SESS. II.—1887.
NEW ZEALAND.

VINE-CULTURE, ETC., IN AMERICA

(REPORT ON), BY MR. G. E. ALDERTON.

Presented to both Houses of the General Assembly by Command of His Excellency.

No. 1.

Mr. G. E. ALDERTON to the Hon. the MINISTER of LANDS.

SIR,— Auckland, 15th December, 1886.

Herewith I have the honour to forward reports on different subjects which I inquired into during my journey through America, *en route* for England, in the early part of the year. Though Government only allowed me travelling expenses for two months, I devoted three months to the work, and then left it not half done. I regret not only that I was unable to complete my inquiries while in the States, but also that my leisure time has not been sufficient to enable me to do the report justice. A man might easily spend a year on this work, half of which he might spend travelling in the States—and every day he would be learning something new—and the other half he could profitably employ writing a book on the subject. It would be impossible to exhaust a subject a full knowledge of which necessarily embraces an acquaintance with chemistry, biology, entomology, meteorology, and other sciences. The field of information open to the student is practically limitless.

The practical conclusion to which I have come from my inquiries is this: That just precisely what they can do in California in regard to fruit-culture we can do here, at least in the northern part of New Zealand, with these differences: that we must substitute the American native grape for the European, which is almost exclusively in cultivation in California. The necessity for this alteration is caused by the difference in rainfall, California having a dry climate, while we have a comparatively wet one; but the difference is not to our detriment, since land is only valuable in California for fruit-culture where it can be irrigated, while here nature affords the necessary moisture, and all our lands are equally valuable. In many parts of California land suitable for fruit-culture fetches from £40 to £120 an acre—its limited character really giving the great value—but here there is no limit to area. We only want the fact demonstrated that we can do here what they do in California. It remains with the Government to do it.

The actual annual value of the fruit-crops of California is £2,000,000, and, when it is considered that the great bulk of this amount is the product of thousands of small landowners, who are settled on the land, and on the highway to prosperity, the immense value of such an industry to the State is at once apparent.

The climate of California varies according to latitude and the topography of the country. In some places in the north oranges mature earlier than in the south; but in California the counterpart of the New Zealand climate is found in many places. In Los Angeles and San Diego, in the south, the finest fruit-districts of the State, the mean temperature for every month of the year is almost similar to that of Auckland, to wit,—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
San Diego ..	52·3	53·3	55·4	57·9	61·1	64·4	66·3	68·3	66·6	61·8	57·0	55·8
Auckland ..	52·9	51·8	53·4	55·3	58·3	61·8	65·6	68·9	68·9	65·9	62·3	56·8

There is a greater difference in the maximum and minimum of heat, but that is not to the disadvantage of our climate, since great extremes are not beneficial to vegetable growth.

The quality of our climate is not appreciated, and, while crowds of English people are going to California and Florida to engage in fruit-culture, our colony is never thought of for such a purpose. But were its merits more fully known in England—that we have here a climate surpassed by none in the world, and a country free from every kind of reptile—how many would then go to Florida, with its malarial climate, its rivers swarming with crocodiles, and its jungle with the most deadly snakes; or to Southern California, the home of the dreaded tarantula! The English farmers I met at Home had been frightened by Froude's "Oceana" into the belief that New Zealand was sinking with debt, and that the taxpayer was so overburdened that the colony would have to repudiate. But is such the case? The farmer in this colony has to pay a property-tax of five-eighths of a penny in the pound (with £500 exemption), and a road-rate of one penny in the pound on the value to let. Now, what has he to pay in the United States? He has to pay 3½d. in the pound on every bit of property he owns, even if it only amounts to a cow; and he, and every son he may

have, has to give six days' labour in the year to road-making and repairing. Apart from the heavy indirect tax the resident of America pays through the heavy protective tariff in force, he pays fully three times as much in direct taxation as the New-Zealander; and yet people insist in raising the bogie of heavy taxation in this country. But how infinitesimal is our taxation compared with what the farmer pays in England. Farmers whom I met were paying one-fourth the amount of their rents in taxes; one gentleman paying a rent of £250 and taxes £15; another gentleman farming 1,000 acres of land was paying £70 a year as a school-board rate alone. These are facts which the English emigrant should hear of; they are facts which some of our own people are not acquainted with.

In the fruit-industry I see no reason why people here should not amass the same large fortunes as have been made in California. All that is wanted is the practical knowledge. Fruit-culture is a science, like all other things, only acquired and mastered after years of patience and perseverance; but we have all the conditions here favourable to its prosecution. We must, however, substitute for the present system that followed in America of laying down an orchard so that it can be worked with the plough, &c., substituting machinery for manual labour in every department, and minimising the expenses. Foreign markets have to be opened up, and the various methods of canning, sealing, drying and preserving fruits introduced.

The Government would, I think, do well to give every encouragement to horticultural societies. I would suggest the giving of small prizes for the best collections of fruit, so that the Government could from time to time have made wax-models of the finest fruits produced in the colony, to be placed in our museums, and also sent Home to the Agent-Geueral for exhibition in London. It is worthy of consideration, also, whether it would not be a great benefit to the colony if the Government were to hold—say, at Auckland—a fruit exhibition, and invite the American manufacturers of orchard implements and appliances for evaporating fruit, &c., to send exhibits. The Government could at the same time have taken at such exhibition wax-models of all the fruit shown. At the Colonial Exhibition in London all the colonies, excepting New Zealand, had its exhibit of fruit in wax-models.

As for markets for our fruit, we have here in Australia upwards of 3,000,000 of people to supply. Other colonies of course produce fruit as well as us; but it is in the difference of seasons where all localities have their innings. Sydney sends fruit to Auckland before any is ripe here; Auckland reciprocates by sending fruit to Sydney after the season is over there. Auckland again can send fruit and early vegetables to the South before any is ripe there; and the southern fruit comes into Auckland when the local fruits have gone out of season. California and Auckland can exchange by means of having the reverse of seasons; and fruit—at any rate apples and pears—can be shipped to London, if kept in a temperature of 40 degrees, with the greatest success. Californian dried apples are selling in this colony at 10d. a pound, of which sum 2d. is import-duty, so that, with such a heavy protective tariff in its favour, the grower here, with the necessary skilled labour, should have a wide margin of profit.

To make fruit-growing a success here, two things are essential, namely, first, a knowledge of how to preserve fruit that cannot be placed in the market for dessert purposes; and, secondly, a union of the fruit-growers to regulate the supply upon the market to prevent gluts and consequently loss. In America the matter is arranged very simply. The fruit-growers band together as a limited liability company. Every orchardist takes a dollar share for every acre of fruit he cultivates. A manager and executive committee are appointed, who sell all the fruit for the growers on commission, which of course goes into the funds of the company. But the way the market is regulated is here: Every fruit-grower sends in to the manager a statement showing how much and of what variety of fruits he will send to market between such and such a date. The manager makes an analysis of all these returns, and sees at a glance how much is likely to come forward on given dates. If the supply is greatly in excess of the probable demand, he warns the growers; and they, instead of risking unprofitable prices, either can seal, or evaporate, their fruit. Thus the market is seldom glutted, and the grower can reckon on a pretty steady price right through. Without such protective measures, fruit-trading is the most uncertain, and liable to end ruinously., In England, during the last session, the Kentish growers sent away tons and tons of fruit, and in some cases only a few shillings were received by the growers for tons of plums. Organization is imperative. Though the Government may think it distinctly not a matter that they should move in, I think its importance would warrant measures being taken to promote such an organization here.

The importance of Government taking measures to deal with our insect-pests at an early date I cannot speak of too strongly. It is of the greatest urgency.

I have, &c.,
GEORGE E. ALDERTON.

The Hon. the Minister of Lands,
Wellington.

CULTIVATION OF THE AMERICAN VINE.

As a number of persons, mostly natives of Germany, France, and Italy, have already entered upon the vine-industry in the Auckland District, and others purpose going into it, and as most of them are cultivating the American Isabella extensively, the following from the "Bushberg Manual" will be of importance to them, as well as a guide in the future to others contemplating vine-culture:—

LOCATION.

The only general rules we can give to guide in the selection of a proper, desirable location for vineyards are—

1. A good wine-growing region is one where the season of growth is of sufficient length to ripen to perfection our best wine-grapes, exempt from late spring frosts, heavy summer dews, and early

frosts in autumn. Do not attempt, therefore, to cultivate the grape in low, damp valleys, along creeks; high table-lands and hillsides, with their dry atmosphere and cool breezes, are preferable to rich bottom lands; low situations, where water can collect and stagnate about the roots, will not answer: wherever we find the ague an habitual guest with the inhabitants, we need not look for healthy grape-vines; but on the hillsides, gentle slopes, along large rivers and lakes, on the bluffs overhanging the banks of our large streams, where the fogs arising from the water give sufficient humidity to the atmosphere even in the hottest summer days to refresh the leaf during the night and morning hours, there is the location for the culture of the grape. Shelter has also an important bearing on the healthy growth of the vines. Some well-located vineyards have not proven lucrative for the want of proper shelter. Where it is not afforded by woods growing near by, it should be provided for by planting trees; large trees, however, should not be planted so near the vines as to interfere with their roots. One of our vineyards has been thus protected by an arbor-vitæ fence from the north and west winds. This fence is now fifteen years old, over 8ft. high, and is considered one of the finest ornaments to our grounds. There are some locations so favoured that no artificial protection is needed. Remember, however, that no one locality is suited to all kinds of grapes.

2. A good soil for the vineyard should be a dry, calcareous loam, sufficiently deep—say, 3ft.—loose and friable, draining itself readily. A sandy yet moderately rich soil is better adapted to most varieties than heavy clay. New soils, both granitic and limestone, made up by nature of decomposed stone and leaf-mould, are to be preferred to those that have long been in cultivation, unless these have been put in clover and rested a few years. If you have such a location and soil, seek no further, ask no chemist to analyse its ingredients, but go at once to

Preparing the Soil.

"The preparation of the soil is undoubtedly one of the most important operations in the establishment of a vineyard, and one of its objects should be to get the soil of a uniform texture and richness throughout, but not over rich. This deep stirring of the soil puts it very much in the condition of a sponge, which enables it to draw moisture from the soil beneath and from the atmosphere above, and hold it for the wants of the plant; hence, soils that are drained and deeply stirred, keeping the good soil on the surface, are less subject to the evils that accompany and follow a drought than those that are not so treated. It is of the first importance, therefore, that vineyards and orchards at least should be put in the best condition for the reception of the vines and trees, if the best results are aimed at."—*Pet. Henderson.*

The old system of trenching is no more practised, except upon very hard, stony soil, and upon steep hillsides, being too costly and of very little, if of any, advantage. The plough has taken the place of the spade, and has greatly lessened the expense. While we would urge a thorough work in the preparation of the soil before planting the vine, and warn against planting in ditches, or, still worse, in square holes, we believe that, by careful grubbing (in timber lands), leaving no stumps, which would only be continual eyesores and hindrances to proper cultivation, and then using a large breaking plough, followed by the subsoil plough, the soil will be stirred as deeply—say, 20in.—as is really necessary to insure a good and healthy growth of vines. This will require two to three yoke of oxen to each plough, according to the condition of the soil. For old ground a common two-horse plough, with a span of strong horses or cattle, followed in the same furrow by a subsoil stirrer, will be sufficient to stir the soil deeply and thoroughly, and will leave it as mellow and as nearly in its natural position as desirable. This may be done during any time of the year when the ground is open and not too wet. Most soils would be benefited by under-draining. The manner of doing this is the same as for other farm crops, except that for vines the drains should be placed deeper. It is less important on our hillsides, and too costly to be here practised to a great extent. Wet spots, however, must be drained at least by gutters, and, to prevent the ground from washing, small ditches should be made, leading into a main ditch. Steep hillsides, if used at all, should be terraced.

Planting.

The soil being thus thoroughly prepared and in good friable condition, you are ready for planting. The proper season for doing this here is in the fall, after the 1st November, or in the spring, before the 1st May. Seasons differ and sometimes make later planting advisable, but never during frost nor while the ground is too wet. If you have been delayed with your work of preparing the soil in spring, the young plants from the nursery should be hilled in some cool, dry place and covered, so that their vegetation be retarded; if they have already made shoots, be specially careful to guard against their roots getting dry. Most vineyards are planted in spring; in northern and very cold localities this may be preferable. We prefer fall planting; the ground will generally be in better condition, as we have better weather in the fall, and more time to spare. The ground can settle among the roots in winter; the roots will have healed and calloused over, new rootlets will issue early in spring before the condition of the ground would have permitted planting, and the young plants, commencing to grow as soon as the frost is out of the ground, will start with full vigour in spring. To prevent the roots from being thrown to the surface by alternate freezing and thawing, a mound of earth hoed up around the plants, or a ridge thrown up with a plough so as to elevate the ground somewhat in the rows, will be found to afford all the protection necessary. By no means delay planting till late in spring, and, if your ground is not ready in time, you had much better cultivate it with corn or hoed crops of some kind, and postpone planting until next fall. Planting in rows, 6ft. apart, is now the usual method; it gives sufficient space for a horse and man to pass through with plough or cultivator; the distance in the rows varies somewhat with the growth of the different varieties and the richness of the soil. Most of our strong vigorous growers, the Concord, Ives, Hartford, Clinton, Taylor, Norton, Herbemont, will need 8ft. to 10ft. in the rows; Scuppernongs are planted 20ft. to 30ft. apart; while the Delaware, Catawba, Creveling, Iona, may have sufficient room when planted 6ft. apart. The dwarfing treatment practised

with European varieties, especially by German vintners, will not do for American vines, which must have ample room to spread and a free circulation of air. The number of vines required to set an acre (containing 43,560 square feet) will be—

Distance, feet.	Metres.	Number.
6ft. by 6ft.	1·85 by 1·85	1,210
6ft. by 7ft.	1·85 by 2·15	1,037
6ft. by 8ft.	1·85 by 2·46	907
6ft. by 9ft.	1·85 by 2·75	807
6ft. by 10ft.	1·85 by 3	725
7ft. by 7ft.	2·18 by 2·15	889
7ft. by 8ft.	2·15 by 2·46	777
7ft. by 9ft.	2·15 by 2·75	690
7ft. by 10ft.	2·15 by 3	622
8ft. by 8ft.	2·46 by 2·46	680
8ft. by 9ft.	2·46 by 2·75	605
8ft. by 10ft.	2·46 by 3	545
9ft. by 9ft.	2·75 by 2·75	537
9ft. by 10ft.	2·75 by 3	484
10ft. by 10ft.	3 by 3	435

One acre=41 *ares* French measure, or one *hectare* nearly equal to two and a half acres.

Having determined the distance at which you desire to plant the vines, mark off the rows, running them parallel, and with the most level lines of your slope or hillside, so that you may easily plough between the rows and that the ground may not wash. (On an eastern slope the rows will therefore run in a direction from north to south, which most vine-dressers prefer.) Be careful, on sloping ground, to leave spaces for surface-drains; the steeper the hill-sides the more frequent must these surface-drains be. Then divide the rows into the desired distances by the aid of a stretched line, and put small stakes where each plant is to stand. The depth of these holes must necessarily vary somewhat with the nature of the soil. On very steep hill-sides, and especially on southern slopes, with naturally warm, dry soil, you must plant deeper than on gentle slopes with deep, rich soil, or on bottom land and rich prairies. Eight inches will be deep enough on the latter; on the former we should plant from 12in. to 14in. deep.

Having made the holes—and it is best not to make too many at a time, as the ground will dry out too quickly—you can go to planting. In planting it is important to give the roots their former position, and to have them each and all firmly sorrounded with good fine soil, pressing it down with the hands or foot; then fill up the hole with earth, forming a very small hill over the head of the plant, so that no part of it may dry up, yet so as to permit the young tender shoot to penetrate easily.

Every beginner in grape-culture knows that young rooted vines are used for planting, whether it be for whole vineyards or merely for the garden or arbour, and that such young vines are usually raised in the nursery from cuttings or layers. But the reason why they are not grown from seeds is not generally so well known, and even among old experienced grape-growers some erroneous ideas prevail with regard to seed-culture and questions connected with this now more than ever important and interesting subject. It is scarcely necessary to mention that the wild grape grows and propagates itself from seed only. This wild grape constantly reproduces itself; *i.e.*, its seedlings do not materially differ from their parent vines. Transplanted into richer soil, and receiving care and cultivation, its berries may increase in size, and in the course of years may somewhat improve and change its character; if, then, we take the seed of this cultivated vine, especially if it was grown in proximity to other different grapes, the seedlings of these will more materially differ. So great is this tendency to variation, that of a hundred seedlings of one cultivated vine scarcely two will be found exactly alike; some will differ widely; nearly one-half will be male plants and will not produce any fruit at all, while most of the others will retrograde to their wild origin.

For practical grape-culture we should use none but the best rooted plants of those kinds which we wish to produce. Some vintners, from supposed economy, use only cuttings to plant their vineyards, placing two cuttings where one vine is to grow; but the result generally is unsatisfactory, especially with American varieties, most of which do not root as easily as those of the European vinifera class, and make much replanting necessary; and, where both cuttings do grow, one must be pulled out. Those vintners would do better, by far, by first growing their cuttings one or two years in nursery rows, and afterwards transplanting the best of them to their intended vineyard.

But if we desire to obtain new varieties we must plant seed. This is a far more uncertain, slow, and difficult operation than most people imagine, and but very few have been successful in it. Just as some careful breeders of animals have succeeded in raising improved kinds, on which they engrafted certain qualities by crossing, so have horticulturists endeavoured to reach the same end by hybridizing the best varieties of grapes and planting their seeds, having due regard to the characteristics of the parents from which they breed.

But now let us return to the *modus operandi* of planting. Take your vines, in a pail with water, or wrapped in a wet cloth, from the place where they were heeled-in,* to the holes; when planting, let one person shorten the roots with a sharp knife, then spread them out evenly to all sides, and let another fill in with well-pulverised earth. The earth should be worked in among the roots with the fingers, and pressed to them with the foot. Lay the vine in slanting, and let its top

* On receiving your vines from the nursery they should be taken out of the box without delay, and heeled-in, which is done as follows: In a dry and well-protected situation a trench is made in the soil 12in. to 15in. deep, wide enough to receive the roots of the plants, and of any required length, the soil being thrown out upon one side. The plants are then set thickly together in the trench, with the tops in a sloping direction and against the bank of soil thrown out of the trench; another trench is made parallel to the first, and the soil taken from it is thrown into the first, covering the roots carefully, filling in all of the interstices between them. Press down the soil, and smooth off the surface, so that water shall not lodge thereon. When one trenched is finished, set the plants in the next, and proceed as before. When all this is completed, dig a shallow trench around the whole, so as to carry off the water and keep the situation dry.

come out at the stake previously set. Then, with your knife, cut back the top to a bud just above, or even with the surface of the ground. Do not leave more than two buds on any one of the young vines which you are planting, however strong the tops, or however stout and wiry the roots may be. One cane is sufficient to grow, and merely to be prepared for possible accident both buds are allowed to start. The weaker of the two shoots may afterwards be removed or pinched back.

When planted in the fall, raise a small mound around your vine, so that the water will drain off, and throw a handful of straw or any other mulch on the top of the mound, to protect it; but do not, under any circumstances, cover the vine with manure, either decomposed or fresh.

It is a well-authenticated fact that, under the action of nitrogenous agents, the grape grows more luxuriant, its leaves are larger, its product increases in quantity. But the products of vineyards so manured have an acknowledged defect—they impart to the wine a flavour which recalls the kind of manure applied. What is gained in size of bunch and berry is lost in quality and flavour. Over-feeding produces a sappy growth of soft and spongy wood, with feeble buds or eyes, which are in far greater danger of being winter-killed. Moreover, nitrogenous substances exclusively used hasten the decay of vineyards and the exhaustion of the soil, and even those authorities who favour manures in preparing certain grounds, or long after planting, mean a compost made of old barn-yard manure, leaf mould, broken bones, &c., laid up to rot and frequently turned; but do not allow any decomposing organic matter to come in contact with the newly-planted vine.

During the first summer little else can be done than to keep the ground mellow, loose about the plants, and free from weeds; stirring the ground, especially in dry weather, is the best stimulant, and mulching (spreading over the ground a layer of tan-bark, sawdust, straw, salt-hay, or the like, to maintain a more uniform state of temperature and moisture for the roots), is far better than watering. Do not tie up your young vines; do not pinch off the laterals; by allowing them to lie on the ground, during the first season, more vigorous stems will be obtained A fair growth is about 4ft. the first summer. Some grape-growers prefer, however, to allow but one shoot, the strongest, to grow, and break the others off; then tie this one shoot to a stake, and pinch back the laterals to one or two leaves each. In the fall, after the foliage is all off, cut back to two or three buds. Cover the short cane left with a few inches of earth before the ground freezes. If any vacancies have occurred, fill out, as soon as possible, with extra strong vines, of the same variety.

During the following winter the trellis should be built. The plan adopted by most of our experienced grape-growers, as possessing some advantages over other plans, especially if grapes are grown in large quantities, is as follows: Posts of some durable timber are split 3in. thick and about 7ft. long, so as to be 5ft. in height after being set; these posts are set in holes 2ft. deep, 16ft. to 18ft. apart in the rows (so that either two vines 8ft. apart, or three vines 6ft. apart, are between two stakes); three wires are then stretched horizontally along the posts, being fastened to each post with a staple ∩, which is driven in so firmly that the wire is prevented from slipping through. The two end posts should be larger than the others and braced (Fig. A.) The first wire is placed about 18in. from the ground and the others 18in. apart; this brings the upper wire about 4ft. 6in. from the ground. The size of the wire used is No. 10 annealed iron; No. 12 wire is strong enough.

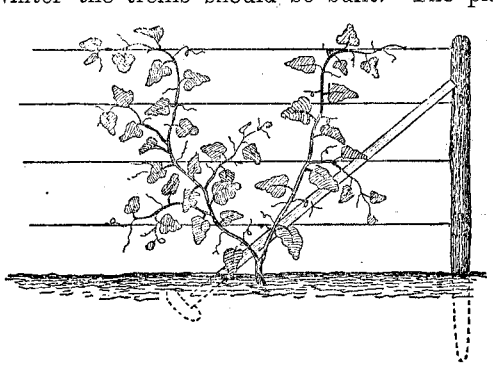

Fig. A.—(Four wires, 15in. apart.)

A good many grape-growers train their vines to stakes, believing it to be cheaper; and the decline in the price of grapes and wine induces many to adopt the least costly plan. This method has also the great advantage of allowing us to cultivate, plough, and cross-plough the ground in all directions, leaving but little to hoe around the vines. Some use one stake only, as shown in Fig. B, but with our strong growers this mode is apt to crowd foliage and fruit too much; others therefore use two, and, where timber is plenty, even three stakes, placed around each vine, about 10in. from it, and wind its canes around them spirally until they reach the top. The disadvantage of training on stakes is, that these soon rot in the ground, and must be almost annually taken out, repointed, and driven into the soil, consequently require more labour, and are not as durable as trellis, unless cedar poles or other very durable timber is used.

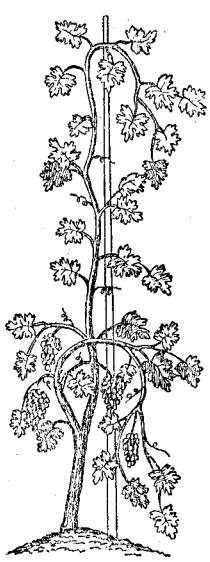

Fig. B.

Some people believe that we could even dispense with both trellis and stakes entirely, and urge the adoption of the "Souche" or "Buck pruning" plan, used in parts of France and Switzerland, but quite impracticable for our strong-growing species in this climate.

Another mode of cultivation, which our G. E. Meissner had occasion to see in Italy, seems more applicable to many of our hardy American varieties: it is the cultivation of the vine on living trees instead of trellis or stakes. The tree principally employed for this purpose is the *Acer campestris*, a species of maple. The trees are planted at the age of two to four years, when they are about 4ft. to 5ft. high. They are planted in vineyards at a distance of about 12ft. each way, some planting also with a wider space between the rows, and cultivating the intervening space with other crops. At the same time with the trees are planted the vines, which are set in the rows about midway between the trees. The vines and trees are both well cultivated, so as to induce a rapid and healthy growth. At the end of the season the vines are cut down to two

eyes above the ground, and the second season one or two strong canes are grown from them and carefully tied up to temporary stakes. At the end of the second season, or as soon as the vine has attained a sufficiently strong growth of cane, it is laid down in a trench, about 8in. or 10in. deep, to the tree; the trench is covered in, and the canes shortened back, so that only two eyes of the vine project at the immediate base of the tree. It is now ready for training up on the tree, the roots of which do not interfere with its growth, as the main feeding-roots of the vine are at a sufficient distance therefrom. The layered cane will also throw out new roots on its entire length, and thus induce an extra strong growth. The trees are generally allowed to branch out at a height of 5ft. to 6ft., and it is at this height, also, that the new head of the vine will be formed on one or more permanent main stems trained up from the bottom. The after-system of pruning and cultivation differs but little from ordinary vineyard-culture. The trees also receive an annual cutting back, so as to keep the head open and within bounds, and, if necessary, some shoots and leaves are removed in the summer to admit air and light. Once that the vine has reached its hold among the forks of the tree but little tying is necessary afterwards, the branches and twigs affording plenty of support and holding to the tendrils.

Those who know the cost of grape-stakes and trellis, and the constant expense and trouble of repairs and renewals which their entertainment requires, will appreciate the advantages which such a plan would offer, if it can be successfully applied in this country. The main difficulty seems to be in finding the proper kind of tree to use in place of *Acer campestris*, which we do not find here. The important points to be observed in the selection of the tree seems to us to be a quick growth in the first years, yet not a naturally large grower—a tree that will shed its foliage tolerably early in the fall, and especially one that is not a gross feeder.

If you have covered your young vines last fall, remove the earth from over them at the approach of spring, as soon as danger from frost is past; then cultivate the whole ground, ploughing between the rows from 4in. to 6in. deep, and carefully hoeing around the vines with the two-pronged German hoe or *karst*, or Hexamer's pronged hoe. The ground should thus be broken up, inverted, and kept in a mellow condition continually; but do not work the ground when wet.

During the second summer a cane or shoot is produced from each of the two or three buds which were left on the young vine last fall. Of these young shoots, if there are three, leave only the two strongest, tying them neatly to the trellis, and let them grow unchecked to the uppermost wire.

With the strong-growing varieties, especially where we intend to grow the fruit on laterals or spurs, the two main canes are pinched off when they reach the second horizontal wire, whereby the laterals are forced into stronger growth, each forming a medium-sized cane, which is shortened in the fall from four to six buds. One of the two main canes may be layered in June, covering it with mellow soil, about 1in. deep, leaving the ends of the laterals out of the ground. These will generally make good plants in the fall for further plantations. With varieties which do not grow easily from cuttings this method is particularly desirable.

Another good mode of training, recommended by Fuller, is to bend down in fall, at the end of the second season, the two main canes of the vines—the laterals of which have been pinched back to concentrate the growth into these main canes—in opposite directions, laying and tying them against the lower wire or bar of the trellis, and shortening them to 4ft. each. Then let five or six of the buds on the upper side of the arms be grown into upright canes. (See Fig. C.) All buds and shoots not wanted for upright canes should be rubbed or broken off. This latter method is not well adapted for varieties which require covering in winter. Where the canes are started lower, near the ground, and cut loose from the wire, they can be easily covered with earth.

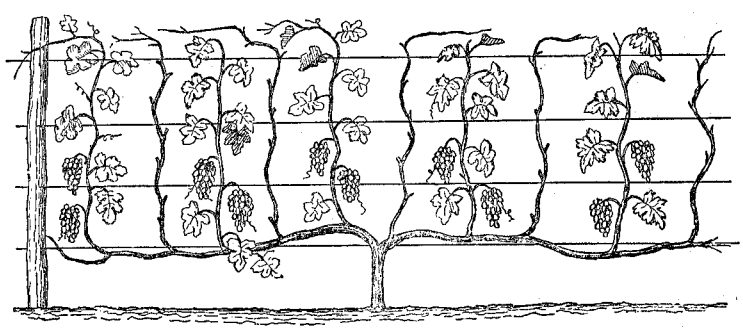

Fig. C.

At the commencement of the third season uncover and tie the canes to the trellis. For tying, any soft string or stout woollen yarn, the shreds of old gunnies, may be used; some obtain their tying material from basswood-bark, soaked for two weeks or longer in running water. Others plant the golden willow and use its small twigs for tying purposes. Tie closely, and as young canes grow keep them tied; but in all cases take care against tying too tightly, as the free flow of sap may be obstructed.

The ground is now ploughed and hoed again as before; one (6in.) deep ploughing in spring, taking care, however, not to cut or tear the roots of the vines, and two more shallow (3in. or 4in.) ploughings in summer. From each of the buds left at the last pruning, as shown in the preceding figures, canes can be grown during the third year, and each of these canes will probably bear two or three bunches of fruit. There is danger of their being injured by over-bearing, on which account the bunches should be thinned out by taking away all imperfect bunches and feeble shoots. In order to secure future fruitfulness of the vine, and at the same time to keep it in our convenient control, we should allow no more wood to grow than we need for next season's bearing, and for this purpose we resort to spring-pruning generally, though improperly, called

Summer-pruning.

The time to perform the first summer-pruming is when the young shoots are about 6in. long, and when you can plainly see all the small bunches—the embryo fruit. We commence at the two

lower spurs, having two buds each, and both started. One of them we intend for a bearing-cane next summer, therefore allow it for the present to grow unchecked, tying it if long enough to the lowest wire. The other, which we intend for a spur again next fall, we pinch with the thumb and finger to just beyond the last bunch or button, taking out the leader between the last bunch and the next leaf, the cross-line indicating where the leader is to be pinched off. We now come to the next spur on the opposite side, where we also leave one cane to grow unchecked, and pinch off the other.

We now go over all the shoots coming from the arms or laterals tied to the trellis, and also pinch them beyond the last bunch. Should any of the buds have pushed out two shoots, we rub off the weakest: we also take off all barren or weak shoots which may have started from the foot of the vine.

The bearing-branches having all been pinched back, we can leave our vines alone until after the bloom, only tying up the young canes from the spurs, should it become necessary. Do not, however, tie them over the bearing-canes, but lead them to the empty space on both sides of the vine, as our object must be to give the fruit all the air and light we can without depriving it of the necessary foliage, which is of greatest importance for the formation of sugar in the berries. To do so the leaves must be well developed and healthy. Diseased mildewed foliage, however, will not promote the sugar-formation, but rather impede the same.

By the time the grapes have bloomed, the laterals will have pushed from the axils of the leaves on the bearing-shoots. Now go over these again, and pinch each lateral back to one leaf. In a short time the laterals on the fruit-bearing branches which have been pinched will throw out suckers again. These are again stopped, leaving one leaf of the young growth. Leave the laterals on the canes intended for next year's fruiting to grow unchecked, tying them neatly to the wires with bass or pawpaw bark, or with rye-straw.

If you prefer training your vines on the horizontal-arm system (Fig. C), the mode of summer-pruning will in the main be the same. Pinch off the end of each upright shoot as soon as it has made two leaves beyond the last bunch of fruit: the shoots after being stopped will soon start, and after growing a few inches should be stopped again, as we wish to keep them within the limits of the trellis, and the laterals should be stopped beyond its first leaf. Thus we try to keep the vine equally balanced in fruit, foliage, and wood. It will be perceived that fall-pruning, or shortening-in the ripened wood of the vine, and summer-pruning, shortening-in and thinning-out of the young growth, have one and the same object in view, namely, to keep the vine in proper bounds, and concentrate all its energies for a twofold object, namely, the production and ripening of the most perfect fruit, and the production of strong healthy wood for the coming season's crop. Both operations, in fact, are only different parts of one and the same system, of which summer-pruning is the preparatory and fall-pruning the finishing part; but, while the vine will bear, without apparent injury, any reasonable amount of pruning during its dormant state in the fall or winter, any severe cutting during the summer is an unmitigated evil. G. W. Campbell, the well-known horticulturist, says: "All the summer-pruning I would recommend would be the early rubbing out of superfluous shoots upon their first appearance, leaving only what is required for next year's bearing-wood. This, with the pinching or stopping the ends of such shoots or canes as were disposed to be too rampant in growth, would be all I would ever consider necessary. Some of the most successful grape-growers within my knowledge carefully prune their vines in the fall or early spring, and then leave them entirely without summer-pruning."

Diseases, etc.

The American mildew (*Peronospora viticola*) first presents itself in the form of spots resembling a small accumulation of powdered sugar, not larger than a lentil, on the underside of the leaf; but imperceptibly these spots extend and join until they cover a larger portion of the entire lower face of the foliage. Later still, the centres of attack dry up and take the colour of brown or dead leaves, so that these mildewed, shrivelled, dried-up leaves are often confounded with or taken for sun-scald; but, on closer observation, mildew can easily be distinguished from sun-scald. If the effect of the latter, there is no white powdery mushroom vegetation visible on the lower face of the leaf. Mildew mostly attacks the foliage, sometimes also the young green stems; rarely the small, young, never the full-grown, ripening berries.

The important difference between Peronospora (the American mildew) and *Oïdium* (the European mildew) is not only that Peronospora appears on the lower, while Oïdium appears on the upper surface, but that the former penetrates the entire tissue of the leaf, while Oïdium grows on its upper surface only. Humidity and dryness exert a preponderating influence on the development of the disease; rain, dew, even fog, favour the spread and germination of the spores, while a prolonged drought restricts and kills them.

Professor Riley, the United States Entomologist, at Washington, handed me the following bulletin of his on these mildews (I have never heard of the Peronospora having developed itself in New Zealand, but it is as well that viticulturists should be acquainted with its appearance and characteristics):—

Two Chief Species.

There are very many fungi known to attack the grape-vine, as is evidenced by a glance at such works as "Fungi parassiti dei Vitigni," by Dr. Romueldo Pirotta (Milan, 1877); Die Pilze des Weinstockes," by Felix von Thumen (Vienna, 1878). But the two principal fungi, both of them popularly called "mildews," which interest the grape-grower, on account of the extensive injury they cause, are the *Uncinula spiralis* (Berkeley and Curtis), and the *Peronospora viticola* (Berkeley). Any popular statement in reference to grape-vine mildews, in order to be accurate, must take cognisance of these two species which occur ordinarily under opposite atmospheric conditions.

Failure to do so has wrought much confusion in the fugitive literature on the subject. As popular distinguishing terms, it would be well to call the former the "powdery grape-vine mildew," and the latter the "downy grape-vine mildew."

It is my purpose here to deal chiefly with the latter, but it will be desirable first to briefly consider the characteristics of the former, that the differences between the two may the more readily appear.

The Powdery Grape-vine Mildew.

This is the *Uncinula spiralis* (Berkeley and Curtis), and the conidial form has long been known by the name of *Oïdium Tuckeri* (Berkeley).

General Appearance.—This particular fungus produces a white, powdery appearance on the upper surface of the leaves, which at first looks not unlike dust, and which is much less conspicuous on the lower surface. Beginning in spots, these grow larger and larger until they cover the whole leaf and include even the young stems and berries.

Structural Characteristics.—The powdery spots consist of mycelial threads attached to the epidermis of the leaf by suckers. These filaments have a diameter of ·004mm. Portions of this mycelium rise up from the surface of the leaf and become constricted or intersected (Fig. 47*a*), thus forming cells. As these cells, which are the conidial spores, multiply, the terminal ones enlarge, ripen, and drop off, so that a succession of conidial spores is formed. The spores germinate at once by pushing out a germinating-tube, generally at one end.

Late in the summer and autumn the perithecia and asci are formed, ripening about the first of October. These are the resting or winter spores, and are small black bodies occurring on both surfaces of the leaf and on the stems. They consist of an opaque sac with a cellular wall, from which a number of appendages radiate to from three to five times the length of the diameter of the perithecium, and some of them are either uncinate or spiral at tip. The perithecium measures from ·07mm. to ·12mm. in diameter, and the number of appendages varies from 15 to 32. Inside the perithecia are the asci or sacs which contain the spores. The asci vary from four to eight in number, nominally six; the spores also vary in number, the average being six. The *Uncinula spiralis* therefore appears in two phases—first, as a white flocculent mould; secondly, as perithecia with more or less uncinate or spiral appendages.

Variation in Habit.—One of the most interesting facts in connection with this fungus is that only the conidial form known as *Oïdium Tuckeri* occurs or is, so far, known in Europe. There is some question as to the actual specific identity of *Oïdium Tuckeri* as found in Europe and the conidial stage of *Uncinula spiralis* as found in this country. The bulk of opinion is, I think, that they are identical, for, while Von Thümen, in his "Fungi Pomicola" and in his "Pilze des Weinstockes," follows Fuckel in giving *Sphærotheca castagnei* (Lev.) as a synonym of *Oïdium Tuckeri*, thus implying that this last is the conidial form of the former, Fuckel merely makes the conjecture without positive proof, and there is great improbability in the conjecture being correct. We have, in fact, in this case, so far as the evidence goes, one somewhat parallel to that of the grape-vine Phylloxera. The gall-making form of this insect upon the leaf is of very common occurrence, and the form most easily observed in America; whereas in Europe the species very rarely produces the gall. Yet the historic evidence is conclusive as to the introduction from America of *Phylloxera vastatrix*, and almost as conclusive as to the similar introduction of this Oïdium; and, to my mind, they both furnish admirable illustrations of a change of habit in an organism sufficiently marked that, without the historic evidence, the question of the exact specific identity of the parent and its transcontinental issue might well be raised. The interesting question, philosophically considered, is, why, if the winter spore is necessary to the perpetuation of the Uncinula in America, the species can propagate for an indefinite period without it in Europe?

Effect on the Vine.—This fungus is less injurious to our hardier native grape-vines than to the European *Vitis vinifera* and hybrids of it. Hence it is more to be dreaded in California and in Europe than in the Eastern United States.

EFFECTS OF THE OIDIUM.

REMEDIES.

Sulphur is well known to be one of the most satisfactory remedies against this fungus, and is in universal application where the disease prevails. It is generally applied dry, by means of bellows, though, it seems to me, the wet method would have advantages with the use of the cyclone nozzle. Mr. A. Vitch, of New Haven, Connecticut, has found that in greenhouses the sulphur may be advantageously applied by mixing it with linseed oil to the consistency of paint, and brushing it on the flues or hot-water pipes. Mr. William Saunders, the Horticulturist of the Department of Agriculture, has for many years used, with great satisfaction, a weak solution of lime and sulphur, obtained by pouring water on one-half bushel of lump lime and ten pounds of sulphur, and then diluting for use.

THE DOWNEY GRAPE-VINE MILDEW.

General Appearance.—The other mildew, namely the Peronospora, shows itself on the underside of the leaves in the form of a small patch of whitish down, and sends its mycelium into the adjacent tissues, destroying the parts, which scorch and turn brown as if sunburnt. It has been known by various popular names, as "blister of the leaf," "blight," and so on. It generally escapes attention in its earliest stages, and experience shows that it is most destructive where the dews are heavy, or in continued damp, rainy weather. This particular mildew is the *Peronospora viticola* (Berkeley and Curtis), DeBarry having first referred to it as *Botrytis viticola*.

Structural Characteristics.—The mycelial threads or hyphæ are about ·01mm. in diameter, somewhat larger in the stems and petioles than in the leaves. They are found everywhere except in the wood proper, but particularly in the tissues of the leaves. Their contents are granular and somewhat oily, and cross partitions so characteristic of the Uncinula are rare. Just beneath the stomata of the leaves the hyphæ are particularly abundant. Those which are to bear the conidia pass through the stomata and grow more rapidly than the rest, ramifying and reaching from ·3mm. to ·6mm. in height, and bearing the conidia on the tips of the branchlets. The conidia are oval and obtuse, varying in size from ·012mm. to ·03mm. in diameter. Germination takes place with great rapidity whenever there is sufficient moisture. Conidia placed in water become swollen and somewhat segmented in an hour. The segments become oval bodies, collect at the distal end of the conidia, rupture the wall in a short time, and escape, swimming off as zoöspores, each with two ciliæ. Each conidum produces, on an average, five or six zoöspores, though the number is quite variable. They vary also in shape, and from ·008mm. to ·01mm. in length. They move from fifteen to twenty minutes, then come to rest, when the ciliæ drops off, and a new mycelium develops from the side.

The winter spores, or oöspores, are found in September and October, in discoloured and shrivelled parts of the leaves. They are spherical, ·03mm. in diameter, with a thick, smooth, yellow cell-wall. They fall to the ground with the leaves, and lie dormant till spring.

So far as I can find, the actual steps by which the winter spores are produced have not been observed in this species, or, for that matter, in the Uncinula, but as the process is known in the order Perisporiacæ, we may confidently assume that they result, later in the season, from the union of the contents of two cells or hyphæ, *i.e.*, they are of sexual origin.

We thus have, as in the Uncinula, both summer and winter spores. The summer spores develop outside the leaf, and germinate rapidly as soon as moistened by rain or dew. Consequently, during a wet summer, the spread of the fungus is extraordinarily rapid, so that within a few days a large vineyard becomes infested. The winter spores are found in the interior of the dry leaves, and hibernate within those on the ground. In summer they again get on to the young leaves by the agency of animals, wind, and rain.

Sulphur, as a means of checking or remedying this particular mildew, has proved a failure, and indeed no satisfactory remedy has until recently been found, though prophylactic means, such as those recommended by Mr. William Saunders—namely, the sheltering of the vines by a board covering over the trellis—have been more or less successful.

The fact that no satisfactory remedy existed until lately was well illustrated by the discussion which followed the reading of a paper by Mr. F. S. Earle, at the meeting of the American Horticultural Society, at New Orleans, last February, on "Fungoid Diseases of the Strawberry." The consensus of opinion was that we have no remedy for most of the fungus diseases of plants. That this was, unfortunately, a true state of the case practical cultivators will admit; for, though intelligent treatment will check the growth of the black knot, and the the proper use of lime and sulphur will check Erysiphe and Uncinula, these are about the only fungus diseases which we can control with satisfaction and certainty. Professor G. C. Caldwell is reported to have stated that mildew could be prevented by soaking the stakes in the vineyard in a solution of blue vitriol; but, as that report does not specify which mildew was intended, I know not how authoritative it is.

During my visit to South France in the summer of 1884 I was struck with the prevalence of this downey mildew in most of the vineyards, and the French grape-growers around Montpellier felt far more anxiety as to the consequence of this Peronospora than they did as to the work of the grape-vine Phylloxera. They feel now that with the aid of our American stocks they can control and defy this underground pest; but the Peronospora, which was a few years ago unknown to them, but which has been introduced with the American vines, has so far entirely baffled them, as I believe it has baffled our own grape-growers.

In an address which I had the honor to deliver before the Central Society of Agriculture of the Department of Hérault in June, 1884, and which treated principally of insecticides and insecticide appliances, I took occasion, in view of the interest then felt in this mildew, to recommend the use of the following as a promising fungicide: The ordinary milk-kerosene emulsion prepared after the formula given in my late official reports as United States Entomologist, with from 2 to 5 per cent. of carbolic acid and the same percentage of glycerine, and then diluted in twenty to fifty parts of water to one of the emulsion and sprayed on to the under surface of the leaves by means of a cyclone

nozzle of small aperture, so as to render the spray as fine as possible. The suggestion of the carbolic acid was due to the results obtained by Professor Gustav Foëx, Director of the École Nationale d'Agriculture at that place.

It was very gratifying to find this recommendation at once acted upon, and, up to the time when I left Montpellier, with satisfactory results. Reports of further trials showed also that this mixture so sprayed at once arrests the spread of the mildew. I was well aware of the difficulty of dealing satisfactorily with a fungus which may, in a single night, without any warning, manifest itself all over a vineyard; but it is a great point gained to know how to check it, even if the knowledge may at times be of little practical avail in large vineyards. But much good nevertheless resulted, and "*le procéde Riley*" was much written about in *La Vigne Americaine* and other viticultural journals a year ago. However, the experience of the past year in France has furnished a remedy which, from all accounts, is in every way satisfactory, because it not only destroys direct, but acts as a prophylactic.

My attention was drawn some months ago to two articles by C. B. Cerletti, published the 15th and 30th August in the *Revista di viticoltura ed Enelogia Italiana*, announcing the success of hydrate or slaked lime. My friends, M. J. Lichtenstein and P. Viala, of Montpellier, the latter having charge of the Labaratoire de Viticulture at the École Nationale d'Agriculture de Montpellier, soon thereafter communicated to me the discoveries made. M. Velicogna, in a report in the *Actes et Memoires de la Societé Imperiale et Royale de Agriculture de Gortiz*, for September and October, 1885, has also discussed the effect of hydrate of lime at length, his formula being 2½ kilogrammes of the lime (chaux éteinte) in 100 litres of water.

The general tone of the experience with this hydrate of lime is satisfactory, but a mixture of hydrate of lime and sulphate of copper is still more conclusive, and numerous communications to viticultural journals and to the French Academy attest the complete efficacy of the remedy. It has been the custom in some of the wine-growing parts of France to sprinkle lime and verdigris upon those vines which border on the roadside, as a means of warding off depredators. It was found that vines so spattered were not infested by Peronospora, while the rest of the vineyard might be attacked. This discovery led to further experiments.

Various formulæ have been given, but the most important articles are those by M. A. Perrey in the *Comptes Rendus de l'Ac. d. Sc.*, 5th October, 1885, and by M. A. Millardet in the same publication, and reproduced in the *Messager Agricole du Midi* for the 10th November, 1885. From this latter article I condense the following: Dissolve eight kilogrammes (18lb.) of ordinary sulphate of copper, in 100 litres (about 22 gallons) of any kind of water (well, rain, or river), in a separate vessel. Mix 30 litres (about 34lb.) of coarse lime so as to make a milk of lime. Then mix with this the solution of sulphate of copper which will form a bluish paste.

WINE-MAKING.

We have been urged to embody in this manual a chapter upon this subject; and, notwithstanding the assurance that, within the limited scope of this catalogue, we think it impossible to furnish anything that would be valuable, either as a guide to the inexperienced or as a *vade mecum* to the wine-maker, we have been called upon again and again by many of our customers for some concise information which might aid the intelligent farmer and the amateur grape-grower to transform their surplus fruit into that health-giving beverage "wine." The books on wine-making to which we have referred were either not accessible or too costly, and contained so much that was unnecessary, to say the least, that we finally concluded to write this brief treatise, which, however, should be regarded as a collection of mere hints, being only intended to give the inexperienced a correct idea of the general principles of wine-making, and to contain some plain directions that may guard against false theories and wrong practice.

Those who intend to make wine, as a business, on a large scale, and who desire full information on all its branches, cannot expect to find it in this brief manual. Moreover, wine-making is an art which, however simple, cannot be acquired from books only, but must be learned practically; and we can only repeat our advice, given in the former editions of this catalogue, viz., to engage some experienced "wine-cooper" who knows how to make and treat wines, who has learned and has been accustomed to attend to wines from his youth, and who will watch over and nurse them with the care and cheerfulness of a mother to her infant, until you or your son may have practically learned from him. Such a man you may have to pay well, and you may think you cannot afford it; but to learn from sad experience, unless on a very small scale, would prove by far more costly and unprofitable.

Thus, without presuming to present anything new in this chapter, we hope that the grape-growers of this country may find therein as much information of practical value on so vast a subject as could be condensed in so limited a space.*

I. Wine, its Nature and Substances, its Formation ang Classification.

Wine is the properly fermented juice of the grape; its unfermented juice is called must. The product of vinous fermentation of other saccharine juices of plants and fruits is also often called wine, but none contain the life-giving, restorative qualities, the exquisite taste, the delicate bouquet, that harmonious combination of substances that we enjoy in the properly fermented juice of the grape. At all events, we, as grape-growers, have to deal with the product of grape-juice only, and it is of this alone that we intend to speak.

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* There are but few books on wine-making written in the English language. Haraszthy's "Grape Culture and Wine-making" was published (by Harper and Brothers, New York, 1862) more than twenty years ago. Among the many scientific German works on this subject, the new "Handbuch des Weinbaues und der Kellerwithschaft, von Frhr. A. v. Babo, &c., Berlin, 1883," is probably the best and most complete.

However important it is to fully know the nature and chemical substances of wine and the law of fermentation, we must restrict ourselves to the absolutely necessary; it may also suffice, for most practical purposes, to know that the juice of the grape contains, chemically speaking,—

(1.) *Sugar*, which afterwards, by fermentation, is transformed into alcohol. Most of the cellular substances in the unripe grape have transformed themselves, during the process of ripening, into sugar; the residue of these are thrown out during fermentation, and sink to the bottom. The less ripe the grapes, the more of these substances and the less sugar will be contained in the must.

(2.) *Acids.*—Tartaric, tannic, and other acids, more or less, according to the degree of ripeness and the character of the grapes.

(3.) *Albumen.*—A nitrogenous substance, plainly visible in the scum of the must; also some resinous substances, gum, affecting the body and taste of the wine; colouring matter adhering to the skin, giving the colour especially to red wines, and so called extractive matter. All these substances, and many more, which have been chemically analysed, are combined and dissolved in about three to four times their quantity of water in the juice of the grape.

As long as this juice is enclosed in the skin, which protects it from contact with the oxygen of atmospheric air, so long no fermentation can take place. As soon as the grapes are mashed, the influence of the air begins to act thereon. Spores of ferment are contained everywhere in our atmosphere, and develop themselves under certain conditions. They grow and augment in the must (as can be seen by the aid of a microscope), decomposing the sugar, setting the fluid in motion, and forming alcohol; at the same time the other substances combine, transform, and form new substances. Thus, however clear the unfermented juice may be, it becomes turbid by fermentation. The albumen commences to oxydize; the alcohol, while forming, separates the colouring matter from the skin; carbonic-acid gas is formed in the mass, pushing up the firm parts and forming a dense cover over the liquid; the gas is developed in increasing quantities and escapes with a bubbling noise, and the heat of the fermenting mass is augmented. Gradually all these phenomena disappear, fermentation becomes less stormy, and the undissolved substances and new-formed matter fall to the bottom. The new wine is formed; by degrees it becomes almost clear, but fermentation still continues slowly—almost imperceptibly; there are still substances of the must, finely distributed, floating in the young wine, and these substances, under an increased temperature, create anew a stronger fermentive motion, until the wine is clear and fully developed.

The more sugar grapes contain the more alcohol will be developed in the wine under proper fermentation, and the more durable will it be, from the fact that the floating yeast more effectually settles. The durability of a wine depends largely on the quantity of the remaining undissolved substances in the same; it is therefore necessary to free it from those substances as soon as possible. The more regular, uninterrupted, and complete the first fermentation, the more of the dregs or lees will have settled and the better the wine will become; particles of the sugar, however, remain floating undecomposed until after the second fermentation, usually during the time of the next blooming of the vines. Some of the acids, tannin, and albumen are also generally precipitated, and settle only during the second summer; and not till then can most wines be considered completely developed. Even after that period there is a further change perceptible in most wines. They become milder, and not only their taste but also their effects change. Old wines are considered less intoxicating and more beneficial; but there is a limit to this improvement by age, and very old wines become rougher and less palatable, unless younger wine is added from time to time.

It is self-evident that the qualities of wine depend on the combination and proportion of the above-mentioned substances in the must, and their proper development during fermentation. From analysis of the best wines we find that a good wine should contain from 10 to 12 per cent. of alcohol, from 1 to 3 per cent. extractive substances, and $\frac{1}{2}$ per cent. (5 to 6 per mille) acids, bouquet, and aroma in proper proportions (which cannot be expressed or measured by any scale).

The alcoholic strength of wines cannot be measured by any of the so-called wine scales; these show the specific gravity, but never the alcoholic strength. A small distilling apparatus, *alambic Salleron*, would be required for this purpose. (Instructions for its use accompany this instrument.) The wine-maker may, however, know in advance, from the sugar percentage of his must, how many per cent. of alcohol his wine will have after complete fermentation, calculating 1 per cent. of alcohol for every 2 per cent. of sugar, measured by Oechsle's well-known must scale. For a correct examination of the must, it should be clear (filtered), not yet fermenting, and its temperature about 65° F. (14° R. or 17° C.). Tables showing the percentage of sugar for the various degrees of Oechsle's scale may be obtained with the instrument. To determine the acidity of wines, as well as of must, we have now in Twichell's acidometer a safe and practical instrument.

Wines are generally classified, according to their saccharine substances, as follows:—

(1.) Dry wines, in which all the grape sugar has been absorbed or transmuted by fermentation.

(2.) Sweet wines, which still contain a considerable quantity of sugar.

The former might be called the wines of the North, the latter the wines of the South. The northern wines contain more acidity, and are consequently of a richer perfume, bouquet; the southern wines lack acidity; the spirituous element, sweetness, is predominating. They generally have no bouquet, and even the strong muscadine flavour of some southern grapes disappears in a few years.

With regard to colour, wines are classified as white and red wines, though there are many shades between the two extremes, from the pale greenish-yellow of the Kelly Island Catawba to the deep dark-red of our Norton's Virginia. The intermediate shades are generally not as well liked. Sometimes wines are also classified as still and sparkling wines—a merely artificial classification, as the sparkling is simply the result of a peculiar mode of manipulation (by fermentation in closed

bottles, so as to retain and hold the carbonic-acid gas), a manipulation too complicated to be here described, or to be of any practical use to most wine-growers.

We shall now endeavour to proceed to the *modus operandi* of the grape-grower as a producer of still wines.

II. Gathering the Grapes—Mashing and Pressing.

Some are impatient to gather their grapes for wine-making as soon as they colour; others delay until they are over-ripe. Both are wrong. Not until the grapes have reached their full sweetness, the berries separate easily from the stem, the stems have lost their freshness, and have become harder, dryer, brown, or woody, are they ripe; but when they have reached that state of maturity gathering should not be delayed. It is impossible to describe or determine with exactness the point of full maturity. Some varieties, especially those deficient in acidity, will reach it sooner than others; and in bad seasons grapes will not reach a perfect degree of maturity. In such seasons it would be even more useless than in favourable years to wait for an improvement by "after-ripening," as, aside from the danger of their entirely spoiling by late rains and frost, the loss in quantity would be far greater than the gain in quality. Grape-growers cannot afford to risk a large portion of their crop for a little better quality, especially as long as the latter is not sufficiently appreciated and paid for in this country. The dangers of loss are, of course, greater in the northern than in the more southern States, and in some localities the fall-season is so constantly dry and warm that the above rule is thereby modified. Moreover, some varieties improve more than others by getting over-ripe, and are far better adapted for late gathering. As such, we would especially name the Norton's Virginia.

To obtain a wine of superior quality it is necessary to select the best and most perfectly ripened grapes, of varieties best adapted for wine, and to press them separate from those which are poor in quality or imperfectly ripe. But, instead of sorting the gathered grapes, it is generally considered more advisable, especially in seasons when the grapes do not ripen evenly, to sort them while gathering, that is to say, to pick first the best and ripest grapes, and let the others hang on the vines several days to ripen more fully, thus making two gatherings from the same vines. We here desire also to caution wine-growers not to plant too many varieties. A few kinds, suited to their locality, will pay best, and make better wine. By this we do not wish to discourage the testing of different and new varieties in small quantities, with a view to progress and improvement; but the planting of a great many varieties, each insufficient in itself, would necessitate the gathering of their grapes while some are not sufficiently ripened, others over-ripe, and these, mixed together, cannot produce good wine. It seems almost unnecessary to say that white-wine grapes and red-wine grapes should be each gathered and pressed separately. Grapes should be gathered with knives or scissors adapted to the purpose, and not torn from the vines merely by the hand. Some gather in baskets, others in hods, made for the purpose; but, whatever kind of vessels may be used, it is important that these, as well as all vessels used in wine-making, should be perfectly clean. Plenty of fresh water for washing them is therefore an essential requirement. Some first use hot water, to which some lime and salt have been added, in order to remove every trace of fungus which may have formed, and, after leaving such water in the vessels about twenty-four hours, rinse the same with plenty of pure cold water.

The grapes being gathered, we now come to—

The Mashing or Crushing, which is generally done in a press-house. For this purpose we use a wine-mill consisting of two roughly-notched rollers, so arranged as to be moved by a crank and cog-wheels in opposite directions, and having a hopper over them. Its construction is so simple that no explanation is required. The mashers should be so adjusted as to avoid the laceration of the stems and combs of the grapes, yet close enough to break each berry without crushing the kernels. Some wine-makers believe that the stems should be removed from the berries before mashing, which is done by the aid of sieves or rasps; others contend that the wines are not materially improved thereby, and that for red wines especially it is better not to remove the stems; owing, probably, to the tannin which these contain. But when the grapes have ripened poorly, and had to be gathered in that condition, it is necessary to remove the comb, which, being green, would still more increase the acidity and roughness.

The press-house or press-room need not be in or near the vineyard, but should always be close to, and, best, immediately above the wine-cellar. It might be divided into two parts—one for mashing and pressing, the other for the fermenting-room. The press and mill should be placed in the centre of the press-room, leaving space enough to go all around the press in turning the screw with the press-beam.

The Pressing, whereby the must is separated from the mashed grapes, called the marc or pommace, can be done with any kind of a cider-press; for large quantities, however, good screw-presses, specially made for wine, are generally used; and the principal qualities of a good press are —to require but little force, and to afford abundant means of outflow to the juice.

The mode and method of using the press, before and after fermentation, differs widely, according to the kinds of wine we intend to make. Before speaking of these, it is necessary to remark that the temperature of the room, while fermentation is going on, should be kept uniform without interruption: here in Southern Missouri at about 70° Fahrenheit (about 17° Réaumur);* in the South, where wine-making commences in August, it should be so arranged that it can be kept as cool as possible, and farther North so as to keep it warm—by the aid of fire, if necessary. A fire-place and kettle may also otherwise prove very useful in the press-house.

To the necessary furniture of the press-house fermenting-vats also belong, and may be ordered of any suitable size (not less than 100 gallons) from any experienced cooper: these are best made of poplar-wood; then good pine or cedar tubs and pails, not forgetting the must-scale, heretofore

* In northern wine-regions a lower temperature (about 60° F. = 12° R.) will favour a slower fermentation.

mentioned; and, finally, sufficient hose to run the fermented wine down the cellar. A good common house-cellar, cool in summer and safe against frost in winter, will fully answer the purpose.

For those, however, who intend to make wine on a large scale, a separate wine-cellar will, of course, become a necessity. A good wine-cellar should be dry; in damp cellars the casks become mouldy, the wine gets a bad taste and spoils. The cellar should be well drained, that it may be daily washed, for which purpose it must be amply supplied with water; it should have a sufficient number of air-holes to regulate ventilation and temperature. The temperature of a wine-cellar should not rise above 60° F. (12° R.) in summer, nor fall below 50° F. (8° R.) in winter. Such a cellar, with press-house and fermenting-room, store-room for casks, pumps, and other tools, costs thousands of dollars, and the additional expense of having plans and specifications made by an able architect or builder, well informed as to the requirements of a good wine-cellar, will be money well spent; it will protect you from great losses, which are the inevitable result of poorly and incorrectly constructed wine-cellars. In places where deep cellars are impracticable or too costly, good wine-cellars can also be built above-ground, on the system of the American ice-houses, whose double-frame walls are tightly stuffed with straw, sawdust, ashes, or other substances which are non-conductors of heat; the roof should be well projecting, and heavily covered with straw.

As necessary furniture and tools of a producer's wine-cellar must be mentioned—Supports and layers of sound timber on which the casks rest, about 18in. above the floor and at least 15in. from the wall, so as to enable you to examine and to clean the casks at all times. The casks should vary in size from 160 to 500 gallons (the capacity to be distinctly marked on each). Very large establishments will, of course, also use larger casks. They should be made of good, well-seasoned white-oak wood. The larger-sized casks should have so-called "man-holes," through which a man can slip in and clean them thoroughly; also, wooden funnels, pails, and tubs, which can be obtained from any cooper; faucets, funnels; thieves for drawing samples out through the bunghole; rotary pumps with rubber hose, to facilitate the drawing-off from one cask into another; bunghole-borers, wooden hammers, and various kinds of other tools; sulphur-strips and hooks, candles and candle-sticks, gauge-sticks and measures, wine-glasses for tasting, small step-ladders; and other utensils which are demanded in the course of operations, and may be seen in any properly furnished wine-cellar.

New casks, however are not ready and fit to receive wine; they must first be rinsed with boiling-hot water—the casks must, however, be emptied again before the water gets cold—they are then to be filled with fresh water daily during several days; then again a few gallons of hot water, in which common salt (2oz. to each gallon) has been dissolved, are to be poured into the empty cask, the bung firmly put in, and the cask rolled or turned until every part has been in contact with the hot salt water. After this operation (considered unnecessary by some) the cask is treated in like manner with 2 to 4 gallons of fermenting or boiling-hot young wine. This is called making new casks wine-green. Another process much in use is to put in the cask a hot lime-wash, made of unslaked lime and hot water, forming a kind of milk; the cask is turned about, so that its entire inside becomes coated with the mixture, after which the cask is washed with clean water, and finally rinsed with hot wine, as before. If this last operation is not convenient, pour in a pint of pure alcohol, or brandy, and ignite it, leaving the bung slightly open. The fumes of the burning brandy will free the wood from its unpleasant taste, which would otherwise taint the wine. In large modern wine-houses steam is used to great advantage in this important operation.

When a wine-cask is emptied, and not at once refilled with other wine, it should be cleaned, and when dry a small piece of sulphur (about 1in. square) should be burnt in the cask, which is then to be closed tightly by the bung; when it is again to be used, it must be examined as to tightness, by pouring water into it, and, if leaking, is to be made tight by filling it with water and driving the hoops until it ceases to leak. It must also be examined as to the purity of its air, which can be tested by a small piece of burning sulphur-strip or paper. If extinguished when brought into the cask, this indicates the impurity of its air, from which it may be freed by the common small bellows, and by then washing it thoroughly, as above indicated. Old casks and barrels which are to be used for wine must be watered and treated in like manner as new casks to be made wine-green: but never use a mouldy or sour cask; better burn it up than to attempt its cure.

White Wines.

The white-wine grapes—and, as a rule, no black or blue grapes should be used for white wine—are to be mashed as soon as they are hauled to the press-house. This is best done in a grape-mill, placed above the fermenting-vat. The vat is covered with a board or cloth as soon as filled, and the mashed grapes are there allowed to ferment from twenty-four to forty-eight hours. The juice, which may then run off through the faucet inserted in the spigot-hole near the lower end of the vat, is put into a well-prepared, clean cask; then the entire balance of the mashed grapes is pressed, and the juice which comes off from the press is added to that obtained without pressing.

The cask into which the juice has thus been put should not be completely filled, nor the bung-hole closed, as long as violent fermentation lasts. During that time the (carbonic-acid) gas which rises and fills that space prevents an access of air, and the old method of closing the bung-hole by a grape-leaf, over which a small sand-bag is placed, is still preferable to any complicated siphon. Care must be taken that the sand-bags remain clean, for if soaked by the must or by wine, vinegar would form in them; some, therefore, use a cork stopper, holding a doubly bent glass or rubber pipe leading into a small glass jar, half-filled with water, through which the gas escapes without admitting the outer atmosphere. A funnel-shaped bowl with an air-tube or chimney in the centre, covered by an inverted cup or tumbler, which forces the escaping gas to pass through the water in the bowl, combines the same advantages and is less apt to break or get out of order. When the

principal fermentation has ceased, or is no more perceptible, the cask should be filled up with similar young white wine, and then closed with a tight-fitting wooden bung. Mohr recommends a cork bung perforated by a glass tube filled with cotton, whereby the atmospheric air would be admitted without any germs of fungi. Babo recommends an ordinary wooden bung, perforated by a few small air-holes, so arranged that an india-rubber ring will close it against the air, yet permit the escape of any carbonic-acid gas by the elasticity of the ring.

White wine can also be made from black or blue grapes, as the colouring matter is merely in the skin, and is dissolved only during fermentation; consequently, by pressing the grapes at once, as soon as mashed (or even without first mashing), and before fermentation commences, thus separating part of the juice of the husks, a white or light-coloured wine is obtained. The pressings, still containing a great deal of juice, are then thrown into the fermenting-vat, some sugar-water is added to replace the portion of the juice heretofore withdrawn by a light pressing, and, after fermenting for several days, they are pressed again, and a red wine is produced from the same grapes. While we do not recommend this method, and consider both the white wine and red wine thus made as inferior to what could have been produced from the same grapes had their juice been allowed to ferment altogether on the husks, it certainly does not deserve that vituperation which has been heaped on our producers, who, in view of the failure of the Catawba and other white-wine grapes, resorted to that method with the Concord. Hereafter it will scarcely be practised by any, since there are a number of productive white-wine grapes planted, and especially since grape-juice is cheaper than sugar-water.

After the main or violent fermentation the must will have become clear young wine, provided that fermentation has been uninterrupted and complete; having become clear, in December or January, it is drawn off from its sediment into clean, properly-prepared wine-casks. By this drawing-off the young wine again becomes cloudy, only to become clearer in March or April following, when it is again drawn off before its second fermentation. As soon as it is apparent that, with the rise of temperature, in May, this second fermentation approaches, the bungs must be opened, some wine drawn off from the full casks to make room for the inevitable expansion, and the sand-bag or other apparatus is placed on the bung-holes until the termination of this second fermentation, when the yeast and other impurities will have been precipitated and settled, and the finished wine must be drawn off again into clean, well-prepared casks. The proper and frequent drawing-off is one of the most essential operations in wine-making. The object thereby aimed at is not merely to separate the young wine from its sediment, the dregs or lees, but to bring it in contact with the atmospheric air, while in older wines such contact must be carefully avoided. In drawing off the young wine we use a vulcanised rubber hose, one end of which is placed in the wine, so as not to touch the bottom of the cask, and from the other end the air is drawn by the mouth, until the wine flows through it into wooden pails or tubs below. By a mere pressure of the two fingers the hose is closed, and the flow stopped at will; the clear wine is filled into fresh casks by the aid of the wooden funnel, heretofore mentioned among the necessary tools. Rotary pumps, specially made for wine, are now generally used for drawing off older wines; but, as long as the wine is not quite and permanently clear, contact with the air during the drawing-off process is necessary. Permanent clearness, however, is often reached only after the wine has passed six or more times through this process.

This slow process of clearing or finishing the wines is accelerated by fining (with isinglass, gelatine, eggs, &c.), by filtering, by aërating, by heating (Pasteurising), and other artificial methods, which require special skill and apparatus, and which belong more to the manipulations of the wine-dealer's cellar than to those of the producer.

Red Wines

Differ from white wines not merely in colour, derived from the black or dark-blue grape-skins, but these also contain other valuable ingredients, especially more tannin, which gives to red wines a peculiar character and important hygienic qualities.

The red-wine grapes need not be crushed so soon after picking as the white-wine grapes. Many authorities recommend that their stems be first removed, as these contain and impart more acidity than is desirable in red wines. The grapes are usually fermented from one to two weeks in upright, firmly-closed fermenting-vats in which a perforated double or false bottom is placed, at about one-fourth the space from the top. This false bottom is to prevent the rising of the husks to the top of the liquid, as they would do in a fermenting-tub without such double bottom, when they would have to be pushed down into the liquid several times each day, to prevent the formation of acetic acid in those husks, and to extract from them all the colour and other valuable substances. The vat is, of course, first filled with the crushed grapes; then the double bottom is put in, so that it will be covered by about three inches of pure juice, which may be drawn off by the opening or faucet below, and poured in again after the double bottom is placed over the grape-mash. The fermenting bung or funnel is used the same as in white wines, to exclude the air and permit the escape of the carbonic-acid gas. In various wine-countries somewhat different methods are in use, but in all and every one of them success depends on a rapid, complete, and uninterrupted fermentation, and this depends on the temperature of the fermenting-room, which should be kept at about 75° F. (18°–20° R.), by artificial heating if necessary.

The further treatment of red wines is entirely the same as that of white wines, and red wines are generally much sooner ripe and finished if at first well fermented; but, if this has not been well done, its after-fermentation and cure will be the more difficult: such red wines will receive a disagreeable sweetish-sour taste, and all the fining will sooner be harmful than beneficial.

All wine-books contain more or less voluminous instructions upon various methods of improving the must which is to be made from sour grapes, gathered during unfavourable seasons, and of curing

wines which have suffered either from defective fermentation or through errors and neglects in their treatment.

We do not pretend to condemn all these methods, as many others do; but, while we consider it justifiable that the producer endeavour to improve his wine by an addition of pure sugar to the must, if it has been insufficiently developed in the grape, or to add a little pure spirits to the wine, to make it more durable, and while we cannot see anything reprehensible in the fact that wine-producers will try to extract from the pressed husk the large portion of wine-making properties which they still contain to make a very good, wholesome, and cheap domestic wine—especially as the revenue laws make their distillation impracticable—we do condemn the use of any and all foreign deleterious substances, and of all other so-called cellar mysteries. We would also warn the inexperienced against the use of any and all other attempts to improve or to add anything to their wine, as these manipulations require scientific accuracy and practical skill; otherwise the result will surely be no improvement—aye, will most likely prove ruinous. Moreover, the knowledge of the chemistry of wine is as yet very imperfect. Quite lately Adolph Reihlen, of Stuttgart, invented a process which upsets former scientific doctrines. He demonstrated that the fermenting properties exist exclusively in the grape-skins, and that old wines can be readily brought to a new fermentation and restored by the use of clean and pure grape-skins, and by the action of heat, applied to the wine. But his method is patented, and therefore cannot here be described. Neither is the manufacture of sweet wines, cordials, or liqueurs, nor that of sparkling wines, within the scope of this brief manual.

A natural wine, the pure juice of the grape, properly fermented and educated, will always be superior to any artificially improved wine; and the only necessary conditions to obtain such superior natural wine are,—

(1.) Good ripe grapes:
(2.) Clean vessels and utensils:
(3.) A proper, uninterrupted, high temperature during fermentation:
(4.) Drawing off, as herein described, in December or January:
(5.) Drawing off again in March or April:
(6.) Drawing off after second fermentation:
(7.) Keeping the casks full, by refilling from time to time with good similar wine.

If these essential conditions are strictly complied with,—and they are neither many nor very difficult,—wine-making will be a success.

Some, however, say that American wines are very inferior, "scarcely fit to drink!" This was the preconceived opinion of foreigners, and of a great many Americans too. Also, most American hotels and restaurants kept none but foreign wines—or else native wines under foreign names and labels—and we are often asked whether we hope ever to produce as good wines here as in Europe. Now, while we are far from presuming that "we can make wines which will rival and surpass the best wines of France, Germany, and Spain,"* we do claim that we are producing some very good wines, and shall, before many years, by planting our best varieties, and by progressing in the art of wine-making, fully equal the average production of the wine-countries of Europe. This is no idle boast—no mere opinion of our own. The good qualities of American wines are now appreciated by the best and most impartial judges. Professor St.-Pierre, the late celebrated Director of the Agricultural School of Montpellier,† says in his "Memoir,"—

"The study of wines furnished by American varieties has engaged my whole attention since 1875. . . . The musts of the following varieties: Jacquez, Rulander, Cynthiana, Black July, Elvira, and many others, are found to be sweeter and richer than the musts of our best southern varieties. . . . The fine mountain wines of the South of France find their equivalents in the Black July, Jacquez, Norton, and Cynthiana; colour, alcohol, savour, body, and keeping qualities—none are missing, and their products are equal to the good wines of Provence or of Roussillon. . . . Trade will also find American wines for blending, similar to those of the Narbonne. The colour and richness of the Jacquez, Norton, Clinton, &c., do not yield in the least to the deep-colour wines of France. Of those named, none except the Clinton wines have a disagreeable taste; and even of the Clinton, we shall obtain, by blending, age, clarification, &c., a wine that is fit to enter into general consumption.

"In the category of white wines, some American varieties offer equally valuable types. The wines of Diana and Elvira remind us of our good Piquepouls; the Cunningham, made as a white wine, presents characteristics approaching our Grenache wine. . . . It is thus evident that, besides grafting, which enables us to obtain our French wines on American stocks, the direct cultivation of many American varieties can give us wines of true value. . . . I hope that the prejudice against these wines by persons who never tasted any others than Concord and Isabella wine will finally fall before the evidence of experience."

May we not hope that the prejudice of our own American people will finally yield, and that they will rather trust to their own palates than to foreign labels and high prices?

But we are aware that there exists still another prejudice, one which condemns all wines, both native and foreign, from fear of their intoxicating effects.

INTRODUCING VINES FROM AMERICA.

In my interim report I pointed out the feasibility of Government introducing from America vines without any fear of bringing with them any of the diseases that have proved so harmful, such as the Phylloxera or Peronospora. I attach herewith a table by T. V. Munson, M.Sc., of Denison, Texas, who is recognised as the most eminent authority on the subject, showing what vines are proof against the different diseases, and these only I would recommend the Government to obtain

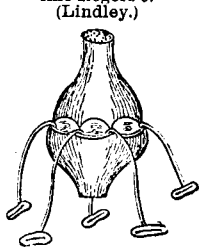
* "American Wine and Fruit Grower," August, 1882, page 75. † He died December, 1881.

and plant out on experimental grounds in at least three different districts: say Whangarei, Napier or Gisborne, and Wanganui. It would, perhaps, be advisable, in the first place, to plant them all at Whangarei "in quarantine," and, as soon as they were found free from disease, to send collections to the other districts, to be placed in charge of practical men who would acquaint themselves with the particular kind of culture required by the American vine.

It is just possible that there are nurserymen in the colony who may claim to have all the varieties of the American vine, and might urge that there is no necessity for Government sending to America. If the Government decide upon testing the adaptability of these vines to our climate, I would most strongly impress upon Government the importance and necessity of obtaining vines true to name direct from America, and having the matter settled in such a way as would leave no doubt whatever in the minds of the public that it had been given a perfectly fair trial. I am led to make these remarks because it is asserted in Auckland that a number of American varieties of the vine were introduced here some years ago, and gave very unsatisfactory results. The history of those vines would fully account for their failure. They came from Victoria to Auckland; and what guarantee was there of their having been true to name? As a matter of fact, it is well known that, some years ago, so great was the demand made upon the American nurserymen for cuttings of the improved varieties of the Phylloxera-proof vine that they could not fill the orders, and some of them were dishonest enough to go into the bush and get cuttings of the wild vine and ship them to France, and perhaps Victoria too. I have no authentic information for saying such was the case with the Australian shipments, but it is reasonable to suppose that Australia would fare no better than France in that respect, and there is every reason to doubt the pedigrees of the vines that are now offered in this colony as American, and which originally came from Victoria; for it is well to bear in mind that even in America hundreds of varieties have failed to give good results, and have been condemned as worthless. It has also been asserted here in Auckland that, although the American vine will grow luxuriantly, it will not fruit, and it is stated that a nurseryman has had these vines growing for six or seven years, but never got them to fruit. If such is the case, it would go to prove that the vines are from the stock of the wild vine, and have never been fertilised in all probability. Munson draws particular attention to this characteristic of American pure species. He says,—

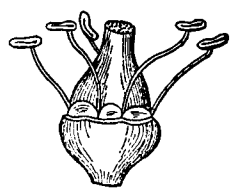
"So far as observed in thousands of bearing vines of the pure species, the *riparia*, *rupestris*, *cordifolia*, *cinerea*, *æstivalis*, and *candicans* always have reflexed stamens, and, if standing at a distance from vines having erect stamens, will not set much fruit, yet will bear abundantly if varieties with erect stamens, blooming at the same time, stand near. They are practically pistillate, like Crescent strawberry, and need fertilisers. These they naturally have, as over half the wild vines are purely staminate or male, bearing superabundantly of pollen, but never a berry.

Flower of Bearing Vine with Reflected Stamens, like Rogers 9. (Lindley.)



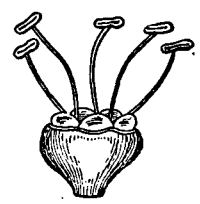
Non-fertilising.

Flower of Bearing Vine with Erect Stamens, like Concord.



Self-fertilising.

Flower of Male or Pollen-bearing Vine.



Non-bearing.

"Lindley and most all varieties with reflexed stamens, if planted alone in vineyard, are almost fruitless, but planted among Lady, Martha, Concord, or many others, quickly selected by the use of the table, having erect stamens and blooming at same time with Lindley, or still better, if you can get such, male plants blooming at same time, and the reflexed-stamened varieties bear heavily.

"This important principle cannot be too strongly emphasized. The lack of cross-fertilisation is the cause of much loss to fruit-growers. The varieties to be cross-fertilised must bloom with the same period, and better to have the variety to be fertilised to begin blooming a day after the one which is to furnish pollen. A grape-vine remains in bloom from three to eight days, and each flower must be fertilised the first or, at farthest, the second day after it opens. In the wild state the male vines begin blooming a day or two before the bearing vines. This and the fact that over half of all wild vines are males, gives us a hint which we cannot neglect without loss in crop or the experimenter without imparing the longevity of his varieties and breeds. Even the bearing vines with erect stamens do better if some properly-selected males be planted in the vineyard. I know of but one vineyard planted upon this principle, and that is a new one, by H. Jaeger, of Missouri. We hope in a few years to learn the results. To further illustrate this principle and the healthful influence on the seedlings, let us take a few examples.

"One of my seedlings having reflexed stamens had two clusters with part of the flowers just ready to cast the caps (bloom), when I lifted the caps and applied pollen from Berckman's (an erect-stamened kind), and then enclosed the clusters in thin muslin sacks, with part of the flowers yet to bloom. These bloomed the next day or two, but, instead of setting fruit, every one soon withered and fell away, while those fertilised with pollen from Berckman's set and matured fruit.

"Concord, Clinton, Triumph, Norton, Herbemont, and all other erect-stamened varieties, from which I have grown seedlings, make feeble plants when pure-bloods—that is, self-fertilised—in comparison with crosses or hybrids with other varieties and species.

"Indeed, it seems a pretty well established fact that if a variety's own pollen, even if it has erect stamens, and that of another erect-stamened variety, especially so if from a male vine, be

MUNSON'S DESCRIPTIVE TABLE OF AMERICAN NATIVE GRAPES.

Name.		Origin.		Characteristics of Plant.							Diseases.				Description of Fruit.								
Common.	Botanical. From what Species derived.	Place.	Originator.	Growth.	Hardiness. South. Endures Heat.	Hardiness. North. Endures Cold.	Cuttings root	Time of leaving out.	Bloom at Denison, Texas, 1885.	Stamens.	Anthrax (Sphaceloma).	Rot (Phoma).	Mildew (Peronospora).	Root Louse (Phylloxera).	Size. Cluster.	Size. Berry.	Ripe.	Colour.	Skin.	Pulp.	Number and Size of Seeds.	Quality. Table.	Quality. Wine.
Sugar or sand beach	Vitis Rupestris	S. W. Missouri		V. V.	V. H.	V. H.	Easily	V. early	April 24	Ref.	None	None	None	Res. per.	V. S.	S. to M.	Earliest	Black	Thin, firm	Melting	3 to 5 s	Pure, fair	Fine claret.
Woolly riparia or New Mexico	" Nuevo-mexicano	N. W. Texas		V. V.	V. H.	V. H.	Easily	V. early	April 24–8	Ref.	None	None	Severe	Resists	S. to M.	Small	V. E. to M.	Black	Thin, firm	Melting	3 to 5 s	Fair to fine	Fine claret.
Riverside	" Riparia (proper)	N. Texas		V. V.	V. H.	V. H.	Easily	V. early	April 24–8	Ref.	None	None	Little	Resists	S. to M.	V. small	V. early	Black	Thin, firm	Seedy	3 to 5 s	Too small	Vinous.
Bacchus (Clinton)	" Lab. riparia	New York	J. H. Ricketts	V. V.	H.	V. H.	Easily	V. early	April 28	Erect	Some	Some	Severe	Res. well	Med.	Medium	Medium	Black	Thin, firm	Pulpy	1 to 3 m	Fair	Good claret.
Mustang, hybrid	" Candicans and riparia	Red River, Tex.	Found wild	V. V.	V. H.	H.	Fairly	V. early	April 28	Ref.	None	None	None	Res. per.	S. to M.	Medium	Early	Black	Thick, firm	Pulpy	3 to 5 s	Poor	Good claret.
Berckmans	" Lab. ½, Rip. ½, Aest. ½, Lab. ½, Vin. ½	South Carolina	Peter Wylie	V. V.	H.	H.	Well	Early	April 30	Erect	None	Some	Some	Res. well	Med.	Medium	Early	Red	Thin, firm	Tender	2 to 3 m	Excellent	White.
Mustang	" Candicans	Texas		V. V.	V. H.	T.	With dif.	Early	May 1	Ref.	None	None	None	Res. per.	Small	L. to V. L.	E. to M.	Black	Thick, acrid	Tough	3 to 5 m	"No go"	Heavy claret.
Secretary	" Lab.-rip. (Clinton) vin.	New York	J. H. Ricketts	V.	H.	T.	Easily	Early	May 1	Erect	Some	Severe	Severe	Poorly	Long	Medium	Medium	Black	Thin	Tender	1 to 3 m	Good	Heavy claret.
Mary Ann	" Labrusca	Pennsylvania	J. B. Garber	V. V.	V. H.	V. H.	Easily	Early	May 1	Erect	None	Some	None	Res. well	Med.	M. oval	V. early	Black	Thick	Tough	2 to 4 m	Poor	Poor.
Golden gem	" Aest. lab.-vin. (Del-Iona)	New York	J. H. Ricketts	V.	H.	H.	Fairly	Early	May 2	Erect	None	Some	None	Fairly	S. to M.	S. to M.	Early	Yellow	Thin, firm	Tender	2 to 3 m	Excellent	White.
Waverly	" Lab.-rip., vin. (Clinton-Muscat)	New York	J. H. Ricketts	V.	H.	T.	Easily	Early	May 3	Erect	Some	Severe	Some	Fairly	Long	Medium	Medium	Black	Thin, firm	Tender	2 to 3 m	Good	Red.
Perkins	" Labrusca	Massachusetts		V.	H.	V. H.	Easily	Early	May 3	Erect	None	Little	None	Resists	Med.	Medium	Early	Red	Firm, med.	Some	2 to 4 m	Good	Fair white.
Telegraph	" Labrusca	Pennsylvania	Christine	V.	H.	V. H.	Easily	Early	May 3	Erect	None	Some	None	Resists	Med.	Medium	Early	Black	Thin	Some	2 to 4 m	Good	Good red.
Hartford	" Labrusca	Connecticut	Steele	V. V.	H.	V. H.	Easily	Early	May 3	Erect	None	Some	None	Resists	Med.	Medium	Early	Black	Thin	Some	2 to 4 m	Fair	Poor.
Elvira	" Riparia-labrusca	Missouri	J. Rommel	V. V.	H.	V. H.	Easily	Early	May 3	Erect	None	Little	None	Resists	S. to M.	Medium	Medium	White	Cracks	Tender	2 to 3	Fine	Good white.
Vitis champini	" Monticolo-candicans	W. Texas	H. Jaeger	V. V.	V. H.	H.	Fairly	Early	May 3	Erect	None	..	None	Resists	..	..	..	..	..	..	..	..	..
Concord	" Labrusca	Massachusetts	E. W. Bull	V. V.	H.	V. H.	Easily	Mod.	May 5	Erect	None	Severe	None	Resists	Large	M. to L.	Medium	Black	Tender	Some	2 to 4 m	Very good	Red.
Moore's early	" Labrusca	Massachusetts	John B. Moore	V.	H.	V. H.	Easily	Med.	May 5	Erect	None	Some	None	Resists	Med.	V. large	V. early	Black	Firm	Some	2 to 4 m	Very good	Red.
Early victor	" Labrusca	Kansas	John Burr	V. V.	H.	V. H.	Easily	Early	May 5	Erect	None	Severe	None	Resists	Med.	S. to M.	Early	Black	Firm	Tough	2 to 4 m	Fine	Red.
Missouri riesling	" Rip.-lab.	Missouri	N. Grein	V. V.	H.	V. H.	Easily	Med.	May 5	Erect	None	None	None	Resists	Med.	Medium	Late	White	Thin, firm	Tender	2 to 3	Excellent	White.
Brighton	" Lab.-vin.	New York	Jacob Moore	V. V.	H.	H.	Easily	Early	May 5	Ref.	Little	Severe	Little	Fairly	Long	Medium	Early	Red	Thin, firm	Tender	2 to 3	Very fine	White.
Lady	" Labrusca	Ohio	W. S. Imlay	W.	H.	H.	Easily	Med.	May 6	Erect	None	Some	None	Resists	Med.	M. to L.	Early	White	Tender	Tender	1 to 3 m	Good to very good	White.
Lindley (Rogers 9)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Early	May 6	Ref.	Little	Some	Little	Fairly	Med.	M. to L.	Early	Red	Firm	Little	1 to 3 m	Excellent	White.
Wilder (Rogers 4)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Med.	May 6	Ref.	Little	Severe	Little	Fairly	Med.	V. long	Medium	Black	Firm	Some	1 to 3 lg	Good	Red.
Pocklington	" Labrusca	New York	J. Pocklington	V. V.	H.	V. H.	Easily	Med.	May 6	Erect	None	Severe	None	Well	Med.	V. large	Late	Yellow	Tender	Tough	2 to 4	Fair	White, musky.
Martha	" Labrusca	Pennsylvania	Samuel Miller	V.	H.	V. H.	Fairly	Med.	May 7	Erect	None	Little	None	Well	S. to M.	Medium	Early	Yellow	Tender	Tender	2 to 3 m	Sweet, good, foxy	White.
Delaware	" Aest. ½ (lab. ½, vin. ½)	New Jersey	P. H. Provost	M.	H.	H.	Poorly	Early	May 7	Erect	None	None	Little	Fairly	S. to M.	Small	Early	Bright red	Firm, thin	Little	1 to 3 m	Best	White.
Noah	" Rip.-labrusca	Illinois	O. Wassinzieher	V. V.	H.	V. H.	Easily	Med.	May 7	Erect	None	Some	None	Resists	Med.	Medium	Late	Yellow	Firm	Tough	3 to 4 m	Good	Fine white.
Salem (Rogers 22 or 53)	" Lab.-vin.	Massachusetts	E. S. Rogers	V.	H.	M.	Easily	Med.	May 7	Erect	None	Some	None	Fairly	Med.	Large	Early	Red	Firm	Tender	2 to 3 l	Fine	Fine white.
No. 2	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Med.	May 7	Ref.	None	Severe	None	Fairly	Long	V. large	Late	Black	Firm	Tough	2 to 3 l	Fair	Red.
Goethe (Rogers 1)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Med.	May 7	Erect	None	Little	Little	Fairly	Med.	V. large	Late	Pink	Firm	Tender	1 to 3 l	Fine	White.
No. 32	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Med.	May 7	Ref.	None	Much	None	Fairly	Med.	Large	Medium	Black	Firm	Tender	1 to 3 l	Good	Red.
Agawam	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Easily	Med.	May 7	Erect	None	Some	None	Fairly	Med.	Long	Early	Red	Firm	Tender	1 to 3 vl	Fine	Amber.
Prentiss	" Lab.-vin.	New York	Prentiss	W.	T.	T.	Easily	Med.	May 7	Erect	None	Much	Some	Poorly	Med.	Medium	Early	White	Firm	Tender	1 to 3 s	Fine to very fine	White.
Walter	" Aest.-lab.-vin.	New York	A. J. Caywood	V.	H.	H.	Poorly	Med.	May 8	Erect	None	None	Little	Resists	Med.	Medium	Medium	Bright red	Thin, firm	Some	1 to 3 m	Very fine	White.
Eumelan	" Aest. ½ (or vin.), lab. ½	New York	Thorne	V.	H.	H.	Fairly	Med.	May 8	Ref.	None	Some	Little	Resists	Long	Long	Early	Black	Thin, firm	Tender	1 to 3 l	Fine	Red.
Merrimac (Rogers 19)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Well	Med.	May 8	Ref.	None	Severe	Little	Fairly	Med.	V. large	Medium	Black	Thick	Tender	1 to 3 l	Good	Red.
Essex (Rogers 41)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Well	Med.	May 8	Ref.	None	Severe	None	Fairly	Med.	V. large	Medium	Black	Thick	Tough	1 to 3 vl	Fair	Red.
Massasoit (Rogers 3)	" Lab.-vin.	Massachusetts	E. S. Rogers	V. V.	H.	M.	Well	Med.	May 8	Ref.	None	Severe	None	Fairly	Med.	Large	Early	Red	Thin	Tender	1 to 3 m	Fine	White.
Irving	" Lab.-vin.	New York	S. W. Underhill	V.	M.	M.	Well	Late	May 8	Erect	Little	Severe	Some	Fairly	Med.	Large	Medium	White	Thin	Tender	1 to 3 s	Fine	White.
Lady Washington	" Lab.-vin.	New York	J. H. Ricketts	M.	T.	M.	Well	Med.	May 8	Erect	Little	Severe	Some	Fairly	Long	Medium	Medium	Pink	Tender	Tender	1 to 3 s	Fine	White.
Holmes	" Aest.-cin.-vin.-lab.	S. Texas		V. V.	V. H.		Fairly	Early	May 9	Ref.	None	Severe	None	Resists	Med.	Medium	Medium	Purple	Thin, firm	Melting	2 to 3 s	Very fine	White.
Diana	" Lab. ¾, cin. (?) ¼	Massachusetts	Mrs. D. Crehone	V.	H.	M.	Well	Med.	May 10	Erect	Little	Little	Little	Resists	Med.	Medium	Late	Red	Thin, firm	Tough	2 to 3 m	Fine	White.
Triumph	" Lab.-vin.	Ohio	G. W. Campbell	V.	H.	M.	Well	Med.	May 10	Erect	Little	Little	Little	Resists	V. L.	M. to L.	Late	White	Tender	Melting	1 to 3 s	Excellent	White.
Peter Wylie	" (L.-V.) (Aest.-L. V.)	South Carolina	Peter Wylie	W.	M.	T.	Well	Early	May 10	Erect	Little	Severe	Little	Fairly	Med.	Medium	V. early	White	Thin, firm	Tender	1 to 3 s	Fine	White.
Duchess	" Lab.-vin.	New York	A. J. Caywood	V.	T.	T.	Well	Med.	May 10	Erect	Some	Severe	Some	Fairly	Long	S. to M.	Medium	White	Thin, firm	Tender	1 to 3 s	Fine	White.
White Ann Arbor	" Labrusca	Michigan	C. H. Woodruff	M.	H.	V. H.	Well	Late	May 11	Erect	None	Some	None	Well	Med.	Medium	Early	White	Tender	Tender	1 to 3 m	Good	White.
Naomi	" Lab.-vin.	New York	J. H. Ricketts	M.	T.	T.	Well	Late	May 11	Erect	None	Some	Little	Fairly	Med.	Medium	Medium	White	Thin	Tender	1 to 3 s	Fine	White.
Catawba	" Lab. ¾, vin. (?) ¼	North Carolina	J. Adlum	V.	H.	H.	Well	Late	May 11	Erect	Some	Severe	Some	Fairly	Med.	Medium	Late	Red	Firm	Tough	1 to 3 m	Fine	White.
Black eagle	" Lab.-vin.	New York	S. W. Underhill	V.	T.	T.	Well	Med.	May 11	Ref.	Some	Destroys	Some	Poorly	Long	M. to L.	Early	Black	Firm	Tender	1 to 3 m	Fine	Red.
Vergennes	" Labrusca (?)	Vermont	W. E. Green	V.	H.	V. H.	Well	Med.	May 11	Erect	None	Some	None	Well	Med.	Medium	Medium	Red	Firm	Tender	2 to 4 m	Good	White.
Frost grape	" Cordifolia	N. Texas	Wild	V. V.	V. H.	H.	Poorly	Late	May 12	*	None	None	None	Res. per.	Large	V. small	Latest	Black	Thin, firm	Tender	1 to 3 m	Acrid till frosted	Red.
Zinfandel	" Vinifera	Europe		V. V.	H.	T.	Easily	Med.	May 12	Erect	Little	Severe	Little	Fairly	V. L.	S. to M.	Medium	Black	Thin, firm	Tender	1 to 3 s	Fine	Red.
B. Hamburg	" Vinifera	Europe		V. V.	M.	T.	Easily	Med.	May 12	Erect	Little	Severe	Little	Poorly	V. L.	V. long.	Late	Black	Thin, firm	Tender	1 to 3 vl	Very fine	White.
No. 70	" Rupestris Aest. rup. (post oak)	S. W. Missouri		V. V.	V. H.	H.	Well	Early	May 12	Ref.	None	None	None	Resists	Med.	Medium	Medium	Black	Thin, firm	Tender	1 to 3 m	Good	Fine claret.
White Norton	" (Aest. ⅜, chin. ⅛) lab. ½	Missouri	J. Balsiger	V.	V. H.	H.	Fairly	Med.	May 14	Erect	None	None	None	Resists	Med.	S. to M.	Late	White	Thin, firm	Tough	1 to 3 s	Fair	White.
Excelsior	" Labrusca vinifera	New York	J. H. Ricketts	V.	T.	T.	Well	Late	May 15	Erect	None	Severe	Severe	Fairly	Large	M. to L.	Late	Pink	Thin, firm	Meaty	1 to 3 s	Best	White.
Norton's Va. (Cynthiana)	" Aest.-cin.-lab. (?)	Virginia	Lemosq	V. V.	V. H.	H.	Poorly	Late	May 15	Erect	None	None	None	Resists	Med.	Small	V. late	Black	Thin, firm	Firm	2 to 4 s	Pure, fine	Best clarat.
Post oak	" Aest. (Lincecummi)	N. Texas		V. V.	V. H.		With dif.	Med.	May 15	Ref.	None	None	None	Resists	Med.	Medium	V. H.	Black	Thin, firm	Some	2 to 4 m	Fine	Red.
Neosho	" Aest. (Lincecummi)	S. W. Missouri	H. Jaeger	V. V.	V. H.	H.	With dif.	Early	May 16	Ref.	None	None	Little	Resists	Med.	Medium	V. late	Black	Thin, firm	Firm	2 to 5 s	Good	Fine claret.
Jefferson	" Lab. ¾, vin. ¼	New York	J. H. Ricketts	W.	T.	T.	Well	Late	May 16	Erect	None	Little	None	Fairly	Long	M. to L.	Late	Pink	Firm	Meaty	1 to 3 s	Best	White.
Le noir	" Aest.-cin.-vin.	North Carolina		V. V.	V. H.	T.	Poorly	Early	May 17	Erect	Some	Severe	Some	Resists	Large	Small	V. late	Black	Thin, firm	Melting	1 to 3 s	Fine	Red.
Summer grape	" Aest.	E. Tennessee	Wild	V.	V. H.	H.	Hardly	Late	May 17	Ref.	None	None	None	Resists	Med.	Small	V. late	Black	Firm	Firm	2 to 4 s	Acid	Acid.
Cunningham	" Aest.-cin.-vin. (?)	North Carolina		V. V.	V. H.	T.	Poorly	Late	May 18	Erect	None	None	None	Resists	Med.	Small	Late	Dark purple	Thin, firm	Melting	1 to 3 s	Best	White.
Herbemont	" Aest.-cin.-vin.	South Carolina	N. Herbemont	V. V.	V. H.	T.	Poorly	Late	May 19	Erect	None	Little	None	Resists	V. long	Small	V. late	Purple	Thin, firm	Melting	1 to 3 s	Best	White.
Warren	" Aest.-cin.-vin. (?)	Georgia	Neil, not Herb	V. V.	V. H.	T.	Poorly	Late	May 19	Erect	None	Little	None	Resists	V. long	Small	V. late	Purple	Thin, firm	Melting	1 to 3 s	Best	White.
Harwood	" Aest.-cin.-vin.	S. Texas	Major Harwood	V. V.	V. H.	T.	V. poorly	Late	May 19	Erect	None	None	None	Resists	V. long	Medium	V. late	Purple	Thin, firm	Melting	1 to 3 s	Best	White.
Ashy or sweet winter grape	" Cinerea	N. Texas	Wild	V. V.	V. H.	T.	Fairly	V. late	June 1–5	Ref.	None	None	None	Res. per.	V. long	V. small	Sept., Oct.	Pur. & black	Thin, firm	Melting	1 to 3 s	Vinous	White and red.
Scuppernong	" Rotundifolia	North Carolina		V. V.	V. H.	T.	Poorly	V. late	June 8–10	Erect	None	None	None	Res. per.	V. S.	V. large	V. late	Yel., black	Thick, tough	Pulpy	1 to 3 vl	Good	White.
Muscadine	" Rotundifolia	South	Native	V. V.	V. H.	T.	Poorly	V. late	June 8–12	Erect	None	None	None	Res. per.	V. S.	V. large	Aug., Sept.	Black	Thick, tough	Pulpy	1 to 3 vl	Good	Red.

W.—Weak. V.—Vigorous. V. V.—Very vigorous. H.—Hardy. V. H.—Very hardy. T.—Tender. L.—Large. V. L.—Very large. M. or Med.—Medium. S.—Small. Ref.—Reflexed. V. E.—Very early. Dif.—Difficulty. Res. per.—Resists perfectly. * Female reflexed, male erect.

applied to the stigma at the same time, the pollen of the other variety will be chosen, its own rejected, and the seeds will be crosses or hybrids. In artificial hybridizing it is quite useless to cut away stamens on varieties where they are short and reflexed. Thus we learn that Nature abhors in-and-in breeding even in plants.

"Nearly all varieties of *labrusca* in cultivation, and a goodly part of those of *vinifera*, have erect stamens; hence I conclude that these species generally, both in bearing and sterile plants, have erect stamens, though actual observation in wild nature would be necessary to establish the point. The important truth remains that, if only one variety is planted in a vineyard, it must have erect stamens, in order to make a crop.

"As to the stamen characteristics in *californica, arizonica, palmata, coriacea*, and *rotundifolia* species, I have not yet observed.

"Norton's Virginia and some known hybrids between *æstivalis* and *cinerea* have erect stamens; hence the conclusion that erect stamens in bearing vines are partly the result of hybridization. Why *labrusca* in its pure-bloods has erect stamens in bearing vines, and continuous tendrils, while no other pure species have these, only the hidden work of past cycles of evolution can explain.

"On this subject of far-reaching importance, I trust you will see the great value of a correct table, such as is attempted here, so far as the tests and notes have been made. Though I believe myself the first who has ever compiled and made known such a table, yet I hope it may not stop here, but be added to, till it shall become a manual with every grape-grower, as it almost necessarily must with every successful originator.

"In this table you will find the common and botanical name, origin, growth, hardiness North and South, readiness with which the cuttings root, time of leaving out, blooming, kind of stamens, diseases affecting, and description of fruit, with time of ripening of a large number of different varieties of our American species of grapes, and some foreigners. So you will find, when you come to study this table in the society's printed report, that I have treated upon our grapes at a far greater extent than it is proper to read here, though in the conciseness of tabulation.

"Effects of Crossing and Hybridizing further considered.

"This is a subject within itself worthy of a book. Permit me to present a few facts more, and I am done.

"1. In growing thousands of seedlings, the hybrids have almost invariably shown greater vigour the first two or three years than pure-bloods.

"2. Many of the hybrids sicken and remain puny, much more so than pure-bloods.

"3. Some of the hybrids continue permanently very vigorous. Well-known examples of permanently vigorous hybrids are found in Warren (the original vine still standing in Warren County, Georgia, hale and bright, with a circumference of over thirty-three inches near the ground), Herbemont, Louisiana, Taylor, Elvira, a few of Rogers's hybrids, with some other *labrusca* and *vinifera* hybrids; Norton's Virginia is a remarkable instance, Jaeger's *æstivalis* and *rupestria* hybrid 'No. 70,' and many more of purely American parentage.

"4. Many of the pure-bloods, weak or slow at first, become permanently vigorous, especially so if crossed with other varieties of same species.

"5. Seedlings of varieties having reflexed stamens, and which were chiefly crosses or hybrids through this circumstance, are generally very vigorous, and remain so."

By reference to Munson's table, the Government will see what vines strike from cuttings and what would require to be imported as rooted vines. I am informed that Messrs. Bush and Son and Meissner are the most reliable people to deal with for American vines. Their address is Bushberg, Jefferson County, Missouri. Colonel C. F. Clayton, editor of the *Wine and Grape Grower*, and Secretary of the National Viticultural Convention, of 24, Park Place, New York, will act as agent for the Government, if required, in selecting vines and supervising their shipment. Professor Hilgard, of the Agricultural College of the University of California, at Berkeley, will also assist Government, if required, in seeing that every precaution is taken with shipment to prevent the introduction of disease.

It is hardly necessary for me to dwell on the importance of the subject. Grape-culture is one of the most profitable of all pursuits; it settles a large population on the land in prosperity; it increases the national wealth; it makes a nation a producer instead of an importer of one of the largest products of human consumption; it tends to make a nation temperate in the consumption of alcohol. An acre of vines will produce from 500 to 5,000 gallons of wine, according to location, soil, age of vines, &c. The wine is worth in America from 2s. to 3s. a gallon. Figured out at that price, it will be seen that grape-culture will pay better than any other industry for which the land can be used. Land that now lies waste and idle may, in the future, be found of great value for viticultural purposes.

There can be no doubt whatever of the suitability of the American vines to our climate. We have already here, as I have said before, the Isabella vine, and it does remarkably well—nothing could possibly do better—and it has proved itself proof against the oïdium mildew. No better instance of that could be desired than is to be found in the nursery of Mr. McDonald, at Newmarket, Auckland. He has an Isabella growing there in the most luxuriant manner, and alongside of it is a Sweetwater vine (a *vinifera* or European vine) which every year is smothered with mildew; yet the Isabella is never affected, and bears heavy crops annually. But the Isabella is by no means one of the best varieties of American grapes—in fact, in America is discarded for better and finer varieties; I could only learn of one man growing the Isabella, and he did so only on a small scale, for the purpose of blending this grape with others to get a particular flavour in his wine. It is the other and better varieties we want here, and it remains for Government to introduce them, to make the necessary experiments in different localities and in various soils, to demonstrate what varieties are the most suitable, &c. I now leave the matter in the hands of your Department of Agriculture.

REPORT ON AMERICAN GRAPES.

VITICULTURE.

THE subject to which I attached the greatest importance during my visit to America was that of grape-culture, and the bulk of the very short time at my disposal was devoted to inquiries in that direction. The task I had set myself was to find out whether the grape was grown successfully in "the open" in any part of America, under climatic conditions similar to those which prevail in New Zealand. The European grape (the *Vitis vinifera*) had failed with us here altogether since the appearance of the oïdium mildew, and, though in Australia, California, and Europe that disease was successfully combated, here in New Zealand the same remedies were quite ineffectual. Why? A study of the "climatology" of the grape demonstrated the fact that in the northern part of New Zealand our rainfall and mean humidity were far in excess of those prevailing in wine countries. These influences were not only conducive to cryptogamic diseases, but the prevalence of rain in the fruiting season destroyed the efficacy of the sulphur when applied to the vines for the mildew. Could we then obtain a vine that would thrive under climatic conditions such as ours? In the Eastern States of America it was known that some native vines had the power of resisting such diseases as the Phylloxera, and were being extensively used in Europe as stocks for vineyards. Would these vines also suit our climate? Seeing the great expanse of country over which these vines grew, from the Gulf of Mexico to the Canadian lakes, it seemed only feasible that in some part of that great continent would be found a district with many climatic conditions similar to our own; and moreover, seeing that the American Isabella grape had grown here in the North for many years and resisted the attacks of the oïdium, there was absolute evidence to show that it was at least possible to get a vine that would thrive here in spite of the humidity of our atmosphere and the existence of the European mildew.

That the grape would succeed here was beyond all question, since in years gone by the vine grew luxuriantly everywhere and fruited abundantly. The questions to solve were these: In what country does the grape thrive in which the rainfall and atmospheric humidity are as great as ours, and what is the particular species or variety of that vine?

In looking at the rainfall of Georgia, South Carolina, the Virginias, &c., I saw that there the rainfall was not only as heavy as it is between Auckland and Wanganui, but, similarly, it was distributed throughout the year in such a way as to leave no actually dry season, such as is required for the ripening and maturing of the European grape. The American grapes do admirably in those States; in fact, a large area of land is there utilised for vineyards; and what is done there may be done here, once the right varieties are obtained.

I was very fortunate, on arrival in America, in being able to attend the National Viticultural Convention at Washington, at which I met most of the leading vine-growers of America, and was able to obtain from them much valuable information. I am greatly indebted to Colonel B. F. Clayton, the courteous Secretary of the Convention; to Colonel S. A. Jonas, of the Interior Department; to Professor C. V. Riley, United States Entomologist; to Mr. William Saunders, the eminent Superintendent of the Experimental Gardens of the United States Department of Agriculture; to Professor Hilgard, of the State University of California; to General S. D. Lee, President of the Mississippi University; and to many others, all of whom put themselves to considerable trouble in showing me everything of interest and in supplying information.

One of the best authorities on the American grape is Mr. Isidor Bush, of St. Louis, whom I met at Washington, and obtained from him copies of his manual on the American grape, a work which I was assured on all hands was the best and most reliable extant, and a proof of which may be found in the fact that the work has been translated in both France and Italy. From this manual I purpose making a number of extracts, as they are to the point, and will be accepted as more authoritative than anything that I could say.

En passant, it may be as well to explain that the American native grapes are not, as many people popularly suppose, "wild, sour grapes," hardly worth growing, but, on the contrary, are, so far as the cultivated and improved varieties are concerned, fully equal to the European grapes, either for dessert or for wine-making purposes. In its wild state the American grape, like other unimproved fruits, is next to worthless; but, like other fruits too, is capable of being improved with cultivation, &c. Some of the choicest varieties, such as have not yet been introduced into the colony, are fully equal, even for dessert, to the best European kinds; and, as for wine-making purposes, the claret made in Virginia from the Norton's Virginia grape took first prize at the Vienna Exposition, and the champagne made in New York State from native grapes is shutting out the French brands very rapidly. The Isabella, which is the chief variety known in this colony, is one of the fox-grapes, having a strong, muscat flavour, which unfits it for dessert purposes; but none of the better varieties have this defect.

Speaking of the meteorological influences under which the American grapes will succeed, the "Bushberg Manual," before alluded to, says,—

"No matter how excellent the soil, if there is a less average than fifty-five degrees of temperature for the growing months of April, May, and June, and a less average than sixty-five degrees for the maturing months of July, August, and September, there can be no hope of success; and where the temperature averages sixty-five degrees for the former months and seventy-five for the latter, other conditions being equal, fruit of the greatest excellence can be raised, and wine of the greatest body and finest quality can be produced.

"When there is an average rainfall of 6in. for the months of April, May, and June, and an average of 5in. for the months of July, August, and September, though other conditions were favourable, we cannot succeed in raising grapes. When the average rainfall for the first months is not more than 4in., and the average for the latter is not more than 3in., other conditions favourable, the hardy varieties can be cultivated with success. But where there is less average rainfall than 5in.

for April, May, and June, and a less average than 2in. in July, August, and September, all other conditions being favourable, fruit of the best quality can be raised, and wine of the greatest body and excellence can be made. The humidity of the atmosphere in some countries, the dryness of the air in others, will, of course, materially change the proportion of rainfall required for or injurious to the grape.

"With regard to the necessity of attention to the most advantageous climatic conditions, it is enough to remark that, where these are favourable, good crops of fruit are the rule, and that, too, even in the absence of experience in cultivation; but in unfavourable locations the application of the highest attainments in the art and science of grape-culture, so far as relates to pruning manipulations or culture and management of soil, will not insure success. Grape-culture has now reached a point from which but little further progress can be made without a close recognition of the requirements of the plant, in connection with local climatic conditions, the most important being that of freedom from heavy dews, freedom from those cryptogamic diseases—mildew and rot. The topographical configuration of a locality is of far more importance than its geographical formation. Where the atmospheric conditions are favourable, satisfactory results may be obtained even from poor soils, but in ungenial climates the very best soils will not guarantee success. . . .

"There are only a few countries where the grape will in favourable seasons grow to perfection, and there is no country in the world where all kinds of grapes would succeed. Species found in the lower latitudes will not flourish if removed further north; the natives of higher altitudes will not endure the southern heat; the Scuppernong cannot ripen north of Virginia; the Fox grape of the north will scarcely grow in the lower regions of Carolina and Georgia; a vine which produces delicious grapes in Missouri may become very inferior in the most favoured localities of New Hampshire.

"Thus the climate, the mean temperature as well as the extremes, the length of the growing season, the relative amount of rain, the ameliorating influence of lakes and large rivers, the altitude as well as the soil, have an almost incredible influence on various varieties of grapes; and a judicious choice of locations adapted to the grape, and of varieties adapted to our location, its climate and soil, is therefore of the first importance.

"No one grape is suited to all localities, neither is there any one locality which is suited to all grapes.

"Notwithstanding that over fifteen hundred varieties are cultivated in Europe, yet the number of kinds especially adapted to the different localities is very limited for each of them, and we seldom find more than three or four varieties to form the main bulk of the vineyards of the different sections, each province, county, or township even, having its own special favourites. This question of adaptability to soil and local climate is one of the greatest importance, and should be closely studied by the intelligent grape-grower, if he would make its culture a success. No existing variety, and probably none that will ever be produced, is well adapted to general cultivation in more than a limited portion of this vast country. This limitation is not determined by isothermal lines. Success or failure of a variety depends not only on degrees of heat and cold, not only on earliness or lateness of seasons, however important factors these may also be, but on numerous causes, some of which we cannot, so far, sufficiently understand and explain. We need but remember that the grapes we cultivate in the United States have originated from one or the other of several distinct species, or from crosses between some of their varieties, and that each of those native species is found growing wild in certain limited portions of our country, and not at all in others. Thus the *wild* Labrusca is a stranger to the Lower Mississippi Valley and westward. By observing what species grows in a locality, we may safely assume that cultivated varieties of the same species will thrive best in that locality or its vicinity under otherwise proper conditions. Where the native species does not exist, its cultivated varieties may for a time promise excellent success; but in many localities this promise will probably, sooner or later, end in disappointment. This has been our sad experience even with the Concord, which is generally considered the most reliable, healthy, and hardy American grape.

"On the other hand, this proposition seems to conflict with the fact that American vines of different species have been successfully transplanted even to Europe. But it would be a great mistake to believe that they would succeed in all parts of that continent. It was found, on the contrary, that there also some of our varieties which succeed well in one portion of France, for instance, entirely failed in others; and this only proves that we may find in far-off foreign lands localities which exactly correspond in soil, climate, &c., with certain localities in our own country; and, where this is the case, well and good; but where these are different the results are unsatisfactory. In evidence we quote from the report of the Commission, composed of some of the best French authorities, to the International Phylloxera Congress, in Bordeaux (October, 1882). After giving a detailed report of their observations in the principal vineyards of France where American vines have been planted, they say, 'But they [these resisting American vines] do by no means succeed equally well in all locations. The nature of the terrain and the climate must be taken into serious consideration. But was it not one of the great difficulties with the French vines to know which variety suited such or such soil or aspect? How many failures were the consequence of bad selection! It is, of course, the same with American vines, coming from widely different conditions of temperature, humidity, and altitude.'"

Mongonui, Auckland, and Napier have means of temperature within those named in the above extract as being requisite, and Taranaki, Wanganui, Wellington, and Nelson are slightly below. This, however, is neither conclusive that the former are, as a whole, suitable, nor the latter unsuitable, in that the suitability of districts cannot be defined by isothermal lines, and the data recorded at signal-stations are not always a guide to what may be the temperature of a district quite close at hand, but whose topography may influence the temperature very materially. For instance, the signal-station at Auckland is in the most exposed position, and stands on a narrow isthmus, on

either side of which is the sea. The temperature registered there cannot be accepted as a true index of what may be the maximum and minimum of heat prevailing in the great inland valleys of the north: 90° is quite an exceptional maximum for Auckland City, yet it is often registered in the warmer and more confined districts of the north. In fact, the climate of Auckland is, in many respects, greatly at variance with that further north, owing more to the topography of the country than to distance; and no doubt the same thing applies to other ports of the colony, notably to Wellington, where the local character of the weather is most marked. Most probably the climate of the district lying between the Hutt and Napier is quite different from that which prevails at Port Nicholson. The meteorological data available in the colony are of a somewhat meagre description, and it has occurred to me that it is very desirable that arrangements should be made with the Signal Office in Wellington to collect daily reports from the Telegraph Office with the weather reports, with a view of publishing yearly tables showing the rainfall of each district for each month, and the number of days in each month upon which rain falls; also the mean temperature of each month, together with the maximum and minimum heat. This information could be gathered with very little extra expense, and would be an invaluable guide to persons interested in fruit-culture, and viticulture particularly. It is very important, too, to have recorded in each district the first day on which frost appears and the last, so that the length of the season can be judged for, say, grapes. If the season is short, quite a different variety would be planted than if it were a long season. In America the Signal Office does a good work, by notifying a district of the approach of frost, and this enables the vineyardist to have fires ready to light so as to make a cloud of smoke to keep off the rays of the early morning sun. In this way the vines are guarded from all harm from late frosts.

From the topography of the country it is reasonable to suppose that the great eastern foothills of the mountain-ranges of the interior of the North Island will ultimately be found to contain the most suitable locations for vineyards in the colony, being favoured most likely with a warmer temperature and drier atmosphere than the coast districts. Napier itself has, so far as rainfall is concerned, the best climate in New Zealand for vine-culture, but is subject to late cutting frosts, consequently only a rapidly-maturing grape would answer there. In the Opotiki District we see in the successful culture of maize a sure indication that the vine would also do well there. And in the interior it is quite possible that the pumice-plains would prove a genial home to the vine. These are all matters for experiment, but tend to show the necessity of having meteorological records kept of every part of the Island. No doubt the whole country right through from the Bay of Plenty to Wanganui would furnish many favourable locations for vine-culture. The Wanganui River has been likened to the Rhine, and we know that for some time past good wine has been produced at Wanganui. It is quite the popular idea to suppose that for grape-culture it is necessary to go to the district having the warmest climate—to the far north—for instance, to Hokianga or Mongonui; but it must be remembered that the farther north one goes the heavier is the rainfall, and the extra heat hardly compensates for the excess of moisture. At Napier the rainfall is 38in., at Auckland 47in., and at Mongonui 58in.—a difference of 10in. as between Auckland and Mongonui, and of 20in. as between Mongonui and Napier. Mongonui, on the other hand, has a decided advantage over Auckland in only having 152 days upon which rain falls, against Auckland's 186; and, while the daily wind-velocity at Auckland is 331 miles, it is only 193 at Mongonui. Napier records 250; Los Angeles, Southern California, 120; Chincoteague, Virginia, 290. The number of days upon which rain falls in the Middle Atlantic States (New York, New Jersey, Pennsylvania, Maryland, Delaware, and Virginia) varies from 122 to 146, or slightly less than Mongonui; while in the Lower Lakes District (part of New York, Pennsylvania, Ohio, and Michigan) the number of days varies from 150 to 169, or more than at Mongonui. What is very important to observe in this connection is this: that throughout the Eastern States of America, where this particular vine has its native habitat, the rainfall is nearly equally distributed throughout every month of the year—there is no dry season such as is required to ripen and mature the European grape. We have no such dry season in the northern part of New Zealand; hence another cause why the *vinifera* does not succeed with us, and why we should make an effort to discover what varieties of the American stock will adapt themselves to our climate. Varieties that will suit the north will not answer in the southern districts, and consequently it will be necessary to have more than one experimental station. Napier has only 74 rainy days, and Wanganui 134, but these districts have the disadvantage of late frosts, while between Auckland and Mongonui frostless districts may be found, and in this respect we have a decided advantage over nearly the whole of the Eastern States of America, for, excepting a few frostless districts in Florida, everywhere else is subject to the terrors of King Frost. I may remark here, as showing how prejudices are sometimes unjustly made to work against new industries, that on my return from America I was informed by a gentleman that grapes would never grow here excepting under glass, "because we had no frost to insure the requisite rest for the sap of the plant." On being pressed, he also informed me that his authority was a gardener holding a public position. It is well that theories such as these should be refuted, because there is no doubt that the fruit industry generally suffers very much from the fact of the bulk of our fruit-growers placing altogether too much reliance on the wisdom of gardeners who, however practical they may be, seldom have any acquaintance with any of the sciences which underlie horticulture. To say that frost is necessary to the growth of the vine is nonsense, as shown from the fact of its doing best in the frostless districts of Spain and Portugal, and in Los Angeles, Southern California, or, nearer home, at Albury, New South Wales. No finer grapes are grown in the world than at Los Angeles, and a frost is hardly ever known there. But the manner in which the Isabella has grown here for years past should be sufficient evidence to anybody but the wildest theorist.

The climate of the Eastern States differs from ours in the matter of temperature in a marked degree. The growing season is much shorter, the day is hotter, the night is colder, and the rainfall in many districts just similar. In the Lower Lakes District the means of temperature are as follow:—

	Means.			
	Spring.	Summer.	Autumn.	Annual.
Mongonui, New Zealand	58°28	66°56	61°52	59°90
Auckland, New Zealand	57·56	66·92	61·16	59·54
Lower Lakes, United States America—				
Buffalo, New York	42·0	68·0	50·0	46·6
Oswego, New York	43·2	68·2	50·9	47·8
Rochester, New York	43·4	68·8	49·6	...
Erie, Pennsylvania	45·0	70·2	52·6	49·4
Cleveland, Ohio	45·8	70·0	51·9	49·1
Sandusky, Ohio	48·4	71·0	53·9	...
Toledo, Ohio	47·6	71·9	52·1	51·1
Detroit, Ohio	45·1	69·7	50·5	49·4

The above shows that what our climate lacks in maximum heat is compensated for by the greater length of our season. Vegetation in the vine does not begin till the average temperature reaches 50°, so that in the whole of the above districts spring has nearly passed before the buds begin to swell; yet in that district the vine is successfully cultivated.

Comparing our seasons with those of the wine districts of France, we find a great similarity in regard to temperature. The average temperatures for the seasons at Bordeaux, as given by Humboldt, are as follow: For the year, 55·50°; summer, 69·75°; autumn, 58°; warmest month, 71·75°. In Alsace, the years of fine vintages, 1811 to 1857, showed average temperatures as follow: For the year, 52°; April to September (six months), 63°; June to August, 69°; May, from 58° to 66°; September, 59° to 65°; maximum heat, 92° to 94°. (These temperatures approximate very closely to those of North Auckland.) In the Burgundy district (Côte d'Or), the average maximum temperature for the seasons between blooming and vintage for the years 1838 to 1844 varied between 69° and 76°. The year of finest vintage showed an average maximum, for the season of one hundred days, of 72°.

Below I attach tables supplied by the Signal Office at Washington, and which will be of value for future reference.

MAXIMUM and MINIMUM TEMPERATURES and ANNUAL RANGE of TEMPERATURE (in Degrees Fahrenheit) at Stations of the Signal Service, United States Army, July, 1883, to June, 1884, inclusive.

[Obtained from self-registering thermometer.]

Stations.	1883.												1884.												Annual Range.
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
Albany, New York ..	94	53·8	87·5	49·3	80	41·7	77	32·6	67·5	22	55	— 8·5	50	— 4	50·6	8·6	55·7	10	71·2	30	85·2	38·8	91·5	50·7	102·5
Atlanta, Georgia	95	63·5	91·2	60	90	52	86	44	76·5	20	65	21·8	64	— 1·3	73	11	76·5	24·5	82·3	35	85	55	89	57	96·3
Atlantic City, New Jersey	94	57	91	55	80	45	75	39·8	63	18·7	57·6	11	50	4	54·6	11	60·2	8	67	29·5	78·1	41	87·2	49	90
Augusta, Georgia ..	100	71·7	96	63	94·5	55·5	92	49	82·5	28	74	28·8	68	14	78	24	82	27·5	87·8	40	90	54·5	92	57·5	86
Baltimore, Maryland ..	96	62	92	59	81	46	82·5	40·5	71	23	60	17	52	8	68·2	10·5	64·5	14	79·7	34	89	44·9	92·6	52·3	88
Barnegat City, New Jersey	91	59·5	86	58	77	48	74	40·3	63	24	57	11	52	7	56·8	13	63	11·3	61·9	32·3	81·2	42·4	82·8	48·1	84
Buffalo, New York ..	79·7	51·7	83·5	47	80·5	35·6	77·8	29·8	66	17·4	57·6	6	45·7	—13·5	55	— 7·4	60·9	— 2	71·8	26·2	76·9	35·8	85·1	47·9	98·6
Cape Henry, Virginia ..	96	65	92	62	85·5	59	89	48	81	26	68·7	21	68	12	74	19	76	22	79	38	92	47·1	89·8	51·4	84
Cape May, New Jersey ..	89	59	86	57	80	44·5	74	38	64	22	57	14	50·5	11	54	13	54·5	13	63·5	32	80	43	86	49	78
Cape Mendocino, California	69	45	68	46	90	46	64·5	43	72	38	71	40	61·5	36·5	68·5	28·5	63·5	36	63·1	38·3	69·5	42·1	64·9	46·6	61·5
Cedar Keys, Florida ..	92·5	69·4	96	72·2	90·3	65·5	87·5	59	80·2	43·3	75·4	30·2	68·9	25·2	77·4	37·2	78·9	42·2	84·8	50·7	90	60·5	91	62	70·8
Charleston, South Carolina	101	71	96	65	90	58	93	53	80	30	75	29·3	70	13	76	27·5	81·2	34	86·4	43·5	91·3	60·5	89·1	58·2	88
Charlotte, North Carolina	97·5	64·5	94	60·2	91·8	51	85	46	78·2	19·8	66·6	22·6	62·8	5	75	17·8	75	23	81·8	38·4	88·5	46·6	91	51·5	92·5
Chattanooga, Tennessee ..	97	62	93	60·5	91	51	83	44	76	17	66	22	62	— 1	70	11	78	22·8	84·5	34·5	89	51·6	91·5	55·4	98·0
Chincoteague, Virginia ..	92	63	90	61	82	52	83	44	72	24	63	21·5	54·3	8	58·6	18	61·2	15	72·2	34·6	84·5	46·2	88·6	50·1	84
Cincinnati, Ohio	94	60·5	91·5	58	88	46	82	39·6	74·1	18·8	64	18·8	59·7	— 9·7	66·9	6·4	71·8	13·9	80	34·7	85	43·6	93·1	58·8	103·7
Cleveland, Ohio	92	49·6	92·5	47·8	86·7	38·5	82·8	33·5	70·5	14·6	60·8	11·3	51·8	—13	64·2	— 3·5	64·8	— 1·5	75·9	27	83·8	38	84	51·1	105·5
Jacksonville, Florida ..	98	69·5	94·5	70·5	90·5	62·5	92	59	83	43	78	30·5	72·2	21	79	36·8	85·2	42·4	88·5	47·2	90·7	62·3	91·6	61·7	77
Keokuk, Iowa	95·5	56	90	55	86·5	39	84	32	68	12	62	2	52·5	—24·2	51·8	2	66·5	2·5	80·4	28·2	80·2	40	91	51	119·7
Key West, Florida ..	94·2	72·7	94·7	74	92	71·5	91	71	85·5	67	81	57	81	51	83	60·2	85·9	58	88·8	65·8	90·7	70·8	91·9	72·5	43·7
Kitty Hawk, N. Carolina ..	99·5	64	90·5	63·9	87·5	59	88	49·9	78·2	29	67·5	23	65	8·6	71·1	21·1	71	21·5	73	38	89	42·5	91	52	90·9
Knoxville, Tennessee ..	96	58·2	94	53·2	92	47	83·9	40·3	76·2	14·1	63·0	19	59	—16	74·3	7·5	75·7	14	86	30·7	89	45·8	92·1	53·1	112
Los Angeles, California ..	90	52·5	98	50	103·5	53	83	43·5	84	42	80	37	78	33·7	81	38·5	72·5	37	80	41·5	79	47	98	49·5	69·8
Louisville, Kentucky ..	95	61	94	58	92	44	85·9	41	75	16·3	67·5	15	62·5	—19·5	70	8·8	75	13·5	83·1	37·1	89	46	95·2	58·3	114·7
Lynchburg, Virginia ..	96·6	58·2	95	56	86·6	46	83	41·8	75·8	19	66	22·5	52	1·8	69	11·2	72	16	83·2	33·3	90·6	45	91·5	50·5	94·8
Mackinaw City, Michigan	80·2	46·8	83·2	42·8	74·2	34	69·1	24	59·8	8·4	51·5	3·3	39·8	—15·9	39	—16·6	52·2	—20·2	66·1	19·1	73	33	81·4	43·5	103·4
Macon, Fort, N. Carolina ..	89·5	70·5	91	63	85	62	80	49·5	71	30·3	64·5	27	60·5	8·5	66·2	24·3	70·7	25·6	74·3	40·7	79·2	53·4	83·4	55·1	82·5
Maricopa, Arizona ..	..	..	..	..	..	..	..	..	85	31	71	29	70	30	81	26	74	35	93	39	104	49	114	55	..
Marquette, Michigan ..	94	40·3	88	34·7	82	28	66	24	56·8	1	53	—12	44·5	—19	38·8	—20	56	—16	69	17·9	72·5	31·2	91	37·4	114
McDowell, Fort, Arizona ..	..	..	..	..	..	..	..	..	..	..	75·7	28·7	76	22·5	85·3	23·7	79·8	36·5	92·6	37·5	102·2	43·5	113	50	..
Memphis, Tennessee ..	97	64	94	61·5	92	51	88	44	77·3	20	72	22·5	71	— 2	72·7	18·5	75	26·8	83	40·5	86·8	54	96	59	99
Milwaukee, Wisconsin ..	90	50	88	51	83	39	78	31	60·5	5	55·5	— 7	45·1	—24·3	45	—13·3	58·1	— 8·5	78·8	27·8	79·4	35·1	84·5	44·3	114·3
Mobile, Alabama ..	101	71	99·4	68	94·5	57	91	46·3	80·5	33·4	74·0	28·5	67	13·9	75·5	28·9	83·9	37	85·9	43	92·7	58·7	96	61·7	87·1
Montgomery, Alabama ..	98·6	69·2	96·6	65	96	53	95	43·3	82·3	29	72·5	26·9	70·5	8	80·9	22	82·8	32	85·3	42·6	93·1	59·4	94·1	59·8	90·6
New Haven, Connecticut ..	91	52	85	48	79	38	79	28	62·8	17·5	52·4	— 6	50·4	4·2	52·8	0·7	58·2	0·8	66·1	29·2	85	32	92	41·4	98
New London, Connecticut	89	53	84	49	78	41	70·2	27·2	63·2	17	56	— 7·5	51·5	6	51·5	3	60	4	67	29	83	34·7	87·5	43	96·5
New Orleans, Louisiana ..	94·1	74·5	92·5	73·9	90·5	63	88·7	49·8	81	36·8	76	37	72	22·5	77·1	32·7	80·5	40·9	82	50	86·2	61·7	90·9	68·5	71·6
New River Inlet, N. Carolina	94	66	..	..	93	58	88	48	77·2	24	71·3	19·5	66·5	4	71	23	75	23·1	88·9	39	86·1	46·1	88·2	46·2	..
New York City	90·5	58	87	59	81	46·5	81	36	68	8	54	4	47	7·8	61	2	63	5	73·5	32·1	84·7	42·4	92	49·1	90
Norfolk, Virginia ..	98·2	64·5	94·5	61·6	85	55·3	86·6	47·1	79·2	27·5	68·9	24	67	10·2	72	22·8	75	23·3	78·5	40·9	91·1	47·8	92·5	53	88
Oswego, New York ..	92	52	97·5	52·3	81	40·2	83	31·8	70	19·8	58	— 6	45·8	— 3·6	51·5	6·8	56	7·5	78	29·2	83	37	90·2	49·3	103·5
Pensacola, Florida ..	93·3	72·4	92·5	69·5	92·4	59·7	88·5	48·7	80	35·5	74·2	28·8	71·3	16·3	74·3	29	82·7	37·5	83	44·7	86·9	60·3	91·6	64·1	77
Philadelphia, Pennsylvania	94	56	90	57·5	82·5	44·8	81·5	37·5	72·8	25	57·3	10	55	10	65	10·5	66	12	74	33	88	41·5	94·8	47·2	84·8
Rochester, New York ..	..	..	..	..	..	..	79	27	69	16·5	55·5	— 4·5	47	—10·5	53·5	— 6	56·8	— 2	75·5	27·8	82·6	33·3	86·1	46·6	..
Roseburg, Oregon ..	93	46·4	86·4	45·2	86·2	39·4	65·2	32	58·8	27·4	57·3	28·5	63·3	25	68	3·3	67·3	28·2	78	35·2	88·2	35	84·3	42·7	89·7
Sacramento, California ..	103·5	56	100	54·8	101	52·9	81	42·2	71	29	67	24	61	31	71	21	70·5	39	74·2	40	85	50·5	92	52·9	82·5
Saint Louis, Missouri ..	96·5	59	97	58·2	92	43·3	86	34·6	72·2	17·5	71·5	8·5	67	—21·5	63·5	7·1	69	10	83·3	34·1	86	44	95	52·5	118·5
San Diego, California ..	80	59	84	59·9	101	59	80·5	47·8	82·2	43	78·2	42	77·5	38·7	79	37·8	67·9	43	68·8	44·8	72·3	47	81	50	63·2
Sandusky, Ohio	..	..	91·8	55·3	83·5	45	85	38	69·5	15·2	57	14	52	—10·7	62	— 2·8	64·5	6	72·9	30·1	86·9	42	88	53·2	..
Sandy Hook, New Jersey ..	95	59	91	61	83	49	77	39	67	22	57	5·5	50	8	62·5	6	63·6	6·9	67	34	86	45	91·2	51·3	89·5
Sanford, Florida	99·4	70	96·9	69	91	66·5	91·8	62	82·3	50·5	80·5	36	81·5	28·5	83·5	40·4	88·5	43	91·5	49	94·7	63·2	94·8	62·6	70·9
San Francisco, California ..	80	50·5	82	52	91	53	74·5	48	67	43·5	62	39·5	58·5	43	71	35	68·5	45	68·5	45	80	49	71	52·5	56

TABLE showing the AVERAGE NUMBER of DAYS on which ·01in. or more PRECIPITATION fell at the below-named STATIONS of the SIGNAL SERVICE, UNITED STATES ARMY, for each MONTH and the YEAR.

[Compiled from the commencement of observations at each Station to and including December, 1885.]

Districts and Stations.	Stations established	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
MIDDLE ATLANTIC STATES.														
Albany, New York	Dec. 22, 1873	14	12	14	12	12	13	12	10	10	10	12	14	146
New York City	Nov. 1, 1870	12	11	12	11	10	11	11	10	9	10	10	11	128
Philadelphia, Pennsylvania	Jan. 1, 1871	12	11	12	11	10	10	11	11	9	8	10	10	125
Atlantic City, New Jersey	Dec. 10, 1873	14	11	14	12	10	9	10	10	7	10	11	11	129
Barnegat City, New Jersey	Dec. 10, 1873	14	13	14	12	11	10	12	11	9	11	12	12	140
Cape May, New Jersey*	May 24, 1871	13	11	12	12	10	10	10	10	8	8	10	11	127
Sandy Hook, New Jersey	Dec. 10, 1873	13	12	13	12	11	10	12	9	8	10	10	11	135
Delaware Breakwater, Delaware†	Jan. 28, 1880	15	12	14	12	8	9	10	8	5	8	10	11	125
Baltimore, Maryland	Jan. 1, 1871	12	11	13	11	11	10	12	13	9	10	10	11	133
Washington City	Nov. 1, 1870	12	10	12	11	10	11	11	12	8	8	10	11	125
Cape Henry, Virginia	Dec. 15, 1873	12	10	13	12	12	10	10	10	8	8	10	10	126
Chincoteague, Virginia	Mar. 16, 1880	17	13	14	12	11	10	11	10	6	9	11	10	131
Lynchburg, Virginia	May 24, 1871	12	10	11	11	10	12	11	11	8	7	9	10	122
Norfolk, Virginia	Jan. 1, 1871	13	11	12	11	11	10	12	12	9	8	10	11	129
SOUTH ATLANTIC STATES.														
Charlotte, North Carolina	Oct. 6, 1878	15	11	12	11	11	12	12	10	7	8	10	12	131
Hatteras, North Carolina	Dec. 1, 1880	17	11	14	12	10	11	11	13	8	9	10	12	136
Kitty Hawk, North Carolina	Jan. 15, 1875	15	11	14	12	10	10	11	13	8	9	11	11	135
Macon Fort, North Carolina	May 23, 1878	16	11	13	11	10	12	11	12	8	9	10	13	137
Smithville, North Carolina	Oct. 15, 1875	13	10	10	10	8	9	10	12	10	9	9	10	120
Wilmington, North Carolina	Jan. 1, 1871	12	11	12	10	10	11	12	8	10	8	8	11	129
Charleston, South Carolina	Jan. 5, 1871	11	10	10	8	8	10	11	13	11	8	8	10	117
Augusta, Georgia	Nov. 2, 1870	12	10	11	9	9	11	11	12	8	7	10	10	121
Sarannah, Georgia	Jan. 1, 1871	10	9	9	10	9	13	12	13	11	8	7	9	119
Jacksonville, Florida	Sept. 11, 1871	9	10	7	7	9	13	13	14	14	10	8	7	121
FLORIDA PENINSULA.														
Cedar Keys, Florida	Nov. 7, 1879	10	6	7	6	7	12	13	13	7	7	6	7	102
Key West, Florida	Nov. 1, 1870	8	8	5	5	10	11	14	15	17	13	9	8	122
Sanford, Florida	Sept. 1, 1882	11	10	10	7	10	20	16	19	17	11	8	7	147
OHIO VALLEY AND TENNESSEE.														
Chattanooga, Tennessee	Jan. 8, 1879	18	13	14	11	10	12	13	12	9	9	9	12	138
Knoxville, Tennessee	Jan. 1, 1871	14	12	13	12	12	13	12	11	8	8	10	13	137
Memphis, Tennessee	Feb. 28, 1871	13	11	13	11	10	10	9	8	7	8	10	11	122
Nashville, Tennessee	Nov. 1, 1870	13	11	12	11	10	12	11	8	8	7	10	12	128
Louisville, Kentucky	Sept. 11, 1871	13	10	12	12	10	12	10	9	8	9	10	12	128
Greencastle, Indiana	July 23, 1864	14	10	13	15	12	10	10	10	10	10	11	16	142
Indianopolis, Indiana	Feb. 10, 1871	12	11	14	12	12	13	11	10	8	10	11	14	139
Cincinnati, Ohio	Nov. 1, 1870	14	12	13	13	11	12	12	10	9	10	11	14	142
Columbus, Ohio	July 1, 1878	16	13	15	13	13	12	11	12	10	11	11	16	153
Pittsburg, Pennsylvania	Nov. 1, 1870	16	14	16	13	12	12	13	9	10	10	12	15	153
LOWER LAKES.														
Buffalo, New York	Nov. 1, 1870	18	15	17	12	12	12	11	10	11	14	16	18	169
Oswego, New York	Nov. 1, 1870	16	14	15	12	12	11	10	8	10	14	17	17	148
Rochester, New York	Nov. 1, 1870	20	16	17	13	12	12	12	10	11	14	16	19	172
Erie, Pennsylvania	May 25, 1873	19	16	18	13	12	12	11	10	12	15	17	12	177
Cleveland, Ohio	Nov. 1, 1870	16	14	16	13	13	12	12	10	12	13	15	17	163
Sandusky, Ohio	Aug. 2, 1877	14	14	14	13	12	13	11	10	10	12	14	17	156
Toledo, Ohio	Nov. 1, 1870	13	11	13	12	11	11	10	10	9	11	12	15	136
Detroit, Michigan	Nov. 1, 1870	14	14	14	10	13	11	11	11	10	11	14	16	150
UPPER MISSISSIPI VALLEY.														
Saint Paul, Minnesota	Nov. 1, 1870	9	8	10	10	11	13	11	10	10	9	9	11	122
La Crosse, Wisconsin	Oct. 15, 1872	11	9	10	10	12	12	11	10	11	10	9	10	126
Davenport, Iowa	May 24, 1871	10	8	9	10	11	13	9	9	8	9	9	10	118
Des Moines, Iowa	Aug. 1, 1878	11	10	9	12	12	15	11	10	10	10	8	11	129
Dubuque, Iowa	July 10, 1873	10	9	10	11	12	13	10	9	10	10	9	11	125
Keokuk, Iowa	July 16, 1871	8	8	10	9	11	13	9	7	8	8	7	10	111
Cairo, Illinois	June 1, 1871	12	10	11	10	11	12	9	7	7	8	10	11	120
Springfield, Illinois	July 1, 1879	12	11	12	12	13	14	9	8	8	11	9	11	131
Saint Louis, Missouri	Nov. 1, 1870	9	9	11	10	12	12	10	8	6	8	9	11	156

* Station closed 31st October, 1885. † Station closed 1st March, 1885.

TABLE showing the average PRECIPITATION in Inches and Hundredths, for each STATE and TERRITORY, compiled from Thirteen Years' Records on file at the Office of the CHIEF SIGNAL OFFICER of the ARMY.

States and Territories.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Alabama	4·35	5·28	7·35	6·29	4·22	4·69	5·38	5·59	4·44	3·34	4·35	5·24	60·52
Arkansas	4·96	9·01	5·41	4·07	7·95	3·74	3·27	4·38	2·57	3·46	5·86	2·55	57·23
California	3·14	3·41	2·12	2·29	0·45	0·09	0·09	0·10	0·11	0·71	1·54	3·41	17·46
Connecticut	4·09	3·70	5·41	4·22	3·35	3·34	4·46	5·64	3·94	3·84	4·36	3·26	49·61
Delaware	4·28	2·68	4·39	2·24	2·20	2·84	3·16	5·22	3·54	2·75	3·11	3·30	39·71
District of Columbia ..	3·16	2·66	4·11	2·99	3·02	3·87	4·03	5·11	4·43	3·03	2·97	2·92	42·30
Florida	3·37	3·42	2·38	2·70	3·68	4·93	6·78	9·14	7·23	5·10	3·00	2·99	54·72
Georgia	4·33	4·66	5·86	4·88	3·07	4·67	4·55	5·69	4·48	3·10	4·04	4·66	53·99
Illinois	2·51	4·43	4·05	3·38	5·13	5·72	2·81	2·92	2·97	3·73	3·74	3·15	44·54
Indiana	3·16	3·14	3·94	3·91	3·97	4·93	4·66	3·28	2·75	3·24	3·32	3·27	43·57
Iowa	1·46	1·40	2·24	2·98	4·49	6·56	4·39	3·54	3·84	3·39	2·44	1·72	38·45
Kansas	0·83	0·97	1·62	2·45	4·53	3·90	4·00	3·15	2·18	2·02	1·66	1·23	28·54
Kentucky	4·71	4·55	4·91	5·04	3·64	4·41	4·78	3·53	3·12	3·00	3·84	4·10	49·63
Louisiana	4·49	4·91	4·20	5·70	4·59	3·58	7·92	6·28	5·47	3·96	4·23	5·58	60·91
Maine	3·21	3·33	4·52	3·19	3·51	4·00	3·88	3·39	3·56	4·06	4·28	3·10	44·03
Maryland	3·04	2·89	3·95	3·24	2·95	3·59	4·14	4·60	4·41	2·98	3·18	3·13	42·10
Massachusetts ..	3·61	3·69	5·36	4·33	3·18	3·64	3·84	3·93	3·14	3·63	5·62	3·42	47·39
Michigan	1·80	1·84	2·57	2·11	3·52	4·20	3·30	3·58	3·91	3·69	2·70	2·12	35·34
Mississippi	4·68	5·50	6·99	6·88	4·76	3·98	4·02	3·60	3·78	3·16	4·70	4·92	56·97
Missouri	1·27	1·67	1·91	2·23	4·07	3·56	3·74	2·75	1·95	1·82	1·70	1·42	28·09
New Hampshire ..	2·63	1·88	2·50	2·32	2·62	3·33	3·66	3·47	3·22	3·45	2·90	2·17	34·15
New Jersey	4·20	3·31	5·19	3·85	2·99	3·76	3·72	5·43	4·71	2·98	4·14	4·09	48·37
New York	3·10	2·67	3·46	2·68	2·76	3·38	3·87	3·27	3·15	3·45	3·21	3·19	38·19
North Carolina	4·74	4·01	5·38	4·50	3·11	4·08	6·36	6·85	5·88	5·32	4·30	5·08	59·61
Ohio	2·79	2·73	3·36	2·83	3·33	4·53	4·10	4·07	2·88	3·03	3·26	3·24	40·15
Pennsylvania	3·15	2·60	3·27	2·75	3·86	3·73	4·23	3·84	3·61	3·28	3·52	2·93	39·77
Rhode Island	4·77	5·82	6·10	4·09	4·13	5·59	3·14	3·27	3·84	4·21	4·88	4·20	54·04
South Carolina	4·08	3·98	5·27	4·82	3·76	4·67	5·85	6·13	5·48	3·80	4·02	3·94	55·80
Tennessee	6·24	5·23	5·81	5·91	3·84	4·33	4·06	3·91	3·47	3·16	4·52	4·50	54·98
Vermont	2·36	1·77	2·28	2·32	2·62	3·46	4·12	3·33	3·47	3·16	2·29	2·08	33·26
Virginia	3·47	3·16	4·11	3·46	3·18	3·73	4·30	5·31	4·34	3·31	3·44	3·31	45·12
West Virginia	4·71	3·83	4·84	4·02	2·90	4·69	5·47	4·48	3·79	2·94	3·79	4·09	49·55

Signal Office, War Department,
Washington, 18th September, 1884.

TABLE showing the MEAN TEMPERATURE of each STATE and TERRITORY for each Month and the Year, compiled from Thirteen Years' Records on file at the Office of the CHIEF SIGNAL OFFICER of the ARMY.

States and Territories.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Alabama	50·3	53·4	59·1	65·7	73·9	80·3	82·3	80·5	75·8	66·4	56·3	50·1	66·2
Arkansas	45·4	49·2	54·6	63·5	71·0	78·6	80·3	78·4	71·6	65·2	50·4	45·5	62·8
California	47·9	50·7	53·6	57·1	61·6	67·1	70·7	70·7	67·4	60·6	53·6	49·6	59·2
Connecticut	28·5	29·7	35·8	45·3	57·3	66·6	72·2	70·4	63·9	54·0	40·6	31·4	49·6
Delaware	33·6	36·7	40·9	48·3	59·2	68·3	73·5	72·9	69·4	60·2	46·5	37·2	53·9
District of Columbia ..	33·5	36·0	42·3	52·8	64·4	73·6	78·2	75·0	67·8	57·9	43·8	35·4	55·1
Florida	61·5	62·6	66·6	71·4	77·0	81·3	82·2	81·5	79·3	73·6	65·7	60·7	72·0
Georgia	48·7	50·8	56·9	63·9	71·8	78·6	81·2	78·6	73·9	64·6	54·0	47·9	64·2
Illinois	29·8	34·8	40·4	51·4	63·2	70·6	75·7	74·9	66·6	56·0	40·2	32·0	53·0
Indiana	30·8	34·1	40·3	51·3	63·1	71·2	76·2	74·5	66·0	55·4	41·0	32·9	53·1
Iowa	23·3	28·4	35·8	49·0	62 6	70·5	75·4	74·3	64·2	53·2	36·6	26·4	50·0
Kansas	27·2	34·0	41·6	53·2	64·6	73·8	77·7	76·3	67·2	55·6	38·8	30·8	53·4
Kentucky	37·5	41·1	47·3	57·6	68·7	76·2	79·9	77·8	69·6	59·2	46·0	39·2	58·3
Louisiana	54·3	57·1	63·1	68·1	74·7	81·0	82·3	81·7	77·3	70·6	60·0	54·2	68·7
Maine	21·7	24·3	31·0	40·3	51·1	59·3	65·1	64·3	58·2	49·0	36·4	27·4	44·0
Maryland	34·8	37·0	42·4	53·0	64·6	74·0	78·7	75·5	68·0	57·7	44·9	36·8	55·6
Massachusetts ..	27·8	29·3	35·3	44·2	55·5	64·6	70·2	68 8	62·5	53·0	40·8	31·8	48·6
Michigan	21·2	22·5	27·9	39·6	52·9	62·3	68·2	67·3	59·1	47·8	33·5	24·8	43·9
Mississippi	49·0	52·5	58·6	65·1	73·5	79·9	82·2	80·4	74·9	65·5	54·6	49·2	65·4
Missouri	30·2	35·6	42·9	54·1	65·1	74·1	78·2	76·5	67·6	56·5	40·0	32·5	54·4
New Hampshire ..	22·3	25·1	31·5	42·1	56·2	64·1	70·2	68·5	61·9	50·2	36·7	27·7	46·4
New Jersey	32·3	33·2	38·7	46·5	57·8	67·5	73·2	72·6	67·3	57·4	44·5	35·5	52·2
New York	26·0	26·7	33·0	43·9	56·9	66·3	71·6	70·5	63·1	52·1	38·4	29·6	48·2
North Carolina	44·8	46·7	51·9	58·2	67·5	75·7	79·6	78·0	73·7	65·1	53·2	45·3	61·6
Ohio	30·4	32·6	38·7	49·1	61·8	70·0	74·9	72·9	65·5	55·3	40·7	32·3	52·0
Pennsylvania	30·1	32·5	38·1	47·4	59·4	69·7	73·8	71·9	65·1	55·0	40·8	32·7	51·4
Rhode Island	30·6	32·4	37·1	43·6	52·7	63·0	69·7	69·6	64·6	55·4	43·4	35·0	49·8
South Carolina	48·5	51·2	57·2	64·2	72·6	79·5	82·4	80·2	75·5	65·4	55·2	48·8	65·1
Tennessee	41·0	43·9	50·6	59·5	69·2	76·2	79·2	77·3	69·8	60·6	47·9	41·2	59·7
Vermont	22·2	24·5	31·5	42·9	58·4	66·1	71·6	69·9	63·1	50·5	37·0	27·0	47·1
Virginia	37·3	39·6	45·5	55·1	65·8	74·6	78·9	76·0	69·1	59·0	46·2	38·6	57·1
West Virginia	36·5	38·4	43·9	53·2	64·0	71·5	75·0	72·4	65·7	55·6	43·9	37·6	54·8

INSECT-PESTS AND HOW TO SUPPRESS THEM.

One of the greatest difficulties besetting the fruit industry is the spread of insect-pests. Some people think this nuisance should be suppressed by Act of Parliament; but that is impossible. The most the State can do is to frame laws that will check the nuisance as far as possible. With scab in sheep, the State successfully eradicated it; but the insect-pests of trees are not so easily got at. If it were merely a question of dealing with orchards the difficulty might be grasped and crushed; but the plant-food of these insects is everywhere—in the garden, the conservatory, the forest, and every hedge of our highways. To make a hard-and-fast law, giving any one power to destroy any shrub or tree or hedge upon which a pest had settled if it were not eradicated, would be altogether too arbitrary and too unpopular. The better way, it appears to me, would be for the Government to appoint Boards of Horticultural Commissioners where required, with powers similar to those possessed by such bodies in California, and the responsibility of suppressing the insect-pests should be left in the hands of such Boards. These Boards, of course, would be composed of practical fruit-growers, whose interest it would be to suppress the insect nuisance as a measure of mutual protection, and who, in doing so, would never dare resort to too harsh measures, lest they pickle a rod which subsequently would be applied to themselves. The Government could depend on such Boards doing all that is possible to minimise the losses caused by tree pests. The best feature that I see in the Californian law is the one giving the Board power to "quarantine" a district. The effect of this law is to force every one to keep his orchard clean, otherwise the whole district may be quarantined; consequently it behoves every one not only to see that his own orchard is clean, but that of his neighbours also, as the whole district may suffer for the one neglectful orchardist. It is this principle that makes every district alive to suppressing the pests, and it relieves the Government of all trouble and responsibility. It forces every district from self-interest to regulate and manage this matter without outside aid. For instance, while in California I noticed a district in the south was sending into Los Angeles fruit badly affected with scab and codlin-moth. The local Board immediately "shut down" on the infected district, declaring it quarantined, and no more fruit could be sent out till the Inspector of Fruit-pests gave a clean bill of health. This principle is undoubtedly the chief one to be relied on in framing a workable Act to regulate fruit interests. At the present time, the *Icerya purchasi*, or white-cottony scale, is very bad in and around Auckland, in fact is in many of the nurseries, but it has never yet spread into any northern district so far as I am aware; and, if such a law as the one indicated were in force here, the northern fruit-districts could protect themselves by quarantining Auckland, and forcing the nurseries to clean up and disinfect all stock before shipment. No doubt the insect-pests are chiefly spread through the country from the nurseries, where far less care is taken to guard against the spreading of pests than should be the case. Nurserymen are not wholly to blame, for under present circumstances they have no protection, in that their neighbours may have orchards which are simply breeding-beds for every kind of insect. Such is the case in Auckland, and nurserymen would be powerless to keep their trees clean unless their neighbours were forced to do likewise. The sending of old fruit-boxes into the country is undoubtedly the chief means of spreading disease. I heard of a case in Auckland in which a fruiterer makes a trade of buying up all the fruit-boxes he can obtain and stores them for the next season, when he sends them into the country far and wide. These boxes had come from Sydney and Hobart Town, and were sure to spread the codlin-moth and scale-insects wherever they went. Such boxes should have been dipped in boiling water before being sent out. But the fruit-grower who bothers with return fruit-boxes richly deserves to suffer from insect-pests. There is no economy in it, for, at the prices boxes are now supplied by the Auckland mills, fruit-growers can depend upon so much better prices for fruit put up in new, clean boxes than old, dirty ones. Another way in which insect-pests may be thoughtlessly spread about the country is by the propagation of clumps of trees which furnish the chief plant-food of particular insects. For instance, wherever the Australian acacia or wattle is planted, the *Icerya purchasi* follows sooner or later. Of course no one bothers to wash wattle-trees; consequently the scale increases unchecked, and is spread by the wind and birds in every direction. To my mind, such plantations should only be made in isolated districts, and never in proximity to a great fruit-district. The planting of wattle at the Agricultural School reserve at Whangarei I cannot help thinking a mistake, for Whangarei is the largest fruit-district in the north, and is so far free from the cottony-scale.

Probably the reason why insect-pests have got such a hold in this country is the general want of information on the subject. The ignorance there exists is simply inexplicable. The Auckland papers from time to time have devoted considerable space to describing the various insects, their habits and life-histories, and have also given illustrations of them; yet the people seem to know nothing about them, and it is quite evident that some other means must be adopted for bringing home to the minds of fruit-growers a knowledge of economic entomology. The best way of doing this, to my mind, would be for some competent person to be appointed to give a series of illustrated lectures on the subject in the different fruit centres. This is done with marked success in America, and here it might be done by the Inspector of Fruit-Insects, an officer whom the Government will have to appoint sooner or later if they intend grappling with this subject in a practical manner. (I am sending with this report some stereopticon slides obtained in New York, showing how pictures are photographed on to glass for illustrating lectures; the same system I should recommend for illustrating lectures on fruit-insects.)

I would point out that some more stringent measures than those in force now should be taken to prohibit the landing of infected fruit. Much of the fruit sent down from Sydney to this colony is badly infected, the oranges particularly. It is the custom in Auckland, I have noticed, for the fruiterers to pick out all the inferior Sydney oranges and pack them off to the country districts. These oranges are small, and covered with scale-insects (the red scale of Australia, as troublesome an insect as any to eradicate), and the pests are sure to spread. If a few cargoes were sent back to Sydney the exporters would learn to send only clean fruit. The San Francisco fruit-shippers

learnt that lesson, and are now sending into Auckland clean fruit. Some of the Island fruit is also infected. But these are all matters that could best be dealt with by a Board of Horticulture, and I feel sure there is no way that would be more popular and effective than for the Government to hand the whole business over to such a Board, having the necessary power to give effect to its decisions.

Briefly, what I would recommend would be this: The Government to appoint Boards of Horticulture for each provincial district (where required, say Auckland and Nelson), with a paid Inspector of Fruit-pests under each Board; the Inspector to also act as lecturer when travelling through the larger fruit-centres. The Board should have the power to appoint County Boards of Supervisors where required, and these County Boards could appoint two of their number as orchard-viewers, having the power to call upon an orchardist to wash his trees, if infected, within a given time, and, failing his doing so, to do it themselves at his expense. This would be an effective way of dealing with the insect-pests, and would have the recommendation of only costing Government the salaries of the Inspectors of Fruit-pests, whose duties it would be to go up and down the country inspecting orchards, giving advice, and doing everything possible to minimise the evil effects of the pests, and ridding the country of them as far as possible.

Lest, in my anxiety to draw serious attention to this question of fruit-pests, I should give any one the impression that such pests are worse here than elsewhere, I must state emphatically that in America things are infinitely worse. With the aid of the information which such entomologists as Mr. Maskell, of Wellington, and some of the professors of our university colleges, who are at present studying the life-histories of many insects, can give, and the assistance of Government, we may reasonably hope to get the pests within measurable bounds before very long.

Herewith I attach copies of the laws in force in California:—

AN ACT to create and establish a State Board of Horticulture, and appropriate Money for the Expenses thereof.

Sec. 1. There shall be a State Board of Horticulture, consisting of nine members, who shall be appointed by the Governor: two from the State at large, and one from each of the seven horticultural districts, which are hereby constituted as follows:—

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Sec. 2. The members appointed from each district shall be residents of the district from which they are appointed, and shall be specially qualified by practical experience and study in connection with the industries dependent upon horticulture. They shall each hold office for the term of four years, except that, of the nine first appointed, four, to be determined by lot, shall retire at the end of two years, when their successors shall be appointed by the Governor.

Sec. 3. The Board shall appoint and prescribe the duties of a secretary, who shall not be one of their number, and elect of their own number a treasurer, both to hold office during the pleasure of the said Board. The treasurer shall give a bond to the State, with sureties approved by the said Board, in the sum of ten thousand dollars, for the faithful discharge of his duties.

Sec. 4. The Board may receive, manage, use, and hold donations and bequests for promoting the objects of its formation. It shall meet semiannually, and as much oftener, and at such places, as it may deem expedient, to consult and adopt such measures as may best promote the horticultural industries of the State. It may, but without expense to the State, select and appoint competent and qualified persons to lecture in each of the horticultural districts named in section one of this Act, for the purpose of illustrating practical horticultural topics, and imparting instruction in the methods of culture, pruning, fertilising, and also in the best methods of treating the diseases of fruit and fruit-trees, cleansing orchards, and exterminating insect-pests. The office of the Board shall be kept open to the public, subject to the rules of the Board, every day, excepting the legal holidays, and shall be in charge of the secretary during the absence of the Board.

Sec. 5. For the purpose of preventing the spread of contagious disease among fruit and fruit-trees, and for the prevention, treatment, cure, and extirpation of fruit-pests and the diseases of fruit and fruit-trees, and for the disinfection of grafts, scions, orchard débris, and empty fruit-boxes and packages, and other suspected material or transportable articles, dangerous to orchards, fruit, and fruit-trees, said Board shall make regulations for the inspection and disinfection thereof, which said regulations shall be circulated in printed form by the Board among the fruit-growers and fruit-dealers of the State, shall be published at least twenty days in two daily newspapers of general circulation in the State not of the same city or county, and shall be posted in three conspicuous places in each county in the State, one of which shall be at the County Courthouse thereof. Such regulations when so posted shall be held to impart notice of their contents to all persons within this State, and shall be binding upon all persons.

Sec. 6. The said Board shall elect of their own number, or appoint from without their number, a competent person especially qualified by practical experience in horticulture for the duties of his office, who shall be known as Inspector of Fruit-pests (to hold office at the pleasure of the Board), whose duties it shall be to visit the horticultural districts of the State, to see that all regulations of said Board and provisions of law to prevent the spread of fruit-pests, and diseases of trees and plants injurious to the horticultural interests of the State, and all regulations of said Board in the nature of quarantining infected or infested districts, and also all rules and regulations of said Board concerning disinfection of fruits, trees, plants, grafts, scions, orchard débris, empty fruit-boxes and packages, and other material dangerous to orchards, fruit, and fruit-trees, are enforced. He shall also, whenever required, and under the direction of the Board, and may also upon his own motion, and upon the complaint of interested parties, inspect orchards, nurseries, and other places suspected or believed to be infested with fruit-pests, or infected with contagious disease injurious to trees, plants, or fruits, and he shall report the facts to said Board. If, upon report of said Inspector, or from well-attested facts otherwise before it, said Board shall be of the opinion that any locality,

orchard, district, or place is infested with fruit-pests, or infected with contagious disease injurious to trees, plants, or fruits, and liable to spread to other localities to the injury of other persons or places, the said Board shall, by an order entered upon its minutes, so declare said and such infested or infected district or place shall be under the quarantine regulations of said Board. As soon, however, as, in the opinion of said Inspector, the danger from such locality has ceased, he may suspend said quarantine regulations, and shall immediately report the fact to the Board, who may approve or disapprove his action. He shall from time to time, and whenever required by said Board, report to it such information as he may acquire from observation, experience, and otherwise, as to the best modes of diminishing and eradicating fruit-pests and diseases from orchards; and also suggestions in practical horticulture, the adaptation of products to soil, climate, and markets, and such other facts and information as shall be calculated to improve the horticultural interests of the State.

Sec. 7. The said Board, and, in case of necessity during the recess of the Board, the said Inspector, may appoint such quarantine guardians as may be needed to carry out the provisions of this Act, whose duties it shall be to see that the regulations of the Board and the instructions of the Inspector are enforced and carried out; they shall also report to the said Inspector or to the State Board all infractions or violations of said directions, regulations, and of the law in regard to quarantine disinfection and destruction of pests, and precautions against the spreading pests and diseases. The salary of quarantine guardians shall not exceed two dollars per day, and shall be paid by the owners of orchards and other places and localities under quarantine regulations; and they may maintain an action therefor before any Justice of the Peace in any township in which any quarantined locality is wholly or in part situated. But in no case shall they have any claim upon the State for such services.

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Sec. 9. The Inspector of Fruit-pests shall receive as compensation for his services not to exceed the sum of one hundred and fifty dollars per month, and his actual travelling expenses shall be allowed, not to exceed seven hundred and fifty dollars per annum; the other members of the said Board shall receive no compensation whatever.

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An Act to protect and promote the Horticultural Interests of the State.

Sec. 1. Whenever a petition is presented to the Board of Supervisors of any county, and signed by five or more persons who are resident freeholders or possessors of an orchard, or both, stating that certain or all orchards or nurseries, or trees of any variety, are infected with scale, bug, codlin-moth, or other insects that are destructive to trees, and praying that a commission be appointed by them, whose duty it shall be to supervise their destruction as hereinafter provided, the Board of Supervisors shall, within twenty days thereafter, select three Commissioners for the county, to be known as the County Board of Horticultural Commissioners. The Board of Supervisors may fill any vacancy that may occur in said Commission by death, resignation, or otherwise, and appoint one Commissioner each year, one month or thereabouts previous to the expiration of the term of office of any member of said Commission. The said Commissioners shall serve for a period of three years from the date of their appointment, except the Commissioners first appointed, one of whom shall serve for one year, one of whom shall serve for two years, and one of whom shall serve for three years from the date of appointment. The Commissioners first appointed shall themselves decide, by lot or otherwise, who shall serve for one year, who two years, and who three years, and shall notify the Board of Supervisors of the result of their choice.

Sec. 2. It shall be the duty of the County Board of Horticultural Commissioners in each county, whenever they shall be informed by complaint of any person residing in such county that an orchard or nursery, or trees, or any fruit-packing house, storeroom, saleroom, or any other place in their jurisdiction, is infested with scale, bug, codlin-moth, red-spider, or other noxious insects liable to spread contagion dangerous to the trees or fruit of complainant, or their eggs or larvæ injurious to the fruit or fruit-trees, they shall cause an inspection to be made of the said premises, and, if found infected, they shall notify the owner or owners, or the person or persons in charge or possession of the said trees or places as aforesaid, that the same are infected with said insects, or any of them, or their eggs or larvæ, and shall require such person or persons to disinfect the same within a certain time to be specified. If, within such specified time, such disinfection has not been accomplished, the said person or persons shall be required to make application of such treatment for the purpose of destroying them as said Commissioners shall prescribe. Said notices may be served upon the person or persons owning or having charge or possession of such infested trees or places or articles as aforesaid by any Commissioner, or by any person deputed by the said Commissioners for that purpose, or they may be served in the same manner as a summons in a civil action. If the owner or owners, or the person or persons in charge or possession of any orchard or nursery, or trees or places, or articles infested with said insects, or any of them, or their larvæ or eggs, after having been notified as above to make application of treatment as directed, shall fail, neglect, or refuse so to do, he or they shall be deemed guilty of maintaining a public nuisance, and any such orchards, nurseries, trees, or places or articles thus infested shall be adjudged, and the same is hereby declared, a public nuisance, and may be proceeded against as such. If found guilty, the Court shall direct the aforesaid County Board of Horticultural Commissioners to abate the nuisance. The expenses thus incurred shall be a lien upon the real property of the defendant.

Sec. 3. Said County Board of Horticultural Commissioners shall have power to divide the county into districts, and to appoint a local Inspector for each of said districts. The duties of such local Inspectors shall be prescribed by said County Board.

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Sec. 6. Each County Commissioner and local Inspector may be paid five dollars for each day actually engaged in the performance of his duties under this Act, payable out of the county treasury

of his county: Provided that no more shall be paid for such services than shall be determined by resolution of the Board of Supervisors of the county for services actually and necessarily rendered.

Sec. 7. Each of said Commissioners may select one or more persons, without pay, to assist him in the discharge of his duties, as he may deem necessary.

Sec. 8. If any County Board of Commissioners, after having received complaint in writing, as provided for in section two of this Act, shall fail to perform the duties of their office, as required by this Act, they may be removed from office by the Board of Supervisors, and the vacancy thus formed shall be filled in the same manner as provided for in this Act.

The Fruit-pest Law.

An Act to prevent the Spreading of Fruit and Fruit-tree Pests and Diseases, and to provide for their Extirpation. [*Approved 9th March, 1885.*]

The people of the State of California, represented in Senate and Assembly, do enact as follows:—

Sec. 1. It shall be the duty of every owner, possessor, or occupier of an orchard, nursery, or land where fruit-trees are grown within this State, to disinfect all fruit-trees grown on such lands infested with any insect or insects, or the germs thereof, or infested by any contagious disease known to be injurious to fruit or fruit-trees, before the removal of the same from such premises for sale, gift, distribution, or transportation. Fruit-boxes which have been used for shipping fruit to any destination are hereby required to be disinfected previous to their being again used for any purpose; all boxes returned to any orchard, storeroom, salesroom, or any place used or to be used for storage, shipping, or any other purpose, must be disinfected within three days after their return; and any and all persons failing to comply with the requirements of this section shall be guilty of misdemeanour. All packages known as free packages must be destroyed or disinfected before being again used.

Sec. 2. It shall be the duty of the owner, lessee, or occupier of an orchard within this State to gather all fruit infested by the insects known as the codlin-moth, peach-moth, red spider, plum-weevil, and kindred noxious insects, their larvæ or pupæ, which has fallen from the tree or trees, as often as once a week, and dispose of and destroy the same in such a manner as to effectually destroy all such insects, their larvæ or pupæ. It shall be the duty of the Inspector of Fruit-pests, or the quarantine guardian, to inspect fruit packages, and all trees and plants, cuttings, grafts, and scions, known or believed to be infested by any insect or insects, or the germs thereof, or their eggs, larvæ, or pupæ, injurious to fruit or fruit-trees, or infected with any disease liable to spread contagion, imported or brought into the State from any foreign country, or from any of the United States or territories, and, if upon inspection such fruit or fruit-packages are found to be infested or infected, it shall be a misdemeanour to offer the same for sale, gift, distribution, or transportation, unless they shall be first disinfected.

Sec. 3. Every person shipping fruit-trees, scions, cuttings, or plants from any orchard, nursery, or other place where they were grown or produced, shall place upon or securely attach to each box, package, or parcel containing such fruit-trees, scions, cuttings, or plants, a distinct mark or label, showing the name of the owner or shipper, and the locality where produced. And any person who shall cause to be shipped, transported, or removed from any locality declared by the State Board of Horticulture to be infested with fruit-tree or orchard pests, or infected with contagious diseases injurious to trees, plants, or fruits, unless the same shall have been previously disinfected, shall be guilty of a misdemeanour. Disinfection shall be to the satisfaction of the State Board of Horticulture, or the Inspector of Fruit-pests. When disinfected, the fact shall be stamped upon each box, package, or separate parcel of fruit-trees, scions, cuttings, or plants; and any person who shall cause to be shipped, transported, or removed any such box, parcel, or package from a quarantine district or locality not bearing such stamp, shall be guilty of a misdemeanour, and may be punished by fine, as provided by section six of this Act. Any person who shall falsely cause such stamp to be used, or shall imitate or counterfeit any stamp or device used for such purpose, shall be guilty of a misdemeanour.

Sec. 4. It shall be the special duty of each member of the State Board of Horticulture to see that the provisions of this Act are carried out within his respective horticultural district, and all offenders duly punished.

Sec. 5. All fruit-trees infested by any insect or insects, their germs, larvæ, or pupæ, or infected by disease known to be injurious to fruit or fruit-trees, and liable to spread contagion, must be cleaned or disinfected before the first day of April, one thousand eight hundred and eighty-five, and on or before the first day of April in every succeeding year thereafter. All owners or occupants of lands on which fruit-trees are grown failing to comply with the provisions of this section shall be guilty of a misdemeanour, and fined as provided for in section six of this Act. All fruit, packages, trees, plants, cuttings, grafts, and scions that shall not be disinfected within twenty-four hours after notice by the Inspector of Fruit-pests, or a duly-appointed quarantine guardian, or any member of the Board of Horticulture, shall be liable to be proceeded against as a public nuisance.

Sec. 6. Any person or corporation violating any of the provisions of this Act shall be deemed guilty of a misdemeanour, and shall, on conviction thereof, be punished by a fine of not less than twenty-five dollars nor more than one hundred dollars for every offence.

Approximate Cost of Paper.—Preparation nil; printing (1,475 copies), £25 3s.

By Authority: George Didsbury, Government Printer, Wellington.—1887.