bear its own fruit without even the aid of a stake.

Having set these considerations before the reader it remains to give the figures showing the numbers of vines that will be contained in an acre of ground laid out in the various forms of spacing.

Square Formation.		
Ft.	Ft.	PER ACRE.
3 x 3	give	4,840 vines
4 x 4	"	2,722 "
5 x 5	"	1,742 "
6 x 6	"	1,210 "
7 x 7	"	889 "
8 x 8	"	680 "
9 x 9	"	537 "
10 x 10	"	435 "
11 x 11	"	360 "
12 x 12	"	302 "

Rectangular Formation.		
Ft.	Ft.	PER ACRE.
4 x 3	give	3,632 vines
5 x 3	"	2,904 "
6 x 4	"	1,816 "
6 x 5	"	1,452 "
7 x 4	"	1,556 "
8 x 5	"	1,090 "
8 x 6	"	908 "
10 x 6	"	726 "
10 x 8	"	545 "
10 x 12	"	363 "

### Septuple or Quincunx Formation.

The distances marked are those between the vines along the top and bottom boundaries; on the sides the interval is taken as seven-eighths of this.

Ft.	PER ACRE.	Ft.	PER ACRE.
3 give	5,491 vines	8 give	762 vines
4 "	3,083 "	9 "	600 "
5 "	1,966 "	10 "	482 "
6 "	1,362 "	11 "	399 "
7 "	999 "	12 "	335 "

The septuple system is arranged upon the same principle as the architecture of the honeycomb, namely, that the hexagon or figure of six equal sides gives more space to each cell or section to a given area with a greater distance from centre to outside than any other simple figure. By no other simple means can so large a distance between vine and vine be secured in so small an area of land, and therefore the septuple plan is to be preferred where special facilities exist for irrigation, and it is intended to make the very most of the area so treatable, or where land is comparatively dear and simplicity of working is not so much an object as the full utilisation of the area at command, without overcrowding the vines.

In order to carry out the true septuple system, it is necessary, as has been said, that each vine should grow exactly at equal distances from six other vines. For this purpose it would obviously be a mistake to measure out the same distances for the side spaces as for the top and bottom ones, because then the slanting distances from row to row would be longer than the distances measured from side to side. The true septuple system is obtained by measuring out the top and bottom with the settled interval which it is intended that the vines should have between one another, and then measuring off the sides by seven-eighths of this length, or, to put it more mathematically correctly, by the "square root of 3" over 2, this being the relative length of the perpendicular in an equilateral triangle.

One advantage which the septuple system presents besides that of securing the greatest space for each vine out of a given area of land is the matter of convenience of ploughing. Every one who had any experience of ploughing in and out among fruit trees or vines knows how awkward it is when a branch is standing out rather obtrusively from one tree or vine and the plough has to be hitched suddenly to one side so as to avoid it. It is self-evident that if there be an open space opposite the tree or vine in such circumstances, there will be less danger of doing damage than if the planting has been done on the square or rectangular system and there is no space on the other side.

On the other hand, the corners of a vineyard are rather more difficult and tedious to plough if it has been set out on this plan owing to the shortness of the run which the plough has on the oblique avenues. On this account it has been sometimes recommended that the corners should be left out in the arrangement of the planting so that all the spaces will present a fairly good length for the plough. In this way the vineyard becomes an eight-sided figure, and it is easy enough to count how many vines will have to be deducted from the total owing to the leaving out of the four corners.

There is every reason to believe that a very large proportion of the new vineyards of South Australia will be planted wide, especially in the warmer districts and on the lower rises of the foothills where the soil is poor and a good large area is required to give adequate nutrition to each plant. Yet it is not so certain that on more elevated localities to which we shall have to look for some of the best vines of the claret and hock types, 6ft. may not be found to be after all the best and safest interval.

One of the leading Californian authorities, after having spent much time and trouble in advocating wide planting in all sorts of positions and soils on the Pacific Slope, had an opportunity of going through the leading wine-producing countries of Europe, and making close investigations and comparisons. He said as the result of his observations that he had come home quite converted on that point, and would advocate closer planting in the future. In the neighboring colony of Victoria one of the very best authorities states that ten years ago a vineyard in a fairly elevated situation was partially thinned out by the removal of alternate vines along the row in one direction, a portion being so treated and another portion being left alone. After ten years it has now been found that on the whole the closer vines have done better than those which were left wider apart. At the same time in South Australia if we inquire on the vineyards east of Adelaide we find

that 6ft. or at most 7ft. is the favored interval, while both in the south and in the north 9ft., 10ft., and even 12ft., have been more advocated.

If any intending planter should feel bewildered on this account, he can easily try the following expedient for determining the relative advantages of close or of wide planting on his land:—Make the interval 12ft. by 7ft., but on one portion of the land fill in the 12ft. space so as to reduce it to 6ft. by 7ft. If in the future growth and productiveness of the vines it becomes apparent that the part having close planting thrives better than the part having wider planting, then it is easy enough to fill in the blanks between the vines that are 12ft. apart, but if on the other hand the trial gives an opposite conclusion, then the alternate vines can be taken out from the closer portion.

At Renmark and Mildura, the irrigation colonies on the River Murray, the best practice seems to be to plant on the rectangular system with spaces 8ft. by 10ft. for ordinary vines, and 10ft. by 16ft. for currant vines. Fruit trees get more space and are placed at about 24ft. from one another.

## CHAPTER VI. PLANTING OUT CUTTINGS.

**Sixth Direction.**—The positions of the future vines having been all determined, the ground may be planted with cuttings directly if the conditions of soil and season be favorable.

The best time for planting out cuttings into the vineyard in South Australia is about the middle of August in ordinary seasons; but it sometimes happens that owing to the lateness of the rains the ground is in a good moist condition even well into September, and the rule to be observed is the same as has been already stated, namely:—To get as near to growing-time in the planting out as is possible consistently with safety from too much dryness for the growth of the young plant. As regards the amount of confidence with which the result of planting-out operations may be looked forward to, it should again be mentioned that authorities are not exactly in accord with one another. One vigneron of very great experience says:—"In very wet seasons do not hesitate to plant cuttings; but if the winter up to the time of planting has been deficient in rainfall it is better to wait another year, and to plant the cuttings to root in beds where they can be irrigated." Another, on the contrary, says:—"I have always found that cuttings can be planted out with perfect security of a good result if only the proper precautions are fully observed; I have got even as high as 95 to 100 per cent. of my cuttings to grow successfully, and that, too, after being planted out during an exceptionally dry season." Others assert that, at any rate, the intending vigneron can easily secure himself against the probability of ultimate failure by not only taking all proper precautions, but also putting in say 20 or 30 per cent. of the total number of his cuttings as a reserve in a nursery, and it is on this account that care has been taken to point out how essential it is that every vinegrower should be familiar with the methods of raising young vines in the nursery.

There are two ways of planting cuttings in the vineyard, namely, planting in the spade hole, and planting in the dibble hole. The first mentioned is by universal consent acknowledged to be the safer plan, although it costs about three or four times as much for labor as the use of the dibble, or planting bar. In the first place, the holes dug by the spade should be from 7in. to 9in. square, that is to say, of those dimensions in length and breadth, and of sufficient depth to take in practically the whole of the cutting; thus as a general rule it will be found necessary to make the holes over 12in. in depth, and it should be remembered

that this is not actual depth from the place in which the cutting is set, but depth relative to the general level of the surface. If the holes are being dug in a furrow made by a plough in lining out the ground, it will of course be necessary to allow for the depth of this furrow, in order to avoid having the cutting covered over with 2 in. or 3 in. of soil afterwards when the land has been ploughed in. It is sometimes advised that the cutting should be set into the ground at an inclination towards the general direction of the sun; that is to say, towards the north in level localities, and away from the hillside in slopes. In fact there is a plan which finds much favor in some parts of Europe by which the cutting is merely inserted in a slanting hole made by a kind of pick in the ground, and under this system the inclination of the cutting towards the sun amounts to as much as sixty degrees from the perpendicular. It is only in the cooler parts of South Australia, however, that this point requires much attention. As a general rule the young plant receives quite as much heat from the sun as it actually requires, and often a great deal more.

After the hole has been dug the cutting is to be placed in it, and made to rest right down firmly on the solid ground. It is well in planting out not to run any risk of the ground subsiding and taking the plant with it. This is a matter which can be better watched in the nursery in order that any injury may be prevented, so that if placed in beds the cuttings may safely have some soft soil under them. But in the vineyard itself greater security is attained by setting the cutting down solidly against the bottom of the hole than by putting in some soil underneath. Some loose mellow soil must then be thrown in and pressed against the cutting, so as to hold it firmly in every direction. In some vineyards it is customary to have a wooden rammer for this purpose, but in other places it is considered quite sufficient to use the foot. The operation of closely packing the cutting with soil is, however, the crucial test of good planting. The hole should be about half filled with the tightly pressed soil, and then on the top of this the rest of the soil in a loose condition may be thrown in and allowed to settle down (see illustration on Plate 1). It is well to have a good test by which to know whether this operation has been well done, for nothing can be more disheartening than to have to wait a whole year in order to have your crop of young vines, and then to find at the end of that time that owing to a simple piece of easily preventable carelessness the cuttings have given sickly plants or have never even sprung into life. The leaving of spaces around the cutting invites the lodgment of water and allows the too free admission of the air, so that the cutting rots or becomes mouldy.

In order to make sure that this defect may not spoil the result of the year's operations, the vinegrower should go round after the planting has been completed in each row or section of his vineyard, and taking the head of the cutting between his thumb and forefinger he should give it a fairly strong pull upwards. If it comes up under this pull it has not been well planted, and it is far better that the hole should be dug out and the cutting set in again than that it should remain to prove a failure. Of course it is difficult to tell without actual trial what amount of pull the cutting should be able to resist, seeing that in very loose and sandy soils it would be quite impossible to set in a cutting so strongly that it could not be pulled out by the finger and thumb. But the object should, nevertheless, be kept in view, namely, to leave in only such cuttings as are firmly bedded in the ground.

With regard to the digging of the holes, several practical hints have been given by various local authorities which will be of some service. If the ground has been merely lined by means of the plough it will be advisable that in digging the holes along the lines thus made the vinegrower should have some guide as to the intervals to be preserved. This can easily be attained by the use of two or three stakes of wattle or of bamboo, which are to be set up in such positions that if the man who is digging always keeps two or three poles in a line covering one another he cannot go wrong.

Another hint that is valuable to those whose land is very well drained and inclined to be dry is to have the holes dug as long as possible before they are actually required, so that the lodgment of the water during some spell of rain may give a good moist patch around each cutting after it has been set in. This, of course, must be done with judgment, seeing that on land inclined to be at all wet the precaution of early digging might prove to be of more harm than good. In planting out cuttings in the vineyard, two buds of the slip should be left above the ground. In all cases it is advisable that as little of the old wood of the cutting should be left above the ground as possible because, as already explained, the shoot which grows from the upper of the two buds will usually be found to be the weaker of the two, and nothing at all is gained in the effort towards providing the proper length of stem for the future vine by leaving a large space of the cutting above the ground.

The most signal failures which have occurred in the planting of cuttings have often been chiefly due to a misapprehension on this point. The cutting should be looked upon as the nucleus of the future root, and not in any sense as that of the future wood; and any wood that remains over from the cutting in



the growth of the more fully developed plant is really a source of weakness rather than of added strength. Indeed, so strongly is this felt by some vignerons that they advocate that only one bud should be left above the ground, and the only reason which induces others to dissent from this ruling is that there is always a chance that one or other of the two shoots may get destroyed or injured, and then the future growth of the vine is absolutely dependent upon the other one. After the planting has been completed it is important that the vinegrower should see to it that no water is allowed to lie about. A good deal in the way of drainage, by cutting small channels to admit of the escape of little runlets of water in wet weather, will be found necessary in some descriptions of land. It is true that, where irrigation is possible, a good flooding over the young vines at the proper season, as explained later on, may be of very great service. But a very broad distinction must be drawn between the benefits of irrigation and the very injurious effects of allowing stagnant water to lie about the vineyard near the roots of the young vine; as much difference, indeed, as between watering sheep and drowning them.

In positions where the full force of the sun is felt during the scorching days of summer it must be expected that a moderate proportion of the cuttings planted out will prove failures. In California and some other portions of the United States, where the sun has equal force with what it has in Australia, and where the practice of planting out the cutting instead of rearing it in a nursery is more general than it is here, a great many vignerons take the precaution to give the young cutting a little mulching, and to keep it partially covered up with straw, leaves, or tan until it makes a vigorous growth; others cover over the head with a handful of loose sand, earth, or light gravel. The American mode of planting most in vogue is with the use of the planting-bar, or dibble, an implement of extreme simplicity, and which has been used with success in some parts of Australia and with signal failure in others. It may be constructed either of iron or of wood, and consists essentially of a bar not unlike a crowbar; indeed there are many cases in which a crowbar has been employed for the purpose, but a dibble specially made for planting operations is far better, and can very easily be constructed. It is a bar about 3ft. or 4ft. long with a piece fastened on to one side, something in the fashion of the step of a stilt, the cross piece serving the double purpose of a place on which the foot can be set while pushing the point into the ground in making the hole and of an indication of the depth attained by each thrust, so that regularity of planting may be secured. The point, of course, should be sharpened, and if the

dibble be made of wood it can be conveniently shod with iron. Some of our Australian timbers are so hard that a stake will last for a long time even without any iron point, especially if the ground be soft; on other soils an iron bar is indispensable. A simple handle is fixed at the upper end of the bar, which, by the way, may be either round or square. The use of this primitive looking implement is obvious. It should be pushed into the ground to a distance of fully as much as is to be the desired depth of the cutting in the ground, and then pulled from side to side until the hole has been enlarged considerably at the surface.

Into the hole thus made a little liquid manure made by mixing up cow dung and water with some fine soil may be poured by means of a pannikin. It is also advised that the cutting itself in being taken round for planting should have its lower end immersed in the same liquid manure, a bucket or similar utensil being employed to carry round a bundle of the cuttings in this style. Around the cutting, when placed in the hole, the ground must be packed as before quite closely, and some make a practice of again pouring a little liquid manure into the hole when half full of soil, in order to give the young roots at their start the best chance possible. It must be noted in connection with this mode of planting that its great defect lies in the liability of the soil, against which the bar has been worked in enlarging the hole, to get hard-caked and to resist the passage of the young roots into the surrounding soil at a time when they have very little penetrating power of themselves. If, therefore, they are stimulated in their first growth by a little enrichment of the soil quite near them they acquire more strength to undergo the ordeal of having to branch out into the adjacent ground. After the hole has been well filled the earth may be heaped up loosely so as to leave exposed only the top bud, but yet not to preclude the growing of the next one which will come through in due season. An important part of the operation of planting with the dibble is that of compressing the earth by lateral pressure. After the hole has been filled and covered up the dibble should be pushed into the ground at 2in. or 3in. distant, and then forced towards the cutting. This should be done two or three times in different directions, so as to lever the earth against the cutting and fix it in very firmly.

It is claimed for the use of this instrument that one man can plant with it as many as 700 vines per day, but, if all the precautions are fully attended to, it may fairly be doubted whether this average can be kept up. The number of failures in the attempts to use it in South Australia, as well as in Victoria and

New South Wales, suggests either that there are some peculiarities in the climate of Australia as compared with those of the south of France or California which render it impossible to attain the same results here that are usually arrived at in these countries; or, on the other hand, that some of the precautions which are considered essential to success elsewhere have not been properly observed in Australia. It is needless to stay to inquire into this question. The method of planting by the spade-made hole is undoubtedly far more approved in Australia than that of boring holes with the dibble, and the chief matters in dispute are not concerned with the manner of planting out, but whether it is usually safe to plant out at all. The wide difference in the results attained by men of equal skill and experience makes it fairly plain that local conditions have more to do with the chances of success than anything else. For instance, in regard to South Australia it has been found by inquiry that on the western slopes of the foothills, below the Mount Lofty Ranges, the operation of planting out can be conducted with remarkable success, but in the more inland slopes, between the north-eastern railway and the Murray river, the use of rooted vines presents by far the safer plan in all but exceptional situations.

A vigneron who has the advantage of rich soil and who goes to the trouble of watering his cuttings throughout his vineyard, or who can take advantage of natural facilities for irrigating his young vines may indeed secure a splendid percentage of successes; but in the great majority of cases the planting out of cuttings in this latter district does not give the favorable results that are recorded in some favored localities. It must be remembered that if a vinegrower puts his cuttings into his vineyard and loses 60 or 70 per cent. of his vines, there is little use in his attempting to save the miserable remnant of growing vines that are still left. It will be better and more economical in the end for him to plough the whole of the land up again, and go through every operation just as if he had to begin from the beginning. If, however, he has had the foresight to put in a bed of cuttings as a precaution, he can afford to treat the loss as a light one in any case. He can either use some of his rooted vines for filling in his blanks, if he should have secured above 50 per cent. of growing vines or thereabouts, and use the balance for planting out and enlarging his vineyard, or else he can, if not so fortunate, simply fall back upon his nursery for the whole area, and so he will not lose a day of the time that is needful for bringing his vineyard into profitable bearing.

## CHAPTER VII.

### PLANTING ROOTED VINES.

**Seventh Direction.**—When the young vines have been well rooted in the nursery, plant them out into the vineyard.

It is the most general practice among vigneronns to plant out rooted vines into the vineyard at one year from the time of planting in the nursery beds. In many localities there is no doubt that a yearling rooted vine is quite ready to stand the risk of transplanting, and the very large percentage of successes that may be habitually obtained by means of following this ordinary practice is good evidence that in these localities, at any rate, the year old vine is the best for transplanting. Yet it is found in other places, especially where the soil is comparatively rich, that the roots of the yearling vine are rather scanty and exceedingly tender, so that the progress of the plant towards maturity is very greatly checked by the process of transplanting. Some even go so far as to say that in such localities they would advise that the vine should be left in the nursery until three years after the cuttings have been put into the beds, but it is probable that in the districts of the colony where vines grow most rapidly the plant would be altogether too large and too nearly fully grown to stand transplanting at this age without serious injury. It will be noted, then, that the practice of experienced vigneronns varies considerably in this respect, and that the variations of soil and climate have much to do with the discrepancy that is observable in the evidence. One thing, however, is certain, namely, that the great majority of vigneronns prefer to plant out their rooted vines when only one year old, and the beginner cannot do better than follow this practice unless he has distinct evidence from the very slow growth of his nursery that he will not have any roots to speak of when the suitable time for transplanting arrives.

The proper season for planting out the rooted vine into the vineyard is after the winter rains, and the month of August may be taken as the most usual period. It is not infrequent, however, for vigneronns to plant out in July, and, on the other hand, there are some who have had very good success in the month of September, just as in the case of planting out cuttings. The rule to be followed in this case is very much the same as that with regard to cuttings. It is well to get as near to the period of growth in the early spring as possible, without losing the advantage of a moist soil

resulting from the winter rains; therefore, if it has been evident that the season is to be a late one, it will be better to wait till the latter part of August at any rate. The chances which the young vine has to undergo when standing in the soil without any rising of the sap are too uncertain to make it wise to put it in any earlier than is necessary.

Above all, it is in every case advisable that young rooted vines should not be allowed to lie about after being taken up from the nursery beds, and allowed to become dry and shrivelled. If this serious mistake be committed the result will most probably be seen in a most unfortunate loss of time, for the growth of the future vine will be indefinitely retarded. If possible a cloudy day should be chosen for the actual transplanting, and every care should be taken to see that the roots are kept in the freshest and most healthy condition possible. In some cases it will be found that the roots have unavoidably been torn and mutilated by being removed from the beds. Under these circumstances the ragged ends may be trimmed with a sharp knife, but in no case is it advisable to try anything in the shape of what is known as "root pruning" with the young vine. Let the young plant have the benefit of all the sound roots which it can command, for it will require them all in order to provide for the vigorous growth which ensues in the spring season. Nothing can be more dangerous to the young vine than to let it shoot up into leaf and wood strongly in the second year of its existence without having a sufficient amount of root to keep it from overtaxing its strength. It is necessary, however, that the shoots of the young vine should be carefully cut back with the design of leaving only one or at most two buds standing above the ground when it is planted out.

The positions for the vines in the future vineyard having been marked out it is necessary that the holes should be dug for the rooted vines about 1ft. or 15in. in depth and about 9in. or 1ft. square. Some vignerons go further, and say it is always well to make the hole for the rooted vine at least 6in. or 8in. deeper than the lowest roots are intended to lie, in order that some good mellow soil may be thrown in for the young vine to put its roots down into and avoid contact with the colder and lower stratum of earth. For this purpose it is a convenient practice when digging the holes to place the top soil on one side of the hole and the bottom soil on the other side, so that the former may be thrown in first and the lower soil will then be used for filling up afterwards. In ordinary land the cost of digging 100 holes to a depth of 12in. or 15in. may be reckoned at from 3s. to 5s., according to the lightness or stiffness of the soil.

The method of putting the vine into the ground is not unlike that of putting out any other similar plant. Particular care, however, must be taken to secure the perfect contact of the soil with the roots of the vine all round, the reason being that the roots of the vine are peculiarly liable to rot and mildew, and if any opportunity for the lodgment of water is allowed with rooted vines, just as with cuttings, there may be expected to result a percentage of loss that might with a little care have been avoided. For this reason it is a good thing to arrange that two persons shall engage together in the actual work of planting out, and that the more experienced of the two shall have the task of putting in the soil and seeing that it is well packed close around the vine. The young plant is to be placed in position, and as the fine earth is sprinkled upon its roots the whole is to be well shaken so that the earth mixes in among the roots in all directions. With a little practice the operator soon gets into the knack of doing this rapidly and effectively. Then when the hole is about half or two-thirds full the earth should be firmly pressed down with the foot, and more put on top of it and again pressed, when, finally, the rest of the earth may be put on top in a loose state and allowed to lie until it settles down with the rain. It is usual to arrange that the last bud or shoot shall be just about 2in. or so above the surface which the ground will afterwards have when levelled out, and for the purpose of avoiding burying it altogether it is also customary to "hill" the young vine up a little with earth placed round about it and about as high as the plant; otherwise the whole will be put under ground with the next ploughing when the furrows have to be closed. It is the practice in most countries having a warm summer temperature to leave as little of the young vine exposed to the sun as may conveniently may be done, and in America the vignerons usually place a slight covering of leaves or straw over the young plant during the early summer just as they do over the cutting when it is striking.

The results obtained in some parts of South Australia with transplanted yearling vines prove in a most striking manner the exceptionally favorable climatic conditions which exist in this part of the world for viticulture. Some early-bearing varieties have been known to yield a fair crop at three years from the time of their being put into the nursery, and one instance is quoted of a vigneron actually getting two tons of grapes per acre off vines that were of this age. They had been rooted in beds and planted out into the vineyard as yearling vines, and from their subsequent progress it was made to appear that the process of transplanting had checked their growth scarcely at all; in fact a prominent



grower makes the assertion that in his district—the vicinity of Angaston—the process of transplanting checks the growth of the yearling vine scarcely a single month. At the Murray irrigation colonies the best vinegrowers use rooted vines and make a practice of putting them out into the vineyards when they are one year old.

Another leading viticulturist, whose operations have been chiefly conducted in a more southerly part of the colony, says that “yearling vines have such scanty roots and these get so mutilated in the process of transplanting that they are nearly worthless, and are little if anything better than cuttings.” In California also Mr. Hyatt, the editor of the *Rural Home Journal*, as already quoted, asserted that “rooted vines gain not much in point of time over cuttings for one will come into bearing as soon as the other, and will in many localities make stronger and healthier vines.” A third authority, however, in summing up the whole matter, so far as it concerns the colony of South Australia, says that he notes that where the rainfall is exceptionally good the system of planting out cuttings may fairly be recommended; where the soil is congenial and a marked feature of the climate is that the spring and summer days, however dry they may be during daylight, are usually followed by heavy dews, the yearling rooted vine is the best and safest thing to plant; but in localities which are apt to be visited by spells of dry weather alternating with gales from the sea, it will be wise to have the vines exceptionally well-rooted before planting them out, and two years will not be too long for this purpose.

In addition to the ordinary mode of putting cuttings into the soil, there is another way of obtaining rooted vines which may conveniently be described in this place, namely, the method of “layering.” The fact upon which this system depends is that any long shoot of the vine, if drawn out and buried in a trench or hole alongside, will utilise its buds in order to give forth roots, and thus at the end of a year it is possible to secure by this means an entirely new plant by merely severing the connection with the parent plant. The operation is conducted in the following manner:—In the third year of a vine's growth let the layers be drawn out to 4ft. or 5ft. distance from the vine, and bent down so as to run along horizontally in a trench about 9in. or 10in. deep. In some cases this operation is most easily managed by simply prying a broad spade into the earth and making an opening sufficiently large to admit of the layer being shoved underground. Before this is done, however, it is to be noted that the intervening buds between the stem of the old vine and the place where the new one is intended to grow should be rubbed off, otherwise they will form roots and interfere with the parent plant.

In France the whole of the buds are frequently allowed to grow and make roots, but this is with the object of subsequently cutting the rod or shoot up into fractions, each of which will form a separate vine for transplanting. If the layer is only intended to give rise to one new vine the intervening buds should be removed as mentioned, and there should be only two or three buds left above ground. About 2in. below the lowest bud left in the soil where the layer is bent to form the new vine, a slit should be cut with a sharp knife on the underside of the shoot upwards, and into the layer to about the middle of its width. This at once facilitates the bending, and provides a place from which the future vine can make a nucleus of roots just as a cutting would.

But it may be asked, “Why should all this trouble be taken when a cutting might be put in much more easily?” The reason is that, by means of layering, the parent vine and the young ones can be made to come into bearing at the same time. The new vines, in fact, date their real age, so far as fruit-bearing is concerned, from the time of the planting of the original vine, and not from the date when the layering was effected. The system is, therefore, economical in the saving of rooted vines, seeing that the parent rows may be planted as much as 20ft. apart both ways, and the intervening spaces filled in by means of layering—one row being layered out in the third year of the parent vines' growth, and the next in the fourth. But against this consideration it is to be remembered that a certain narrowness of planting is a feature of the system, and, in addition to this, there is an interference with the freedom of ploughing due to the presence of the layer at a shallow distance from the surface, and any carelessness with the plough means the mutilation of the layer.

To prevent having to bury the layer at all the French vigneron sometimes bend down a shoot and set only its extreme end into the ground. The buds thus go into the soil upside down, and it might be thought that they would refuse to grow in this position. Such is not the case, however, as we have already seen in treating of planting by means of single buds. The bent-layer system, of course, puts it out of the question to send the plough through between the parents and the new rows. To obviate this it has been the practice in America to make the layering plants take root in roughly constructed boxes of wood or wicker, filled with soil, and placed close in near the stems of the parent vines. In this way a number of comparatively old vines can be secured in a very short time for planting out into spaces which have been missed owing to some failure.

It will be seen, therefore, that in the matter of the means whereby the blanks may be filled in, when the vineyard is being constituted, the vigneron has a good many "strings to his bow." Layers have the merit of saving time. But in other respects they are inconvenient and take a good deal of attention and trouble to train them satisfactorily. Rooted vines have hitherto been not at all dear, as the prices have been variously stated at from £2 to £5 per thousand, the rate being of course variable in accordance with the variety.

The raising of rooted vines has been made a branch of the work of the Forest Department of South Australia, and it will be noted from the proceedings of the House of Assembly that on June 11, 1891, the Treasurer, the Hon. Thomas Playford, stated in answer to a question asked by Mr. Gillen, that "about one and a half acres would be utilised by the Forest Department for rooted vines for free distribution in the next ensuing season." The kinds planted would be Muscatel, Sweetwater, Pedro, Doradillo, Grand Turk, Red Prince, Baillie's Blanco, and the Zante currant. These vines are intended, it may be mentioned, for small holders and holders of working men's blocks. The exact acreage and the selection of vines of course varies from year to year, but the aim of the Department will be to keep on hand a limited selection of good and well-proved varieties, rather than a large ampelographic collection, which will be more suited to the Botanical Gardens. These will include such useful sorts as Shiraz, Carbenet, Grenache, and Mataro for red wine grapes, and Muscatel, Doradillo and Zante for drying and table purposes. In 1892 the Government issued instructions that 2,000,000 cuttings should be planted in the various nurseries.

## CHAPTER VIII.

### PROTECTION AND CULTIVATION.

**Eighth Direction.**—Protect the young vines from possible injury by vermin; leave them unpruned during the first year of their growth, but keep the soil well turned over and free from weeds.

The temptation to meddle with the young vine during the first year of its growth has led to a great deal of loss and dissatisfaction that might easily have been avoided. The object of the vigneron during the first three or four years of his work—that is, until the vines come into bearing—should be merely to assist the operations of nature in building up in the most natural way possible a healthy and vigorous plant. To attempt to force the young vine during spring and summer to assume the form which it ought to possess only in the winter is a most fatal mistake, seeing that the vital functions are at those seasons in their fullest vigor, and it is as absurd to prevent the plant from making use of its breathing apparatus—that is to say its foliage—as it would be to try to cut off the supply of fresh air from a young animal. Nothing really artificial enters into the rational mode of cultivating the vine until the time arrives when the plant is not only making its seed—which is an entirely natural product—but also elaborating the pulp and juice with which that seed is surrounded, which, it need hardly be said, are, in their present state of development, largely an artificial product, due to the long process of training which cultivated vines in the fruit-bearing stages have been made to pass through. This may be easily seen in the fact that when the artificial conditions are removed the first thing in which the vine shows its return to the wild state is in its losing the juicy pulp, which is the characteristic of the fruit of the well-cultivated grape vine. So far as the vines themselves are concerned, therefore, the best advice during the first year is to let them alone as far as possible consistently with the cultivation of the ground.

In some districts of South Australia, more especially among the hills, it will be found necessary to protect the young vineyard against the ravages of hares, and for this purpose wire netting will be required. This work should be done thoroughly, and it is false economy to employ a larger mesh of netting than is absolutely safe, seeing that young hares often get in through a wide mesh and do quite as much mischief as their elders would have done. It is well worth the vigneron's while to take pains and go to a little expense

for the full protection of his vines. A vineyard in full bearing is reckoned to be worth from £20 to £40 per acre in South Australia, and it is a most fatal mistake to neglect any ordinary precaution, which may be the means of averting the destruction of many of the vines at a time when, perhaps, two or three years of labor have been bestowed upon them. The expense demanded for the cultivation of the vine in respect of implements is exceedingly small; in fact the only things which are really required for the full cultivation of a vineyard are a plough, a scarifier, and a pruner. Nearly all the remaining expense is due to the expenditure of labor, and the small amount that may have to be spent for the protection of the vines from hares, rabbits, or any other depredators is usually not felt.

Before quitting the subject of ploughing and preparing the ground, one or two hints given by leading viticulturists of South Australia may be conveniently quoted:—"One or two good harrowings between the rows once or twice, according to the growth of the weeds, and a little hoeing round each plant will be all the cultivation required the first year." The amount of cultivation needed for keeping down the weeds during the first and subsequent years will of course vary very much in accordance with the locality and the nature of the soil. If the ground be dry and the situation be such that the limited rainfall is itself a good check upon the growth of weeds, the amount of cultivation mentioned in this quotation will be ample, but if, on the other hand, the land be situated at an elevation where the winter rainfall is heavy and the spring and autumn also have more than the average rainfall, it will be necessary in some cases to do, in keeping the weeds down, as much as three times the work that would be needed in the case of the drier country.

The urgent and constant need for keeping all weeds under control in order to secure a good crop is seen in the case of the vineyard perhaps more clearly than in that of any other kind of cultivated land. Everyone has noted how soon a vineyard will go completely out of bearing if left to be overrun with weeds. Under such circumstances the plant, for the time being, practically reverts to the condition of one of those wild vines which are botanically of the same species as the cultivated vine and which bear berries which, from a botanical point of view, are complete, of course, but which from a commercial point of view are absolutely worthless. It may also be remarked in this place that so thoroughly does cultivation enter into the industry of vine-growing as an absolute and constant essential that even after a vineyard has been left for years in a state of neglect—overrun with weeds, entirely unpruned

and bearing only a few stray berries which are little else but seeds—the vigneron can bring them back into full usefulness and value if he will only take the pains to keep the ground well cleared of weeds, and cut them back and give them a fair chance in other ways.

When the vineyard has been established it is the practice to plough towards the vines as early in the winter season as June if the ground be at all favorable for the work. This is the first ploughing of the year and should be undertaken as soon as possible. When the vines have been planted moderately close in the rows, it may be found advisable prior to this ploughing to get rid of all the shoots which project into the rows so as to leave a clear run for the plough. The lopping off of these shoots will supply a source of green feed for horses, cattle, and sheep, which is much relished by them at this particular season of the year, owing to the astringent and tonic properties of young vine shoots. This practice of course is not so necessary when wide planting has been adopted, and the possibility of avoiding it is one of the reasons alleged in favor of the wider plans of formation. The operation of pruning, which will be described later on, is one which may extend into the month of August, and it would be too late to leave the first of the year's cultivating operations until that time. The working with the scarifier and harrow after the first ploughing requires no explanation, but it may be mentioned that in the event of only one ploughing being required, owing to the unfavorable nature of the ground for the growth of weeds, it should be the aim in both operations to gather the soil into the middle of the space between the rows. It is the practice in many vineyards planted on the square principle to plough only one way and go as near to the vines as convenient; then to use the scarifier in the other direction. This is quite sufficient to break down the narrow ridge left between the furrows on one side and between the adjacent vines in the row on the other side, and it leaves only a small piece around each vine which has to be taken out by the hoe.

The foot of the vine should always be left as clear of weeds and young shoots as possible, and in every vineyard the use of the hoe around the vine will be required. If no trellising has to be adopted then it will usually be practicable to plough or scarify in at least two directions so that the space left unploughed at the end will be reduced to a minimum as explained. In the case of square planting where a width of anything over about 8ft. has been adopted, it is possible to plough no less than four ways, while with the quincunx or septuple system three directions are possible for ploughing, but the intervening spaces in the middle get far more attention than the

little triangular bits next to the vines, unless the hoe be very freely used. As the season advances it will be found that the growth of the shoots will more and more confine the cultivation within limits, until ultimately it will stop the work.

There are, as might be expected, many wide variations in the practice with regard to the cultivation of the ground during the period of the vine forming its leaves, wood, and fruit. But they all have for their objects the carrying out of the threefold duty of keeping down the weeds, letting the air have free access to the soil so as to supply the roots with the elements from the atmosphere which are necessary to their healthy growth, and keeping up such a free state of sub-division in the soil as shall conduce to the retention of moisture without allowing the ground to get soaked or caked together.

In addition to the starting of a thorough method of tilling the ground, there is one other duty which may be regarded as an appendage to those more immediately concerned in the actual planting of the vineyard, and that is the staking of the young vine. As a general rule the earlier this is done the better, if it should be considered necessary to put in stakes at all, the hardy-growing varieties requiring no such assistance. It is the practice among some vigneron to put in very small stakes for the support of the vine for the first year or two of its growth, and then to substitute longer ones later on. The matter is one about which, of course, every one may safely consult his own convenience; but in most cases it will be found best to supply the young vine with stakes of a sufficient size to last throughout. The stake should be placed in the direction of the sun, so that the young vine may tend to grow towards it, and if this be done it will be found sufficient to place it at a distance of 3in. or 4in., or nearer if thought better.

Some very successful growers of the vine in South Australia are altogether opposed to the use of stakes on any consideration, and lay down the general rule, "Unless you *must* prune long, you should train the vine to bear its own fruit." Of course, in the case of a vine like the Shiraz (or Red Hermitage, as it is called in Victoria), which grows and yields best when pruned long, it is necessary to put up posts and wires for trellises, as will be explained further on. But this is a matter which concerns the later growth of the vine.

In the following statements of the cost of the planting and first year's maintenance of a vineyard it will be noted that almost the whole of the expense consists of wages for labor, so that corresponding deductions should be made where any saving under this

heading can be effected. The figures were given by first-class authorities in their evidence before the Select Committee on Vegetable Products:—

*Cost of Planting with Cuttings.*

	£	s.	d.	
Ploughing 6in. deep .....	0	10	0	per acre
Setting out furrows to mark places for vines at 9ft. 3in. apart .....	0	2	0	"
Cuttings, 500 at 1s. per 100 .....	0	5	0	"
Planting with the bar or dibble .....	0	3	0	"
Harrowing, scarifying, and hoeing round the vines .....	0	10	0	"
Total .....	£1	10	0	per acre

*Cost of Planting with Rooted Vines.*

	£	s.	d.	
Ploughing 6in. deep .....	0	10	0	per acre
Setting out furrows at 9ft. 3in. apart .....	0	2	0	"
Digging holes, 500 at 3s. per 100 .....	0	15	0	"
Rooted vines, 500 at 6s. per 100 .....	1	10	0	"
Planting in holes .....	0	15	0	"
Harrowing, scarifying, and hoeing .....	0	10	0	"
Total .....	£4	2	0	per acre

In the event of the soil being of a stiff character in the lower stratum, it may sometimes be found advisable to use subsoil ploughs, one following in the furrow made by the other, as already described, and in that case the estimate of another grower, who cultivated and prepared his land to no less a depth than 14in., was £3 17s. 9d. per acre for labor alone, the cost of the vines not being included in that total.

It will be seen at a glance that where, owing to the favourable nature of the soil and climate, a good "take" can be secured by the method of planting out cuttings, the balance of economy is much in favor of that system.

The prices per acre for cuttings and for rooted vines stated in respect of the Murray irrigation colonies in the published "Memorandum" are considerably higher than those mentioned above, partly owing to the planting being closer, and partly on account of the exceptional demand which exists along the River Murray for all sorts of horticultural nursery stock, &c. The cost of raisin vine cuttings is given as £1 per acre, and of rooted vines as £6 per acre. The "Memorandum" says:—"It should be noted that whilst rooted vines cost about £6 per acre, *i.e.*, six times the cost of cuttings, the former give an earlier yield, and the growth is

more certain." The briskness of the demand for cuttings and rooted vines in any part of South Australia may at any time produce a marked effect on the market rates for them, so that the prices mentioned must be taken as only provisional. The rates for labor are of course more stationary.

