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*Author of "The Dictionary of Modern Gardening," "The  
Gardener's Almanack," &c.*

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THE  
GARDENER'S  
MONTHLY VOLUME.

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THE GRAPE VINE:  
ITS CULTURE, USES, AND HISTORY.

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BY GEORGE W. JOHNSON,  
Author of "The Dictionary of Modern Gardening,"  
"Gardener's Almanack," &c.  
AND  
ROBERT ERRINGTON,  
Gardener to Sir P. Egerton, Bart., Oulton Park, Cheshire.

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# THE GRAPE VINE.

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## GREENHOUSE.

UNDER this head may be considered not only the modes of cultivating the grape vine in the same house with flowering plants, but also its cultivation in a vinery by itself, with a similar employment of heat only sufficient to exclude frost and other low temperatures at certain periods of the vine's growth. These periods are chiefly in early spring, when the occurrence of night frosts and easterly winds endanger the opening buds—and late in autumn, when cold damp weather may render a little artificial heat desirable, either to promote the ripening of the wood, or preserve from mouldiness the ripened fruit.

With regard to training, pruning, and thinning, in the greenhouse, they are fundamentally the same as in the stove (see next section), but with especial care on these points: 1. To train the vines to the rafters or otherwise, so that they shall not overshadow the interior before the end of May. 2. To empty the greenhouse of all greenhouse plants after that period,

and to take every possible pains to get the wood ripe. You cannot have grapes without well-ripened wood. If grapes are very late in growing, they will require fire-heat in autumn, in many seasons, in order to ripen their wood. Vines and greenhouse plants do not agree very well; but under such a system they may be kept from quarrelling much. (*Johnson's Dict. Mod. Gardening*, 286.)

The most successful cultivator of the grape under glass, without the employment of heat, is Mr. Crawshay, of Colney Hatch; and the outline of his practice is thus traced by Dr. Lindley:—

The grapes are grown without the aid of fire-heat, so that the expense incurred is trifling; and, instead of having rich borders of several yards in width facing the vineries, and lying in a comparatively useless state, or looking unsightly with straw, the walks are allowed to run close up to the houses, with no preparation beneath of the ordinary soil, which is of a strong loamy texture. A border properly prepared would be better, but we merely state what Mr. Crawshay has effected without that powerful auxiliary. But what is yet more at variance with the opinion of many writers is, that the laps between the squares of glass, instead of being either close to each other, or filled with putty, are so far apart that in many places the finger can be inserted between the panes. This free ventilation, and having the floor of the vinery

paved with common red flags or tiles, Mr. Crawshay considers to be most essential in growing grapes to perfection without the assistance of fire-heat. And there is no doubt that the excellence of the ventilation is most important. On entering one of his vineries with a south-west aspect, when the sun is shining full upon it, a refreshing air meets you, with the thermometer indicating a temperature of only 75 degs. The use of the paved floor is this : in the early stage of the vine's growth water is liberally thrown upon it to create vapour ; and this treatment is continued until the berries are supposed to be stoned ; after which it is gradually withheld ; and when the colouring process commences, it is altogether discontinued ; so that, by the time the grapes approach maturity, the floor becomes dry, and during the cool nights of autumn continues to give off slowly to the interior of the house the heat which it absorbs during the day. But there are other points in which Mr. Crawshay's treatment is peculiar. The stems of the vines are trained up the rafters about a yard apart. Every season the young wood is pruned back nearly close to the original stem, so that, even upon minute inspection, scarcely a bud is visible. This may be one reason why the wood is of such uniform size, not a single watery shoot being observable in any of the houses. After the pruning is completed, a free circulation of air is allowed, by means of the front sashes

and top lights, and thus the breaking of the vines is considerably retarded; in fact, it is rendered later than upon the open walls. In general the vines do not begin to push until the latter part of April, and it is only in the first week of May that the houses are closed at night. Air is then admitted less freely during the day; the vines are frequently syringed, and abundance of water is thrown down upon the floors, to keep up a constant supply of moisture in the atmosphere. When the vines are in bloom, the houses are closed earlier in the afternoon, and the syringe is of course dispensed with, but is again made use of a few times after the grapes are thinned, to wash off the remains of dead flowers and dust, as well as to assist in restoring the leaves to their proper position. Air is then given more freely during the day, in wet as well as in dry weather; for, it is the opinion of Mr. Crawshay that the spots upon the grapes, commonly called "pitting," are caused by the stagnation of the atmosphere, which is consequent upon keeping a vinery closed for several days during wet weather. As we before stated, no water is admitted into the house after the colouring process has commenced, but abundance of air is left on through the night as well as during the day. Through the whole period of their growth no fire-heat is applied; but when the grapes are perfectly ripe, and the autumn frosts commence, an Arnott's stove is used to



preserve the temperature of the house above the freezing point. Thus but a trifling expense is incurred beyond the bare attention necessary to ensure success; and the fruit so produced may, with care, be kept in perfection until February. It is fruit, too, of which every gardener might be proud. When the grapes are ripe air is admitted to the houses every morning between eight and nine o'clock: in fine weather, both in front and at the top; in rainy days, by means of the front sashes only. When a frost occurs of sufficient intensity to render the fire-heat necessary, just so much is applied as will keep the temperature of the house at 35 degs. (*Gard. Chron.* 1842, 603-739.)

Having been eye-witnesses of the great success of Mr. Crawshay's mode of vine-culture, which is of a very superior character, we may add our testimony to its complete success. One of the most striking features connected with Mr. Crawshay's system is the preference he gives to moderate-sized bunches over those of an overgrown character. This seems to be founded on the fact that small bunches, well thinned, will keep longer than very large ones. It must not, however, be inferred from this, that Mr. C.'s vines are not allowed to carry a good crop, for the reverse is the truth. At the time we saw them (1844), they were thoroughly cropped, from the bottom of the rafters to the top, scarcely a blank spot being to be

found. Instead of a large bunch from a single spur, at a given point, there were in many cases two, or even three, shoots encouraged, each carrying a bunch of from half a pound to a pound in weight; so that, instead of one spur shoot, with a branch of  $1\frac{1}{2}$  lbs., Mr. C. had two or three shoots with this amount of produce divided between them. Now this we consider a very excellent system for late grapes, as it will be found, we believe, that large branches do not possess such good keeping properties as those of moderate size; they are, moreover, more liable to shrinking or shrivelling. Another singular practice was related by Mr. Goodbrand (the gardener at that period), as being adopted by Mr. Crawhsay, viz., that when the bunches were what is technically termed "too large a show," in consequence of large shoulders, that such shoulders were systematically cut off: in fact, several of the shoulders had been recently cut away, and were lying on the floor. It must be borne in mind that Mr. C.'s aim is to produce well-ripened, late, autumn grapes, and to encourage keeping properties. To accomplish this, it is necessary to thin the berries more than usual.

Having grown very late grapes for many years, and with much success, Mr. Errington would offer as the results of his experience, that with regard to thinning the berries, it should be carried so far as that no two should touch when full swelled. Some

who have not had experience in this matter may urge that the bunches will not “dish well”—and perhaps it is true that the Hamburgs may not lay quite so full on the dish—but this is amply compensated for by the superior character and keeping properties of the berries. He wishes also to lay the utmost stress on another and important object, viz., *ripening the wood*. Unless this principle is duly carried out, all appliances will be vain. This brings us to the subject of fire-heat, as connected with greenhouse culture. In offering advice on this head, we must leave out of the question the use of fire-heat applied for the sake of pot plants, which are frequently cultivated under the vines. In such cases a compromise of course takes place ; and, we need scarcely add, some sacrifice must be endured.

It was stated, at the time Mr. Crawshay’s mode of culture so much occupied the public attention, that Mr. C. never used fire-heat. At that period, we have been informed, he indeed used very little. From subsequent information, we are led to think that Mr. C. has somewhat increased the use of artificial heat ; in fact, to do justice to the keeping of late grapes, it cannot be entirely dispensed with : it may in spring and summer, but when the damp autumn months arrive it must be had recourse to. In a bad summer, artificial heat will, moreover, become necessary at the end of September, for awhile, to complete

the ripening process ; for, in all cases, grapes to hang well, should be perfectly ripe by the end of September. It is a complete fallacy to imagine that retarding their ripening after that period will conduce to their long keeping.

We have already stated that Mr. Crawshay is a great advocate for thorough ventilation : his houses are the very reverse of a “ Ward’s case.” There has, in our opinion, rather too much stress been laid upon having a draught in hothouses. Certainly no man in his senses would invite a cold or frosty wind ; and here arises the question, as to whether motion is really necessary in the air of hothouses ? We are of opinion that it is by far more essential to the health of plants in general—more especially fruits—than people commonly imagine. We anticipate the time when it will be deemed necessary to keep up a ventilation, or rather *circulation*, night and day ; indeed, this is Mr. Errington’s practice at the present time. The scalding in the berry, as it is termed, most commonly proceeds from the neglect of early ventilation. If the atmosphere is charged abundantly with moisture, and the sun breaks out rather suddenly in a May or June morning, this will speedily occur. Some of the best vine-growers we know have made a point of giving air, if only in the most trifling degree, by six o’clock in the morning, during the months before alluded to : that is to say, they allowed the con-

finer damp and stagnant air to escape at the back, and promote an ingress of fresh air from the front of the house.

With regard to keeping grapes long on the tree, much depends on the selection of the kinds. The two best for this purpose are, undoubtedly, the true Black Hambro' and the true West's St. Peter's. We imagine the latter to be synonymous with the Black Lombardy, or Raisin des Carmes, of the Horticultural Society's catalogue. Of this, however, we are not perfectly assured, as there are two or three grapes called St. Peter's. The kind we mean has rather slender wood; the lobes of the leaf are rather obtuse, or not well defined; and one peculiarity is, that the leaf turns as red as the old Virginian Creeper, in the month of November. This is an invaluable grape, and should be in every collection; it is, moreover, exceedingly prolific, and particularly adapted for the "close spur" system recommended by Mr. Crawshay.

The Black Hambro' is too well known to need a description here: this, for general utility, may be placed at the head of useful grapes, and is equally adapted for late or early purposes. The Muscat of Alexandria is also a fine late grape, but will not submit to the low temperature and degree of atmospheric moisture which the Hambro' and West's St. Peter's will endure. It should by all means have a small house to itself, and would require a good deal of fire-

heat, with a free ventilation, in November and December.

In cultivating plants in pots under vines, two or three points deserve consideration. In the first place, the pots should be at all times placed very thinly ; any attempt at crowding them will assuredly defeat the end in view. Those tribes also should be encouraged, chiefly, which require very little water in October and November. The Cape Bulbs, the Achimenes, the Cacti, &c. are somewhat eligible for this purpose. Particular attention should be paid to an almost constant ventilation, as before urged.

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## STOVE CULTURE

THE vinery is very variously constructed, both as regards form and material. It is built round, square, and parallelogram, with wood or iron for the rafters, and with flues, steam, hot water, and warmed air, as the sources of artificial heat. It will enable us to be more explicit if we consider each part of the structure separately.

But before proceeding to discuss the merits or demerits of the various structures, we would offer a few remarks on the vast importance of the greatest possible amount of light. The great improvement that has taken place in the manufacture of glass, together

with much improved and more natural mode of management in regard to the atmosphere of hothouses, as now practised by our best gardeners, augurs well for vine forcing in future years. Indeed, we see no reason why good grapes may not be obtained the whole year round: for, as before stated, the imperfect admission of light through bad glass, the frequency of laps, together with clumsy and heavy structures, constituted the main obstacle under the old system, more especially with regard to early forcing.

With all deference to the opinion of the late T. A. Knight, who recommends 34 degs. for the angle of the forcing-house, we are inclined to think that what is termed by workmen the "mitre angle," or 45 deg., will be found quite as eligible for general purposes. It will be found, we think, that the internal arrangements will in general be carried out with greater ease.

The next great point to secure is a permanency of atmospheric moisture under a perfect control. So many plans for this purpose are adopted that it is somewhat difficult to recommend any particular mode as superior to the rest. One mode, however, we would protest against, which is, the producing a sudden cloud of steam by pouring water on hot flues or pipes. This is by no means so congenial to vegetation as is commonly supposed. Atmospheric moisture thus produced, certainly cannot be considered a pro-

per imitation of the ground vapour in tropical climates, inasmuch as the soil under those circumstances will not in general be much above 90 or 100 degs.

And here it is that we fear the Polmaise system may prove in part a failure, for with the great increase of heat will be required a corresponding increase of atmospheric moisture, otherwise vegetation will be plundered. It remains to be seen, therefore, whether this amount of moisture will not prove too great for general purposes, and whether it be of a healthy character.

The best and most simple mode with which we are acquainted is to provide a cemented gutter in front of the house ; at least, where hot-water pipes are used. We have had this mode in use for three years, and find it perfectly satisfactory. The bottom or return pipe rests on the bottom of this trench or gutter, and by having a tap with a short leaden pipe fixed at the furthest end of the house, together with a reservoir which feeds the boiler at a higher level than the tap, the bottom or return pipe, whenever necessary, can be covered with water in less than half an hour. Now the return pipe, as is well known, is of a lower temperature than the flow or advance pipe, and the amount of atmospheric moisture thus produced, is sufficient for any tribe in cultivation. In fact, it is seldom the full powers of this mode of producing moisture are put in requisition. By admitting the cold or fresh air at



the lowest level, in fact immediately over the piping, the moist air becomes condensed, and instead of proceeding to the roof to form drip, passes at a low level through the body of the house.

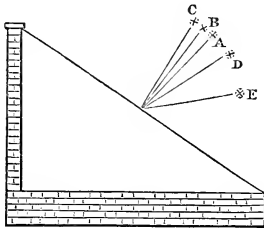
One caution is necessary here, at least with regard to vines, and that is to empty the gutter the first thing every morning, for fear of scorching or blistering the vines. This may be easily effected by having a tap or plug at one end, and communicating immediately with the main vine-border drain; and by pulling out the plug the gutter will be emptied in a few minutes. This mode is far preferable to the open gutter, inasmuch as it is under the most perfect control, without the trouble of moving covers.

*Glass.*—This should be of the best manufacture, for just in proportion to its goodness of quality is the freedom with which the rays of light pass through, and a plant performs its digestive and assimilating processes the nearer to the vigour with which it effects them in a state of nature, just in proportion as the light it basks in is similar to that of its native habitat. But this is not the only reason why good glass should be employed in our garden structures; for whilst panes of common crown glass readily break from frost or the slightest twist of the wood-work, good sheet glass will remain uninjured by much greater violence and by the fiercest hailstorms. Some injury from the last, however, will always arise, and

this leads me to observe, that no one having greenhouses or stoves should fail to have them insured by the "Hailstorm Insurance Company." Good glass is of little value unless kept clean, and for this purpose it should be cleansed on both sides twice annually, early in February and October, and on the outside only in June.

The angle formed by the glass roof of the hothouse is of very considerable importance, because rays of light are reflected in proportion to the obliquity with which they fall upon any given surface; those which fall upon it perpendicularly from the source of light pass through with very slight diminution, but those falling upon it in a slanting or oblique direction are reduced in number in proportion to the obliquity of that direction. To ascertain how a glass roof may be constructed, so as to receive the greatest number of rays of light from the sun perpendicularly, or near to perpendicularity at any given time of the year, it is necessary to know the latitude of the place where the hothouse is erected, and the sun's declination at the period when most light is required. The latter information may be obtained from most almanacks, and if it be subtracted from the latitude, the remainder will be the angle desired. If London be the place, and May the 6th the time about when the most light is desired, the latitude being 51 degs. 31 min., and the sun's declension then 16 degs. 36 min. north,

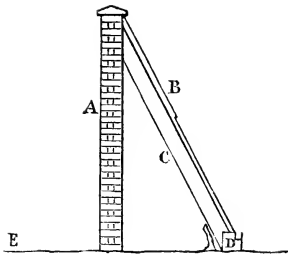
therefore the roof ought to slope at an angle of 34 degs. 55 min.



In latitude 52 degs., Mr. Knight found from lengthened experiments, that the best angle is about 34 degs., considering the services of a hothouse through the year; and to illustrate this, he gave the preceding diagram. About the middle of May, the elevation of the sun at noon corresponds nearly with the asterisk, A; in the beginning of June, and early in July, it will be vertical at B, and at midsummer at C, only six degrees from being vertical. The asterisk, D, points out its position at the equinoxes, and E its position at midwinter. If the best glass be employed, it is an excellent plan to have it put double in each sash, an interval of half an inch being left between the two panes, and a small hole at the corner of the inner one to prevent the glass being broken

by the expansion or contraction of the air between. This confined air is one of the worst possible conductors of heat, keeping the house from being rapidly cooled during even the coldest weather. (*Johnson's Princ. of Gardening.*)

In conformity with the foregoing principles, Mr. Saul, of Castle Hill, Lancaster, has given the accompanying section of a vinery, as the form best suited for keeping late grapes. The great superiority which a house of this construction has over the old form is, first, that by the nearly upright position of the glass, scarcely any of the rays of the sun are lost; while, for the same reason, scarcely a drop of wet can find its way into the house. Another recommendation for this plan is, the small space to be heated; consequently the temperature can the more readily be raised to any degree required. This kind of house will also be the very best for early forcing, as, from the small space to be heated, one boiler placed in the centre would be quite sufficient for heating a house of 150 feet in length. This kind of structure differs very little from that recommended by the late Mr Atkinson, except in the more upright position of the sashes; and probably the method of ventilation adopted by Mr. Atkinson would be found the best. The upper sashes could, however, be made to slide up and down, if necessary.



A, back wall ; B, rafters ; C, trellis upon which the vines are trained which are planted inside ; D, parapet wall upon which the sashes rest at bottom ; E, ground level. (*Gard. Chron.* 1842, 22.)

How important is the provision of the greatest possible amount of light to our forced plants is known to every gardener, from the fact that in proportion to the deficiency of light does the plant under glass become, in the gardener's phraseology, *drawn*. That is, its surface of leaves becomes unnaturally extended, in the vain effort to have a sufficient elaboration of the sap effected by means of a large surface exposed to a diminished light, for which a less surface would have been sufficient if the light were more intense. The plant with this enlarged surface of leaves becomes unfruitful, the sap being expended in their production, which should have been appropriated to the formation of fruit.

Mr. Williams made some experiments intended to

illustrate this point, and he found that varieties of the vine, when grown under white, or crown glass, under green glass, and in the open air, had the diameters of their leaves, in inches, altered as in the following table :—

| Name.                     | White. | Green. | Open Air. |
|---------------------------|--------|--------|-----------|
| White Muscat . . . . .    | 8      | 12     | 7         |
| Malmsey Muscadine ..      | 6½     | 12     | 6         |
| Syrian . . . . .          | 8      | 14½    |           |
| White Sweet Water . . . . | 6      | 9      | 6         |
| Black Hamburgh . . . . .  | 8      | 13½    |           |
| White Frontignac . . . .  | 6      | 11     | 6         |
| White Muscadine . . . . . | 6      | 11     | 6         |

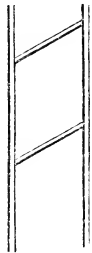
*Glazing*, or the mode in which the glass is inserted in the frames, is a very important consideration ; for if done imperfectly, moisture from rain, dew, or vapour condensed within the house, penetrates between the rebate of the framework and the glass, or between the laps of the panes themselves, and, expanding in the act of freezing, unfailingly cracks them. Again, if the panes fit tightly into the rebates, any sudden expansion causes a similar fracture.

We are of opinion that panes of glass seven inches wide and twelve inches long are the best practical size for hothouses. The glass should be clear, stout, and selected as flat as possible, so that the panes may lie perfectly level one upon the other, and so cut that they may not fit too tightly against the ribs

(which is frequently practised by some glaziers), but room should be left for the ribs to swell and expand. Before a light is glazed, all the panes should be laid in loose, to see that they fit easy and are quite level, as well as range one with the other; when that is done, the panes must be taken out, and some well worked putty laid in the rebate; the panes must then be replaced and pressed firmly down, and the bottom frame bedded in the putty, so as not to leave a vacancy. When the glass is bedded in the putty along the astragals, the usual way is to 'front putty' the whole at once; but at Kew, the lights are put by after the glass is bedded till the bedding putty is dry. The astragal then gets a coat of paint, and also a strip of the glass, the depth of the bedding on the astragal, and when this is dry the front putty is put on. The coat of paint on the glass will cause the front putty to adhere to the glass, and it will remain sound many years longer than when it is put on without this precaution. This is a capital contrivance for lights that slide up and down; but for lights that are fixed, the best way is to have no front putty at all. Instead of overlapping the panes, as is done in the ordinary way, cause the glazier to cut each with a perfectly straight edge, and then to place them one before the other, so that they shall all fit exactly. When the light is completed, the surface of the glass is perfectly level, and there are no interstices

in which the dust, &c., can accumulate, or for the deposit of moisture. By this means one cause of considerable breakage in frosty weather is entirely avoided; and if a pane of glass is accidentally broken, as each pane is independent of the others, the fracture does not extend beyond the single pane. The whole is very firm and compact, and the glass is not liable to shake out, as frequently occurs in opening and shutting sashes. (*Gard. Chron.*)

If lapping be permitted, its width should not exceed one-eighth of an inch, and the panes should be acutely rhomboid, to throw the condensed vapour down to the lower corner, and induce it to trickle down the bars instead of dropping. It is very doubtful whether it reduces the amount of moisture taken between the laps by capillary attraction. (*Johnson's Mod. Gard. Dict.* 617.)



Instead of lapping, as glass is fractured during frost, owing to moisture freezing between the laps of the panes themselves, or between metal laps and the glass, it is advisable, as before recommended, to do away with all laps. The edges of the panes may be cut accurately rectangular, and wetted with liquid putty before being placed in contact, and the join resting upon flat narrow bars of iron passing the whole length of the house. The bars across the breadth of



the roof need be very few, being only required to render the others firm.

*Roof.*—The framework of this may be of iron or of wood, and the comparative merits of the two materials are thus fairly stated by Dr. Lindley. The advantage of iron roofs for hothouses are, that they are more durable than wood, and allow a far greater quantity of light to pass through them than wooden roofs, the difference being as 7 to 28, or even 30, in favour of iron, and this is a most important property, when we consider that the healthy action of plants is in proportion to the quantity of light which reaches them. The disadvantages of such roofs are, that they rapidly heat, and as quickly cool down. They are therefore liable to sudden changes of temperature, which can only be guarded against by great attention, which is expensive, and by a large consumption of fuel. We should say use iron, if you prefer success and beautiful form, to cost, and can rely upon the attention of your people; but employ wood, if you are obliged to study economy. (*Gard. Chron.*)

*Heating.*—Flues, for imparting heat to hothouses, are for the most part superseded by either tanks or hot-water pipes; but where retained, the top should be formed of iron plates, these admitting the heat most readily into the house, and consequently requiring a less consumption of fuel. If it be desirable to have a covering for the flues that will retain the heat

longer, as when the fires are made up at night, this may be readily accomplished by putting a row of the thick square paving tiles on the top of the whole length of the flue, an hour or two before the houses are finally closed.

Flues are best built of bricks set on their edges, and the top formed of a shallow iron trough for the purpose of holding water, and thus keeping the air moist as required. At night, for retaining heat, pantiles may be placed along within the trough. The best form is the annexed.



*Hot Water in Tanks.*—It is a law of fluids that their hottest portions rise to the surface of the containing vessel, and the coldest portions as invariably subside to the lowest surface, because heat makes them expand, and consequently diminishes their specific gravity; and the abstraction of heat makes them contract, and as consequently increase that gravity. When the boiler and tank are filled with water, as well as their connecting pipes, and a fire is lighted, the hottest portions rise to the top, flow along the surface, and getting cool, sink to its bottom, and passing downward enter again at the lower part, to be once more heated, and pass through the same circulatory system. A very small boiler will speedily raise the heat of the water, in a very large tank, to 180 degs.; and if this heat be imparted late in the

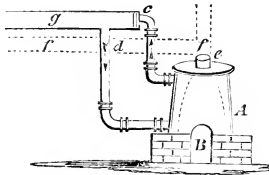
evening, it will retain its heat but little diminished until the morning. The smoke, by means of a flue, may be made to impart heat to the house, by passing through it, or may at once enter the chimney or pipe attached to the summit of the boiler.

Hot water in a tank is superior to the same source of heat in pipes, because it is not liable to freeze ; and it is preferable to steam, because its heating power continues until the whole mass of water is cooled down to the temperature of the house, whereas steam ceases to be generated as a source of heat the moment the temperature falls below 212 degs.

Mr. Rendle, nurseryman, Plymouth, the first successful suggester of the tank system of heating, has furnished us with the following particulars :—A tank of iron or wood, twenty feet long, five feet broad, and six inches deep, is constructed in the centre of the house, and surrounded by a walk, except at the end, where the boiler is fixed for heating it. The top of the tank is covered with large slabs of slate, cemented together, to prevent the excessive escape of steam. Around this is a frame sufficiently high to retain the bark, in which the pots are plunged. The boiler and tank are filled with water, and this circulates, when the fire is lighted under the former, by means of two pipes, one from the top of the boiler, and the other returning nearer to its bottom. The expense of piping, and danger of their freezing, is

avoided ; the fire only requires to be kept lighted for two hours at night, and again for the same period in the morning ; the water, when once heated, retaining its temperature for a long time. In a small house the apparatus can be constructed for £5 ; and in all, for less than half the cost of hot-water pipes. The saving in tan and labour is also very great ; in some places tan costs 19s. per cart load, and where it is cheaper, the trouble and litter incident to its employment, and the dangers of loss from fungi and insects, of which it is the peculiarly fertile foster-parent, render it objectionable as a source of heat. And whenever the tan has to be renewed, the trouble and destruction of plants is always great.

In the following sketch, for which, as well as for the next, we are indebted to Mr. Rendle :—*A* is a transverse section of Roger's conical boiler ; *B* is the fireplace ; *g*, the tank ; *c*, the flow-pipe ; *d*, the pipe by which the water returns to the boiler ; *e*, is the hole for the smoke, which, joined to a flue, *f*, can be made either to ascend the chimney at once, or to pass round the house.



*Hot-water in open Gutters.*—Mr. Griffin, gardener to Mrs. Wells, of Cowley, near Exeter, has published the following remarks upon this mode of circulating hot-water.

The open trough, or gutter, may be applied to a boiler of any construction. The water flows from the top of the boiler, through a four-inch pipe, into troughs made of cast iron, of the following dimensions: inside measure six inches wide at the top, three inches and a half at the bottom, and seven inches deep; the trough is constructed in lengths three feet long, neatly fitted together by a rivet in the bottom, and one on each side near the top. The water returns in a cast iron pipe, three inches in diameter. There are thin iron lids or covers, of the same length at each portion of the trough, to fit upon the whole length of the apparatus, so that the degree of humidity may be regulated by making up some portions of the covers, without disturbing the others. The troughs or gutters might be made of various materials, but Mr. Griffin prefers iron. The heat is diffused from the surface of the trough or pipes, nearly as quickly as it would be from copper or zinc, and retains the heat much longer. The width and depth of the troughs should be varied according to the plants intended to be grown in the house. An orchidaceous house requires a wider surface on the top than those intended for the growth of *ericæ* and

greenhouse plants generally. During the resting season of orchidaceous plants, the atmosphere of the house is easily kept less humid, by not removing the whole or any part of the lids.

For vineries and peach-houses, it would answer exceedingly well, and entirely eradicate the red spider; for the trough can be covered when the trees are in flower, and when the fruit is approaching towards maturity. On the other hand, during the growing season you may maintain a regularly humid atmosphere with less trouble than by any other means. In a pine-stove, forty feet long, with a walk between the back wall and bark bed, the trough being two feet from the level of the walk, Mr. Griffin says, 'I can command any degree of heat with much less attention than is required for some houses with a boiler of the same description and equal power as regards pipe.' (*Gard. Chron.*)

*Heating by Steam.*—If this be employed, Mr. Tredgold has given the following rules for calculating the surface of pipe, the size of the boiler, the quantity of fuel, and the quantity of ventilation, required for a house thirty feet long, twelve feet wide, with the glass roof eight feet, length of the rafters fourteen feet, height of the back wall fifteen feet. The surface of glass in this house will be seven hundred and twenty feet superficial, viz., five hundred and forty feet in the front and roof, and one hundred and eighty

feet in the ends. Now, half the vertical height, seven feet six inches, multiplied by the length in feet, and added to one and a half time the area of glass in feet, is equal to the cubic feet of air to be warmed in each minute when there are no double doors.

That is, 7.5 multiplied by 30 added to  $1\frac{1}{2}$ , multiplied by 720=1305 cubic feet. But in a house with wooden bars and rafters, about one tenth of this space will be occupied with woodwork, which is so slow a conductor of heat, that it will not suffer a sensible quantity to escape, therefore 130 feet may be deducted, leaving the quantity to be warmed per minute=1175 cubic feet.

To ascertain the surface of pipe required to warm any given quantity of air, multiply the cubic feet of air to be heated per minute by the difference between the temperature the house is to be kept at, and that of the external air in degrees of Fahrenheit's thermometer, and divide the product by 2.1, the difference between 200, which is the temperature of the steam pipes, and the temperature of the house; the quotient will be the surface of cast-iron pipe required.

Now, in the house, the dimensions of which are above given, if the lowest temperature in the night be fixed at 50 degs., and 10 degs. are allowed for winds, and the external air is supposed to be at zero or 0 of Fahrenheit, then 1175 multiplied by 60 degs. and the product divided by 2.1, the difference between

200 and 60, will give us the quotient  $236 =$  to the surface of pipe required. Now the house being thirty feet long, five pipes of that length, and five inches in diameter, will be about the proper quantity.

If hot water be employed instead of steam, the following proportions and information, obtained from Mr. Rendle, may be adopted confidently as guides. In a span roof propagating house, forty feet long, thirteen feet broad, seven feet high in the centre, and four feet high at the two fronts, having a superficial surface of glass amounting to 538 square feet, Mr. Rendle has a tank of eighty-three feet long, running round three sides of the house, four feet wide and about eight inches deep, and consequently capable of containing nearly 300 cubic feet of hot water, though only half that quantity is used. This is closely approaching to the size pointed out, according to Mr. Tredgold's formula. The mean temperature of a hot-water tank will never be much above 100 degs., so that for the sized house mentioned by that skilful engineer, the divisor must be 2.1 times the difference between 100 and 60 degs., which gives as the quotient 335 cubic feet.

The tank in Mr. Rendle's propagating house is lined with Roman cement, and if the temperature at the time of lighting the fire be 90 degrees, the temperature of the atmosphere of the house 67 degrees, and the temperature out of doors 50 degs., the



quantity of small coal or breeze required to raise the temperature of the water to 125 degs. is 28 pounds. In twelve hours the water cools, after the fire has been extinguished, from 125 to 93 degs.

When steam is employed, the space for steam in the boiler is easily found by multiplying the length of the pipe in feet, by the quantity of steam in a foot in length of the pipe.

| Interior diameter<br>of pipe<br>in inches. | Decimal parts<br>of a cubic foot of steam<br>in each foot of pipe. |
|--------------------------------------------|--------------------------------------------------------------------|
| 1 . . . .                                  | 0.0545                                                             |
| 1½ . . . .                                 | 0.1225                                                             |
| 2 . . . .                                  | 0.2185                                                             |
| 2½ . . . .                                 | 0.34                                                               |
| 3 . . . .                                  | 0.49                                                               |
| 4 . . . .                                  | 0.873                                                              |
| 5 . . . .                                  | 1.063                                                              |
| 6 . . . .                                  | 1.964                                                              |
| 7 . . . .                                  | 2.67                                                               |
| 8 . . . .                                  | 3.49                                                               |
| 9 . . . .                                  | 4.42                                                               |
| 10 . . . .                                 | 5.45                                                               |

In the above noticed house, the length of pipe five inches in diameter is 150 feet ; and these multiplied by 1.363=20.5 cubic feet of steam, and as the pipe will condense the steam of about one cubic foot and one third of water per hour, therefore the boiler should be capable of evaporating 1½ cubic feet of water per hour, to allow for unavoidable loss. In the extreme case of the thermometer being at zero, the consumption of coals to keep up this evaporation will be 12¾ pounds per hour.

These calculations are all founded upon the supposition that the condensed water is returned to the boiler whilst hot ; but if this cannot be effected, then one twelfth more fuel will be required. The boiler for the supply either of steam or hot water, should be covered with the best available non-conductor of heat ; and this is either charcoal or sand.

A case of brickwork, with pulverized charcoal, between this and the boiler, is to be preferred to any other. A boiler having a surface of seventy feet exposed to the air, in a temperature of 32 degs., requires an extra bushel of coals to be consumed per day, to compensate for the heat radiated and conducted from that surface ; and the smaller the boiler, the greater is the proportionate waste. The surface of the pipes should be painted black, because a surface of this colour gives out more heat in a given time than any other. (*Johnson's Principles of Gardening.*)

In heating by hot water there are some practical questions which gardeners require to have answered, but to do which neither the country ironmonger nor country builder is usually qualified. One of these questions very usually is, "How large ought the boiler to be to keep these pipes hot?" Now, the total size of the boiler really has nothing to do with the question ; indeed, the smaller it is, the better, provided *a sufficient surface of it can be exposed to the fire.*

Mr. Hood furnishes the following useful table,

showing the amount of boiler surface which must be exposed to the fire to heat given lengths of pipe, respectively 4 inches, 3 inches, and 2 inches in diameter.

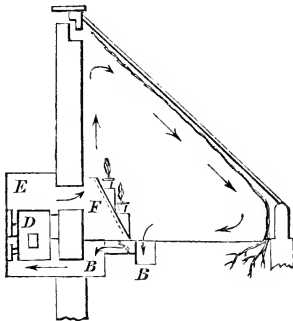
| Surface of Boiler exposed<br>to the fire. | 4 in.<br>pipe.<br>ft. | 3 in.<br>pipe.<br>ft. | 2 in.<br>pipe.<br>ft. |
|-------------------------------------------|-----------------------|-----------------------|-----------------------|
| 3½ sq. feet will heat . . .               | 200                   | or 266                | or 400                |
| 5½ . . . . .                              | 300                   | .. 400                | .. 600                |
| 7 . . . . .                               | 400                   | .. 533                | .. 800                |
| 8½ . . . . .                              | 500                   | .. 666                | .. 1000               |
| 12 . . . . .                              | 700                   | .. 933                | .. 1400               |
| 17 . . . . .                              | 1000                  | .. 1333               | .. 2000               |

—(*Johnson's Mod. Gard. Dict.*)

*Heating by Hot Air.*—Every system of heating is more or less founded upon the fact that, if a hot body be introduced into an enclosed room, the air in contact with that body becomes lighter, and rises as it is heated, is cooled and becomes heavier when it reaches the upper part of the room, and consequently sinks down to be again heated by coming in contact with the hot body, and thus is kept in perpetual circulation. This is the principle upon which all heating is founded; yet no one, that we are aware of, ever thought of making the air circulate at once over, and be heated by the furnace direct, as suggested by Mr. Murray, head gardener at Polmaise, and thence designated the *Polmaise* system. Other persons have always employed flues, or pipes, or tanks, heated by a distant fire, to communicate the desired warmth.

Mr. Murray deserves great thanks from horticulturists for the publication of his cheap mode of heat-

ing hothouses. His system is an adaptation of long known scientific facts to a useful purpose ; and its success, like that of Mr. Rendle's system, depends upon the constant circulation of a heated fluid, rising as it is heated, and sinking down as it cools to be heated again. The difference is, that Mr. Murray's fluid is the atmospheric air of the house, and Mr. Rendle's is water. The great merit of using air is, that it does not require an expensive tank or arrangement of pipes.



In the above sketch of a lean-to house, **B** is the drain or underground flue, conducting the cooled air to the heating stove, **D** ; **E** is the warm air chamber ; **F**, a woollen cloth or blanket fastened over the orifice admitting the warmed air into the house. This blanket is kept moist by means of skeins of worsted, having one of their ends dipping in water, and the

other end touching the blanket. The arrows show the currents of rising and descending air. But this structure has since been much improved upon, and the following, erected by Mr. Meeks, is the most perfect hitherto promulgated. The furnace, bricks, &c. cost less than £19, and there is no doubt that no expense was spared in this model erection. We are indebted to the *Gardener's Chronicle* for the following plans and details.

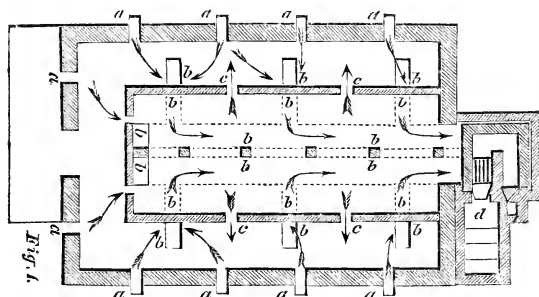


Fig. 1. Plan of house, showing cold air entrances, cold air drains, hot air chamber, and entrances for air into the house, with furnace, chimney, and direction of currents; *a, a*, cold air entrances, covered at pleasure with a horizontal lid outside the house; *b, b*, cold air drains, covered at pleasure with sliding covers made of slate; *c, c*, entrances for hot air into the house, which may likewise be covered at pleasure with doors sliding along the face of the pit; *d*, the furnace.

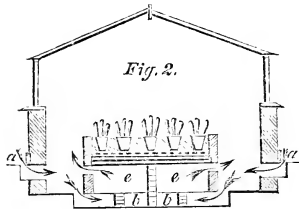


Fig. 2. Section of house, showing bottom heat chamber, cold air drains, and direction of the currents; *a*, entrance for cold air; *b*, cold air drains; *e*, bottom heat chamber.

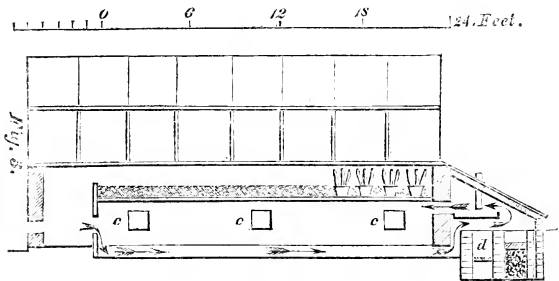


Fig. 3. Longitudinal section of house, showing hot air chamber, furnace built of Stourbridge brick, and surrounded with two inches of sand, and covered over with a half-inch iron plate in three widths; the cistern is made of iron, four inches deep, in two divisions, and fed through a pipe from above; the roof has a cavity to be filled with sawdust, to prevent the escape of heat; *c*, entrance for hot air; *d*, furnace.

*Ventilation.*—The accumulation of gaseous mat-

ters, such as sulphurous acid and ammonia, and the consumption of carbonic acid, render ventilation essential to the health of vines, and of all plants in hot-houses. They cannot inhale air overloaded with these contaminations without being speedily injured, and the proportions of those gases which rapidly cause disease or even death, are much less than the gardener usually suspects ; for if the sulphurous acid amounts to no more than one cubic foot in ten thousand of the air in a hothouse, it will destroy most of its inhabitants in two days. To avoid such destruction, for the comfort of visitors, and above all for the sake of the plants' vigour, air should be admitted as freely as the temperature will permit. The foul warm air can be easily allowed to escape through ventilators in the most elevated parts of the roof, and fresh warm air can be as readily supplied through pipes made to enter near the flooring of the house after passing through hot water, or other source of heat.

We are quite aware that Mr. Knight has stated that he paid little attention to ventilation, and that plants will be vigorous for a time in Wardian cases ; but this does not prove that their Creator made a mistake when he placed vegetables in the open air.

Plants confined in houses or other close structures, may be made to grow in spite of such confinement ; but all experience proves that other favourable circumstances, such as heat, light, and moisture, being equal, those plants are most vigorous and healthy

which have the most liberal supply of air. — Those who doubt the propriety of an almost constant ventilation will, by referring to the description of Mr. Crawshay's houses, as described by Dr. Lindley, find that very much of Mr. C.'s success is imputed to the circumstance of open laps. It has been said that, shut up a house how we will, there is still a circulation, and undoubtedly there is; but is it sufficient? For, after all, how different the sensation between breathing in a shut-up house and in the open air. So important do we consider ventilation that we use it night and day on all possible occasions. It must be remembered, however, that a very small ingress and egress is sufficient where there is so great a disparity of temperature between the outer and inner atmospheres. One great desideratum remains to be accomplished in this respect, and that is to circulate and promote motion in the atmosphere, and avoid unnecessary extremes of heat, without dissipating the atmospheric moisture. All new modes of heating should, in combination with the question of economy, combine this most important consideration.

There have been many modes suggested for self-acting ventilators, descriptions of which may be found in Loudon's *Encyclopædia of Gardening*, and the *Transactions of the London Horticultural Society*; but there are none that can supersede the gardener's personal care, directed by the thermometer and experience.



The practice of all ventilation is founded on the principle that the hottest air rises to the highest part of the house, and if there allowed to escape, colder air will come in below to supply its place. To prevent the hot air escaping too rapidly, the ventilators should be fitted with doors or caps, capable of regulating the size of the orifice; and the openings admitting fresh and colder from without, should have similar regulators, and be made by means of pipes passing through the bark-bed, tank of hot water, or other source of heat, so that the reduction of temperature be not too rapid.

Some guide in constructing ventilators proportioned to the size of the house to be ventilated, will be found in Mr. Hood's following table of the quantity of air, in cubic feet, discharged per minute through a ventilator, of which the area is one square foot.

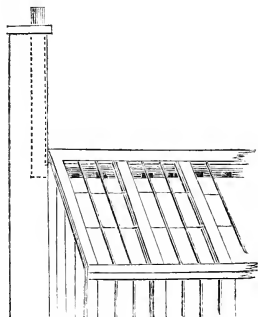
| Height of ventilator in feet. | Difference between temperature of room and external air. |         |         |         |         |         |
|-------------------------------|----------------------------------------------------------|---------|---------|---------|---------|---------|
|                               | 5 deg.                                                   | 10 deg. | 15 deg. | 20 deg. | 25 deg. | 30 deg. |
| 10                            | 116                                                      | 164     | 200     | 235     | 260     | 284     |
| 15                            | 142                                                      | 202     | 245     | 284     | 318     | 348     |
| 20                            | 164                                                      | 232     | 285     | 330     | 368     | 404     |
| 25                            | 184                                                      | 260     | 318     | 368     | 410     | 450     |
| 30                            | 201                                                      | 284     | 347     | 403     | 450     | 493     |
| 35                            | 218                                                      | 306     | 376     | 436     | 486     | 521     |
| 40                            | 235                                                      | 329     | 403     | 465     | 518     | 570     |
| 45                            | 248                                                      | 348     | 427     | 493     | 551     | 605     |
| 50                            | 260                                                      | 367     | 450     | 518     | 579     | 635     |

The foregoing table shows the discharge, through a ventilator of any height, and for any difference of temperature. Thus, suppose the height of the ventilator from the floor of the room to the extreme point of discharge to be thirty feet, and the difference between the temperature of the room and of the external air to be 15 degs., then the discharge through a ventilator one foot square will be 347 cubic feet per minute. If the height be forty feet, and the difference of temperature 20 degs., then the discharge will be 465 cubic feet per minute.

The best form of a ventilator would be a zinc tube about 9 inches in diameter, placed along withinside at the highest point of the house, with openings beneath, and the tube elongated and continued up within the chimney of the fire heating the stove, or any other chimney in its vicinity, as in the following sketch.

The law which regulates the operation of such a tube is this: When equal *bulks* of two fluids are put into the opposite limbs of a syphon, the lighter fluid is forced upwards with a velocity equal to the velocity which a solid body would acquire in falling, by its own gravity, through a space equal to the additional height which the lighter body would occupy in the syphon, supposing a similar *weight* of each fluid had been used. This velocity is easily calculated: a gravitating body falls 16 feet in the first second of time of its descent: 64 feet in two seconds, and so on, the

velocity increasing as the square of the time; therefore, the relative velocities are, as the *square roots of the heights*.—(*Hood on Ventilation*, p. 31.)



Now, in the pipe sketched above, the total height from the floor of the stove to the point of final escape of the heated air, is the height of the syphon. The force of motion is the difference of weight between the column of heated air and that of a column of the external air of the same height. Now air expands when heated  $\frac{1}{480}$ th of its bulk for each degree of Fahrenheit's thermometer, and the velocity of motion is equal to the additional height which a given weight of heated air must have in order to balance the same weight of cold air; therefore, the higher the tube in the chimney, and the hotter the air is kept in it, the greater the velocity of ventilation.

The passage of air may be regulated by a slide to pass through a cut in the pipe just within the house,

and close to the end next the chimney. (*Johnson's Gardener's Almanack*, 1847.)

*Borders.*—These should be formed inside the house and eight or ten feet wide. They should be of the same materials recommended for vines upon the open walls, and with quite as much attention to their drainage; and the walls being built upon arches, a similar breadth of border made in every respect similar should be on the outside.

Loam, of a somewhat more tenacious character, however, should be used for inside borders, than for outside ones, as there is no fear of their becoming “soured” unless through injudicious watering.

In making borders inside the building, which are far more preferable to the outside for early forcing, care should be taken not to bring the roots in contact with very hot flues or pipes; when the border is of necessity brought close to them, some non-conducting body, as wood, should be interposed. An enclosed body of new and dry sawdust would be found, perhaps, superior to anything else, provided it could be kept dry.

When the borders must of necessity be outside, it is of the utmost importance to endeavour to preserve the accumulated warmth of summer. To this end, the top-dressings necessary should be laid on betimes. For a house to ripen grapes in May, it might be applied as early as September. The top-dressing should

be composed of coarse and open materials, and should be placed a considerable depth, finishing at top with clean straw or fern of some thickness; and if this could be so disposed as to carry off the moisture, it would be a great advantage, as there is little doubt that the border will have moisture enough: the main business is to avoid excess. Such a covering as a tarpaulin would be of great service in this case: it might be supported on spars, to avoid close contact. Some of our best gardeners increase this covering just before they commence forcing; and, by the addition of fermenting materials, endeavour to produce a temperature in the mass of 80 or 90 degrees.

This amount of heat has startled some persons, who do not sufficiently consider that, through the tendency of heat to ascend, the volume of the border in the vicinity of the roots is perhaps not above 60 or 65 degrees. This cannot be too much, if it be admitted that warmth of root is necessary to excite the vital forces, and that without such action the vine will have to exist entirely on the accumulated stores of former years. Care must be taken to remove such covering in due time—not, however, entirely. Mr. Roberts' directions are excellent on this head, and may be implicitly followed.

Although we join with our best practical gardeners in recommending the roots of early-forcing vines to

be kept in the house ; yet, when circumstances are favourable, there can be no possible harm in throwing the front wall on arches, and allowing a portion of the roots to go outside. When such is the case, however, a protecting process ought to be carefully pursued, or some derangement in the reciprocal balance which ought to exist between root and branch may ensue. It is, at least, well to provide against it.

There scarcely needs more to be said on the construction of the borders than has been already, but, as is truly said by Mr. T. Appleby, gardener at the Fence, near Macclesfield—

Unless this is properly done, however excellent the internal management, however good the construction of the house, and however well it may be heated, if the vine is not right at the root, all the expense, labour, and attention, will end in disappointment. We shall, therefore, give this gentleman's directions, as well as those of Mr. Roberts, and of some other modern and first authorities. The site of the vinery should, if possible, be neither too high nor too low ; though, of the two, an elevated situation is to be preferred. But whatever the situation is, the border must be well and effectually drained. If the situation of the vinery is in a flat country, the front wall ought to be as high as the border is deep. In this case take off only the surface spit of the soil, that is about nine inches ; but should the situation be elevated,

take out as much more, the object being to raise the border above the natural level of the surrounding soil ; but this is not so requisite in a high situation as in a low one. The width of the border need not be more than 20 feet, and should not be less than 15 feet. It is a good general rule to have the border the same width as the houses. The width of the border being determined, and the soil removed, the top spit, if it be good, may be mixed with the compost ; then slope the bottom with a gentle descent from the houses, making it pretty firm. This is the floor of the border. At the extreme edge build an open drain, extending six inches below the level of the floor and six inches above it, by one foot wide. The sides to be built in the pigeon-hole manner, to allow a ready passage for the superfluous water. Have this floor paved with strong slates or thin flags, and then covered all over with broken stones or brick ends, about the size of a man's fist. When these are levelled, cover them either with small twigs, bean-straw, or thin turf, laid with the grassy side downward. This is to prevent the soil from falling amongst the stones below. It is now ready for the compost. The best compost for the vine is the thin top spit from an old pasture, chopped, and thoroughly mixed with one-fourth rotten horse-dung and one-fourth rotten leaves, or one-third dung when leaves cannot be had. Bones are excellent, broken small, and mixed in the compost ; but

not indispensable. The border should be two feet deep in a low damp situation, or three feet in a high dry one. To provide for the compost settling below the wall plate, place boards or thin slates against the houses, and keep the border at least six inches above its intended level. This should be done early in autumn, to allow the earth to settle before the planting time. There ought not to be a foot placed on the border; whenever it is needful to walk upon it, boards should be laid on in the places where the person must tread. A border made in this manner will last many years, with the help of a covering of dung every autumn, to be pointed in with a three-pronged fork when the winter is over. The vines intended to plant place in a forcing-house early in spring, in baskets lined with thin turf, and filled up round the balls with leaf-mould. The two top buds only are to be allowed to push. Keep two for fear of accidents, removing one after the vines are planted and quite safe. As soon as the warm weather of May or June sets in is the best time for planting. Holes sufficiently large are to be opened; the vines are brought out one at a time, the baskets sunk, and left to rot, only just covering them; then give a good watering, and secure the vines to the rafters, which finishes the operation of planting. (*Gard. Chron.* 1841, 627.)

Mr. J. Roberts, gardener at Eshton Hall, in Yorkshire, gives the following directions upon the same



subject, in his excellent work on “The Vine under Glass.”

The width of the borders outside the house ought to be 24 feet, cleared out to the depth of three feet six inches, upon a bottom of retentive clay, well prepared, with one foot of fall from back to front. A main drain ought to run along the extremity of the border, one foot six inches deep, with cross-drains in an oblique direction, leading into it, so as to have perfect command in draining off superfluous water, in order to keep them dry. Place upon the bottom thus formed, broken stones and lime rubbish to the depth of one foot, leaving a depth for compost of two feet six inches. Upon the broken stones, every six or eight feet square, place limestones, of the same nature as the far-famed Skipton rock, which contributes to retain moisture in a dry season, and facilitates the drainage in a wet one. In autumn, when all is ready and the weather favourable, proceed at one end of your border, wheeling in and mixing the materials in proportion as they stand to each other, on no account breaking the materials in mixing, but turn them in as rough as possible, adding one good-sized horse or cow carcase to every ten or twelve square yards; using caution, and not bringing to the surface of the border within one foot, as its assistance is not wanted the first year. (*Roberts's Vine under Glass*, 6.)

As it is natural to have the roots vegetating in a soil of which the heat bears a relative proportion to that in which the foliage is expanding, means should be taken to effect this very essential object. To neglect it is to invite disease and imperfection in the crop; and so convinced of this are the majority of first-rate gardeners, that expensive structures, hot-water pipes, &c. have been proposed for the sole purpose of warming the soil; but we entirely agree with Dr. Lindley, when he observes that there are two reasons why it is not advisable to bury hot-water pipes in a vine border. In the first place, that plant does not require so much bottom heat as the pipes would give; and, secondly, they would dry the earth, and in that way do more harm than they would do service in warming it. If a border is to be heated by hot-water pipes, they must be enclosed in a hollow chamber, so that their drying action may be prevented. It is desirable to guard the roots of vines from frost; but that should be done by a covering to the border which keeps off cold rain and snow, and prevents the escape of heat. (*Gard. Chron.* 1842, 561.)

The best covering for outside vine borders is one of horse-dung and leaves. Of these, Mr. Clarke, gardener at Shirley Park, near Croydon, recommends, in December, eighteen inches in thickness to be laid, and thatched with any material to carry off the water; green broom looks very neat, and will carry off all

superfluous water. The covering is to be removed in March, and the border slightly forked up; it is much better to remove it than to allow it to remain one day longer than required as a protection, the sun and air being of the greatest advantage. (*Gard. Journ.* 1845. 219.)

This removal of the fermenting dung in March is not objectionable, but we certainly think that it is much better to continue a covering of dried fern or other similar material until the spring months of cold dry winds are passed. In this our experience coincides with that of Mr. H. Bowers, of Busbridge, who observes that—

The practice of protecting the vine border with straw is particularly beneficial in March, April, and May, when the days are clear and warm, and the nights cold and frosty; the staw is drawn to one side during the hours of strong sunshine, exposing the soil to its genial influence; towards sunset the straw is again spread over the border, and being a good non-conductor it retains in the border much of the solar heat. Always cover after an application of liquid manure, as it in some measure prevents the ammonia from escaping and the heat of the border from being lost; for, with the escape of watery vapour, more or less heat is abstracted from the earth. This should be guarded against where forcing is going forward; for though the fluids may be always in motion, yet

the absorbing powers of the plant become less active when the roots are exposed to a low temperature. (*Gard. Chron.* 1845, 52.)

Mr. J. Roberts, gardener at Rabey Castle, is entirely of the same opinion. He says, when the fermenting material is applied a week or two previously to the starting of the vines (which it ought to be, to put the roots in motion), the border is surcharged with moisture, which will be sufficient during the forcing season. When the fruit has changed colour, remove the fermenting material by degrees; but should the season prove dry or hot, leave an inch or two of leaf-mould or rotten dung, to prevent too excessive evaporation. By the heat of July, August, and September, the roots, having been stimulated to give a generous support to the top in time of need, as well as induced to keep near the surface, will, by the powerful influence of the sun and dews during those three months, have become perfectly ripened. (*Ibid.* 1846, 613.)

Mr. G. Fleming, gardener at Trentham Hall, says that when the heat has once reached 80 degs., it continues so without any material deviation, by merely keeping a covering of strawy litter, in which the heat never exceeds 70 or 75 degs. once a fortnight, when it is to be turned and a little fresh litter added, which causes it to heat briskly for a short time. (*Ibid.* 1845, 115.)

If vines are planted outside the house, which we consider a most objectionable practice, their stems ought to be protected during the winter and early spring months; and at the same time, not to give them an unsightly appearance, you may have square wooden boxes, about 6 inches in diameter, with one side wanting, made to fit over each stem, and secured to the front of the house by hooks and staples. The intervening space between the vine and the sides of the box may be filled with hay and dry moss. In summer, these boxes may be removed without injury to the stems of the vine. (*Ibid.* 1843.)

There ought not to be any kind of crop grown upon a vine border: but it should be kept frequently hoed during the summer and autumn. To turf it over is one of the worst possible plans; firstly, because the turf prevents the reflection of heat from the border to the vines; and secondly, because it exhausts the border; and thirdly, because it prevents the free penetration of the air and solar warmth at such times as the border is uncovered.

*Planting and Pruning.*—No other directions for planting are necessary in addition to those given in a previous section, for the same care is requisite in doing this for those vines which are to be grown out of doors as for those under glass. Yet, as this is by no means an unimportant operation, whether in doors or out, more especially in the latter case, we give a few

additional directions. A very fine loose soil should be provided, containing a considerable portion of lively sand, which is well known to facilitate quick rooting. Beneath each vine should be placed a barrowful of chopped turf and of sandy loam, which have been lying together for several months: this being in lumpy masses, not disintegrated, will at once facilitate the escape of moisture and promote a rapid extension of root. To prevent sudden droughts owing to extreme porosity, the looser compost may be strewn through and over the fibres. The best time to plant is when the plants are about emerging from their torpidity, whether naturally or induced. The ball of earth should be carefully separated, and the roots trained as carefully out as an exhibition flower on a trellis. When merely covered with a fine compost, a layer of the same turfy matter may be placed over it, and over that a mulching of such fermented droppings and litter as gardeners prefer for making a mushroom bed. If in doors, they require skilful applications of water for the first four months: after which they may have it more frequently in the heat of summer, especially if they have made much progress. Those planted outside are liable to suffer in the first four months through drenching rains. If such occur, it is a good practice to place old hotbed lights over them: if such are not to spare, oil-cloth, tarpaulin, &c. will readily suggest themselves. If,

however, the summer is hot and dry, frequent sprinkling will be necessary: let little and often be the maxim.

With respect to summer pruning, we say let the young vines ramble freely, training the wood so as to expose every available surface of leaf to the light. The complete elaboration of a few select buds is as nothing compared with the ultimate advantage arising from a border well filled with roots. For, rest assured, the volume of roots will be in direct proportion to that of the top, although unseen.

The system adopted by Mr. Mearns is as follows: The vines are planted inside the house at two feet and a half apart, nearly close to the front wall, and are headed down to within a foot of the soil. One shoot only is allowed to proceed from each plant, which at the end of the first season is cut down to the second or third eye. Next year two leading shoots are encouraged, the strongest of which is stopped when it has grown three or four joints beyond the middle of the roof, and the weaker, after having grown three or four feet, for the purpose of strengthening the eyes. At the fall of the leaf the leading shoots are reduced, the main one to the length of the middle of the roof, and the lower one to the third eye. In the third season, one leading shoot is trained in from each shoot, and from the leading shoot fruit-bearing side shoots are produced. One bunch is left

on each, and the shoot stopped at one or two joints above it. No sides shoots are allowed to proceed from the spur, the leading shoot from which is to become the bearing wood for the next year. Thus, in the autumn of the third season the lower part of the house is furnished with a crop of grapes from shoots proceeding from wood of the preceding year, and parallel to this bearing shoot on each vine is the young shoot for the next year's crop.

In winter, the shoot from the extremity of the bearing branch is cut off at the top of the roof, or within twelve or fifteen inches of it, and the shoot from the spur is cut down to the middle of the roof, and all the spurs which had borne the grapes are now cut out. Each vine is now furnished with two shoots of bearing wood, a part of old barren wood, and a spur for producing a young shoot the following year. In the fourth summer a full crop is produced, both in the upper and lower half of the house. The longer shoots bearing on the upper half of its length, and the shorter on its whole length; a leading shoot is produced from the short shoot, and another from the spur. In the pruning season of the fourth year, the centre shoot is entirely removed, and replaced by the side shoot, now the whole length of the roof, and this side shoot is in its turn supplanted by the shoot from the spur, while a spur is prepared to succeed it.

It is sometimes necessary, observes Mr. Main, to lay in shoots of great length, as is the general practice



in pine stoves, or to fill the trellis in common vineries. In such cases much care is required that a regular and sufficient number of the fruit buds should break from top to bottom, and prevent the lower part of such shoots from being quite naked and barren. To avoid this let the pruner, after cutting the shoot to the required length, and finding, from the firm texture of the wood, that it is sufficiently ripened, proceed to thin the buds as follows: viz. leave the uppermost bud, which may be called 1, cut out 2 and 3, leave 4, and cut out 5 and 6, leaving 7, and displacing 8 and 9, and so on to the bottom of the shoot. This thinning of the eyes will cause all those which are left to break regularly, and so alternating with each other, that the disposition, whether for the sake of superior fruit or facilitating the future management of the tree, will be found exactly what the manager would wish; he taking care to stop all the young shoots in their progress, immediately beyond the fruit, except the lowest, which must be trained to its full length for similar management the following year. (*Gard. Mag.* ii. 413.)

*Summer Pruning* consists in rubbing off ill-placed and superfluous shoots as soon as they appear, and in shortening or stopping those destined for bearing.

Stopping, it has been well observed, has its limits, the passing of which will lead to weakness in the constitution of the vine. Two reasons seem to exist

in favour of the process ; the one, concentration of the powers of the vine for a period in the immediate neighbourhood of the fruit, thereby increasing its size ; and the other, the prevention of the secondary shoots of the vine from overlapping and smothering the principal leaves. After these points are duly accomplished, vines, especially young ones, may be allowed to ramble freely, more especially in the period between the first and last swelling, or during what is termed the stoning process. It is by no means uncommon to see young vines nearly destroyed by over-bearing, especially the Muscats. These “show” in an extraordinary way, on strong young canes in newly-made borders ; but if the fruit be allowed to remain, and close stopping resorted to, the constitution of the Muscat will be completely broken up. Let such make as much wood as they please. (*Gard. Chron.* 1846, 359.)

We prefer stopping at one joint beyond the fruit, as is the general practice, but some stop close to the bunch. In either case the leaf accompanying the bunch must be carefully preserved, otherwise the fruit will not attain perfection. In case of accident to this leaf, it is better to have one at the joint beyond the fruit, to elaborate, as is absolutely necessary, the sap. Mr. Mearns, however, is of a contrary opinion, and says, “Stop the bearing branches at the bunch instead of the next joint above it, which is the usual prac-

tice ; for the fruit does equally well, and it allows a much larger portion of light to come into the house, together with a more free circulation of air among the fruit and young wood. Blind all the eyes on each fruit spur as soon as they push above a joint or two, before pinching them back, always cautiously retaining one eye; and be particularly cautious that nothing should happen to injure the leaf that accompanies the bunch, for, if that is lost, the fruit comes to nothing.” (*Hort. Soc. Trans.*)

When vines will not break at the lower buds, depress the shoots and shade the upper extremity until the lower buds have started. If the bend is at the place where the buds are dormant, the operation expedites their appearance. (*Gard. Chron.* 1841, 169.) Another good suggestion made by Mr. Power, of Raynham, is that, in forcing vines pruned on the spur system, besides the one eye left upon each spur, a number of eyes will be formed about and between the spurs and the main stem. In looking over these, after they have made their appearance, care should be taken to rub off all, with the exception of one or two to a spur, and those should be left in the most favourable situation, on the upper side, or front of the spur.

Mr. T. Appleby, gardener at the Fence, Macclesfield, also considers the best mode of pruning the vine to produce certain crops of fine well flavoured fruit, is undoubtedly the “spur system,” but as he offers

some fresh hints, we give the detail of his practice. The first season after planting, he says, train one shoot to each rafter, stopping at the first joint all the laterals, and nipping off every tendril. When the shoot has reached three-fourths of the length of the rafter, cut off the bottom laterals, and continue from time to time to remove them all the way up as the wood hardens. This season do not stop the shoot at all, but continue to tie it in across the top of the house, to obtain as long and strong a shoot as possible. The second season prune down to three eyes from the bottom of each rafter, and allow one bunch of fruit to each vine, to prove the kind. Train the uppermost shoot to the rafter, managing in the same way as the first season, excepting stop it by pinching off the end near the top of the rafter, to strengthen the lower buds. The two bottom shoots stop at the third or fourth joint to make spurs. If the vines are strong, they will push again, when stop them at the first joint, repeating this as often as they shoot again. Tie them in at nearly right angles, to give the leading shoot all the benefit of the sun and air. In the third season the vines should be very strong, with short joints and plump buds. If the wood is sound, firm, and of a good brown colour, cut out one third the length of the rafter, which will mostly be six or seven feet. Train the top shoot up the rafter again, repeating the same operations of removing tendrils, stop-

ping laterals, &c., stopping it at the top. The side shoot or spurs stop at the joint which shows fruit, and only leave one bunch on each spur. This is a general rule for every year afterwards. Tie each spur at right angles from the centre, so that there are two rows of bunches, one on each side of the rafter. The fourth season bring up the spurs to two-thirds of the intended length of the vine, following the system as during the third season, with this difference, that if any of the spurs are weak and show poor bunches of fruit, nip off the bunch to strengthen the spur. The fifth season the shoot extends the length of the rafter, so that in four years you have all the rafter clothed with fruit-bearing spurs; after which all they require is to cut through the second bud every pruning season. Only leave one bud to each spur, though some cultivators leave two; but in that case the spurs will too soon become long and unsightly; and the farther the bud is from the main stem, the weaker it will be. Even with one bud each year the spur will in time require renewal. To effect this, train up a young shoot from the bottom, and the year after cut off the old shoot with all its spurs, and manage the young one exactly in the same way as a young vine. Do this to every other vine, as the house would be without fruit one or two years were they all cut down at once. Suffer those that are cut down to get into a bearing state again, and then cut down the remainder.

The question may be asked, when is the proper time to prune the vine? This entirely depends upon circumstances. If they are to be forced early, they must be pruned early. It may serve as a general rule, to prune at least six weeks before it is intended to begin to force: if it can be done two months previously it will be better; the pores of the wood, when it is cut, will then be stopped so as not to bleed when brought into a higher temperature. (*Gard. Chron.* 1841, 659.)

As a general rule, spurred vines confined to the rafter, and established on the principle of border-making before detailed, will, under good management, produce from fifteen to twenty pounds weight each, every year, for many years. Vines spread over the whole house will yield a third more. It is, however, a better plan, where very superior fruit is the object, to keep below this mark. The leading shoot, if there be one, is a pretty good criterion of the energies of the vine; this, if it is honestly cropped, should always be disposed, and also allowed, if possible, to ramble freely. (*Hort. Soc. Journ.* 51.)

*Training.* The simplest mode of providing for the training of a vine up the rafters of a house, is to drive long shanked nails with eyes at the head every two or three feet, so that a wire can be strained through these eyes the whole length of the rafter; and if other plants are to be grown in the house, one branch along

each rafter to bear fruit, and one growing for the following year's bearing, are all that need or should be grown; indeed at the ordinary distance of rafters, it is advanced to the contrary, the extent of, and the injury sustained from these is innumerable, as much work as a vine ought to do for many years. Any other fastening injures the rafter itself, whereas the wire being a fixture, the vine branch needs only to be tied to the wire with good twisted bass matting, which will last the season; at the end of which the old branch is cut away, and the new one may be fastened in its place. (*Gard. and Florist.* iii. 431.)

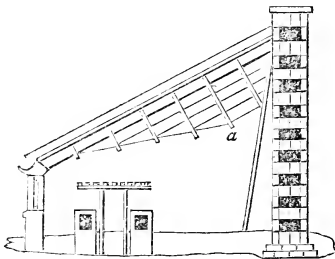
Another mode is by having wires extending longitudinally the whole length of the house, through eyes fastened about twelve inches apart into the rafters.

A third plan, is to have the vines planted in a border at the back of the house inside, and to train them *down* the rafters. This plan was suggested by Mr. W. Smith, of the Chiswick Gardens, and is thus recommended by him.

The common practice in vineries, he observes, of training the trees from the front to the back, upon laths or wires fixed to the rafters under the whole of the glass roof, forms so impervious a shade to the floor and back wall of the house, as to render both these places almost useless for any other purpose.

To get rid of this inconvenience, it occurred to Mr. Archibald Read, gardener at Balcarras, to confine the vines to the space immediately beneath each rafter; and in order to retain the same or any additional number of fruit-bearing shoots, he formed a kind of drop, or hanging trellis, by wires fixed to each side of the rafter, descending vertically, and attached to a slight wooden frame of the same width as the rafter, fixed from the front to the back wall, and depending from two feet at the front of the house, to five feet at the back part. Each rafter having such a frame, the vines are trained on each side of them, by which contrivance a greater surface of fruitful vines is obtained, and also a far greater share of light.

Different modifications of this plan have been adopted; one of the simplest is, a single surface of wires suspended by iron rods (*a*) The judicious gar-

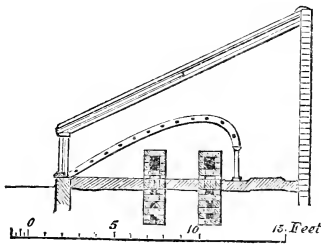


dener will adopt wires or wood, a double or single trellis, and greater or less depth, as may best suit the



particular circumstances of his case ; he will not forget to allow himself head-room over the path, and that it can never be desirable to have such trellises very deep, on account of the distance to which the lower part of the foliage would be removed from the glass. These circumstances taken into consideration and acted on, hanging trellises may be an improvement in the construction of the vinery, and applicable also to the peachhouse, but we consider it very doubtful. (*Hort. Soc. Trans.* vi.)

Mr. J. Acon, gardener to the Earl of Surrey, at Worksop Manor, has suggested another mode of trellis training, which is superior to the usual mode by not rendering the house dark, by preserving the grapes from the consequences of sudden violent depressions of temperature, and by enabling other trees to be cultivated against the back wall. Mr. Acon adopts a wide flat-roofed house, plants the vines within the house at



the back and front, trains them on an arched trellis with horizontal wires one foot apart (see above plan),

and on the back wall. He commences forcing on the 1st of September ; and the fruit begins to be ripened about the first week in March, and continues to be gathered till the middle of May. About six weeks after the forcing has commenced, vines are introduced from the front, and trained under the rafters, which yield a succession crop, from the early part of May till late in June, when the vines in the pine-stoves produce their crops. By the form of the trellis, which admits of the use of the whole of the back wall, and of at least one shoot on each rafter, this house presents the greatest possible surface for the growth of the vines, consistent with sufficient light. Mr. Acon has proved by experiment that vines will ripen their fruit a fortnight sooner on the trellis than on the rafters. (*Hort. Soc. Trans.* vii.)

The late vinery under Mr. Acon's care is narrower and has a steeper roof, like that of Mr. Saul's, delineated in a previous page. Its flues are on arches, as in the preceding, and the vines are planted within the house ; and trained on a trellis near the glass. The house is shut up about the middle or end of May, as soon as the bunches make their appearance ; and till they are out of blossom the air is kept very warm. This is of more importance than is generally imagined ; the wood which has to bring the future crop will be all made during this period. In a good heat it will be found to grow more compact, and to receive a form

better calculated to produce and ripen fruit under the cold atmosphere to which it is afterwards exposed. If the house be kept too cool at the beginning, the wood will be soft and long jointed, and therefore subsequently barren. Those who attempt to grow late grapes must pay serious attention to this circumstance: the failures of many may be attributed to the neglect of it. (*Trans. Hort. Soc.* vii.)

*Forcing.*—Mr. Beaton, gardener to Sir W. Middleton, at Shrubland Park, near Ipswich; Mr. G. Fleming, gardener at Trentham Hall, and some other first authorities in horticulture, are of opinion that September is a better time to begin to force vines than any time between that and the middle of December, as the fruit is set before the middle of November, and has more assistance from the sun than it would have in January, at which time it would be setting if started in November, the usual time for beginning to force for an early crop of grapes. (*Gard. Chron.* 1845, 115.) Notwithstanding these reasons and authorities, the majority of gardeners do not begin forcing until the end of October, or early in November, considering that to begin earlier does not allow the vines a sufficient period of rest.

Mr. Appleby, already quoted, says that in places where there are a number of houses devoted to the vine, it is possible to have ripe grapes all the year round. To accomplish this completely, six houses

are necessary, though it may in some degree be done with three. In the former case, the first house ought to be started at the end of October, the second on the first of December, and so on, the first day of every month till April. Where there are but three houses, it will be early enough to commence the first house in November, the second in February, and the third in April. To cause the vines to break equally all the length of the shoots, tie them down to the front windows, until the buds are all expanded, that one part may not be more excited than another. When every bud has pushed, carefully separate the vines one by one; regulate the shoots, stop them, and thin the number of branches, and do all that is required. Then tie them up loosely to the rafter; and should they hang down a foot from the glass, it is an advantage, especially during the early part of the season. (*Gard. Chron.*)

*Temperature.*—We quite agree with Dr. Lindley in thinking that there can be no doubt that 48 degs. is quite high enough at night for grapes in the first month of their growth, and 54 degs. in the second. The reason why a low temperature at night is desirable, seems to be that if much heat and moisture are applied to a plant in vegetation, it must grow in proportion to the amount of those agents. Now, it is in daylight only that plants can digest their food and harden their texture; and the amount of digestion,

and consequent hardening, will be in proportion to the intensity of the light they receive. If, then, they are compelled to grow in the dark, they are filled with undigested sap, and their wood becomes watery and soft. Even where they can be excited each day by very powerful light, it would seem that nature exposes them to no such risks, although one might suppose that beneath a southern sun the mischief caused at night might be repaired during the day. How much more, then, in these dull, northern regions, where we never behold the sun in all his brightness, and for weeks together in the spring, only as he struggles through clouds, how much more ought we to avoid that nightly growth for which our daylight can bring no help! (*Gard. Chron.* 1844. 35)

Quite coincident with this reasoning is the confirmed practice of our best vine forciers, as is thus detailed by Mr J. Roberts, gardener at Eshton Hall, in Yorkshire. He says the temperature must not exceed 55 by day, and may be allowed to fall to 45 in the night, until the buds are in motion. They will then require a little more heat, raising the temperature gradually until it attains 53 by night by the time the first leaves are fully expanded; always allowing them 10 or 15 degs. more by day, or sun heat, keeping a moist temperature, syringing and shutting up early in the afternoon. As they advance raise the temperature by day to 80, 85, or 90 degs. by sun

heat ; if by fire, 72 or 75 degs., syringing and shutting close up, early in the afternoon, allowing the temperature in the night to fall back to 58 or 60 degs. (*Roberts's Cult. of the Vine*, 22.)

Mr. G. Fulton, gardener to Lord Northwick, also concurs in the importance of a low night temperature, though, like the late Mr. Knight, he finds that in lighter days the vine will bear a very high temperature, occasionally, with advantage.

He says, to have an attentive eye to the young shoots at an early period of their growth is of great importance; and, to procure round short-jointed wood, his practice is to keep a low temperature in the night, and a very high one in the day. Vines by such a mode of treatment are not excited in an unnatural degree, and nature is more imitated than exactly followed, which may be said to be the main principle in the art of forcing. He has frequently, in the spring months, had the mercury in the thermometer stand at 110 degs. in a pinery early in a day, when, with abundance of moisture, vines have grown very rapidly with round short-jointed, instead of flat long-jointed shoots, caused by an extreme of fire heat in the night. The observations already made he wished to be understood as applicable to pines as well as vines, where they are necessarily grown together. (*Gard. Mag.* vi. 707.)

Mr. Appleby agrees in the propriety of commenc-

ing forcing at a low temperature, adding—The first week keep up the heat to 50 degs., the second to 60, the third to 65, and the fourth to 70 degs. Night temperature about 10 degs. lower. A good rule is 60 degs. for vines in leaf, and 70 when blooming and ripening fruit; the night temperature may then be 20 degs. lower.

*Syringing.*—Some excellent gardeners practice this less or more through most of the forcing period: some equally good gardeners entirely dispense with it. If sufficient atmospheric moisture is provided by means of a permanent character, little syringing will be needed. It may be practised with benefit during the time the buds are swelling, two or three times a day. When blossoming commences it must be altogether omitted. It may be resumed again until the berries are as large as peas, when it will be better, in our opinion, entirely dispensed with; taking care to provide plenty of atmospheric moisture in lieu of it.

The desirable amount of moisture in the air of the vinery is by no means arbitrary, but ought to be regulated according to the rule pointed out by nature. Her law is that the moisture of atmospheric air, unaffected by accidental causes, is proportional to its temperature, the moisture increasing with the heat. The exceptions offered by the sirocco and other hot dry winds, have their accidental origin from passing over arid torrid plains incapable of affording moisture

to the passing air. The consequences such winds bring upon vegetation is well known to be destruction of its foliage, and, in many instances, death. Air at rest, as in a hothouse, does not absorb moisture so rapidly as air in motion; therefore if the whole area of its floor was a tank of water, the air confined within the house would never be so saturated with moisture as air at the same temperature passing over water, moist earth, and vegetation, as in the ordinary course of nature. To obviate this, gardeners promote the diffusion of watery vapour through the air of their hothouses, by placing pans of water upon the flues, by having open gutters of hot water within them, and by even admitting jets of steam. The difficulty attending all these processes is to have the amount of vapour in a natural proportion to the temperature of the house. A little inequality is not of much consequence, but, other treatment being correct, the nearer to the dictate of nature, so much nearer will the plants be to a state of best vigour.

A consequence of air being duly impregnated with moisture is, that evaporation of water from a given surface exposed to that air proceeds slowly, shown by its causing but little cold. This is demonstrated by the following registries of thermometers, kept at Calcutta, during some of the months of 1841 and 1842. In June, August, and September, the air there is saturated with moisture. In December, January, and February, it is driest.



|            | Average<br>Temp. of Air.<br>at Noon. | Average Temp.<br>of Evaporating Sur-<br>face at Noon. |
|------------|--------------------------------------|-------------------------------------------------------|
| 1841. June | 91.6 deg.                            | 85.4 deg.                                             |
| Aug.       | 86.8                                 | 83.0                                                  |
| Sept.      | 90.2                                 | 84.3                                                  |
| Dec.       | 81.6                                 | 72.5                                                  |
| 1842. Jan. | 84.5                                 | 73.8                                                  |
| Feb.       | 90.4                                 | 77.4                                                  |

The easiest mode of ascertaining the difference between the temperature of the air and an evaporating surface is by having two equally graduated thermometers hanging in the hothouse, with the bulb of one inclosed in a piece of thin muslin. Upon moistening this with water of the house's temperature—made so by keeping it in the house—the number of degrees this causes the mercury to sink will be the difference between the air's temperature and that of an evaporating surface. In the winter months the gardener may be satisfied that the air has the desirable moistness if that difference be not more than 6 degs. and during the summer months 3 degs. This is much less than the difference found by observation in a tropical climate, but there the evaporation was promoted by exposure to a free circulation of the air.

Connected with this important portion of the practice of forcing is the following table, shewing the number of grains of water at the temperatures named, contained by a cubic foot of air saturated with moisture.

| Temp. of air. | Grains of Water. | Temp. of Air. | Grains of Water. |
|---------------|------------------|---------------|------------------|
| 20 deg.       | 1.52             | 62 deg.       | 6.21             |
| 22            | 1.64             | 64            | 6.60             |
| 24            | 1.76             | 66            | 7.0              |
| 26            | 1.90             | 68            | 7.43             |
| 28            | 2.03             | 70            | 7.90             |
| 30            | 2.25             | 72            | 8.40             |
| 32            | 2.32             | 74            | 8.95             |
| 34            | 2.48             | 76            | 9.53             |
| 36            | 2.64             | 78            | 10.16            |
| 38            | 2.82             | 80            | 10.78            |
| 40            | 3.02             | 82            | 11.49            |
| 42            | 3.24             | 84            | 12.20            |
| 44            | 3.48             | 86            | 12.91            |
| 46            | 3.73             | 88            | 13.61            |
| 48            | 3.98             | 90            | 14.42            |
| 50            | 4.24             | 92            | 15.22            |
| 52            | 4.52             | 94            | 16.11            |
| 54            | 4.82             | 96            | 17.11            |
| 56            | 5.13             | 98            | 18.20            |
| 58            | 5.51             | 100           | 19.39            |
| 60            | 5.83             |               |                  |

Although syringing and steaming, duly regulated, are unexceptionable practices occasionally; yet, as before observed, they are not to be depended upon solely as the means of keeping the air of the hothouse in a proper state of moisture, in conformity with the natural laws already pointed out. Gardeners know this from their experience, and have adopted, consequently, several modes of keeping the moisture of the air always accordant with its temperature. The most efficient plan we have previously described, but another is as follows :

Mr. Milne supplies a compound vapour to his vines by sprinkling his vinery every afternoon, when first shut up, with water, and then throwing down about a quart of gas ammoniacal liquor on the front pathway. When thrown on the soil, he has found that the liquor did not smell so much as when sprinkled on the stones or hard-burnt bricks. He has no doubt but this method would be sufficient without placing it in cans, if it could be applied in the morning without offence to the family. It has a bad appearance on the pathway, and no lady or gentleman would like to walk over it; its smell being bad enough, without the sight of it. He had three tin cans, holding about a quart each, in a house 42 feet long; and he found that in two days the liquor wasted to one-third of its usual bulk, and changed from a clear small-beer colour to a thick substance like coal-tar. It was never applied to the roots of the vines. (*Gard. Chron.* 1842, 761.)

Closely connected with the regulation of the vinery's atmospheric moisture, is the due admission of air, (see *Ventilation*); indeed, it will be found that every writer has found himself more or less obliged to amalgamate the two when considering ventilation, as in the following comprehensive and sound remarks of "A Practical Observer." He says—

A hygrometer is just as necessary in a vinery as a thermometer, and probably the time will soon come

when we shall as seldom see a house without the one as the other; and wherever one is used, it will be found that it is not a sprinkling of water on the flues or pipes, once or twice a day, that will keep a sufficiency of moisture in the air, but that water should be almost constantly on the pipes; and that the borders, footpaths, &c. should be sprinkled frequently besides. But, as much judgment is required in managing this, let the hygrometer be your guide. The admission of fresh air is intimately connected with the preceding; yet almost invariably do we see air admitted without the slightest regard to its effects on the internal atmosphere, further than keeping down the heat. In long-continued dull, cold weather, the houses are usually kept nearly closed; consequently more moisture is retained than usual, and the shoots and leaves are tender, and very susceptible of injury from sudden change; but as soon as a strong, clear sunshine occurs, the houses are opened, and air let in unsparingly to keep down the heat. The vines are thus checked; and if this happen just when the grapes are colouring, they do no more good, but assume a dull brown colour, viz., the dingy hue so well known and so much dreaded by gardeners; and when this happens, nothing will recover them. The too frequent practice of keeping on strong fires, with the view of remedying the evil, only aggravates it. From the time the vines are started, the strictest attention

ought to be paid to admitting air, and to its effects on the hygrometer. In cloudy, wet weather, short fires are to be put on in the morning, so as to raise the heat nearly 10 degs. above the night temperature, and a little air admitted both at front and back of the house, taking care to keep plenty of water on the pipes; for a strong fire-heat, accompanied by a brisk circulation, will be found very injurious, if not counteracted by moisture. In bright weather, equal attention is necessary; for, if a great deal of air is admitted to keep down the heat, it is impossible to keep the atmosphere sufficiently moist, consequently the vines suffer. Air ought to be admitted not so much to keep down the heat as to keep a current of fresh air in the houses; and small openings at front and back are quite sufficient for that purpose. Vines will seldom be hurt by sun-heat, if surrounded by a properly moistened atmosphere; but to retain this in dry, hot weather, the utmost vigilance is necessary. As, then, there is but little heat in the pipes, they ought to be kept deluged with water; indeed, the return-pipes should always be laid in gutters, so that they can be kept covered with water when required. Now, although strict attention must be paid to the admission of air, it is not intended that the ventilators are to be opened and shut always as a cloud passes over the sun; for, although the thermometer may be kept pretty steady, it is impossible to keep the hygro-

meter so too. A little air ought to be admitted as soon as the sun raises the heat a few degrees; and in an hour or two a little more, or as much as you think will cause a sufficient circulation, without putting it out of your power to keep up a sufficiency of moisture. If there is absence of sunlight at the time of colouring, fires ought to be applied to the house, raising the temperature to 72 degs. at night, and maintaining a dry atmosphere. If you have flowers in the vinery, take them out. Should your grapes begin to colour in March or April—the most precarious months in the year—when the sun begins to shine, and there is every prospect of a fine day, put out the fire immediately; and as the sun raises the temperature in the house to 76 degs., give about half an inch of air to every sash at top, but none in front upon any account; and when the heat rises to 78 degs. give as much air again, and so on until the thermometer stands at 85 degs. Be sure not to allow the heat to decline without taking the air away by degrees, as it was given; ultimately, when closing the sashes, the house is at 76 degs. At the last movement of the sashes, half an inch of air only should be shut off; for, if you have a foot or six inches of air on each light when the heat is at 85 degs., and you suffer the temperature to become colder without reducing the air a little, then the berry shanks. In March and April, a day's sunshine is very acceptable, and the gardeners throw

open their houses, and allow them to be open until the heat is only 70 or 76 degrees ; they then close the house, and the heat rises again, and does more harm than the sun has done good. (*Ibid.* 1845, 722.)

*Setting the Grape*, says Dr. Lindley, like that of all other plants, is accomplished by bringing the pollen in contact with the stigma. The stigma is a viscid space, often extremely small, upon the upper end of the young fruit ; the pollen is a fine powder, contained in the anther, which is a bag that must be split open in order to permit the pollen to escape. To insure the setting of a fruit, it is, therefore, indispensable that the anther should be placed in a situation favourable to its opening. Nature rarely provides mechanical means for effecting this important operation, but, by a simple and beautiful contrivance, insures its taking place spontaneously. The anther is formed of a membrane whose lining consists of an infinite multitude of delicate springs, so arranged, that by their contraction in opposite directions they pull open the sides of the anther along a line which is thinner than any other part. In wet weather, or in a green state of the anther, these springs are relaxed, and are incapable of action ; but when the anther ripens, and the air is dry, they contract, and pulling against each other, their combined action is sufficient to rend asunder

the sides of the anther and to permit the pollen to escape. If any one wishes to behold—not the phenomenon itself, for that is microscopic, but its effect—let him station himself near a Red Cedar, or a Chinese Juniper tree, in a warm, dry, spring morning, and he will see the air filled with myriads of little glittering particles; these are the grains of pollen discharged into the air by the natural elasticity of the anther-springs: let him observe the same tree in a wet morning, as windy as he pleases, or with the rain pattering upon the flowers, and he will not find a symptom of the dispersion of pollen. And why is this? Nature never chooses her seasons of action in vain. It is because the natural glue upon the stigma enables the pollen to adhere, and it is necessary that the adhesion should be complete if setting is to take place; but an atmosphere charged with moisture dilutes the natural glue, and renders the attachment of the pollen to the stigma precarious. Moreover, if the anther could open in wet weather, the pollen would not quit it; for although the latter is often dispersed by its own buoyancy, yet if the particles hold together in masses, as happens when damp, they are then incapable of floating. (*Ibid.* 1841, 259.)

These facts demonstrate why the gardener finds it necessary to have the air of his hothouse drier during the blooming time than at any other. Yet, with all



his care and science-directed art, impregnation of the grape in a vinery very often fails. The Tokay is one that sets with difficulty, but Mr. D. Wright of Greenland, near Paisley, says the difficulty is overcome if, before the vines come into flower, they are kept in a temperature of from 70 to 75 degrees ; and on the first opening of the flower, gradually lowering the temperature to 60 or 65 degrees, the air is then less moist, and they set freely, and as well as the Hamburgh and other free-setting kinds. (*Gard. Mag.* vi. 602.)

A more mechanical mode of effecting the impregnation, however, is often necessary ; for, to quote the words of Mr. J. Craig, gardener at Howsham, near York—

On close inspection, when the blossoms are fully expanded, it will be obvious to every observer who is acquainted with the parts of fructification, that the main cause of their abortiveness is a defect in the filament and not in the anther, as supposed by many. It will be found that the filaments are very small and recurved, so as to render it almost impossible for the anthers to come into contact with the stigma of the same blossom. There is a sufficient quantity of pollen on the anther for the fecundation of the stigma ; but so awkwardly is the anther situated, that in very few instances can the pollen perform its function on the stigma without the assistance of art.

Hold a sheet of white paper under the bunches from which it is intended to gather the pollen (selecting those which are fullest in flower), and then apply the pencil gently to various parts of them ; and when the pencil is charged with yellow powder, apply it to the bunches to be fecundated, and touch lightly with the pencil the female parts of the flowers, holding the paper as when gathering the pollen. The pollen may be obtained from the same vine, or any other in blossom at the time. (*Ibid.* vi. 688.)

*Thinning the Berries.*—As soon as the berries are set, and swollen to the size of a small pea, it is time to thin them. For this operation there are proper scissars, with long handles and short blades. Provided with these, some good soft matting, and with something to catch the berries in (which make excellent vinegar, or tarts, &c.), commence the operation by tying up the shoulders of such bunches as require it, to the wires on each side of the rafter ; or, if the bunches are very large, fasten some thin narrow lath to the rafter, to tie the shoulders to.

Some persons use a thin piece of lath notched at each end, to prop the shoulders off from the main body of the bunch ; but we do not like this plan so well as the matting, the props being apt to drop out.

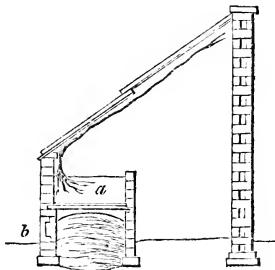
In order to have large berries, thin very freely ; so much so, that the bunches look like skeletons. Of course thin according to the kind. Some sorts, under

the best management, do not swell to such a size as others; hence it is necessary to know the medium size to which every variety will swell, and thin accordingly.

*Vines in Frames.*—The following system of growing the vine in frames, which is well adapted for gardens where the quantity of glass is limited, is practised by Mr. Dawson, gardener to Lord Ducie, at the Hoo, Hertfordshire. About the first week in April, a bed of partly-decayed dung, to which a small quantity of raw material is added, so as to produce a slight heat, is made at about 18 inches from the wall in front of the selected vines. This bed is built sufficiently deep to admit of its being about 3 feet high after settling. The frame used by Mr. Dawson separates into two portions, so that the lower part can be first placed upon the bed. It contains a trellis upon which the vines are trained, fixed about a foot above the surface of the dung. The upper portion of the frame can be afterwards put on, and secured to the lower by small brackets. The advantage of having the frames constructed in this way, is the ease and safety with which the vine can be taken in; since, in introducing the shoots of a vine through a hole cut in the back of a frame of ordinary construction, the buds would be liable to be rubbed off. No more care is required, except in stopping, thinning, &c. Air is given freely, but no linings to the bed are required.

In severe weather a covering is put on, but this is not generally resorted to. By pursuing the above method, fruit of good quality has been cut by the latter end of August; for which, Mr. Dawson has obtained several prizes at local horticultural exhibitions. (*Gard. Chron.* 1843, 54.)

The Rev. B. Cooper, for many years, forced vines trained under glass cases, resembling melon frames, with the aid of stable dung only. The border



on which the vines were planted (*a*) was within the frame, and raised by means of cast-iron joists, and Welsh states, over a cavity which, from time to time, was filled with hot dung, through openings in front (*b*). By these simple means he raised abundant and early crops. (*Trans. Hort. Soc.* vi.)

*Ripening Process.*—A dry atmosphere and a most free ventilation are the requisites, in order to obtain high flavour with perfect berries. Too much air can

scarcely be indulged in, providing the thermometer can be kept from descending below 60 degrees.

Slow ripening, if not carried too far, conduces to high flavour, and with vines inclined to shrivel or shank, slow ripening will be found the safest plan. This seems to point to defective elaboration, and that the tree, or rather the leaves, cannot provide matter sufficiently quick to feed the produce, much less to return a surplus to the root to meet the exigencies of the coming year.

*Rest.*—There is no real necessity for turning vines out during the resting season, providing they are kept in a somewhat low temperature in doors, and where they will be occasionally moistened in the bark and receive a little air. The thermometer, during this period, need not be much above 32 degrees, and should not be allowed to range above 55 degrees.

If they are turned out, let them, by all means, receive protection from frost. They will bear a moderate amount, but will be found much better laid flat on the ground and covered with ordinary litter.

#### CALENDAR.

The following succinct calendar of in-door vine-culture combines the chief principles of cultivation, applicable conjointly to stove forcing and ordinary greenhouse culture. Instead of arranging the subject in monthly divisions, it has been deemed expe-

dient to divide it into the following heads, founded on the habits of the vine :—

1. Preparatory steps to the commencement of forcing.
2. “ Breaking ” or budding period.
3. Blossoming period.
4. Thinning the berry.
5. First swelling of ditto.
6. Stoning period.
7. Second swelling.
8. Ripening period.
9. Preservation of fruit on the tree.
10. Ripening the wood.
11. Rest period.
12. Border management, including renovation of bad borders, &c.

Before proceeding with the discussion of these heads in the order in which they stand, it is necessary to remark, that the period selected for the commencement of forcing is the first week of February.

By assuming this period, the principle of both vine forcing, in the ordinary acceptance of the term, and greenhouse culture may be combined. The great and general utility of such a calendar will, we think, be obvious.

1. PREPARATORY STEPS.—In the first place, the flues (if any) should be thoroughly cleaned, and the house painted within, if requisite. At all events

it is a most prudent step, and by no means expensive, to apply a wash to the walls. Ordinary lime or whitewash is generally used; this, however, may be coloured to any desirable tint. The most important point is, to take care that abundance of sulphur is mixed with the wash: it is scarcely possible to add too much, remembering that a profusion of sulphur gives a very yellow tint to the wash, which may readily be subdued by a mixture of umber or tan water, made by straining a limited quantity of water through a good deal of tan. A wash of this kind will destroy the eggs of numberless insects, and is one of the best safeguards against the depredations of the red spider, the great enemy to successful grape culture. These things being accomplished, and the heating apparatus in order, the vine stems should receive a wash. Work some clay in warm water to a thin paint; add to a gallon of this, a pound of sulphur, half-a-gallon of strong tobacco water, half-a-gallon of fresh slaked lime, and beat up a lump of soft soap, as large as a walnut. This will be found a destroyer of any eggs which may lurk in the old bark of the vine, and a valuable assistance in preventing the ravages of the red spider. When the old bark has become loose and rough, it should be stripped off previous to the operation. As vines of luxuriant growth are liable to bleed under the application of artificial heat, it is our practice to daub a

patch of white lead or thick paint on every wound of the knife ; this, however, should be applied the moment the vines are pruned in the end of autumn.

2. **BREAKING PERIOD.**—The house being now closed, some little advance in temperature will, of course, take place, independent of fires. We may as well state, however, at the commencement of this division of the subject, that slow “breaking” tends to equalize the sap, or in other words, the aggregate strength of the vine ; whilst hurried “breaking” tends to give an undue preponderance to the upper parts already gorged, it may be, at the expense of the inferior or weaker parts. The chief point, in addition, is to secure plenty of atmospheric moisture : in fact, the stems, from the commencement of forcing until the leaf begins to expand, should be seldom quite dry. The old plan of introducing fermenting matter in some parts of the house, during this period of breaking, has ever been found an excellent practice. However, in the modern and improved mode of producing atmospheric moisture, such may be in the main dispensed with. Until the buds are actually developing, little alteration of either heat or cold, moisture or dryness, is necessary : a temperature, ranging from 45 to 55 degs. will be found sufficient until the buds begin to unfold. When such takes place, a gradual rise must commence in the thermometer, of a steadily progressive character : such



advance, for the most part, taking place in the day, more especially in the afternoons of those bright and sunny. By the time the blossom is fairly developed, a day temperature of 70 degs. ought to be insured, if possible, sinking at night to 60 degrees. On sunny days the thermometer may be allowed to rise to 85 degs., from two o'clock until four, provided a slight circulation or motion in the air be provided: this latter is of much importance under high temperatures, for it will prevent scorching, which sometimes takes place if much atmospheric moisture is present under a high temperature without motion. As the leaf is being developed, some alternations of moisture and comparative dryness must be allowed to take place. As a general maxim, we would say, ventilate rather freely, and allow the atmospheric moisture to be dispersed, from nine o'clock A.M. until two o'clock P.M., after which, close and encourage atmospheric humidity—not, however, all at once, if sunny—reduce the air in part at two o'clock, and close for the evening at three. During the “breaking period” the syringe may be freely applied whenever necessary, in order to keep the wood in a somewhat moist state; for ordinary purposes, twice a-day will suffice: for instance, very early in the morning, and again about three o'clock P.M. One of the most important points to be practised, during the “breaking period,” is disbudding the vine. By this, practical men mean, as a general principle, removing all

the barren shoots. This is, however, too sweeping advice for the inexperienced, as there are sometimes ulterior objects in view besides the crop of the present year. Blanks may have to be supplied, or a peculiar course of training carried out, to effect which, shoots must, of course, be reserved where necessary. Beyond such provision, however, all other shoots may be deemed superfluous, and may be rubbed away the moment it is determined what ought to be reserved.

3. **BLOSSOMING PERIOD.**—“Stopping,” as it is termed technically, is a very important affair in vine-culture, more especially in-doors; without this, all would be confusion. This process might, perhaps, have been discussed under the head “breaking.” It will, perhaps, be as well, however, to connect it with the “blossoming period.” “Stopping,” like “slow breaking,” tends to equalise the sap, providing the strongest shoots are first operated on, and the others in succession. It, moreover, tends to concentrate the energies of the vine to a given point; thereby enlarging the character of the branch. A distinction must, however, be drawn here, between the “long rod” system and the “close spur,” each of which are respectively eligible in certain situations. The chief difference, as before observed, does not consist in the aggregate amount of produce, but in the size of the individual bunches or berries, conjointly with their keeping properties, and the ultimate end in view. If long rods be re-

quired in given situations, in order to carry out a peculiar system of training, it is obvious that "close stopping" must give way. If, on the other hand, the "close spur" system is pursued, then the "close stopping" must be resorted to in the great majority of cases. The general principles of "stopping" are, to pinch off with the thumb and finger the terminal point of the growing shoots, one or two joints beyond the bunch, as soon as the leaves connected with such joints are somewhat developed. As soon as the blossoms begin to expand, which may readily be known by the delightful fragrance which will pervade the house, some nicety of atmospheric management must take place. In former days it was deemed necessary to provide an unusual amount of atmospheric moisture during the blooming period, accompanied by an increase of heat. It has, however, been proved subsequently, that too much stress had been laid on a great amount of humidity in the air. Mr. Paxton was one of the first to show that such practice was somewhat erroneous, and that the vine, whilst blossoming, was amenable to those general laws which are known to be conducive to "setting," as it is technically termed, in the great majority of fruit trees. The more extended cultivation of what are termed the "shy setting kinds," such as the Tokays, the Damascus, and the West's St. Peters, doubtless, throw some light on this matter. There can be little doubt, that some increase of heat should be al-

lowed at this period, not, however, for the sake of heat alone, but that through increase of temperature a livelier state of atmosphere may be maintained. Now, by a lively atmosphere, we mean one in which there is a constant motion, or a continual ingress and egress of air. Atmospheric moisture must not, however, be left out of the question, for that constant egress which promotes circulation or motion somewhat disperses the moist air, and an adequate replacement must be provided. Let it be also remembered that the stamens and pistillum of the vine are enclosed in a sort of Macintosh envelope, and that atmospheric moisture, as well as heat, is necessary to burst their bonds. The best advice we can give, is to apply atmospheric humidity in profusion from three or four o'clock P.M. until sunrise; then, by a liberal circulation of air, to disperse the accumulated moisture, providing thereby for the free dispersion of the pollen; and keeping during the time a thermometer at 70 degs. artificial heat, or as much as 80 degs. maximum solar heat.

4. **THINNING THE BERRY.**—This is a process requiring a nice hand, especially in forced grapes. Thinning cannot be commenced too early, providing a real berry can be distinguished. It is well, however, in shy setting kinds, to wait until they are of the size of very small peas. All the interior berries should be cut away, taking care to leave the extreme points if beauty of bunch be desired. The distance of

the berries apart must be regulated in the main by their size, as also whether they are required to hang long on the tree. If for the latter purpose, they should be thinned so that no two berries could be said to touch in a general way when full swelled. We are perfectly aware that it may be urged that the bunches will not "dish" so well. There is some truth in this; but such a trifling point should give way to keeping principles, which are sometimes of much greater importance. The Hambro' is one of the worst to "dish" when over-thinned; the Tokays will always lay firm, as will also the Frontignacs. As a general maxim, we would say thin liberally but progressively: it may be done at three distinct periods: first, thin away the crowded berries in the interior of the bunch; secondly, "set them out," as it is termed, that is, form the character of the bunch; and thirdly, go over the bunches when the berries are as large as pease, when superfluous berries will be readily seen. Take care that a fine-pointed pair of scissars is provided, and that they work easily in the joint. Some persons steady the bunch while thinning by holding a condemned berry in the left hand; others use a smooth and pointed stick to separate the shoulders. Whatever mode is adopted, much care is necessary, and neither head, hand, nor scissars, should be allowed to gall or chafe the berries. If such accident occur, cut the berries away at once.

5. FIRST SWELLING OF THE BERRY.—We come

now to a period when much care should be exercised in controlling atmospheric irregularities. It is well known that sudden depressions of temperature are not favourable to either size, colour or flavour in the berry. Now although, the vine in Syria, or any other country where it flourishes, may have to endure a temperature of from 86 to 90 degs. during the swelling period, it is obvious that the same amount ought not to be allowed in Britain, under a somewhat artificial course of treatment. Light is the great desideratum, and if there be one axiom of greater import than another, in gardening, it is this : regulate your heat by the amount of light. In this stage of the vine we would advise an artificial dry heat of 65 degs. in February, 70 degs. in March, and 75 degs. in April and May, maximum. As night heat during the same period, we would say, 55 degs. in February, 60 degs. in March, and 65 degs. in April and May, minimum. Let it be understood that we here advise three temperatures on the assumption that, during the day, at least, a circulation or lively motion in the air is maintained, especially until the latter part of the afternoon.

Atmospheric moisture must be well looked to, and nicely balanced ; not sudden guests of steam, but a permanent supply from an unfailing source ; and here it must be confessed, that our hothouses are in general lamentably deficient. And here it is that a

source of bottom heat from tan, or other fermenting matter within the house, is found so very congenial to the swelling of grapes. It is, however, of much importance to gain air very early in the morning, especially if much moisture has been confined during the night; we have no doubt that rust and other evils are frequently engendered by the morning sun, acting on a stagnant atmosphere. Syringing has many advocates during the first swelling. We, however, say, if all other appliances are right, there is no real necessity for it, and it certainly damages the "bloom," as it is termed. A somewhat close system of stopping should be pursued during the first swelling; always, however, allowing some of the uniform shoots to ramble occasionally a joint or two in order to prevent the back or main buds from bursting; as also to encourage action of root.

6. STONING PERIOD.—As soon as the berries have completed their first swelling, which may always be known by their size and by their becoming stationary, the "stoning process" (as it is called by gardeners) commences. During this period a little more rambling may be allowed to take place, more especially in parts of the house where there is room for more healthy foliage without shading the principal leaves. The same atmospheric management may be pursued as in the former period; if any difference, let a still freer circulation of air take place. The season will

be now somewhat advanced, and every opportunity should be seized of shutting up much solar heat in the afternoons of sunny days. The thermometer may be allowed to reach 90 degs. by these means, from three or four o'clock p.m. until six or seven in the evening, on such days taking care to apply much atmospheric moisture with it. Still, however, persist in an early ventilation the next morning, giving a little air as early as six or seven o'clock. Dispense with fire heat whenever solar heat can be thus enclosed, and resume it as soon as the glass descends below 70 degs.

7. SECOND SWELLING.—Little can be added peculiar to this stage, excepting that the atmosphere in general must be of a drier character; not so dry, however, as to cause undue perspiration in the leaf. A somewhat closer system of stopping must be again had recourse to, in order to concentrate the energies of the vine in the neighbourhood of the fruit. Give very free ventilation, avoiding, however, wind. Do not remove any laterals with the idea of throwing sunlight on the berry: this is one of the most erroneous ideas in vine culture. The berries will always swell much finer under shade than in sunlight; the colouring, and, of course, flavouring, process being accomplished through the medium of healthy and abundant, yet uncrowded, leaves.

8. RIPENING.—As the grapes acquire full matu-



riety, and are completing their colouring process, they require abundance of air, with a dry atmosphere. No water need be thrown about at this period, unless much artificial heat is used, and then in moderation. Let it be borne in mind that slow, or rather steady, ripening conduces to flavour and colour, whilst the converse holds good of hurried ripening. We are persuaded that the latter, more especially great night heat, has been much concerned in the shanking and shrivelling of grapes; and that much lower temperatures, accompanied with a free circulation of air, ought to be allowed at this period. When the grapes have attained their full colour, or nearly so, then we advise a partial removal of laterals and superfluous shoots. This should, however, be accomplished progressively. When grapes are intended to hang long on the tree, the latter process is sometimes better omitted; at least, enough should be left to shade the berries, as sunlight will, of course, hasten their maturity.

9. PRESERVATION OF FRUIT.—The preservation of the fruit for a long time on the tree is one of the nicest parts of vine culture. This, however, in July or August, and November and December, becomes a very different process. In the summer months it is merely keeping a free circulation of air and as low a temperature as possible. Some gardeners, for special purposes, shade their vines when the fruit is quite

ripe: this is, however, a serious matter, and can only be justified in very special cases. All such shading is at the expense of the ripening of the wood and the energies of the tree in the ensuing year. With regard to ripe grapes in November and December, fire heat must be had recourse to, in order to carry away all accumulating damps, and to prevent the temperature from descending too low. Too great a depression of heat will induce a state of rest; too much heat will hurry them through this stage. We have found, by experience, that an average of 45 to 55 degs. will suit better than either a higher or a lower temperature; unless, indeed, as sometimes happens, that the leaves have ripened and are shed; then, indeed, 35 degs. will suffice, providing damp can be expelled by such a temperature. Fires should be kept going early in the morning, accompanied with a free circulation of air, more especially if somewhat dry, and free from fogs. The house may be closed towards two or three o'clock P.M., with the exception of a very little back air to permit the egress of steam during the night. The West's St. Peter's and Hambro's are by far the best for any late purposes; and the fruit should be thinned, as before observed, so that no two berries touch. They should be examined with the scissars at least once a week, and berries removed the moment that the slightest decay is visible.

10. RIPENING THE WOOD.—This is, of necessity,

almost entirely involved in the preceding section ; a few features may, however, be presented in relief with advantage. In the first place, the importance of this part of the subject is, we are sorry to say, much underrated. When we take into consideration the character of atmosphere that prevails in some of the vine-growing countries, together with the enormous temperature that at times prevails, it will appear evident that this process is seldom overdone in Britain. The vast difference between unripe wood and wood which is thoroughly ripened is more than people commonly imagine. Those who have been much accustomed to pruning, however, are perfectly aware of the much superior hardness, as well as much less amount of pith in the wood of the latter. An experienced vine-pruner may, by these points alone, guess at the amount and character of the produce for the ensuing year. He can also discover, if the wood is particularly firm, of a round character, and possessing a very small proportion of pith, that the border is pretty safe, and that there has been a permanent action of root through the previous season. It need scarcely be urged here, that this process cannot be carried out without much heat, and this of rather a dryish character.

11. REST PERIOD.—Not long since, practical men insisted that vines must be frozen to ensure a proper rest. Such ideas are now completely repu-

diated. That a small amount of frost will not be prejudicial, providing the wood is thoroughly ripe, and is cooled down by degrees, we do not doubt; a temperature of 32 to 40 degs., however, as a general maxim, will be found everything that is requisite, providing the root is right, and the top management in the preceding summer as here detailed. Above all things, let no tyro in vine-culture expose the stems of his vines suddenly to a thermometer indicating 10 degs. of frost; more especially if just in the commencement of the rest period, or at the termination of it. Vines in doors, even without fires, can scarcely suffer without a very severe frost. Those, however, recently removed from the hothouse, or pine-stove, should always, when placed outside, during the months of December or January, be covered immediately with mats or litter.

12. BORDER MANAGEMENT, RENOVATION OF BAD BORDERS, &c.—The first maxim we would here lay down is, providing the borders are rightly constructed, never allow any garden tool, whether spade or fork, to be used in them. There are exceptions in all matters, we know, but, in the present state of garden affairs, when so much meddling of this kind is in practice, we would rather content ourselves with giving prominence to the rule. Our maxim is, as soon as the leaves are falling or crumbling from the vine, to apply what manure is necessary as a top-

dressing. How often have we seen stable and other manures lying in badly constructed stables or fold yards, during November and December, with their properties washing away with drenching rains, and which might as well have lain over the vine-roots during the same period. If a border is well drained, of a good texture, and more than a foot in depth, all the rest may be accomplished by top-dressing for very many years. Top-dressing, in the rest season, may be laid on any thickness, according to the wants of the vines, from six inches to two feet; the latter depth, however, is seldom requisite. One point of caution is here necessary, viz., that the chief body of this top-dressing be removed when the roots are in action. Admitting this to be in April or May, its place may be supplied by a little rotten manure, or half-rotten vegetable soil, about two inches thick; this will ward off extreme drought, and encourage a new layer of surface roots.

In old borders the chief fault is stagnation. This may be caused in two different ways. First, by the inefficiency of the drains, either improperly disposed at the first or choked up by age in some portion or other. Secondly, by derangement of texture in the soil; and this undoubtedly constitutes the great majority of the complaints. Now, even a border made of loam, unless what is termed sandy loam, if 2 or 3 feet in depth, would become in time too much closed

up to suit the natural habits of the vine: how much more, then, a 3 feet-deep border, in which decomposing organic matter constitutes nearly one-half its volume. Every body knows that this black and fatty humus—for such it becomes by age—does not, in its own nature, contain sand sufficient to ensure, at all times, a speedy transmission of moisture, and to secure permeability to the atmosphere, especially if buried nearly a yard in depth. Now, although it is impossible to correct the texture of the whole body of the soil thoroughly without breaking it up, it is quite in our power so to ameliorate its character as to ward off the necessity of the latter expensive measures for several years. The first thing to be done is to examine the whole course of the main drain, if there be one; if not, to establish one without delay. The next is to take advantage if any gaps may exist in the border, through the decay of old vines, and where, it may be, one is about to be planted, and to introduce in all such places cross drains, reaching from the house frontage to the main, which we are supposing runs parallel to the frontage, at the extremity of the border. These cross drains should be well secured, and filled, to within 9 inches or a foot of the surface of the border, with open rubbly matter. If such chances of introducing cross drains are not sufficiently frequent, the next best plan is to open deep holes or “pots” in every possible situation, without offering

much damage to the roots, fairly down to the drainage or subsoil, and to fill these "pots" with the same rubbly materials as the drains. After these things are accomplished, it would be well to fork in a dressing composed of lime rubbish, charcoal, coarse sand, and bones, &c., on the surface, not going deeper than 6 inches, unless there are no roots in the way. Finally the border may be coated over with 3 inches of manure from the stable door, if to spare. This, however, should only lie from November until Midsummer; it might then be removed and dug into the celery beds, and an inch or two of old vegetable soil, or decayed linings, be substituted in its room.

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### POT-CULTURE.

WHERE there is no early vinery, the culture of grapes in pots is a most valuable system, though, from the facilities it offers to the gardener of making good deficiencies apprehended at any time in his produce of forced grapes, it is desirably practised in many establishments where both early and late vineries are maintained.

The first impulse given to fruiting vines in pots was by a paper in the *Horticultural Register* for 1831, by Mr. G. Stafford, then gardener at Willersley Castle, in Derbyshire, and which at the time elicited

much surprise. It has since been most successfully practised by Mr. Mearns, Mr. Spencer, gardener to the Marquis of Lansdown, at Bowood; Mr. Elliott, gardener at Rudding Park, near Gainsborough; and other eminent horticulturists, whose combined information we will here arrange, previously observing, for the sake of those who are inexperienced in pot culture, that the cultivation of vines under the "coiling system," and of those established in pots, differs in some respects worth notice. The "coiling" system proceeds on the assumption that the buds on the ripened cane are already formed for fruit, and that they only await a development under favourable circumstances. With regard to those established in pots, the difference is that they possess already a good root, equivalent to the demands of the branches the moment they are in action: the latter, therefore, do not require precisely the same management as the former.

Now, it is obvious that until roots can be formed by the coiled canes, any undue excitement in the atmosphere must be at the expense of the concentrated energies of the cane above the soil; at least, in our ordinary atmospheres. This points at once to the necessity of a bottom heat much in advance of the atmosphere. This is found to be the case in practice, and much of the success with coilers must ever depend on this circumstance; in fact, by taking care



that no undue excitement or perspiration take place, as to the portion of the coil above the surface of the pot. It may be urged by some that such treatment is immaterial : let it be remembered that the average amount of ground heat is well known to be several degrees in advance of that of the atmosphere in most parts of the globe. The average, however, does not alone suffice to establish the fact that such a power exists in nature ; what we want to know chiefly is the greatest disparity—at what ratio it advances, and, when at its height, the condition of vegetation. As bearing on this point, we would make a quotation from the *United Gardeners' Journal* of January 16, 1847. The subject (p. 40) is the “Potato disease at the Cape of Good Hope.” The writer, Mr. R. Smith, of The Oaks, South Africa, affirms, from experience, that the soil there, at the hottest period in the year, frequently reaches 130 to 140 degs. at two or three inches in depth. Mr. Smith does not state the temperature of the atmosphere at that period—a circumstance rather to be lamented. However, there can be little doubt that the thermometer would scarcely advance beyond 100 degs., and would perhaps be somewhat between 90 and 100 degs.

And here we would direct attention to the amount of atmospheric moisture necessary. This, with regard to the coilers, can scarcely be exceeded by ordinary means. Let it, however, be remembered, in

these tank-heating days, that a confined tank does not produce the amount of atmospheric moisture which the old tan beds did; unless some provision be made for the escape of atmospheric moisture in the sides of the chamber containing the tanks, and which must, to produce an equivalent to the tan bed, be permanently supplied with water.

When the coiled canes are well rooted, it may perhaps be necessary to remove them from the bottom heat, as few can afford to appropriate a pit or house entirely to them. Now this, if rendered imperative, is a serious matter. The only advice that can be offered under these circumstances is, to do it by instalments; that is to say, begin by raising the pots an inch or two out of the plunging medium. In another week they may be placed on the surface, and in a few days after removed to any house which will carry out their forcing process. In such a case, it would be well to let them get rather dry previously to removal from the bottom heat, and to apply liquid manure the moment they are placed in their fresh quarters. Mr. Burns, whose practice is here quoted, sets his pots on moss; and where atmospheric moisture is somewhat deficient the plan is undoubtedly good.

We come now to the consideration of those established in pots; and here the process is rather more simple. These can dispense with the bottom heat if they have a good volume of root; although,

be it understood, that an advance in bottom heat of 5 to 10 degs. in the earlier stages would undoubtedly be beneficial. The same process of stopping during growth, &c. apply here as in the treatment of vines trained in hothouses. Little need be added, therefore, on this head.

We must here be permitted to observe that, after all, much—very much—of the success in all these cases must ever depend on the way in which the vines are potted. Drainage is the first essential ; secondly, texture of soil ; thirdly, quality. In regard of drainage, nothing can exceed a mixture of broken crocks, small lumps of bone (boiled), and lumpy charcoal. There is no real necessity for having the pots so large as Mr. Burns recommends ; in fact it would be extremely inconvenient to many persons. There is, however, little doubt that a bushel pot will excel a half-bushel one in amount of produce—all other matters being equal. It may, nevertheless, be safely affirmed, that a pot of about 14 inches diameter, and the same in depth, is, under good cultivation, capable of perfecting of from four to six pounds of Hambro' grapes. More than this, undoubtedly, may be produced ; we speak, however, of high-flavoured and well swelled berries.

Next in order comes texture and quality of soil, or in other words, compost. If a system of applying liquid manure is to be pursued—and it ought to be—

there is no necessity to add so many enriching materials to the compost, in the shape of manures. For, be it understood, that these, in decomposing, are more liable to fitful and pernicious extremes than mere soils. Manures, therefore, are not to be relied on as to their texture in this affair, and the preservation of a proper texture is a question of paramount importance. We would here urge a reliance, for the most part, on chopped turf, which, combined with a system of liquid manuring, will be found equal to any complicated compost. However, if manure be used, let it be a mixture of horse and cow droppings, in a half decomposed state, adding thereto half rotten leaves; these, when blended, may form about a fourth of the mass. Let not, however, boiled bone and charcoal be forgotten. The charcoal made by some gardeners is probably superior, for this purpose, to the best charcoal, being, for the most part, of an intermediate character, between charcoal and mere wood ashes.

We must here be permitted to revert to the character of the loamy turf. If this be procured in March, when dry, and piled up in an outhouse or shed, it will be what gardeners term "mellow" in the October following, and chopped down small with the spade, without riddling, will be in excellent order for this purpose.

We now come to the last consideration, viz.,

quality. This, as we have stated beforehand, can be supplied to any extent necessary, by the judicious application of liquid manures, properly prepared and applied. And here some caution is necessary, for it must be admitted that the character, as well as mode of application, of such powerful stimulants, are not so well understood as they will be hereafter. Enough is known, however, to build successful practice on, and we will here describe the kind and mode of application, which we have found to answer. It may be stated, in the first place, that no application of this kind will answer long, if applied in a turbid state, for it will defeat, after a few applications, the fundamental principle of all good potting, viz., so to prepare, or compound, the ingredients of any compost, as to ensure, for a great length of time, the free percolation of fluids through the mass, and by consequence a free admission of atmospheric influences. This being premised, a good liquid manure may be made, by mixing guano with water, after the rate of two ounces to a gallon of water. To this, add stale urine of any kind, and clarified soot water. The two latter articles we apply indefinitely. Let it, however, be remembered that this forms a most powerful manure, and if applied without dilution will destroy vegetation. Our present practice is to merely colour the tepid water with it, adding about half-a-pint to a large water-pot. This we have found to answer well,

and is probably within the bounds. However, if an error, it is one on the safe side, and it will yet require much more experience to say how much farther it may be carried, but we know, from long practice, that nothing is gained by over-strong doses; they occasion a sort of vegetable dyspepsia, which shows plainly that nature's bounds have been exceeded.

Mr. Spencer, of Bowood, however, a clever and most experienced gardener, goes a much greater length in the liquid manure way. Mr. Spencer recommends the Black Hamborough, and the Muscadine and Sweetwater, for early work. We quite agree with him. Those who are not in a hurry, however, will do well to try the Muscat of Alexandria; this, although much later, will be found to succeed admirably. The Muscat is a vine that will not bear such a close "stopping" system; and many of the failures in the cultivation of this prince of grapes are to be attributed to this close stopping, or, in other words, to the want of more foliage.

Having made these preliminary observations, we will now proceed to a further detail of the various stages in this mode of culture.

*Raising Plants.*—This is done either from eyes, or from shoots coiled within the pots, or from layers.

*By Eyes.*—Procure eyes (or buds) of the required kinds, from some known good bearing vines, taking care to have the wood perfectly hard and ripe, with

the eyes prominent and round ; leave about an inch or wood attached to each bud, and longest at its base. If the vines are intended to be fruited the next season, the eyes should be potted in 32-pots, placing them one inch below the surface, and using loam of a light turfy nature, or if stiff, adding a portion of half-decayed leaves ; only one eye must be planted in each pot. This should be done early in February, and when finished the pots containing the eyes may be plunged in any pit or frame that may be at work, where a bottom-heat can be maintained of 90 degs. or thereabouts. They may remain there until growth has commenced, when sun-light being indispensable to the welfare of the young plants, they should be placed (if they were not previously) as near the glass as possible, sinking the pots as the plants reach the glass, but still keeping a steady bottom-heat, and supplying them with air every day if possible ; the heat of the frame or pit varying from 60 to 90 degs. in sunshine. When the pots are filled with roots, which will be sometime in April, they may be transferred at once into their fruiting-pots, which should be twos or fours, according to the strength you wish your vines to attain, bearing in mind that those in the smaller size will ripen their wood earlier, and consequently be available for forcing at an earlier period than the others. For compost, use two-thirds turfy loam, from a down having a chalky bottom, and one-third de-

composed night-soil. Should the loam be strong, use the same proportion of half-rotten horse-droppings. The turves in the loam should only be half-decayed, and used as rough as possible. (*Gard. Chron.* 1844, 195.)

*By Coiling.*—This system, we believe, was first suggested by Mr. Mearns, and the practice is thus particularized by Mr. Elliott—

Take a shoot of sufficient length, with good bearing wood at the extremity; all buds to be carefully removed from that part to be coiled into the pot, say seven or eight feet in length, leaving about three feet of bearing wood; in size, the pot from 12 to 14 inches in diameter, and well drained; the soil, fresh turfy loam direct from an old sheep-walk close upon the lime-stone, with a little of a more sandy nature added, well chopped up and mixed together; some of the roughest turfs put over the drainage, and the rod coiled in; when filling up the pot the soil to be well pressed down, especially against the coil; when finished, and the stem tied to a stake, the pot to be sunk into a dry border, and protected from the extremes of the weather, until introduced to the forcing-house, when the pot must be plunged up to the rim in a bark bed ranging from 87 to 97 degs. while the atmospheric temperature must be kept from 40 to 50 degs. to prevent evaporation; the stem to be covered loosely with moss, and kept always moist by syringing with cool



water ; by this process a little assistance to the stem may be derived by absorption. From the high temperature of the medium into which the coil is plunged the vital energy is strongly excited, and the speedy emission of vigorous roots is the natural consequence; the more slow and gradual the evolution of the buds the better : and here is rather a critical point, viz., the proper time for disbudding ; if delayed too long, too great a surface for respiration and transpiration is exposed for the yet limited absorbing powers of the young roots, and if performed too soon the action of the system is paralysed. Upon examining the pots, should abundance of rootlets be found, the atmospheric temperature must be raised by degrees, as with established vines. The moss must not be removed until the fruit is set, and then all is safe. (*Ibid.* 1841, 749.)

*By Layers.*—Mr. W. Stothard, gardener at Chantry House, in 1841, gives these directions :—When the vines that are let into the house have reached the top of the rafters, instead of stopping the leading shoot, as is commonly done, and often too soon, which causes the eyes to burst, and renders them useless for the succeeding year, turn the shoot back, and having ready a pot of suitable size, well drained and filled with fresh turfy loam and rotted dung, in equal parts ; place it upon the back shelf or wall of the pit, and as soon as the young shoot has attained a suffi-

cient length to be laid into the pot, cut out two or three eyes, and as many of its leaves, and scrape off a little of the bark the whole length of the part intended for roots, which is bent into the pot, and covered with mould six or seven inches. No attention is required, excepting to train the shoot as it advances in growth, and to keep the mould in the pot a little moist, to encourage the emission of roots, which will appear in a fortnight or three weeks, and soon fill the pot. When the shoot is laid in the pot, allow it to grow from four to eight feet long, according to the strength of the parent vine, to which leave it attached until it has done growing, and perfectly ripened its wood. Should there not be a sufficient quantity of leaders, place pots under the rafters at most convenient situations, and likewise on the front flue; but the shoots that are laid in these pots never suffer to exceed five feet in length. When the plants are severed from the parent vines, put them out under a wall where they are protected from frosts, and take into the house as required for forcing; at that time shift into pots about a foot over and fourteen inches deep, to remain until the fruit is cut, after which they may be thrown away, sure of a fresh supply of plants every year by the same process. (*Johnson's Dict. Mod. Gard.*)

*After-culture.*—The fullest information on this head is the following, furnished by Mr. Spencer—

After potting, the plants should be placed in some

house or pit where a temperature from 60 to 80, or 85 degs. is maintained ; they should also be so arranged that the shoots, as they advance, can be trained immediately under the glass, and be exposed as much as possible to the light. The front kerbs and back shelves of pine-pits are suitable places, and the partial shade that the vines afford benefit the pines during three or four of the summer months. Where there is only a vinery, they may be trained between the permanent vines, or in any other place where the cultivator can make room for them. As the shoots advance, train them carefully, and stop the laterals as they appear. When first potted, the plants will want but little water ; but it must be gradually increased as the pots become filled with roots ; they will then require it regularly during their growth, and manure-water may occasionally be given, although the quantity they demand the first season is small in comparison to what they require afterwards. The most suitable length of cane for pots is from four to six feet ; but if, from any peculiarity in the house, in which they are to be fruited, a longer length may be required, they should be left accordingly, as the vine will grow strong enough for fruiting, eight, or even ten feet long. After it has grown a foot more than the length required the next season, it should be stopped ; three or four of the upper laterals, however, may be allowed to grow at a few joints, to pre-

vent the topmost eyes breaking. Manure-water may now be applied to cause the buds to swell, and care must be taken to preserve the principal leaves, as they are now performing a most important part in regard to the crop next season. When the wood appears to be turning brown (or ripening), water should only be applied to prevent the vines flagging; the laterals should be taken off, and every means employed to ripen the wood perfectly. Indeed, if it is not convenient to allow a large admission of air when they are growing, it would benefit them much by removing them to a cool house, where they would have the benefit of more, and a lower temperature at night. By the beginning of September, if the former directions have been followed, the vines will be ripe enough to place out of doors. The north side of a wall is the best place, and the pots should be laid on their sides, and every means taken to throw the plants into a state of rest; the cultivator will thus find himself in possession of vines which, for strength and vigorous habits, may justly be mistaken for older plants. If the above mode of obtaining fruiting vines for one year should be thought too troublesome, from the plants requiring bottom-heat during their first stage, the eyes may be planted singly, as before, in 48-pots, and set in any house or pit where there is a little heat; they will be longer, however, by this method, in developing their roots, and may not want

shifting into larger pots before May or June, when the plants may be moved into 24's, in which they may remain through the season, in any house or pit in which room can be found for them, paying attention to watering, tying up, &c. They may be stopped when two or three feet high; and when the wood is fully ripened, removed out of the house, and plunged in any material out of doors that is a non-conductor of heat. In February, or March, cut these plants down to two or three eyes, shake them entirely out of the pots, and place them in similar sized pots to fruit in as the former ones, taking care to spread their roots (in potting) regularly through the soil, that when the growth commences, each spongelet may be in immediate contact with food; this is a much better practice than placing them in a pot without disturbing the ball, as is often done. The same routine of management must be followed with these through the season, as recommended for the others. From the larger amount of organisable matter the vine possesses by this mode of treatment, they will generally be found stronger than those raised the same year, and they possess the advantage of ripening their wood earlier in the summer. (*Gard. Chron.* 1844, 212.)

The next consideration is the time when you wish your grapes to ripen; this being ascertained, it is easily known when forcing ought to commence. It

may be stated, that vines under the above-mentioned treatment will be ready for forcing early in November, and consequently will ripen their crop by the end of March. The precise mode in which the vines are to be fruited depends on the kind of houses the cultivator has at his command ; a flued pit answers well ; but the best description of house is that which admits the rays of the sun to pass through it in the winter, at as near right angles as can be. Such a house, admitting considerably more light during the winter months, is much more suitable for such a plant as the vine than low flat houses. Whatever the house is, if not perfectly ready for the vines when you wish to begin forcing, get them placed in a dung frame, where you can give them a moist heat of 55 degs. ; this will cause their buds to swell regularly, and prepare them for their removal to the fruiting-house, when ready, without losing time. Previously to losing their leaves in the autumn, they may be disbudded on Roberts' system, leaving a few more buds than you want bunches ; but one objection to this system is, that if by any accident, through the winter, the bud should get injured, it leaves a blank which, had the next buds remained, might easily have been supplied. The number of bunches that may be left on each vine will depend on the soil, size of the pot, &c. When the vines are strong, and No. 2 pots are used, leave six or seven

bunches on the Hamburgh, the same on the Sweet-water, and one or two more on the Muscadine. If the vines are not so strong, four or five bunches on the Hamburgh will be sufficient. It is much better to have rather fewer bunches, and the berries fine and well coloured, than ill-coloured puny bunches, which always is the case when too many are left on the vine. The vines, when placed in the house, presuming their buds to be swelled, must have their temperature raised from 55 degs., fire-heat, to 65 degs. when in bloom, and it will be better if this degree of heat, by night, is never exceeded; of course, on all days when there is no likelihood of sun-heat, the heat of the house should be raised 5 or 10 degs. by artificial means. Air should be admitted every day early; this is of consequence, or the leaves are apt to get damp, and their texture being so extremely thin, when the hot sun and drying winds of March act on the foliage, they often burn and shrivel, and consequently are unable to swell off the fruit or give it colour. During all the time the vines are in a fruiting state, manure-water, in some shape or other, must be frequently given. Dung-water is made of various ingredients, but in whatever way it is made, it ought to ferment before using, and should be applied in a pure state, and at a temperature equal, at least, to that of the house. The draining from farm-yards is always good and safe. So is manure-water, made by pouring nearly boiling water on equal parts

of sheep's or deer's dung, and fresh horse-droppings, fined by a lump of fresh lime, drawn off clear, and when used diluted with equal parts of rain water. A very weak solution of guano is beneficial, but great caution is required in using it. It is astonishing, during the period of active growth, what an immense quantity of dung-water vines will take. If the dung-water is properly cleared and diluted, it may be given twice for fresh water once; when the grapes are fully swelled and beginning to colour, water must be more sparingly applied, using clean water only. The flavour of grapes is often spoiled by being over-watered when ripening their fruit, by the proportion of carbon and water, which constitutes the saccharine matter in grapes, being destroyed, and water formed in excess. When the fruit is ripe, if the house is wanted for other purposes, the plants may be removed to any dry house or room, where the grapes will keep until wanted. The varieties Mr. Spencer finds best for early forcing in pots are, the *Hamburgh*, *Dutch Sweet-water*, and *Muscadine*. The small-berried varieties, as the *Esperione* and others, are hardly worth growing, compared with the above. *Muscats*, and all the delicate sorts, as the *Frontignan*, answer admirably later in the season, and thus the amateur, and those who possess but a small extent of glass, may cultivate all the varieties of grapes procurable in British nurseries, at but a trifling additional expense. Where the cultivator prefers boxes

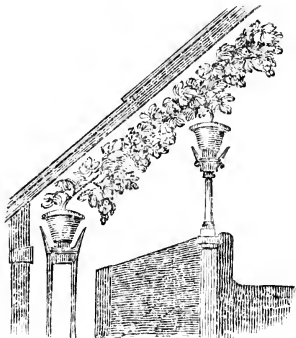


to pots, they may be used, from 14 to 16 inches square, which will be quite large enough; they can be packed on shelves more closely together than pots, and are more handy to move about. By the above process, grapes may be procured by the end of March and April, without interfering with those planted outside. (*Ibid.* 1844, 228.)

As the practice of Mr. H. Burns, gardener, at Tottenham-park, differs somewhat from that of Mr. Spencer, and affords, besides, some useful details of practice, we subjoin the particulars he furnishes, though by no means approving of his system of frequent shifting. He says—

Set the eyes in thumb pots on the first of February, putting moss about two and a half inches deep on the flue at the back of the pine pits, and place the pot upon it, keeping the moss always moist. As soon as the bud or eye has become well furnished with roots, replot into sixty-sized pots, and continue afterwards to shift as fast as the pots become filled with roots; from sixties to forty-eights, thirty-twos, twenty-fours, sixteens, and twelve-sized pots successively; and lastly, into bushel-pots, or tubs. Encourage rapidity of growth as much as possible, by feeding with liquid manure made from cows' and deer's dung; and during the whole time keep a good drainage at the bottom of the pots. The soil, three-fourths strong turfy loam and one-fourth horsedung; from the linings of the pine pits select the most decayed parts of the manure.

Allow the shoots to run to the extent of thirteen eyes, and then stop them. By the middle of September the wood becomes ripened, and then prune them back to the ninth eye, and remove them from the pinery to the open air, setting them under a south wall, on bricks placed edgeways, so as to admit free drainage. On the first of November take in the required pots for forcing; after they are washed with soft soap and sulphur. After all the eyes have shown fruit, select from six to eight of the best bunches to remain, and pluck off the others, never allowing one eye to bear more than one bunch. Syringe the vines gently with warm water three times a week, and water them with the liquid manure. Should they, however, occasionally require more moisture, give them nothing more than soft water about milk warm. Mr. Burns fruits annually from 100 to 120 vines, taking in after the first fifty the rest in succession.



The preceding sketch represents a transverse section of the vinery, with bed for tree leaves to decay and heat ; framework for the support of front trough, sixteen inches wide at top, and ten inches deep, and the wire under the rafters on which the vines are trained. (*United Gard. and Land Steward's Journ.*)

*Preparation for Forcing.*—Mr. Arkwright proved that vines, of which the wood and fruit have ripened late in one season, will vegetate late in the following season, under any given degree of temperature ; and Mr. Knight has shewn the converse of this proposition to be equally true ; the plants under each different mode of treatment requiring a period of rest, during which they regain their expended excitability. A Verdelho vine, growing in a pot, was placed in the stove early in the spring, where its wood became perfectly mature in August. It was then taken from the stove, and placed under a north wall, where it remained till the end of November, when it was replaced in the stove ; and it ripened its fruit early in the following spring. In May it was again transferred to a north wall, where it remained in a quiescent state till the end of August. It then vegetated strongly, and shewed abundant blossom, which, upon being transferred to the stove, set very freely ; and the fruit, having been subjected to the influence of a very high temperature, ripened early in February. The plant retained its foliage till April, and would not

be prepared to vegetate again till late in the spring. This experiment will probably succeed well with those varieties of the vine only which produce blossoms somewhat freely, and are of hardy habits; but abundant crops of fruit of these may be obtained at any period of the winter or spring by proper previous arrangement of the plants, and by the application of a higher or lower degree of temperature. (*Knight's Papers*, 288.)

*Size of Pots.*—The smaller the pot, consistent with healthful vegetation, the better, not only because less room is thus occupied, but because the smaller development of root required, the earlier will be the production of ripe fruit. In using bushel pots or tubs there is no doubt that Mr. Burns used a size needlessly large, and we have no doubt that the largest size required are those nine inches in diameter by nine inches deep. We know this from having seen it successfully practised, and vines grown in them bearing five noble bunches, commencing from within eight inches of the soil. Our opinion is further sustained by the authority of the late Mr. Knight, who has stated that—

A pot containing a quantity of mould, equal to a cube of 14 inches has been found large enough for a vine whose foliage occupied a space of 20 square feet; water holding manure in solution being abundantly given. And Mr. Knight states, he saw grapes ac-

quire a larger size, and other fruits a higher flavour, under such management than under any other. (*Knight's Papers*, 255.)

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### DISEASES.

The diseases afflicting our grape vines are chiefly confined to their fruit, and we conclude that they are caused by the vines being over-stimulated to production at an unnatural season, without there being secured to them either a due supply of sap, or a favourable atmosphere to ripen in. The probability is, that a chief source of the maladies is the absence of an accordant temperature of the soil and the atmosphere; for grapes grown in the open air are liable to none of the diseases which afflict them under glass.

*Shrivelling* of the berries of the grape in stoves appears to arise from the roots of the vine not supplying a sufficiency of sap, as well as from its not being duly elaborated in the leaves. This occurs if the roots are in a cold soil, or are vegetating in an outside border, the temperature of which is too low compared with that of the stove. In the first case, thorough draining and the incorporation of calcareous rubbish; and in the second case, protection to the border and stem, will remove the evil. If the sap be not duly elaborated, it must arise, either separately or con-

jointly, from the leaves vegetating in an ungenial atmosphere, or from their being too reduced in number. In either case, we consider with Dr. Lindley, that a deficiency of organizable matter is the consequence ; and such deficiency is a satisfactory explanation why the disease occurs. It must never be forgotten (says the authority just quoted) that plants, like animals, consist of two essentially distinct parts ; the one the organised material of their structure, the other the organizable matter out of which additions are to be made to that structure ; and that under no circumstances whatsoever can growth take place, except in the presence of the latter. This law is not only one of the foundations of vegetable physiology, but one of the most important of all facts for the gardener to bear in mind, explaining as it does the sources of success or failure in multitudes of the operations in which he is engaged. (*Gardener's Chronicle*, 1843, 709.)

Shrivelling, or rather the withering of grapes produced from weakness, is a very different disease from shanking. *Shanking* takes place almost as quickly as a tree withers when struck by lightning, but shrivelling is much more gradual in its advance, and occurs, at first, without any disease appearing in the footstalks of the berries. The other symptoms are, that after the berries are formed they advance pretty rapidly in size until the period when the seeds are

forming; for a time their increase then seems suspended. Immediately after this, the footstalks, sometimes, suddenly turn brown and shrink, and the berries, ceasing to increase in size, shrivel, acquire an unpleasant taste, and ultimately fall off. (*Trans. Hort. Soc.* vi. 25.)

If the roots of the vines are found to have penetrated the soil deeply, they should be lifted very carefully, brickbats placed beneath the roots, and these trained about nine inches beneath the surface. If drainage of the border has been neglected, let it be effected at the same time. If the loss of the crop which would be occasioned by the lifting of the whole of the vines would be inconvenient, only one or two can be so treated in successive autumns. The most injurious time for an unnatural disparity of temperature in the air and soil to occur is at night; for, as was justly observed by the late Mr. Knight, an ill effect of high temperature during the night is, that it exhausts the excitability of the tree much more rapidly than it promotes the growth, or accelerates the maturity of the fruit, which is in consequence ill supplied with nutriment at the period of its ripening, when most nutriment is probably wanted. The Muscat of Alexandria, and other late grapes, are, owing to this cause, often seen to wither upon the bunch in a very imperfect state of maturity; and the want of richness and flavour in other forced fruit

is often attributable to the same cause. (*Knight's Papers*, 216.)

The Frontignans are among the varieties apt to shrivel under great disparity of temperature between the roots and branches. This disparity will be lessened by not commencing forcing this grape so early as usual. (*Gard. Chron.* 1841, 73.) But the legitimate mode of obviating the evil is by taking care that the soil of the border is preserved in a due temperature.

Somewhat allied in its causes to shrivelling is that unsightly imperfection where the berries do not come to maturity at the apex of the bunches, leaving from five to ten quite colourless and sour, though others on the same bunch are fine and large. In such case the remedies are to give more heat and air, keeping the border warmer than before, and to avoid cold damps in the house; leave as much foliage as can be exposed fully to light. The leaves removed must be by little at a time. In thinning, clip off a few berries at the lower extremity of the bunch; the rest will swell better.

*Shanking* is an ulceration, or gangrene, attacking the footstalks of the bunches, and appears to be occasioned, like shrivelling, by the temperature of the soil being too much below that in which the branches are vegetating; and, consequently, the supply of sap to the grapes is too much diminished, and the parts



which thus fail of support immediately begin to decay, this is an effect always the consequence of a diminished supply of sap, apparent either in the leaves, flower, or fruit. The disease, like every other putrefaction, does not advance rapidly unless there be much moisture in the atmosphere.

The coldness of the soil causes this torpidity in the action of the root ; and this, perhaps, at the very period when the greatest demand is made upon it to sustain the excessive perspiration which is going on in the leaf, and to furnish fresh matter for elaboration ; to both which ends it is frequently quite inadequate, owing to drenching rains. If the young fibre be examined at such inclement periods, it will be found somewhat discoloured ; and, in some cases, quite rotten. This is not to be wondered at when the habits of the plant are duly considered, and the difference estimated between a vine on the slope of a rocky surface in the south of Europe or Asia, with six inches of soil, and one in the cold northern clime of Britain, in four or five feet of rich soil, every breathing pore closed with a kind of alluvium. If shanking were caused by sudden depressions of temperature, why should it not occur more frequently on walls out of doors, where the thermometrical changes are at least as great as in doors ? Yet here it seldom occurs, and here again the border is seldom so deep, so rich, or so far below the surface level, as some of

our hothouse borders, many of which contain material sufficient for thrice their extent. (*Hort. Soc. Journ.* i. 52.)

We cannot but think, in re-examining this subject, that shrivelling is chiefly caused by an insufficient supply of the pabulum necessary to sustain uninterrupted progress in the berry. It does not follow, however, that it must, of necessity, be a case of non-elaboration. It more frequently arises, in our opinion, from torpidity of root, brought on by various causes; amongst which, as chief, may be named the cold and continuous rains of wet periods during the growing season. Such, acting on borders already become too close, and "sour" through age, and imperfect texture, produce utter stagnation, if not destruction of fibre, at the very period when the greatest demand is made on the root. How can such end otherwise than in debility?

Shanking, we conceive, is generally caused by the unnatural disagreement of temperature between the root and top, independent, in the main, of the question of moisture. It generally occurs with vines which have been somewhat forced; seldom on open walls—seldom with vines forced in pots or tubs. The obvious prevention of shanking is securing a congenial relative temperature to the roots and foliage.

*Rust.*—This disease, affecting the berries of the grape, comes in the form of a rough, rusty appear-

ance of their skins, which have, in fact, become thick and indurated. Some think it arises from their being handled, or the hair of the head touching them; but the disease is often too general to admit of this topical explanation. We believe it to arise from an overheating of the vinery, however unintentional, whilst the grapes were young, and thus tending to force them to a premature rapidity of growth. Any excessive pressure upon the cuticle, whether from within or from without, causes its thickening. This considerable elevation being succeeded by as sudden reduction of temperature, will almost certainly induce the disease.

One writer thinks that this, or whatever causes the rust, occurs whilst very young, for he states that he never saw grapes with this disease, but dark spots were to be observed on the bunches before they were in bloom. He adds, that if the diseased berries appear to have a more oily appearance, until nearly the size of a pea, and the pollen adheres to them as dust does to anything fresh painted, whether syringed, thinned, or not, there is nothing will prevent them from having the rust that season. (*Gard. Chron.* 1842, 805.) We can only say, that we have not observed these phenomena, and that we are convinced, if the temperature to which the bunches are exposed is not subjected to sudden vicissitudes, the rust will not appear upon their berries.

*The Spot* affecting the berries seems to be the same disease as shanking, only affecting a different part. Like this disease, it is a gangrene, and is probably occasioned by an irregularity in the supply of moisture and vicissitudes of temperature, but especially if one of the extremes is much below the degree of heat most favourable to the healthy growth of that plant. The reason of this is very obvious. If any plant be placed in a highly stimulating heat, and is abundantly supplied with root moisture, it immediately increases its surface of leaf and fruit. If this amount of sap is subsequently suddenly reduced, by lowering the temperature, and adding water to the soil less freely, the increased surfaces are no longer required, and it is a law pervading all the vegetable creation, that the moment any of the parts of a plant are unnecessary to it, that moment they begin to decay. We placed a plant of the Marvel of Peru, or Heliotrope, in a high temperature and abundant moisture; these were then much reduced, and the leaves in a few days were completely decayed round their edges, and in spots upon their surfaces. The extent of leaf was accommodated to the amount of sap to be elaborated. (*Princ. of Gard.*)

Muscats are particularly liable to the spot. Our opinion that sudden vicissitudes of temperature are the causes of this disease, seems to be well sustained by the fact, that the parts nearest the glass, that is,

the upper portions of the bunches, and those parts most exposed to the sun's influence, are the first to suffer ; and this, also, goes far towards substantiating the assertion, that the shade of the foliage is necessary to the well-doing of grapes. (*Gard. Chron.* 1843, 505.)

*Want of Colour* is often a defect of the Black Grape, but not at all necessarily arising from deficient light. The green colour of leaves depends entirely upon the presence either of light or of uncombined hydrogen gas, but vegetable reds, purples, and other colouring matters of fruits, are formed, though less intense, even in a total absence from light. So far from full exposure to light being requisite for the full colouring and ripening of grapes, they never attain these desired qualities so well as when shaded by one thickness of leaf. The colouring matter of all fruit is dependent partly upon the leaves immediately above it, and partly upon the fruit itself ; the necessary digestion of the sap being commenced in the one, and perfected in the other. If this digestion or elaboration of the sap is checked by ungenial temperature, but more particularly if the crop is too heavy for the vine, or if the leaves, especially above the bunches, are too much thinned, defect of colour will be the very usual consequence to the berries.

Let it not, therefore, be assumed at any time, that want of colour is caused by the want of sunlight to

the berry. We have seen the blackest of berries in situations where the sun had never shone on them since they blossomed : indeed, it only requires a little close observation for one season to dispel such a fallacy. It sometimes, however, happens, that the principal leaves on the same shoot with the bunch are shaded by other main leaves, or by laterals ; such shading is sure to be prejudicial to the colouring of the berry, as well as to the maturation of the buds connected with the shaded leaves. And here we have one of the reasons for such close stopping as the vine is subjected to.

Over-cropping, alone, will lead to bad colouring ; indeed, is one of the most fruitful sources of it. It exhausts the tree of every particle of prepared sap, and produces a kind of debility in the root, which renders it readily susceptible to the stagnating rains of an unpropitious season.

In order to promote good colouring, the ripening process should not be hurried. It is evident, that very high temperatures are not required for this purpose, for the Black Hamborough, on common walls, is not deficient in colour, in a good season. Now the colouring process, in the latter case, occurs in the end of September, when the temperature at night must sometimes be near the freezing point. It is a common observation of practical men, that the cold nights of autumn hasten maturity in many crops ;

and this is undoubtedly a fact, and traceable, we presume, to a cessation of the growing principle; causing, thereby, a concentration of the energies of the plant. We would say, therefore, beware of too high a temperature during the colouring process, unless accompanied with much solar light, and even then avoid extremes. We would more especially avoid night heat at this period, and would promote a circulation of air night and day.

*Warts, or Blisters*, on the leaves, occur to the cells of the under surface, immediately beneath the cuticle, which become much elongated and multiplied, with a vertical arrangement, the cuticle being sometimes wholly, sometimes only partially, obliterated. The leaf is discoloured and withered in consequence of the absorption of the neighbouring chlorophyll by the diseased and multiplied cells. It is very difficult, in the present state of our knowledge of the diseases of plants, to say what is the cause, and consequently to assign a remedy. Though so strongly resembling one of the epiphyllous fungi outwardly, it is of an entirely different nature. (*Gard. Chron.* 1844, 320.)

The probable cause seems to be excessive moisture to the root, which induces a large supply of sap to the leaves faster than they can dispose of its moisture by transpiration; ruptures of the vessels, and contortions of the parenchyma, are the con-

sequence. Good drainage, and an atmosphere not too moist, would remove, probably, the evil.

*Bleeding.*—This only occurs to the vine, from the unhealed surfaces of cuts made after the sap has commenced its motion, and before the leaves are well expanded. A red-hot iron, applied to the bleeding surface until it be charred, will stop the effusion of sap for a time, if not permanently, and to effect a complete stoppage at once, coat the charred surface, and rub well into it, a paste made of lime newly burnt and grease. This hardens and forms an effectual plaister.

Two other plaisters have been suggested; the first of which, by the late Mr. Knight, we know to be effectual, but of Sir John Sebright's we have had no experience.

One fourth of calcined oyster-shells, beaten to fine powder in a mortar, and three-fourths of cheese, worked together, until they will form a sort of paste; this mixture pressed into the pores of the wood, either with the thumb or any other means, will effectually stop the flow of the sap; sometimes a repetition may be necessary, if it is not well forced into the pores. (*Hort. Trans.* i. 102.)

Sir John Sebright's cement consists of four parts resin, one part bees-wax, and one part fine brick-dust, melted and well mixed together. The mixture is to be applied whilst hot and liquid. (*Gard. Chron.* 1844, 280.)



*Erineum vitis* is the name of a very minute fungus making its appearance very often on the leaves of the vine in places where, from wounds or other causes, extravasated sap occurs. It is in the form of yellow, woolly tufts. We are not aware of its occurring so abundantly as to be injurious to the vine, and it would be destroyed probably by the usual sulphur fumigation.

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## INSECTS.

THE vine is subject, under bad cultivation, to be attacked by every genus of insect that infects the hothouse. In the open air no tree is less liable to insect ravages.

*Acarus tellarius*, the Red Spider, is one of the vine's in-door enemies. It generally resides and breeds on the underside of the leaves, and the infested leaves are very distinguishable as soon as they are thus attacked; for the insect wounds the fine capillary vessels with its proboscis, and this causes the upper surface of the leaf to appear full of very small dots, or spots of a light colour. When the Acari are very numerous, they work a fine web over the whole under-side of the leaf, as also round its edges; and it is curious to observe, that they commonly carry this web in a straight line, from one angular point of the leaf to another, on which boundary line, in a warm

day, they pass and repass in very great numbers. They do not confine themselves to the leaves only, but attack the bunches of grapes also, especially at the time when they are almost ripe ; and as they extract the juices from them, the grapes soon become flabby, and ill-flavoured. (*Speechley*, 171.) The Red Spider cannot thrive—scarcely exist—where a sufficiency of water is regularly applied. As, however, syringing cannot be persisted in at all times, something else is requisite at those periods, when the syringe is laid by. Sulphur, then, is the best thing at present known for this purpose ; but as many persons are deterred from the use of it, through a fear of its pernicious effects, we will here detail our mode of using it, by which we have been kept (we might almost say entirely) free of this pest for the last twelve years. We apply it about three or four times in the course of the year, to each house ; the houses are on the average about thirty feet long, by some sixteen feet wide, and we use about six ounces to each house each time ; applied in the form of thick paint. The houses are heated by hot water, and the sulphur paint is applied to the under or return pipe alone. The best way is to beat a lump of soft-soap, as large as a walnut, up in warm water ; and to add some clay water, made by working a lump of clay in warm water until the water becomes a thin paint ; then to blend this with the soap water ; and finally to mix the sulphur also. The soap and

the clay form a body, and prevent the sulphur washing or rubbing off. This application, then, with the proper use of the syringe, as detailed in the calendar—the regular washing of floors, twice a-day at least, with the moistening of walls, shelves, or other bare surfaces—keeps us entirely free from the Red Spider. And, be it observed, that this is the greatest enemy of the vine we have ; no one can get proper colour or flavour, whilst this robber of the elaborated sap is allowed to suck that life-blood of the tree.

The occurrence of the Red Spider is greatly checked by washing the stems and branches of the vine at the end of the forcing season, and again before forcing is commenced, with the following composition :—Put 4 lbs. of flowers of sulphur, 2 lbs. of tobacco,  $\frac{1}{2}$  lb. of soft soap, and 4 ozs. of powdered nuxvomica, into five gallons of boiling rain water ; stir them until well incorporated, and apply with a brush whilst warm.

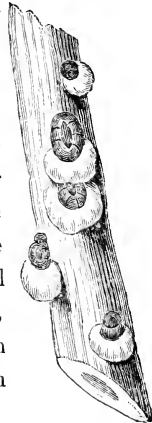
Mr. Speechley's directions are these :—To 1 lb. of flowers of sulphur put 2 oz. of common Scotch snuff (very good tobacco dust will answer equally well) ; let these be well mixed together ; then take a small brush, such as is used for common painting, dip it lightly in the sulphur, then lay one hand on the upper surface of the leaf, and with the other draw the brush very gently backwards and forwards all over the under side : by this means a little sulphur

will be left on the leaf. The *Acarus* being soft and delicate in its nature, is destroyed with the most gentle touch. The brush also most readily wipes off the web, as well as the globular transparent eggs, which are, by a fine membrane, fastened to the leaves; and thus we are secured from the danger of a succeeding brood. This process may, to some, have the appearance of a tedious operation; and, indeed, when vines are injudiciously trained, it certainly must be attended with great trouble; but it is very easily performed upon vines trained in the regular method here set forth, and a single operation is generally sufficient for a whole season. (*Speechley*, 175.)

*Aphis vitis*, the Louse, Puceron, or Vine Fretter, sometimes appears upon the young shoots of the vine, but these grow so rapidly that we never observed any injury caused to them by this insect. It is speedily destroyed by tobacco fumigation.

*Coccus vitis*.—The vine scale preys upon the stems and branches of the grape vine, both in the open air and under glass. It seems to be the same species which also attacks occasionally the peach, nectarine, and plum. It is, says Mr. Curtis, a longish brown insect, which in old age assumes a blackish brown colour, and becomes hemispherical and wrinkled. The females are shield-like, being convex above and flat or concave below; they are furnished with six small legs, which, when the insect is old, become part

of the substance of the body. On the under side of the insect is a sucker, with which it pierces the cuticle of the plants, and extracts their juices. Soon after impregnation the female dies, and her body becomes a protection for the eggs, which are covered with long white wool, and sometimes completely envelope the shoots of the vines, or of plants, growing underneath them. The males are furnished with four wings, and are apterous. Their powers of propagation are immense; and, where they once become very numerous, they are exceedingly difficult to eradicate. This species belongs to the true genus *Coccus*, characterized by the female having a scale inseparable from her body. While young, both sexes are alike, but the male larvæ produce two-winged insects, with two tail threads. The females have no wings, and their dead bodies, beneath which the young are sheltered, appear as in the annexed wood-cut.



*Coccus adonidum*, the Mealy Bug, feeds on tropical plants, with which it has been introduced into our hothouses, especially *Coffee*, *Cestrum*, *Justicia*, *Canna*, *Musa*, *Renealmia*, &c.; but it also is very injurious to the vine and pine-apple; though it is of much rarer occurrence than the *C. vitis*. The female is not

shield-like, as is the preceding, but more resembling in form the woodlouse. Being reddish, though sprinkled over with a white dust, it has been mistaken for the Crimson-tinged Pine Bug. The body of the female is divided into twelve segments, and these have small tubercles at their sides. The male is gnat-like and slender, with two broadish wings, and two long brush-shaped tail filaments. This scale insect may be removed with a soft brush, and easily killed by washing with soap-suds.

*Coccus hesperidum*, the Orange Scale Insect, sometimes, though still more rarely, appears upon the vine. It attaches itself both to the branches and leaves. The female appears like an oval, nut-brown shield. Both the male and female are represented magnified in the accompanying sketches.



Whilst the leaves are on the vine, if any species of

scale appears on its stem and branches, the least offensive remedy is to paint over the whole with a strong solution of gum arabic or starch ; allow it to remain on for a week, and then wash it off. But the most effectual remedy is to brush them over thoroughly twice, after an interval of a day, with spirit of turpentine. To prevent the recurrence of the plague, a very effective mode in autumn is, to scrape away and burn all the rough bark, and then, with a rough brush, to paint over the stem and branches with a creamy mixture of clay, lime, soft-soap, flowers of sulphur and urine.

Another formula, quite as effective and less disgusting, is this :— $\frac{1}{2}$  lb. of soft-soap, 1 lb. of sulphur, and  $\frac{1}{4}$  oz. of black pepper, to 4 gallons of water, boil together for 20 minutes, and make it thick enough to adhere to the wood like paint. If it does not, thicken it with lime, adding sufficient soot to take off the glaring white colour of the lime. The proportions are of little consequence, the object of this and similar washes being, by adhering to the wood, to prevent the eggs or larvæ of insects from coming to life. (*Gard. Chron.* 1842, 840.)

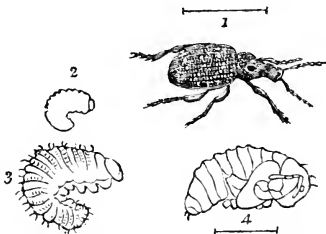
*Curculio (Otiorynchus) sulcatus* is by far the most injurious vine weevil, and every means should be used to prevent its increase in vineries. They eat the margin of the leaves into all sorts of shapes. The weevil always feeds in the night, hiding itself by day

under the leaves or loose bark of the vines, or in any similar place, to avoid the light. Advantage may be taken of this habit to destroy it, by placing a handful of moss here and there among the branches of the vines, by way of trap, and into this it always retires at the approach of day. The moss to be taken down and examined every morning, and the insects found in it killed. Another species (probably *C picipes*) often causes the failure of grafts by eating the buds just as they are bursting into shoots, when, if the season be adverse, or the graft too weak to develop an adventitious bud, it, of course, dies. Both species suddenly drop to the ground if disturbed, when, either from the instinct of self-preservation, or from being stunned by the fall, they lie as if dead, and being nearly the colour of the earth, they are difficult to discover ; caution is therefore necessary in catching them. (*Ibid.* 1841, 325.)

*Curculio sulcatus*, as described by Mr. Curtis, is a dull black weevil, with a stout proboscis, at the extremity of which is the mouth ; the thorax is granulated, and the elytra are rough, with several elevated lines and minute ochre-coloured dots placed somewhat transversely ; it has no wings. The period for the appearance of these weevils depends upon temperature, for May is mentioned by some, and June by others, as the months when they are mischievous in gardens, and in hot-houses much earlier. Mr. E.



Edwards says that he has seen them in an early vinery at Studley Castle about the end of January, when they make great havoc amongst the young shoots and foliage ; and from that time until the end of April they feed upon the buds and leaves, always high up, and are never seen in the day. They will also eat the leaves of the peach, and have been known to attack the fruit. The eggs are deposited a little beneath the surface of the earth, and produce white maggots, and these live at the roots of the vine, rendering the plants weak and sickly ; some say that about June the maggots change to pupa, whilst others state that they live through the winter, and undergo their metamorphoses in the spring ; however this may be, they remain in the chrysalis state only 14 days. The maggots also do great mischief to succulent and other plants in pots, as well as in the border, such as Sedums, Saxifragas, the Trollius, Auriculas, and Primroses, eating round the tops of the roots and detaching them from the crown.



1. The Weevil. 2, 3. Maggots. 4. The Pupa. The straight lines show the natural length of the Weevil and Pupa.

*Curculio picipes* is a most destructive insect in the vinery as well as in the garden. This beetle is very similar in figure to *C. sulcatus*, but smaller, and forms, with about twenty other indigenous species, a genus called *Otiorhynchus*; they are also nearly alike in sculpture, but vary in tint, *C. picipes* being of a clay-colour, the wing cases more or less clouded with darker-coloured spots, and altogether it so much resembles in tone the clods and bark under and between which this insect secretes itself by day, that it is with difficulty detected. In the night these weevils sally forth to feed upon wall-fruit trees and the vines in hot-houses, either attacking the stems of the new wood in April, which soon becomes black, or feeding near the tips of the shoots.



Every crevice in old garden-walls often swarms with these weevils. Nothing would prove a greater check to their increase than stopping all crevices, or holes in walls, with mortar, plaster-of-Paris, or Roman cement; and the interior of hot-houses should be annually washed with lime; the old bark of the vines under which they lurk should be stripped off early in the spring, and the roots examined in October, where they exhibit any unhealthy symptoms

from the attacks of the maggots of *C. sulcatus* as soon as the beetles appear ; sieves should be held at night under the branches and leaves, when, by shaking them, the beetles will readily fall into the sieves, but as they drop down when approached, this operation must be proceeded with gently and quietly ; multitudes may be thus collected, both in and out of doors, and if the person who carries the light has a pail or jug of water, the sieves can be emptied into them, as occasion may require ; but when the beetles are eventually destroyed, boiling, not warm water, must be used, as the hardness of their horny covering will resist a considerable degree of heat. When the larvæ are ascertained to reside at the base of a wall, salt might be freely sprinkled, which will kill them as readily as it will the maggots in nuts ; strong infusions of tobacco-water, aloes, and quassia, are also recommended. Where the blood of animals can be obtained, it might be beneficially applied, as it would coagulate over the tender larvæ and pupæ, and set them fast in the earth. (*Gard. Chron.* 1841, 292.)

*Thrips*.—This minute insect belongs to the same genus as that (*Thrips physapus*) which tickles the face so intolerably during the sultry weather of our summers. The thrips sometimes attack the young shoots of vines growing in the open air, especially those of weak vines, or vines newly planted. If

young shoots chance to receive any injury by late spring frost, the tender part of the leaf will immediately curl up and change to a dark brown colour; and in this state the thrips generally attack them with great greediness, especially the white Sweet-water and white Muscadine kinds. The thrips, however, are seldom injurious to vines growing in the open air, except in the spring; and to those in the hot-house, they are most hurtful when the grapes are nearly ripe. They attack the bunches as well as the leaves, and commonly prey upon the extremities of the berries, but more particularly at the end next the foot-stalk. In white grapes, the part of the berry injured changes to a dark colour, the foot-stalk turns black, and the berry withers. (*Speechley*, 172.)

Fumigation, with tobacco smoke, is the most effectual mode of removing this marauder from the vine. For a house, 43 feet long and 11 feet wide, 1 lb. of tobacco is sufficient; take an old wire basket, containing a few hot cinders, put the tobacco on them and hang the basket up in the house; then blow it with bellows until it is well lighted, then raise steam in the house by any mode most convenient. The tobacco will keep burning until it is all consumed. The steam keep on for about an hour, in which time the plants are covered with dew, which is well mixed with tobacco smoke. Repeat this on the following day, using only half-a-pound of tobacco. Those who

have not got the means of steaming the house from a boiler, will find a trough, with small holes pierced in the bottom, fixed over the hot-water pipes or flues, a very good substitute. Enough of steam will be generated in this way in one hour to cause a fine dew on the plants ; if the house or frame can be covered during the operation, so much the better, as it will prevent the steam from condensing on the glass, and also keep the tobacco smoke from escaping through the laps in the roof. (*Gard. Chron.* 1844.)

In other parts of the globe there are other insects which are very serious depredators upon the vine. There is a singular beetle, common in Hungary, (*Lethrus cephalotes*) which gnaws off the young shoots of the vine, and drags them backward into its burrow, where it feeds upon them ; on this account the country people wage continual war with it, destroying vast numbers. Three other beetles also attack this noble plant : two of them mentioned by French authors (*Rynchites Bacchus* and *Eumolpus Vitis*,) devour the young shoots, the foliage and the footstalks of the fruit, so that the latter is prevented from coming to maturity ; and a third (*C. Corruptor, Host*) by a German, which seems closely allied to *Otiorhynchus picipes* before mentioned, if it be not the same insect. This destroys the young vines, often killing them the first year ; and is accounted so terrible an enemy to them, that not only the animals but even

their eggs are searched for and destroyed, and to forward this work people often call in the assistance of their neighbours. In the Crimea the small caterpillar of a *Procris* or *Ino* (lepidopterous genera separated from *Sphinx*, L.) related to *I. Statices*, is a still more destructive enemy. As soon as the buds open in the spring, it eats its way into them, especially the fruit buds, and devours the germ of the grape. Two or three of the caterpillars will soon so injure a vine, by creeping from one germ to another, that it will bear no fruit, nor produce a single regular shoot the succeeding year. Vine leaves in France are also frequently destroyed by the larva of a moth (*Tortrix vitana*); in Germany another species does great injury to the young bunches, preventing their expansion by the webs in which it involves them, and a third (*Tortrix fasciana*) makes the grapes themselves its food: a similar insect is alluded to in the threat contained in Deuteronomy xxviii. 39. (*Kirby and Spence's Entomology*. i. 204.)

*Field Mouse.* Mr. Fleming, at Trentham Hall, finds this little animal attacks the inner bark in severe winters. Gardeners, therefore, should see that it is not harboured by the dung on the borders.

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## USES.

ALL the products of the vine are of some service to man, though their employment, in many instances, has been superseded by other preparations. Thus verjuice, the juice of the unripe berries, has been banished from our pharmacy by the introduction of Citric Acid, the acid ingredient of the lemon. Vinegar, however, (Acetic acid) is still made from the fermented juice of the grape, and Tartar (Tartrate of Potass) a mild cathartic, is also obtained from its lees; and the actual sap of the vine has been recommended as beneficial in calculous disorders, and as a coryllium. The leaves and tendrils have been administered in hemorrhage and other cases requiring styptics; and the wood grows to a size in more eastern countries, that render it available in the constructive arts, and its durability and toughness are very great.

The seeds of grapes have been discovered to be an excellent substitute for coffee. When pressed, they first produce a quantity of oil, and afterwards, when boiled, furnish liquid very similar to that produced from coffee. The practice has become very general throughout Germany. (*Mechanic's Magazine.*)

The employment of grapes as a dessert fruit needs no further particularizing; and when dried they appear upon our tables in the form of currants and raisins.

A very delicious preserve or jelly, also, may be made from this fruit, and is prepared as follows:—Pick off the grapes; put them in a stewpan or saucepan; bruise them very slightly; set the pan over a slow fire; and as the seeds rise to the top while simmering, skim them off. When dressed enough, pass the whole through a coarse muslin or cloth; sweeten it to your taste; return it again to the pan, and let it simmer very gently till quite thick; put it in a mould or preserving-pot; and, if properly made, the pot may be turned upside down without disturbing its contents. Put thin paper, moistened with a small quantity of salad oil, over the jelly, and cover with paper or bladder. Keep it in an airy, light, and dry place. It is impossible to state the proportion of sugar required, for situation, season, &c. make so great a difference in the saccharine juice of the grape, that it is better to leave it to the taste of the maker. Skim off as many of the seeds as possible before pressing, as too many of them will give a bitter taste to the jelly. (*Gard. Chron.* 1846, 645.)

To keep bunches of grapes in good condition for dessert long after they have become ripe, several plans have been devised, but of which the following are the best.

Mr. Speechley recommends that, before the autumnal frosts have killed the vine leaves, let the bunch with the shoot be carefully cut off the vine.



Then put the lower end of the shoot into a bottle filled with water. Hang up the bottle with the shoot and bunch in a warm room. A green-house is a very proper place. Only two or three joints of the shoot above the bunch should be left, but a sufficient length below to reach the bottom of a quart bottle, will be required. The bottle should be filled with fresh water every twelve or fourteen days ; and at the same time a thin shaving should be cut off the bottom of the shoot, whereby the pores will be made to imbibe the water with greater facility. By this method grapes have been kept fresh and good till the middle of February. (*Spechley, 27.*)

A still better plan is that detailed by Mr. G. Watson, gardener, at Newton Vicarage, near Stockton-on-Tees. He directs, when, in the last week in December, or first week in January, the latest house of grapes, which are ripe in September, is pruned, that then the whole of the grapes remaining shall be cut off, with a joint or two, or more, of wood below each bunch. Make a clean cut, and apply sealing wax as hot as can be used to it, and seal the wood closely, so that no air can enter the tissues communicating with the bunch. Then hang the bunches up on cords, suspended across a closet in a cool airy room, taking care that they do not touch each other, and after this they are cut down as wanted. In this way the White Muscat of Alexandria has been kept until the

latter part of May ; of course, the berries were slightly shrivelled, yet not so much as they would have been had they remained on the vines. To succeed, much depends on the situation where the grapes are preserved ; they must not be exposed to a current of warm air, nor yet be so damp as to cause mould. (*Ibid.* 1841, 662.)

The best position in which to suspend the bunches, is the reverse of that in which they hang upon the tree ; that is, with the stalk-ends downwards, for the berries are thus better kept from pressing against each other, which is an unfailing cause of mouldiness.

In all cases bagging, by checking evaporation, and excluding insects, promotes the preservation of grapes. It is true, that the preparation of the bags, in the first instance, may be a little troublesome, but when first made, and properly taken care of, they will answer the same purpose for years. They should be made of fine cotton, of various sizes, and prepared in such a manner as to be easily taken off and put on again, if necessary. When thus protected, the fruit will retain its flavour and continue in good condition for a considerable time, even on the open walls, provided the weather is dry and favourable.

Important as are many of the already enumerated purposes to which the fruit of the vine is applied, yet are they as nothing when compared to its value

for the wine press. We are no disciples of Dr. Whitaker,\* but we are equally far from being proselytes of Father Matthew, and although the use of wine, like that of all other good gifts, may be abused, yet we never saw sufficient cause for concluding David was wrong when he gave thanks to God for “wine which maketh glad the heart of man,” or that St. Paul was erring when he bade his fellow workman “to use a little wine” to strengthen him under his infirmities.

\* Dr. Whitaker published in 1638, “The Tree of Human Life, or the Blood of the Grape,” and there expresses his opinion that the name, *Vinum*, is derived *a vi* from its strength, or, perhaps, *quasi divinum*, because it is a species of the tree of life in Paradise. The intention of this curious little book is to prove that, by the judicious use of various wines, life may be prolonged from infancy to old age without disease.









