
Mary Helen Wingate Lloyd

The Botanic Garden:

Consisting of

Highly finished Representations

OF HARDY

ORNAMENTAL FLOWERING PLANTS,

CULTIVATED IN GREAT BRITAIN;

WITH

Their Classification History Culture

AND

OTHER INTERESTING INFORMATION.

BY

B. MAUND, F.L.S.

Vol.

LONDON

SIMPKIN AND MARSHALL, STATIONERS HALL COURT;

AND

SHERWOOD AND C° PATERNOSTER ROW.

THE AUCTARIUM

OF THE

BOTANIC GARDEN;

CONTAINING

MISCELLANEOUS INFORMATION,

CONNECTED WITH THE

CULTIVATION OF A GARDEN,

AND

NATURAL HISTORY.

PART I.

The First Part of the Auctarium has appeared, in small portions, in
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AUCTARIUM

OF

THE BOTANIC GARDEN.

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1 CABBAGES FROM SLIPS. The young sprouts, which first grow from the stalks, after the Cabbage has been cut, should be slipped off, when they are from one to two inches long, and the wound rubbed over with wood ashes. The more fully to constringe and close the mouths of the vessels, where they have been separated from the parent plant, they should be exposed to the air, about twenty-four hours in summer, and at least double that time in winter. They are then to be planted out in the same manner as seedling plants; and they will produce cabbages equally fine, and, of course, sprouts for further increase. Peter Kendall, Esq. of Higham Lodge, Suffolk, saw this method practised in the Brazils. He has since practised it himself; and from his information, it has also been pursued in the London Horticultural Society's Garden with success. He informs us that the first sprouts only, after the cabbage has been cut, are applicable to this method; as the second crop always runs to seed. This new method of propagation is important for several reasons; perpetuating a valuable sort, without deterioration, not being amongst the least of them.

2 SCOTCH PINE. Pinus sylvestris. This species of tree, commonly known, as the Scotch fir, yields the red deal, so abundantly imported from Norway and Russia, and used in house carpentry. The living tree, by incision, in summer, affords common turpentine. This, by distillation, yields spirits of turpentine; and the residuum of the operation is resin, either black or yellow, according as the distillation has been conducted, with or without water. Its roots being submitted to heat, in an appropriate oven, produce tar; and this, again, by exsiccation, becomes pitch.

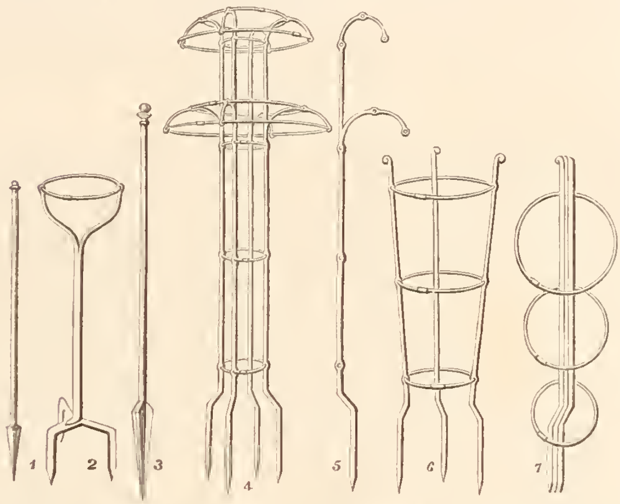
3 Mignionette. Reseda odorata. Sow mignionette at the end of July, in the open ground; pot in September, and leave exposed till frost is expected. Take into the house, and it will flower during winter. Sow, a month later, and protect through winter, for early spring flowering. If potted singly, and trained to single stems, nipping off, all the early flowers as they appear, handsome frutescent plants will be produced. This has been practised, and the plants sold as a new variety, called Tree Mignionette. A correspondent of the Gardener's Magazine No. 43, says he has a plant of common mignionette, in a conservatory, ten feet high.

4 Transplanting Trees. The annular layers of wood, shown in the trunk of a tree, on cutting it through, horizontally, are widest on the side growing towards the south. The central circle will be found nearest the northern side of the tree's circumference. The sap vessels of trees being thus naturally adapted to aspect, they should be placed to their respective cardinal points when transplanted; that is, the side which has been growing towards the south, should again be planted towards the south. Evelyn, in 1660, asserted, from much experience, that one tree in an hundred would not miscarry were this duly observed. We can bear testimony to its importance. Indeed, the constricted vessels of the north, or those of more diffuse growth towards the south, would seem ill adapted to the economy of an opposite aspect.

5 Alpine Strawberries. By picking off their first and second show of flower-stems, their bearing season will be delayed till August, and continue through the two following months.

6 Progressive Potting. Plants which make root freely, such as Balsams, Coxcombs, Lobelias, Chrysanthemums, are greatly encouraged in their growth, by progressive potting; that is, by planting them, whilst they are young, in very small pots; and when their roots begin to spread freely round the inside of the pot, to remove them into others, a little larger. At each removal, the ball of earth, about the roots, should be continued unbroken; and be increased, in the fresh pot, by a stratum of suitable compost, of about half an inch in thickness all round. Thus, the whole pot will be regularly filled with a reticulated mass of fibrous roots, instead of such accumulation of root being found only against the inside surface of the pot.

7 Seeds of Stocks. Mathiola annua, &c. It is an erroneous opinion that double flowering plants have any influence on the seeds of single ones growing near them. Seed should be saved from those flowers which have more than four petals; and such plants as produce flowers having only four petals, should be pulled up as soon as their quality is discovered. The farina of ordinary flowers may deteriorate the seed of good ones; but double flowers are void of farina.



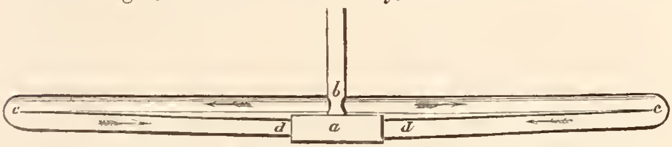
8 Plant Supporters. The durability, the neatness, and the present very low price, of iron, combine to occasion its general introduction to our gardens for ornamental and useful purposes. Above, we have given sketches of plant supporters. Figure 1, a wrought iron rod, let into a cast iron socket. Those of 2 feet in height cost 5s. per dozen. 3 feet, 6s. 4 feet, 7s. 5 feet, 8s. 6d. $6\frac{1}{2}$ feet, 10s. 6d. per dozen. Fig. 3, one of larger dimensions, and wholly of cast-metal. Those of 4 feet high, weigh 40lbs. per dozen, and cost 10s. 6d. 6 feet, $1\frac{3}{4}$cwt. 18s. 6d. 7 feet, $2\frac{1}{4}$cwt. 25s. These are the prices charged by Messrs. Cottam and Hallen, of London. Fig. 2, a wrought iron support, used by Mr. C. Lawrence, for standard Roses. The height must be adapted to the stock. A few of the strongest shoots should be confined to the ring of the support, and all the others cut back as usual. Fig. 4, is a stand which we have had

made by Mr. J. Jones, of Birmingham, for the Calampelis, Maurandia, or other free-growing climbers. Its height, when fixed in the soil, is $6\frac{1}{2}$ feet; the small rings, through the uprights, are 11 inches diameter; the largest ring in the lower extender is 30 inches diameter. The uprights are of $\frac{5}{8}$ round iron; and the rings $\frac{3}{8}$. Fig. 5, represents one upright only, more clearly to show its formation. Fig. 6, a support for Dahlias, made by Mr. Murphy, of Dublin, which stands 4 feet above the surface; 7 of which cost 20s. Fig. 7, shows how it may be placed when out of use. Fig. 4, may be closed up in a similar manner. Mr. Jones unites his rings by a nut; each end of the iron of which the ring is formed, being a screw.

9 DRAINING FLOWER POTS. Of all circumstances connected with the culture of flowering plants in pots, none is more important, and less regarded, than draining. By draining we mean putting a stratum of broken pots, broken tiles or bricks of a soft quality, or, which is an imperfect substitute, gravel, in the bottom of the pots, underneath the soil and roots of the plant. Potsherds should be broken down till the largest does not exceed the size of a French bean. This operation will produce much of smaller size, even powder, which should occupy the top of the stratum. As a general rule, we recommend that every pot have one fourth of its depth occupied by this material.

10 AMERICAN BLIGHT. Aphis lanigera. The simplest mode that we know, of exterpating this enemy of fruit trees, is to brush over the affected parts with spirits of turpentine. This distilled limpid fluid, well applied with a painter's brush, penetrates the most minute interstices of the bark, which is of the utmost importance. Mr. Turner, (Gardener's Magazine, v. 3) used three parts of soap-makers' lees, and one of turpentine, with success, which is more economical. Soot, soot and salt, soft soap, tobacco water, and stale urine; also, heterogeneous mixtures of acids, alkalies, sulphur, nux vomica, mercurial and arsenical preparations, have been used with various degrees of success, and recommended; but as no peculiar efficacy has been discovered in the latter poisonous ingredients which the more simple ones do not possess, we would not recommend their use. It frequently is serviceable to pare away the rough bark of trees, but they should subsequently have due attention, or the evil may be increased.

11 Culture of Pelargoniums. Cut down the plants, pretty closely in August. When they have produced new buds, a quarter of an inch long, clear the soil from them, shorten their roots, and replant them in small pots of fresh compost; afterwards water, and enclose them in a cold frame. When they have fully recovered transplanting, give them full exposure, continue it till frost is expected, and then take them, for winter protection, into a green-house or airy sitting room. In spring, they should be repotted as frequently as the roots are found to have run freely round the inside of the pot. Pelargoniums (Geraniums) thus annually treated, will prove bushy and vigorous; and will flower longer, and more abundantly, than is usual.



12 Heating by Hot Water. Wishing to diffuse the heat, in a sitting room, more regularly than is effected by the common grate, we had, in the building of it, a recess left in the wall, extending all along one side, to the right and left of the fireplace. This recess opens 12 inches to the room; is $4\frac{1}{2}$ inches deep in the wall; and one foot from the floor. The cavity thus made, receives the pipes, which pass behind the chimney-piece, from the boiler, at the back of the grate. They extend in the form here represented, and the space they occupy in the wall is fronted with a frame of wire lattice. The little boiler, *a*, is fixed behind, and close against, the cast-metal back of the grate; which metal back does not reach, as is usual, to the bottom of the grate, but within 2 inches of it. The boiler is also fixed at a corresponding height, so that its bottom is equal with the bottom of the sloping back-plate alluded to; and thus a cavity of 2 inches is left, which forms a flue, from the bottom of the fire, that is continued under and round the back of the boiler, and ultimately communicates with the chimney. To prevent a current of air into this flue, through the bottom of the grate, a solid iron plate is laid on it. The boiler is 14 inches long; 4 inches deep; and 6 inches wide, from back to front. Each pipe, which is 3 inches diameter, is horizontal from its union with the supply pipe at *b*, to its returning point at *c;* thence to the boiler, at *d*, an inch fall is allowed. The supply pipe, *b*, may be carried to

any part required. The whole is of copper. It is so simple in detail, that no minor directions are required. The hot water circulates freely through the pipes, in the direction shown by the little arrows, and diffuses a general warmth in those parts of the room, which must, otherwise, inevitably be coldest. It may be fixed to any grate. Nothing is seen in the room but the lattice work before the pipes, which admits the escape of the hot air. Of course, it is only required to carry the pipes on the other side of the wall, either to heat another room, a hall, or a green house, as circumstances may require.

13 Propagation by Layers. A method of layering, mentioned by Mr. Main, in his Vegetable Physiology, is found particularly successful in the propagation of some flowering shrubs, viz. the shoot, to be layered, has circular incisions made above and below each bud, along its whole length; it is then pegged down on the surface of the ground, and lightly covered with a sandy compost. Each bud will produce a shoot rising erectly in the air, and root fibres being at the same time ejected from the incisions, independent plants, separable in the autumn, are soon formed. The long sucker-like shoots of rose trees are well calculated for this mode of propagation; and as some sorts of these eject roots sooner from young than from old wood, practitioners omit ringing the bark, and wait till the young shoots produced from the layers are five or six inches long: a tongue incision is then made at the bottom of each, and embedded in sand, they readily make roots; the old layer remaining to produce other shoots, which may be struck in like manner.

14 Raspberries in succession. The young stems of raspberries, which shoot up in the summer of one year, produce their fruit in the following year. If such young stems be cut down, in February, to within three or four inches of the ground, in lieu of leaving them nearly their full height, it will so retard their flowering, that their fruit will not be ripened till autumn. They should not be subjected to this treatment two years together.

15 Annuals rendered Perennial. Many annuals may be preserved through winter, in a green-house, by striking cuttings of them, in August or September. The Chrysanthemum coronarium, Clarkia, Collinsia, Stocks, and many others, may be mentioned. The advantage obtained, is their early flowering, and the preservation of superior varieties.

16 Colours of Flowers. The fugitive property of some colours is well known; and in no way better exemplified than as they naturally exist in Flowers. The fume arising from a common sulphur match, which is, in fact, sulphuric acid, will change purple and crimson colours to pink. The blue, in combination with red, is readily discharged; indeed, a pink or purple flower might be completely bleached by holding it in the fumes of sulphur. Thus, roses and dahlias have been made to assume a variegated and very novel appearance. The blue of Commelina tuberosa is more permanent, as are yellows and greens. Bright pink stripes and veins may be produced on the dark purple petals of panseys, dahlias, and other dark-coloured flowers, with a camel hair pencil and oil of vitriol, to yield a rather pleasing effect. Such lines should not be drawn to the edge of the petal, or a little injury will soon be evident; nor should they be strong, nor near together, as they quickly spread. These playful deceptions may yield occasional amusement, but it would be neither good taste, nor good feeling, to permit a friend to quit our society under any false impression occasioned by such arts. Knowledge of this sort is principally valuable by exhibiting the visible chemical action of one ingredient on another, and by awakening the mind to what is, and may be, done. Various silk and cotton articles, having a coloured ground, and white pattern, are first dyed of one uniform colour; and their white patterns given by the application of a liquid, to discharge part of their ground colour. The liquid so employed is, not unfrequently, injurious to the fabric of these articles, which will account for the premature decay, particularly of some sorts, of printed cottons.

17 Onions of Large Size. When the beds are formed, by the usual method, trample them heavily, and roll them firmly. On this compact surface sow the seed, and cover it the usual depth, with a rich compost. The bulbs, instead of sinking, will spread superficially to a good size, and ripen earlier.

18 Preserving Apples. A method of preserving apples, which will be useful to many persons, independently of the superior freshness of the fruit so kept, appears in the London Horticultural Transactions, and also in the Gardener's Magazine. It is by burying them, nearly as potatoes. Dig a pit of two feet deep, in a dry situation, of sufficient extent to contain the

apples intended to be preserved. Put in a layer of straw, at the bottom, and also round the sides, which may be kept up by temporary means, or it may be placed in as the apples are added. Then fill the pit carefully with fruit, and continue the layer of straw entirely over the bed. On this spread the earth that was taken out, raising it highest in the middle, and extending it at least eighteen inches beyond the sides of the pit.

19 Pruning Currants. Martin Doyle, in his useful little work, "Practical Gardening," says that the most productive trees and the largest branches of currants, he ever saw, were 'produced by cutting the shoots of every year to within three eyes of the former year's wood; and by cutting short spurs of but an inch or two in length, for fruiting also, whenever opportunity permitted, upon the chief limbs, which should always be limited to about half a dozen, and kept clear of shoots, except those spurs.'

20 Œnothera cæspitosa and anisoloba, to Propagate. In October, make cuttings of the roots, an inch and a half, or two inches long. Plant these, either singly, in small pots, or several of them, an inch or two apart, in a large pot. Use a light and rather dry soil; place them in a cold frame, where they should remain, without watering, till March. Afterwards, the roots should be gradually stimulated by occasional waterings, and, if it be convenient, the warmth of a gentle hot bed. The root cuttings will soon afford healthy plants, for transferring to beds or the mixed flower border.

21 Holly Hedges. Holly should be transplanted whilst the plants are young; that is, when a foot or eighteen inches high, or they are less likely to succeed. It has been observed in the Horticultural Register, that the whole secret of success in the removal of Holly, consists in performing it at Midsummer, in lieu of Winter, as is the general practice. The soil should, occasionally, be forked up, about the plants; and the young lower shoots hooked down, beneath the soil as layers. They will readily strike root, and the bottom of a fence may thus be rendered exceedingly compact.

22 To Destroy Worms. Put a bushel of quick lime into a tub, with twenty gallons of water, let it remain two or three days, occasionally stirring it. With a watering pan apply the clear lime water, copiously, over garden walks or turf, three or four successive evenings.

23 Pink; Culture of. Raise a frame, a foot above the path; put therein an inch thick of fresh lime, to stop out worms; on this, put four inehes thiek of strong stable manure, and tread it firmly down. Fill up the frame with the follcwing compost: Fresh loam, four parts; old hotbed, three parts; finely broken oil-cake, one part. In this, the young plants should be put out; eighteen inches apart, each way, as soon as they have struck root from the pipings. In February give a top dressing of finely sifted sandy earth, in preference to loose compost or manure, which encourage insects. Sidc buds, and all above four principal ones, for flowering, should be taken off, as soon as they appear. Shade from sun and rain, whilst in flower, and water freely between the plants.

24 Raised Borders. It is well known that the pink, carnation, and some other plants, require to be kept dry; consequently, eareful growers generally raise their beds above the level of the garden paths. This is, sometimes, done with boards, but a much more tasteful border, for the support of the earth, may be raised with lumps of gypsum, spar, tufa, or even rough, over-burnt, and deformed bricks, or any of these materials eonjointly. In the joints of sueh border some of the saxifrages and sedums may be planted, so as to render it a permanent ornament in lieu of a deformity. It is truc that this specics of fenee is, in some dcgree liable to harbour insects, but if florists' flowers be the objects of cultivation, it would not be difficult to protect the plants, from such inseets as crawl only, by a very narrow trough of oil or tar.

25 Skeletons of Fish. As branchcs of natural history, the skeletons of animals, and of vegetablcs also, bccome interesting. Thosc of small fish arc readily obtained, in the spring, when tadpoles are to bc met with. A few of them should be put into a widc mouthed bottle or jar, full of brook water, or of that taken from the place where these animals are found; whieh should be frequently changed. Remove the scales from a small fish, and by threads, suspcnd it in the bottle, in a horizontal position, and the tadpoles will consume the soft part of the fish, leaving a perfect skeleton of elean bones. Should any of the tadpoles die in the bottle they should be immediately removed, or thc survivors will consumc them, and thereby neglect the business you have set them.

26 FUCHSIAS, IN THE OPEN BORDERS. Put out Fuchsias into the open borders in May. At Midsummer strike cuttings of the young shoots, under a hand-glass. When rooted, put them into small pots of light soil, remembering the injunction, as to draining, under paragraph 9. These plants should be fully exposed, till frosts commence; when it will be proper to place them in the windows of an airy room without fire, till very severe weather requires their removal to the warmer atmosphere of an inhabited room. In fair weather give them air in the day time, but they will require very little water, never so much as to keep the soil in what may be considered a moist state. Expose them to warm showers, and the sun, early in the spring; and they will be strong and healthy for turning out of the pots, into the open garden, in May, as first mentioned. In autumn, when the young plants, in pots, are taken into the house, cut off the old ones, which grow in the borders, close to the ground. Cover them to the depth of six inches, with moss, undecayed tan, leaf mould, or saw-dust, taking care to extend this protection a foot each way from the plant, or more, if not inconvenient. In April uncover them, and they will very soon make strong shoots, and flower luxuriantly in autumn. The fleshy roots of Fuchsia thymifolia, from which it readily makes young shoots, render it well suited to this sort of protection. The Fuchsia virgata we consider the hardiest, and under all circumstances, the best species for the borders.

27 COVENT GARDEN MEASURES. In order that quotations of London prices of garden produce may be understood, we have arranged the following table from the Philosophical Magazine.

The Sieve is equal to	$\frac{1}{2}$ a Bushel.
Half Sieve, ...	1 Peck.
Quarter Sieve,...............	1 Gallon.
Large Punnet, ...(nearly)	$2\frac{1}{2}$ Quarts.
Second Punnet, ...	1 Pottle.
Pottle,.....................	2 Quarts.
Third Punnet,...............	1 Quart.
Least Punnet, ...	$1\frac{1}{3}$ Pint.

Carrots, turnips, leeks, and sweet herbs, are sold by the bunch, a completely indefinite quantity. The punnet is nearly as vague. Honest tradesmen must anxiously desire a revision of such a system of measures.

28 Shells to Clean. The following instructions respecting shells, we have drawn up principally from Captain Brown's Conchologist's Text Book. They will be found useful. If any extraneous matter be attached to shells, first steep them in warm water; if too hot, it will greatly injure them, by cracking their polished surface in all directions; then remove as much of the disfiguring material as can safely be done, by cutting and scraping it. Afterwards, very much dilute a little muriatic acid, and apply it with a camel hair pencil, to the matter required to be removed. Let it remain a minute or two; dip the shell in cold water, and brush it. If the extraneous matter be not removed, repeat the operation, taking care so to regulate the strength of the acid, and time of applying it, as not to injure the shell. If there be fear that any delicate parts of the shell may receive injury from accidental exposure to the acid, such parts may be protected by a thin coat of melted bees' wax. When the corrosion has been completed, apply a little Florence oil, and polish with flannel or a brush. Some use also a little emery or tripoly.

29 Cement for Shells. Such shells as happen to be perforated by insects, or otherwise injured, so as to require the filling up of any little cavities, or joining of parts together, may be admirably repaired with the following composition.

Fine Spanish whitening, ..	2 oz.	Gum arabic, in powder, ...	2 oz.
Finest flour, ...	$\frac{1}{2}$ oz.	Ox gall, ...	a teaspoonful.

Well rub these ingredients together in a mortar, and keep the mixture for use. Of this, a paste may be made to fill up holes, or a cement of thinner consistence, for joining broken parts. When required, add a little hot water to part of it for present purpose. If mixed and suffered to harden, it may again be softened by hot water, and is equally good. Or, keep the gum separately, making a strong mucilage of it, and then mix it into the other ingredients. The advantage of this method is the complete solution of the gum, which, otherwise, will sometimes appear as little transparent specks in the cement.

30 Shells to Repair. Fill up injured parts with the above composition, observing to leave the cement more prominent than the adjoining parts of the shell. When it has become dry and hard, reduce the cement to the required height, either by the use of a knife, graver, or file; taking care to represent the natural irregularities of the shell. With water-colour then give

the natural tints, and afterwards polish the part with a brush, flannel, or palm of the hand; and ultimately apply a little Florence oil, dry it off again with flannel, and if attentively executed, the injury may escape the notice of the nicest observer. A little fine olive oil, or Florence oil, as the best sort is usually called, is found of infinite use in preserving the exterior coating of shells, which oftentimes, from lying by, cracks and peels off. It also greatly restores their natural colours, even when the surface is become somewhat chalky. "Shells are composed of animal matter and lime, and when they are decomposed, it is from the animal matter being set at liberty by the action of some acid; consequently the application of oil, is a substitute for the animal matter which they had lost." It is, therefore, a great preservation against decay. A solution of gum arabic is frequently applied as a varnish to shells, but the gloss it gives is unnatural.

31 Scarlet Geranium. This plant is a gay ornament in the borders, and according to a correspondent in the Horticultural Register, may be cultivated without a greenhouse. Plant cuttings of it in September, under a hand-glass, in a warm dry border. Protect from frost, with mats, as occasion may require; and in winter avoid watering, as damp is then injurious. In April, remove them from beneath the hand-glass, into the borders, without disturbing their roots, and they will blossom freely.

32 Transplanting Trees. It frequently happens that trees of a large size, or of several years' growth, require removal; to effect which, without due preparation, would either destroy them, or so affect their luxuriance, as to render them unsightly or useless during two or three subsequent years. Great advantage will arise out of the following practice. In winter, dig a trench, at a proper distance, round the tree, deep enough to cut off its main roots, in such manner as would be required for common transplanting. Let it remain in this state, or with merely covering the trench with boards, twelve months. At the expiration of such time, the roots will have thrown out young and active lateral fibres within the remaining ball of earth, that will not only assist in holding the earth together, during the operation of removal, but will also be ready to take up a due portion of fluids for the immediate nourishment of the tree, after its removal, and prevent the common consequences of transplanting.

33 Currant and Gooseberry Cuttings. The numerous suckers produced at the roots of Gooseberry and Currant trees, are often troublesome, as well as injurious to the trees. When young trees are raised from cuttings, this inconvenience may be entirely prevented, by removing the buds from that part of the cutting which is inserted in the earth. To produce good plants with single stems, no buds should be left on the cuttings within six inches of the soil.

34 Mildew on Wall Trees. Mr. W. Townsend, in the Horticultural Register, states that early in the spring, he used lime water, mixtures of sulphur, of soap, turpentine, and other ingredients, as a preventative against mildew on trees, but found them to have no effect as such. From his experience he has come to this conclusion, that nothing has yet been discovered which will act as a preventative. But after the disease has commenced, he says "Water alone, if applied by a powerful engine, and early in the afternoon, is an effective remedy, but it must be regularly applied until the disease be eradicated; yet, if applied too early in the afternoon, it causes the leaves to assume a brownish appearance, but otherwise it does the trees no injury." We differ, in opinion, from Mr. Townsend, in this last assertion, regarding the injury sustained, for reasons which are explained in the following article.

35 Watering Plants, exposed to the Sun. It is quite proverbial that plants should not be watered under a hot exposure to the sun. It is, doubtless, injurious, which the sceptic may readily prove. It is oftentimes said that plants are scalded, when they have been watered in hot weather, and their foliage become brown from the injury. It would be more philosophic to say they are frozen, notwithstanding it may occur at Midsummer; for the injury thus inflicted, certainly arises from the abstraction of heat, consequent on the rapid evaporation of the water, from the surface of the plant. Its vessels become suddenly constringed, as by an autumnal frost, and brown leaves bear evidence of the damage sustained. As far as is possible, artificial watering should be effected when nature assists the operation; either by a cool atmosphere, dews, or such gentle showers as oftentimes occur without effectually moistening the earth. Let none forget to lighten the surface of the soil, which frequent waterings may in some degree have Macadamized.

36 Soot as Manure. Six quarts of soot to a hogshead of water, is stated, in the Gardener's Magazine, vol. 2, to make a liquid manure of excellent properties. To plants in pots, to pines, and to common vegetables, it is said to have proved an admirable stimulus.

37 Protection of Wall Fruit Trees. It is well known, from observation, that copings of about eighteen inches wide, on garden walls, preserve a temperature on its surface, at times, several degrees above that of the surrounding atmosphere. It obstructs the ascent of heat and the descent of cold; and by the protection which it affords the wall from rain, much evaporation is avoided, which tends so rapidly to carry off its imbibed heat. These copings, however, are expensive, of heavy appearance, and prevent the access of showers when they would be beneficial. This has been somewhat obviated by having it made of boards, with hinges, to admit its being turned back, occasionally, on the top of the wall. But, further to meet some of these objections, Mr. Gorrie, of Annat Gardens, uses a living vegetable coping, which is both useful and ornamental. In the Gardener's Magazine he says " I have long observed the advantage to peach trees of a coping formed by the ample leaves of the fig, compared with others not under such protection. This, some years since, induced me to turn my attention in quest of some ornamental plant which might be trained on a light trellis from the ground upward to the top of the wall, at right angles from the wall, and occupying the same breadth across the border as the trellised projection at the top; the supporting trellises to stand at the extremities of the shoots of peach and other tender fruit trees, or at equal distances from their stems. The plant I have fixed on, and planted for that purpose, is the double-flowered Ayrshire rose. The leaves of this rose tree expand early in spring, when their aid is wanted in exposed situations; and, where plants of it are trained on side trellises, they contribute to produce a calm serenity along the face of the wall, while those on the projecting trellis become sufficiently close for repelling terrestrial radiated heat, and throwing it back on the wall and border: thus, in both instances, contributing towards the protection of the tender blossom, and the setting and maturing of the fruit." Various methods of giving temporary protection will, shortly, be noticed.

38 OXALIS CRENATA, CULTURE. In the Botanic Garden, under No. 433, we have given various particulars regarding this newly-introduced edible plant. We now state our experience in its culture, whence such conclusions may be drawn, by our readers, as will shorten their path to success. In the first week of April, all our tubers were put into small pots of rich compost; a few of them being cut into small pieces or sets, as potatoes; the whole of these grew, but the plants were less luxuriant than those from whole tubers. They were submitted to a hotbed, for six weeks, which induced a free vegetation. After this, the following methods of further culture were pursued. First, a pit, three feet square, and two feet deep, was nearly filled with fresh stable mauure; on this, a nine-inch stratum of good garden mould was laid, and a plant of the Oxalis crenata turned out on the centre of it. A second was planted immediately in manure. A third on a bed very freely dressed with lime. Two plants were turned into a manured trench, a foot deep. Two were planted on a ridge, a foot high; and two on the level surface, without manure. The soil being deep, rich, and very light, they all grew luxuriantly; showing a little difference in favour of the most highly manured plants. They had a slight moulding up, and their stems increased so greatly, that it was found most convenient to tie each plant up to three or four supports. They produced very few flowers; indeed, some of the plants produced none at all. Thus they continued till the preseut week, Dec. 20, when they were taken up, the tops having been destroyed by frost. The produce from the plauts, thus differently treated, has not varied sufficiently to warrant any conclusion that either one or the other methods of planting, are worthy of implicit imitation. Those iu the trench afforded the greatest supply of tubers; and one plant yielded 150 in number; varying in size from a pea to two inches long, the whole weighing a pouud and a half. Each of the other plants produced about half the quantity. The difference did not, however, depend on the plants having been grown in a trench, but from the trench having been filled with soil in the autumn, which formed a late moulding up. Here we discover the peculiar economy of this new vegetable. Every stem is capable of being made productive. In lieu of their being tied up, and even espaliered, as was the case with ours, it seems to be desirable that they be spread out on the

surface of the ground; and either covered with light rich mould as they proceed in growth, leaving only, perhaps, six inches of the end of each shoot out of the soil. Or, as no emission of tubers takes place till late in summer, the stems may remain spread out on the surface of the bed, in all directions, till about August, and then receive a covering of two inches thick of light compost, nearly to the ends of the stems. The propriety of this mode of treatment we deduce from the fact, that our tubers grew from the succulent ascending stems, a little beneath the soil which had been drawn up to them; and furthermore, a stem which chanced to lie on the earth, threw out a good sized tuber from its underside, at six inches from its connexion with the root. On the other hand, where a portion of the surface soil had been taken from about a plant, the produce was only half a dozen diminutive tubers. Still, we conceive that much depth of moulding up would be useless, for the tubers occur only near to the surface, Hence the rationale of laying the stems. The facility of increase in the Oxalis crenata is shown by an experiment which we tried. In July, we took up a strong plant, and divided its stems into thirty parts; some with, and some without, fibrous roots. These were planted in a trench, watered, and shaded, and every one grew, and produced from four to a dozen tubers. Had their treatment been guided by a full knowledge of their habits, the produce would have been great.

A Correspondent of the Gardener's Mag. v. 9, says that a plant produced four pounds of tubers; but of its culture no account is given which has reference to its peculiar habit. In the same volume, Dr. Hamilton observes, that a plant, grown on an old cucumber bed, produced a thousand blossoms. This was very unlike ours. The hardy character of the tubers appears important. Mr. Cameron, Curator of the Birmingham Horticultural Society's Garden, observed some of them exposed to frosts, notwithstanding which, they vegetated in the spring.

This plant, even in its present state of perfection, is entitled to the best attention of the public; but doubly so, when it is recollected that some of our best vegetables have arisen out of insignificant weeds. We invite societies to offer premiums for the best producc from the Oxalis crenata; and in aid of such patriotic object we shall be most happy to present tubers of it to those who apply to us before the first of March next.

39 Microscopic Objects. The Microscope affords a boundless source of delight to the naturalist. We shall, occasionally, throw in our mite to his enjoyments. Mr. Gould, in the Philosophical Magazine, says—"Take a single scale from any fish; put it on a flat piece of glass, and cover it with a drop of pure water; press the scale, to make it lie flat on the glass. Place it under the microscope, with a piece of black paper, or the black ivory stage-piece of the microscope, as it must be viewed as a perfectly opaque object, or the effect is not seen. By means of a condenser, throw a strong light upon it from a lamp or candle, and you will observe a multitude of minute bodies in motion on the scale; but they are much more visible in that part of the drop of water which the scale does not occupy, forming a most beautiful and interesting microscopic object." These little shining particles have been thought, he says, to be animalculæ. We see no shadow of reason in supposing them to be animalculæ. They are fragments of the bright silvery coating which covers the exposed part of each scale, and which gives to fish their attractive brilliancy. This glossy covering may easily be scraped from a scale into a single drop of water; and, on a black substance, and in a bright light, it will be seen with the naked eye, to shine in the water, as iron pyrites in calcareous spar; or as the spangle-like fissures of avanturine. Dried, with pressure, as between the leaves of a book, fishes scales form another object for the microscope.

40 Protection from Drought. In some situations plants suffer much from a long continuance of dry weather, and watering constitutes but a partial, though expensive, remedy. Deep digging, for protection against drought, and the more certain produce of good crops, has long been observed to be highly advantageous. It, doubtless, arises from the increased facility, afforded to the fibrous roots, of their descent to collect moisture. The idea is not new. An old author—Mountain, after describing different modes of watering, says, "But if all these manner of helps and wayes shall faile the Gardener, or cannot well be compassed in the Garden ground, then shall he dig the ground after the mind of Palladius Rutilius, three or four foot the deeper or lower. For the beds on such wise ordered, being workmanly laboured and sowen, may the better endure through the low standing, the whole drought of the Summer dayes."

41 Raising Annuals in the Borders. Dig the soil, and make it light and fine. Mark thereon, with the top of a large flower-pot, a circular impression; within which sow the flower seeds. The pot should then be placed, bottom upwards, over the seeds, there to remain till they have struck root; when it should be raised up, about two inches from the soil, and there supported for a few days, and then be entirely removed. By this practice the seeds, on their first germination, are protected from birds and slugs. A moist atmosphere, and warmth, is afforded them, which hastens the vegetation of the seeds, and increases the chances of success. The use of pots is not recommended to supercede that of small hand-glasses, but as affording convenience where hand-glasses are not at command.

42 Method of Transplanting. Small plants may be very neatly and safely transplanted from the borders, by making narrow trenches round them, and filling such trenches with plaister of Paris, mixed with water to the consistence of a thick cream. This quickly becomes hard, and forms a pot, by which the plant may be taken up without disturbing its roots. With a little ingenuity, the soil and roots may be so encompassed, with the same material, as to greatly facilitate the safe removal of a choice plant to any reasonable distance.

43 To destroy Ants. The most effectual method of destroying ants, that we have ever tried, is the use of the following mixture. Take equal quantities of loaf sugar, arsenic, and finely powdered dried bread; rub them together in a mortar, till they are very well mixed. This should be kept in a bottle, in readiness for laying small quantities near their haunts. Great care is requisite in the use of this mixture, for it is injurious to vegetable, as well as animal, life.

44 To destroy the Aphis. Tobacco water forms the most useful wash that we know, for cleansing all sorts of trees of the Aphis. Every one should raise his own tobacco for this purpose. Sow seeds of the most usually cultivated species of tobacco—the Nicotiana tabacum, on a hotbed, in April. Plant out the seedlings, at the end of May, into a rich soil, three feet apart. If they be topped when a foot high, it will increase the growth of leaves and lateral shoots. Gather the whole of their herbage, when in flower, dry it, and lay it by for making decoctions when required for use. Apply it with a syringe.

45 ATMOSPHERE, INFLUENCED BY LAND AND WATER. Many circumstances, besides the immediate agency, or absence, of the solar rays, combine to influence the temperature of the atmosphere. Both the earth and sea are continually softening the rigours of winter, by imparting portions of the heat they imbibed, during summer; whilst that absorption of summer heat, and also evaporation, ameliorate the intensity of the vivid sunbeams at that season. The capacities of land and water for receiving and communicating heat, are, however, very different; and the capacity of each element is also variable under different circumstances—water from its depth; earth from its quality, colour, or surface position. During summer, a maritime atmosphere is cooler than an inland one, partly by the process of evaporation, and partly by the diffusion of the solar heat to a greater depth; but in winter, it is warmer than over the land, from the surface water giving out its heat, and then descending by its augmented gravity, when its place becomes occupied by water of a higher temperature, to yield up its heat, in turn, and also its situation. This alternate change of heavier and lighter particles proceeds, and the temperature of the atmosphere is thereby continually equalized in a greater degree than by land, from the more ready facility water affords to the diffusion of its heat; and also the depth easily acted upon. Hence it is, that in gardens on the sea coast, even in Scotland, plants thrive in the open air, in winter, which, in the midland counties of England, would perish from the severity of cold.

46 ATMOSPHERE, INFLUENCED BY FORESTS AND POSITION. In latitudes, distant from the equator, islands are warmer than continents, because they participate more of the temperature of the sea. This is, happily for us, elucidated by the temperature of our own island; Great Britain being under the same parallel of latitude as the inclement Labrador, and countries south of Hudson's Bay,—too cold even to admit of cultivation. Countries that lie southward of any sea, are warmer than those that have the same sea to the south of them, at least, in our hemisphere; because, the winds that should cool them in winter, are tempered, by passing to them over that sea. Tracts of land, which are covered with trees and luxuriant vegetables, are much colder than those which have less surface of vegetable matter: for though living vegetables alter their temperature slowly, yet

the evaporation from their numerous surfaces, is much greater than from the same space of land, uncovered with vegetables. From experiments, it appears that forests discharge one-third more vapour into the atmosphere, even than the same space of ground would do if actually covered with water. Now, as water, in the form of vapour, is the evident associate and conductor of heat, this forms one reason why woody countries are colder than those that are open and cultivated. Besides this, when trees are tall and close, as forests, they exclude the sun's rays, and the winter snows are preserved by them, to spread their influence over a milder season. These combined circumstances enable us to account for the amelioration of climate that attends agricultural cultivation.

47 Atmosphere, influenced by Altitude. The Andes, almost under the equatorial line, rest their base on burning sands. About their middle height is a most pleasant and temperate climate, covering an extensive plain, on which is built the city of Quito; whilst their forehead is encircled with eternal snow, perhaps coeval with the mountains. Yet, according to the accounts of Don Ulloa, these three discordant climates seldom encroach much on each other's territories. The hot winds below, if they ascend, become cooled by their expansion; hence they cannot affect the snow on the summit; and the cold winds, that sweep the summit, become condensed as they descend, and of temperate warmth before they reach the fertile plains of Quito. From the preceding observations, a glimpse will be caught of some of the secondary causes of heat and cold; but the temperature of the atmosphere, and the vicissitudes of its heat and cold, are subject to such a variety of irregularities, that no theory which has yet been proposed, is altogether sufficient to explain. It is, notwithstanding, highly delightful and advantageous to the philosophic mind, to search out the cause and effect, as far as it is laid open to us, of the unerring progress of natural agencies, which are continually operating, in the works of nature, for the advantage of created beings.

48 Heat and Cold. It being shown that a variety of circumstances in nature, combine to prevent sudden transitions from one extreme of temperature to the other, the cultivator should assist this process of nature. In frosty weather, shade exposed plants from the sun; and in other cases, as reason may dictate.

49 Specific Gravity of Hot and Cold Water. The following experiment, from Dr. Lardner's Cyclopædia, vol. 17, will elucidate some of the facts which we have previously stated, with respect to the transmission of heat by Water. If a quantity of cold water be thrown into a vessel, a thermometer being immersed in it, and a quantity of hot water be poured carefully over it, so as to prevent the fluids mixing by the agitation, it will be found that the hot water will float on the cold. The thermometer immersed in the cold water will not rise; nor will a thermometer immersed in the hot water, poured over it, fall. But if, by introducing a spoon into the vessel, and agitating the water, a mixture of hot and cold be produced, the lower thermometer will immediately rise and the upper fall, and both will ultimately stand at the same temperature, intermediately between their former indications. If, on the contrary, hot water be first poured into a vessel, a thermometer being immersed in it; and then cold water be carefully poured upon the hot, so as to prevent such agitation as would cause the fluids to mix, and a thermometer be also immersed in it, it will be immediately found that the lower temperature will fall, and the higher one will rise. In fact, the cold water descends through the hot by its superior gravity; but in this case the fluids, in passing through one another, become mixed, and the whole mass will take an intermediate temperature.

50 Preserved Flowers and Plants. Mr. Lindsey, the intelligent manager of the Gardens at Chiswick House, has just presented to the Medico-Botanical Society some very beautiful and highly preserved specimens of dried plants and herbs, retaining, in a peculiar degree, the whole of the volatile oil and aroma, and the colour of the recent plant. The plan adopted, is to dry the substance in a close and dark room; and not, as is usually the case, by exposure to a current of air and the action of the light. When the separation of the aqueous particles is effected by their evaporation, and they are tolerably dry, they are submitted to pressure in small quantities, enveloped in paper, until the oil appears on the surface, and which is known by its discoloration; by this, all change of colour, by the action of the light, or further loss of volatile matters by evaporation, is prevented. In pot-herbs, as well as medicinal plants, the improvement and superiority is very decided.

112 50, New Mo. Mag.

51 Philosophy of Hot-house Management. It is too generally supposed that all plants, from countries between the tropics, may be placed together; and that, if a certain degree of heat be kept up, it is all that is necessary. This, however, is not the case; temperature is only one of the conditions requisite—light, air, moisture, are also essential; and to know how to apportion these properly, it is necessary to study the habits of the plants in their native countries. Plants which grow in thick woods, impervious to the light of day, obviously require shade; while others, natives of extensive open plains, will not thrive without abundant light; some need to be kept dry, others moist; and in short, though experience will, of course, ultimately lead gardeners to pursue the proper course, much time and many valuable plants might be saved by studying the native habits of plants previously to attempting their culture. One point in the culture of exotic plants, which few gardeners are aware of, and which is yet of paramount importance, is the necessity which exists of their having a season of absolute repose. Deciduous trees, growing in the open air, enjoy this when they lose their leaves; and even evergreens have a period when they cease to push out young shoots, and appear perfectly at rest. Most exotics are exposed in their native countries to alternate seasons of drought and moisture; remaining perfectly stationary during the first period, and growing rapidly during the second. This habit should be attended to in stoves; they should be forced rapidly at one season with both heat and moisture, and left in a comparatively neglected state during the other, almost without water, and in a very poor soil. Mesembryanthemums, and most plants brought from South Africa, require this treatment.

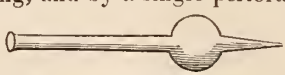
52 Pear Trees, to render Fruitful. Pear trees frequently blossom profusely, but fail to perfect fruit. A few days before the blossoms open, thin them with a pair of scissors, so as to leave not exceeding five or six of the strongest blossom buds near the centre of each cluster of flowers. This operation has the effect of diverting the sap to the flowers which remain, and gives them strength to set one or two pears in each cluster. Another mode is to defer pruning the young wood, until the blossoms are in the state described, and then shortening them to the required length. This also checks the progress of the sap, and enables the tree to set fruit freely.

51, New Mo. Mag. 52, Gard. Mag.

53 TURNIP FLY. The devastation, made in some seasons, by the Turnip Fly, is an evil to farmers, of which it is difficult to calculate the extent. The following important article appeared in the Entomological Magazine, from a correspondent who signs himself Rusticus. We give it verbatim. I first sowed some turnip seed in a flower pot, with earth out of my garden; it produced the animal in abundance. Secondly, I inclosed the pot with pasteboard and canvass, with the same success; but there was still a possibility of the enemy getting in, as I had not made the cover sufficiently close. Thirdly, I made a light frame, about eight inches square, covering it with very fine silk gauze, and carefully stopping the crevices of the door with pasted paper, and round the pot, where the cover was fastened on to it, with putty, so that there was now no possibility of any thing coming to it from without; yet this experiment was attended with the same success: however, one point, that is, a negative point, was now proved, namely, that the fly did not come to the turnip from other plants; this was a point gained. Fourthly, I baked the earth in a cast iron pot over the fire, and used no water to water the seed, but such as I had boiled myself, applying it at the bottom of the pot in a common feeder, then I used the same care and took the same precautions as before—I did not take off the cover till the plants were of a considerable size, and I found them all a-hop with beetles. I had now made another step; that the beetle did not come from other plants, I had found before; but now it was clear it was not in the earth nor in the water. Fifthly, with a lens I examined the seed, and found on it a number of white flattish substances; some seeds were without any, but there were generally one, two, three, four, and in one instance five, on a single seed; these I concluded to be eggs, and thought the only way now left me was to attack them; it would have been easy enough to have poked them off with a needle, but I could not see how I was to employ a needle and a magnifying glass on a sack of turnip seed. I recollected, however, that I had found that some salt and water, into which I had once unintentionally dropped a paper of silkworms' eggs, had killed them to an egg; it was therefore worth while trying in this case: I accordingly made some pretty strong brine, and soaked the seed in it for twenty-four hours, then dried it thoroughly, and with all the precautions I have

mentioned above, I sowed it again, and with a kind of success; there was not a single fly, but neither was there a turnip. Nothing discouraged at this, I tried again and again, and I found that, without weakening the brine, if the seed was only kept in it three hours, there were no beetles, but yet the seed came up as well as ever. I cannot say that I never find beetles on the young plants, but I never have a crop destroyed, or even seriously injured by them.

54 BIRDS' EGGS. Ornithology, or the consideration and description of birds, like other branches of natural history, has of late occupied increased attention. That the works of creation have generally not made the impressions they should do upon us, is chiefly owing to the extraordinary anomaly, as Mr. Drummond justly observes, that natural history forms no necessary part of the education of young or old. One part of its illustration is by the eggs of birds; and these, with their various tints and speckling, when arranged under their respective names, form a cabinet, indispensable to those who collect the birds themselves; and interesting to every observer of nature. Their shapes merit a remark. This is not an exact oval, but generally, one end is smaller than the other, whereby they occupy less space in the nest, than if they were truly oval bodies of the same dimensions. This peculiar arrangement has been thought to exist, more or less, as the number of eggs, in proportion to the size of the bird, require the economy of space. We give, from the Natural History Magazine, the sketch of an instrument, by which their contents may be readily extracted, without the usual danger of breaking, and by a single perforation only.



Make a small pin-hole at the side of the egg, large enough to admit the point of the pipe, which is to be one-sixth part of an inch; then apply your mouth to the entrance of the pipe, and suck as hard as you can, when immediately the contents of the egg rise, and are lodged in the ball of the tube, without proceeding higher towards the mouth. Next, blow the contents from the pipe, and suck a little clean water up into the ball, and blow it into the egg; shake the egg in your hand for about a minute, and, applying the point of the tube, withdraw the water, which leaves the egg perfectly clean.

55 THE CHINESE METHOD OF PROPAGATING TREES. The Chinese, instead of raising fruit trees from seeds, or from grafts, as is the custom in Europe, have adopted the following method of increasing them. They select a tree of that species which they wish to propagate, and fix upon such a branch as will least injure or disfigure the tree by its removal. Round the branch of the tree, and as near as they can, conveniently, to its junction with the trunk, they wind a rope, made of straw, mixed with rich soil or manure, until a ball is formed, five or six times the diameter of the branch. This is intended as a bed into which the young roots may shoot. Having performed this part of the operation, they, immediately under the ball, divide the bark down to the wood for nearly two-thirds of the circumference of the branch. A cocoa-nut shell, or small pot, is then hung over the ball, with a hole in its bottom so small that water put into it will fall only in drops. By this the rope is kept continually moist. During three succeeding weeks nothing farther is required, except to supply the vessel with water. At the expiration of that period one-third of the remaining bark is cut off, and the former incision is carried considerably deeper into the wood, as by this time it is expected that some roots have struck into the rope, and are giving their assistance in support of the branch. After a similar period the operation is repeated, and in about two months from the commencement of the process, the roots may generally be seen intersecting each other on the surface of the ball, which is a sign that they are sufficiently advanced to admit of the separation of the branch from the tree. This is best done by sawing it off at the incision. Care must be taken that the rope, which by this time is nearly rotten, is not shaken by the motion. The branch is then planted as a young tree. This method has been practised in our own country; but, generally, in lieu of wrapping the branch with a straw band, it is run through the hole of a flower pot, which is afterwards filled with soil; or, if this be impracticable, pots may be made with an opening on one side, to admit the branch. If a pot be used, the addition of a straw or hay band round it, will counteract evaporation. The principle is precisely that of layering, but oftentimes may be useful where that cannot be conveniently adopted. The season of spring, when nature assumes her utmost vigour, should be preferred for this operation.

114 55, New Mo. Mag.

56 Bark Beds. As tan is slow of decomposition, and during that process, gives out a considerable degree of heat, it becomes an important article to the horticulturist, inasmuch as it can be procured in many places, at very little cost. Some of our friends make hotbeds of it, on a small scale, merely for raising their annuals and striking cuttings. It should be remembered that a small bed cools quickly, and therefore is less efficient than a large one. Also, that as atmospheric air is a slow conductor of heat, it is advantageous to surround the bed with spongy or porous materials. A well-made straw hurdle is more efficient in confining heat than a four-inch brick wall. Mr. Tyso, in the Gardener's Magazine, gives the result of several years' experience on bark beds. He says, "My bed is made in a brick pit, nine feet long, five feet six inches broad, and six feet deep; and contains more than two waggon loads of tanner's bark. At first, I made the bed in March, of bark exposed two or three days to drying winds. This heated sufficiently for a time; but when I removed it, in September, I found a large portion of the tan quite dry and perished, by a whitish mould, retaining no heat whatever. In the centre, and towards the bottom, there was moisture, and about seventy-five degrees of heat. I then renewed the bed by two-thirds of fresh tan, just as it came from the pits, without drying, and mixed it with another of the freshest old tan. In a few days this began to heat, and retained a good heat for six months. On this bed I preserved, during the winter, a number of pelargoniums and other greenhouse plants, giving them all the heat I could by day, and covering up at night; and the plants, in general, looked better than those in my greenhouse. In the March following I renewed my bed again. On this I struck my georginas, raised two crops of melons, struck my pelargoniums and other plants, and, in September last, I renewed it again for winter use. My plan has been, to sift at least one-third of the old tan, and mix the undecayed parts with the new tan, until the pit was three parts full, and then add fresh tan to complete it."

57 Alpine Plants, their Habitat. Few plants present more attractions to the cultivator, than those called Alpines. The term, as applied to plants cultivated in gardens, comprehends not only such as are found wild in mountainous districts, but also in low swamps, and peat soil. On mountains, they are

watered, during summer, by frequent showers and heavy dews; whilst, in winter, they are protected from the effects of frost by a covering of snow. In marshy situations, during summer, they are subject to frequent inundations and night fogs. During winter, some are completely under water; others grow amongst sphagnum, near to flowing springs, which are seldom frozen. In both the elevated and low stations, the water, being pure and in constant motion, the soil is prevented from becoming sour, although it be constantly moist. Hence the necessity of a peculiar treatment for plants inhabiting such situations.

58 Alpine Plants, their Culture. The subjects of this interesting division may be successfully grown, and more easily preserved, in pots than by any other mode of culture. The requisite materials for this purpose are peat, loam, and sharp gritty river or pit sand. Also, some broken pots for drainage. Where the soil, which is to be used, is apt to adhere too compactly, some of the smallest drainers may be sifted out, and mixed amongst it, to keep it more porous, and allow the water to pass through freely. Most of the genera flourish in a mixture of equal quantities of peat and loam, mixed up with one-fourth part of sand. Some few require pure peat, with a mixture of sand. The general potting ought to be done in April, when the plants begin to grow. This is effected by first putting one inch of drainers in the bottoms of the pots, and a little of the coarse siftings of the mould over them, to prevent the soil from mixing with the drainers. The fine soil should then be used, and be pressed rather firmly about the plants. Many plants succeed best by being again divided, and fresh potted during the summer, allowing the plants to become strong before their flowering season. The best situation for placing a collection of alpines, from April to November, is in a shady sheltered situation, plunged in sand or other porous soil. They should be kept moist, and to be also, in dry weather, frequently watered over head by an engine, or watering pot, with a finely perforated rose. In winter, the more delicate species should be protected in a frame, open to any aspect excepting the south. During this season, they will only require to be watered sparingly, and this should be done without wetting the foliage, or the sand in which the pots are immersed. When grown upon artificial rock work, the same soil should be used as for potting. If attention to water-

ing these plants frequently over head, in dry weather, could be attended to, they would grow more luxuriantly than in pots. Peculiar modes of treatment, for particular genera or species, will be given at a future period. The above directions apply to the general cultivation of alpines.

59 LEAF MOULD. Decayed leaves form a most valuable ingredient in compost for potting; or for enriching and pulverizing the common soil of the garden. We collect them, indiscriminately, in autumn; lay them together, closely, in a heap, turn and well mix them every three or four months; and in the second spring, after gathering, they may be riddled for use. If this be attended to annually, a stock may be accumulated, and part remain to be two or three years old, which is very desirable for the nicer purposes of the florist. For speedily decomposing leaves, Martin Doyle, in his Practical Gardening, directs, that as soon as gathered, they be well saturated with the drainage of the stable or farm-yard, or with soap suds; then enclosed over and about with fresh stable manure, to occasion immediate fermentation. When the heat subsides, the leaves should be turned over, moistened again if requisite, and enclosed as before, by which process, those of the sycamore, elm, alder, maple, and all the soft kinds, become ready for use in two months.

60 LEAVES FOR HOTBEDS. The harder kinds of leaves, as those of the oak, sweet chestnut, beech, and hornbeam, have been advantageously used both in hotbeds and pine pits. Speechly, who published a work on the culture of the Pine, was convinced, after twenty-five years' experience, that leaves are superior to tan for the pine pit. If gathered in a dry state, he first watered them, then laid them together, within hurdles, to the height of several feet, treading them closely. In this state they remained six weeks, after which they were mixed together, watered if requisite, and then well trodden into the pine pits. A thin layer of tan was then spread over the whole, on which the pine pots were placed, and their interstices filled up with tan. He considered that two most important advantages were afforded by leaves. They never heated violently; and their heat was far more permanent. His beds were stirred but once a year, and then re-made, with one-half of fresh leaves, and one-half of the least decayed part of the old ones. Mixed with manure for hotbeds, they greatly prolong its heat.

61 Noisette Rose, to flower low, in beds. To effect this, the Noisette Rose should be wholly pruned back, in February, to within six inches of the ground. When it has made shoots, six or seven inches long, which will be towards the close of April, the ends of the strong shoots, or suckers, should be pinched off, which will cause them to push forth laterals. Their growth should be examined every fortnight, during the summer, and as such strong shoots show themselves, past the stipulated length, they should be pinched off, and a multitude of dwarf free-flowering lateral shoots will be produced in succession, till frosts prevent it. We cannot convey to our readers an idea of the immense mass of flowers thus produced, in beds of this rose, from the early part of June through the whole of summer. A large bed has, at this moment, upwards of five hundred flowers and buds on every square foot of its area. A single shoot only has one hundred and twenty.

62 Noisette Rose, to propagate. In February, when it has been cut back, as above directed, the branches, which have been cut off, should be shortened to a bud, at their lower ends, cut to proper lengths, potted, and then plunged in the tan bed of a stove, where they will root freely in a short time, and may be planted out in the following May. If the plants be not required till the following year, the branches, as they are cut from the old stocks, in February, may, without any sort of dressing or preparation, be laid in a trench, in a cool shady situation, and half of them will grow, and be fit for transplanting in the following spring. A whole hedge of them was so propagated last year.

63 Sowing Small Seeds. Instead of covering flower seeds, indiscriminately, the eighth of an inch deep, or even more, when they are sowed, such as are very small, should not be covered at all. The inequality of the loose surface of the soil forms ample covering for them, when watered, however delicately that watering may be effected. We sowed seeds of Nierembergia phœnicea, in April, and sprinkled a very small quantity of fine compost over them; not so much as entirely to cover all the seeds, but even this was too much. They were submitted to a hotbed for a month, and then put in the open air, in the shade, a fortnight longer; after this the young plants, which were abundant, were wholly drawn from the seed pots and transplanted. The surface of the soil in the seed pots was then slightly stirred

and watered, and the pots again placed in a hotbed. A second crop of plants, almost as numerous as the first, has sprung from the original sowing. The seeds being too deeply buried did not vegetate; and to this cause may oftentimes be attributed the failure of many sorts of flower seeds. It will readily be conceived that seeds, in a state of incipient vegetation, so immediately on the surface of the soil, may be quickly destroyed by heat. This will be most effectually prevented, in the borders, by turning pots over them; and in the greenhouse or hotbed, by a very moderate share of attention to watering; with the addition of a flat piece of glass placed on the top of the seed pot. This latter method is practised by an admirable cultivator, who informs us that the only precaution necessary, to secure all the advantages of this practice, is gradually to raise the glass from the pot, when the seeds are observed to burst their cuticle, by beginning to vegetate. We should not omit to notice that some persons press down the surface of their pots of compost, to make it rather firm, and quite even, before they scatter the seeds upon it. When the compost is very light, this method is beneficial, by its preventing too rapid an evaporation of moisture; and, as the seeds are prevented from sinking beneath the surface, a slight sprinkling of very finely sifted compost over them, will, in most cases be advantageous.

64 Planting Peas. It is a common practice to plant peas over a whole compartment of the garden; or, at least, several rows together. A better method, excepting for the early crop, is that of distributing them in separate rows, a considerable distance apart, filling up the spaces with beds of other vegetables. The partial shade yielded by tall sorts is frequently advantageous to adjoining crops of celery, endive, lettuce, and the cabbage tribe; and the produce of peas will be a third greater than when crowded together. Scarlet runners and common beans are likewise greatly benefited by the same method of single row planting; and it should not be forgotten, that the beauty of the vegetable garden is increased by this method of regular distribution.

65 Alpine Strawberry, from Seed. The Alpine Strawberry, under judicious culture, is a valuable acquisition to every fruit garden. It is generally esteemed as superior to any other for preserves, creams, and confections, and other similar uses, except as a dessert confection, where the fruit is required to be

64, Hort. Reg.

large and whole. In consequence of its growing and bearing almost any where, it oftentimes loses its requisite share of attention. We shall merely notice the methods, generally, by which this fruit may be obtained in perfection, and in almost all seasons. The best mode of propagation, and that least practised, is by raising the plants from seed. Choose fit strawberries, rub them to pieces in water, and collect the seeds by straining the whole through muslin or a fine sieve, and dry them for laying up. In the beginning of March, sow some of these in pots, and forward them in a hotbed; transplant in May, and they will bear fruit from August till frosts commence. Sow again at the end of March, in the open ground, and plants will be produced which will afford a further chance of a late Autumnal crop, and an early crop in the following year. Transplanting from seed or nursery beds may be performed at any season, so that if a few feet of ground be sowed annually, beds may be planted where-ever it happens to be convenient, and a succession of fruit be secured through more than half the year. The fruiting beds should never continue more than two years without a removal. It would be superfluous to detail the routine of culture, nothing but common-sense proceedings being required to secure success.

66 Bark-bound Apple Trees. There are many instances of old and large apple and pear trees, which are almost constantly barren. This is usually attributed to unsuitableness of soil or situation, to unfavourable seasons, or to the ravages of insects, or blight. Barrenness, however, often proceeds from a cause which is seldom suspected, and by very many orchardists not even known to exist. This malady is constriction of the bark. The bark is an excrementitious production of a tree. It consists of a number of layers; a new one being formed in every year; so that the number of coats of bark, like those of the wood, are always equal to the age of the tree. As new layers of both are annually formed within the bark, its exterior being expansible, is either stretched horizontally, rent longitudinally, or thrown off in flakes periodically. This is the uniform and natural process of every healthy tree: but if from any cause the expansible property of the outer layers of bark be lost or destroyed, they become indurated, and no longer yield to the accretion of the vital membrane; the latter is confined, the motion of the sap is arrested, and a general paralysis pervades the whole system. In

this state of a tree, the shoots, foliage, and flowers, are all diminutive. The fruit rarely sets, and if it does, never arrives at full perfection. Besides these defects, such languid trees are the favourite prey of insects, whose depredations, adding to the general debility of their victim, sooner or later occasions premature dissolution.

67 Decortication of Apple Trees should be had recourse to when they are bark-bound as above described. If the tree be twenty years old, sixteen of the exterior layers may be shaved off with impunity, The vital membrane situated within the bark and wood, and whence all accretions arise, is the only vulnerable member of a tree, and so that this is left entire no bad consequence can ensue. If, indeed, only one layer be left, it will be a sufficient protection to the new layers of bark and wood; and which, when relieved from the compression of the exterior layers, will immediately assume healthy functions, swell into full volume, and yield to the languishing head the long-wanted supply of nutrient sap. It should be understood, that it is chiefly through the vital membrane and the recently formed layers of bark and wood, on each side of it, that all connexion between the roots and branches is maintained. The action of the extremities is reciprocal, an increased demand of the head is answered by an increased supply from the root. At the same time, the member which forms the connexion, is itself enlarged to enable it to perform the office of a conduit. But if this enlargement cannot take place by reason of constriction, derangement of the natural processes follows, and a general stagnation is induced. Removing at least half the substance, of the outer bark, not only gives liberty to the vital organization, but in a most efficient manner frees the tree of the nests and eggs of insects so injurious to them. The smoothed surface of the stem and branches is also, for several years after decortication, less inviting to the parent insects to choose for nestling places for their broods.

68 The Growth of Vegetables is a phenomenon ever before our eyes. We can observe the apparently formless embryo swell into a tree of vast bulk. Every member of the system receives annual additions, some of which persist for a limited time; others quickly perish never to be renewed. But whence is derived, and how is the accretory matter accumulated? One

67, 68, J. Main.

physiologist answers, by food taken in by the roots, which being diffused throughout the system, assists to distend, by dilatation, pre-existing membranes: but this idea has been clearly proved erroneous. Another physiologist maintains, that every bud increases the stem by ejecting fibres down between the wood and bark, to form the new alburnum; but neither has this idea been clearly proved. The most generally received opinion is that suggested by T. A. Knight, Esq. President of the London Horticultural Society; namely, that all new accretions are elaborated out of the sap, it being said to be "organizable." Now, whether this be possible has become a question. In whatever state the sap is found, whether as resin, gum, mucilage, &c., it is always homogeneous, and perfectly free from every atom of woody matter; which, by combination, or mutual attraction, might be supposed to form into membranes like the crystals of inorganic matter. Sap serves to fill the cells and distend the membranes; but neither cellular nor vascular organization can be formed of it. Could this happen, entire organs, viz. leaves, flowers, fruit, and seeds, would be the result of accumulations of sap; and if an organ or membrane, why not a whole plant! If a new layer of wood can be formed of sap, so may the whole system: but as the whole must originate in a seed, sporule, or from some previously existing dissevered part of a plant, so must every membrane proceed from a rudimental basis. This basis is the "vital membrane" alluded to.

69 Penguicula grandiflora and vulgaris. These two beautiful species, although seldom seen in collections of alpine plants, are of easy culture. Towards autumn they form a main bulb, surrounded by several smaller offsets. These are readily observed, being close to the surface of the soil, during winter, whilst the plants are in a dormant state. In February, separate these bulbs; put the largest, singly, into small pots; the smaller ones, several in a pot, merely fixing the bulbs in the soil, but scarcely covering them. The strongest plants may, during summer, if necessary, be repotted into pots of larger sizes, keeping the bulbs entire, as they will never bear dividing, nor the removal of any soil from their roots, whilst in a growing state. The finest peat, mixed with one third of sharp sand, forms the suitable soil for them; plenty of drainers being used beneath it. Although some cultivators keep these plants standing in pans of water, during

summer, they succeed quite as well, if plunged amongst other alpines, and treated according to the general directions given under the 58th section of this Auctarium. During winter, a few plants may be placed in the cold frame.

70 Parnassia palustris and Carolina, require to be fresh potted in April, just before they commence growing; which is also the season for dividing them. The best soil is pure peat, with one third part sand. Pots of small size to be used, and these to be nearly half filled with drainers. As the plants increase in size they should be removed into larger pots; taking care to keep the balls entire about their roots. Parnassia Carolina, requires the protection of the cold frame in winter.

71 Potatoes, culture of. In the Irish Farmer's and Gardener's Magazine, several communications have appeared on the culture of the potatoe. As this is a subject of no mean importance, to English as well as Irish, we shall give a few general ideas from amongst the conflicting opinions delivered in that work, and by cultivators of our own acquaintance. Several writers agree that potatoes which have not been well ripened, and fully matured in autumn, are unfit for planting. This may be correct in reference to a general crop, but we know the practice of some experienced men, is to plant for a late crop, on the ground, which has been cleared of early pease; to obtain somewhat immature potatoes, expressly for the supply of the next year's sets, of the earliest sorts. These, certainly, produce an earlier crop; but as early produce is by no means synonymous with large produce—the desideratum of a main crop, it may be as correct as it is reasonable, that well-matured potatoes, are the most suitable for the purpose of reproduction. The next point of consideration is, their preservation, during winter. It is pretty generally agreed, that permitting potatoes to be exposed, and become dry, deteriorates their quality for the purpose of planting. Another very important difference exists in the practice of attentive potatoe growers, regarding which it may be unnecessary to give details of experiments; inasmuch as most persons know that large potatoes, when planted whole, produce a better crop than when cut into sets; and that large potatoes, for this purpose, surpass small ones. This, however, as a general practice, is rejected by most growers, on the ground that planting whole potatoes is the most expensive. It must be admitted as somewhat

more so than planting sets, yet but little, inasmuch as whole potatoes are not required to be planted so closely as sets; and the produce, generally, more than compensates for the difference. Again, the chances of an unproductive crop in an unpropitious season, will be greatly reduced. These advantages however, are not universally admitted. The usual practice of moulding up is objected to by some persons, as not only useless, but detrimental to the crop. They hoe two or three times, to keep down weeds, and lighten the soil, but leave it otherwise flat. We merely submit the hint, as every one can readily satisfy himself as to its truth or fallacy. The most important, and least regarded, circumstance connected with the culture of the potatoe, is its renewal from seeds. To effect this, it is only required, that the balls or apples, as they are usually called, be gathered from the stems, late in autumn, when they have become somewhat soft. These should be broken to pieces, in a fine sieve or cloth, and the pulp washed from the seeds, in the same manner as in collecting strawberry seeds. They should be laid by and sown early in March, in pots or boxes of light rich compost; and they may then be placed either in a hotbed, or the window of a sitting room. When the young plants appear, they should have plenty of air in mild weather; and by the end of May they will be fit for transplanting into the open ground, in rows, two feet apart; and from nine inches to a foot apart in the rows; the soil to be, as a matter of course, rich, light, and well prepared. Large potatoes, of new varieties, will be produced in autumn, all of which should be kept, and planted whole in the following spring, to ascertain their qualities. If, in the first week of April, the seeds be thinly sown, on open beds, in a good situation, the potatoes will, generally, be perfected in Autumn. In this case no transplanting will be required, otherwise than to thin the plants, where necessary. The importance of raising new varieties cannot be too highly appreciated; but as some sorts do not, usually, produce seeds we will, shortly, give Mr. Knight's method of inducing them to do so.

72 Vegetation in glazed Boxes. In a letter from Mr. N. B. Ward, of Wellclose Square, London, read to the Society of Arts, a novel mode of growing plants, in glazed boxes, was described by that Gentleman. His experiments having been made in the smoke of London, their success is, consequently, doubly important,

since they open some of the advantages of a domestic conservatory where they were previously unattainable. In a subsequent letter, communicated to the Gardener's Magazine, he mentions his having observed poa annua, and aspedium filix-mas spring up in a large bottle of moist mould, covered with a lid; he placed the bottle in the open air, iu a northern aspect, and both plauts lived three years, without either watering or the removal of the lid. Accidental admission of rain ultimately destroycd them. Mr. Ward states that he has repeated the experiment, with uuiform success, on more than sixty species of fern; and further says, that, "Various other plants, vascular as well as cellular, and more particularly those which delight in humid situations, succeed as well as the ferns. Among others may be enumerated,—oxalis acetosella, anemone nemorosa, dentaria bulbifera, Paris quadrifolia, veronica montana, Listera nidus avis, &c. The method of proceeding is very simple. The ferns, &c., may be planted in boxes of any size or shape, furnished with glazed sides and a glazed lid. The bottom of the box should be filled with nearly equal portions of bog moss, vegetable mould and sand; and the ferns, after planting, should be most copiously watered, and the superfluous water allowed to drain off through a plughole at the bottom of the box: the plug is then to be put in tightly, the glazed lid applied, and no farther care is requisite than that of keeping the box in the light. In this way many plants will grow for years, without requiring any fresh supply of water. It is scarcely necessary to point out the advantages which this plan, subject to some modifications, according to the enclosed plants, offers to the horticulturist, and to the physiological botanist. To the one, it furnishes a ready mode of importing most plants, without risk, from the most distant regions of the globe; and, to the other, the opportunity of making more accurate experiments than have hitherto been practicable, on many important points connected with vegetable economy. The numerous experiments I have already made have, I think, established one important fact, that the air of London, when freed from adventitious matter, is as fitted to support vegetable life as the air of the country." We need only add that Mr. Ward's boxes are a few inches deep, of wood, firmly made; the glazed sides and top being adapted to the height of the plants which they are intended to contain.

73 Tobacco, cultivation of. Tobacco, in fumigations and infusions, is a principal remedy against the ravages of insects; hence it is an important article to the horticulturist. And as our laws, we believe, do not prohibit the cultivation of it, in such small quantities as would be required for this purpose, we shall give the heads of a paper, by Mr. John Wilson, on its culture and preparation, as practised in the garden of the London Horticultural Society. It has been a common practice, by most persons, to ferment the leaves, by laying them in heaps, when fresh gathered. This practice, in the paper before us, is deprecated. The following are its principal directions. Sow seeds, in pots, about the middle of March; place them in a hotbed. Transplant into other pots, when requisite, and gradually inure the plants to the open air. In the middle of May, finally plant out the seedlings, in rich soil, three feet apart. Shade and water, as occasion may require. Pinch off all lateral shoots, as they appear, that the leaves may possess the whole nutriment. Top the plants, when about sixteen leaves high. When the leaves become mottled, early in September, the plants should be taken up, entire. In the Horticultural Gardens, a mushroom house was employed for the drying process. The plants were hung up, the house closed, and the temperature raised to, and continued at, 70 degrees, for four or five days, till the leaves became yellow; it was then gradually increased to between 80 and 90 degrees, till the thickest part of the midribs were quite dry, and would readily break; which took about twelve days more. The leaves being curled and crisp, the fire was discontinued, and the floor of the house well watered, and kept moist for 24 hours; this had the effect of rendering the tobacco leaves again pliable. They were then stripped from the stalks, laid flat on each other, and pressed smoothly into a tub. Moist weather occasioned their moulding a little; in consequence of which they were taken out, dried again to crispness, and in like manner moistened to render them manageable. They were then repacked in the tub as before, where they kept and improved in smell and appearance. It is said to be requisite to submit the leaves to a low temperature, till they attain their yellow tint, or they will dry of too light a colour. This does not appear to us important. The principal object seems to be, that they be thoroughly dry before they are packed up for keeping. It is suggested that the plants may be

 73, Trans. Hort. Soc. v. 1, n. s.

hung up, in a shed, till the yellow tint be assumed, and then removed to the drying house. We have thought that, in general, the more quickly plants are dried, the better are their qualities preserved. The sort cultivated, is a large-leaved variety of the Virginian tobacco. Its net produce, half a pound to each plant, being 2420 pounds to an acre.

74 PELARGONIUMS, TO PROPAGATE. The following method of culture, as stated in Mantell's Floriculture, is worthy of being remembered by such as desire a gay flower garden. "Those who cultivate geraniums (now known as pelargoniums) extensively in the open air, and who have not the means of protecting them in a green-house during winter, will find it advantageous to adopt the plan recommended by Mr. Mackenzie. In the autumn, cuttings may be taken from old-established plants, and being prepared in the usual manner, twenty or thirty may be inserted in a pot, about nine inches in diameter; they should then be plunged into a hotbed, and allowed to remain until they have taken root. When the frosts set in, they may be removed to a room, or any other place where they can be protected from the cold. A small window, with a shelf in the centre, will contain two hundred plants. About the middle or latter end of March, the cuttings may be repotted singly, and put into any sheltered situation until the season for transplanting them into the open air. By this means a supply of young plants may, from year to year, be obtained, with scarcely any trouble." From the same author we give another direction, which although known to many, is not remembered by all, viz.

75 LAYING CHINESE ROSES. "About the beginning of July, just when the tree is coming into flower, being provided with a sharp knife, and a few hooked pegs, commence by taking hold of the shoot intended to be layered, and making an incision just below the bud, on the upperside of the branch, pass the knife half way up to the next bud; then give the branch a slight twist, that the part so cut may rest upon the soil; fix in the peg, to hold the layer in its place, and cover it with soil, to about the depth of two inches. The custom of layering without the incision, so greatly retards the striking of the roots, that frequently they cannot be detached from the stools till the following spring; whereas if the incision be made, they will be ready, in favourable seasons, in two or three months."

76 BULBS IN GLASSES. The bulbs, usually flowered in water alone, are the hyacinth, narcissus, early tulips, Persian iris, Guernsey lily, and crocuses. Those who delight in relieving their winter apartments, from the destitution which their flower stands must sometimes exhibit, need not confine themselves to this list. They may take up almost any bulbs, from the borders, and place them on water. The absence of glasses, made expressly for the purpose, need not be an obstacle; sheet lead may be fitted in the tops of china, or other stands, and have holes cut in it, of proper size to receive the bulbs. Various other methods, also, may readily be devised. The Greenhouse Companion has explicit directions on this subject, which are practical and good. The author says, "The season for placing the bulbs on water, may be at any period after they have been matured; but the most usual with spring bulbs is October, and from that month to February; aud with autumnal bulbs, August and September. Planting in earth, for a few weeks, such bulbs as are to be blown on water, is the best mode of causing them to protrude roots freely, which, when they are placed on water at once, is not always the case. Whenever the roots are a quarter of an inch in length, take them out of the earth, wash them gently, so as not to injure the radicles, and then place them on the water. It is not essential that bulbs, on water, should be placed in much heat, for the principal stimulus to a newly-planted bulb is the moisture; and if the room in which the glasses are placed, be kept to 45° or 48°, that will promote their vegetation, for some time, as much as if 10° or or 15° higher. When the flower stem has risen an inch or two, then the heat may be considerably increased: that is, the glasses may be removed from a room without a fire to one where a fire is kept, and where the temperature will generally be found between 55° and 65°. Here they will advance with considerable rapidity, especially if placed on a stand, or stage, near a window of south or south-east aspect. They will blow, however, without any sun; but the colours of the flowers will be inferior. Those who keep bulbs on water are often at a loss when to change it. There is no fixed time for this purpose: the principle is to keep the water sweet and pure. In a temperature of 45° or 48°, when the bulbs are newly planted, this will be effected by changing once a week. At 60°, and the glass nearly filled with roots, the water will get putrid and show a muddiness in two or three days

or less, and whenever it does so, it ought to be changed. The operation of changing is easily done by one person, when the roots are only an inch or two long; but after the flower stems are of some length, and the roots nearly at the bottom of the glass, two persons become requisite; one to take out the bulb and hold it, and to dip its roots once or twice in a vessel of clear water, to clean them a little; and another to empty and rinse out the glass, and re-fill it with water. It is essential that the water used for renewal or for rinsing the roots, should be of the same temperature as that which it is to replace; and this can easily be done by pouring a little hot water into the cold water. Whether the water be hard or soft is unimportant." Some persons add the size of a small pea of nitre to each fresh glass of water. We have thought it beneficial.

77 Moles to destroy. It is sometimes with difficulty that these little animals are taken in traps, particularly where the proprietor of a garden cannot, without committing trespass, pursue them in their misdoings. A Brussels work, on horticulture, translated in the Gardener's Magazine, directs that powdered nux vomica be sprinkled on earth worms; that these remain together two days, and afterwards be placed in the runs. The moles will eat them and be thereby poisoned.

78 Scale on Pines. There are very few pine growers who have never had occassion to seek a remedy against the attack of this troublesome insect. Mr. John Rogers, who really appears to write from experience, has published a little work, " The Fruit Cultivator." In this, the venerable author, for he says that he is in his eighty-third year, observes, "Many remedies have been advertised for the destruction of the different insects which infest pines; but the writer used but one, which he always found efficacious. This was nothing more than sponging the plants with soft water, to a gallon of which was put half a pint of tobacco liquor; and while yet moist, dusting the leaves with a hair-dresser's puff, charged with the following ingredients, in powder, viz.

1 lb. Sulphur Vivum.	1 oz. Stone Vitriol, powdered.
4 oz. Camphor finely powdered.	2 quarts of Soot, finely sifted.

The whole to be well mixed, and kept dry in a jar, closely corked when not wanted for use. After this application, the plants should be kept in moist heat for a few days, at the end of which time all the insects will have fled."

79 Lace made by Caterpillars. A most extraordinary species of manufacture, has been contrived by an officer of engineers, at Munich. It consists of lace and veil, with open patterns in them, made entirely by caterpillars. The following is the mode of proceeding adopted. Having made a paste of the leaves of the plant, on which the species of caterpillar he employs feeds, he spreads it thinly over a stone, or other flat substance, of the required size. He then with a camel-hair pencil dipped in olive oil, draws the pattern he wishes the iusects to leave open. This stone is then placed in an inclined position, aud a considerable number of the caterpillars are placed at the bottom. A peculiar species is choseu, which spins a strong web; aud the animals commence at the bottom, eating and spinuing their way up to the top, carefully avoiding every part touched by the oil, but devouring every other part of the paste. The extreme lightness of these veils, combined with some strength, is truly surprisiug. One of them, measuring twenty-six and a half iuches by seventeen inches, weighed only a grain and a half; a degree of lightness which will appear more strongly by contrast with other fabrics. One square yard of the substance of which these veils are made, weighs four grains and oue-third, whilst one square yard of silk gauze, weighs one hundred and thirty-seven grains; and one square yard of the finest patent net weighs two hundred and sixty-two grains.

80 To preserve dried Herbs. Mr. Lindsey, Gardener to the Duke of Devonshire at Chiswick, has made a great improvement in the mode of preserving dried sweet herbs; such as thyme, marjorum, savory, sage, &c. After drying them in the usual manner in the shade, he puts each sort into a small box, 8 or 10 inches long, by 5 or 6 inches broad, and 6 or 8 inches deep; and, by means of boards of the size of the interior length and width of the box, and a screw-press, he presses the herbs into cakes, or little trusses. These are afterwards carefully wrapped up in paper; and, being kept in a dry place, are found to retain their aroma, in as perfect a state as when they were put in the press, for at least three years, the extent of Mr. Lindsey's experience.

81 Desmodium gyrans; or moving plant. This plant was, formerly, called Hedysarum gyrans; and the peculiar property of continual motion which its ternate leaves possess, has interested naturalists ever since it was noticed by the younger Linneus.

 79, Babbage's Manufac. 80, Gard. Mag.

In a letter to his friend Mutis, he says, "I have raised a very wonderful plant this year in my Garden. It is a new species of Hedysarum from Bengal. This plant has a spontaneous motion in its foliage, which seems almost voluntary. You are aware that various parts of the vegetable body, especially those subservient to impregnation, can be so stimulated by the touch as to exhibit some kind of movement. You know also the motion of some kinds of Mimosa and Oxalis, as well as of the Dionæa muscipula, arising from the touch of any extraneous body, or from the agitation of the wind. But the plant in question is not affected by either of these causes. Whether in the open air or in a close room, it spontaneously moves its leaflets, now one way, now another, one, two, or more at a time; not all at once, nor all in one direction; and this takes place whether the air be serene, cloudy, or rainy. It has not yet flowered, but I expect that event in the course of the autumn. The plant requires great heat." Instances of incomprehensible action like this can but awaken the attention of the most apathetic. We will give a figure and particulars of this plant in the fifth page of the Floral Register. The irritability of some plants is better known, especially that of mimosa pudica, or humble plant, whose leaves shrink from the touch, the culture of which may be recommended to the curious amongst our young friends. Seeds are easily obtained, and an efficient hotbed during summer, in which the plants should be constantly kept, will sufficiently mature them for the purpose of shewing their sensitive peculiarities. This is a property which advances the vegetable towards the animal kingdom, just as instinct advances the brute towards the human species.

82 Noxious Animals to Destroy. A novel and scientific method of destroying rats, mice, and other animals, appears in Dr. Thomson's Records of Science, from the French of M. Thenard. It is by sulphuretted hydrogen gas. Animals, when allowed to breathe this gas in a state of purity, fall down as if struck with a bullet; and even in a highly diluted state it is peculiarly deleterious; so much so that a dog is speedily killed by breathing air which has been impregnated with a thousandth part only of the gas. M. Thenard states the success of actual experiments; and from these there appears great probability that in old buildings, ricks and underground runs of rats, or other animals, the method may be advantageously employed. It is easily effected by

generating the gas in a retort, the mouth of which should be fitted into their run with a little plaister. The following are the requisite ingredients. Mix four parts of iron filings, and three parts of flowers of sulphur in a mortar with a pestle. Place the mixture in a convenient vessel and moisten it with four parts of boiling water, stirring it with a piece of wood or glass. Add gradually afterwards four parts more of water, and introduce it into a retort having a tubulare, or side opening. The retort, with its ingredients, should then be fitted to the run. Afterwards pour upon the mixture, in the retort, through its side opening, common oil of vitriol, diluted with five times its volume of water, and close the side aperture. The gas will escape and be diffused through the runs. When the effervescence ceases, add more of the diluted oil of vitriol; and repeat this till no further effervescence can be produced. Should any of the gas escape into an apartment and occasion inconvenience, it may be removed by dropping a little sulphuric acid upon chloride of lime, commonly called bleaching powder.

83 Transmitted Plants. From the mismanagement of House Plants which have been transmitted a considerable distance, however carefully packed, some of the more delicate sorts are occasionally liable to perish, soon after their arrival. A little proper care bestowed upon them for a few days will prevent, to a considerable extent, this loss. Nurserymen, from their experience, know well how to select plants in such state of growth as are most likely to endure the vicissitudes of a journey, as well as the requisite mode of packing for safety of transmission: but frequently from the nature of the package, and various means of conveyance, the plants are, during their journey, nearly excluded both from air and light, and arrive at their destination, in a weakened state; unable, at first, either to endure the rays of the sun or a free current of air. By immediately placing such plants in full exposure in the houses, where they are to remain, many losses will oftentimes ensue. To prevent this, all that is requisite is, that upon being unpacked, the plants be placed in a part of the house where there is no draught of air, but plenty of light; and where they will be entirely shaded from the sun. They should be watered but seldom, and it should be given in small quantities. In a week or ten days they will have so far recovered that they may be placed

amongst other plants, where they are to remain. Hardy trees, shrubs, and herbaceous plants, when removed to a distance, during winter, seldom require any particular care, from their being in a dormant state; unless they have been very long confined in the packages; in which case, all that is necessary is to throw a little soil over their roots, in a temporary manner, in a sheltered situation, and cover them with a mat for a few days previously to their being planted, When herbaceous plants are removed, during summer, they soon become weakly, and require to be potted, and placed in a shaded situation; either in a cold frame, or beneath hand glasses, till they have taken root; when they may be gradually hardened, and finally turned out of the pots into the places where they are to remain.

84 Division of Perennials. Aster alpinus, ramosus, acris, hyssopifolius, amellus, linarifolius, and punctatus, are favourites in almost every garden; whilst the tall robust species are nearly discarded, or only used for filling up vacant spaces in shrubberies, where little care is bestowed upon them. There are, however, few plants that will more amply repay for a little labour in cultivation than many belonging to this genus. Every season, early in March, take up all the free-growing sorts, replant only three suckers of the spreading sorts, and only a small piece from the outside of the more compact rooted kinds. As they advance in growth, keep them carefully tied to stakes; and in autumn, they will produce finer flowers, and in more abundance, than if the whole patch had been left to send up a great number of flower stems, to the detriment of each other.

85 Oil of Seeds. To those persons whose occupation, or their pleasures, introduce them so frequently amongst seeds of innumerable varieties, it might be interesting to ascertain some of the properties of such seeds. All contain more or less of oleaginous matter; and to this circumstance may be attributed, in a considerable degree, their longevity when deeply buried in the earth. Oil, as an article of commerce, is obtained from seeds in various ways; chiefly by heat and expression; sometimes by expression without heat; and essential oils principally by distillation. In a communication from Serangapore, contained in the Mechanic's Magazine, is another method also, which we shall quote, " Let the seeds be ground down or pounded, and well mixed by the hand with water. Strain off the liquid, and

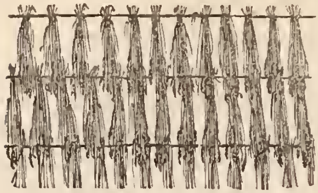
83, 84, D. Cameron.

break so much of the solid parts of the seeds as remain behind, upon the filter, with water as before. Repeat this process until you have made an emulsion, which may be supposed to contain all the oily matter of the seeds. Put the emulsion in a pan, upon a gentle fire, and at the heat of 212° the water will rapidly evaporate; and when wholly dissipated, will leave behind it a pasty mass, consisting of the oil, combined with so much of the solid portion of the seeds as may have passed through the filter. This mass, if allowed to remain in the pan, upon the fire, will gradually separate into two portions, one being the solid matter of the seeds, and the other the oil, which may be removed in a perfectly limped state, with a spoon, or separated by straining. Cold-drawn is a term frequently applied to oil; very few sorts, however, are so obtained.

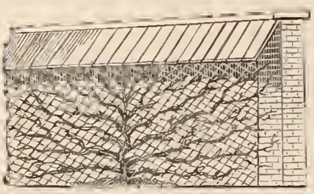
86 Protection of Wall Trees. In the variable climate of Great Britain it is well known that the blossoms and young fruit of trees, trained against walls, are always liable to injury from spring frosts, whereby the fondest hopes of the horticulturist are oftentimes totally annihilated. Various modes of spring protection have been invented, and almost every method has its advocates. We shall explain some of them, and leave our readers to adopt such as circumstances shall dictate. Mr. D. Cameron's method* of protection is to place long boughs of birch against the tree; first cutting off the strongest projecting branches from one side of them, to admit their being placed more closely against the trees; then fasten them by a few shreds, to the wall, spread their branches regularly, and fasten these also, where requisite. Afterwards, extend cords along the wall, as represented by the annexed figure, confining the nails at intervals of five or six feet. As a few vacancies will occur, these should be filled up by the small branches first cut off. Mr. Cameron justly observes that this method prevents a current of cold air circulating against the fruit trees, which some methods of protection do not obviate. If the boughs are gathered about Midsummer and laid by, they will retain their foliage, and prove the more efficient. Another method, probably more convenient to many persons, inasmuch as straw

* Gard. Mag. vol. 7.

can be readily obtained, where birch is a scarce article. This method is effected by simply tying together small handfuls of straw, perhaps forty straws in each, and suspending them on lines



before the trees, letting one line of them overwrap another, as represented. Some persons apply small branches of birch, or beech, or fir, by suspending it on cords according to this method.* A neater practice than either of the above, where expense does not deter its application, is found in the use of woollen net. This article is wove for the purpose, of a mesh from half an inch to an inch square. If a board, of two feet wide, be affixed to the top of the wall, in a roof-like direction, and the net be fastened to its edge, and extended thence to the foot of the wall, a neat and efficient protection will be afforded—one that will be no deformity in the most ornamental garden. Some horticulturists consider that the sloping boards alone form sufficient



protection, as the action of cold is in the greatest degree directly downwards, from the active principle of heat being directed upwards; the projecting roof has, therefore, a double purpose, by its preventing the escape of the heat emitted from the earth in cold weather, and also the consequent descent of cold from above. Again, hurdles with their bars wrapped with straw bands have been placed before the trees; also canvass curtains, oiled paper frames, and various other contrivances which common sense will suggest to every cultivator. Where the daily attention of opening and closing which these require, can be bestowed, no difficulty need occur; but the more essential enquiry is, how sufficient protection can be afforded with the least trouble and expense. The methods we have chiefly dwelt upon are such as are intended to be adopted before the blossom opens, and to remain without further attention till the fruit is beginning to swell. Aspect, exposure, and other local circumstances will always vary the success of different modes of protection. These can only be met by the reflecting and experienced cultivator.

* Gard. Mag. vol 7.

87 Solution of Corrosive Sublimate. This valuable solution was, we believe, first introduced to notice by Mr. Watterton, the celebrated naturalist and traveller. As a protection against the ravages of insects, on preserved specimens, either animal or vegetable, it is more efficient, and convenient of application, than any other at present in use. It is made by adding from a dram to a dram and a half of corrosive sublimate to half a pint of the strongest spirit of wine, (alcohol.) This solution may be applied with a camel-hair pencil to the bodies of insects; indeed, many of them, particularly the coleopterous class, may be wholly immersed in it a few seconds. Large animals should be washed over with it on all parts most likely to be attacked; and the entire surface of the feathers of birds should be carefully brushed over with this protecting fluid. If the solution be made too strong it will leave the appearance of a fine white powder on the dark coloured parts; it should, therefore, be first tried by applying it to some black substance; and if, when dry, the solution appears to have communicated any degree of whiteness to it, more spirit must be added. If the solution has any mixture of small particles or impurities, it should be carefully strained, or poured from such matter.

88 Anatomized Leaves. The exquisitely beautiful structure of the vascular system of leaves can be duly appreciated by those only who have seen specimens properly prepared. Marcus Aurelius Severinus, who published, in 1645, a description of the skeleton leaf of cactus opuntia, is said to have been the first to adopt an artificial method of preparing these interesting objects of vegetable structure. Although we have seen directions for effecting this, we could not, confidently, publish them; but by the favour of W. T. Iliff, Esq. of Newington, we are enabled to gratify our readers. He has, obligingly, sent us beautiful specimens of leaves, completely cleared of their cuticle and pulpy matter, exhibiting the most exquisite network of vessels that can be imagined; and also the following directions for preparing them. He says, Many individuals who have seen the fibrous structure of vegetables, have expressed much admiration at their beauty, and regret at the difficulty attending the preparation of the same. I am induced, therefore, to state to your readers, that the difficulty rests with themselves. If the seed-vessel of the datura stramonium or hyoscyamus niger; the calyx of the

physallis alkekengi, or nicandria physaloides, are put into water, and allowed to remain, without an exchange of water, until decomposition is carried to the requisite extent, they may be freed from their cuticle, and the pulpy matter; and after macerating them a short time in fresh clear water, they may be bleached by immersion in a diluted solution of chloride of lime, say one-sixth of the chloride to five-sixths of water. They must be well washed from this fluid when whitened sufficiently; and quickly dried, either before a fire, or in the sun. Care must be taken not to allow the destructive process to be carried too far, or the fibrous structure will become injured; nor allow the preparations to remain too long in the chloride, or injury will also arise. In selecting leaves for this purpose, those with the strongest fibre should be preferred. Their fibrous parts, and also the seed vessels and calyces alluded to, should be cleared by a camel hair brush, or fine pen, from such portions of cuticle, or pulpy matter, as adhere too strongly to be removed by a small stream of water. The leaves of the ceratoria siliqua, ruscus aculeatus, and ilex, are, with the foregoing, the most easy to prepare. I have tried a variety of other methods, none, however, answer so well as the one I have explained, and therefore I communicate it, without fear of its being attended with difficulty, if properly applied. Some of the specimens may require several months maceration before the preparation can be completed.

89 Oxalis Crenata. We gave but little attention to this plant last year; we had, however, a row of it planted late in the season. In the first week of September, scarcely was there the rudiment of a tuber to any of the plants. We took the whole of them up, and laid them in a broad shallow trench, spread their stems, and covered them, with earth, full two-thirds of their length. In about six weeks, on examining them, many of their stems were, literally, covered with small tubers. They were not taken up till Christmas, when the produce was abundant, although the tubers were, generally, small. This certainly indicates that some modification of such treatment should be employed soon after Midsummer, to induce productiveness at a season when the growth of the tubers may proceed uninterruptedly. Our object in removing the plants, in September, was to check their luxuriance, and thereby induce the produce of tubers. This succeeded fully.

90 **Broccoli from Slips.** In a former part of the Auctarium we gave an account of the successful mode of propagating Cabbages from Slips. Mr. Rutger, in the Gardener's Magazine, has given an account of his success in propagating Broccoli by the same method. The heads having been cut off for use, in the spring, the stems were left to produce sprouts. In June, the sprouts were slipped off, and after being exposed a day or two, in the sun, to cauterize the wound, they were planted in the usual manner. In two or three weeks they had taken root; and in the course of the autumn made fine stocky plants. Mr. Rutger says that he has seen many instances of Broccoli, thus grown, having heads three feet in circumference, and as close and compact as possible; butt his extraordinary luxuriance he attributes to the use of sea weed as manure.

91 **Ferns; Cultivation of.** Ferns, from the variety and delicate forms of their fronds, are favourites with most cultivators of plants. The supposed difficulty of growing those species, requiring the protection of glass, caused their cultivation, for many years, to be limited to very few gardens. It is now rapidly extending, and with so much success, that in many places they are grown as readily as any of the phenogamous plants. The number of species, under cultivation in the various gardens throughout the country, is upwards of two hundred, and that number is still increasing by the importation of living plants, and from seeds taken out of herbariums. Twenty years ago there were not, perhaps, above thirty species to be found growing in the stoves and greenhouses of Great Britain. Attention to the following simple direction is all that is necessary to ensure success in their cultivation, under glass as well as out of doors. Those requiring the protection of the stove and greenhouse may all be grown successfully in the stove only; where they should be placed together for convenience of watering. It is immaterial whether they be exposed to the sun, or kept in the shade, doing equally well in either situation. The most convenient place, however, is frequently the back of the house. Here they become an interesting decoration, under the shade of larger plants, where little else would succeed. The pots containing Ferns, must be kept rather moist at all times; and their fronds also require frequent waterings over head, with the syringe, or a watering pot having a fine rose. This should be attended to

twice or three times every fine day in summer; and once or oftener, in winter; regulating the extent of such over-head waterings according to the weather or strength of the ferns. Those who possess a greenhouse only may there cultivate the species suitable thereto. There the pots should be kept moist; but in summer, the plants will not require over-head watering more than three times a week. In winter the pots should be kept more dry, and the plants, in this season, require no over-head watering. Many of the species, kept both in stove and greenhouse will be benefited by being placed for a few weeks, during summer, in a cold frame, in a shaded situation, where the lights can be drawn off during the night, and in cloudy weather. The requisite soil, for potting the stronger growing kinds, is half peat and half loam, mixed with a fourth part of sharp sand. And for the smaller kinds peat and sand; using at all times plenty of drainers. Most of those ferns which require house protection, may be readily increased by being divided; and of several species, self sown plants will be found in profusion in the pots. Division may be effected at all seasons; spring and autumn are, however, to be preferred. In the operation of potting Ferns, place a piece of broken pot on each side of the root; pressing with them, a little soil against the plant; then fill the pot with the soil pressed down rather firmly. When large specimens are desired, remove into larger sized pots as often as the roots get matted, but before they begin to decay; using at each successive shifting, coarser soil; that for the larger sized pots, being merely turfy soil chopped up with the spade, and mixed with some coarse drainers, to allow the water to pass off more freely. The roots of some of the larger plants will occasionally perish, from the soil becoming sour, from continued waterings. These must be divested of all decayed roots, have their balls reduced, and repotted into smaller pots, where they will soon make fresh roots. The small and more delicate species of hardy ferns are most successfully cultivated in small pots, placed among the Alpine plants. Some require the protection of a cold frame during winter. They may be increased by dividing at any time from spring to midsummer. Five or six species of this description, although natives of cold climates, require, from the shelter and warmth of their native habitats, to be grown along with the stove and greenhouse species. The stronger growing hardy species may also be grown in pots; the best method is, however, to have them planted out into the open ground, in a moist and shaded border, either in sandy peat, or peat and loam; where they will require no further care than occasional waterings in very dry weather. These may be increased by dividing. When the offsets are small they require to be potted, and turned out, with their balls entire, when fully established.

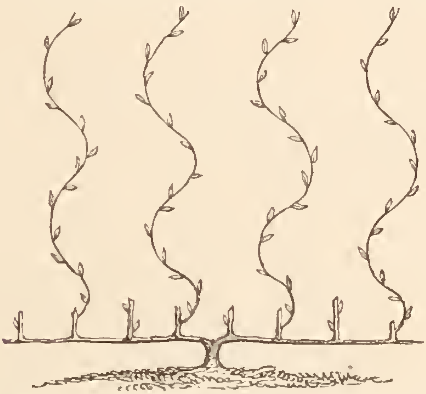
92 Calampelis scaber from seeds. Several complaints have reached us of the uncertainty of the seed of this plant vegetating. This arises, principally, out of mismanagement. Indeed, we have plants, received from a friend, which sprung spontaneously at the foot of a wall, beneath the parent, and endured the frosts of last winter. Its seeds should be sown in a hotbed, on the top of a pot of fine compost, and not covered, excepting by a little moss; and not by this so entirely as to prevent the seeds being seen through it. A few days after the seeds have vegetated remove the moss, and be careful neither to let the sun shine directly on the plants, whilst very young, nor suffer the soil to become too dry.

93 Noisette Roses, in beds. Mr. Markham's method of originating gay rose beds, and prolonging their beauty, as given under No. 61, has already obtained numerous followers. In reply to some enquiries, we add to the former observations, that the system recommended is not applicable to the slow-growing deciduous roses. It is equally as suitable to a single bush of the Noisette, as to a whole bed. The distance at which the Noisette Rose is first planted in beds, may be considered of little moment. The stock of plants, and space to be covered, may be admitted to govern the regulation of distance. If planted pretty numerously, the bed may at once be covered; but if widely apart, layers may be put down, either in spring, or about midsummer, to fill up vacancies to any reasonable extent. If young shoots be pegged down, beneath the soil, in summer, and its surface protected from drought, by a little half-decayed hotbed manure, they will strike root most readily. One scrap of knowledge should have a place in the minds of all lovers of roses; which is, that the soil in which they are planted can scarcely ever be made too rich, and that most frequently it is by far too poor.

94 Culture of Vines. A Practical Treatise on the Cultivation of the Grape Vine on open walls, has been published by Mr.

Clement Hoare. The lucid and practical manner in which the subject is treated, and the advantageous results which are promised by this work, entitle it to the attention of every cultivator of the Viue—indeed, of every person who possesses a spare wall. Mr. Hoare observes, that "The Vine is supposed to have been introduced into Britain at the commencement of the christian era; and history amply proves, that for a long series of ages, vineyards were very common in the southern parts of this island, and that the quantity of wine was so great, as to be considered one of the staple products of the land. From some cause or other, however, they have fallen into general neglect, although good Grapes might be grown on Vines, trained as espaliers, or in the same manner as in the vineyards abroad, from which excellent wine could be made at a cost that wonld not exceed that of moderately strong beer. Why vineyards should have so completely disappeared, it is difficult to say, since there are many thousands of acres of poor land that are of little value in an agricultural point of view, but on which Vines would flourish and produce abundant crops of Grapes, and yield thereby a most profitable return." In regard to the success attainable by training on walls, Mr. Hoare remarks, "It is not too much to assert, that the surface of the walls of every cottage of a medium size, that is applicable to the training of Vines, is capable of producing, aunually, as many grapes as would be worth half the amount of its rental. Every square foot of the surface of a wall, may in a short space of time, be covered with bearing wood, sufficient to produce, on an average, a pound weight of grapes, and I have frequently grown double that quantity on the same extent of surface." Other advantages are available to the attentive cultivator. The method of culture recommended yields a superabundance of young shoots, leaves, and unripe fruit, which require pruning off. Of these, with water and sugar, experiments have demonstrated, both in France and England, as stated by Dr. Macculloch, wine may be produced in no respect differing from that wholly made of immature fruit, and consequeutly resembling wine of foreign growth. Various means are combined to attain the entire advantages. The leading principle, however, depends on extensive pruning of the vine—not permitting the growth of more wood than it is intended shall be productive; nor of more fruit, thau the tree, uuinjured, can fully mature. Mr. Hoare, from various experiments, has arrived at conclusions which promise to be of the highest importance. He has formed a scale of the weight of fruit, which a vine can perfectly mature; the scale being made dependent on the circumference of its stem, near to the ground, at the autumnal pruning. Thus, a vine whose stem is three inches in circumference, can mature 5 lbs. of Grapes. $3\frac{1}{2}$ inches, 10 lbs. 4 inches, 15 lbs. $4\frac{1}{2}$ inches, 20 lbs; and so on, allowing 5 lbs. for every additional half inch of circumference. "No vine is taken cognizance of, until its stem measures three inches in girth, as under that size vines ought never to be suffered to ripen any fruit. This is a rule that should be strictly adhered to in the management of young vines, for it may be safely asserted, that for every pound weight of grapes extracted from a vine before it has grown to that size, ten pounds will be lost during the next five years, independently of the very severe check which is given to its growth by premature bearing. But by husbanding its strength till its roots have multiplied sufficiently to provide a full supply of nourishment without suffering from exhaustion, the plant commences its fruit bearing life with a degree of vigour, which lays a sure foundation for its future prosperity". We will mention a few of the leading features of Mr. Hoare's practice of pruning; at the same time we refer such of our readers as take much interest in the growth of the vine, to his work; in which the details of the subject are so practically illustrated that no slight extract can do credit to the experience whence it has emanated. In the first place we will copy his *General Rules*, which may be advantageously borne in mind. "1. In pruning, always cut upwards, and in a sloping direction. 2. Always leave an inch of blank wood beyond a terminal bud, and let the cut be on the opposite side of the bud. 3. Prune so as to leave as few wounds as possible; and let the surface of every cut be perfectly smooth. 4. In cutting out an old branch, prune it even with the parent limb, that the wound may quickly heal. 5. Prune so as to obtain the quantity of fruit desired, on the smallest number of shoots possible. 6. Never prune in frosty weather, nor when a frost is expected. 7. Never prune in the month of March, April, or May. Pruning in either of these months causes bleeding, and occasions thereby a wasteful and an injurious expenditure of sap. 8. Let the general autumnal pruning take place as soon after the first of October as the gathering of the fruit will permit." *Future bearing shoots.* The shoots intended for the next year's bearing should be selected towards the end of May. The required number may be pretty nearly estimated, and they should be so situated as to have, when trained, a clear space of twenty-eight inches between each. This will afford a space of nine inches on each side of such shoots, when in bearing, in addition to five inches to be allowed on each side of the young succession shoots, which will have to be trained up, alternately, between them. Nailing should be repeated whenever the shoots have grown twelve inches beyond their last nail. If long jointed, they should be curved a little in training, by bending them from their former direction every time of nailing, which will occasion more buds to be produced in a given length. At the commencement of September, these future bearing shoots should be stopped; that is, their points pinched off, to hasten the maturation of the wood, and to give an accumulation of sap to the buds. All *Tendrils* produced at the footstalks of the bunches of fruit should be pinched off. *Side shoots,* also, which are not bearers, should be pinched off an inch beyond the first joint. Those which are bearers, should, at the beginning of June, be pinched off an inch beyond the last bunch of fruit. The *Leaves* should be so disposed, as far as is possible, in such manner as to form a uniform shade or covering, one leaf thickness, over the whole tree. That the fruit have this genial shelter is indispensable. The *Bunches of Fruit,* when as large as small pease, should be counted, and their ultimate weight calculated. Each bunch may be estimated at half a pound, and if the whole amount exceeds the stipulated weight, allowed by the preceding scale to be ripened, it must be reduced to such amount. Now, also, must the berries in each bunch be thinned, and such operation should be continued, weekly, as occasion requires. "The best general rule that can be given, says Mr. Hoare, is that the berries, during the whole period of their growth, until they have made their last swell, must never be suffered to cluster. or to press the sides of each other." *Autumn Pruning.* This should be effected in October; when all the main shoots, which have just yielded their crop, must be cut out; remembering to leave a few of them as spurs, with two buds each, in proper situations, to produce the succession shoots in the following spring. These spurs should, of course, be left alternately with the bearers.

They are left with two buds each, to guard against accidents, one shoot only being required. If, in the following year, two perfect shoots be produced from these spurs, the weakest of the two must be cut out, in the first week of July. Now it is that an estimate should be made of the required quantity of bearing wood, to be retained for the following summer's crop. This is done by counting the buds; as many of which should be reserved for bearing, as the number of half pounds of fruit which it is intended to allow the tree to ripen; observing to allow two extra buds to each shoot. All the superfluous wood should be cut away, and the stems nailed in straight lines till spring.



Spring Training. This consists in wholly releasing the bearing shoots from the wall, and training them in a serpentine direction. The advantage arising from this mode of training is, that the flow of sap is hereby retarded, and every bud is made productive. If, on the contrary, the shoots be trained quite straight, in a perpendicular direction, the buds, at their extremities, will burst first; and these will shoot with undue vigour, whilst the buds, at the bottom will remain entirely dormant. This operation should be performed at the commencement of March. The more clearly to elucidate this method, we have given, above, the representation of a vine, as it would appear after the spring training. These are the prominent features of Mr. Hoare's practice; still, as we have previously said, those who are interested in the culture of the Vine, should consult his work. It is full of practical directions, to many of which we have not even alluded.

95 Diseases of the Larch. According to Mr. Stephens of Edinburgh, who has addressed a letter to De Candolle upon the subject, the Larch, Larix Europæa, is subject, in Great Britain, to two diseases. The first disease consists in the decay of the heart of the wood. It occurs not only in wet situations, but also in dry places, as in Nottinghamshire, where immense losses have been sustained. It has only manifested a slight appearance at Dunkeld, and is most prevalent in England. The Larch has been found not to thrive, where Scotch fir, Pinus Sylvestris, has previously existed; but this is not the cause of the disease. Another disease to which it is subject, is a blister, which forms about two feet above the ground. These blisters are produced on two sides of the tree, alternately, until they reach the top, when the tree dies from above, downwards as it were. Sometimes the blister surrounds a branch, which breaks off in the course of time. This accident is frequently ascribed to the weight of snow. The range of this disease is at present bounded by the county of Forfar, and the south of the Grampians. It attacks entire plantations, but rarely trees above 25 years of age, and is most destructive in poor soils, or on hard formations, as clinkstone. None of the Dunkeld trees, at an elevation of 1000 feet, have been affected. De Candolle states, that on the Alps, the Larch is free from any disease, save the occasional loss of its leaves by the attacks of a caterpillar, and a resinous blister or canker, which however, produce no injurious effect upon the tree. It grows extremely well at Moritzburgh, near Dresden, in a moist sandy soil, 238 feet above the sea. He proposes, for this country, the following recommendations: 1. That the higher parts of the country are best suited for its growth, provided that the ground be not too dry, nor hard, nor marshy. 2. That the sides of the hills are better suited for it than the summits; and if the summits are marshy, the inferior parts of the mountains will be proper for it. 3. It is remarked on the Alps, that the Larch succeeds better in a northern than in a southern exposure. The difference is sometimes so striking, that in vallies running from east to west, it is not uncommon to see the side exposed to the north, covered with Larches, and that exposed to the south, with scarce a tree. This may be ascribed to the irregularity of the spring, but will not apply to this country. 4. The plantations of Larch in this country are too thick, the trees being generally planted at a distance of 3 or

95, Records of Science.—Translated from Bibliotheque Universelle.

4 feet. De Candolle considers that the young trees ought to be planted at a distance of 10 feet, and if planted closer, they should be gradually thinned for 20 years. He recommends, likewise, that for security, new seed should be brought from the Valais, where the cones are dried by the heat of the sun, and not from the Tyrol, where fire is employed for this purpose. M. Em. Thomas sells them at the rate of $2\frac{1}{3}$ francs (2s. 1d.) the half Killogramme ($1\frac{1}{3}$ lb. troy.) M. Thomas advises that the trees should be always transplanted in autumn and not in spring.

96 New method of Drying Plants. Dr. Hunefield recommends a new method of drying plants, by covering them first with the powder of lycopodium, and then placing them in a vessel containing chloride of calcium. By this method the colour and flexibility are preserved. On the 29th of July, 1831, the thermometer being at $53\frac{1}{2}°$, Dr. Goppert of Breslaw, placed in a 24 ounce glass, two leaves of the hyacinth, and a specimen of the Fumaria officinalis, with two ounces of muriate of lime, in such a manner that the plants were not in contact with the salt. On the following day the leaves began to dry, and on the 3rd of August, although not dead, the hyacinth leaves were capable of being reduced to a fine powder. Even fleshy plants, as the Sedum rupestre, are so much dried in seven days, that they may be pulverized. The lycopodium powder prevents the sap from escaping.

97 New Fruits. By this term we do not mean, as the reader might at first be apt to suppose, fruits the produce of foreign countries and recently imported into Britain; but we mean fruits newly introduced in a living state into our gardens or hothouses, and brought to perfection there. Of late years the Loquat and the purple-fruited Granadillo have been successfully cultivated, under glass, in various English gardens. The Longyen (Euphoria longana) has produced its fruit in the splendid and lofty hot-houses at Syon, the seat of the Duke of Northumberland, near Brentford; the Banana was in fruit in the stove attached to the Coliseum, in the Regent's Park, last summer, and it yields a crop every year in the large hot-house at Wynnstay, the seat of Sir William Watkin Wynn, in Denbighshire. In the vinery at the Experimental Garden, Inverleith, near Edinburgh (an institution well worth visiting), a small tree of the Psidium Cattleyanum, or China Guava, has ripened its fruit freely for two years past. The fruit is round, about the

 96, Records of Science; from Brande's Pharm.

size of a small plum, of a fine claret colour; the pulp is soft, only a little firmer than that of a strawberry, and of a delightful subacid flavour. Mr. John Robison, Secretary of the Royal Society of Edinburgh, who had tasted the fruit in India, declared the Experimental Garden specimens to be nowise inferior in quality. These home-grown guavas were found to make most desirable preserves. During the same period, a still more rare kind of fruit has been produced, for the first time in Britain, in the stove of Mr. Bateman, of Knypersley near Congleton,—a gentleman distinguished for his zeal, liberality, and success, in introducing and cultivating the singular tropical epiphytes. This is the Carambola, or the fruit of the Averrhoa Carambola, a native of the East Indies. Mr. P. N. Don, the intelligent gardener there, mentions that "during last autumn (1834) the tree fruited in great abundance." The fruit is of the size and shape of a duck-egg, but with angles on the sides. It "was used by the family for tarts, and also for preserves, and was allowed by excellent judges to be superior for pleasant flavour to any thing they had tasted."

98 SAXIFRAGA, CULTURE OF. This extensive, neat, and ornamental genus, succeeds well under alpine pot culture, and with a greater degree of certainty in preserving the different species than when planted out into the open ground, even in a well prepared soil. They will bear dividing, and repotting, at almost any season; the month of August, however, is perhaps the best time; most of the species will then have flowered, and still sufficiency of time will be remaining for their becoming established before winter. Equal portions of loam, peat, and sand, will suit nearly all the species. Saxifraga rivularis, nivalis, cæsia, and retusu require good peat, mixed with one-third part of sand; and the whole of the species require plenty of drainers in the bottoms of the pots. The stemless species require only to be repotted to the same depth as before dividing, when strong enough for that purpose. The stemmed species, whether they increase in size, by elongating their stems upward, or by spreading over the pots, require dividing and repotting deeper than previously, to enable them to emit young roots from the softer parts of their stems. When in good health the only species requiring frame protection, during winter, are ligulata and cuscutiformis; two species which are most frequently treated as greenhouse plants.

98, D. Cameron.

99 HARDY HEATHS, CULTURE OF. Erica Australis, carnea, ciliaris, cinerea, and its varieties; mediterranea, stricta, scoparia, vagans, and its varicties; Calluna vulgaris, and its varieties; Menziesia polifolia, and its varieties, amounting, in all, to upwards of thirty species and varieties, are all free-flowering, neat, and ornamental plants. They are of low growth, and of easy culture; and suitable either to embellish the flower border, or front of the shrubbery. The requisite soil for encouraging the growth of these very desirable plants, is equal portions of peat and loam; or, light sandy peat. The general complaint of the hardy heaths being short-lived is easily remedied. This is effected by layering a few of the young branches every year; as all the sorts, when so treated, will strike root very freely. For obtaining young plants, by this means, it is not indispensable, that any particular season be observed. It may be performed whenever an opportunity offers. Every second year, after layering, the whole may be taken up, in the month of March, and some of the young plants may be put to occupy the places of the old ones. Or, where large specimens are desired, the young plants may be left growing around the parent, as the latter will rarely die off when the process of laying some of the shoots around it every year is practised. They protect each other from the violent effects of wind, or extremes of temperature. Single upright standard plants of this genus, when fully exposed in the garden, are not unfrequently blown about by the wind, their roots loosened, if not broken off, and thus they are greatly injured or altogether destroyed. It should be remembered that their exposure in the garden, and the pruning to which they are very frequently subjected, are at variance with their natural habits. Layering will remedy much of the evil.

100 BUTTERFLIES' WINGS. In the series of works, entitled the Naturalist's Library, conducted by Sir William Jardine, a delightful volume, by Mr James Duncan, on British Butterflies, has just made its appearance. It has numerous plates, prettily executed. From its introduction, where its author notices the brilliancy and beauty of the wings of various Butterflies, we have the following information, "The mode of painting employed to produce these rich tints, may not improperly be called a kind of natural mosaic, for the colours invariably reside in the scales, which form a dense covering over the whole surface.

These scales are usually of an oval or elongated form, and truncated at the tip, where they are occasionally divided into teeth; but sometimes they are conical, linear, or triangular. They are fixed in the wing by means of a narrow pedicle, and are most commonly disposed in transverse rows, placed close together, and overlapping each other like the tiles of a roof. In some instances, they are placed without any regular order, and in certain cases there appear to be two layers of scales on both sides of the wings. When they are rubbed off, the wing is fouud to consist of an elastic membrane, thin and transparent, and marked with slightly indented lines, forming a kind of groove for the insertion of the scales. The latter are so minute that they appear to the naked eye like powder or dust, and as they are very closely placed, their numbers on a single insect are astonishingly great. Leeuwenhoek counted upwards of 400,000 on the wings of the silk moth, an insect not above one-fourth of the size of some of our native butterflies. But how much inferior must this number be to that necessary to form a covering to some foreign butterflies, the wings of which expand upwards of half a foot; or certain species of Moths, some of which (such as the Atlas Moth of the east, or the Great Owl Moth of Brazil,) sometimes measure nearly a foot across the wings! A modern mosaic picture may contain 870 tesserulæ, or separate pieces, in one square inch of surface; but the same extent of a butterfly's wing sometimes consists of no fewer than 100,736!"

101 Mango, Naturalization of. The Mango, so celebrated in the East, for its delicious fruit, has been ripened in England, by Earl Powis; and, in the opinion of naturalists, familiar with Indian botany, might be more extensively cultivated here, than from its usual arboreous nature, might be supposed possible. Mr. Royle states, (Illust. Himalayan Mountains, part 6), that "by grafting and transplanting, the ordinary growth is much impeded, and shrubs of less than four feet in height have borne in the Saharumpore Botanic Garden, (North India) about a dozen mangoes. It would be necessary only to imitate the climate, by giving a greenhouse cold in winter, rapidly raising the heat in February and March, and continuing it till May and June, or about the accession of the rains, when the addition of moisture to the heat is indicated, as the mangoes ouly perfectly ripen after the atmosphere has become moist in the rains.

101, Mechauic's Mag. June, 1835.

102 Slugs, to destroy. By night and by day, the horticulturist has numerous enemies to guard against and to encounter. Amongst these, two or three species of Lymax, known indiscriminately as Slugs, are, doubtless, the most formidable. Some of our friends have used wheat chaff, cut straw, and the piles of barley; others soot, lime, saw-dust, and sundry similar substances; all with more or less success. Oftentimes under favourable circumstances, and the convenience of such articles being at hand, they are not unworthy of attention. Generally, however, we object to them all. The flower garden, as a work of art, as well as nature, rarely admits the spreading of chaff, and similar substances, without a disagreeable display of litter. In the kitchen garden this will generally be esteemed as less important, therefore we mention them as passing hints, for the advantage of such as may find them convenient. In our own practice we have always regarded hand picking as the only efficient method of protection against the depredations of Slugs. To facilitate this operation it is necessary to entice them together, and in this we have followed the usnal method of spreading slices of turnip, cabbage leaves, or other refuse likely to prove attractive, and afford them a convenient retreat. As an additional attraction to these little animals, our attention has been urgently called by a friend to a method oftentimes mentioned and practised by gardeners, but which, we are assured, deserves to be recommended with more than ordinary zeal. It is simply the addition of a very little fat, of almost any description, to the cabbage leaves, after having thoroughly warmed them before the fire.

103 Iron and Steel, to preserve from Rusting. As the preservation of iron, in a clean and perfect state, is oftentimes very desirable to the gardener and horticulturist, we copy the following from the Records of Science for June, 1835. Several methods of preventing instruments of steel and iron from oxidating are well known; such as covering them with mercurial ointment, grease, oil or marrow, or placing them in calcined lime. The former of these I have found the most effectual as well as the most convenient mode. M. Payen has, however, lately proposed a new plan for accomplishing the same object. He found that a saturated solution of carbonate of soda, mixed with its own volume of water, disengaged only $\frac{1}{1000}$ part of its volume of air, and preserved iron from rusting, and did not lose this power

even when diluted with twenty-five times its volume of water. A saturated solution of borate of soda, as well as a mixture of ammonia and water, disengaged no gas, nor underwent any contraction, but preserved iron from oxidating. Saturated lime water, diluted with an equal volume of water, possessed the same power. A saturated solution of potash, diluted with 1000 and 2000 parts of water, preserved iron; but when saturated with a current of carbonic acid, the oxidation of the metal occurred in common water. A saturated solution of potash diluted with 4000 or 3000 parts of water, had not the property of preventing oxidation, and upon turn sol, this solution exhibited an alkaline reaction. M. Payen, sensible of the impracticability of immersing surgical instruments in a liquid, suggests the propriety of forming a varnish of the saturated solution of potash and gum tragacanth. He made a comparative experiment upon muskets, one of which he varnished over, and the other was left in its natural state. After a lapse of fifteen days the former was quite bright while the latter was rusted. He considers that the solutions of soda will be preferable to those of potash, because they are less deliquiscent. The effects of these solutions in preventing oxidation were so decided, that he compared, carefully, the consequences when iron was placed in common water. About 24 minutes after immersion a thin opaline halo surrounds it, which increases in size and intensity. At the end of an hour, it is sensibly brown, and gradually a deposit begins to form on the greatest part of the iron, and at the bottom of the vessel.

104 Celery, to preserve in winter. Gardeners frequently cover their rows of Celery with straw, or give an additional moulding as a protection against frost. This method is very inferior to taking it up entirely, before severe frosts sets in, and storing it between very thin layers of straw, on the floor of a damp cellar, till required for use. Or, which is still a superior method, as noticed in the Gardener's Magazine, v. 11, 53, take it up, shorten the leaves and roots, let it dry for a few days, and then bury it in sand, in a cool cellar, observing to keep the roots apart by a sufficiency of sand. After being thus covered, the greatest care will be required in washing it, which should be thoroughly performed, by well rinsing, with the root ends upwards. If the sand be once suffered to get between the stalks, entire separation of them is the only remedy.

105 Ink, permanent. The following is from the Records of Science, translated from the Annales de Chemie. Mr. Braconnot, of Nancy has published a receipt for ink, which he says answers extremely well in Botanic Gardens, and in open or wet situations where names are required to be preserved permanently. Take of

Verdigris,......1 part.	Soot,............ ½ part.
Sal ammonia, 1 part.	Water,......... 10 parts.

Mix the powder in a glass or porcelain mortar, adding at first one part of water, in order to mix them well, then add the remainder of the water. Shake the ink well from time to time. When it is to be used we must write with it upon a plate of zinc, and after some days it becomes hard, and cannot be obliterated by atmospherical influence or by rubbing. The ink may be tinged by any color, by substituting for the soot or lamp black some mineral colouring matter. Zinc Tallies are easily procured, as this metal is now rolled into thin sheets for covering buildings, and other uses, in lieu of lead ; it being both lighter and cheaper ; and not liable to decay by oxidation.

106 Marble to preserve. It has long beeen matter of regret, that polished marble cannot be fully exposed in our northern latitude without immediate injury and ultimate destruction. But for this circumstance white marble would prove a valuable adjunct to the buildings and embellishments of the first class of ornamental gardens. Some experiments have lately been made and explained in evidence, before the committee of arts and manufactures, by Mr. John Henny, from which their is every probability that a coating may be so applied to marble as to preserve it for a great length of time. Wax is the substance used, and this he believes to be almost indistructable under atmospheric influence alone. He has tried in on the frieze of the Athenæum, Hyde Park Corner, with complete success. A piece of polished marble was first submitted to experiment. A little melted wax was applied to a part of it, with a camel-hair pencil, and the marble warmed till it absorded the wax. After being exposed during a whole winter, the polish on the unprotected part was destroyed, but where the wax had been applied it was uninjured. If the wax be dissolved in turpentine it penetrates to a greater depth into the marble, but this was thought unnecessary, as the wax alone was observed to sink into it to the

depth of one-sixteenth of an inch. It is indispensable that the marble be made warm, therefore large statues, or architectural ornaments, which cannot be moved to a fire, must have heat applied to them, by the use of hot irons. Thus, by beginning the work at the top it may be gradually warmed, and the wax would run downwards over the marble, and be conveniently exposed to the heat. Whilst warm the superfluous wax is wiped off the surface, which is left with the appearance of beautiful old marble. White wax is recommended, as least liable to change colour. We think that advantage may be taken of this hint, and that wax may be employed iu the protection of ornamental castings and sculpture, which have been executed in various soft materials. We hope that some of our friends will immediately put it to the test.

107 Damping off. Many herbaceous plants that will endure any degree of frost, without injury, are frequently lost, in mild winters, by what is technically called damping off; occasioned by the humidity of our atmosphere This may, to a considerable extent, be prevented, by raising a mound of sand, a few inches high, over their crowns, upon the surface of the soil. This should be done in November, and be removed in spring, just before the young shoots reach the surface; the danger being over as soon as vegetatiou has fairly commenced.

108 Growth of plants. This subject is so full of interest, and also of admiration, to the contemplative miud, that when treated perspicuously and concisely, as we find it treated by Dr. Turner, it becomes important as well, morally, as scientifically. He says, "While a plaut differs from an auimal, iu exhibitiug no signs of perception or voluntary motion, and in possessiug no stomach to serve as a receptacle for its food, there exists between them a close analogy both of parts and functions; which, though not discerned at first, becomes striking on a nearer examination. The stem and branches act as a frame work or skeleton for the support and protection of the parts necessary to the life of the individual. The root serves the purpose of a stomach by imbibiug nutritious juices from the soil, and thus supplying the plant with materials for its growth. The sap or circulating fluid, composed of water, holdiug in solution saliue, extractive, mucilaginous, saccharine, and other soluble substances, rises upwards through the wood in a distinct system of tubes called the common

107, Dareucom.

vessels, which correspond in their office to the lacteals and pulmonary arteries of animals, and are distributed in minute ramifications over the surface of the leaves. In its passage through this organ, which may be termed the lungs of a plant, the sap is fully exposed to the agency of light and air, experiences a change by which it is more completely adapted to the wants of the vegetable economy, and then descends through the inner layer of the bark in another system of tubes called the proper vessels, yielding in its course all the juices and principles peculiar to the plant. This leads to the consideration of the

109 CHEMICAL CHANGES IN PLANTS. The chemical changes which take place during the circulation of the sap are in general of such a complicated nature, and so much under the control of the vital principle, as to elude the sagacity of the chemist. One part of the subject, however, namely, the reciprocal agency of the atmosphere and growing vegetables on each other, falls within the reach of chemical enquiry, and has accordingly been investigated by several philosophers. For the leading facts relative to what is called the respiration of plants, or the chemical changes which the leaves of growing vegetables produce on the atmosphere, we are indebted to Priestly and Igenhousz, the former of whom discovered that plants absorb carbonic acid from the air, under certain circumstances, and emit oxygen in return; and the latter ascertained that this change occurs only during exposure to the direct rays of the sun. When a healthy plant, the roots of which are supplied with proper nourishment, is exposed to the direct solar beams in a given quantity of atmospheric air the carbonic acid after a certain interval is removed, and an equal volume of oxygen is substituted for it. If a fresh portion of carbonic acid is supplied, the same result will ensue. In like manner, Sennebier and Woodhouse observed that when the leaves of a plant are immersed in water, and exposed to the rays of the sun, oxygen gas is disengaged. That the evolution of oxygen in this experiment is accompanied with a proportional absorption of carbonic acid, is proved by employing water, deprived of carbonic acid by boiling, in which case little or no oxygen is procured. Such are the changes induced by plants when exposed to sunshine; but in the dark an opposite effect ensues. Carbonic acid gas is not absorbed under these circumstances, nor is oxygen gas evolved;

but, on the contrary, oxygen disappears, and carbonic acid gas is evolved. In the dark, therefore, vegetables deteriorate rather than purify the air, producing the same effect as the respiration of animals." An ingenious explanation, supported by experiments, of the cause of these opposite effects, has been offered by Professor Burnet, which appears satisfactory. He considers that the influence of vegetation on the atmosphere is owing not to one, but to two functions, that is to the

110 Digestion and Respiration of Plants. Respiration is believed to proceed at all times as in animals, without intermission, and its uniform effect is the production of carbonic acid; while the former takes place only under the influence of light, and gives rise to evolution of oxygen gas, and the abstraction of carbonic acid. A plant exposed to sunshine, purifies the air by absorbing carbonic acid from the atmosphere, as well as that emitted by its own respiration, and emits oxygen gas in return. In the dark, digestion is at a stand, and respiration continuing without intermission, carbonic acid accumulates. From several of the preceding facts, it is supposed that the oxygen emitted by plants, while under the influence of light, is derived from the carbonic acid which they absorb, and that the carbon of that gas is applied to the purposes of nutrition. Consistently with this view it has been observed that plants do not thrive when kept in an atmosphere of pure oxygen; and it was found by Dr. Percival and Mr. Henry, that the presence of a little carbonic acid is even favourable to their growth, Saussure, who examined this subject minutely, ascertained that plants grow better in an atmosphere which contains about one-twelfth of carbonic acid than in common air, provided they are exposed to sunshine. But if that gas be present in a greater proportion, its influence is prejudicial: in an atmosphere consisting of one-half of its volume of carbonic acid, the plants perished in seven days; and they did not vegetate at all when that gas was in the proportion of two-thirds. In the shade the presence of carbonic acid is always detrimental. He likewise observed that the presence of oxygen is necessary, in order that a plant should derive benefit from admixture with carbonic acid. Saussure is of opinion that plants derive a large quantity of their carbon from the carbonic acid of the atmosphere, an opinion which receives great weight from the two following comparative

experiments. On causing a plant to vegetate in pure water, supplied with common air and exposed to light, the carbon of the plant increased in quantity; but when supplied with common air in a dark situation, it even lost a portion of the carbon which it had previously possessed.

111 LIGHT, ITS EFFECTS ON PLANTS. Light is necessary to the colour of plants. The experiments of Sennebier and Mr. Gough have shown that the green colour of the leaves is not developed, except when they are in a situation to absorb oxygen and give out carbonic acid. Though the experiments of different philosophers agree as to the influence of vegetation on the air in sunshine and during the night, very different opinions have been expressed both as to the phenomena occasioned by diffused daylight, and concerning the total effect produced by plants on the constitution of the atmosphere. Priestly found that air vitiated by combustion, or the respiration of animals, and left in contact for several days and nights with a sprig of mint, was gradually restored to its original purity; and hence he inferred that the oxygen gas, consumed during these and various other processes, is restored to the mass of the atmosphere by the agency of growing vegetables. This doctrine was confirmed by the researches of Ingenhousz and Saussure, who found that the quantity of oxygen evolved from plants by day exceeds that of carbonic acid emitted during the night; and Davy arrived at the same conclusions as Priestley. But an opposite opinion has been supported by Mr. Ellis, who from an extensive series of experiments, contrived with much sagacity, inferred that growing plants give out oxygen only in direct sunshine, while at all other times they absorb it; that when exposed to the ordinary vicissitudes of sunshine and shade, light and darkness, they form more carbonic acid in the period of a day and night, than they destroy; and, consequently, that the general effect of vegetation on the atmosphere is the same as that produced by animals. The recent experiments of Dr. Daubeny appear decisive of this question. He has convinced himself that in fine weather a plant consisting chiefly of leaves and stems, if confined in the same portion of air night and day, and duly supplied with carbonic acid gas during the sunshine, will go on adding to the proportion of oxygen present, so long as it continues healthy, at least up to a certain point, the slight diminution of oxygen and increase of carbonic acid which take

place during the night, bearing no considerable ratio to the degree in which the opposite effect occurs by day. He accounts for the discordance between his own results and those of Mr. Ellis, by his having carefully removed the plants from the experimenting jar immediately they began to suffer from the heat or confinement, and conducted the experiments on a larger and more suitable scale.

112 Food of Plants. The chief source from which plants derive the materials for their growth, is the soil. However various the composition of the soil, it consists essentially of two parts, so far as its solid constituents are concerned. One is a certain quantity of earthy matters, such as siliceous earth, clay, lime, and sometimes magnesia; and the other is formed from the remains of animal and vegetable substances, which, when mixed with the former, constitute common mould. A mixture of this kind, moistened by rain, affords the proper nourishment of plants. The water, percolating through the mould, dissolves the soluble salts with which it comes in contact, together with the gaseous, extractive, and other matters which are formed during the decomposition of the animal and vegetable remains. In this state it is readily absorbed by the roots and conveyed as sap to the leaves, where it undergoes a process of assimilation. But though this is the natural process by which plants obtain the greater part of their nourishment, and without which they do not arrive at perfect maturity, they may live, grow, and even increase in weight, when wholly deprived of nutrition from this source. Thus in the experiment of Saussure, already described, sprigs of peppermint were found to vegetate in distilled water; and it is well known that many plants grow when merely suspended in the air. In the hot-houses of the botanical garden of Edinburgh, for example, there are two plants, species of the fig tree, the ficus australis and ficus elastica, the latter of which, as Dr. Graham asserts, has been suspended for ten, and the former for nearly sixteen years, during which time they have continued to send out shoots and leaves. Before scientific men had learned to appreciate the influence of atmospheric air on vegetation, the increase of carbonaceous matter, which occurs in some of these instances, was supposed to be derived from water, an opinion naturally suggested by the important offices performed by this fluid in the vegetable economy. Without

108 to 112 from Dr. Turner's Elements of Chemistry.

water plants speedily wither and die. It gives the soft parts that degree of succulence necessary for the performance of their functions;—it affords two elements, oxygen and hydrogen, which either as water, or under some other form, are contained in all vegetable products;—and, lastly, the roots absorb from the soil those substances only, which are dissolved or suspended in water. So carefully, indeed, has nature provided against the chance of deficient moisture, that the leaves are endowed with a property both of absorbing aqueous vapour directly from the atmosphere, and of lowering their temperature during the night by radiation so as to cause a deposition of dew upon their surface, in consequence of which, during the driest seasons and in the warmest climates, they frequently continue to convey this fluid to the plant, when it can no longer be obtained in sufficient quantity from the soil. But necessary as water is to vegetable life, it cannot yield to plants a principle which it does not possess. The carbonaceous matter which accumulates in plants, under the circumstances, above mentioned, may, with every appearance of justice, be referred to the atmosphere; since we know that carbonic acid exists there, and that growing vegetables have the property of taking carbon from that gas.

113 Ashes of Plants. When plants are incinerated, their ashes are found to contain saline and earthy matters, the elements of which, if not the compounds themselves, are supposed to be derived from the soil. Such at least is the view deducible from the researches of Saussure, and which might have been anticipated by reasoning on chemical principles, The experiments of M. Schrader, however, lead to a different conclusion. He sowed several kinds of grain, such as barley, wheat, rye, and oats, in pure flowers of sulphur, and supplied the shoots as they grew with nothing but air, light, and distilled water. On incinerating the plants, thus treated, they yielded a greater quantity of saline and earthy matters than were originally present in the seeds. These results, supposing them accurate, may be accounted for in two ways. It may be supposed in the first place, that the foreign matters were introduced accidentally from extraneous sources, as by fine particles of dust floating in the atmosphere; or, secondly, it may be conceived, that they were derived from the sulphur, air, and water, with which the plants were supplied. If the latter opinion be adopted, we must infer

136 AUCTARIUM. 113, Dr. Turner's Elements of Chemistry.

either that the vital principle, which certainly controls chemical affinity in a surprising manner, and directs this power in the production of new compounds from elementary bodies, may likewise convert one element into another; or that some of the substances, supposed by chemists to be simple, such as oxygen and hydrogen, are compounds, not of two, but of a variety of different principles. As these conjectures are without foundation, and are utterly at variance with the facts and principles of the science, I do not hesitate in adopting the more probable opinion, that the experiments of M. Schrader were influenced by some source of error which escaped detection.

114 PEAT SOIL. Under the name of Peat, a soil which is so frequently recommended as indispensable to the successful culture of various species of plants, is comprehended two very different kinds of earth, with numerous intermediate varieties. Some of these are totally unfit for use, without previous preparation and admixture. Heath peat is that found upon dry barren heaths, generally only a few inches thick, of a black colour, with a mixture of sand. This answers well for pot culture, either by itself or mixed with other soils. When used for beds of American plants, one-fourth part of fresh loam should be mixed with it. Bog peat is found in low marshy situations, frequently of considerable depth, without any mixture of sand. This description of peat is unfit for garden purposes, in the state in which it is originally dug from such marshy grounds. It should be laid in heaps, or rather in flat beds, to have full exposure, through an entire winter; and in such situation it will require to be frequently turned over, to sweeten and to become pulverized. When thoroughly friable, it is more valuable than heath peat, being, by the addition of sand, applicable to every purpose to which peat soil can be used, whether simply or compounded with more common soils. If peat of this description be laid over the common garden borders, to the thickness of three or four inches, and then very well worked in amongst the common earth, to the depth of 18 inches, it will be found to add greatly to its fertility, for every purpose both of the kitchen and flower garden. There is scarcely a hardy exotic, but will grow in it most luxuriantly. A description of bog peat will sometimes be met with, particularly in mining districts, of a yellowish hue, or having veins or strata, principally of such colour. This we have

114, Darencom.

found to contain a considerable portion of oxide of iron; and although reduced to powder and mixed with sand, before being used, we have seen American shrubs which had been planted in it, dwindle year after year, and ultimately die.

115 WOODLICE, TO DESTROY. Very few hothouses or frames are entirely exempt from that troublesome little animal, the Woodlouse, the Onisens ascellus of Linneus. When few in number the injury done by them to growing plants is trifling; we may, notwithstanding, wish the sons of Galen possessed those few for the benefit of their jaundiced patients. In common hotbeds and mushroom beds, when from overheating or other causes, they become dry, and afford convenient places for shelter and increase, Woodlice are, sometimes, so numerous as to destroy much of their crops, and have been found difficult of extirpation. By complying with the following directions this difficulty may be removed. These insects are very partial to the fleshy roots of the common white Bryony,—Bryonia dioica. If this be cut into thin slices, and allowed to become nearly dry, it makes an excellent bait for entrapping them. The Briony is conveniently used by putting one or two slices into a garden pan, or on a tile, with a little loose dry moss over it, where the insects resort. They will soon both find and feed upon the Briony root; and as the dry moss will afford them convenient shelter they will remain beneath it. These traps should be examined every morning or oftener, when the insects may be destroyed. The Bryony is found sparingly in most old hedge rows; but as the roots are difficult to discover, during winter, a root or two should be transplanted into the garden, to be ready when wanted.

116 FOSSIL FERNS. In a number of the Athenæum of 1835, was a notice on Fossil Ferns. As it contains an assertion somewhat at variance with our anticipations, geologically; and also a method of comparison, worth remembering, we copy it. "As it is very rare to find a fossil fern, the mere impression, generally speaking, being all that remains, a M. Gœpper has taken the impression of a number of recent ferns, in order, by comparison, to try and ascertain the fossil species with greater facility. By this method, M. Gœpper has been able to recognize more than thirty species, which are analogous to those of the present day."

117 RAFFLESIA ARNOLDI. In the Floral Register we have figured this most extraordinary production, and its character de-

mands further notice than we could there bestow on it. Dr. Robert Brown has given an interesting paper on the subject, and the singularity of the plant demands that we should supply our readers with an account of its peculiar structure. "It is a parasite, growing in woods, on the roots and stems of those immense climbers, generally of the genus Vitis, which are attached, like cables, to the largest trees in the forest. The flower constitutes the whole of the plant, there being neither leaves, roots, nor a stem. It is a true parasite, growing out of another plant in the manner of the mistletoe, and not on the decayed surface of plants, as the common fern on the trunks of old oak pollards. The breadth of a full-grown flower exceeds three feet; and the petals, which are subrotund, measure twelve inches from the base to the apex, and it is about a foot from the insertion of the one petal to the opposite one; what is considered the nectarium would hold twelve pints; the pistils, which are abortive, are as large as cows' horns, and the weight of the whole is calculated to be about fifteen pounds. The flower, fully blown, was discovered in a jungle, growing close to the ground under the bushes, with a swarm of flies hovering over the nectary, and apparently laying their eggs in its substance. The colour of the five petals is a brick red, covered with protuberances of a yellowish white. The smell is that of tainted beef. The structure of Rafflesia is too imperfectly known to admit of determining its place in the natural system; but Mr. Brown is inclined to think it will be found to approach either to Asarinæ or Passifloreæ. Its first appearance is that of a round nob, proceeding from a crack or hollow in the stem or root. This knob, when cut through, exhibits the infant flower enveloped in numerous bracteal sheaths, which successively open and wither away as the flower enlarges, until, at the time of full expansion, there are but a very few remaining, which have somewhat the appearance of a broken calyx. It takes three months from the first appearance of the bud to the full expansion of the flower. The fruit has not yet been seen by botanists, but is said by the natives, to be a many-seeded berry. The female flower differs little in appearance from the male, further than being without the anthers of the latter. The modes of union between a parasite and its supporter or stock, vary in different genera and species of this class of vegetables. Some, as the mistletoe and Rafflesia, depend on the stock for nourishment during the whole of their existence; others, as the common broom rape, are originated in the soil, and afterwards, when they have attached themselves to their stock, the original roots die; other parasites, again, are originated on the stock, and in their more advanced state produce roots of their own. In some cases the nature of the connection between the parasite and the stock is such, "as can only be explained on the supposition, that the germinating seed of the parasite excites a specific action in the stock, the result of which is the formation of a structure, either wholly or in part derived from the root, and adapted to the support and protection of the undeveloped parasite; analogous, therefore, to the production of galls by the puncture of insects." on this supposition may be explained, the connection between the flower Rafflesia and the root from whence it springs.

118 Rhododendron, Grafting of. Mr. Joseph Walker of Banner Cross, near Sheffield, has succeeded in grafting the Rhododendron Alta-clerense on the ponticum. In a communication inserted in the last (74th) Number of the Gardener's Magazine, he states that having obtained a small sprig of the Rhododendron Alta-clerense from Mr. Paxton at Chatsworth, he inserted the end of it into a potatoe, and took it home. Happening, he says, to have a small plant of Rhododendron ponticum in a pot, I cut it down to about five inches above the pot, and grafted it in the whip manner with the small sprig thus procured, letting the end still remain inserted in the potatoe. I then clayed it, and put it under a hand glass in a cool vinery, where it united to the stock, and is now a healthy plant, standing out under a south wall.

119 Preserving Plants during a Voyage. Capt. R. Gillies, of the ship Hibernia, communicated the following method to Messrs. Fox; given in the Report of the Royal Cornwall Polytechnic Society. "In accordance with your wishes, I have much pleasure in describing to you the mode in which the plants brought by me from Calcutta were put up. The plants were all intended for the greenhouse in England, and, I presume, were of a delicate kind. Each plant was in a box, six inches square, by one foot in depth, filled to the top with a kind of clay; and, no doubt, well saturated with water, previously to being put into the large outer box, which contained eight of these small ones. The large box was constructed in the usual

way; that is, a glazed roof about two feet high, the glass strong enough to resist the fall of a small rope, or other light body. It was hermetically closed with the common lime cement of the country, and was never opened during a voyage of five months. When we arrived in England, the plants were all in beautiful health, and had grown to the full height of the case, the leaves pressing against the glass. In dry weather, I always observed moisture within the glass, which was caused, no doubt, by the evaporation of the earth, and was again absorbed by the plants. It is difficult to account for the perfect health of the plants, without the full admission of the atmosphere; but oxygen sufficient was probably admitted, either through the pores of the wood, or otherwise. It is, however, a fact, that no water was given to them during the voyage, and that they were landed in excellent order." This reminds us of Mr. Ward's plant cases, explained at section 72.

120 Pomegranate, to flower. Under common management, the double-flowered Pomegranate rarely blossoms freely, and oftentimes not at all. Mr. David Whale, Gardener, of Winchester, in a paper inserted in the Floricultural Cabinet, No. 39. says "The double flowering kind is much more esteemed than the other in this country, for the sake of its large fine double flowers, which are of a most beautiful scarlet colour; and if the trees are well managed, and supplied with due nourishment, they will continue to produce flowers for four or five months successively, which renders it one of the most valuable flowering trees. This sort may be rendered more productive of flowers, by grafting it upon stalks of the single kind, which checks the luxuriance of the trees, and causes them to produce flowers upon almost every shoot. There have been various ways recommended to manage the pomegranate, so as to make it flower freely, and forty years' experience has taught me what I conceive to be the most successful method. I do all my pruning in the summer season; training the branches at a regular distance, of about four inches apart, in the same way as I train a plum tree; towards the latter end of June I look over the trees, and remove all the shoots that are running to wood; at which time they are young and tender, and are easily removed without the assistance of a knife. Care must be taken to leave all spurs and blossom shoots, which are easily distinguished from wood shoots. This I do about three times during the summer, and by this treatment

the tree continues to flower four or five months, making a very grand appearance, and repaying by its beauty for every care a gardener can bestow. The knife should never be used about these trees in winter, except to remove decayed branches, &c. They are easily propagated by layers or cuttings. To accomplish the first, in March, select some of the young branches for the purpose, give a little slit at a bud underneath, or they will easily strike root without slitting, and I consider that method to be the safest; lay them in the usual way, water them occasionally during the summer, and by the following autumn they will be well rooted so that they may be taken off and removed to any warm situation, to gain strength, before they are planted where they are to remain. If cuttings are required, in June, take some young tops of branches, select a warm place in the garden, place them under a hand-glass, shade them in hot weather, and by autumn they will have taken root."

121 Culture of Cacteæ. In the extensive family of Cacteæ are some of the most showy plants which we possess, either for the greenhouse or for decorating a room. Amongst them we may particularly mention Cereus speciosissimus, speciosus, truncatus, Ackermanni, Jenkensonni, hybrida, all of which are of the easiest management, whether cultivated in the greenhouse, or in sitting rooms. The soil in which it was formerly considered requisite to pot these splendid plants, was that which was poor, and mixed with old lime rubbish. It has, however, of late been dicovered that rich soil, mixed with manure, is preferable. How far the same compost would suit other succulent plants has yet to be ascertained by experience. From March to November the various species of Cereus ought to have a plentiful supply of water; and occasionally they should likewise be supplied with liquid manure. During the winter months it is desirable that they be kept both cool and dry, a treatment that will induce a most abundant produce of flower buds, which will soon burst forth after they begin to receive a plentiful supply of water in March. They are readily increased by cuttings, and by grafting upon each other, a method which admits of many species being grown upon the same plant, The best stock on which the Cereus truncatus can be grafted is the Pereskia aculeata, upon which it grows more rapidly than even from its own roots. When thus grafted upon a high stock, and trained care-

fully in an Umbrella form, it produces a most novel and interesting appearance. Much has been done in hybridising these plants, and it is likely that many beautiful and singular varieties may yet be obtained by the same means, particularly if the subgenera Mammillaria, Melocactus, Echinocactus, Opuntia, Periskia, and Rhipsalis, will fertilize the Cereus. In other genera, seeds saved from hybrids are found to produce the greatest number of new varieties, the existing hybrids of this genus ought therefore, in artificial fertilization, to be employed as the female parent.

122 Potatoes, moulding up. Much disparity of opinion occurs respecting the utility of moulding up Potatoes. Joseph Hayward, Esq. in the ninth volume of the Gardener's Magazine, objects to the practice altogether, as one not only of inutility, but of injurious tendency towards the crop. We wish that some of our friends would assist in obtaining further proofs. Mr Hayward says, "Observing that a farmer, in managing a field of potatoes alongside one of mine, did not earth them up, but simply flat-hoed the surface of the soil to clear away the weeds, while I had mine earthed up with great care, I determined on noticing the difference on taking up the crop; and, to my astonishment, he had 14 tons per acre, while I had not more than half the quantity, and his potatoes were of a more marketable quality than mine; being generally of a good size, while mine were large and small. The result induced me to question the farmer; and he told me it was a practice he had followed for many years, as he thought the earthing up was worse than labour thrown away; that, a year or two before, he had obtained 19 tons per acre by the same management. This statement put me upon considering the principles upon which such a result was founded; and it appeared to me that, by drawing up the earth over the potato, in sloping ridges, it was deprived of its due supply of moisture by the rains; for, when they fell, the water was cast into the ditches. Further, in regard to the idea that, by thus earthing up, the number of tubers is increased, the effect is quite the reverse; for experience proves that a potato placed an inch only under the surface of the earth will produce a greater number of tubers than one planted at the depth of a foot. From reasoning thus, I determined to adopt the practice: however, such is the force of prejudice, that I have

been able to make but few proselytes. A year or two since, I prevailed on a clergyman to try the practice on a strip of half an acre, running through a large field, treated in the common manner; and he told me that, on taking up the crop, he did not find much difference in the gross quantity; but that those which had not been earthed up, were more generally of a good size; not so many large and small as the other part of the field. I have no doubt, if potatoes are planted shallow, and placed wide enough apart to admit of the stems being laid down after the young potatoes are formed, and to have the earth between them thrown over five or six inches thick, so as to form a flat surface, that it would increase the crop. But this is a very different operation from that I object to."

123 PROTEACEÆ, CULTURE OF. Difficulties have hitherto presented themselves in the culture of the several species of Banksia, Dryandra, and others of the Proteaceæ, which form prominent ornaments of the greenhouse. Many of these interesting plants, which have at different times been admired in the principal collections around the metropolis, are now no where to be found. One reason of this has doubtless arisen out of the management which has existed in the practice of continuing to stimulate the plants into active growth, immediately after their flowering season; the time which, in their indigenous situations, naturally constitutes their season of repose. In tropical countries the season of vegetable repose does not occur from low temperature, as in our own climate. With us a low temperature, which distinguishes our winters, depresses vegetables into torpidity and rest—a state of existence which is as requisite to vegetable as to animal life. In tropical plains, heat is perpetual, but the magnificent plants, natives of those climates, still have their season of rest; a season which the judicious cultivator will endeavour to imitate. Within the tropics the year possesses two prominent features, as in our northern latitude; but with us this arises from temperature, whilst in the tropics it arises from moisture. During the rainy season, attended as it is by intensity of heat, plants vegetate with a luxuriance, and assume a character of magnificence, of which no artificial means can afford an adequate idea. Under this increased stimulus, their flowers and fruit proceed rapidly to maturity, and by the time of its accomplishment, intense heat and drought begin to spread,

languor and inactivity, and vegetable life thus overpowered, sinks into repose. This season of drought is what the cultivator has studiously to imitate. His tropical plants should have but sufficient moisture merely to continue their existence; and thus they will be prepared, at the proper season, when water is allowed them freely, to vegetate with their natural vigour. We have been led into this comment, by an article of Sir W. J. Hooker, in the Botanical Magazine, combining a paper on the culture of these plants, communicated by Mr. J. Smith, of his Majesty's gardens at Kew. It is stated that Mr. Smith, adverting to the interesting pamphlet of Mr. Macnab, the excellent Superintendent of the Royal Botanic Garden, at Edinburgh, on the propagation and culture of Cape Heaths, which appeared in 1831, observes, that he had pursued with success for some time antecedent to that date, the same mode of treatment of Proteaceæ under his care, that is recommended in that publication, with respect to the culture of Heaths, viz. in regard to shifting the plants into fresh and larger pots; in the process of which, it is very important to afford, by means of potsherds, or or fragments of half-baked pottery, a good drainage below, and especially to avoid deep potting, by placing the plant, with its ball of earth round the roots quite entire, so as to be some two or three inches above the surface of the soil at the edge of the pot, which will have the effect of carrying off any superabundant moisture from the roots to the circumference, and thus prevent the chance of water becoming stagnant round the base of the stem; by inattention to this latter circumstance, many a Banksia and Dryandra in other collections have been killed; whilst a steady regard to free drainage, to an abundant circulation of air, and a low temperature, he has succeeded in preserving many fine proteaceous plants longer than is generally effected in other gardens in the neighbourhood of London. The soil, continues this intelligent cultivator, which I use in the culture of most of the Proteaceæ, is a good fresh loam, with which, if stiff, I mix a portion of sand, so as not to admit of its being retentive of water. In time, after being potted as already directed, the main roots next the stem of the plant will become uncovered: this circumstance I regard as favourable to the health of the plant: there will be no danger of its dying suddenly, as I have known many to do, that have been buried alive,—in other words, been deeply potted!" "In the winter months, care should be taken not to saturate the earth with water, nor wet the leaves or stem more than can be avoided. In dry weather however, during the summer season, water may be freely given to the plants about sunset, and a very essential point to be observed is, that when they are placed out in the open air in groups, the sun's rays should not be allowed to fall directly on the sides of the pots, for if they are, all the feeding spongioles of the tender roots round the inner side of the pot, will assuredly be destroyed, and the life of the plant greatly endangered. Repeatedly have I known a Banksia to have been killed by the solar ray having been thus allowed to act on the side of the pot, which six months' afterwards retained so much of a life-like look—being kept yet in its pot—as to appear to the eye of a superficial observer, to be still alive, and in perfect vigour. The lowest greenhouse temperature that can judiciously be allowed, to prevent the effects of frost, is sufficient for the generality of the family now in cultivation in Britain, and no artificial heat is required for their preservation, excepting in severe frosty weather." "As the rapid upright-growing species are, if left to themselves, shorter-lived than others naturally more robust, the free use of the knife is recommended, and the growth of the plants checked, by keeping the luxuriant shoots cut back. This remark is especially applicable to those beautiful plants of the order, with simple, strait, wand-like stems, such for example as Banksia Brownii and Dryandra Serra, the former of which has been lost to several collections that could once have boasted of it, by its having been suffered to shoot up into exuberant growth, far beyond what the slender, tapering, thinly-fibred root could at all furnish sustenance. By heading these down somewhat, and thus reducing the ascending axis, or column of circulation, a more robust habit is induced, a growth of roots in their pots takes place, lateral branches are thrown out, and the plants thus treated at Kew, are now in the best possible health, with every indicative of being fully established in that garden."

124 Peas. The Fellows of the London Horticultural Society must derive satisfaction from the undoubted benefits which Horticulture and Floriculture have received from their united efforts. One of the useful practices in the Society's garden is that of

collecting Kitchen vegetables, from various sources, and cultivating them in juxtaposition, to ascertain their comparative value. This has been done with Peas, and a Report of the result appears in the fifth part of the Society's Transactions. An abridgement has been given in the Gardener's Magazine, which we shall further curtail. Mr. George Gordon the writer of the Report has given the estimate of the most superior sorts, for cultivation, under four heads, viz:

For early sowing. Early Dwarf, or Pois nain hâtif. Height about $1\frac{1}{2}$ ft., and somewhat resembling Bishop's Dwarf, but is more prolific; broad, mostly containing 5 peas. It is the best of the dwarfs, as it is very prolific, and of good quality. Early Frame; also known as Best early, early single-blossomed, early double blossomed frame, early one-eyed, double dwarf frame, single frame, early dwarf frame, superfine early, Batt's early dwarf nimble, early Wilson, Young's very early, early Nicholas, Perkins's early frame, early Nana, Mason's double-blossomed, Russell's fine early, early French, dwarf Albany. About 4 ft. high, and rather slender. Pods small and round, mostly containing 5 or 6 peas. Very prolific, of excellent quality, and the earliest pea in the whole collection. The number of blossoms on this pea entirely depends on the soil and situation it is grown in. It must not be confounded with the following sort. Early Charlton; also, known as Golden Charlton, early sugar frame, late dwarf, Twesly dwarf, Hotspur, Wrench's Hotspur, double dwarf Hotspur, early Hotspur, golden Hotspur, common Hotspur, early Nicholas Hotspur, Nimble Taylor, very fine late garden, Paddington, Essex Reading, Russell's early blossomed. About 5 ft. high, and of strong growth. Pods large, broad, and rather flattened, mostly containing 6 or 7 peas. A very prolific bearer, of excellent quality, and the best pea for standing the winter in the collection. It is about a week or ten days later than the early frame, but will continue much longer in bearing, and, like the preceding, varies in appearance according to soil, situation, &c. D'Auvergne. About 5 ft. high, and rather slender. Pods very long, nearly round, much curved and tapering a good deal to the extremities, mostly containing 11 or 12 peas if well grown. A very abundant bearer, of excellent quality, and later than the early Charlton in coming into use. It is the best pea for produce, and deserves to be generally cultivated in all gardens, which it doubtless will be, when its qualities become better known.

FOR LATE SOWING. KNIGHT'S DWARF MARROW. English Synonymes: Dwarf Knight's, Knight's new dwarf. About 3½ ft. or 4 ft. high, very much resembling the dwarf white marrow, but of stronger growth. Pods broad, and rather flat, containing 5 or 6 peas. Of excellent quality, and very prolific. The seed wrinkled when ripe. KNIGHT'S TALL MARROW. Ridé hâtif, ridé tardif, ridé. English Synonymes: Knight's late. About 6½ ft. high, and of very strong growth. Pods large and broad, containing 8 or 9 peas. Of excellent quality and later than the preceding by a week. Peas, when ripe, shrivel very much, and are remarkably sweet. This pea is the best of all the tall ones for late sowing in summer. TALL GREEN MARROW. English Synonymes: Green tall, new large green, imperial green. About 7 ft. high, and of very strong growth. Pods large, broad, and rather flat, containing 8 or 9 peas. Of excellent quality, late, and very prolific. Peas, when ripe, of a yellowish green colour. CROWN PEA. English Synonymes: American crown, rose or crown. About 5½ ft. high, of very strong growth, with the blossoms in tufts at the extremity, somewhat like a crown, from which it derives its name. Pods, small, round, and straight, containing 5 or 6 peas. A very abundant bearer, of good quality, and very good for summer use.

SUGAR PEAS, (not to be sown before the first of March) EARLY MAY SUGAR. English Synonymes: Early Dutch, early sugar, dwarf Dutch sugar. About 4 ft. high and very slender. Pods, small, round, and straight, containing 6 or 7 peas. Of good quality, but only a moderate bearer. This is the earliest pea in the collection, but is very tender, and will not do to sow before the beginning of March. LARGE CROOKED SUGAR. English Synonymes: New pea, sugar pea, broad sword, early Spanish. About 6 feet high and very strong. Pods very large, broad, and much twisted, containing 9 peas. Peas large and prominent in the pods. Of excellent quality, very productive and the best in its class. VILMORIN'S SUGAR. About 6½ feet high, and of slender growth. Pods, small, round, and straight, containing 7 or 8 peas, which as in all the other sugar peas, are very prominent, even when quite young. Of excellent quality, and the greatest bearer in this class. It was received from M. Vilmorin as an "espèce de pois très-excellent." TAMARIND PEA. English Synonyme: Late dwarf sugar. About 4 ft. high, and of robust growth. Pods large, broad, and much curved, containing 9 or 10 Peas. Of excellent quality and a very abundant bearer. The pods are from 4 in. to 5 in. long, and are produced the latest in this class.

DWARF BLUE PEAS FOR SUMMER USE. DWARF IMPERIAL. English Synonymes: Blue imperial, dwarf green imperial, new improved imperial, new improved dwarf imperial, new dwarf imperial, new long-podded imperial, Sumatra, green nonpareil, dwarf blue prolific, blue scymitar, sabre, blue sabre, new sabre, dwarf sabre. About 4 ft. high, and of strong growth. Pods large, long, and rather flat, much pointed and containing 8 or 9 peas. Of excellent quality, a good bearer, and one of the best peas for summer, as it is very late in coming into use. BLUE PRUSSIAN. Nain vert petit, nain royal, gros vert de Prusse. English Synonymes: Dwarf blue Prussian, royal Prussian blue, fine long-podded dwarf, Prussian prolific, early Dutch green, green Prussian. About 3½ ft. high, and of strong growth. Pods long and rather round, containing 8 peas. This is so well known, that it is quite useless for me to say anything about its good qualities. It is undoubtedly the best for summer use, and one of the greatest bearers. WHITE PRUSSIAN. English Synonymes: Prolific or poor man's profit, prolific, tall Prussian, dwarf white Prussian, new dwarf Norman, royal dwarf, royal prolific, dwarf Tewsley, Stowe pea. About 4 ft. high, and very robust. Pods broad, long, and rather flat, containing 7 or 8 peas, which are large and white. Of good quality, and, like the blue Prussian, an excellent summer pea, and very prolific. This is the best sort for general cultivation, and well deserves the name of poor man's profit; but it will not remain so long in bearing as the blue Prussian. GROOM'S SUPERB DWARF BLUE. About 18 in. high, and of robust growth. Pods large, broad, and rather flat, containing 8 or 9 peas. Of excellent quality, a very abundant bearer, and a few days later than the blue Prussian, of which it seems a distinct dwarf variety. Raised by Mr. H. Groom, of Walworth, who sent seeds of it to the garden in 1831. This deserves general cultivation, as it requires no sticking, and produces more on the same space of ground than any other dwarf sort.

125 CROPPING A GARDEN. As we have just copied directions, which we hope will be useful in enabling the cultivator of the kitchen garden to select from amongst the numerous sorts of peas those which will prove most useful for the purposes required; we shall now extract from the same source a few general directions to be observed in cropping a garden. "The object to be obtained by a system of cropping is that of procuring the greatest quantity, and the best quality, of the desired kind of produce, at the least possible expense of labour, time, and manure; and, in order that this object may be effectually obtained, there are certain principles which ought to be adopted as guides. The chief of these is to be derived from a knowledge of what specific benefit or injury every culinary plant does to the soil, with reference to any other culinary plant. It ought to be known whether particular plants injure the soil by exhausting it of particular principles; or whether, as has been lately conjectured by De Candolle, and as some think proved, the soil is rendered unfit for the growth of the same or any allied species, by excretions from the roots of plants; while the same excretions, acting in the way of manure, add to the fitness of the soil for the production of other species. The prevailing opinion, as every one knows, has long been, that plants exhaust the soil, generally, of vegetable food; particularly of that kind of food which is peculiar to the species growing on it for the time being. For example, both potatoes and onions exhaust the soil generally; while the potato deprives it of something which is necessary to insure the reproduction of good crops of potatoes; and the onion of something which is necessary for the reproduction of large crops of onions. According to the theory of De Candolle both crops exhaust the soil generally, and both render it unfit for the repetition of the particular kind of crop: but this injury, according to his hypothesis, is not effected by depriving the soil of the particular kind of nutriment requisite for the particular kind of species; but by excreting into it substances peculiar to the species with which it has been cropped, which substances render it unfit for having these crops repeated. Both these theories, or rather perhaps hypotheses, are attended with some difficulty in the case of plants which remain a great many years on the same soil; as, for example, perennial-rooted herbaceous plants and trees. The difficulty, however, is got over in

 125, Gard. Mag. Vol. 12, 476.

both systems: by the first, or old, theory, the annual dropping and decay of the foliage is said to supply at once gencral nourishment and particular nourishment; and by the second, or new, theory, the same dropping of the leaves by the general nourishment which it supplies, is said to neutralize the particular excretions. It must be confessed, that it is not very obvious how general nourishment, dropped on the surface of the soil, can neutralize the excrementitious matter, deposited many feet beneath the surface; as in the case of long-rooted herbaceous plants, like the saintfoin, lucern, &c.; and deep-rooting trees, such as the oak, &c. Nevertheless, we find that these plants will remain a longer period on the same soil than others, the roots of which never go to any great depth beneath the surface; such as the fibrous rooted grasses, the strawberry, &c., and the pine and fir tribe. We mention these things to show, that though it is not yet determined which is the true theory, yet that the fact of plants injuring, or diminishing the fertility of the soil, both generally and particularly, does not admit of a doubt. In the absence of principles founded on whichever of these hypotheses may be true, recourse is obliged to be had to rules drawn from the experience and observation of those who believe in the old theory. These rules, as adopted by the best gardeners, are as follows:—Crops of plants belonging to the same natural order or tribe, or to the natural order and tribe most nearly allied to them, should not follow each other. Thus, turnips should not follow any of the cabbage tribe, sea-kale, or horseradish; nor peas, beans. Plants which draw their nourishment chiefly from the surface of the soil should not follow each other, but should alternate with those which draw their nourishment in great part from the subsoil. Hence carrots and beets should not follow each other; nor onions and potatoes. Plants which draw a great deal of nourishment from the soil should succeed, or be succeeded by, plants which draw less nourishment. Hence, a crop grown for its fruit, such as the pea; or for its roots or bulbs, such as the potato or the onion; should be followed by such as are grown solely for their leaves, such as the common borecole, the cellery, the lettuce, &c. Plants which remain for several years on the soil, such as strawberries, asparagus, &c., should not be succeeded by other plants which remain a long time on the soil, but by crops of short duration;

and the soil should be continued under such crops for as long a period as it remained under a permanent crop. Hence, in judiciously cropped gardens, the strawberry compartment is changed every three or four years, till it has gone the circuit of all the compartments; and asparagus beds, sea-kale, &c., are renewed on the same principles. Plants, the produce of which is collected during summer, should be succeeded by those of which the produce is chiefly gathered in winter or spring. The object of this rule is, to prevent too active and exhausting crops from following each other in succession. Other rules or principles may be drawn from the nature of the plants themselves; such as some requiring an extraordinary proportion of air, light, shade, moisture, &c.: or from the nature of the changes intended to be made on them by cultivation, such as blanching, succulency, magnitude, &c. In a good soil it is highly advantageous to pursue the mixed or simultaneous mode of cropping, which is founded on the principles, that most plants, when germinating, and for some time afterwards, thrive best in the shade; and that tall-growing plants, which require to receive the light on each side, should be sown or planted, at some distance from each other. Hence, tall-growing peas are sown in rows, 10 ft. or 12 ft. apart; and between them are planted rows of the cabbage tribe; and, again, between these are sown rows of spinach, lettuce, or radishes, &c. Hence, also, beans are planted in the same rows with potatoes or with cabbages (an old practice in the cottage-gardens of Scotland); and so on. The great object in this kind of cropping, is, to have crops on the ground, in different stages of growth; so that, the moment the soil and the surface are released from one crop, another may be in an advanced state, and ready, as it were, to supply its place. For this purpose, whenever one crop is removed, its place ought to be instantly supplied by plants adapted for producing another crop of the proper nature to succeed it. For example, where rows of tall marrow-fat peas have rows of broccoli between them, then, the moment the peas are removed, a trench for celery may be formed where each row of peas stood; and between the rows of brocoli, in the places where lettuces were produced early in the season, may be sown drills of winter spinach.

126 Hydrangea, blue-flowering. A value has been attached to the blue flowering variety of the Hydrangea hortensis, from

its being less commonly seen in collections than the rose coloured. Its value has been further enhanced by the mystification of culture and supposed difficulty in obtaining flowers of that colour, This may, probably, be done by various processes. The colour is not, however, likely to continue beyond one season, when the means used to obtain it have been by any ingredients, given in a liquid state; unless the application be repeated every year. A fine blue colour may be obtained by growing the plants entirely in good heath mould. This may be done by potting young-rooted cuttings in that soil, or by removing all the soil from old plants, and repotting them with heath mould. The blue colour is generally obtained in the first season, to a certainty in the second, and will continue as long as that soil is used. It would be an interesting subject for investigation to ascertain how the colour is changed by the use of heath mould, as it does not appear to have the same effect upon other plants. As the Hydrangea is hardy the change may be produced by planting them out amongst the American plants. Various ingredients have been added to common soil to effect the same purpose; these we intend to notice in a future number.

127 Artichokes, to improve. Running small pieces of lath, or splinters of any wood through the flower stems, within 4 in. of the flower or head, at right angles to the stem, and keeping the wound open, retards the opening of the flower, and makes the head nearly double the ordinary size." This is a German practice, and seems to operate, like ringing trees, by impeding the return of the sap, and so stagnating it in the head.

128 Roses, culture of. In a well-arranged catalogue of Roses by T. Rivers, jun. of Sawbridgeworth, are some useful observations on this universally admired genus. As a few of the ideas are original, we shall give them further publicity. He says, "I still think, that, in unfavourable soils, Roses require being removed, aud their roots trimmed every third or fourth year. In cold clayey soils, the best compost for them is rotten manure and pit sand; in warm dry soils, cool loam in lieu of sand; annual pruning which is quite essential, should always be done in October, or in March; but October pruning will be found greatly advantageous as the Rose will then prepare itself during the remainder of the autumn, for vigorous growth in spring. The families of roses are now so well defined, that each ought to

127, Gard. Mag. Vol. 11, 41.

have its department. A clump of Hybrids for their gorgeous colours in June and July; of Perpetuals, for their fragrance in the cold autumnal months; of Noisettes, for their elegance and abundance of flowers; of Scotch Roses, for their precocity and humble growth; in short all require separate culture to have them in perfection; but this of course will only apply to flower gardens rather extensive. Climbing Roses for pillars should be planted in a very rich soil, as they will then put forth strong central branches, of eight or ten feet in length. These, when fastened to the stakes, will furnish a plentiful supply of lateral blooming shoots for many seasons. Climbing Roses, to cover a sloping bank, as their flexible branches can be pegged to the ground in any direction, is perhaps a new idea. Thus trained they will form a beautiful carpet of foliage and flowers, the dark crimson and white varieties blending with peculiar elegance. I also hope to give more zest to Rose culture, in suggesting that all the Perpetual, Isle de Bourbon, and Noisette Roses, from their vigorous habits and tendency to flower, may be made fine objects for ornamenting the Hall, &c., during the autumnal months. For this purpose they should be put into large pots and well furnished with surface manure and plenty of water in summer; their blossoms ought also to be cut off just before expansion. The crimson perpetual Rose has also been forced in France with fine effect. The pots should be plunged in the natural soil to the rims, a deep frame placed over them, and the heat kept up with linings of hot manure, giving air as required. This fine autumnal Rose when thus forced and blooming in March or April is most beautiful: its too short flower stalks are lengthened by this mode of culture, adding to the elegance of the plant. Its flowers are erect, unlike many other forced Roses, and lose none of their colour or fragrance. For all these purposes Roses should be "worked" on the Dog Rose stock, as its vigorous and easily excitable habit are quite necessary, in fact with the exception of the Climbing Roses (to be grown as climbers,) and a few others, this stock is the only medium by which many choice Roses can be brought to perfection. My system of cultivating the Tea Scented Rose, by budding on it and sheltering in winter, has succeeded admirably.

129 Tea scented roses. Of these Mr. Rivers observes, they are China Roses, having a strong odour of tea, they are seminal

varieties of the blush tea scented Rose, (Rosa Indica odorata) and of Rosa ochroleuca, or the yellow China Rose. They are more delicate than the common China Roses, as to cold in Winter, and also in their flowers, as they seem to require the warm dewy nights of August and September to bring them to perfection. In hot weather, in June and July they are very fleeting, as their flowers are large and of a delicate texture, soon fading in sunny weather. They require careful cultivation, and must have a raised border against a south, south-east, or west wall. This border should be a compost of rotten manure, or leaves, light loam and sand, equal parts, and raised about eighteen inches above the surface. When grown as low Standards, they are surpassingly beautiful; but they should be taken up in November, and their roots laid in mould, in a shed, as our sharp winters would injure them, so as to prevent their blooming in perfection if left exposed.

130 Moss Roses. Mr. Rivers publishes a List of twenty-four varieties of Moss Roses, and says, one step further towards a dark crimson Moss is made in the "Rouge de Luxembourg," which is very beautiful, and a most luxuriant grower. Most of the varieties prefer a cool soil, though Mossy de Meaux is perhaps an exception, as it seems to flourish better in light dry soils. The White Moss unless budded on the dog Rose, (Rosa canina) will not in general grow well; its sickly appearance in some situations may be often traced to its being worked on some improper stock. If on its own roots in rich soils, it will often change to pale blush. All are well adapted for Standards; but to have them in perfection in warm dry situations, in March, put round each stem, on the surface of the soil, the fourth of a barrowful of manure; on this, place flints or moss, to take of its unsightly appearance, and make a little ornamental mound. This treatment will keep the soil cool, and make them bloom in a most superior manner, even in situations previously thought to be most ungenial to their culture. The manure should be spread on the surface in November, and lightly forked in. We should add that the List of Roses published by Messrs. Rivers and Son, of Sawbridgeworth, Herts, is by far the most complete and best digested which has come under our notice. The Roses are classed in a popular method, and the colour, form, and character of the flower of each is mentioned.

131 Poisons; their Action on Vegetables. Dr. Harlan, in his Medical and Physical Researches, 1835, has stated the effects of numerous experiments which he made to ascertain the effects of poisons on living vegetables. As the subject is one of importance, we copy the following interesting facts. "The application of certain poisons to plants and flowers, in order to destroy noxious insects and larvæ is not unfrequently recommended; and doubts have been expressed as to the injury that might occur to the plants themselves by such treatment. It has even been positively asserted, that the destruction of the plant is the necessary consequence of the application of certain vegetable poisons in some instances. I have been led to the present investigation by perusing a notice of experiments of a similar nature, by M. Marcaire Princep, a professor of botany at Geneva, in the Bulletin des Sciences Naturelles for March, 1830, of which the following is an extract: "The experiments detailed in this memoir, have for their object to prove that the juices or extracts of plants, poisonous to animals, are equally so to the vegetables from which they are obtained. Thus M. Marcaire Princep has succeeded in killing branches, and even entire individual plants of the datura stramonium, hyoscyamus niger, and momordica elaterium, by plunging them into distilled water, charged with the juices and extracts of these plants, or even by watering them with this narcotic water. M. Goeppert of Breslau, has published in the annals of Poggendorff, an account of experiments from which he derived very different results." But neither of these authors extended his experiments to the introduction of poisons into the substance of the plants. I first confined myself to a repetition of the experiments of M. Princep, but obtained results entirely at variance with his. I now determined to pursue the subject on a more extensive scale. In the garden of the Philadelphia Alms-house Infirmary, I selected a number of young and thriving plants, and assisted by the gardener and several of the resident physicians, I applied the following named poisons, as hereafter specified, taking care to wound the bark of the perennial, and the interior parts of the annual plants, so that the poison should be directly applied to the wounded sap-vessels. The poisons used were, the extracts of stramonium, belladonna, and cicuta; the essential oil of nicotiana tabacum, diluted hydrocyanic acid, and oxydum arsenici.

"Experiment 1. September 18th. A strong thick solution of the extract of belladonna and cicuta, (German manufactory) was introduced into the bark and pith of different stems of the stramonium. 2. Extract of belladonna introduced into the stem of the palma Christi. 3. Powdered white oxyd of arsenic was freely spread about the root of a young palma Christi, and the plant was watered. 4. Arsenic introduced into the stalks of two young tobacco plants, near the roots. 5. Two young stramonium plants were selected: arsenic was introduced into the stalks and stems of one, and spread about the root of the other, and the plant watered. 6. Dilute hydrocyanic acid introduced into an incision made in the stalk of a stramonium. 7. Dilute hodrocyanic acid poured on the root of lady-slipper. 8. Strong oil of tobacco introduced into the stalk of palma Christi. 9. The same into the stalk of stramonium. 10. The same into the stalk of a young tobacco plant. 11. The same into a branch of the fig-tree. 12. The same placed freely round the root of a young pear-tree, the earth being loosened and watered. 13. The same placed round the root of palma Christi. 14. The same introduced into the stalk of euphorbia sericea. 15. Arsenic freely spread round the root of the mimosa sensitiva—exposed to the rain and dews."

"Some of these experiments were frequently repeated with great care. The same result universally followed in every instance. Not one plant, shrub, or flower, displayed signs of the least injury from the various applications of the different poisons; some, indeed, appeared to thrive better for the attentions which were rendered them. Some of the experiments were subsequently repeated at my request, by Mr. John Carr, at Bartram's Botanic Garden, with extracts of belladonna, and cicuta, and oil of tobacco. These additional experiments performed by a skilful practical botanist, confirmed the observations previously made: hence, we are permitted to conclude, first, that the experiments detailed by Professor Princep are erroneous. Second, that substances which act as lethal poisons to animal life, are not so to vegetables. We cannot but admire the wisdom, order, and harmony of creation! fixed to the earth by immutable laws, plants and flowers would have soon ceased to exist, had their susceptibilities, like those of animals, rendered them liable to the agency of poisons, to contact with which they are exposed.

Dr. Featherstonhaugh adds the following testimonial: "We had the satisfaction of assisting, during the present month, together with Professor Del Rio, at a repetition of curious experiments on vegetable substances, with vegetable and mineral poisons, conducted by Dr. Harlan, assisted by Dr. Moore, in the garden of the Philadelphia Alms-house Infirmary. Each of the poisons were separately introduced into the circulation of individual plants, by incisions made in the stems, under the leaves, and by similar, separate applications of them to their roots; by infusions, and by powder also, in the case of arsenic. In some instances the poisons were placed round the roots only, viz. corrosive sublimate, arsenic, sp. turpentine, and oil of tobacco. In none of these instances was any of the plants poisoned. One of the young geraniums faded after constant impregnation, for three days, of the earth about its roots, but this is evidently attributable to its soil being rendered unfit for the support of vegetable life. We must therefore adhere to the reasonable opinion, that plants have the property of segregating from the soil or atmosphere those principles which are proper for their healthy state, and of rejecting those which are injurious to their organization. If plants yield to the deleterious influence of those principles which are injurious to other organized bodies, it is because—as in the case of the young geranium—they cannot appropriate those salutary principles, upon which their existence depends, and which enables them to excercise their natural functions, one of which is, to reject that which is injurious to them. We speak now of the circulation of plants, and not of the mechanical application of poison to their parts. Oil of turpentine applied several days to the bark of many trees, and especially the linden tree, will soften and eventually destroy the part; but the experiments tried with the balsamina, or lady-slipper, the palma Christi, the cabbage, and tobacco plant, whose roots were liberally supplied with spirits of turpentine, prove that it did not affect them through their circulation."

We do not entertain a single doubt of the correctness of Dr. Harlan's statement of experiments, here set forth; but, judging from these alone, we cannot admit the justice of the Doctor's conclusion—namely "That the experiments detailed by Professor Princep are erroneous." As far as Dr. Harlan has detailed HIS experiments they cannot be taken as a total disproof of those of Professor Princep. The one applied his poison to the surface of the leaves, which may be said to be the lungs of a plant; the other to its roots and wood. We hope that some of our friends will extend these interesting enquiries, and favour us with the result, that we may publish it for the gratification of our readers.

132 Brugmansia suaveolens. It is not generally known that Brugmansia suaveolens, a plant very generally called Datura arborea, is nearly hardy, and that it flourishes, and becomes so magnificent a plant, in the borders, during summer. To give assistance and encouragement to the culture of this plant, we will copy a communication of Mr. Spence to the Gardener's Magazine, Vol. 12, 589. "About the first of June, I turned the Brugmansia out of the pot, and planted it in the open border, with its ball entire; giving plenty of water at the time, and occasionally repeating it at the root, and likewise over the top. This, I think, it is best to do in the morning, as the plant is not then so liable to flag throughout the day. About a month after this, the roots having extended a considerable distance from the stem, I allowed the plant to flag a little, by withholding water; and then with a spade I cut all round close to the old ball; but first had a quantity of rotten dung ready to be worked down with the spade to the bottom of the roots. After working in the dung, I gave the ground a good watering, in order to moisten the ground down to where the moisture was most wanted, instead of letting it remain to be dried up on the surface. In a week after this, the plant had made thousands of young roots, which found plenty of food close at home. This treatment I repeated twice in the season, the last time cutting the roots one inch farther from the ball, than the first time. This does not injure the plant; on the contrary, it is surprising to see how it will grow immediately after the operation: and another advantage of cutting off the roots is, that the plant is easily repotted in the autumn; provided the diameter of the space included within the last cutting be a little less than the pot for which it is intended. By the above treatment, this plant (without including the flowers that were on it in May) has, from the middle of August to the end of September, expanded 1050 flowers, each of which measures 50 square inches; so that it has produced in six weeks, 52,500 square inches of flowers. The height of this

plant is six feet, its diameter ten and a half feet, and its age four years. We have two more, nearly as good; and two others one year old, which have opened 100 flowers each. In the morning and evening, the fragrance of these flowers scented the air to the distance of 60 yards. An engraving of the Brugmansia sanguinea, will shortly appear in the Botanist.

The principle here acted upon by Mr. Spence, that of shortening the roots to induce the production of laterals, or additional feeders, and then increasing their supply of nutritive matter, is one that deserves the attention of all Horticulturists. This principle may be applied by numerous methods, which will readily present themselves to the minds of practical men. Judging of the principle, theoretically, (for we have not practical knowledge on the subject) we may as reasonably anticipate advantages to accrue, in many instances, from pruning the roots of a plant, as from shortening its branches.

133 Filberts; Planting. So little attention is usually paid to the management of Filbert Bushes, that we think an article on the subject in the Auctarium may be useful to very many of our readers. More plain and practical directions we have not met with, than are given by Mr. Rogers in his Fruit Cultivator, a little work of real merit,—a practical guide; to which we are indebted for the following instructions. The cultivation of the Filbert in England is but little regarded, excepting in the county of Kent, where hundreds of acres testify that it forms a prominent branch of rural economy. The most favourable land for a plantation seems to be a light loam on a dry gravelly subsoil; with proper attention, however, the Filbert will succeed on almost any soil or situation. It should be observed that too rich a soil is not favourable to its productivencss; hence it is not requisite that manure be supplied to the ground in which it is planted. Winter, or very early in spring, is the season for making plantations. "The young plants which are chosen by the Maidstone growers are such as have been raised from layers, and which have been lined or bedded out in the nursery for two or three years. The plantations in Kent are either in single rows, or in entire quarters or fields. The plants are put in at eight or ten feet distances, more or less, according to the quality of the soil. Six hundred and eighty plants are required for an acre, at eight feet distances every way; at ten feet distances,

four hundred and thirty-five; and at twelve feet distances, three hundred and two trees will be required."

134 FILBERTS; EARLY PRUNING. "It may be matter of wonder, but so it happens, that the generality of gardeners know little or nothing about pruning Filbert Trees. The art has never been studied either by masters or men; and it is remarkable, that this branch of the pruner's art should have been brought to perfection by the untaught, unlettered Kentish peasant—without books—without master, save experience—without mistress, save Nature herself! It is curious too, that this art has been engrossed by the labourers in the central parts of the county, and without its being followed in other parts of the kingdom. The principle of the Kentish pruners appears to be this: to check and control the natural growth, and thereby bring forth the fruit-bearing principle in greater force and energy. After training the tree to a dwarfed habit, they allow it to expend its strength in no other way than in the production of flowers and fruit. The Filbert is naturally only a shrub, or small tree, and the cultivator makes it still less, for his convenience in pruning and gathering the fruit. That style of pruning which is found the best for the currant, is also the best for the Filbert. Each plant should have one strong upright shoot, of not less than three feet in height, this being necessary in order to the future form of the head; and this, early in the spring, after the trees have been put out in their final stations, is cut down to about eighteen inches from the ground. This height will admit of a clear stem of twelve inches below, and which part must be at first and ever afterwards kept free from shoots, as well as suckers from the root. This deprivation of shoots and suckers will cause the buds left at the top to push with greater vigour. If eight strong shoots be produced in the first summer, they must be carefully preserved, as that number is required to form the head; but if less than this number come forth, then two or three of the strongest (or the whole if necessary) must be shortened back to half their length at the next pruning, in order to obtain the requisite number. The sufficient number of branches being obtained, if not in the first, certainly after the second pruning, they are to be carefully preserved and trained outwards and upwards; at first nearly horizontal, but curving gradually upward at the point. The easiest mode of doing this is by using

a hoop of the proper size placed within the shoots, and to which the latter are tied in star-like order, and at equal twelve-inch distances. Such a laterally curving position may be much assisted and caused by a careful pruner, always cutting at an outside bud, which, when grown sufficiently far outwards, naturally turn up to form the permanent branches. The points of the branches are allowed to rise to the height of six feet, but never higher; and the middle of the tree is always kept free from shoots and branches, so that a well-trained head resembles a large bowl."

135 Filberts; Productive pruning. "The subsequent management of the trees, both while gaining the desired form, and after having gained it, consists in preserving all the short spurs which will be produced on the branches, and cutting away or shortening the laterals which every year rise from the same. The management of these laterals is of great consequence. If they exceed the length of six inches, they may be cut back to a few buds; but if less, they should be preserved, as their points are generally fruitful. The grand object with the pruner is to have the branches thickly beset with fruitful spurs, and which are only reduced in length, when, after a few years' growth, they become too distant from the branch, when they are cut back to a healthy spur behind. If any part of the branch becomes accidentally naked, a strong shoot from the bottom may be led up, and managed so as to fill up the vacancy. When Filbert Trees are thus managed, and have arrived at their full volume in width and height, they may be kept in the same state for many years—say twenty or thirty—by the knife only, and with the requisite skill in using it. The practical example set us by the Maidstone pruners confirms two very essential principles in the art of gardening, viz. that by counteracting the natural tendencies of a plant, it may be dwarfed, and by thus dwarfing, making it more fruitful. The Filbert Tree is so constituted, that it is ever extending itself by throwing up a multiplicity of suckers, which exhaust the bearing branches and render them sterile; but denying the plant its tendency to increase itself by suckers, promotes its energy to increase itself by seeds."

136 Plants, Slips, and Flowers to revive. Most persons have heard of Camphor water as a stimulant to faded plants

and flowers, but as we have not registered the method of using it, we will now do so. The directions of M. de Droste are to "dissolve camphor to saturation in alcohol, adding the former until it remains solid at the bottom of the latter; a sufficient quantity of rain or river water is then to have the alcoholic solution added to it, in the proportion of four drops to one ounce of water. As the camphor comes in contact with the water, it will form a thin solid film, which is to be well beaten up with the water: for a short time the camphor will float in the water in small flocculi, but will ultimately combine with the fluid and disappear. Plants which have been removed from the earth, and have suffered by a journey or otherwise, should be plunged into this camphorated water, so that they may be entirely covered: in about two, or at most three hours, the contracted leaves will expand again; the young faded and dependent shoots will erect themselves, and the dried bark will become smooth and full. That being effected, the plant is to be placed in good earth, copiously watered with rain or river water, and protected from the too powerful action of the sun, until the roots have taken good hold of the ground. When large plants, as trees, are to be revived, their roots are to be plunged into the camphorated water for three hours; the trunk and even the head of the tree being frequently wetted with the same water, so as to retain them in a properly moistened state. But it is always best, if possible, to immerse the whole of the plant. Shoots, sprigs, slips, and roots, are to be treated in a similar manner. If plants thus treated are not restored in four hours, their death may be considered as certain, for they cannot be recalled to life by any artificial means. They should, consequently, never be left more than four hours in the camphorated bath; because the exciting action of the camphor, when it is continued for a longer period, may injure the plants, instead of doing good to them. It is not necessary to say that the final prosperity of the plants, thus re-animated by the camphorated water, must depend upon the particular properties of the former, the state of their roots, and the pains that are taken with them. The camphor produces no other effect than to restore life to plants nearly dead: after that, all proceeds according to the ordinary laws, and their ultimate state must be left to art and nature." It should not be forgotten that a hand-glass placed over faded seedlings, or other young plants which have been removed, will assist greatly in recovering them and making them strike root afresh. We may add, that flowers in nosegays will continue much longer in beauty, if the water in which they are kept be changed daily; and at each change a small piece of the lower end of the stem, which has rested in the water, be cut off.

137 Electricity, its influence on Vegetation. Mr. Pine, of Maidstone, in a letter on this interesting subject, inserted in No. 692 of the Mechanics' Magazine, says, "We have endeavoured to trace a relation between the structure and functions of plants, and the properties of the surrounding elements, favouring the conclusion that electricity is the grand agent by which the several processes of vegetation are carried forward. Air, water, and solar light, have respectively been viewed as conveying electric influence to the vegetable kingdom. The predominant influence of each of these elements appears to take place in the order just mentioned; and the dry winds of March, the copious rains of April, and bright sunshine of May, appear to exhibit this succession in a general view, while the mingled and varying states of the weather show the almost continual necessity of their mingled operation in different degrees. It may here be observed by the way, that whereas the vital principle in animals is maintained by means of a portion of the atmosphere which is uniformly supplied at all seasons, and is administered to all the more perfect kinds in the exact proportion which is requisite to preserve the uniformity of their heat and vitality; that of vegetables depending on the vicissitudes of the seasons, and even on the variations of the weather, is subject to the like vicissitudes and variations. To me it appears, that in reality they both depend upon the same subtile fluid as emanating from the sun; but whereas, plants derive it in an uncombined state from the floating winds, the condensing vapours, and the direct rays of the sun; animals imbibe it by means of the peculiar organisation of the lungs in those more copious and uniform supplies which their more elevated nature requires, by a chemical decomposition of oxygen in those organs. But this important branch of inquiry cannot be pursued in this place. I now wish to offer a few remarks on the progress of vegetation under the influence of the several elements. 1st. The electric influence of the air in producing the first ex-

150 Auctarium. 136, Qrly. Jl. of Science, n. s. 1, 499.

citement and spring of vegetation, appears to depend much on the partial absence of its influences under the forms of condensing vapour, and of solar light; as these, by employing the electric fluid in the processes of growth and maturation, would direct large quantities of it from that which is all-essential in the first instance. Hence, our March commences with a total destitution of leaves in all the more foliagenous species of trees, while the annuals among herbs have disappeared. The only vegetative remains of these respective kinds are contained in the buds protruding from the trees, and the seeds which lie concealed in the soil. Thus a large proportion of those rays, which, as the season advances, are employed in the two subsequent processes of vegetation, are reserved to impart electricity to the air, as the instrument of producing the first excitement in the yet closed germs. As a farther preparation,—during the winter, now at its termination, the vapours exhaled into the atmosphere in the preceding summer are gradually condensed, and conveyed into the earth in the forms of rain, snow, and hail, by which means that extraordinary dryness, which distinguishes the early spring, and is remarked by agriculturists for its salutary effects, is in part produced; and in part, probably, by the rarifying influence of the increasing rays, causing the lower strata of our climate to ascend and give place to the denser and yet drier air rushing in from regions into which fewer vapours had been exhaled, and from which they had been more completely removed by a more condensing temperature. These winds are, moreover, of use in removing all particles of moisture, together with other impurities from the exterior of plants, and from the surface of the soil; so that nothing may be left to be acted upon by the electric influence, but the buds, seeds, and emerging shoots. When the winds have sufficiently performed their office of dessiccation, that of vegetative excitement and germination seems speedily to commence. The glancing rays of the early season of the year are evidently more favourable to their accumulation in the atmosphere than the more direct rays of the advancing season; and from this cause in conjunction with those above stated, a much larger proportion of them will be lodged in the air, or resting upon it, reaching to some distance upward, than at a later season. The electric matter accumulating in the higher strata, will propel it downward, and probably at once force a portion of it into the earth, and cause a partial state of negation of it upon its surface; which being followed by a powerful rush upward, as the temperature and rarefaction of the contiguous air increases, must give a great impulse to the seeds and shoots, and act as the immediate cause of germination. As the first incitement to the seeds contained in the soil may thus be produced, so that of the buds of trees must be greatly promoted by the electricity of the rushing winds. That the electricity is much more intense during the cold dry winds of March, in a clear atmosphere, than at any other season, I have been assured by Mr. Sturgeon to be the result of his numerous experiments, in conformity with the few observations which I have made. It may be worth while, however, to observe, that the conclusion had presented itself from the above considerations previously to his favouring me with this information; so that theory and experiment have in this respect coincided, without the one being biassed by the other. That a negative state of the seed and the soil in which it is deposited, in respect to the atmosphere, is peculiarly favourable to germination, while it is much promoted by electricity in general, appears from the following experiment. I sowed some mustard seed on the 20th of April in similar soils, one electrified positively, a second negatively, and a third in its ordinary state. In four days the electrified plants appeared, but those negatively electrified were the most advanced; those not electrified did not appear till two days later. On the 12th of May the plants in a negative state had grown to $2\frac{3}{4}$ inches; those in a positive state to $2\frac{1}{4}$ inches; those not electrified to $1\frac{1}{8}$ inches; the electrified plants were strong and flourishing in proportion. I am here induced to recite the particulars which I received from a medical electrician, of which a general mention has been made. A narcissus plant which was in a very languishing state, being placed in the room in which his powerful electric machine was kept in frequent action, soon began to exhibit signs of extraordinary vigour. It grew to the height of thirty-six inches, and was stout and luxuriant in proportion. Some branches of the moss rose and various other flowers placed in water on the mantle of his room, retained their colours while the seeds were forming, during five weeks, and at last dropped off without assuming a withered appearance. A turk's-cap lily drooped during several hours of the night when the action of the machine was suspended, but resumed its vigour, and again stood erect under its renewed action. These particulars, on the general correctness of which I have every reason to rely, are admirably illustrative of the principle, that a relative state of negation in the source of vegetation from beneath, as compared with the positive state of the atmosphere, though without any absolute addition to the quantity of electric matter, is a most material requisite to its origin and progress. The general high temperature of the room no doubt aided considerably in the process. I lately observed, that whereas sprigs of plants inserted in water, from which the carbonic acid has been expelled by boiling, appear to perish nearly as rapidly as if they had been destitute of moisture: when the water is impregnated with an additional quantity of this gas they retain their vigour. It appears, therefore, highly probable that this gas is essential, or greatly conducive, to the rise of the sap, in consequence of the affinity of its oxygen with the positive electricity of the atmosphere, while its carbon is separated from it and deposited in the leaf, or conveyed into the substance of the plant. The electricity of the air, as distinguished from that of vapours and of solar light, has chiefly occupied the above remarks. My endeavour has been to show that the solar fluid is economised in it, to the exclusion, in a great degree, of the action of vapours and of the direct rays of light upon the shooting and expanding leaf, for the purpose of imparting the first excitement to the germ. The process of nutrition, in connection with an increased supply of electric matter, as the principle of vitality now becomes indispensable, and is accordingly administered in abundance.

138 Flies to exclude from Houses. It seems to have been known to the ancients that the common House Fly (Musca domestica) may be deterred from entering apartments simply by extending a network of white thread before the openings of the room. The Italians sometimes adopt this plan, and for fruit houses, or even for wall trees, it may probably be of essential service. It is further stated in the Transactions of the Entomological Society, I, p. 4, that "if small nails be fixed all round the window frame, at the distance of about an inch from each other, and threads be then stretched across both vertically and horizontally, the apparatus will be equally effectual in ex-

cluding the flies;" but that "the light should enter the room on one side of it only; for if there be a thorough light, either from an opposite or side window, the flies pass through the net without scruple."

139 Olive Tree. Olea Europæa. Few vegetables have been so repeatedly noticed and enthusiastically described by the ancient writers as the olive tree. In all ages it seems to have been adopted as the emblem of benignity and peace. It is frequently mentioned in the Bible: the ancient Greeks were well acquainted with it; and several products of it were employed in medicine by Hippocrates. Pliny is most diffuse in his account of it. Notwithstanding that the olive is now so common in the southern parts of Europe, it is supposed by many to have been derived from Asia. Pliny tells us on the authority of Fenestella, that there were no olive trees in Italy, Spain, and Africa, in the reign of Tarquinius Priscus, in the 173rd year from the foundation of the city of Rome. The Phœnicians are said to have introduced the olive tree into France 680 years before Christ. It is a tree which grows slowly, and may live for centuries; indeed there are some plantations of it in Italy which are supposed to have existed in the time of Pliny. Its ordinary height is from twenty to thirty feet. The wood is hard and is employed in cabinet-work. The leaves stand in pairs on short petioles; they are lanceolate acute, on the upper side of a dark green, on the under, whitish. Countries like Provence and Languedoc, where the olive is extensively cultivated, have a dull and monotonous appearance, from the whitish character of the foliage. Mr. Sharpe in the 48th letter from Italy, says he was wretchedly disappointed to find the hue of this tree resembling our hedges when covered with dust. The flowers are small and white; they form axillary compound racemes. The fruit is an elliptical dark bluish green drupe, which incloses a very hard kernel (pyrena) in which there is usually only one ovule, the others having become abortive. The products of this species necessary to be noticed are the following.

140 Products of the Olive Tree. Resin. The older writers speak of an exudation from olive trees, and which Dioscorides describes as the tears of the Æthiopic olive. In modern times it has been improperly termed olive gum. It was formerly employed in medicine. Olive Leaves. The leaves of the olive tree have

152 Auctarium. 139, to 142, Medical Gazette, vol. 20, p. 375.

been analysed by Pallas, who, among other products, found tannin and gallic acid. They have been employed externally, as astringents and antiseptics; internally, as tonics in intermittents. FRUIT. The preserved olives which are so admired as a dessert, are the green unripe fruit deprived of part of their bitterness by soaking them in water, and then preserved in an aromatised solution of salt. Several varieties are met with in commerce, but the most common is the small French, and the large Spanish olive. Olives à la picholine have been soaked in a solution of lime or alkali. OIL. The olive is certainly remarkable as a fruit, from the circumstance of its sarcocarp abounding in a bland, fixed oil, which is readily obtained by expression. The process for curing it is somewhat modified in different countries, but its principle is in all essentially the same.

141 PREPARATION OF OLIVE OIL. In Spain the olives are pressed by conical iron rollers, elevated above the stage or floor, round which they move on two little margins to prevent the kernel being injured, the oil from which is said to have an unpleasant flavour. Spanish olive oil, however, is inferior to other kinds, from the circumstance of the time which elapses between the gathering and the grinding of the olives. This arises from the number of mills not being in proportion to the quantity of fruit to be groud; so that the olives are placed in heaps to wait their turn, and in consequence often undergo decomposition. An excellent account of the manufacture of French olive oil is given by Duhamel du Monceau, in his "Traité des Arbres Fruitiers." The finest oil is procured by bruising the fruit in the mill immediately they are gathered, and then submitting the paste to pressure. The first product has a greenish tint, and is termed virgin oil. The cake or marc is removed from the press, broken up with the hand, moistened with boiling water, and re-pressed. The products are water, and oil of a second quality: these separate by standing. The cake which is left is termed grignon, and is employed by some as fuel; others, however, ferment it, and by the aid of boiling water obtain a very inferior oil, called gorgon, which is employed either for soap-making or burning in lamps. With the view of increasing the quantity of oil, some persons allow the olives to undergo incipient fermentation, which breaks down the parenchyma of the fruit before they are pressed; but the quality of the oil is thereby injured. Gui-

beurt tells us that it is a yellow, mild, agreeable oil, and is much used for the table. Recently-drawn olive oil deposits by standing, a white fibrous matter, which the ancients employed in medicine under the name of amurca. In commerce we meet with several varieties of olive oil of unequal quality. A very fine kind (Florence oil) is brought from Florence in flasks, which are surrounded by a kind of net-work formed by the leaves of a monocotyledonous plant, and packed in what are called in commerce half chests. Lucca oil is imported in jars, holding nineteen gallons each. We have, besides, Gallipoli, Sicily, and Spanish oil: they are of inferior quality. According to Sieuve, 100 lbs. of olives yield about 32 lbs. of oil; 21 of which come from the pericarp, 4 from the seed, and 7 from the woody matter of the nut. That obtained from the pericarp is of the finest quality. Olive oil is an unctuous fluid, of a yellow or greeuish yellow colour, having little or no odour, and a mild taste. It is lighter than water; readily dissolves in æther, but is very slightly soluble ouly in alcohol. With alkalies it forms soaps. The Castile soap employed in medicine is made with this oil and soda: it is essentially a mixture of oleate and margarate of soda. Olive oil combines with the oxyde of lead to form the well known emplastrum plumbi or eleomargarate of lead. By exposure to air this oil readily becomes rancid.

142 Adulteration of Olive Oil. Olive oil is said to be sometimes adultcrated with poppy oil, though I believe such an occurrence to be rare in this country. Four methods, however, have been proposed for detecting the fraud; and as they have refcrence to some characteristic propertics of olive oil, they deserve notice. The first is the beading: if we shake pure olive oil in a phial half filled with it, the surface of the oil soou becomes smooth by repose; whcreas when poppy oil is present, a number of air bubbles (or beads, as they are termed) remain. The second method is by congelation,—olive oil more readily congealing than poppy oil. The third method is that founded on the conducting power of the oil for electricity, and effected by an instrument called an electrical diagometer. This consists of one of Zamboni's dry piles and a feebly magnetized needle moving freely on a pivot. The electricity developed by the pile is made to produce a deviation iu the direction of the needle; but when any substance is interposed between the ueedle and the

pile, the deviation is less in proportion to the bad conducting power of the interposed substance. Now the conducting power of olive oil is, according to Rosseau, 675 times worse than other vegetable oils; but the addition of two drops of poppy or beech nut oil to $154\frac{44}{100}$ grains of olive oil is sufficient to quadruple the conducting power of the latter. The fourth method is by nitrate of mercury. If recently made nitrate of mercury (prepared by dissolving six parts of mercury in 7·5 parts of nitric acid, sp. gr. 1·36) be mixed with twelve times its weight of pure olive oil, and the mixture strongly agitated, the whole mass becomes solid in the course of a few hours. With poppy or other oils, the nitrate of mercury does not form a solid compound, and therefore when they are mixed with olive oil, we judge of their presence and quantity by the degree and quickness of the solidification of the suspected oil. I have already discussed the theory of the process. In this country the employment of olive oil for the table is limited, when we compare it with the extensive and important uses made of it in some other more southern countries. Thus in Spain it is consumed as a substitute for butter.

143 Insects, destruction of. At the last meeting of the Horticultural Society, a communication was read from Mr. Ingram, of Southampton, on a simple an efficacious method of destroying the red spider, green fly, thrip, and scale, and other insects obnoxious to vegetation, without any injury to the plant. It consisted merely in placing the plants within a frame well closed, and putting between the pots laurel leaves well bruised. After remaining in this state for about an hour it will be found that all the two former insects are destroyed, and the plants must then be removed to a warm place, but a long exposure to the vapour of the leaves for about eight hours is found necessary for the removal of the thrip and scale. For a house, 20 feet long by 12 feet wide, two bushels of leaves are found sufficient, which may be bruised inside; the roof and sides are to be kept close with matting, and the night time is considered best for the purpose of the experiment. The effects are to be attributed to the hydrocyanic acid evolved from the leaves, which agrees with a recommendation made by Mr. Waterhouse, at a late meeting of the Entomological Society, for the destruction of insects in the canvas of pictures or wood of the frames, and in old books, &c., similar to the plan he employs in destroying insects in spe-

143, Athenæum, No. 510.

cimens of natural history. It consists in introducing a few drops of prussic acid into a box closed as tightly as possible, and placing therein the infested article, when the destruction of insects will be very quick, as will be seen from their falling down to the bottom of the box, which has sometimes been quite covered with them, although a small quantity only of the acid has been employed.

144 Truffle, observations on. Although the edible Truffle (Tuber cibarium) is indigenous to several parts of England, it is very little known; and the tables of the opulent are usually supplied with it, somtimes at an exorbitant price, from the continent. It is universally admitted to be far superior to the mushroom, or other of the fungi; notwithstanding this, we believe that no successful attempt to cultivate it in England has been made, a circumstance which should stimulate gardeners to surmount the difficulty, if any really exist. The Germans have preceded us in their attention to this subject, and two of their works have been lately translated by F. Mascall, Esq. From these Mr. Loudon has given a long article in his Gardener's Magazine, to which we are indebted for the following concise extracts. Much is said on the subject of training dogs, and even pigs to discover the truffle in its native habitat, but our more immediate object is to invite attention to its culture in situations where it may be collected without such aid. With connoisseurs the Truffle is said to be in higher estimation than the pine-apple amongst fruit, or the oyster amongst bivalves, therefore it may be presumed that persons who possess favourable situations for their growth will gladly avail themselves of instructions for their culture, either to enhance the pleasures of the table or as a source of profit.

145 Truffle; a description of. It is of a round form, more or less approaching to that of a sphere, or of an egg, or sometimes kidney-shaped, and somewhat rough with protuberances. The colour of the surface is, when it is young, whitish; but in those that are full grown, it is either blackish or a deep black. The colour of the inside is whitish, with dark blue and white, grey, reddish, light brown, or dark brown veins, of the thickness of a horse-hair, which are usually variously entangled, and which form a kind of net-work, or mat. Between the veins are numerous cavities, filled with a great deal of mucilage and small

solid grains. These scarcely visible glands were formerly said to be the seeds or germs of the young Truffles. The less the inside of the truffle is coloured by dark veins, the more tender and delicious is its flesh, The blackish external rind is hard, and very rough, by means of fine fissures, grains, and protuberances; and forms, with its small facets, which are almost hexagonal, an appearance by which it somewhat resembles the fir-apples of the larch. Whilst the Truffle is young, its smell resembles that of putrid plants, or of moist vegetable earth. When it first approaches the point of time at which it has attained its full growth, it diffuses an agreeable smell which is peculiar to it, resembling that of musk, but which lasts only a few days; it then becomes stronger, and the nearer the fungus is to its death and its dissolution, which speedily ensues, so much the more unpleasant is its smell. Whilst young, the flesh is watery, and its taste is insipid: when fully formed, its firm flesh, which is like the kernel of the almond and the nut, has an extremely aromatic and delicious taste; but as soon as the fungus begins to decay, and worms and putrescence to attack it, its taste is bitter and disagreeable. Wherever Truffles are produced, there they are to be found the whole year through, from the beginning of spring till late in autumn; but in the greatest plenty from towards the end of the month of August to the latter end of October. They thrive extremely, like all fungi, in warm moist autumns, and are then most delicious. After warm continuing showers, they are found nearer the surface of the soil, sometimes so high that they form little hemispherical mounds of earth, in which small clefts are produced by the sun's rays. If the soil is loose, and dry weather succeeds, the earth which was raised up falls down, and the Truffle is seen half-uncovered. Nevertheless, these Truffles are of small value, as they are generally either dead or worm eaten. The favourite habitat of Truffles is a somewhat moist light wood-soil, which is defended from the immediate effect of the burning rays of the sun by large oak trees, standing at a distance from each other, but is not deprived, by thick bushes, of the free access of currents of air. Where, in woods, there are places bare of timber trees, and with but few bushes, or covered with pollarded wood that does not stand thick, they thrive under an oak, beech, whitethorn, and even under a fruit tree, and sometimes attain the weight of from a pound to a pound and a half: this unusual size, however, is only met with in moist warm grounds. Here they lie nearer the surface of the soil. The drier the soil is, the deeper they are produced in it; but are usually so much the smaller: to this the vicinity of springs is the sole exception.

146 Truffle, Cultivation of. Upon the first production of the Truffle its size is scarcely perceivable; as it proceeds in its growth, the earth that is around it is pressed together and pushed off. On this account the Truffle can prosper in none but a loose soil. If the soil is everywhere equally loose, the Truffle assumes a globular form; but this is changed if there is on one side a greater opposition than on the other; as, for instance, by a root or a stone. Hence the different forms of the tubers may be explained. Where the soil is most moist, whether above or under the Truffle, there it will either rise up or sink deeper. In laying out Truffle beds a distinction must be made between wood land and garden land. The former needs not much preparation, and promises a surer profit than garden land, with which must be artificially mixed those species of earth that, in the former, have for several years been accumulated by nature. He, therefore, who can take for new Truffle beds wood land, especially that which for centuries has produced the above mentioned trees, spares both time and expense. But whether the Truffle plantation be made in a wood or a garden, the first requisite is a somewhat moist soil in a low situation. The ground itself, however, must not contain any sharp or sour component parts, but must be mellow and fertile. Least of all are adapted to the purpose, situations in the neighbourhood of morasses or turf moors; and especially those low situations the subsoil of which is full of saline or sour matter. This is easily known by the reeds, horsetail, (Equisetum,) coarse kinds of grass, and mosses, which grow upon their surface, and, whether green or dry, are rejected by cattle and sheep, or only eaten by them from excessive hunger. He who has no such mellow soil, in a depressed situation, upon his property, may most easily form it by art in the neighbourhood of springs, or at the foot of a rising ground; but the first plantation is thereby proportionally rendered more expensive. The ground designed for the cultivation of Truffles must, in the first place, be dug out from four feet to five feet deep, and be lined at the bottom, and on the

sides with a stratum of clay or very fat loam of a foot thick, that the spring water which is conducted to it may not strain through and run off. If the subsoil be loam or clay, the thickness of the stratum of clay to be placed upon it may be diminished; but, if it be a dry sand, it must be more than a foot thick. This artificial depression is then filled with earth artificially prepared, and now the spring, or small brook is turned upon it. Truffles certainly require a moist soil, but they cannot endure boggy ground or standing water; a ditch, must, therefore, be cut to carry away all superfluous water. This ditch is either opened or shut accordingly as a superfluity or want of water renders necessary. But if, in very hot dry summers, the supply of water should itself fail, the Truffle beds must be sufficiently moistened with pure river water. This is the expedient to which recourse must be had in dry situations, that neither possess a spring, nor a small brook for watering a plantation of Truffles. Since only small beds, and not large fields, are taken for the cultivation of Truffles, the greatest care may be taken in the preparatory steps, the expense of which will however, never be so considerable as to be much felt by the landed proprietor. A calcareous or chalky marl forms the groundwork of all artificial mixtures of soils for the cultivation of the Truffle. When this is to be had in the neighbourhood, it is mixed with the fourth part of iron sandstone. If this marl be not in the environs, then finely-beaten calcareous stone or beaten chalk must supply its place: to this must be added from the fourth to the third part of ferruginous sand, and the whole mixed together as uniformly as possible. With this artificial calcareous marl the Truffle bed (which has been dug out from two and a half feet to three feet deep) is filled up a foot high, in the place of the natural earth. It is advantageous when the pit, which is dug out for that purpose, before it is filled with the new soil, is lined on the sides and bottom with unburnt calcareous stone. By this means not only will mice, and several kinds of worms, be prevented from establishing themselves in the new Truffle beds, and preparing to destroy the young germs of the Truffles, but sudden heavy rains will be prevented from occasioning an injurious mixture of the different kinds of earth. Where calcareous stone is not to be had, sandstone may be used instead of it, especially if it contains iron; or, at all events, either other natural stones, or artificial ones, made by the hands of men, may be made use of. The bottom of the pit must not, however, be paved so as to be water tight, in order that the water may sink into the subsoil, and not cause an injurious bog, instead of the moist depression that is intended. If, when the pit is dug out, a compact soil is met with, for example, a loamy bottom, the paving of the bottom of the pit is superfluous: it would obstruct the binding of the under strata with the new-laid bottom of the truffle plantation. It sometimes happens, that, in digging out the pit, a bed of clay is met with, which is impervious to water. In such a case, it is better to leave the place and choose another, than instead of raising Truffles, only to make a small bog. All the above preparations are necessary for wood lands, and for plantations in large gardens and English shrubberies; but the further filling up of the pit is different for each place. In woods the soil contains much vegetable matter; but that is not enough, especially when an artificial mixture of earths is undertaken. In order to obtain a very nutritious vegetable earth, let pure cow dung be carried into heaps in the spring, and left to fall into earth in the course of the summer. That is best which is collected as fresh as possible on pastures and commons. That it may not lose its nutritious matter through drought and heat, the heaps must be made in a shady place, be turned from time to time, and, in dry weather be often moistened. In autumn when the leaves fall from the trees, a fourth or fifth part of this earth is to be added to the natural wood soil; and of fallen oak leaves, or, if these are not to be had, of fallen hornbeam leaves, as much in bulk as half the mixture amounts to: the whole must then be carefully mixed together. The pit is to be completely filled with the mixture, which is to be covered with a layer of oak leaves, of from four inches to six inches thick. A wood soil, with much vegetable earth from oak trees, requires a smaller addition of oak leaves, than a soil that contains less of it. The pit, when filled, is to be covered over with a thick layer of leaves, the scattering of which may be prevented by some earth taken from the mixture being spread over them, or by small branches of oak being laid upon them, and secured by stones. Such a cover of leaves is of great service to the planting of Truffles; since by the moisture of the winter the most efficacious matter is extracted from it, and communicated to the soil beneath. For this reason, a new cover must be laid upon it every autumn. Early in the following spring, the uppermost layer being exhausted by the air, is to be taken away; but the under and moist one lightly dug in, or, which is still better, raked flat, lest the tender germs of the Truffles should be injured or destroyed; but when the Truffle plantation is first made, the whole cover must be deeply dug down. Every previous preparation is thus made for the cultivation of Truffles. We now come to the mode of causing them to be produced. Since they are neither sown, nor, like animals, propagated by eggs and young ones, the only thing that remains for us to do is, to cause the soil to produce Truffles. If Truffles are to be transplanted from one situation to another, and to be promoted to be the ancestors of their species, the greatest precautions must be taken lest they die on the journey, and become useless. This is the greatest difficulty to be encountered in the planting of Truffles, and thus the plantation may easily fail. Truffles, at their full growth, must not be chosen for transplanting: at that time their vital powers are too feeble; they are then too near dying to cause the production of their species in their new situation. They are as little able to bear the violent removal from their ancient situation, and transplantation into a new one, as an old tree. Equally injurious is the planting of tender Truffle germs or very small Truffles. These also cannot be taken from their parental earth, and abandoned to their new situation, without being exposed to the hazard of dying. Let, therefore, Truffles of a middle size, and in the full possession of their vital powers be chosen for transplanting. They should be taken up on a showery day, or at least a cloudy one, in such a manner as that they may remain completely enveloped in a ball of earth, and be as little as possible exposed to the access of the air. If the earth is very loose, so as not to hold firmly together; or if, through previous drought, it had lost its natural viscidity, which it has not fully recovered again through the last rain; the place where the Truffles are must have a great deal of water poured over it a few hours before they are taken up. The fungi then will be easily taken up, together with the earth about them, and put into a wooden case, which must be filled with moist wood earth, from the place of growth of the Truffles, and closely fastened down. Truffles may thus be sent many miles, without any danger of their perishing. Only upon long journeys, which last several days and weeks, the case must often be opened, for an hour at a time, and the earth from time to time be moistened with fresh river water, that the Truffles may not become mouldy and putrid. When the Truffles have reached their appointed destination, the case must be immediately opened in an airy but shady place, and the earth moistened, if necessary; after which, they must be planted as soon as possible in the situation intended for them. It is not advisable to distribute the Truffles over the whole of the bed; it is better to plant them upon a small part of it. As, upon a newly-made bed, the matter in the earth has not taken the direction necessary to the production of this species of fungus, it is easily conceivable that a single Truffle cannot act sufficiently to produce this direction, but that the united power of several is requisite. In the earlier attempts, it was, indeed, expected from a single fungus, or even from pieces cut off, that they should exert this power upon the new soil; but the expectation was continually frustrated. According to the nature of the soil, whether more or less moist, the Truffles are set from two inches to four inches or at the most, six inches deep. The soil in which they are enveloped in their journey is left upon them, and the utmost efforts are made to prevent their being exposed to the access of the air, or even to that of the sun's rays. On this account, the planting of them must take place only in the evening, when the sun is gone down, or in very cloudy weather. Holes of the depth required must be made beforehand, the bottoms of which must be strewed with soil out of the case; then each Truffle must be carefully lifted up, with the soil that is about it, planted, and the soil that still remains in the case be distributed in the holes. If the holes are not filled with this, they must be filled with the soil of their new situation, which must be moistened with repeated sprinklings of water. The new plantation must then be amply covered with twigs cut from the oak or hornbeam; and the soil must be planted with young trees of these kinds, not crowded, but at such a distance as to give sufficient shade, so as to prevent the land from being dried up.

The best time for transplanting Truffles is towards the middle of spring, and in the beginning of autumn, about which latter season the greatest number of half-grown Truffles is to be found. About this time, the land is usually moist enough of itself, so that it is not necessary to water it to prevent its being dried up. But, in case it should be dry from great drought, it must assuredly be moistened in this manner; in doing which, the water, nevertheless, must not be poured on in streams, as the germinating brood would thereby be easily choked, or entirely destroyed. It has already been observed, that, in the succeeding autumn, the new plantation should be covered with a layer of oak leaves. The plantation thus remains undisturbed till the next autumn, only that it is to be freed from large plants that shade it too much, and exhaust all the strength of the soil; but small fine grasses must be suffered to remain, as they give the ground beneficial shade, and prevent too great exhalation. In general, at least in the first years, let endeavours be made to imitate the wood soil as much as possible, in order to obtain the sooner a rich return of Truffles. In the first year, the Truffles will be little increased. These fungi have, as yet, too little strength to act powerfully upon the environs, and to compel them to bring forth a large number of tubers. If the plantations have been made in the spring, there will be found in the next autumn some few young Truffles, about the size of a nut, with a yellowish outer rind, and of a spongy consistence; an indication that they must remain a longer time to attain their ripeness, and along with it, their firm consistence and dark colour. In the mean time, these young Truffles are the most certain indication that the plantation has succeeded, and that a well-furnished Truffle bed will be obtained in the sequel.

By the preceding observations, it will be seen that the old black vegetable soil of woods must be obtained or imitated, as a compost to favour the growth of Truffles; that the situation should be moderately shaded from the summer sun by trees, and a regular moisture maintained, without approaching the quality of a marsh. An old Wood or Forest, or well established Shrubbery will generally afford a better situation for Truffle beds than a garden. A small open space in either of these, partially shaded by any trees excepting firs, and possessing the qualifications previously mentioned, should if possible, be chosen. The best manure to stimulate the growth, and yield a fine flavour, according to the authority we have followed, is that from oak leaves, lightly forked in when decayed, and also applied as a winter covering leaving them till April, when they will be partially rotted and fit for that purpose. In all cases like the present, where experience has not produced definite rules for the guidance of the young cultivator, he must study nature. The usual places of growth of any plant should be regarded in respect to quality of soil, moisture, shade, aspect, &c. and by imitating these in cultivation success may be rendered almost certain. It will be requisite to remember that pigs, foxes, squirrels, and mice, are enemies from which Truffles must be defended.

147 FUSCHIAS. When in the open ground they should be cut down in October or November, and covered over with tan; or in the absence of this, with leaves, straw, or sand. Many persons, thinking that part of their stems may survive the winter and assist the spring growth, suffer them to remain; but it should be known that such stems, unless they can be completely protected as in a greenhouse, will, in their gradual decay, act as sponges on the roots, and exhaust their strength. Should the plants have been neglected till frosts have partially destroyed their stems, it will, even then, be desirable to treat them as above described.

148 LEAVES, WITHERED. As with the stems of the Fuschia so it is with withering leaves. In their decay, they absorb, and assist in evaporating, the sap of the plant, without performing any useful office in return. Therefore, when leaves of any shrubby plant begin to wither, take them off immediately. We have seen orange trees, which have been removed at an unseasonable period, with their leaves drooping and partly withered. Some of these trees, by way of experiment, were entirely stripped of such leaves. These threw out young foliage and soon recovered; whilst those on which the withered leaves continued till they fell off naturally, recovered with difficulty, and evidently suffered more than those which had a contrary treatment. It must not be forgotten that it is prejudicial to the course of nature to destroy the foliage of a healthy plant; but here it was the choice of two evils—the destruction of the foliage, or the continuance of it when worse than useless.

149 INSECTS AND LAUREL LEAVES. Under Section 143 we gave an account of a method of destroying insects, by inclosing

the infested plants in frames, with bruised laurel leaves. By an artiele contained in the Gardener's Magazine, it appears that plants also may be injured by the same treatment, and that preeaution in the use of such reeipe is indispensible. From the latter work, Vol. 13, p. 550, we eopy the following eommunieation. "Having read in the Gardener's Magazine, an account of a method of destroying inseets that infest plants, taken from a paper read before the Hortieultural Soeiety, I was indueed to give it a trial, as the means stated were so simple. I aecordingly procured a quantity of laurel leaves; and, having well bruised them, spread them in the evening on the floor of a small stove. On the following day, at noon, I was surprised to see all the young leaves of some vines under the rafters appear as though seorehed; and, upon further examination, I found many of the stove plants affected in the same manner: the euphorbias, in a few days, lost nearly all their leaves; and the gesnerias, gloxinias, &c., though they did not lose their leaves, yet presented a very unsightly appearanee. I immediately eoneluded that this was caused by the odour of the laurel leaves, and instantly swept them all out of the house; but, to be sure of the matter, I took a plant of pelargonium and plaeed it under a hand-glass with a quantity of the bruised laurel leaves, and on the following morning it presented preeisely the same appearance as the plants in the stove; which satisfied me of the injurious effeets of the laurel leaves on vegetation, though, at the same time, they were ineapable of destroying the mealy bug, whieh was the insect I was ehiefly annoyed with. I send you this aeeount, that you may, if you think fit, publish it as a eontradiction to the assertion, that the odour of laurel leaves will not injure plants, and thus prevent other gardeners from falling into the same error that I have done."

150 Rhododendrons, without peat. It may not be uninteresting to many of our readers to know that it is not absolutely indispensible to the successful growth of the Rhododendron, that it be planted in peat soil. Shade seems to be of greater importanee to it than peat. In many situations, having shade, a northern aspeet, a moist subsoil, eontiguity to water, or other similar advantage, this plant may be seen growing luxuriantly without any portion of peat applied to its roots. On the other hand, after proper eare has been taken to provide peat soil for

planting in, and all due attention paid to the removal of this magnificent shrub into situations, exposed, dry, and open to the full effects of the sun, we rarely, if ever, have seen it grow with that vigour which could be considered satisfactory. One instance apparently at variance with this opinion occurs to our recollection, but here its success we found dependent on a moist red sand-stone rock two feet only beneath the surface. In considering what description of earth, independently of peat, is best suited for the Rhododendron, we recommend a light sandy loam; and this may be improved by the admixture of decayed leaves, or other vegetable matter. Young plants may now be purchased at a very reasonable price from any nurseryman, otherwise their propagation from seed is quite easy; and particularly desirable on account of the variation in tint and character of the plants so raised, the more especially if seeds be preserved from plants which have flowered near to other species. If care be taken to fertilize the flowers of one species with the pollen of another, (see Botanic Garden, No. 262) hybrids may of course be expected, many of which may now be met with of the most splendid character.

151 Chemical changes in Vegetables. Very few subjects offer a greater degree of interest to the enquiring mind than the chemical changes continually going on in vegetable substances. All matter is composed of very few simple elements. Its variable character is produced by the varying proportions of these elements. The woody fibre of vegetables consists of Carbon, 51.43, Oxygen 42.73, Hydrogen 5.82. An hundred parts of sugar is compounded of carbon 42.85, and 57.15 parts of Oxygen and Hydrogen in the proportions which constitute water. Hence the elements of sugar are nearly the same as water, with the addition of carbon. Wood is also composed of the same elements, with a larger proportional of Hydrogen. This subject has been introduced more immediately to our notice by Mr. Everitt, in a lecture before the Medico-Botanical Society which was reported in the Lancet, No. 753, from which we copy the following: "Mr. Everitt delivered a lecture on a peculiar class of chemical changes brought about in compound bodies, more particularly in organic compounds, merely by the presence of certain agents, where these agents do not enter into combination with the substance acted on, either as a whole, or yield to them any

part of their constituents; they appear to us as far as our observations and their changes go, to act only by their presence. The instances which Mr. Everitt cited in illustration of this class of phenomena, were the conversion of starch into sugar, merely by its being boiled for a few hours with water slightly acidulated with sulphuric acid, which acid, after it has effected the modification, is found in a perfectly uncombined and unaltered state, and can be removed by chalk, the sugar being then left alone in solution. A similar action is effected by the same agent on the fibres of wood or lignin; thus if linen be cut into very small pieces, and oil of vitriol dropped on little by litlte, carefully stirring the whole to prevent the temperature rising, afterward rubbing the mass in a mortar, it soon loses its fibrous character and becomes homogenous, and quite soluble in water, from which if we remove the acid by chalk and evaporate to dryness, we obtain a substance exactly similar to gum arabic. If, previously to removing the acid, the solution be kept at 212 degrees, or the boiling point of heat, for thirty or forty hours, and then the acid be removed as before, in lieu of gum we have sugar, like that obtained from the starch. Here, as in the other case, no part of the acid has disappeared or been destroyed. Another instance is the conversion of sugar, when dissolved in water and the solution kept at a certain temperature, into alcohol and carbonic acid, by the presence of a little ferment or some few other matters. The conversion of alcohol into ether and water has been proved to be a similar case, it having been shewn that a definite quantity of sulphuric acid, properly diluted with water, and the process managed in a peculiar way, was capable of etherifying any indefinite quantity of alcohol."

152 Garden Walls. We have, previously, had occasion to mention, in terms of commendation the straight-forward directions contained in a little work—Rogers's Fruit Cultivator. From this we copy the following observations, "Garden walls are usually built higher or lower, according to the size of the garden itself. From eight to ten feet from the offset at the bottom, to the underside of the coping, is height enough for a garden containing from two to four acres. Garden walls have been built on arches, for the purpose of allowing the roots of the trees to extend themselves in all directions; but this can answer no good purpose, because their is quite scope enough

for the roots of a wall tree in the border in front, without inviting them into the border behind. Arched walls are only necessary for the front walls of vineries or peach-houses. For the safety of the walls, they should be built with piers or pilasters behind, twenty or thirty feet apart, and projecting four inches from the face of the wall. Low walls are much more convenient in the management of the trees, than those requiring ladders to perform the necessary business; and all fruit trees extended horizontally are for the most part much more fertile, and certainly easier defended and under more control than if trained upright, and high up out of reach: so that two walls of six feet in height, with trees planted at good distances from each other, will yield during any term of years, much more fruit than one wall of twelve feet in height. True it is, we often see pears or vines trained to a great height on buildings; but the value of the fruit is (supposing the trees are fruitful) much lessened, when the great trouble and danger of dressing the trees is taken into account. Besides high walls are by no means necessary for the crops of either a fruit or kitchen garden. A free ventilation is necessary at all times The effects of high winds are much less to be dreaded than those of foul, stagnated air, pent up all round by lofty walls.

The advantages of walls for the protection and ripening of exotic fruit, need not be insisted on. Their reflection of the sun's light, and retention of his heat throughout the greater portion of the night, are the favouring circumstances which forward as well as defend the tender trees; and at the same time, the branches being all securely fastened, and trained in any form to the wall, renders them safe from the violence of storm or tempest. Walls of a moderate height, however, are preferable to over-lofty ones, more especially if the upper part of them be naked. Many of our best fruits are naturally dwarfish, and we take pains to make them more so. How ridiculous then it is, to see such dwarfed trees planted against a wall of treble their full-grown height. For the convenient culture of dwarf fruit trees, low walls are sometimes built across gardens of sufficient extent. These are usually nine-inch work, with pilasters of fourteen-inch work, at about sixteen feet distances behind. The height need not be more than six feet, and on which great quantities of fruit may be produced both in front and on the back;

these are particularly convenient for matting up currants or other fruits required to be kept on the trees after the regular season.

The best form of a garden is a square, or long square, with the angles rounded. The centre of the northward wall is the place for hothouses, if any be built. The borders, for wall fruit, should not be less than twelve feet wide; and if the bottom be hard and dry (and if not it should be first made so), a depth of eighteen inches of good fresh soil will be sufficient for any kind of tree. These borders should never be cropped with rank-growing vegetables; nor ever dug deeply, but with a blunt-tined fork. In dry summer weather, the surface of these borders should be kept moderately moist, by mulching and occasional waterings; and frequently sprinkled with soot, to deter insects from nestling in the ground or on the trees. There have been, in former times, many fanciful ideas entertained respecting the best directions or lines in which garden walls should be built. Some projectors advised, that they should be built in a zigzag form, to obtain a greater variety of aspect, by means of which they expected the fruit season would be prolonged. Others embracing the same principle, advised the garden wall to be built circular; in order to meet the direct rays of the sun in every hour of the day. Others again advised the south walls to be built straight, but with (at short intervals) segments of circles bowing backwards, to form recesses for every tree. All this was contrived with a view to obtain a greater variety of the effects of light, or greater shelter from the withering winds of March. These notions, however, are all now forgotten; experience proving, that these fantastically built walls created so many eddies and sudden gusts of wind, that, instead of genial warmth and quiet shelter, they caused cold and bleakness. Hot walls, that is, walls heated by internal smoke flues, have been extensively built in the North of England and Scotland; but without some other covering over the trees, to keep in the heat and protect the excited flowers from sudden changes of weather, the trees seldom bear an earlier crop than those on the common walls. Such structures are therefore not so much in fashion as formerly, as a very little more additional expense will build a proper forcing house that may be depended upon. For the perfectly ripening of late French pears, hot walls have been often found useful; but for which purpose alone, they are seldom built.

153 Soda as a Manure. It has been oftentimes stated that Soda imparts a very beneficial effect as a stimulant to vegetation. We cannot refer to any specific authority for proof of the assertion, probability, however, is in its favour, and the experiment may be made with very little trouble and expense. If Soda be not generally advantageous it may be so under certain circumstances, therefore it is desirable that it should have a fair trial, the more especially as it is remarkably cheap, being worth at the maker's works, but ten or twelve shillings per cwt. The method of using it is to dissolve one pound in fourteen gallons of water, and apply the solution to the plants as common water.

154 Rosa Indica odorata, Culture. The Messrs. Rivers and Son, Nurserymen, of Sawbridgeworth, Herts, are directing their particular attention to Roses, and we doubt not, as well as advantageous to themselves, their exertions will prove very gratifying to Rose growers generally. Mr. T. Rivers, jun. has issued gratis, a classified catalogue of nearly .900 Roses, each one named, described, and priced. He has also published a further description with directions for their culture, entitled "The Rose Amateur's Guide," founded, as he says, on "The result of twenty years' experience, gained by the culture of choice Roses on a much larger scale than any where in Europe." As a specimen of the information which it contains we copy from it, (page 76) the following directions for cultivating the Rosa Indica odorata, commonly called the sweet-scented, or tea-scented China Rose. "As these interesting Roses require more care in their culture than any yet described, I will endeavour to give the most explicit directions I am able, so as to ensure at least a chance of success. One most essential rule must be observed in all moist soils and situations; when grown on their own roots they must have a raised border in some warm and sheltered place. This may be made with flints or pieces of rock in the shape of a detached rock border, or a four-inch cemented brick wall, one foot or eighteen inches high, may be built on the southern front of a wall, thick hedge or wooden fence, at a distance so as to allow the border to be two feet wide; the earth of this border must be removed to eighteen inches in depth, nine inches filled up with pieces of bricks, tiles, stones, or lime rubbish; on this place a layer of compost, half loam or garden mould, and half rotten manure well mixed, to which add some

river or white pit sand: this layer of mould ought to be a foot thick or more, so as to allow for its settling: the plants may be planted about two feet apart. In severe frosty weather, in the dead of winter, (you need not begin till December,) protect them with green furze or whin branches, or any kind of light spray that will admit the air and yet keep off the violence of severe frost. I have found the branches of furze the best of all protectors. With this treatment they will seldom receive any injury from our severest winters, and they will bloom in great perfection all summer. This is the culture they require if grown as low dwarfs on their own roots; but perhaps the most eligible mode for the amateur is to grow them budded or grafted on low stems of the Dog Rose, or Blush Boursault, which seems, if possible, even a more congenial stock; they may be then arranged in the beds of any flower garden, and graduated in height so as to form a bank of foliage and flowers. Grafted or budded plants, when established, will in general brave our severest winters; but still it will be most prudent in November either to remove them to some warm shed, and lay their roots in damp mould, or to reduce their heads, and give each plant an oiled paper cap. This is a mode practised in the north of Italy, with great success, to protect their tender roses and other plants; and though paper caps may not be thought objects of ornament on an English lawn, yet the method will be found very eligible in many cases. In March those that have been laid in the shed for protection, may be removed to the flower borders, pruning off all superfluous and dead shoots; they will bloom the following summer in great perfection, and in general surpass those that have been suffered to remain in the ground without protection. Some of the varieties are much more robust and vigorous than others, and equally beautiful as those of more delicate habits; it will therefore be scarcely worth while to grow any but what are of known hardihood and vigour. I have pointed out some of these in my notices, but time can only make a knowledge of their habits more perfect. Worked plants of Tea-scented Roses force very well: they do not require to be established one year in pots, for if only potted in October or November, and forced with a gentle heat, in January and February they will bloom finely; in March and April the extreme beauty of their foliage and flowers will amply repay the attention given to them, as they have a peculiar softness and delicacy of appearance when forced and growing luxuriantly."

155 Grasses for Lawns. In many situations it is difficult to obtain good turf to lay on lawns or grass-plots, we, therefore, now give directions for forming it from grass seeds, a practice which is rarely pursued, although a very efficient means of obtaining the end required. It may be regretted that so little attention has been paid to this subject by the agriculturist. Dutch clover (*Trifolium repens*), Trefoil (*Medicago lupulina*), Rye grass (*Lolium perenne*), Cocksfoot grass (*Dactylis glomerata*), and a few others of the coarser species are all that have generally been thought of by the farmer, as necessary to produce a permanent pasture; and an early spring crop of bents from the Rye-grass has oftentimes been seen to be the chief produce of the best soil. The error of such plan is best shown by an examination of the produce of those pastures which we would desire to imitate. The late George Sinclair, under the direction and support of his Grace the Duke of Bedford, instituted various enquiries and experiments, regarding the nutrition, culture, and value to the agriculturist, of the grasses, usually found in English pastures, the results of which he published under the title of Hortus Gramineus Woburnensis, a work that deserves to be more generally known. In his examination of the herbage of various old pastures he discovered from twelve to twenty distinct species of grass in a single square foot; it is therefore evident that to obtain a good turf, without waiting for its natural production, we must sow the requisite variety of seeds. Although we had not intended to enter so generally into this subject, we will, as it is one of importance, annex a list of the grass seeds and their proportions, recommended by Sinclair, to be sown together, to form a permanent pasture, and afterwards select those species which are best calculated for our own immediate purpose—the clothing of Lawns.

The proportions in which the seeds of the different species should be mixed for permanent pasture: —

Cock's-foot grass (*Dactylis glomerata*)————8 pecks.
Meadow-fescue (*Festuca pratensis*)————8 ..
Meadow foxtail-grass (*Alopecurus pratensis*)————8 ..

Rough-stalked meadow grass (*Poa trivialis*)	8	pecks.
Tall oat-like soft-grass, (*Holcus avenaceus*)	2	..
Meadow cat's-tail (*Phleum pratense*)	15	lbs.
Hard or smooth fescue (*Festuca duriuscula* or *glabra*)	8	pecks.
Crested dog's-tail (*Cynosurus cristatus*)	4	..
Nerved meadow-grass (*Poa nervata*)	2	..
Wood meadow-grass (*Poa nemoralis*)	4	..
Narrow-leaved meadow-grass (*Poa angustifolia*)	1	..
Broad-leaved creeping bent, or fiorin (*Agrostis stolonifera*, var. *latifolia*)	2	..
Rye-grass (*Lolium perenne*)	4	..
White or Dutch clover (*Trifolium repens*)	15	lbs.
Bush vetch (*Vicia sepium*)	2	pecks.
Sweet-scented vernal grass (*Anthoxanthum odoratum*)	1	..
Perennial red clover (*Trifolium pratense perenne*)	12	lbs.
Yarrow, (*Achillea millefolium*,)	4	..

It appears that seeds mixed in the above proportions, and sowed, one bushel on an acre, would yield only about two seeds to every square inch, whilst on the most fertile pastures seven plants are found within the same space. The propriety, however, of sowing three bushels and a half on an acre, which would be equal to seven seeds to an inch may be much questioned. Half this quantity would suffice to produce such a crop as would shed its seed in the second year, and supply an ample stock of young plants; and it may be presumed that those species would prove the most fertile to which the soil was most congenial, whereby seeds of unsuitable species would not be unprofitably spent. The method of sowing is given by Sinclair as follows:—

"I have sown the seeds of the same grasses in every month of the year, January excepted: and though much depends on the weather and the state of the ground, the results were always in favour of the month of September and the beginning of August; and, next to that, the middle or latter end of May, according as the weather was dry. The seeds vegetated, and grew with most vigour under the following circumstances; when the ground had been deeply stirred, broken very fine, and made perfectly smooth and compact on the surface, with a heavy roller, previous to sowing the seeds; the ground in a dry state, at the time of sowing, the seeds sown on this fine, dry, compact surface: the larger seeds not more than just covered, by drawing a fine rake on the level surface, and afterwards sowing the small seeds and covering them no farther than what was effected by a repetition of the roller. The results further shewed, that, next to a course, inconsolidated, or loose surface, the practice of deep sowing was, in the second degree, more injurious to the vegetation of the seeds and the first progress of the plants, than any other error that could be made in the *manual* part of the process of sowing the natural grasses on a soil of good quality. When land is to be sown for permanent pasture, no admixture of any annual or grain crop, or broad-leaved clover, should be admitted with the grass seeds. Experience proves that they are highly injurious to the intention of speedily forming a solid productive sward; and that the profit that may accrue from a grain crop thus obtained, will be much overbalanced by the loss of grass in the two following seasons. Every plant of these annual crops occupies a place, to the detriment of the expected sward; besides rendering the surface porous by the decay of their roots in the end of autumn, much mischief, likewise, is done to the sward by portions of the crops being beat down with heavy rains. The above mixture should be sown in the autumn or spring, at the rate of four bushels and a half to the acre; much less will form a good pasture, but when the seeds can be had from the farm at a moderate expense, the maximum quantity should be adopted. If sown in spring it will be found highly useful, in the following autumn, to give the surface a slight top-dressing with rotten manure or compost, in which the seeds or roots of weeds are not suspected, and to sow immediately after half a bushel, more or less, of the mixture of seeds, according as the sward appears to be deficient of plants; after which, (the top-dressing being previously well reduced by a slight bush-harrow,) the roller should be liberally used; and rolling for the first two years, should never be neglected at any favourable opportunity. If the seeds are sown in autumn, the top-dressing, resowing, and rolling, will be found equally requisite and beneficial in the following month of May; and even if repeated in the following autumn, they will greatly forward the intention. This is imitating the process of nature in forming pastures,—with this advantage, that for one seed of a valuable species of grass supplied to the soil by the slow and gradual process of nature, in one season, a thousand are supplied in the same space of time; and thus take possession of their natural soil, without the danger and inconvenience of expelling its usurpers.

There has been some difference of opinion respecting the manner of reaping the produce of seedling grasses; whether by depasturing with sheep, or by mowing after the plants have perfected their seed. The manure supplied by sheep to the young grasses is of great advantage; but the animals are apt to bite too close to the root, and sometimes tear up the young plants altogether. I have found, on repeated trials, that cropping seedling grasses before they had produced flowers, had the effect of retarding and weakening the after-growth of the plants for that season very much. But after the period of flowering, cropping was found to strengthen, and rather encourage the growth of plants. In the same way I found that old plants of grass, when cut very close after the first shoots of the spring made their appearance, afforded about one-third less weight of produce in the whole season than those plants of the same species which were left uncut till the flowering culms began to appear. As the advantages of the manure of the sheep may be supplied by top-dressing, and the disadvantages resulting to the tender seedling plants from early and close cropping cannot so speedily be removed, the practice of suffering the grasses to produce flowers before they are cut, with the application of top-dressings, and the use of the roller, till the spring of the second year, appears to be far more profitable than the former practice of depasturing the seedling grasses at an earlier period than the spring of the second year. But in this, no doubt, as well as in other particular modes of management recommended for general practice in the culture of plants, local circumstances may interfere so much as often to render some modification of them necessary."

Having given the general principles to be regarded in the production of a permanent turf, we shall now give a list of those species of grass, &c. which are proper for Lawns, that is, such as will produce a close and fine surface. As well as for forming a close and permanent turf, these grasses will be found admirably adapted for repairing bare and injured places in shrubberies and pleasure grounds, arising from shade; but in the greatest part of such situations they will require to be sown annually, which cannot be done in a more suitable month than April, when the earth can be properly prepared for the reception of the seeds, and the young herbage will quickly effect the purpose intended.

LIST OF GRASSES, SUITABLE FOR LAWNS.

Agrostis canina.	Festuca duriuscula.
Agrostis vulgaris.	Festuca ovina.
Alopecurus pratensis.	Festuca rubra.
Anthoxanthum odoratum.	Lolium perenne, (narrow-lvd.)
Avena flavescens.	Phleum pratense.
Briza media.	Poa pratensis.
Cynosurus cristatus.	Trifolium minus

Having been led into the present subject farther than we first intended, we have endeavoured to obtain every sort of information which may be likely to facilitate the ready attainment of permanent pastures by those who desire to practice the method we advocate. In a communication with which we have been favoured by Messrs. Cormack, Son, and Company, of New Cross Nursery, Kent, (in which firm the late George Sinclair before-mentioned, was a partner) we are informed that they supply grass seeds, mixed of fifteen or sixteen species, duly proportioned according to the nature of the soil on which they are to be sown. The quantity recommended is from three bushels to three bushels and a half per acre; the price thirteen shillings and sixpence per bushel, for pasture seeds; and the finer sorts, for Lawns, eighteen shillings per bushel.

156 Strawberry, annual planting of. It has long been the practice of some horticulturists to break up their Strawberry beds after gathering the first year's produce, and consequently of planting fresh beds annually. The recommendation of this mode of culture to general adoption may require to be somewhat qualified; still, we believe, that in light rich soils, with due attention, more abundant crops, and finer fruit, can be produced by this than by any other method of cultivation. Strong soils, in which the Strawberry is not unfrequently grown with great success, in beds of many years' standing, will require due amelioration before they can be expected to afford all the advantages consequent on annual planting. This arises simply from the young plants requiring more time to become well-established

and to develope their full powers, in stiff than in light and well pulverized earth. For their attainment of requisite strength, in one seasou, they are much dependent on the months of August and September; therefore a stiff and unyielding soil, with dry weather, would certainly prevent the growth so indispensable. We have been led to these considerations by the practice of a philosophical horticulturist, Mr. Darke of Birmingham, as explained in a Lecture delivered by him before the Birmingham Society for the Promotion of Floral and Horticultural Knowledge. Mr. Darke's mode of proceeding meets the difficulty arising out of soils which we have noticed, by first establishing his plants in a prepared compost, and we entertain no doubt but the practice of his method will generally be crowned with complete success. Mr. Darke observed that "The portion of the plant which yielded fruit was confined to the offsets or runners of the preceding year, and from thenceforth they were nearly barren. Having observed that runners ceased to be produced about the month of September, it followed that the principal part of the sap was deposited subsequent to that time; and since the produce of the following year wholly depended upon the deposition of a sufficient quantity to render the blossom buds productive, he concluded that if any means could be adopted to prolong the time naturally assigned for that purpose, in the same proportion would be insured a superior crop of fruit. The experiment he made was with the Downton Strawberry. As soon as the runners had produced roots about half an inch in length, and previous to their penetrating the soil, he cut off a quantity, leaving on each side of the roots about four inches of the runner. Having prepared a nursery bed, by throwing out the soil to the depth of six inches, and trodden the bottom very hard, to prevent the young fibres from penetrating, he then mixed the loose soil with a quantity of light half-decomposed stable manure, which he returned into the bed, raking the whole smoothly over, and dividing the surface into drills, six inches assunder and one inch deep. He then took the young plant and placing a finger upon each end of the runuer left thereto, he pressed it down in the form of an arch, the plant being on the top, and resting on the surface of the soil; the portions of the runner left on each side thus held it firmly, and as appeared to him, materially forwarded its growth aud strength, by supplying it with the moisture absorbed from the soil. When the whole bed was thus planted, it was well watered; and as the weather was very dry, a mat was thrown over it for a few days, to exclude the heat of the sun. Under this management the plants soon established themselves, and increased rapidly; the roots having in about ten weeks penetrated the soil in all directions. About the latter end of August, or early in September, he formed the bed for their final situation, in an open, exposed part of the garden. This he made eighteen inches wide, and having thrown out the soil to the depth of twelve inches, he filled up the trench with well-decomposed manure, mixing it up with the soil at the bottom of the trench to the depth of another foot. The surface was then reduced to a proper height, on which the plants were placed, having, in order that their roots might sustain no injury in removing them from the nursery bed, divided the soil into cubes with a spade, each having a plant in the centre of its upper surface, which were placed twelve inches distant from each other. He then placed a portion of the soil that had been mixed with manure round the plants, which were afterwards watered, and nothing further was done to them till the following spring, when the bed was cleaued by hand weeding, to prevent injury to the roots by the use of either hoe, or rake; and in the course of the spring they were twice well supplied with liquid manure. About this period, to his great surprise, instead of one scape from each plant being produced, as he had anticipated, none threw up less than three, and the average number was five, all sufficiently strong to support the fruit above the foliage. Having previously observed, that after the first seven or eight blossoms on each scape had set their fruit, the remaining ones were so small as to be nearly useless, he cut off all the blossoms except this number. Thus managed, the fruit all assumed the cockscomb shape, and were unusually large and of a delicious flavour. Plants, which, for experiment, were left to bear a second crop, produced numerous weak offsets, but little fruit, and that of an ordinary quality.

Mr. Darke's method, here stated, is, we doubt not, excellent. We have, ourselves, for several years, practised annual planting of Strawberries, and generally, with complete success. If however, the months of July and August prove very dry, particular attention will be required to watering and encouraging the rooting and growth of the runners, both before and after they are separated from the old plants. Various means may be employed to effect this, such as hooking down the runners at the first joint, or placing stones on them; but of all methods which we have tried, and which comes near to Mr. Darke's, that of sinking small pots in the sides of old beds and then fixing the joint of a runner in each, is the most efficient; because the plants may be turned out of the pots, as soon as well rooted, with their balls of earth entire, without the least check being given to their growth.

New beds should be prepared by double digging, and well pulverizing the earth; and whatever manure is applied should be thoroughly broken and mixed with it. The width of the beds is matter of fancy. We prefer beds having two rows of plants only, and these rows only from a foot to eighteen inches asunder, with intervals of three or four feet between each double row. In the rows, we put the plants but from four to six inches apart, according to the sort. When the plants remain but one year in the bed, close planting does not impoverish them, therefore it increases the produce, and assists in keeping it clean. As the fruit of the double rows can be conveniently gathered from one side only, the alternate spaces between them should be left untrodden, for the runners to spread over in the following spring. Even if these be to be cut off, agreeably to Mr. Darke's method, they are less interfered with than when walks are made on both sides the beds. Draining tiles placed along the outsides of the double rows of plants make a neat support for the fruit from the earth, at the same time as they assist in retaining moisture. The leading consideration for the horticulturist who renews his beds annually should be to plant them as early as is possible. Attention to this point cannot be too forcibly insisted on. The best means of effecting it is to prepare the new beds as soon as a few of the first runners have struck root, and continue to transfer the young plants to them, (or to Mr. Darke's nursery beds) as they are found sufficiently rooted for removal. We never have, willingly, deferred the latest planting past the month of July; having seen the loss of a week or two in planting, with subsequent hot and dry weather, most materially retard the growth of the young plants, and consequently reduce the crop of fruit.

157 Evergreen Shrubs, transplanting. The great importance of choosing a suitable season for removing Evergreen Shrubs will be acknowledged by every one who has had even but little experience in garden or shrubbery culture. By those who have removed only a few American plants, it may be said that all seasons are alike, if but moderate attention be paid to the operation. It is true that many of these bear removal at almost any time of the year, but this arises from their numerons tufted fibrous roots, which grow together in a complicated mass, and hold the soil amongst them. This, however, is not the case with Evergreens generally, and more particularly with those of large growth, therefore attention should be paid to the season, as well as the mode, of removal. An article written by Mr. Glendinning on this subject, and inserted in the thirteenth volume of the Gardener's Magazine is written in the true spirit of philosophy, and may assist the cultivator in his reasonings on this subject. Every one must acknowledge how desirable it is that gardening operations, as far as is possible, be reduced to philosophical principles, in lieu of being executed on merely empirical rules. Mr. Glendinning says "The following hints are applied to the transplanting of large plants, as small ones may be removed at almost any season with nearly equal success. In the prosecution of some alterations, which have involved the planting of numerous large evergreens, and in considerable variety, immediate effect being desired, opportunities presented themselves of comparing extensively the result of the various seasons, and marking the effect of each. I may premise that an opinion, and not an erroneous one, is commonly entertained, that, should evergreen shrubs be removed during the months of November, December, January, and February, the effect will be nearly the same. Notwithstanding this, I am still, however, persuaded that there is a certain time better than any other for performing every operation, especially of gardening, the data for the fixing of which are found in the immutable laws of vegetable economy. The various scientific operations of the skilful horticulturist are guided by these axioms; and a knowledge of them, he is aware, is indispensable to the success of his performances. Hence, such an acquaintance with the physiology of plants points out to him the seasons of grafting and budding, the removal of shrubs, and every other operation

which he has to perform; and enables him, also, to calculate with certainty on his success. Having said thus much by the way of preliminary remark, I come now to what more immediately forms the subject of this paper; viz. the proper season at which evergreen shrubs should be transplanted, so as to sustain the least injury from their removal. The period, then, of the greatest action in the economy of these shrubs is surely not the desirable time; neither can that be the most fitting season when they are in a comparatively torpid state. In the former instance, the plants will suffer from the natural season of excitement, which the more or less unavoidable mutilation of the roots will render them unfit to sustain; whereas, in the latter case, the fibrous roots will perish from the extended period during which the plants will be compelled to remain in a torpid condition. Well, then, a time between the two extremes (say during the month of April) may be suggested; but this would be a fatal suggestion, as at this season all vegetable life is, as it were, charged, like a voltaic battery, waiting the influence of a genial sun to discharge its accumulated provisions into leaves, flowers, and fruit. The branches must sympathize with the roots, which, at the three periods cited, ought not to be disquieted. It will be perceptible, from the preceding observations, that there is yet another season at which the proceedings of the skilful and cautious may be rendered successful; and the guide for discovering this period is a very simple one. The time I propose shall be alike free from the extremes of either present or immediate prospective excitement, and shall yet not be the season of maximum transpiration. It is a well-known and understood fact, as well as a matter of common practice, that the successful propagation of a great number of evergreen shrubs is prosperously effected at the time the young shoots have attained a firmness of texture, easily distinguished by the practical operator. We may instance the laurel, camellia, &c., which will have arrived at this condition about the end of August. These cuttings then contain abundance of the active circulating fluid, which, in its downward course, forms a callosity which presently emits roots. It is this time, during the declining year, which I have found the most desirable season to conduct the operation of transplanting evergreen shrubs. I have thus laid down a general rule for removing evergreens familiar to every body, and mentioned a law upon which it is founded, which is within the comprehension of all. The young shoots, at this season, will have attained sufficient maturity to render their suffering from removal, or from the aridity of the season, very trifling; as the whole plant will contain enough of the active sap to propel fresh spongioles when located; so that, after a copious watering, the general appearance of the plant will have sustained little change. The preceding statement may be rather loose; still, my recommendation is founded on some degree of reason, as in practice it has proved successful. I may just add that, if it does not render the contending, and apparently somewhat anomalous, opinions held on this subject reducible into one regular and rational mode of proceeding, it may, at least, have a tendency to that end.

158 Leaf-mould, as a substitute for Peat-soil. In a former section of the Auctarium we reminded our readers that Leaf-mould was a valuable ingredient in composts for garden uses. We shall now extract some useful hints and directions from Haynes's Essay on Soils and Composts. The subject is one of primary interest to every cultivator of a garden, and one which has not met with corresponding attention. The author recommends decayed leaves as a substitute for Peat-soil; and when properly mixed with sand it will generally not inappropriately supply its place. 'In this preparation, the decayed leaves of deciduous trees are a principal ingredient. These may be readily obtained, and at an easy expense, in most situations. In October the general fall usually commences, and immediately after the first frost they will come down plentifully; when, if there is no wind, those fallen near the trees may be readily gathered into heaps. Previous, however, to forming the leaves into large heaps, it will be necessary to give the leaves an ample watering, whilst putting them together, in order to promote an early heat or sweating throughout the whole heap; such warmth being most essential to their rotting fully down, and by which they will the more speedily decay. There will also be no danger of their being disturbed or removed by the wind, if they are abundantly watered on being first put together, as they will immediately heat and turn to decay; requiring no other watering, except on the top, should the weather continue extremely dry. Having thus compleated a large heap, thrust

therein a strong and sharp-pointed stake, nearly to the bottom, there to remain, as is commonly practised in hot-beds: you may judge of the decay of the leaves by the abatement of the heat; which, if sufficient, will have much reduced the bulk of the heap. As it is necessary that the whole heap be fully and completely rotted down, it will be requisite to turn it over once or twice during the winter, after the heat has subsided; and especially in snowy or frosty weather, to render the whole more light: and it being thereby, in a slight degree, exposed to severe and penetrating frosts, the whole will better decay, and become more rotten before the spring; when it is likely that at least a part of the compost may be required for use.

On the whole being completely rotted down, it will produce a soil not dissimilar to that collected from decayed trees; and will prove equally genial to vegetation, when aided by another ingredient, to render it more similar to peat-earth. It will now therefore, be requisite to add to it one-fourth part of the softest and finest white sand that can be procured; taking care that it be intermixed, so that the whole may become fully incorporated, by repeatedly turning it over weekly, or, at least, once in a fortnight: and, in doing this, it will be necessary to remove all the rubbish you perceive in it, such as any stones, wood, tiles, or undecayed substances which might have been collected with the leaves: but on no account be prevailed upon to sift over the heap, under the idea of better mixing the sand and decayed leaves together; a process which has, invariably, proved hurtful to composts of every description. Where there is not the convenience of collecting a great quantity of these leaves at home, it may be very desirable as well as easy, to obtain them, at the fall of the leaf, from some neighbouring plantations, copses, or woods: raking them together early, as they fall from the trees; and carting them home at the most convenient times in the winter season, after they have decayed, when but little room will be required, to stow them, where they are wanted for use, On removing them home, it will be proper to afford further waterings to such leaves as remain undecayed; and they should remain, as much as possible, exposed to the action of the air, wind, rain, sun, frost, snow, &c. to mellow and ameliorate; as, without such exposure, the soil would contract a fusty and unhealthy smell, and prove ungenial to the purposes designed; always recollecting that a full exposure to the air, in composts of every description, will render them most salubrious to every species of trees, shrubs, plants, and flowers.

159 White Sand, its utility, In the business of planting cuttings in the open ground of the more tender evergreen trees and shrubs, under hand-glasses, in the autumn; as well as the more hardy greenhouse plants, such as the myrtle, fuchsia, rose, cistus, germander, &c. no unmixed soil whatever can be found to bear a comparison with the finest white sand; as cuttings planted therein will be far the most secure from mouldiness and damp, throughout the autumnal and winter seasons; during which periods, the pots in which they are planted, generally remain standing up to their rims in the common ground, as the greatest preservative from frost; but in which situation they are more exposed to damp, than if standing on the surface of the ground. Although but little more than a knob, or swelling protuberance at the foot of the cuttings, can be expected to be formed during the first autumn and winter; yet on the advance of spring, they will early make roots, even without the addition of any other soil or compost to the sand, to promote their growth; These young plants should be potted off, or transplanted in some way, as soon as they have formed sufficient roots. Immense quantities (from planting small cuttings) may thus be annually propagated, by means of covering them with full sized single hand-glasses: but this process will only extend to such as are evergreen; and amongst them not to such as are resinous, as firs, pines, &c.: these, however, producing as they do, abundance of ripe seeds in favourable seasons, we are less anxious to propagate them by cuttings. In the propagation, by this process, of the trees and shrubs alluded to, it must be recollected, that the sand is to be considered as not farther essential than merely to cause or promote a growth in the cuttings, sufficient for their transplantation; as on their being removed to another situation, in the next stage of the process, a mixture of suitable soil, with a proportion of sand only will be requisite, We are not asserting that yellow sand will not equally apply in both cases of planting cuttings of hardy evergreen trees and shrubs, both by summer planting in the open exposure, and autumn-planting under hand-glasses; but, in all the experiments we have witnessed, and throughout the whole of our

own practice, white sand, where it could be obtained, has been invariably employed, and most successfully.

When we reflect that dampness is the chief annoyance to cuttings, of almost every description, planted under hand-glasses, it seems reasonable that every propagator should strenuously guard against it; to effect which, nothing is likely to be devised so admirably calculated to discharge wet and prevent retention of moisture, as sand alone; and this in preference to every other soil or compost we know of. Barren and sterile as sand may appear to be, we know of no article of greater utility in the propagation and culture, not only of shrubby plants, but also of the more choice and delicate herbaceous plants; invariably preferring that which is most fine and soft, but which is only to be obtained in particular situations. We are not aware how far sand, of any particular description, is in itself possessed of vegetative properties; but of this we are fully assured, from numerous and repeated experiments, that there are few soils, with which it cannot be intermixed to the greatest advantage, and in various other branches of horticulture, as well as in the propagation of plants and flowers; it being admirably adapted from its opening nature, to open the pores of heavier, more close, and adhesive soils; thereby expanding the entire mass of compost, and rendering it porous, and open to the free admission and full expansion of the delicately fine thread-like roots of plants and flowers; and, in this, we have most satisfactorily witnessed and experienced its singular and superior efficacy. We have known, in various cases, plants to have been placed in soils most opposite and ungenial to their natures, and thereby early inclining to decay; but which have been speedily restored to their original vigour by a proper and timely application of white sand.

Sand, like many other articles, will be found a local rather than a general production throughout the kingdom. In its colour and softness it most materially varies; and is more or less favourable to our present purpose. That, however, which has been invariably found to surpass all others, for general and particular purposes in horticulture is a peculiarly soft and white sand, of such unusual smoothness, that it is considered as useless for certain domestic purposes, scouering, &c.; and, in point of fineness, is nearly equal to emery flour. The finer the sand is which we employ, the more soft will the compost prove which we form with it; tending to promote expansion in the heavier soils. Where none other than white sand, which is usually coarse, can be obtained, small quantities of the finer parts of it can be sifted out with a fine sieve or washed. Little argument can, however, be necessary to convince the unprejudiced florist, gardener, or amateur, of the general utility of suitable sand, when intermixed with the more cold and heavier soils; and thereby rendering them open and porous, and capable of discharging all copious falls of rain, snow, &c.; which tend to overcharge those soils which are adhesive with an undue proportion of moisture, and thereby chill and starve the stock of plants and flowers upon them.

160 An Excellent Compost. This is applicable to superior fibrous-rooted perennial, herbaceous plants, in the open ground; as well as to the common hardy and greenhouse plants. Of the efficacy as a general manure of the blood of bullocks or other animals, farmers and gardeners who have habitually employed the refuse of slaughter-houses will be able to afford testimony; and there is no method by which it can be better applied, in the culture of any crop, than as compost; as, by repeatedly turning it over, it will mix and incorporate most readily with the earth. Blood is an ingredient to be readily and cheaply procured in most situations; and it may be applied warm or cold, fresh or stale, as may best suit the convenience of the florist: it may be also kept a length of time without injury or annoyance when occasion does not require its immediate use. Where blood cannot be procured in the immediate neighbourhood, the best mode of conveying it from a distance will be in small casks, as is adopted by the sugar-bakers in London; who thus receive their supplies from the principal slaughter-houses, from whence it may be procured at a trivial expense. In general it will, however, be most convenient and efficient to use it in a compost. To form a superior compost, prepare the following ingredients, Hazle-loam earth, from the richest pasture ground; bog soil, from meadow or other low lands; hot-bed stable manure fully rotted down; and the finest white sand; mixing them in equal quantities. On first putting the above together, add bullocks or other blood, in the proportion of one gallon to two wheelbarrows' full of compost. That the whole may be more completely incorpo-

169 AUCTARIUM. 160, Haynes on Soils and Composts.

rated, give it repeated turnings over; and lay it in a situation where it may be fully exposed to the weather, as long as occasion will permit. The longer time can be allowed in preparing it, the better will the compost prove. Where it is convenient to allow twelve months for its preparation, it will require to be turned over monthly; if six months, once in a fortnight; and if a shorter time, as three months only, it will require to be turned over weekly. In such a short period as the latter, however, there will be scarcely sufficient time for the greensward to rot; which will prove a material inconvenience, as it would occasion the decay of many roots planted therein: and consequently, must be all picked out, before the compost is applied to the beds. On no account be prevailed upon to sift the compost; which process is invariably injurious, by promoting decay in most roots.

Long experience has fully demonstrated the great utility of hazle-loam earth in the culture of the superior bulbous-rooted and other flowers; but the practice of later years has clearly proved that our mode of treatment will admit of great improvement, in numerous cases, by the addition of more soft and cool soils. In the present case, the loam which ought to be procured is that partaking of a sandy nature, and somewhat light; and thereby rendered more open and inadhesive, so as to admit of the fibres of the plants more readily and effectually making way thercin, and to discharge all heavy falling rains, and prevent that standing wet so frequently injurious to roots during the cold seasons of autumn and winter: whereas that of a more close, binding and adhesive nature, inclining to clay, would by retaining such moisture, abundantly decay the roots. In procuring this loamy earth, it will be necessary to dig and take away all the turf or greensward therewith; which on becoming rotten, will enrich the compost and make it light; recollecting, that, in order to obtain only the best and richest part of the earth, you must dig no deeper than from eight to ten inches, or even less, to avoid an inferior soil. A further advantage attends the use of a loam of a sandy nature, that it will, in all stages of the business, work better than that which inclines to clay, especially on its being, in the least degree, moist or wet; and without settling heavy in the beds, so as to bind about the roots of the plants: it will also be at all times more open and loose, to admit of being hoed and raked on its surface : hence the necessity of employing fine white sand in a greater proportion than before directed, where only clayey or binding loam can be obtained

161 PEAS, EARLY CROP OF. The following description of a method of raising early Peas, by the late Thomas Andrew Knight, was published in the fifth volume of the London Horticultural Society's Transactions, and although an exact adherence to the details of the practice here described may be unimportant we know the general principle to be so advantageous that we have no hesitation in laying it before our readers. The practice is rendered valuable on account of the contingencies attending autumn-sown Peas. Mr. Knight observes, "I purposely delayed the experiment, which I proceed to relate, till the first day of March. Upon that day the ground was prepared, and part of the seed sown, as usual, in rows, were the plants were to remain: at the same time other peas of the same early kind, were sown in circles, within the circumference of pots, of ten inches in diameter, inside measure. These pots were nearly filled with a compost of a peculiar kind; from the highly nutritive and stimulating qualities of which I anticipated much acceleration in the growth of my plants; with the advantage of being able to remove them, at the proper period, to the open ground, without having their roots at all detached from their pasture, owing to the fibrous organic texture of the compost. This was made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented stable manure, without litter; and a quantity of the ashes of burnt weeds, containing, as usual, a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials. The whole was reduced to small fragments, and well intermixed; and the pots were filled with it, within an inch of their tops. The peas were then sown upon the surface of the compost, and covered with common mould; and the pots were placed in my peach house. In this they remained till the plants were an inch high, when they were removed into the open air; but they were protected, during the night, for some time, and particularly when the character of the evening indicated the probability of frost.

In the last week of March, the plants were taken from the pots, and planted in rows in the open ground; and I have the satisfaction to observe, that very nearly the whole of the compost adhered firmly to their roots; and that their growth, subsequently, was not apparently checked in any degree, by their transplantation. They were placed in rows, contiguous to those which had been previously sown; a small quantity of compost, similar to that put into the pots being added; and the common mould was then closed round their roots, and raised upon each side of the rows. Sticks to support and protect the plants were immediately added in rather more than the ordinary number and quantity; and subsequently, no particular care or attention was paid to them. On the morning of the 29th of April, I ascertained the comparative growth of my plants, which had been subjected to the different modes of treatment above mentioned, in two rows which grew contiguous to each other: when I found the height of those which had been raised in pots to be fifteen inches; and that of the others to be scarcely four inches; and I much doubt, whether I ever possessed in the most favourable season, as forward a crop of peas as my garden now contains.

Many causes appear to me to have operated in conjunction, to produce the foregoing effects. It has long been known that snow does not, in winter, lie so long upon the ground which has been manured in the same season, with fresh unfermented stable manure, as upon unmanured ground; and therefore I conclude, that some degree of heat existed in and emanated from the compost; though probably, never in a sufficient degree to have been sensible to the touch of any warm-blooded animal. If placed in a considerable heap, such a compost as that described, and even when the stable manure is much less in quantity will heat violently. I have often suffered the compost of this kind, which I employ for pine-apples, to become hot, to prevent the subsequent appearance of earth-worms in it. If heat was in any degree generated by the compost in which the peas grew, the escape of it was necessarily retarded by the numerous sticks by which the ground was partially covered; and little injury could have been sustained from the shade of those, because the quantity of light, comparatively with the temperature of the air, and growth of the plants is very great after the vernal equinox; and it is every day increasing in power and influence. Another cause of the rapid growth of the transplanted peas, has probably, been the very favourable state of the soil, in which they have been placed it having been turned over with the spade, immediately before transplantation took place; for peas never thrive well in strong soils, when such have been compressed, and soddened, in early spring, by much moisture. But the chief causes of their very rapid growth have, I believe, been the highly nutritive and stimulating quality of the compost, and the presence of some degree of additional warmth: for I have, in former seasons derived great advantage from placing a moderate quantity of nearly similar compost immediately under the rows of peas which have been sown in the usual manner; except that the seeds were placed upon the surface of the soil within which the compost had been buried, and covered by having had the soil collected from each side, to form a ridge over them. In all cases, where a compost of the kind I have described is employed to accelerate the growth of dwarfish and early peas, it should be used in small quantities only; that the early growth of the plants may be promoted, without excessive, and consequently injurious, luxuriance being given. For transplanted peas, I should prefer a poor and light soil; so that the roots might be led, as they would be under such circumstances, to confine themselves to narrow limits; and the plants, consequently, be brought to an early maturity." The above experiment was ultimately productive of a very abundant crop, at least twelve days earlier than those sown at the same time in the usual way, and with a much more rapid succession of produce.

162 Microscope. The great difficulty of viewing the animalculæ, &c. in fluids under high magnifying powers, must have been continually felt, by all the admirers of the microscope. An improvement, therefore, which effectually removes every obstacle to this investigation,—by rendering the surface of the fluid truly plane, spreading it thinner, and extending it to a much wider space around, at the same time confining the animalculæ in more limited depth, whereby their forms and movements become most readily discernible; and also preventing evaporation from the surface of the fluid, which often dims the lens and perplexes the observer, or even puts a stop to his proceeding; as well as totally doing away the possibility of the lens dipping into the fluid, whilst adjusting its focus, as is continually happening in the present methods of viewing these

objects;—will, no doubt, be duly appreciated by the scientific world. It will render every one capable of extending the powers of the microscope in a much greater degree than has hitherto been done; and thereby, must inevitably lead to the discovery of many of Nature's minute secrets, which for want of such facilities have remained indefinite, or entirely concealed. The necessity of continually adjusting the microscope, from time to time, to follow the various movements of the animalculæ, in rising to the surface, or descending into the depths of the fluid, is by this discovery rendered totally unnecessary. The evaporation of the fluid is very greatly diminished by this invention; and, consequently, the examination of it, and of the various animalculæ, &c. contained in it, may be prolonged to a much greater period than could be effected under the usual modes of employing high magnifying powers.

These great advantages may appear to many to be quite unattainable, by any thing less than a great expense in apparatus; but, when it is said, that the only addition to that usually employed, consists in laying upon the surface of the drop of fluid a thin slice of talc or mica, the wonder ceases; and we can only wonder that so exceedingly obvious, simple, and useful a contrivance should have remained so long unemployed. Of course, it will be understood, that the fluid should be laid upon the flat surface of a glass slip, when under examination. The animalculæ in the water may be viewed under the power of a lens in a single microscope, of only one sixtieth of an inch focus, with the utmost facility; and also, the full powers of a compound microscope may be employed in the same manner, the object lens nearly touching the talc.

The substitution of a slip of talc, in place of the two glass slips, usually employed in viewing transparent objects, well deserves to be universally adopted. This new application of it, however, to viewing the animalculæ, &c. in fluids, will now render slips of talc an indispensible part of the microscopic apparatus: in their absence, one of the round talcs, usually to be met with, will be found highly useful upon many occasions. Instantly upon the talc touching the surface of the fluid, the capillary attraction between the talc and the slip of glass, disperses it on every side, and produces most of the beneficial results described in the beginning of this article. The others follow as matters of course. The slip of talc should be rubbed as little as possible, in cleaning it, as it is exceedingly liable to become scratched, to lose its polish, and to be dull or discoloured; when either of these is the case, it should be exchanged for another slip.

163. PEAR TREES AGAINST WALLS. It is now no uncommon practice for the horticulturist to pave the bottom of his fruit tree borders, but as the following observations, written, it is evident, by a practical man, possess much good reasoning, we copy them. They are communicated by Mr. Robert Hiver to the Gardener's Magazine, vol. v. p. 60. "There are few subjects in horticulture which can be more acceptable to your readers than a system by which good crops of fruit may be obtained from pear trees planted against the east and west walls in gentlemen's gardens; the bad crops these trees have afforded have been proverbial ever since I can remember; and the unnatural schemes that are now resorted to, such as strangulation, ringing, depressing of the branches, and reverse-grafting, show that a good system of cultivation is not yet established. This failure has generally been imputed by gardeners to the climate; but as the trees are seldom without fruit at the extremity of the branches, the supposition may be considered erroneous.

It is about twenty years ago since I noticed a brown Beurrée pear tree, trained against the east front of a farmer's cottage. This tree grew upon a limestone rock, where there was very little earth, yet it never failed to yield, yearly, plenty of large and well-flavoured fruit. From what I observed of this tree, it appeared evident that the rich and deep border, usually prepared by gardeners, was decidedly wrong, as the plants in this case generated too much sap, which always induces disease and barrenness; and, I believe it will be found in the tree, as in the human constitution, that the state of health consists in the medium between emptiness and repletion. Sir H. Davy has shown the utility of stones in agricultural crops; and I have found them exceedingly beneficial in the formation of fruit-tree borders; they prevent the accumulation of water in very wet weather, and also retain sufficient moisture for the purposes of the plant in dry seasons. In 1813, I replanted an old pear wall, 240 ft. long: the border for these trees was 12ft. wide, and only 26 in. deep, 8 in. of which were filled with stones, such as could be most readily procured in the neighbourhood, and the remaining 18 with the mould which composed the old border. By this scanty supply of earth for the roots of these plants I have succeeded in obtaining a fruitful and healthy growth, equally remote from debility and luxuriance; and by this simple process I procure fruit all over the tree, as regularly as if it had been mechanically placed, both plentifully up the main stem, and on the lowest horizontal branches. My trees are fan-trained in the best manner; the shoots are kept as uniform and straight as the plications of the instrument from whence the term is derived, and, when the fruit is full grown exhibit one of the most interesting scenes to be met with within the confines of a garden.

With regard to pruning, the knife should be used as sparingly as possible; I conceive it to be as injurious to this tribe of fruit-trees, as the lancet is to animal life; it creates those inconveniences which it is employed to remove: whoever indulges in its free use, most certainly defeats his own purpose. Let any man who is inclined to dissent from this opinion, consider the common thorn confined in a hedge, where it annually undergoes the operation of clipping, and the shrub in its primitive growth, and he will want no argument to convince him of the impropriety of the practice. But my plants require very little assistance from the knife: they make no breast-wood, the energies of the tree being chiefly engaged in forming blossom-buds for the future crop.

It may be justly inferred, from what is here stated, that the bad success which most gardeners have experienced in the cultivation of this valuable fruit, arises principally from the luxuriant state of their trees; the limited space which they occupy on the wall is so disproportionate to their natural growth, that it is almost impossible, with deep and highly manured borders to reclaim them from a habit of plethorical sterility. The farina and the whole fructification, partake of this unhealthy condition; and it may be observed, that fruits fecundated with bad pollen scarcely ever resist the atmospheric changes which they afterwards encounter, From observations made in vegetable physiology, I am persuaded that the tree is principally the produce of the earth, and the fruit of the atmosphere; a great diminution of vigour may take place in the one, without any perceptible alteration in the other. It is, therefore, the first object of the cultivator to proportion the supply of nutriment to the extent of his tree, and this will be best effected by the shallow border above described."

164 GERMINATION OF SEEDS. This subject is one which falls more or less frequently under the observation of all our readers, but the attention of all may not be alike directed to the interesting circumstances under which it takes place, and its attendant phenomena; therefore, we purpose laying before our readers, information on this process of nature, as given by Professor Thompson, in his admirable work on the Chemistry of Vegetable bodies, p. 961. He says "Natural historians have proved, by a very complete induction of facts, that all plants arise from seeds. The pretended exceptions have disappeared, one after another, as our knowledge of vegetables increased: and now there remains scarcely a single objection entitled to the smallest regard. The attempt of Girtanner to revive the doctrine of equivocal generation, deserves no attention whatever; because his conclusions are absolutely incompatible with the experiments of Mr. Sennebier upon the very substance on which his theory is founded.

A seed consists of three parts; namely the cotyledons, the radicle, and the plumula, which are usually enclosed in a cover. If we take a garden bean, we may perceive each of these three parts with great ease; for this seed is of so large a size, that all its organs are exceedingly distinct. When we strip off the external coats of the bean, which are two, and of different degrees of thickness in different parts, we find that it easily divides into two lobes, pretty nearly of the same size and figure. Each of these lobes is called a cotyledon. The cotyledons of the bean, then, are two in number. Near that part of the lobes which is contiguous to what is called the eye of the bean, there is a small round white body, which comes out between the two lobes. This body is called the radicle. Attached to the radicle there is another small round body, which lies between the cotyledons, and wholly within them, so that it cannot be seen till they are separated from each other. This body is called the plumula. The appearance and shape of these three parts vary much in different seeds; but there is no seed which wants them. The figure and size of the seed depend chiefly upon the cotyledons. This is evidently the case with the bean, and it is so with all other seeds. The number of cotyledons is different in different seeds. Some seeds have only one cotyledon, as the seeds of wheat, oat, barley, and the whole tribe of grasses; but most seeds, like the bean, have two cotyledons.

When a seed is placed in a situation favourable to vegetation it very soon changes its appearance. The radicle is converted into a root, and sinks into the earth, the plumula on the other hand, rises above the earth, and becomes the trunk or stem. When these changes take place, the seed is said to germinate: the process itself has been called germination. Seeds do not germinate equally and indifferently in all places and seasons. Germination, therefore, is a process which does not depend upon the seed alone; something external must also affect it. It is a well known fact, that seeds will not germinate unless moisture have access to them; for seeds, if they are kept perfectly dry, never vegetate at all, and yet their power of vegetation is not destroyed. Water, then, is essential to germination. Too much water, however, is no less prejudicial to most seeds than none at all. The seeds of water plants, indeed, germinate and vegetate extremely well in water; but most other seeds, if they are kept in water beyond a certain time, are rotted and destroyed altogether.

It is well known also, that seeds will not germinate, even though supplied with water, provided the temperature be below a certain degree. No seed, for instance, on which the experiment has been tried, can be made to vegetate at or below the freezing point: yet this degree of cold does not injure the vegetating power of seeds; for many seeds will vegetate as well as ever after having been frozen, or after having been kept in frozen water. We may conclude, then, that a certain degree of heat is necessary for the germination of seeds: and every species of plant seems to have a degree peculiar to itself, at which its seeds begin to germinate; for every seed has a peculiar season at which it begins to germinate, and this season varies with the temperature of the air. Mr. Adanson found that seeds, when sown at the same time in France and in Senegal, always appeared sooner above ground in the latter country, where the climate is hotter than in France.

Seeds, although supplied with moisture and placed in a proper temperature, will not germinate, provided atmospherical air be completely excluded from them. Mr. Ray found that grains of lettuce did not germinate in the vacuum of an air pump, but they began to grow as soon as air was admitted to them. Homberg made a number of experiments on the same subject, which were published in the Memoirs of the French Academy for the year 1693. He found that the greater number of seeds which he tried refused to vegetate in the vacuum of an air pump. Some, however, did germinate: but Boyle, Muschenbroek, and Boerhave, who made experiments on the same subject in succession, proved beyond a doubt that no plant vegetates in the vacuum of an air pump; and that in those cases in which Homberg's seeds germinated the vacuum was far from perfect, a quantity of air still remaining in the receiver. It follows, therefore, that no seed will germinate unless atmospherical air, or some air having the same properties, have access to it. It is for this reason that seeds will not germinate at a certain depth below the surface of the earth. Mr. Scheele found that beans would not germinate except oxygen gas were present: Mr. Achard afterwards proved that oxygen gas is absolutely necessary for the germination of all seeds, and that no seed will germinate in azotic gas, or hydrogen gas, or carbonic acid gas, unless these gasses contain a mixture of oxygen gas. These experiments have been confirmed by Mr. Gough, Mr. Cruikshank, and many other philosophers. It follows, therefore, that it is not the whole atmospheric air, but merely the oxygen gas which it contains, that is necessary for the germination of seeds. Nay, Mr. Humboldt has ascertained that seeds vegetate more rapidly when steeped in chlorine, or when watered with it; and this substance is well known for the facility with which it decomposes water and sets at liberty oxygen. It seems even to augment the vegetative power of seeds. At Vienna several seeds which had been long kept, and which had constantly refused to germinate, grew readily when treated with it.

Light also has considerable influence on the germination of seed. Ingenhousz found that seeds always germinate faster in the dark than when exposed to the light. His experiments were repeated by Mr. Sennebier with equal success. But the Abbé Bertholin, who distinguished himself so much by his labours, to demonstrate the effect of electricity on vegetation, objected to the conclusions of these philosophers, and affirmed that the difference in the germination of seeds in the shade and in the light was owing, not to the light itself, but to the difference in the moisture in the two situations; the moisture evaporating much faster from the seeds in the light than from those in the shade; and he affirmed, that when precautions were taken to keep the seeds equally moist, those in the sun germinated sooner than those in the shade. But when Mr. Sennebier repeated his former experiments, and employed every possible precaution to ensure equality of moisture in both situations, he constantly found the seeds in the shade germinate sooner than those in the light. We may conclude, therefore, that light is injurious to germination; and hence one reason for covering seeds with the soil in which they are to grow. But from the recent experiments of Saussure, there is reason to believe that light is only injurious in consequence of the heat which it produces; for when the direct rays of the sun were intercepted, though light was admitted, the germination of the seeds was not sensibly retarded.

Thus we have seen that seeds will not germinate unless moisture, heat, and oxygen be present. Now, in what manner do these substances affect the seed? What are the changes which they produce? It was observed before, that all seeds have one or more cotyledons. These cotyledons contain a quantity of farinaceous matter, laid up on purpose to supply the embryo plant with food as soon as it begins to require it. This food, however, must undergo some previous preparation before it can be applied by the plant to the formation or completion of its organs. It is probable that all the phenomena of germination which we can perceive, consist in the chemical changes which are produced in that food, and the consequent development of the organs of the plant.

When a seed is placed in favourable circumstances, it gradually imbibes moisture, and very soon after emits a quantity of carbonic acid gas, even though no oxygen gas be present. If no oxygen gas be present, the process stops here, and no germination takes place; but if oxygen gas be present, a portion of it is converted into carbonic acid gas. From the experiments of Saussure, it appears, that if seeds be left to germinate in a determinate portion of oxygen gas or common air, the bulk of that gas is not altered; the carbonic acid formed being equal to the oxygen which has disappeared. Hence it follows, that the carbonic acid contains in it exactly the whole oxygen consumed. No oxygen, then, is absorbed by the seed; or at least, if it be absorbed, none of it is retained, the whole being thrown out in combination with carbon. The quantity of oxygen thus changed into carbonic acid by the germination of seeds, is in some measure proportional to the weight of the seed: but some seeds require more than others. In the experiments of Saussure, wheat and barley, weight for weight, consumed less oxygen than peas; while peas consumed less than beans and kidney-beans. The oxygen consumed by wheat and barley amounts to between $\frac{1}{1000}$th and $\frac{1}{2000}$th of their weight; while that consumed by beans and kidney-beans may amount to $\frac{1}{100}$th part of their weight. Similar experiments were made by Dr. Woodhouse.

From the observation of M. T. de Saussure, it appears that during the first stage of germination, the carbonic acid evolved exceeds the bulk of the oxygen absorbed, but afterwards the oxygen absorbed exceeds the bulk of the carbonic acid evolved. Azotic gas he found was always absorbed during germination in air, but not during germination in oxygen gas, or a mixture of equal volumes of oxygen and azotic gases. It does not appear that any water is decomposed during the process of germination, at least we have no evidence that it is so. Neither hydrogen nor oxygen gas are emitted. It would not be surprising if a portion of water, so far from being decomposed, were actually formed by the union of its constituents previously existing in the grain. When Saussure dried seeds at a certain temperature before germination, and afterwards brought them to the same degree of dryness after germination, he always found that the loss of weight was greater that it ought to have been. Thus 73 peas, which together, (when dried at 77°) weighed 200 grains, when left with five times their weight of water in a vessel full of air, and standing over mercury for two days, germinated, and produced 4½ cubic inches of carbonic acid. They were taken out and dried slowly at the same temperature; during their drying they changed 4½ cubic inches more of oxygen into carbonic acid. Now these 9 inches of carbonic acid contain 1.7 grains of carbon. The water in which the peas had been placed while germinating, when evaporated to dryness, left 0.75 grains of mucilaginous matter. Thus the peas, by germinating and drying ought to have lost only 2.45 grains, leaving a residue of 197.55 grains. But their weight was only 189 grains. So that they had lost 8 grains more than can be accounted for by the mucilage taken up by the water and carbonic acid formed. We are obliged to suppose this loss owing to water. From Saussure's experiments, this water seems to be formed or set at liberty during the drying of the seeds, for the quantity of it always increased with the slowness of the process of drying.

Several seeds, by germinating, acquire a sweetish taste. Hence it has been supposed, that the mucilage which they contain is converted into saccharine matter. We see that the carbon is diminished by germination; and unless water be formed, the proportion of hydrogen and oxygen must be proportionably augmented. It is obvious from the process of malting, that heat is generated during germination. I have seen the radicles of barley, when kept without turning on the malt floor, shoot out half an inch in a single night, and the heat rise as high as 100°.

So far seems to be the work of chemistry alone; at least we have no right to conclude that any other agent interferes; since hay, when it happens to imbibe moisture, exhibits nearly the same processes. Carbonic acid gas is evolved, oxygen gas is absorbed, heat is produced so abundantly, that the hay often takes fire: at the same time a quantity of sugar is formed. It is owing to a partial change of the same kind that old hay generally tastes much sweeter than new hay. Now we have no reason to suppose that any agents peculiar to the vegetable kingdom reside in hay; as all vegetation, and all power of vegetating are evidently destroyed. But when the farina in the seeds of vegetables is converted into sugar, a number of vessels make their appearance in the cotyledon. These vessels may indeed be detected in many seeds before germination commences, but they become much more distinct after it has made some progress. Branches from them have been demonstrated by Grew, Malpighi, and Hedwig, passing into the radicle, and distributed through every part of it. These evidently carry the nourishment prepared in the cotyledons to the radicle; for if the cotyledons be cut off, even after the processes above described are completed, germination as Bonnet and Sennebier ascertained by experiment, immediately stops. The food therefore is conveyed from the cotyledons into the radicle; the radicle increases in size, assumes the form of a root, sinks down into the earth, and soon becomes capable of extracting the nourishment necessary for the future growth of the plant. Even at this period, after the radicle has become a perfect root, the plant, as Sennebier ascertained by experiment, ceases to vegetate if the cotyledons be cut off. They are still, then, absolutely necessary for the vegetation of the plant. The cotyledons now assume the appearance of leaves, and appear above the ground, forming what are called the seminal leaves of the plant. After this the plumula gradually increases in size, rises out of the earth and expands itself into branches and leaves. The seminal leaves soon after this, decay and drop off, and the plant carries on all the processes of vegetation without their assistance.

As it does not appear that there is any communication between the cotyledons and the plumula, it must follow that the nourishment passes into the plumula from the radicle; and accordingly we see that the plumula does not begin to vegetate till the radicle has made some progress. Since the plant ceases to vegetate, even after the radicle has been converted into a root, if the cotyledons be removed before the plumula is developed, it follows that the radicle is insufficient of itself to carry on the processes of vegetation, and that the cotyledons still continue to perform a part, Now we have seen already what that part is; they prepare food for the nourishment of the plant. The root, then, is of itself, insufficient for this purpose. When the cotyledons assume the form of seminal leaves, it is evident that the nourishment which was originally laid up in them for the support of the embryo plant is exhausted, yet they still continue as necessary as ever. They must therefore receive the nourishment which is imbibed by the root; they must produce some changes on it, render it suitable for the purposes of vegetation, and then send it back again to be transmitted to the plumula. After the plumula has acquired a certain size, which must be at least a line, if the cotyledons be cut off, the plant, as Mr. Bonnet ascertained by a number of experiments, afterwards repeated with equal success by Mr. Sennebier, does not cease to vegetate, but it continues always a mere pigmy: its size, when compared with that of a plant whose cotyledons are allowed to remain, being only as 2 to 7. When the plumula has expanded completely into leaves, the cotyledons may be removed without injuring the plant, and they very soon decay of themselves. It appears, then, that this new office of the cotyledons is afterwards performed by that part of the plant which is above ground.

Thus we have traced the phenomena of germination as far as they have been detected. The facts are obvious; but the manner in which they are produced is a profound secret. We can neither explain how the food enters into the vessels, how it is conveyed to the different parts of the plant, how it is deposited in every organ, nor how it is employed to increase the size of the old parts, or to form new parts. These phenomena are analagous to nothing in mechanics or chemistry, but resemble exactly the organization and nourishment of animals. They belong therefore to that difficult branch of science known by the name of Physiology.

165 GRAPES TO RIPEN EARLY In a communication to the London Horticultural Society, J. Williams, Esq. of Pitmaston, detailed a method of hastening the Maturation of Grapes, which may be important to many of our readers. Observing that old trees, with long trunks, the rigidity of whose vessels probably obstructed the descent of the sap, ripened their fruit the earliest, he considered that the same effect could be produced artificially by ringing the stem or branches. This he tried, with success, and says, "The best time for performing the operation on Vines growing in the open air is towards the end of July, or beginning of August; and it is a material point, not to let the removed circle of bark be too wide: from one to two eighths of an inch will be a space of sufficient width; the exposed alburnum will then be covered again with new bark before the following winter, so that there will be no danger of injuring the future health of the tree. It is not of much consequence in what part of the tree the incision is made, but in case the trunk is very large, I should then recommend, that the circles be made in the smaller branches.

It is to be observed that all shoots which come out from the root of the vine, or from the front of the trunk situated below the incision, must be removed as often as they appear, unless bearing wood is particularly wanted to fill up the lower part of the wall, in which case one or two shoots may be left.

It will be satisfactory to the philosophic horticulturist to follow Mr. Williams through his experiments, from which he came to the preceding conclusions. He says, "to prove whether or not my conjectures were correct, I made incisions through the bark on the trunks of several Vines growing in my garden, removing a circle of bark from each, and thus leaving the naked alburnum above an inch in width completely exposed; this was done in the months of June and July. The following autumn the fruit growing on these trees came to great perfection, having ripened from a fortnight to three weeks earlier than usual: but in the succeeding spring, the Vines did not shoot with their accustomed vigour, and I found that I had injured them by exposing the alburnum unnecessarily."

"Last summer these experiments were repeated; at the end of July, and beginning of August, I took annular excisions of bark from the trunks of several of my Vines, and that the exposed alburnum might be again covered with new bark by the end of autumn, the removed circles were made rather less than a quarter of an inch in width. Two vines of the White Frontiniac, in similar states of growth, being trained near to each other on a south wall, were selected for trial; one of these was experimented on, (if I may use the term) the other was left in its natural state, to form a standard of comparison. When the circle of bark had been removed about a fortnight, the berries on the experimented tree, began evidently to swell faster than those on the other, and by the beginning of September showed indications of approaching ripeness, while the fruit of the unexperimented tree continued green and small. In the beginning of October the fruit on the tree, that had the bark removed from it, was quite ripe, the other only just began to show a disposition to ripen, for the bunches were shortly afterwards destroyed by the autumnal frosts. In every case in which circles of bark were removed, I invariably found that the fruit not only ripened earlier, but the berries were considerably larger than usual, and more highly flavoured. The effects thus produced, I can account for only, by adopting Mr Knight's theory of the downward circulation of the sap, the truth of which these experiments, in my opinion, tend strongly to confirm. I therefore imagine by cutting through the cortex and liber without wounding the alburnum, that the descent of that portion of the sap, which has undergone preparation in the leaf is obstructed and confined in the branches situate above the incision; consequently the fruit is better nourished and its maturation hastened. It is certainly a considerable point gained in the culture of the vine, to be able to bring the fruit to perfection, by a process so simple and so easily performed."

"I think that this practice may be extended to other fruits, so as to hasten their maturity, especially Figs, in which there is a most abundant flow of returning sap; and it demonstrates to us, why old trees are more disposed to bear fruit than young ones. Miller informs us, that the vineyards in Italy are thought to improve every year by age, till they are fifty years old. It therefore appears to me, that nature in the course of time, produces effects similar to what I have above recommended to be done by art. For, as trees become old, the returning vessels do not convey the sap into the roots, with the same facility they did when young; thus by occasionally removing circles of bark, we only anticipate the process of nature; in both cases a stagnation of the true sap is obtained in the fruiting branches, and the redundant nutriment then passes into the fruit. I have sometimes found that after the circle of the bark has been removed, a small portion of the inner bark has adhered to the alburnum; it is of the utmost importance to remove this; though ever so small, otherwise in a very short space of time, the communication is again established with the root, and little or no effect produced. Therefore in about ten days after the first operation has been performed, I generally look at the part from whence the bark was removed, and separate any small portion, which may have escaped the knife the first time."

To the cultivator of Vines on open walls in England, and there are but few persons who occupy a house in the country but may cultivate the Vine, the practice here detailed appears most important. Mr. Williams found that when he had taken off a ring of bark of unnecessary width from the trunks of his Vines, his success, in regard to the fruit, was complete, but that his Vines were less vigourous in the following spring. This would be expected; but as the same effect may be produced by ringing the branches, no such inconvenience would be likely to arise, because, if the trees be trained on Mr. Hoare's principle, as detailed under section 94 of the Auctarium, the mutilated stems would be wholly cut away as soon as the fruit on them had been matured. We recommend every person possessing Vines to aim at combining these advantages.

166 WATERPROOF CANVASS. As gardening operations may frequently be much assisted by waterproof canvass, we copy the following directions for preparing it from the French of Farrimann and Thilly, as translated in the fifth volume of the Technical Repository. "To 100lbs. of the best linseed oil add 1½lbs. of acetate of lead, 1¼lbs. of calcined umber, 1½lbs. of white-lead, and 1½lbs. of very finely-powdered pumice stone. These solid substances, well ground and mixed together, must be boiled in the oil for ten hours, over a moderate fire, to prevent the oil from burning. This varnish should be of such a consistence, that, when mixed with a third part of its weight of pipe-clay, it should be as thick as treacle. It should be left to settle eight days, and then passed through a lawn sieve. Then grind in a solution of strong and clear glue, as much pipe-clay as amounts in weight to the tenth part of the oil employed, and mix to the consistence of ointment; adding the varnish by degrees, and stirring it well with a wooden spatula. This varnish must be repeatedly stirred, till it becomes perfectly fluid; and then the desired tint is given by adding a fourth part of the colour ground in oil. The linen must be stretched upon a wooden frame; and the composition applied upon it, with a large spatula, three inches broad and nine inches long. The frame, then, must be inverted, and the operation repeated upon the other side of the cloth: it is then to be left to dry for a week, and separated from the frame for use. This cloth may be used for riding hoods, covers for carriages, &c."

167 FRUIT, ITS CHANGE OF CHARACTER. The following observations of a late assistant to the London Horticultural Society, inserted in the fifth volume of its Transactions, are such as should be known to the fruit grower, and will be interesting to the Physiologist. "In the course of the two last seasons, several specimens of fruits came within my observation, in which a deviation from their true character was very perceptible. In remarking on the evident intermixture of colour, form, and flavour, which some of these fruits presented, I did not hesitate

to ascribe it to the farina of one variety having come in contact with the flowers of another, at a moment when the stigmas were in a proper condition to receive it: and, on mentioning my opinion, I was surprised to find, that the fact of such intermixture producing an immediate change in the fruit, was generally doubted, and by many persons pronounced to be impossible. This led me to inquire, whether the subject had ever before engaged the attention of horticulturists; and not to go farther back than the beginning of the last century, (though both Theophrastus and Pliny seem to allude to it,) I found that the notion was entertained by Bradley, who, in his New Improvements in Planting and Gardening, after giving directions for fertilizing the female flowers of the hazel with the pollen of the male, says,—" By this knowledge we may alter the property and taste of any fruit, by impregnating the one with the farina of another of the same class; as, for example, a Codlin with a Pearmain, which will occasion the Codlin, so impregnated, to last a longer time than usual, and be of a sharper taste: or if the winter fruit should be fecundated with the dust of the summer kinds, they will decay before their usual time: and it is from this accidental coupling of the farina of one kind with the other, that, in an orchard where there is variety of apples, even the fruit gathered from the same tree differs in its flavour and times of ripening; and moreover, the seeds of those apples so generated, being changed by that means from their natural qualities, will produce different kinds of fruit, if they are sown."

In the Philosophical Transactions, also, for the year 1745, the subject is noticed by Mr. Benjamin Cook, in a paper, concerning the effect which the farina of the blossoms of different sorts of apple-trees had on the fruit of a neighbouring tree. In this communication it is stated, that Mr. Cook "sent to Mr. Peter Collinson, some Russetings, changed by the farina of a next neighbour, whose name he wanted skill to know; but could only say, that the Russeting had acquired its face and complexion. Mr. Collinson then produced several samples of the apples: an untainted Russeting; a Russeting changed in complexion, which grew among a great cluster of unaltered brethren; and some apples of the other tree which had caused the change in the Russetings, and whose fruit, had in return, received a rough coat from the Russetings." A farther proof of such intermixture taking place, is given by the same writer, in the Transactions for the year 1748, and again alluded to by him in those for the year 1749.

Having thus shewn that the opinion entertained is not a novel one, I shall proceed to mention the instances which I have observed. In the spring of 1819, I gave some carefully-saved melon seeds, of the Netted Succado kind, to a friend near London. The young plants raised from these were injudiciously planted by the gardener, in a frame with another larger and inferior variety. The fruits of the Succado set well; but, as they swelled, they gave evident symptoms of having lost their true character; and, when cut, were found to be very worthless; arising, as I conceive, from the share which the inferior variety had in them. In the autumn of the same year, I examined on the trees in Mr. Braddick's garden, at Thames Ditton, an evident mixture of character in a Codlin and the Ribston Pippin, in more than one individual, on the sides of the trees next to one another; while the fruit on the opposite sides where wholly untainted. The probability of such mixtures taking place is great in Mr. Braddick's Garden, owing to many varieties being grafted on the same stock, and to the closeness with which both the espalier and standard trees are planted. Early in the year 1820, Mr. Braddick sent to the Society samples of two sorts of apples of the preceding year's growth which he had himself taken from the trees, and carefully preserved, to shew the extraordinary sport which they had made. The two sorts were the Holland Pippin, and the White Winter Calville, apples totally dissimilar in appearance; they grew on low standards, very near each other: two of the specimens, gathered from the sides of the trees not contiguous, retained their natural character perfectly well, but the White Calville gathered from the side of the tree next the Holland Pippin, had lost much of its own form and colour, and partaken largely of those of its neighbour; while the Holland Pippin, taken from the side next the Calville, had become nearly a Calville in form and colour. In October of the same year, Mr. Brogden shewed me two apples, in which a no less remarkable change had taken place. The one was a French Crab, grown near a Ribston Pippin, the character of which it had taken; and the other was a Golden Pippin, which grew near a Russet, and in which the two varieties, though so wholly different were evidently blended. These several instances, all coming within my observation in the course of two seasons, have fully satisfied me, that a change both in character and quality, is frequently effected. It will be for the physiologist to instruct us as to the mode by which it is done; and probably a close investigation of the subject may discover, in this process of nature, sufficient to account for the occasional appearance of a nectarine on the same branch with a peach: this, indeed, appears to me a more reasonable mode of accounting for such an anomaly, than any which I have yet heard suggested.

I have noticed these few facts, for the purpose of drawing the attention of horticulturists to the subject; and I trust, that those who have leisure and opportunities will, by actual experiment, endeavour to ascertain whence these occasional deviations arise. Such an investigation will not be useless; for if their does exist in fruits such a liability to change, it will at once be evident to the intelligent cultivator how much care is requisite in growing melons, cucumbers, &c. to secure their fine characters, even without reference to saving seed for a future crop. Such experiments will, I doubt not, frequently succeed, if made with care and on large-flowered plants. On apples, pears, &c. it will probably be accident only that will give success.

168 Distribution of Orchidaceæ. The universal admiration bestowed on orchidaceous plants may render occasional observations regarding them not uninteresting, even to those who take no part in the cultivation of these members of the nobility of vegetation. As they require to be constantly kept in a high stove temperature, under peculiar management, few persons, comparatively, devote their time and pecuniary means to their culture; still, through floral exhibitions and the liberality of those who do possess them, most persons, who desire it, have opportunities of witnessing the variously mingled colouring, and the monstrous shapes, assumed by these plants. This subject has been more immediately brought under our notice, by the splendid publication of James Bateman, Esq. who possesses a magnificent collection of this noble family of plants; a family which, as he says, "is remarkable for having always its dwelling aloft upon the branches of trees, and which scorns the lowly ground; like the seats and castles of the great, which are usually built in elevated situations." In the days of Linneus this family

contained 100 known species, the zealous researches of modern botanists have extended the number to 2000; and from the success attending the exertions of numerous botanists who are travelling the wildest parts of Asia, Africa, and America, in quest of these and other plants, no just estimate can be made of the magnitude to which ultimately the Flora of the globe may be found to extend.

As the Botanic Garden is intended to interest and assist those who cultivate flowers in the open ground of our own climate, so the Botanist is intended to carry out the science still further, and to pourtray, chiefly, those plants of the most surprising forms, which demand of us the protection of the greenhouse or the stove. Here we have, and intend still further to delineate some of the choicest specimens of orchidaceous plants, to which the above observations refer. Mr. Bateman, in reference to their geographical distribution, observing that "Asia, Africa, and America will, perhaps, be found to divide the species of the order amongst them into three nearly equal proportions (for the few which Europe produces need scarcely be taken into the account); and the closer we approach the tropics, the more numerous and beautiful they become. Arrived, at length, within the precincts of the torrid zone, we find them no longer 'prone on the ground' as heretofore, but conspicuous on the branches of the most rugged trees of the dampest and wildest forests, attracting the eye of the naturalist from afar, by the dazzling brilliancy of their colours, or arresting his attention by their delicious fragrance. And, here, we must take occasion to observe, that, although plants of this description are not unfrequently termed 'parasitic,' the epithet is altogether misapplied; for while the parasites prey upon the vital juices of their victims, and perish with them, the 'epiphytes' derive nothing but their stay, or local habitation, from the plants on which they have established themselves; and continue to flourish and flower, indifferent whether their supporters live or die. The great majority of the Orchidaceæ of the tropics belong to the latter, or epiphytic, class; there are however, a few that do not, as was long ago observed by the same ingenious Rumphius, to whom we have already had occasion to advert. After noticing, in terms of due commendation, the dignified habits of most of the tribe, he proceeds with a sigh to remark that 'among these vegetable nobles, just as among the nobles of mankind, some degenerate individuals are ever to be found, who are on the ground always, and seem to constitute a class of their own.' But it is not merely in their habits that the terrestrial species are placed below the epiphytes, they are also greatly inferior to them in singularity and beauty."

"The Orchidaceæ of each of the three great divisions of the globe have features of their own, so marked and peculiar, that, in most cases, a practised eye would have little difficulty in referring even a totally new form to its proper habitation. Thus, for example, the pendent stems and graceful flowers of many of the dendrobiums, ærides, and their allies, give a character of beauty and lightness to the orchidaceous flora of tropical India, which contrasts most strongly with the clumsy pseudobulbs of the bolbophyllums, or the long tails of the angræcums of Africa. Again, in America, the characteristic features are, the upright vegetation (as distinguished from the pendent) of the epidendrums, the long straggling flower-spikes of many of the oncidiums, and a much greater variety of grotesque and marvellous forms than is to be met with in any part of the old world."

"The uses to which the plants of this family are applied are few; but, in several instances, highly romantic. In Demerara, that most dreadful of all poisons, the 'Wourali,' is thickened by the juice of the catasetums; and in Amboyna, the true 'Elixir of Love' is prepared from the minute farina-like seeds of the Grammatophyllum speciosum, which plant has just been received in England, in a living state, from Mr. Cumming. In Mexico, where the 'language of flowers' is understood by all, the Orchidaceæ seem to compose near the whole alphabet. Not an infant is baptized, not a marriage celebrated, nor a funeral obsequy performed, at which the aid of these flowers is not called in by the sentimental natives, to assist the expression of their feelings. They are offered by the devotee at the shrine of his favourite saint; by the lover, at the feet of his mistress; and by the sorrowing survivor, at the grave of his friend; whether, in short, on fast days or feast days, on occasions of rejoicing, or in moments of distress, these flowers are sought for with an avidity which would seem to say there was no sympathy like theirs;—thus 'Flor de los Santos,' Flor de Corpus,' Flor de los Muertos,' 'Flor de Maio,' 'No me Elvides' (or forget me not), are but a few names out of the many that might be cited to prove the high consideration in which our favourites are held in the New World. Nor are these the only honours that are paid to them, for Hernandez assures us that, in Mexico, the Indian chiefs set the very highest value on their blossoms, for the sake of their great beauty, strange figure, and delightful perfume. The following are, however, almost the only known instances in which the tribe do any direct service to mankind. The bulbs of Maxillaria bicolor contain a large quantity of an insipid watery fluid, which is greedily sucked by the poor natives of Peru in the dry season. A fluid of a similar nature is obtained from what is probably a Lælia, in Mexico, and is administered as a cooling draught in fevers. From the roots of some of the orchises, even in Europe, the nutritive substance called 'salep' is obtained; in New Zealand, certain species are of considerable importance as esculents; and, in Guiana, the soles of the shoemaker are much indebted to the viscid matter obtained from the Catasetums and Cyrtopodiums, as are the poisoned arrows of the Indian. If the Orchidaceæ have few uses they yield us pleasure of an intellectual kind, and so intense that it might attract the man of pleasure by its splendour; the virtuoso, by its rarity; and the man of science, by its novelty and extraordinary character."

Now that our aim is to give to those of our readers some general information respecting those wonders of the desert, of which they may occasionally witness specimens, we will copy the translation of M. Descourtilz's remarks on the Orchidaceæ of Mexico given by Dr. Lindley in the Miscellaneous matter of the Botanical Register. "It is in the bosom of the vast solitudes of America that these, the most diversified of plants, spring up, flower, and perish. The entire life of a man, though devoted to their special study, would never finish their examination, so prodigious is the variety of their species, many of which are only seen after the fall of the protector upon which they lived.

There is no part of Brazil, no latitude, no elevation above the sea, where are not to be found Orchidaceæ as different from each other as the conditions under which they grow. Some bask in the heat of the plains, others luxuriate in the agreeable freshness of a stream of water, attaching themselves to the branches of the trees which cover the waves with a verdant grotto; and others, real children of the mist, delight in a drizzling atmosphere, and support with ease the violence of stormy winds, and the often icy coldness of the Serras, whether stationed within a few feet of the earth, or swinging in the air from the boughs of the ancient patriarchs of the forest. Some grow in deep recesses and gloomy arcades, where there is a perpetual circulation of a damp and heated atmosphere; others, on the contrary, prefer the open glades, or Rocas, where some fallen trees, whose own foliage has perished, supply them with a scanty but sufficient nourishment.

It is impossible to form an idea of a tropical forest by the woods of Europe, where the ivy is the only parasite which finds a permanent support. The Sertoes, or virgin woods, which cover a part of America, present the traveller with scenery incomparable for its majestic character, and rich variety. Who is there that would not be astonished at finding himself amidst a vegetation, of which each individual struggles with its neighbour for existence, darting up, eagerly searching for the light of a cloudless sun and a purer air, only to be found at a prodigious elevation, and leaving darkness and water at their feet. It is here that trees of patriarchal age perish in the embrace of enormous climbers which overwhelm and bear them down, and which are sometimes carried overhead like cables, in other cases interlaced like the meshes of a net, and not unfrequently stand like lofty leaf-capped columns of spiral open-work, after the trees about which they have writhed themselves have fallen to decay within their grasp.

Amidst this forest of ropes of sylvan rigging, grow innumerable Ferns, which hang down in plumes, or festoons, or the gayest lacework, vast quantities of Araceous plants, and especially Tillandsias, forming broad patches of verdure upon a sombre ground. In the midst of airy garlands of Aristolochias, Bignonias, Convolvuluses, and Passion-flowers live the Orchidaceæ, each particular species of which seems to haunt its own peculiar plant. Thus the Epidendrum of the Cinchona refuses to live in the branches of the Lecythis and Couratari, notwithstanding that the seeds of these epiphytes are scattered indiscriminately by the wind. Other tribes again are always free from Orchidaceæ, as the huge trunks of Malvaceous trees, Isoras, Carolineas, Plantains, and Palms.

It is chiefly at the time of flowering that Orchidaceæ become remarkable in their native haunts, and then less for the diversity of their forms, or the gaudiness of their colours, than for the exquisite perfume which they exhale. It is thus that I have often been led to the discovery of charming species, lurking amidst the foliage, and which my eye would never have detected."

169 Planting Trees. The following extract from the Inverness Courier contains information of a practice which should not be forgotten by planters. "In most plantations there is a loss of about eight per cent. on the plants, from frost or other causes, and the great object of the forester is to accelerate and secure their growth the first year. On this head we can give a useful hint from the experience of Darnaway. One hundred and fifty acres have, within the last two or three years, been planted there without a single instance of loss, and this has been achieved by a very simple process, which merits the name and the honours of a discovery. It is merely putting a small quantity of lime into the hole in which the plant is laid. About four bushels of lime will suffice for an acre: it is thoroughly mixed and incorporated with the mould, before the plant is inserted. The effect of the lime is to push on the growth of the plant in its first and most precarious stage: new fibres begin to form and ramify from the tap-root, and not only is the growth of the plant secured, but it is advanced in a double ratio, compared with the ordinary system, where no lime is used. We saw this process in operation two years ago, and were not a little anxious as to the result of the lime. We had great faith in the sagacity and practical knowledge of Mr. Cutlar, the forester, but we confess we had a doubt that liming the plant would force it on prematurely, and that after a brief season of remarkable growth it would be found deficient in stamina, and decline as rapidly as it had arisen. Experience and observation have dispelled these fears. The plants are thriving steadily and vigorously in the most exposed parts of the forest; and, the dangerous period of their existence being over, there seems no doubt that they will continue to assert and maintain their superiority of growth over their brethren of the forest. Indeed, we anticipate that in a short time lime will be universally used for this purpose, as it is in the operations of agriculture. The person that first used

lime for manuring his land in Ross-shire, was Major Mackenzie, of Fodderty, and many of his neighbours shook their heads in wonderment and pity at the adoption of such a scheme for "burning up the land." The worthy major, however, triumphed over all the unbelievers of the district, and has lived to see the universal adoption of lime, as well as another potent auxilliary of the soil, bone dust. May we not hope for a similar result as to the application of lime in our forest plantations? With respect to quality of soil, we need only remark that, where-ever ferns grow strong and abundantly, oaks will thrive and prosper; and it is on a soil of this description that lime has been found to answer in the nurture of plants.

170 Grafting Ipomœas. A mode of grafting Ipomœas, communicated by Mr. D. Beaton, to the Gardener's Magazine, (vol. 15, p. 161) is worthy of notice; not alone for its value in describing an easy mode of propagating this genus, but from its explanation of a principle, which is known to be applicable to many others. Mr. Beaton observes "I practise grafting Ipomœas, in order to get plants with as little trouble as possible of Ipomœa Horsfalliæ, which does not strike roots so readily as some others of this graceful family from cuttings, and laying is not always convenient in ornamental plant stoves. The process of grafting is quite simple, and, to a person versed in the subject, it would be quite sufficient to say that cuttings of Ipomœa Horsfalliæ were grafted on the spare tubers of Ipomœa insignis, or on those of any other species in that section; but to the amateur it may be useful to state, that when the shoots of Ipomœa Horsfalliæ begin to grow in the spring, and when the eye is just ready to push in a young shoot half an inch long, is the best time for this operation. Then cut the scions with two eyes, the upper one to form the leading shoot, and the lower one to help the union with the tuber; cut the scion or shoot just below the joint, and cut out a slice an inch long on the opposite side to the eye. Then take a young tuber, and cut away a slice to correspond with your graft; fit them close together, and tie them tight with a piece of matting; pot the tuber in as small a pot as you can get it into, using very light soil; set the pot into a hot frame, or merely into the stove, and in a few days the union will be complete, and your plant will go on just the same as if it were on its own roots from the first.

A few side tubers can easily be spared from an established plant for this purpose; but for the nurseryman, or where a great number of plants are wanted, the following is the best and shortest way to go to work. At any time during the growing season, take as many cuttings as you want of plants, of Ipomœa insignis, or of the species of Ipomœa which Mr. Low of Clapton introduced from the higher parts of Brazil, which is much hardier than the Ipomœa insignis, and in all respects a better stock for Ipomœa Horsfalliæ than Ipomœa insignis. They will strike roots in a fortnight; and in a short time they will form young tubers, like those of young dahlias; then shake them out of the pot, and graft them as above. Or any practised person may take the young points, of the current season's growth, and insert them in the bottom of the cutting, instead of in the tuber, and they will take just as well; but when this plan is adopted the cuttings ought to be divested of their bottom eyes when first put in, otherwise these eyes will be found troublesome in pushing up and contending with the graft.

171 Apple Trees, pruning. The late T. A. Knight, in his excellent Treatise on the Apple and Pear, animadverting on the unscientific mode of pruning practised by farmers, says "The apple tree, being naturally very full of branches, frequently requires the operation of pruning; and when properly executed, great advantages will be found to arise from it. But, as it is generally performed in Herefordshire, the injury the tree sustains is much greater than the benefit it receives. The ignorant pruner gets into the middle of it, and lays about him to right and left, till he leaves only small tufts of branches at the extremities of the large boughs. These branches, now receiving the whole nourishment of the tree, of course increase rapidly, and soon become, when loaded with fruit or snow, too heavy for the long naked boughs to support, which are of necessity full of dead knots from the former labours of the pruner. Many hundred trees annually perish from this cause. The present system of pruning ought to be precisely reversed; and the pruner should confine himself almost entirely to the extremities of the bearing branches, which are always too full of wood, and leave the internal part of the tree nearly as he finds it.

In pruning the apple tree, and all other standard trees, the points of the external branches should be every where rendered thin and pervious to the light; so that the internal parts of the tree may not be wholly shaded by the external parts; the light should penetrate deeply into the tree, on every side; but not any where through it. When the pruner has judiciously executed his work, every part of the tree, internal as well as external will be productive of fruit. A tree, thus pruned, will not only produce more fruit, but will also be able to support a much heavier load of it, without danger of being broken; for any given weight will depress the branch, not simply in proportion to its quantity, but in the compound proportion of its quantity, and of its horizontal distance from the point of suspension; by a mode of action similar to that of the weight on the beam of the steel-yard; and hence a hundred and fifty pounds, suspended at one foot distance from the trunk, will distress the branch, which supports it, no more than ten pounds at fifteen feet distance would do. Every tree will therefore support a larger weight of fruit, without danger of being broken, in proportion as the parts of such weight are made to approach nearer to its centre.

Each variety of the apple tree has its own peculiar form of growth; and this it will ultimately assume, in a considerable degree, in defiance of the art of the pruner. Something may nevertheless be done to correct whatever is defective. When the growth of any variety is weak and reclining, the principle stem should be trained to a considerable height, before it be allowed to produce branches; and if any of these take a horizontal, or pendent direction, they should be regularly taken off. One principle leading stem should be encouraged almost to the summit of the tree, to prevent a sudden division into two large boughs of nearly equal strength; for the fork which these form is apt to divide and break, when the branches are loaded with fruit. All efforts to give the heads of young trees a round and regularly spreading form, whilst in the nursery, will be found injurious in the future stages of their growth. Large branches should rarely, or never be amputated.

In the garden-culture of the apple, where the trees are retained as dwarfs or espaliers, the more vigorously growing kinds are often rendered unproductive by the excessive, though necessary, use of the pruning knife. I have always succeeded in making trees of this kind fruitful by digging them up, and replacing them, with some fresh mould, in the same situation. The too great luxuriance of growth is checked, and a disposition to bear is in consequence brought on ".

172 Berberis and Mahonia. It will be known to most of our readers that the genus Berberis has been divided; and that a portion of its species are called Mahonia. Some of these are very ornamental shrubs and but little known, which has occasioned the introduction of the following observations, for the benefit of those who can cultivate them.

Mahonia glumacea, repens, and aquifolium, are three species, which, from their extreme hardiness, abundance of blossoms, and evergreen habit, deserve to be planted more extensively in flower gardens, than they at present are. They do not require protection, however severe the winter may be. The soil best suited for them is a mixture of loam and peat, or a light sandy loam. After being established for two or three years, these three species send out abundance of creeping suckers, which frequently do not show themselves above ground until they are two or three feet from the stem of the parent; these, if not wanted for increase, will rapidly add to the size and beauty of the original plant. If required to be taken off, the suckers should be cut asunder with a sharp spade, near to the stem of the plant, late in summer, and taken up for transplanting late in autumn, when they will be found furnished with abundance of roots.

Mahonia fascicularis is considerably more tender, and will seldom survive a severe winter without injury, unless carefully covered. This species does not send out suckers from the roots, as is the habit of those mentioned above. The Berberis empetrifolia, (figured under No. 653 of the Botanic Garden) is a hardy evergreen shrub, of great beauty, when in flower. Its small leaves and slender prostrate branches, give it a very different appearance from the other species of Berberis and Mahonia, and make it a desirable plant for rock-work. The soil should be the same as for the Mahonias. When planted in flower beds it is beneficial to lay down the prostrate branches occasionally, both to prevent their being tossed about by the wind, and for increase. The laid branches seldom produce many roots in the first season after laying, but in the autumn of the second, abundance of roots will be formed, and the young plants may be taken off and transplanted. This species, sometimes flowers late in the autumn as well as early in spring.

173 Grapes to preserve. A translation of several articles from the Transactions of the Prussian Gardening Society, is given in the eighth volume of the Gardener's Magazine, amongst which occur directions for Preserving Grapes. The method is easy as well as advantageous, and may be very gratifying to the curious in the growth of fruit. The following are the directions given. "In the spring, before the buds begin to swell, take healthy well-ripened shoot of the preceding year, and draw it up through the bottom hole of a flower-pot of about fifteen inches in diameter; then fill the pot with rich soil, and cover both the soil and the outside of the pot with moss, to keep in the moisture. Water now and then, according to the season. By the end of August, cut the shoot half through, just below the pot, so as to increase the number of roots, which will be formed about this time in the soil contained in the pot. In the course of the month of October, according to the season, cut the shoot quite through, and remove the pot, with the vine, laden with from twelve to twenty bunches of fruit, to a dry airy room, with a northern exposure; here water occasionally, till the leaves drop off, but no longer. Thus treated, the fruit will keep good on the vine till the end of February, preserving its natural flavour. The best sort for this purpose is the white sweetwater."

Fruit, thus exhibited, as if entirely grown in the pot, would not be an uninteresting object, independently of the advantage obtained by its preservation. Various methods have been practised to preserve Grapes after being gathered. Foreign Grapes are usually packed in casks or jars, amongst saw-dust, which answers the purpose of preserving them from decay, as well as injury from carriage to this country. Some persons after gathering the fruit, dip the stems of each bunch into melted resin, and then hang them up, in paper bags, in a cool dry room. Others suspend the bunches of fruit in boxes, place the berries as far asunder as the stems will admit, and then fill the box with clean dry sand; or what appears to be less objectionable, clean small seed of some sort. None which could be readily obtained, would answer better for this purpose than clover seed. Whatever system be pursued, it would seem to be desirable that the fruit be kept cool and dry.

174 Soils, their Temperature. "Many soils are popularly distinguished as cold ; and the distinction, though at first view it may appear to be founded on prejudice, is really just. Some soils are much more heated by the rays of the sun, all other circumstances being equal, than others ; and soils brought to the same degree of heat, cool in different times, i. e. some cool much faster than others.

This property has been very little attended to in a philosophical point of view; yet it is of the highest importance in agriculture. In general, soils that consist principally of a stiff white clay are difficultly heated; and being usually very moist, they retain their heat only for a short time. Chalks are similar, in one respect, that they are difficultly heated; but being drier they retain their heat longer, less being consumed in causing the evaporation of their moisture. A black soil, containing much soft vegetable matter, is most heated by the sun and air ; and the coloured soils, and the soils containing carbonaceous matter, or ferruginous matter exposed under equal circumstances to the sun, acquire a much higher temperature than pale-coloured soils. When soils are perfectly dry, those that most readily become heated by the solar rays, likewise cool most rapidly, their power of losing heat by radiation being greatest; but I have ascertained, by experiment, that the darkest coloured dry soil, (that which contains abundance of animal or vegetable matter, substances which most facilitate the diminution of temperature,) when heated to the same degree, provided it be within the common limits of the effect of solar heat, will cool more slowly than a wet pale soil, entirely composed of earthy matter. I found that a rich black mould, which contained nearly ¼ of the vegetable matter, had its temperature increased in an hour from 65° to 88° by exposure to sunshine ; whilst a chalk soil was heated only to 69° under the same circumstances. But the mould removed into the shade, where the temperature was 62°, lost, in half an hour, 15°; whereas the chalk, under the same circumstances, had lost only 4°. A brown fertile soil, and a cold barren clay, were each artificially heated to 88°, having been previously dried: they were then exposed in a temperature of 57° ; in half an hour the dark soil was found to have lost 9° of heat ; the clay had lost only 6°. An equal portion of the clay containing moisture, after being heated to 88°, was exposed in a temperature of 55°; in less than a quarter of an hour, it was found to have gained the temperature of the room. The soils in all these experiments were placed in small tin plate trays, two inches square, and half an inch in depth, and the temperature ascertained by a delicate thermometer.

Nothing can be more evident than that the genial heat of the soil, particularly in spring, must be of the highest importance to the rising plant. And when the leaves are fully developed, the ground is shaded, and any injurious influence, which in the summer might be expected from too great a heat, entirely prevented; so that the temperature of the surface, when bare and exposed to the rays of the sun, affords at least one indication of the degrees of its fertility; and the thermometer may be sometimes a useful instrument to the purchaser or improver of lands. There is a very simple test of the cooling or radiating powers of soils, the formation of dew upon them, or their relative increase of weight by exposure to the air, after being dried in the day or the night, in sunshine or in shade. The soil that radiates most heat acquires the greatest increase of weight; and of course the radiating powers of the soil are not only connected with its temperature, but likewise with its relations to moisture The moisture in the soil influences its temperature; and the manner in which it is distributed through, or combined with, the earthy materials, is of great importance in relation to the nutriment of the plant. If water is too strongly attracted by the earths, it will not be absorbed by the roots of the plants; if it is in too great a quantity, or too loosely united to them, it tends to injure or destroy the fibrous parts of the roots.

The power of soils to absorb water from air is much connected with fertility. When this power is great, the plant is supplied with moisture in dry seasons; and the effect of evaporation in the day is counteracted by the absorption of aqueous vapour from the atmosphere, by the interior parts of the soil during the day, and by both the exterior and interior during the night. The stiff clays approaching to pipe clays in their nature, which take up the greatest quantity of water when poured upon them in a fluid form, are not the soils which absorb most moisture from the atmosphere in dry weather. They cake, and present only a small surface to the air; and the vegetation on them is generally burnt up almost as readily as on sands. The soils that are most efficient in supplying the plant with water by atmospheric absorption, are those in which there is a due mixture of sand, finely divided clay, and carbonate of lime, with some animal or vegetable matter: and which are so loose and light as to be permeable to the atmosphere. With respect to this quality, carbonate of lime and animal and vegetable matter are of great use in soils; they give absorbent power to the soil without giving it likewise tenacity: sand, which also destroys tenacity, on the contrary, gives little absorbent power." Due attention to the foregoing observations cannot fail of being useful to those who are desirous of increasing the productive qualities of their soil; an object which is sometimes sought without the guidance of any scientific or rational principle.

175 Pæonia moutan, to Increase. Various methods may be practised to increase the Tree Pæony, none of which, however, seem to have the effect of making it a cheap and generally cultivated plant. This can but be regretted, on account of its splendour and its hardiness. Under No. 241, in the Botanic Garden, we have published a method of raising young plants with facility, and it has been practised very successfully, by many amateur gardeners, but it has not been attended to generally. Another method has been adopted by M. Soulange Bodin of Paris, and published in Le Bon Jardinier for 1839. A translation is given in the 15th volume of the Gardener's Magazine. The method is simply that of cleft-grafting a young shoot of the Tree Pæony on a tuber of the common herbaceous Pæony, placing it in a pot, plunging it heat, and covering it with a bell-glass. It is recommended that the operation be performed at the end of July or beginning of August. Mr. Loudon observes, that "Mr. Masters of Canterbury has adopted this mode of propagating, with this difference, that, after grafting, the graft being tied with bast, and covered with grafting-wax, the whole is inserted into a bed of tan, leaving only about half an inch of the point of the scion above the surface. The grafted plants are inserted in the angular interstices between the pots, with which the pit is usually occupied; two, three, or four, are placed together, according to the size of the triangular space; and a larger or smaller bell-glass is placed over them, as may be requisite. The tubers throw out roots by the end of September, or the beginning of

October, and are then taken up and potted, and placed in a cold frame, where they remain through the winter.

The grafting wax used for covering this graft is composed as follows:—Burgundy pitch, 1 lb.; black pitch, 4 oz.; rosin, 2 oz.; yellow wax, 2 oz.; tallow, or suet, $1\frac{1}{2}$ oz. The whole melted together, and, after being allowed to cool, it is used when rather less than milk-warm.

176 Food of Plants. In a former part of the Auctarium, we inserted some interesting remarks on Germination from the late work of Dr. Thompson, on the Chemistry of Organic bodies, a treatise which we recommend to such persons as feel an interest in the chemistry of vegetables. We will here extract a portion of his observations on the Food of Plants. He says, "Plants after they have germinated, do not remain stationary, but are continually increasing in size. A tree, for instance, every season adds considerably to its former bulk. The root sends forth new shoots, and the old ones become larger and thicker. The same increment takes place in the branches and the trunk. When we examine this increase more minutely, we find that a new layer of wood or rather of alburnum, has been added to the tree in every part, and this addition has been made just under the bark. We find too that a layer of alburnum has assumed the appearance of perfect wood. Duhamel has shown also that a new layer of liber next to the alburnum, is formed every year. Besides this addition of vegetable fibre, a great number of leaves have been produced, and the tree puts forth flowers and forms seeds. It is evident from all this, that a great deal of new matter is continually making its appearance in plants. Hence, since it would be absurd to suppose that they create new matter, it must follow that they receive it by some channel or other. Plants, then, require food as well as animals. Now, what is this food, and whence do they derive it? These questions can only be answered by an attentive survey of the substances which are contained in vegetables, and an examination of those substances which are necessary for their vegetation. If we could succeed completely, it would throw a great deal of light upon the nature of soils, and of manures, and on some of the most important questions in agriculture. But we are far indeed at present from being able to examine the subject to the bottom.

Dr. Thompson pursues the preceding subject as follows, shewing the dependence of vegetables on water, air, and soil, viz.

177 WATER INDISPENSABLE TO VEGETATION. "In the first place it is certain that plants will not vegetate without water; for whenever they are deprived of it they wither and die. Hence the well-known use of rains and dews, and the artificial watering of ground. Water, then, is at least an essential part of the food of plants. But many plants grow in pure water; and therefore it may be questioned whether water is not the only food of plants. This opinion was adopted very long ago, and numerous experiments have been made in order to demonstrate it. Indeed it was the general belief of the seventeenth century; and some of the most successful improvers of the physiology of plants, in the eighteenth century, have embraced it. The most zealous advocates for it were, Van Helmont, Boyle, Bonnet, Duhamel, and Tillet.

Van Helmont planted a willow which weighed five pounds in an earthen vessel filled with 200 lbs. of soil, previously dried in an oven, and then moistened with rain water. This vessel he sank into the earth, and he watered his willow, sometimes with rain and sometimes with distilled water. After five years it weighed 169¼ lbs. and the earth in which it was planted, when again dried, was found to have lost only two ounces of its original weight. Here it has been said, was an increase of 164 lbs. and yet the only food of the willow was pure water; therefore it follows that pure water is sufficient to afford nourishment to plants. The insufficiency of this experiment to decide the question was first pointed out by Bergmann, in 1773. He showed, from the experiments of Margraff, that the rain water employed by Van Helmont contained in it as much earth as could exist in the willow at the end of five years. For according to the experiments of Margraff, one pound of rain water contains one grain of earth. The growth of the willow, therefore, by no means proves that the earth which plants contain has been formed out of water. Besides as Mr. Kirwan has remarked, the earthen vessel must have often absorbed moisture from the surrounding earth, impregnated with whatever substance the earth contained; for unglazed earthen vessels, as Hales and Tillet have shown, readily transmit moisture. Hence, it is evident that no conclusion whatever can be drawn from this experiment; for all the substances which the willow contained, except water, may have been derived from the rain water, the earth in the pot, and the moisture imbibed from the surrounding soil.

The experiments of Duhamel and Tillet are equally inconclusive; so that it is impossible for them to decide the question, whether water be the sole nourishment of plants or not? But all the attempts hitherto made to raise plants from pure water have failed; the plants vegetating only for a certain time, and never perfecting their seeds. These experiments were made by Hassenfratz, Saussure, and others, with the same unfavourable result. Duhamel found that an oak, which he had raised by water from an acorn, made less and less progress every year. We see, too, that those bulbous roots, such as hyacinths, tulips, &c. which are made to grow in water, unless they be planted in the earth every other year, refuse at last to flower, and even to vegetate; especially if they produce new bulbous roots annually, and the old ones decay. From all these facts and experiments, it is reasonable to conclude that water is not the sole food of plants

So far, indeed, is water from being the sole food of plants, that in general, only a certain proportion of it is serviceable, too much being equally prejudicial to them as too little. Some plants, it is true, grow constantly in water, and will not vegetate in any other situation; but the rest are entirely destroyed when kept immersed in that fluid beyond a certain time, Most plants require a certain degree of moisture in order to vegetate well. This is one reason why different soils are required for different plants. Rice, for instance, requires a very wet soil: were we to sow it in the ground on which wheat grows luxuriantly it would not succeed: and wheat, on the contrary would rot in the rice ground. We should therefore in choosing a soil proper for the plants which we mean to raise, consider the quantity of moisture which is best adapted for them, and choose our soil accordingly. Now the dryness or moisture of a soil depends upon two things; the nature and proportions of the earths which compose it, and the quantity of rain which falls upon it. Every soil contains at least three earths, silica, lime, and alumina, and sometimes also magnesia. The silica is always in a state of sand. Now soils retain moisture longer or shorter according to the proportions of these earths. Those which contain the greatest quantity of sand retain it the shortest, and those which contain the greatest quantity of alumina, retain it longest. The first is a dry, the second a wet soil. Lime and magnesia are intermediate between these two extremes: they render a sandy soil more retentive of moisture, and diminish the wetness of a clayey soil. It is evident therefore, that by mixing together proper proportions of these four earths, we may form a soil of any degree of dryness and moisture that we please.

But whatever be the nature of the soil, its moisture must depend in general upon the quantity of rain which falls. If no rain at all fall, a soil, however retentive of moisture it be, must remain dry; and if rain were very frequently falling, the soil must be open indeed, if it be not constantly wet. The proportion of the different earths in a soil, therefore, must depend upon the quantity of rain which falls. In a rainy country, the soil ought to be open; in a dry country it ought to be retentive of moisture. In the first, there ought to be a greater proportion of sand, in the second of clay."

178 AIR INDISPENSABLE TO VEGETATION. "That air is necessary for the vegetation of plants has been completely proved; and that a considerable portion, at least of the carbonaceous matter which they contain, is absorbed from the air, has been rendered probable by the experiments of chemical philosophers. Three articles which furnish nourishment to plants are supplied by the atmosphere; namely, carbonic acid, oxygen, and moisture; but it has been disputed how far plants are capable of absorbing carbonic acid, without the assistance of the soil on which they usually vegetate.

Mr. Hassenfratz analyzed the bulbous roots of hyacinths, in order to discover the quantity of water, carbon, and hydrogen, which they contained; and by repeating the analysis on a number of bulbs, he discovered how much of these ingredients was contained in a given weight of the bulb. He analyzed also kidney-beans and cress seeds in the same manner. Then he made a number of each of these vegetate in pure water, taking the precaution to weigh them before hand, in order to ascertain the precise quantity of carbon which they contained. The plants being then placed, some within doors, and others in the open air, grew and flowered, but produced no seed. He afterwards dried them, collecting with care all their leaves and every other part which had dropped off during the course of vegetation. On submitting each part to a chemical analysis, he found that the quantity of carbon which it contained, was somewhat less than the quantity which existed in the bulb, or the seed from which the plant had sprung.

These experiments have been repeated by Saussure with a very different result. Sprigs of mentha piperita, allowed to vegetate for some time in distilled water, nearly doubled the portion of carbon which they originally contained; but when the same experiment was repeated in a place where but little light had access, the carbon, instead of being increased, was somewhat diminished, has Hassenfratz had found. Hence, it is possible that the result obtained by Hassenfratz was owing to the want of light, Thus it cannot be doubted, that plants, even when they vegetate in pure water, are capable of absorbing nourishment from the air; but as plants in this situation cannot produce perfect seeds, and as they gradually decay and cease to vegetate, it is obvious that water and air alone are not sufficient."

179 Soil indispensable to Vegetation. "The third, and only remaining source from which plants can draw their food, is the soil on which they grow. Now this soil consists of two parts; namely, pure earths, which constitute its basis, and the remains of animals and vegetables applied as manure. One use of the earthy part of the soil is to furnish a support for the plants, and to administer the proper quantity of water to them; but as all plants contain earthy and saline matters, and as these substances are constantly present, we cannot avoid considering them as in some measure constituting an essential part of plants. Now there is reason to believe that the proportion of earthy and saline matters in plants is considerably influenced by the soil on which they vegetate. Saussure made beans grow in three different situations. The first set was supported by distilled water; the second was planted in sand and supported by rain water; the third was planted in a pot filled with mould and placed in a garden. The ashes yielded by these different plants were to each other in the following proportions:—

1	Those fed by distilled water .	3.9
2	Those fed by rain water, .	7.5
3	Those growing in soil .	12.0

Here the quantity of fixed water, yielded by the beans which had vegetated in soil, was more than three times greater than what was obtained from those which had been fed solely by distilled water.

The same philosopher examined the ashes of various plants growing on a granitic, and on a calcareous soil. The plants which grew on the granitic soil contained a considerable proportion of silica and metallic oxides; those which grew in the calcareous, little or none of these bodies, but a greater proportion of calcareous earth than the granitic plants.

Thus it cannot be doubted, that the proportion of earthy matter contained in plants is considerably influenced by the nature of the soil on which they grow; but whether plants derive the whole of these fixed principles from the soil, or whether they are capable of forming them to a certain extent by the unknown powers of vegetation are questions not yet finally decided.

180 Saline matter in Plants. "Besides earths, plants always contain a portion of saline matter. Those that grow at a distance from the sea contain potash, while sea-plants contain soda and common salt. Phosphate of lime is a constant ingredient, and phosphate of potash a very common one. Some plants contain peculiar salts. Thus nitrate of soda is usually present in barley, nitrate of potash in nettles and the sunflower, &c. It appears from the experiments that have been made, that peculiar salts promote the vegetation of peculiar plants. Sea plants require common salt, and languish in soils where it is not to be found. Borage, nettles, and pellitory, thrive only in soils which contain nitrate of lime or potash: gypsum promotes the vegetation of lucern and clover.

Salts then are not inactive; and when properly applied, they promote the growth of vegetables. In these cases they appear to be absorbed by the plants which they invigorate. Duhamel found that sea plants made little progress in soils which contain no common salt. Bullion made seeds of sun flower to grow in a sandy soil, containing no trace of nitre. On examining the plants, no nitrate of potash could be detected in them, but the salt made its appearance as usual when the plants were watered with a weak nitrous solution. From the experiments of Saussure, we learn that plants absorb saline solutions in very different proportions, and that in general those are absorbed in greatest quantity which are most injurious to vegetation. Saussure explains this apparent anomally by supposing that a portion of the roots were soon destroyed by the injurious liquids, and that then they absorbed the solution indiscriminately. When various salts were dissolved at once in the same solutions, and plants made to vegetate in them, it was found that different proportions of the salts were absorbed. Thus it appears that plants do not absorb saline bodies indiscriminately. Saussure supposes that the difference depends rather upon the degree of liquidity which the solution possesses, than upon any discriminating power in the root. But if this were the case it would be difficult to explain how so much greater a proportion of water should be absorbed than of the salt which it holds in solution.

181 Animal and Vegetable Manure. Water, carbonic acid, and oxygen, and perhaps also earths and salts, constitute a part of the food of plants; but is very clear that the whole food is not furnished by these substances. It is well known that if vegetables be successively raised on the same ground, they at last exhaust it, or render it sterile; and to prevent this, farmers are obliged to supply their grounds annually with a quantity of manure. Without this manure or some equivalent, plants cannot be made to thrive, or to perfect their seeds. Neither water, air, nor earths, nor salts, will prevent them from perishing. Giobert mixed together the four earths, silica, alumina, lime, and magnesia, in the proper proportions to constitute a fertile soil; and after moistening them with water, planted several vegetables in them; but none of them grew well till he moistened his soil with water from a dunghill. Lampadius planted different vegetables in compartments of his garden, filled each with one of the pure earths, and watered them with the liquor which exuded from a dunghill. They all grew, notwithstanding the diversity of the soil; and each contained the usual earthy constituents of plants, notwithstanding the absence of these constituents from the soil.

It is not the earths which constitute a fertile soil, but the remains of animal and vegetable substances, and the proportion of these capable of being held in solution by water. It appears from the experiments of Mr. Hassenfratz, that substances employed as manures produce effects in times proportioned to their degree of putrefaction; those substances which are most putrid producing the most speedy effects, and of course soonest losing their efficacy. Having manured two pieces of the same kind of soil, the one with a mixture of dung and straw highly putrefied, the other with the same mixture newly made, and the straw almost fresh, he observed, that during the first year, the plants which grew on the land manured with the putrefied dung produced a much better crop than the other; but the second year (no new dung being added), the ground which had been manured with the unputrefied dung produced the best crop: the same thing took place the third year, after which both seemed to be equally exhausted. Here it is evident that the putrefied dung acted soonest and was soonest exhausted. It follows from this, that carbon only acts as a manure when in a particular state of combination; and this state, whatever it may be, is evidently produced by putrefaction. Another experiment of the same chemist renders this truth still more evident. He allowed shavings of wood to remain for about ten months in a moist place till they began to putrefy, and then spread them over a piece of ground by way of manure. The first two years this piece of ground produced nothing more than others which had not been manured at all; the third year it was better, the fourth year it was still better, the fifth year it reached its maximum of fertility; after which it declined constantly till the ninth, when it was quite exhausted. Here the effect of the manure evidently depended upon its progress in putrefaction.

When vegetables are allowed to putrefy in the open air, they are converted into a loose black substance, well known under the name vegetable mould. On this mould plants grow with great vigour. It is the substance which renders newly-cultivated lands in America, &c. so fertile. When exposed to the air, in the course of cultivation, it is gradually wasted and destroyed, and the lands are thus impoverished. This vegetable mould, therefore, is obviously one of the grand sources of the food of plants. It deserves, therefore, an accurate examination.

182 Acid Soils. Einhof examined a sort of mould to which he has given the name of acid vegetable mould. It occurs in low-lying meadows and marshes, and the plants which grow upon it in these situations are the different species of carex,

juncus, and eriophorum. It constitutes also the principal part of the mould in high-lying situations, and moors where the soil is covered with heath (erica vulgaris). This mould is distinguished from the preceding by containing a notable portion of phosphoric and acetic acids, which give it the property of reddening vegetable blues. The extractive which it contains is chiefly insoluble in water. This sour vegetable mould bears a considerable resemblance to peat, into which indeed it probably passes. Like it, peat contains a portion of phosphoric acid, and probably also of acetic acid, and an extractive readily soluble in alkalies, though but sparingly in water. Einhof has observed, that acid vegetable mould never occurs in those soils which abound in lime, and that it is counteracted and brought to the state of good mould by the action of lime and marl. It is clear that these manures will neutralize the acids, and thus enable the extractive, and other vegetable substances, to be acted upon by the atmosphere, to yield carbonic acid, and to assume those states which are proper for the nourishment of vegetables. It is probable that they act also directly upon the vegetable matter, and occasion decompositions favourable for vegetation. Hence the efficacy of lime when supplied to peat moss, and to sour lands in general.

Upon the whole, then, it appears that plants are fed chiefly by that portion of vegetable matter which becomes soluble in water, and assumes the properties of extractive; that the quantity of it in soil must neither be too great nor too small; that the insoluble part of vegetable mould gradually assumes this state, either by the action of the atmosphere, or of earths or salts; that the presence of an acid, by counteracting this change, injures the nourishing quality of vegetable mould; aud that lime is serviceable, partly by neutralizing the acid, and partly by accelerating the decomposition of vegetable mould. Animal manures probably supply similar materials with vegetable mould. They probably prevent the formation of acids, or neutralize them when formed: and likewise promote the decomposition and solubility of vegetable matter. The striking effects which animal manure produces on the growth of vegetables are well known; though it is not possible at present to point out the way in which they act.

Such is the present state of our knowledge respecting the food of plants, as far as it is supplied by the soil in which they vegetate. It is probable that it is imbibed by the extremities of the roots only; for Duhamel observed, that the portion of the soil which is soonest exhausted is precisely that part in which the greatest number of the extremities of roots lies. This shows us the reason why the roots of plants are continually increasing in length. By this means, they are enabled, in some measure, to go in quest of nourishment. The extremities of the roots seem to have a peculiar structure adapted for the imbibing of moisture. If we cut off the extremity of a root, it never increases any more in length: therefore its use as a root has been in a great measure destroyed. But its sides send out fibres which act the part of roots, and imbibe food by their extremity. Nay, in some cases, when the extremity of a root is cut off the whole decays, and a new one is formed in its place. This, as Dr. Bell informs us, is the case with the hyacinth. The extremities of the roots contain no visible opening. Hence we may conclude that the food which they imbibe, whatever it may be, must be in a state of solution; whilst the absolute necessity of water renders it probable that water is the solvent. And, in fact, the carbonaceous matter in all active manures is in such a state of combination that it is soluble in water. All the salts which we can suppose to make a part of the food of plants, are more or less soluble in water. This is the case also with lime, whether it be pure or in the state of a salt; magnesia and alumina may be rendered so by means of carbonic acid gas; and Bergman, Macie, and Klaproth, have shown that even silica may be dissolved in water. We can see, therefore, in general, though we have no precise notions of the very combinations which are immediately imbibed by plants, that all the substances which form essential parts of that food may be dissolved in water." See Thomson's Chemistry of Organic Bodies.

183 Chrysanthemums, Culture of. Although our own practice inclines us to prefer propagating Chinese Chrysanthemums from cuttings, still we are free to confess, that where they can be divided, trained to a wall of good aspect, and have a light rich compost to grow in, they become exceedingly splendid. The late Mr. Haworth, of Chelsea, paid much attention to this plant, and as he so decidedly preferred division of the old plants, we will take the liberty of copying his directions, for the benefit

of our readers, as they appear in a communication to Mr. Loudon, and given in the ninth volume of the Gardeners' Magazine. He says " There have been various methods recommended for the cultivation and propagation of these showy plants, and that by cuttings in May, is now almost universally adopted. But I do not approve of this for strong fibrous-rooted, hardy herbaceous plants with late autumnal blossoms; for critical time is lost by the delay of striking the cuttings; and, if they are accelerated by heat and glass, they are (more than any other plants) debilitated, weakened, and dwarfed, and often lose their lower leaves by the time their flowers are open, having a faint and sickly appearance, instead of the vigorous growth of such roots, if annually parted and transplanted like perennial asters or other hardy and herbaceous plants.

I recommend their voracious and very fibrous roots to be parted in autumn or early spring, and planted in very rich manured light soil, at the foot of a south or west aspected wall, with not more than one, two, or three branches from each root, trained to the wall as regularly and as thinly as a peach tree, cutting off all superfluous shoots and weak lateral flower-buds. They must, when planted, be watered in the usual way, and afterwards all over their leaves, with a fine rose wateringpan, lightly, as a fine slight shower, as often as their foliage flags, quailing to the beams of a powerful sun, which will sometimes be three times a day in the hottest weather. This will quickly re-erect their drooping leaves, without scorching or blistering them, and cause these uncommonly slow-growing plants to advance with a degree of comparative rapidity that is as pleasing as it is surprising, and their leaves will become twice as large as when treated in the usual way. The size of this foliage, too, as in bulbous and most other plants, will indicate the increase of size also in the expected but as yet invisible flowers. Thus treated, these conspicuous plants will reach the height of three or four feet in the smaller sorts, and that of seven and eight at least, in the tallest kinds, terminating in abundant and most beautiful flowers, many of which will far surpass five inches in expansion, and with almost every colour, except deep scarlet and the tints of blue.

But other aspects than the south or west, and even the open borders in very favourable seasons will suit the greater part of these plants, near London, tolerably well, and enable them to open their flowers, though much later and smaller than those against a south aspected wall, where they will expand every season; and if properly blended as to colour, at the middle and end of every November, they are capable of making a more showy and magnificent appearance of flowery beauty, richness, and elegance, than I ever beheld in any other group. The duration of their hardy flowers is likewise greater than that of other autumnal plants, both as to individual blossoms, and in the lateral successional ones, and even when cut for bouquets and placed in vessels of water; one plant of the old purple, in my garden, having had flowers from the beginning of November, to the second week in January. But the earlier they can be made to come into blossom, by open air treatment (for all forcing irretrievably weakens them) the better, and the longer will be their duration, and the finer their soft but agreeable chamomile scent.

184 Alpines, Winter Treatment of. To be successful in preserving the more tender sorts of Alpine plants, in pits and frames, care must be taken to make the bottom perfectly dry, to plunge the pots in dry sand, as near the glass as possible, to remove, occasionally, wet adhesive soil from the tops of the pots, and supply its place with dry light sandy compost; to admit plenty of air during fair weather, by drawing the sashes entirely off during the day, and during bad weather to give air by lifting up the lights. When winter sets in, a layer of fern, straw, or other similar protecting material, should be put round the pit, or frame, to prevent the frost from penetrating it. During the night, when frost is severe, protect with mats or other covering. When once the frost has reached the surface of the pots it then becomes safer to let the covering remain on during the day-time also, and not remove it or give air until the soil, &c. is thoroughly thawed, the sun and air then doing the plants more injury than they receive by exclusion from light.

This mode of management approaches pretty nearly to their natural winter treatment on their native mountains, covered as they are for months by snow, and thereby excluded from atmospheric changes. Little or no water is necessary from November until February or March, when, as the sun becomes more powerful, many begin to grow, and require moistening over

192 Auctarium. 184, D. Cameron.

head as well as by the soil. In March the plants will also be benefited by leaving off the sashes during mild nights, prepartory to their being placed in their summer quarters. The pits and frames should be made to face east, west, or north, but not south.

185 SEEDLING FRUIT TREES INDISPENSABLE. The decay of the best varieties of fruit-bearing trees, which have been distributed through the country by grafts, is a circumstance of great importance. There is no mode of preserving them; and no resource, except that of raising new varieties from seeds. Where a species has been ameliorated by culture, the seeds it affords, other circumstances being similar, produce more vigorous and perfect plants; and in this way the great improvements in the production of our fields and gardens seem to have been occasioned.

Wheat, in its indigenous state, as a natural production of the soil, appears to have been a very small grass; and the case is still more remarkable with the apple and plum. The crab seems to have been the parent of all our apples. And two fruits can scarcely be conceived more different, in size, colour, and appearance, than the wild plum and the rich magnum bonum.

The seeds of plants exalted by cultivation always furnish large and improved varieties; but the flavour, and even the colour of the fruit, seems to be a matter of accident. Thus a hundred seeds of the golden pippin will all produce fine large-leaved apple-trees, bearing fruit of a considerable size; but the tastes and colours of the apples from each will be different, and none will be the same in kind as those of the pippin itself. Some will be sweet, some sour, some bitter, some mawkish, some aromatic; some yellow, some green, some red, and some streaked. All the apples will, however, be much more perfect than those from the seeds of a crab, which produce trees all of the same kind, and all bearing sour and diminutive fruit.

The larger and thicker the leaves of a seedling, and the more expanded its blossoms, the more it is likely to produce a good variety of fruit. Short-leaved trees should never be selected; for these approach nearer to the original standard; whereas the other qualities indicate the influence of cultivation.

Seeds should be chosen from the most highly cultivated varieties, as they give the most vigorous produce.

185, Davy's Agricultural Chemistry.

AUCTARIUM.

186 REVIVING FLOWERS. Under section 136 some directions will be found concerning the method of reviving plants, or parts of plants, which may have become faded, as recommended by M. de Droste. Camphor he found to be the most efficient stimulant, and entire submersion of the plants in a weak solution of it to be the best method of application. In reviving flowers, submersion may occasionally be resorted to, with those of strong petals, but it cannot be generally practised. If the following easy method of application of Camphor be employed, it will oftentimes be found particularly useful to those who desire to prolong the beauty of a flower for the purpose of making a correct drawing of it. Add a tea-spoonful of camphorated spirit of wine to a tumbler-full of water, then having cut off the ends of drooping flowers, insert them therein. After four or five hours take them out again, cut off the extreme ends of the stems, and put them in fresh water. Another method, which we have found to be useful, is to place the ends of flower stems in hot water for ten minutes, then cut off as much of their stems as was immersed in the hot water, and place them in cold water to remain. Either of these methods will be found useful, but flowers rarely last long after such resuscitation.

When cut specimens of flowers have been long enclosed in a box, as is sometimes the case with those which are transmitted to distant parts of the country to be drawn and published, we find that exposure to the light quickly destroys their beauty; but by keeping them still secluded from light, and in a somewhat moist atmosphere, which may be produced by a little damp moss kept in the box which contains them, the freshness of many may be much prolonged. Specimens which we have received in boxes by post, from the Royal Botanic Garden, Edinburgh, through the favour of Dr. Graham, have occupied two nights and a day in their transmission, yet they have generally arrived in perfection; and by continuing as much as was convenient, their seclusion from light, some flowers have been kept a fortnight in perfection.

187 Camphor. The mention of this gum in the above article reminds us that some further notice of it may not be unacceptable. This substance exists in rosemary, thyme, sage, lavender, anemone, and other plants, but the article of commerce is imported from Japan, Sumatra, and Borneo. That from the two latter islands is obtained from a large forest tree called Dryobalanus camphora, of Forster, in a concrete state, by splitting its central or heart-wood to pieces. The Japan Camphor is from a species of laurel, the laurus camphora, which the natives cut into chips, and obtain the camphor in a crude state by distillation, It is further purified in this country and submitted to a sort of sublimation, with steam. Camphor is lighter than water, and a singular phenomenon has been observed relative to its floating on this fluid which may interest some of our readers. If into a bason of clean water a few small light pieces be scraped from a lump of Camphor, they will instantly commence whirling round on the surface with great velocity, some describing circles, and others spinning on their own axis. This phenomenon has not, we believe, been satisfactorily accounted for.

188 Greenhouse Plants. As many of our readers are interested in the management of Greenhouse plants, and our chief desire is to be useful to all, some hints on the general management of a greenhouse may not be unacceptable. It should be first observed that "Greenhouse Plant" is an appellation of local import only, for it will be seen, as a matter of course, that plants which will require the greenhouse in one country will not do so in another, nor even in opposite parts of our own country, as may be instanced in the difference of treatment some require in the north of England and Devonshire.

The principal part of these which we cultivate in the Greenhouse are such as are natives of New Holland, the Cape of Good Hope, some parts of China, Mexico, and various other countries situate between the tenth and fortieth degrees of latitude, both north and south of the equator. It has been already noticed that altitude, or the height which any part of a mountain rises above the level of the sea, has its temperature affected by such elevation as well as by the distance at which it happens to be situated from the equator. Hence it is evident that plants will not always be found hardy or tender in proportion as they are natives of a more northern or southern latitude. It is therefore chiefly on the experience of themselves or their predecessors that cultivators depend for a knowledge of the hardihood of any plant under their care.

Plants which we consider as belonging to the Greenhouse require a higher temperature to bring them to perfection than is usually present in this country; but this increased temperature is in general obtained simply by an inclosed building of glass, which admits and confines the heat of the sun's rays without permitting it to be dissipated by wind or cold air. Artificial heat, produced by fire, is required only in winter, and then only to keep the temperature of the house above the freezing point, or to dissipate the damp which may collect therein, from the evaporation continually going on from the plants and moist soil, which in winter the more readily becomes condensed, from the coldness of the glass and walls.

"The plants should be looked over most days to see if any require water, which must only be given when quite dry; in the winter season; from nine to twelve o'clock in the morning is the best time for watering them, for, if watered in the afternoon, they are apt to be chilled at night, which makes their leaves look yellow and unhealthy. When the surface of the mould is green with moss, &c., the top should be taken off, and the surface moved with a flat stick, but not deep enough to disturb the roots; if a little fresh mould is wanted on any of them, it should be added, always being careful to put the same kind of soil they are already grown in, for we have seen a different kind put on sometimes, which injures plants more than some cultivators are aware of. When the weather begins to get warm in spring, a little air should be admitted all night, to harden the plants before they are set out, a little must be given at first, and continue to increase it till they have full air, if the weather will allow of it. The time of setting them out in the open air depends entirely on the weather. Sometimes they may be put out with safety by the middle of May, in other seasons not till the latter end; but they had better stay in a little too long, than be put out too soon. Calm cloudy weather is the best for setting them out, when a sheltered situation should be chosen for them. The best time for shifting them into fresh pots, is early in spring; some shift them before they are set out, and let them make fresh roots whilst in the Greenhouse, which is a very good plan, particularly for young or tender plants. If any plants are too tall, and want cutting back, it should be done early in spring, as soon as they begin to grow; then they have time to recover themselves, and make good bushy plants by autumn.

Cuttings require to be put in at various seasons. From Christmas to May, may be considered the best time for cuttings in general, but some will require to be put in at various seasons throughout the year, according to the state of the shoots, in the same manner as Stove Plants. Most of the young plants that are potted off in spring, will want shifting into larger pots in autumn. While the plants are out they must be attended regularly with water. The best time for watering them in summer, is as late as possible in the afternoon, then they have all the night to refresh themselves. If watered in the morning of a warm day, they will dry again almost immediately. Plants should not remain out too long in autumn, as they are liable to have too much wet. The middle of September should be the latest, but give them full air as long as the weather will permit.

Seeds of Greenhouse plants should be sown early in spring; the beginning of February is a good time, then the plants get strength before winter; and the sooner seedlings are potted off the better.

In preparing mould for the plants, it should be chopped up with the spade altogether, turf and all, and not sifted as is the general practice, and a great reason of plants not succeeding; for by sifting it all the stringy and rooty part of the mould is lost, which is certainly the best part of it, for it keeps the soil light in the pots, so that the roots can spread themselves regularly, which is not the case when sifted, for then it gets close together, and often bakes as hard as a brick, so that it is impossible for the roots to get through it."

189 Dessert Apples and Pears. A correspondent of the Gardener's Gazette, who signs himself W. P. A., Newmarket, has given in that much-improved and now excellent Gardeners' Newspaper, lists of the best twelve dessert Apples and twelve Pears for espalier training, with remarks which are evidently

from the pen of an experienced cultivator, and we are sure the talented and never-tiring conductor of that paper will not object to our availing ourselves of the prominent parts of so useful an article. The labours of the late Thomas Andrew Knight have been of inestimable value to this department of horticulture, not alone from the improvements which, during a long and active life, he himself effected in the varieties of the apple and pear, but also from the attention which he has thereby drawn to these fruits, making them of infinitely more value in the dessert than any other produced in this country. The writer of the article referred to has given synonymes, or the different names, by which the sorts are usually known, their season of ripening, and also remarks which will be useful to the cultivator of these useful fruits. The following is the list of apples, restricted to twelve varieties.

APPLES.

Names.	Synonymes.	Season of Ripening.
Devonshire Quarrenden	Red Quarrenden	Aug., Sept.
Oslin	Arbroath Pippin	Aug., Sept.
Wormsley Pippin	Knight's Codlin	Sept, Oct.
King of Pippins	Hampshire Yellow	Sept., Oct.
Kerry Pippin		Sept., Oct.
Court of Wick	Wood's Huntingdon	Oct., Jan.
Golden Pippin	Pepin d'Or, Reinette d'Ang.	Nov., April.
Ribston Pippin	Formosa Pippin	Nov., March.
Sam Young	Irish Russet	Nov., April.
Old Nonpareil	Reinette Nonpareil	Jan., May.
Scarlet ditto	New Scarlet ditto	Jan., April.
Court Pendre Plat	Garnon's Apple	Dec., April.

In the above list I have placed such only as I know to be vigorous-growing and free-bearing kinds in almost all soils. The Golden Pippin, however, as generally planted, is an exception to this rule. Young trees of this kind appear determined not to grow in old orchards; but if pits four feet wide and eighteen inches deep be prepared, and well drained with brick rubbish, and then filled with fresh loam from an old pasture, with about one-fourth of leaf-mould, or perfectly decayed manure, they will grow quite as well as any of the delicate kinds. I intend to plant according to the above suggestions, and have not a doubt but success will crown my labours. Sam Young is an excellent dessert apple, by no means so well known as its merits entitle it to be. In the autumn of 1838 I had an opportunity of tasting it in the neighbourhood of Dublin, where it is much cultivated, and in my estimation it is very little inferior to the Golden Pippin. The tree is a low, vigorous grower, seemingly well adapted for a moist situation; it produces fruit abundantly, which is in perfection till the middle of April. The Court Pendre Plat, or, as it is called in the north of England, the Wollaton Pippin, is one of the best and most beautiful apples in cultivation; it keeps well until May, and in Belgium, I am informed, it is brought to table in great perfection in June and July. To the above list many excellent varieties might be added; but I am not acquainted with any better than those I have enumerated.

PEARS.

Names.	Synonymes.	Season of Ripening
Jargonelle	Epargne	Aug., Sept.
Summer Franc Real	Franc Real d'Ete	Sept., Oct.
Brown Beurré	Golden Beurré	Oct, Nov.
Seckle	New York Red Cheek	Oct., Nov.
Marie Louise	Braddick's Field Standard	Oct., Nov.
Crassane	Bergamotte Crassane	Oct., Dec.
Winter Nelis	Bonne de Malines	Nov., Jan.
Hacon's Incomparable	Downham Seedling	Dec., Jan.
Napoleon	Médaille	Dec., Jan.
Glout Morceau	Beurré d'Hardenpont	Dec., Jan.
Passe Colmar	Chapman's	Dec., Jan.
Beurré Rance	Hardenpont du Printemps	Feb., May.

Of pears, the above collection contains the cream of all that I have yet met with, and which I consider worthy of cultivation. There may be a few equal to those enumerated, but I am not aware that there are any superior to them. The Jargonelle planted against east, west, and north walls, and a few trained as espaliers or standards will give an excellent succession from the end of July to the middle of September. Summer Franc Real is a September pear, requiring to be used fresh from the tree; if kept only a few days after being gathered, it will be quite useless. As a bearer, either as a standard or against a wall, it is as prolific as the Hawthornden apple. Brown Beurré; this excellent pear is too well known to require any note of commendation from my hands. With me it is rather a precarious ripener. Last year I had some of it ripe on the 20th of September; this year, from the same tree, they were not ripe until the 7th of October. I have trees on all aspects except the north; from the west it is ripe first, second from the east, third from standards on a dry soil, fourth from a south wall, and last from standards on a very strong soil in a wet situation. What can be the reason of its keeping better from a south aspect than from any other? Is it because the tree being exposed to the full solar influence, the juices are more highly elaborated, and consequently the fruit being formed of superior material, is better able to resist decay, on the principle that strong wine is not so liable to turn acid as weak? I should like to have the opinion of some of your scientific contributors on this subject. The Seckle is an American pear of first-rate quality." (The origin of the introduction of this pear to notice shall be mentioned at the end of this article.) "Marie Louise is one of the best, if not the very best, pears in cultivation. It produces its fruit on the points of the young shoots, and therefore in pruning it must not be spurred in like the generality of pears, but only have the strong shoots thinned out. On a wall it should be treated the same as a peach, that is, have young wood laid in every season. The Crassane is a good but rather tender pear; with me it is generally ripe about the middle of October, from a west aspect; but fruit from branches of the same tree trained perpendicularly down the east side of the wall do not ripen until December, and I have some now from a south wall which will keep a fortnight or three weeks longer. Winter Nelis, or, as it is called in this part, "Curtis's Royal," is a small pear of first-rate quality. It bears very freely as a standard, and this year the fruit is much superior to that from a wall. Last year, from standards, the fruit was not ripe until January; this year, from the same tree, it was ripe early in November, and is now done, but fruit from a west wall is just ready for table. How are we to account for this discrepancy in ripening? Hacon's Incomparable, Napoleon, Glout Morceau, and Passe Colmar, are all excellent at this season. Napoleon and Passe Colmar are the only two pears in this collection that are improved in quality by being grown on a wall. This, I should think, arises from their containing a great quantity of juice, which by being exposed to the superior heat of a wall, a great portion of the aqueous matter is evaporated, and consequently, the saccharine being concentrated, the fruit is richer than it would be if ripened under the more disadvantageous circumstance of a full exposure. For my own part, I am convinced that many of our pears, both native and continental varieties, are deteriorated rather than improved in quality by being grown on walls; and I am sure that such as Summer Franc Real, Maria Louise, Winter Nelis, Hacon's Incomparable, and others of similar consistency of flesh, will, if ripened under anything like favourable circumstances, that is, with the heads of the tree tolerably open, so as to allow the sun to get to the fruit, always be superior in flavour to fruit of the same kinds ripened on walls. As a proof of this I may mention that the Beurré Rance (" De Ranze"), from east and west walls, under my care, is almost tasteless; from a south wall it is tolerably good, but from espaliers it is decidedly the best. Hacon's Incomparable is a hardy good bearing kind, of very superior quality, and deserving to be planted by the dozen. The original tree of this kind stands in a baker's yard at Downham, in Norfolk (hence the synonyme Downham Seedling), and annually produces an abundant crop. Glout Morceau is a delicious pear; the flesh is so rich and deliquescent that no one can avoid admiring it.

I have now given what I consider the twelve best pears in cultivation, that is, to give a succession for table throughout the season; but to those who may feel inclined to have a more extensive collection, I can recommend as good and early ones —Muscat Robert, Passans du Portugal, and Williams's Bon Chretien; for October, Louis Bonne (of Jersey), Beurré Bosc, and Gansel's Bergamot; and for late ones, Ne plus Meuris, and Easter Beurré. The latter, however, with me, and likewise Beurré Diel, Duchess d'Angouleme, and Chaumontel, except for their fine appearance and large size, are quite worthless. Any one wishing to plant what to me appears the most beautiful fruit in existence, may plant Forelle, or, as it is commonly called, the Trout pear, from the speckles resembling those of the fish of that name. It is not a fine-flavoured pear, but this is made up for by its beautiful appearance in the dessert."

The above article has been copied under the impression that it will be useful to many readers of the Auctarium, and if any cultivators of the Apple or Pear, possess varieties which are decidedly superior to those here named, we hope that they will inform us of the fact, and enable us to communicate it for the benefit of others, seeing that the best fruit is as easily cultivated as the most worthless.

We have alluded to the origin of the Seckle Pear. The correct spelling of the name of this pear, we have been politely informed by T. B. Barclay, Esq., of Wavretree Lodge, Liverpool, is Seckel; and that the occasion of its application, and the introduction of the pear to notice, is as follows. About fifty years ago a portion of that fine range of pasture ground, spreading from Philadelphia to the confluence of the Delaware and Schuylkill, belonged to a German, who discovered, in one of his meadows, the pear-tree in question. The quality of the fruit being very superior, it was soon increased, and spread far and wide, under its discoverer's name, Seckel (not Seekle, as usually spelt). As no other tree of the same description has been found in the United States, it is of course considered, says Mr. Barclay, to be a cutting brought by some early European settler, probably from Holland, or possibly from Sweden, this very spot having been first taken possession of by settlers from those countries, where, possibly, the parent tree of the variety may yet be found.

190 Greenhouse Plants in the Open Garden. The practice of transplanting greenhouse and half-hardy plants into the flower garden, in May, or the beginning of June, for the purpose of enlivening the borders with their blossoms during summer and autumn, is justly carried to a considerable extent, in most places, with such showy plants, as all the varieties of Verbenas, Salvias, Fuchias, Lobelias, Anagallis, &c. This practice may be extended to almost all other soft-wooded free-flowering greenhouse and half-hardy plants, both frutescent and herbaceous. And although all are not calculated to make so splendid a display as those mentioned above, still they add much additional variety, flower much more freely, and continue much longer in blossom, than if kept in pots in the houses; while their removal gives more room in the greenhouse, for hard wooded plants necessarily left there, as well as for the introduction of Balsams, &c. as they come into flower, Those about to be recommended for planting out, being chiefly of easy propagation, cuttings of their young wood may be readily struck in the latter end of

197 Auctarium. 190, D. Cameron.

August and beginning of September; and when rooted, may be placed, several together, in store pots, during winter, in frames, pits, or a greenhouse, where they occupy but small space; and by being potted singly, in February or March, will be fit for turning out into the open ground when the planting season arrives.

It would occupy too much space to enumerate every individual species, fit for this purpose, but almost all the species which are usually considered greenhouse plants, of the following genera might be so employed; viz.—Anigozanthus, Aristea, Agathæa cœlestis, Cobæa, Berckheya, Crassula, Calendula, Calceolaria, Cineraria, Dianthus, Dracocephalum, Gazania, Gnaphalium, Lophospermum, Heliotropium, Leconites, Lavendula, Lotus, Lobelia, Mesembryanthemum, Maurandia, Neja, Nicotiana, Nierembergia, Othona, Petunia, Rochea, Salvia, Selago, Stachys, Salpiglossis, Tropæolum, Verbena, Veronica, &c.

The ground where they are to be planted should be well dug or trenched, and enriched by well rotted manure. The time for transplanting will vary in different seasons; that best suited for turning out Dahlias will also be suitable for species of the above genera. Much of their subsequent progress will depend upon the plants being so thoroughly hardened, before transplanting, as to sustain no perceptible check in their transition from a protected state to that of being wholly exposed to the vicissitudes of the open air. They may be hardened by various means, but a spare frame or pit will be most efficient, in which they ought to be placed a fortnight before being turned out, that they may receive an increased portion of air every day, until the sashes can be left off a few days entirely, without the plants sustaining injury. When hardened in the greenhouse, they should be placed as near to the glass as possible, and near to that part of the house where the air is admitted. In transplanting, select a cloudy day for the purpose, or one when there is the appearance of coming showers. Turn them out of the pots with their balls entire; and if the roots are fresh and not over matted around the ball, plant them without disturbing their roots, about an inch deeper in the soil than they have been in the pots; but if the roots are much matted, or beginning to decay, it will be better to remove the greater portion, particularly those in a state of decay, from around the ball before planting. When they have been well hardened, and a judicious time selected for turning them out, they commence growing immediately; whereas, if not well hardened, the leaves will turn entirely brown, and several weeks of the season will be lost before they recover their vigour; and perhaps then will not have sufficient time for flowering so well as they otherwise would have done. Those who have the advantage of a spare wall, might also, with advantage, cover it with some of the more hardy of the hard-wooded New Holland plants, which seldom flower profusely, until established for two or three years, receiving some slight protection in winter. These are more appropriate for walls, than such plants as will, in every season, flower well in the open ground. We will, shortly, give a list of shrubs which are suited to the purpose here suggested.

191 Manure, the application of. The properties of various species of Manure, the comparative stimulus which they afford to different plants, and the best modes of applying them, are subjects of the first importance to the horticulturist. These considerations, hitherto much neglected, are now meeting due attention from practical as well as theoretical men; and as general principles become established, or particular facts of importance elucidated, we intend introducing them to our readers. Dr. Lindley, in his Theory of Horticulture, has some observations on the application of Manures, which are much to the purpose, and which we transcribe. They may be useful to be held in mind, when we, hereafter, treat on the preparation of stimulating substances. He says "Provided manure is of a permanent character, it does not very much matter at what time it is administered, because, if it does not act at first, it will sooner or later; but when it is of such a nature as to be easily dissipated, like malt-dust, or soot, or yeast, a knowledge of the proper season becomes extremely necessary. Plants will not receive the influence of manure so readily at any season as when they are in the most rapid and steady growth; because at that time the absorbing force of their roots, and their vital energies are all greatest. It is for this reason that a top-dressing is almost useless to a lawn at midsummer, but better in the spring, and best of all in October. If applied at midsummer, the ground is dry, and the vegetation extremely languid. When a top-dressing is applied in the spring, the lawn profits by it so long as it continues to

grow vigorously; but the quick approach of summer daily interferes with the force of this kind of vegetation, and diminishes the effects of the manure. On the contrary, if October is the season chosen for the operation, the grasses are then beginning to grow steadily, the operations of the mower are, or should be, suspended, and there are seven clear months at least during which the effects of the manure continue to be felt. It may be indifferent at what season such manures as bones, and other kinds of matter which decompose very slowly, are employed; yet there can be no doubt that upon every known principle they also should be given at a time when vegetation is most active; hence the every-day practice of digging manure into the borders of a garden in spring, or shortly before an annual crop is about to be committed to the soil. As to the manner of applying manure, it must be obvious that it can be of no use unless it is in contact with the absorbing parts of the roots; now those parts are the young fibres and spongioles, and, when plants have arrived at any considerable size, the roots form the radii of a circle whose circumference is the principal line of absorption. This being so, if a plant has arrived at the state of a bush or tree, it is useless to apply manure to the base of the stem, because that is precisely where the power of absorption is the weakest, if it exists at all; and as the circle formed by the roots is generally greater than that of the branches, the proper manner of applying manure is, to introduce it into the ground at a distance from the stem about equal to the radius formed by the branches. And yet, although this is so evidently right, I have seen a gardener, who ought to have known much better, sedulously administering liquid manure, by pouring it into the soil at the base of the stem; which is much the same thing as if an attempt were made to feed a man through the soles of his feet."

192 Nitrate of Soda. In accordance with our previous remarks, we copy the following fact communicated by a correspondent to the Gardener's Chronicle, (May 15, 1841). "In the beginning of June, 1840, I planted a piece of ground with Dahlias, the soil of which was very poor and light; in August they flowered freely, but small, and open in the centre when full blown. I then dissolved 1lb. nitrate of soda, in 12 gallons of soft water, and applied it liberally all over the soil with a

watering-pan, and repeated it whenever watering was necessary; in the course of a fortnight its effects were truly astonishing; the plants became a fine healthy green—the flowers much larger, very brilliant, and perfect; some of which, exhibited in a stand in the amateur class, obtained a second prize at a provincial Dahlia show, notwithstanding there were twenty-four competitors.

193 REPOTTING PLANTS. The proper management of plants in pots requires not only attention, but also, some experience; or, in the absence of experience, a knowledge of the requirements of plants, when growing under such artificial circumstances. The following observations, copied from Lindley's Theory of Horticulture, will prove useful to many cultivators, by exhibiting to them the reasons for adopting certain operations which are so frequently recommended. "It is found that the roots of potted plants invariably direct themselves towards the sides of the pot, as must indeed necessarily happen in consequence of their disposition to grow horizontally. Having reached the sides, they do not turn back, but follow the earthenware surface, till at last they form an entangled stratum enclosing a ball of earth; then, if not relieved by repotting, they rise upwards towards the surface, or they attempt to force themselves back to the centre. The greater part, however, are always found in contact with the porous earthern side of the vessel; and especially all the most powerfully obsorbent, that is youngest, parts. They are, therefore, in contact with a body subject to great variations of temperature and moisture, in consequence of exposure to the sun, or to a dry air in motion, unless in those rare cases where the air is kept by artificial means shaded, and uniformly damp. By these means, in a dry summer day, when the leaves are perspiring freely, and therefore requiring an abundance of water from the roots, the latter are placed in contact with a substance whose moisture is continually diminishing; or in a greenhouse, where the pots are syringed, the heat of the earth in contact with the roots is lowered by a copious evaporation from the sides of the pot, just when, in nature, the bottom heat should be the greatest. The evil consequences of this are well known to gardeners, who however seldom take any sufficient precautions to prevent it. Greenhouse plants exposed to the open air in summer always suffer severely from the irregular

condition of the sides of the pots; whence the common practice of plunging them in the earth, for the purpose of bringing them into the condition of plants growing in the open ground. This is, however, attended with some disadvantage; for the plants root, through the bottom of the pots or over the edges, among the earth in which they are plunged; and, when taken up in the autumn for removal into the greenhouse, they must have all such roots cut off again; for there are no means of bringing them within the limits of a pot. For these and similar reasons, no good gardener will expose his greenhouse plants to the open air in summer, if he can help it; unless they are duplicates, or unless there is some object to be attained very different from the strange notion that they are hardened by this process. The effect that is really produced upon them is, to give them a sort of artificial winter in summer, that is, to expose them to a period of comparative rest from growth, which, in many cases, is useful. The best method of counteracting the injurious effects of exposure to the air is by employing double pots, the space between the two pots being filled up with moss, or any other substance retentive of moisture.

To be managed perfectly, a plant, when young, should be placed in as small a pot as it will grow in, and it should be gradually and successively transferred to larger pots as it advances in size. If this is done, the warmth to which the pot is exposed will be more immediately felt by the roots; the latter, as they grow, will ramify regularly all through the mass of earth, which, moreover, will be thoroughly drained: but, if, on the other hand, a very small young plant is placed at once in a large pot, and left to grow there, the drainage will be less perfect, the large mass of earth will be less sensible of the heat to which it is exposed, the roots will from the first take a horizontal direction towards the outside of the pot, and, once there, will follow its surface as has been already stated, exhausting the small quantity of earth with which they are then in contact, and profiting little or nothing by the main body of soil in the interior of the pot. It is by paying constant attention to the shifting of the growing plant, by the employment of a very rich stimulating soil, and by a thorough knowledge of the kind of atmosphere which suits them best, that have been obtained those magnificent Pelargoniums, Cockscombs, Balsams, and similar flowers, which have so often and so justly excited the admiration of even the most experienced gardeners." It should be observed that those plants, such as Balsams, Lobelias, &c. which throw out roots from their stems, will be benefited by being sunk a little deeper in the soil at each potting, but those which do not do so would be injured by such sinking. It should be remembered, too, that in pots plants demand a lighter or more porous soil than would be suitable to them in the open ground.

194 RANUNCULUSES, CULTURE OF. We have been favoured with flowers of remarkably fine seedling Ranunculuses, raised by Mr. Tyso of Wallingford, Berkshire, one of which has been drawn, and will shortly be published in the Botanic Garden. Mr. Tyso is, we believe, the most extensive and successful cultivator of this favourite flower in England, and we are obliged to him for furnishing us with practical instructions for its cultivation. This paper is the result of long experience, we therefore, give it entire.

The Ranunculus Asiaticus, or Garden Ranunculus, is a hardy herbaceous perennial, forming a fasciculus of small tubers, about an inch and a half deep in the soil, which require to be taken up as soon as vegetation has ceased, or they are in a state of rest: these should be kept dry till the return of the planting season. There are innumerable varieties of this interesting species, above a thousand of which have received distinctive names, but they are for the most part of an arbitrary character. The Ranunculus has long been a favourite with the Florist, although by many unsuccessfully cultivated. It is deservedly esteemed for the symmetry of its double blossoms, the brilliancy of its colours, and the great variety it displays. In a well selected bed may be seen, scarlet, purple, crimson, yellow, white, dark, (approaching to black,) with others which are denominated selfs: and bicolored sorts with white, yellow, buff, or crimson grounds, beautifully edged, spotted, mottled, shaded, or striped, in infinite variety. In offering a few hints on the cultivation of this attractive flower, it may be desirable to arrange them under different heads. The first point then after the possession of a collection of roots is to seek a suitable

SOIL. The Ranunculus delights in a rich hazely loam. If the natural soil of the garden be unfavourable, the top spit of a pasture, of rather heavy and tenacious qualities should be procured, with the turf, and laid in a ridge some months before use. To this may be added, about one third of old manure, turning it over, and mixing it till thoroughly incorporated. This is of importance, as the tubers coming in contact with fresh manure engenders disease, and is highly injurious. To give precise directions for selecting a soil is difficult, but it is deserving of remark, that a pasture abounding with, and luxuriantly sustaining, the British varieties of Ranunculus, or Butter-cups, as they are usually called, has also been found congenial to the Asiatic species.

Preparation of Beds. Having chosen an open but not exposed part of the garden, remove the earth a foot deep, and about three feet wide, and fill the bed with the prepared compost. This is best done in Autumn, that time may be allowed for the earth to settle. The surface of the beds should be level, and not more than an inch higher than the paths, in order that the roots may be kept regularly cool and moist; and as the Ranunculus thrives on a firm bottom, the compost should not be disturbed at the time of planting, more than is just needful for that operation.

Season for Planting. The best season for general planting is the last week in February—the plants have not then to contend with the severities of the winter. In some seasons roots may be planted with advantage in October; they will have more time to vegetate, and establish themselves; will make stronger plants, and will bloom more vigorously, and about a fortnight earlier than if planted in spring. Considerable risk however, attends autumn planting, and it is not recommended, except to those who have a large stock, by way of experiment. Plant the roots in drills, and an inch and a half deep, four inches apart in the rows, and the rows six inches asunder. The plants will make their appearance in a month; after which it will be advantageous to press the soil closely around them with the hands, stopping up the holes made by worms, frosts, and the protrusion of the leaves through the surface. A little addition of rich mould, between the rows, as a top dressing, will promote vegetation.

Watering. April showers, and rains in May, are essential requisites of a congenial season. The Ranunculus delights in a moist soil, and if there be a deficiency of rain in May, water must be plentifully supplied, just at the time the flower buds are appearing. This is a critical point of time, and for lack of moisture many plants fail to bloom, and send up only an abortive flower stem. Water from a pond or brook is better than from a well; it should be applied morning or evening, between the rows, from a tube pot, and not over the foliage, except in cloudy and showery weather. It may appear an anomalous direction to water in wet weather, but advantage should be taken of a shower falling to give a copious watering, as the plants are then naturally in a better state to receive moisture than in dry weather, when their pores are contracted.

Shading. To obtain perfect blooms, a shade of hurdles, netting, or white calico should be used, when the blooms begin to expand. It should be so placed as to admit of abundance of air, and be removed in cloudy weather, and at night. This will not only prolong the period of flowering, but increase the size of the blooms, and preserve the colours of the darker sorts: those with light grounds will, much better, sustain the sun's rays. Many sorts will produce more flower buds than should be permitted to mature, they should, therefore, be pinched off when young, leaving two or three to each root.

Taking up. The roots may be lifted as soon as the foliage turns yellow, or if the weather be dry, they may remain till it becomes brown. The Ranunculus is apt to vegetate again immediately after it is brought to a state of rest, care is therefore required when the weather is moist at this season, to select and take up the sorts as they ripen, and not to wait until the whole are fit. Spread the roots thin, in an airy cool place, that they may dry gradually, and keep them in bags or boxes, till the planting season.

Properties of a fine Ranunculus. First. Stem.—The stem should be strong, straight, from eight to twelve inches in height, and capable of supporting a large blossom. Second. Shape.—The blossom should resemble half a globe, with petals having entire well rounded edges, termed rose-leaved. Third. Size.—From two to three inches in diameter. Fourth. Colour.—Anything clear, rich, and brilliant, either consisting of one colour, as dark, white, crimson, yellow, &c. or bicolored, as edged, spotted, mottled, or striped.

Seedlings. Every admirer of this beautiful flower, should cultivate seedlings, as they possess all the luxuriance and vigour of youth, and produce larger and finer blossoms than the old varieties. Persons desirous of saving seed, should procure some seedlings, possessing fine properties, because these afford pollen for the purpose of impregnation, which is very seldom the case with long established sorts. The perfection of the art of raising seedlings, consists in having some of the best show flowers in each class, which produce an eye or pericarp: viz. dark, white, scarlet, yellow, edged, spotted, &c. and a number of the best semidoubles of each corresponding class, which produce anthers, as well as pericarps. Then apply the farina of any semidoubles that afford it, to the pericarp of the flower you have selected as a seed bearer. The most approved method of fertilizing, is by gathering the semidoubles, and apply the pollen, by lightly pouring it on the pericarp, but if semidoubles are scarce, then the application may be made with a large camel's hair pencil. This operation should be repeated for several days, in fine sunny weather. The stems bearing seed vessels, should be supported with sticks, and two or three bandages of matting, to prevent the stalks from breaking down, which would deprive the seed of the necessary nutriment. Gather the seed when it turns brown, and keep it loose in a drawer, in a dry place. The seed vessels should be preserved entire till the time of sowing, when the seeds should be separated from the pod, by carefully scraping them off with a knife.

Sowing. The seed should be sown on a moderately light rich loam, in boxes or pots, not less than five inches deep. Put some coarse siftings at the bottom of the boxes, and then fill up with your compost, which should be broken fine but not sifted. Make the surface quite level and press it gently with a board, then sow the seeds about an eighth of an inch apart, and water with a finely perforated rose water pot, to make them lie flat; then sprinkle with fine dry mould, just sufficient to cover the seeds which should not be more than the thickness of a shilling below the surface. The boxes should be kept regularly moist by gentle waterings, which will often make the seeds bare, when this occurs they must again be lightly covered with fine mould.

The best seasons for sowing are October and February, the seed will come up in about a month. The boxes may be placed in a cold frame, on a thick layer of ashes, and be shaded when there is much sun. Care must be taken to preserve the young plants from slugs and other insects. About the second week in May, plunge the boxes up to the edge, in the open ground, where they have only the morning sun. About the beginning of July, when the foliage begins to turn yellow, water must be gradually discontinued, and the roots suffered to go into a state of rest; they may then be taken up, sifting the surface soil of the boxes, that the small tubers may not be lost. After gentle drying, store the roots in a box of dry sand. The seedling roots may be planted at the same time and treated in the same way as directed under the head 'season for planting'. In consequence of their luxuriant growth they will require to be planted quite as far distant apart as the established sorts; though the seedling roots the first year are much less in size, yet the major part of them will bloom profusely the following season, and will, under the management above detailed, amply compensate the florist for the trouble attending their culture.

195 Linnæa borealis, Culture of. This little plant is highly interesting, from the association which it has with one of the most talented naturalists that ever existed. Men, like all other objects, whether of nature or art, are judged of comparatively, and although we have those of the present day whose knowledge in natural history exceeds that of any in the preceding century, still they are less in advance of their contemporaries than was Linneus in advance of the age in which he lived. He so far outstripped all his competitors in the investigation of the works of creation, as to be entitled to be called the most eminent naturalist the world has ever produced. On this account in part we advocate the culture of the little plant which bears his name and partly because it claims our attention for its own sake—for its pretty pale rose-coloured sweet-scented flowers.

In commencing its cultivation care should be taken to obtain well rooted plants, or first to pot them in light sandy peat until they are well rooted; they may then be turned out into a light sandy peat bed, in any sheltered situation, either in full exposure to the sun, or in the shade. As the slender shoots

202, Auctarium. 195, D. Cameron.

advance in growth they should be pegged down to the surface at some of the joints, and covered here and there with a little soil, to cause them to make young roots; and when once the plants become thoroughly established they will grow rapidly into a dense mass of interwoven creeping stems. Amongst these some light peat may, occasionally, be mixed; and if it be desired that a considerable space should be covered with the plants, they may be divided in April, into small patches, and taken up with the soil about their roots and then planted two feet apart; and by subsequently attending to the pegging down of the shoots, they will cover, in little more than a year, all the spaces left between the plants. There are what are considered to be two varieties in cultivation; that from North America is said to be of freest growth, but a shy flowerer; whilst the other—a Scotch variety, is said to flower freely but is of slower growth. After cultivating both sorts, for several years, I find them equally luxuriant, and to flower equally well, when treated as I have directed. Generally, in the month of June they flower abundantly, and prove quite hardy.

196 Layers, Rooting. To the late Thomas Andrew Knight, the vegetable physiologist and horticulturist are more indebted than to any individual of the present century. His numerous experiments have determined questions, and exposed facts previously un-thought-of, we shall, therefore, occasionally select from his papers which have lately been published by his family, with a sketch of his life, forming a single, but highly interesting, volume. The following experiment on Layers, will suggest to the propagator of shrubs new modes of operation.

When a layer is prepared, and deposited in the ground, the progress of the sap, in its descent towards the original roots, is intercepted upon the side where the partially detached part, or tongue, of the layer is divided from the branch; and this intercepted sap is, in consequence, generally soon employed in the formation of new roots. But there are many species of trees which do not readily emit roots by this mode of treatment; and I suspected that, wherever roots are not emitted by layers, the sap, which descends from the leaves, must escape almost wholly through the remaining portion of bark, which connects the layer with the parent plant. I therefore attempted, in the last and the preceding spring, to accelerate the emission of roots by layers of trees of different species which do not readily emit roots, by the following means, having detached the tongue of the layers from the branches in the usual manner. Soon after Midsummer, when the leaves upon the layers had acquired their full growth, and were, according to my hypothesis, in the act of generating the true sap of the plant, the layers were taken out of the soil, and I found that those of several species of trees did not indicate any disposition to generate roots, a small portion of cellular bark only having issued from the interior surface of the bark in the wounded parts. I therefore took measures to prevent the return of the sap through the bark, from the layers to the parent trees, by making, round each branch, two circular incisions through the bark, immediately above the space where the tongue of the layer had been detached; and the bark between these incisions, which were about twice the diameter of the branch apart, was taken off. The surface of the decorticated spaces was then scraped with a knife, to prevent the reproduction of the bark, and the layers were recommitted to the soil; and at the end of the month I had the pleasure to observe that roots had been abundantly emitted by every one. In other instances, I obtained the same results by simply scraping off, at the same season, a portion of the bark, immediately at the base of the tongue of the layers, without taking them out of the ground.

By the preceding mode of management, the ascending fluid is permitted to pass freely into the layer, to promote its growth, and to return till the period arrives at which layers generally begin to emit roots; the return of the sap through the bark, is then interrupted, and roots are, in consequence, emitted; and I entertain little doubt that good plants of trees, of almost every species, may be thus obtained at the end of every season. I wish it, however, to be understood, that my experiments have been confined to comparatively few species of trees; and that I am not much in the habit of cultivating trees of difficult propagation.

197 Onion, Culture of. Every bulbous-rooted plant, and indeed every plant which produces leaves, and lives longer than one year, generates, in one season, the sap, or vegetable blood, which composes the leaves and roots of the succeeding spring; and when the sap has accumulated during one or more seasons,

203, Auctarium. 197, Knight's Papers, p. 181.

it is ultimately expended in the production of blossoms and seeds. This reserved sap is deposited in, and composes in a great measure, the bulb; and the quantity accumulated, as well as the period required for its accumulation, varies greatly in the same species of plant, under more or less favourable circumstances. Thus, the Onion, in the south of Europe, acquires a much larger size during the long and warm summers of Spain and Portugal, in a single season, than the colder climate of England; but under the following mode of culture, which I have long practised, two summers in England produce nearly the effect of one in Spain or Portugal, and the Onion assumes nearly the form and size of those thence imported.

Seeds of the Spanish or Portugal Onion are sown at the usual period in the spring, very thickly and in poor soil; generally under the shade of a fruit tree; and in such situation the bulbs, in the autumn, are rarely found much to exceed the size of a large pea. These are then taken from the ground, and preserved till the succeeding spring, when they are planted at equal distances from each other, and they afford plants which differ from those raised immediately from seed, only in possessing much greater strength and vigour, owing to the quantity of previously generated sap, being much greater in the bulb than in the seed. The bulbs, thus raised, often exceed considerably five inches in diameter, and being more mature, they are with more certainty preserved, in a state of perfect soundness, through the winter than those raised from seed in a single season. The same effects are, in some measure, produced by sowing the seeds in August, as is often done; but the crops often perish during the winter, and the ground becomes compressed and saddened (to use an antiquated term) by the winter rains; and I have in consequence always found that any given weight of this plant may be obtained, with less expense to the grower, by the mode of culture I recommend, than by any other which I have seen practised.

198 Stems of Fruit Trees, Protection of. The blossoms of fruit trees fall off abortively in some seasons, and produce much fruit in others, in which the weather, relatively to temperature and moisture, has been nearly the same during the flowering season of such trees, and it is in very favourable, or very unfavourable seasons only, that the gardener can, with

198, Knight's Papers. p. 286.

any degree of precision, pronounce what portion of his blossoms will afford fruit. If a larger part of it than he has been led to anticipate prove abortive, he generally attributes its falling off to something which he calls a blight, and which he supposes to be the operation of some unknown noxious quality in the atmosphere, during the season in which his trees have been in blossom.

Many circumstances have at different periods come under my observation, which have led me to draw a different conclusion, and to believe that whenever a very large portion of the well organized blossom of fruit trees falls off abortively, in a moderately favourable season, the cause of the failure may generally be traced to some previous check which the motion and operation of the vital fluid of the tree has sustained.

It is well known that the bark of oak trees is usually stripped off in the spring, and that in the same season the bark of other trees may easily be detached from their alburnum, or sapwood, from which it is, at that season, separated by the intervention of a mixed cellular and mucilaginous substance; this is apparently employed in the organization of a new layer of fibre, or inner bark, the annual formation of which is essential to the growth of the tree. If, at this period, a severe frosty night, or very cold winds occur, the bark of the trunk or main stem of the oak tree becomes again firmly attached to its alburnum, from which it cannot be separated till the return of milder weather. Neither the health of the tree, nor its foliage, nor its blossoms, appear to sustain any material injury by this sudden suspension of its functions; but the crop of acorns invariably fails. The apple and pear tree appear to be affected to the same extent by similar degrees of cold. Their blossoms, like those of the oak, often unfold perfectly well, and present the most healthy and vigorous character; and their pollen sheds freely. Their fruit also appears to set well; but the whole, or nearly the whole, falls off just at the period when its growth ought to commence. Some varieties of the apple and pear are much more capable of bearing unfavourable weather than others; and even the oak trees present, in this respect, some dissimilarity of constitution. It is near the surface of the earth that frost in the spring operates most powerfully; and the unfolding buds of oak and ash trees, which are situated near the ground, are not unfrequently destroyed, whilst those of the more elevated branches escape injury; and hence arises, I think, a probability that some advantages may be derived from protecting the stems or larger branches of fruit trees, as far as practicable, from frost in the spring; and the following facts appear strongly to support this conclusion.

Mr. Williams, of Pitmaston, pointed out to me, two or three years ago, an apple tree which, having had its stem and part of its larger branches covered by evergreen trees, had borne a succession of crops of fruit; whilst other trees, of the same variety, and growing contiguously in the same soil, but without having had their stems protected, had been wholly unproductive. I subsequently saw, in the garden of another of my friends, Mr. Arkwright, of Hampton Court, in Herefordshire, a nectarine tree, which having sprung up from a seed accidentally, in a plantation of laurels, had borne, as a standard tree, three successive crops of fruit. The possessor of it, with the intention of promoting its growth and health, cut away the laurel branches which surrounded its stems, in the winter of 1823-4, and in the succeeding season not a single fruit was produced. Never having known an instance of a standard nectarine tree bearing fruit in a climate so unfavourable, or nearly so unfavourable, I was led to expect that the variety possessed an extraordinary degree of hardiness; but having inserted some buds of it into bearing branches upon the walls of my garden, at Downton, in the summer of 1822, I have not had any reason to believe that its blossoms are at all more patient of cold than those of other seedling varieties of the nectarine,

I planted some years ago in my garden, under a wall, in a north-east aspect, and shaded by a contiguous building, a common China rose tree (Rosa indica) and a plant of Irish ivy. Both have risen considerably above the top of the wall, which is thirteen feet high; and the rose tree, of which the stem is wholly covered by the branches and foliage of the ivy, has annually produced more abundant flowers, and exhibited symptoms of more luxuriant health, than any other tree of the same kind in my possession. The soil in which it grows is poor and unfavourable; and I am unable to discover any cause, except the protection it receives, from which it has derived its luxuriant health and growth.

Ivy is generally, I believe, known to gardeners as a creeping dependant plant only; but when the trees have acquired a considerable age, and have produced fruit-bearing branches, these exhibit an independant form of growth, which they retain when detached, and form very hardy evergreen shrubs of low stature. If these were intermixed with plants of the more delicate varieties of the Chinese rose, or other low deciduous and somewhat tender-flowering shrubs, so that the stems of the latter would be covered in the winter, whilst their foliage would be fully exposed to the light in summer, I think it probable that those might be successfully cultivated in situations where they would perish without such protection; and the evergreen foliage of the ivy plants in winter would be generally thought ornamental, Detached fruit-bearing branches of ivy readily emit roots, and the requisite kind of plants would therefore be easily obtained.

199 Greenhouse Shrubs, for Walls. Having, at section 190 of the Auctarium, given a list of greenhouse and half-hardy free-flowering plants, suitable for turning into the open ground, in the month of May, with directions concerning their management, we now proceed to give a list of the hard-wooded and less free-flowering greenhouse plants, for planting against an open wall. These, to be seen in perfection, must be preserved for years, by some slight protection, every winter; such as fern, spruce fir, branches of broom, &c., according as one or the other may be conveniently obtained. The covering should not, however, prevent light being admitted to the plants, otherwise they will be likely to suffer upon the covering being removed. As most of the plants about to be recommended ripen their wood in autumn, and remain dormant during winter, they endure much more cold, without injury, than those recommended for the flower-beds; which, from their succulent nature, are sometimes destroyed by the first sharp frost of autumn. The wall for planting against should have a border prepared in front of it, four feet wide, by mixing a portion of peat and sand, with the common soil, to the depth of two feet and a half, the bottom being first made perfectly dry. The plants should be hardened gradually, as recommended in section 190, and turned out against the wall in the latter end of May, at such a distance from each other as the different species

may require, according to the sizes they are likely to attain. In their subsequent management they should be kept closely nailed to the wall, and part cut out of them, when they become too crowded, The surface of the border should be loosened twice or thrice each season, but no manure dug in. The plants should be selected from some of the following genera: Acacia, Arbutus, Banksia, Beaufortia, Callistachys, Callistemon, Camellia, Cassuarina, Ceanothus, Colletia, Duvaua, Edwardsia, Eucalyptus, Grevillea, Hakea, Leptospermum, Melaleuca, Metrosideros, Pillosporum, Pomaderris, Sollya, Veronica, Viburnum, &c. Until the plants cover the wall, vacant spaces may be covered with some of the free-growing greenhouse creepers, such as Cobæas, Lophospermums, Maurandyas, Tropæolums, &c. The soil, as well as the situation near the wall, will also be well-suited to the Gladiolus, Ixia, Oxalis, Zephyranthes, and other greenhouse bulbs. The Belladona Lily (Amaryllis belladona), of which flowering bulbs are annually imported, would, if planted near the wall, grow finely; and, after being established two or three years, will, every autumn, send up plenty of flower scapes, of a much larger size than those obtained from imported bulbs. This plant will also withstand the severity of ordinary winters, without protection. A few plants of Melaleucas, Edwardsias, and Metrosideros, were, as far back as 1810, cultivated against a dwelling-house, in the nursery of Dicksons and Co., Edinburgh, where they grew for many years, and were, perhaps, amongst the first plants so treated in our island.

200 Alstrœmeria, treatment of. We are indebted to Mr. W. Scott, the intelligent gardener at Bury Hill, for the following observations on the culture of Alstrœmeria, a genus of which he is a most successful cultivator. Most of the species will do very well in the open ground, but require to be planted under a wall, or in front of a greenhouse. As they begin to grow in the autumn, and early in spring, they will require frequent examinations, as snails and slugs are very fond of them; and a covering of finely-sifted coal ashes will be found very useful, in keeping off these enemies, and also as a protection from frost. The border should be made of old rotten manure and light loam; and, if the subsoil be wet, a draining of brick rubbish would be useful, as too much moisture would

rot the roots in winter. They should also be sheltered from rough winds. Pelegrina will be found the tenderest of the genus, excepting the stove species — caryophylla. If grown in the greenhouse, Simsii, hœmantha, ligtu, tricolor, and aurea, will require a period of rest, from the beginning of August till November; whilst pelegrina, psittacina, and Errembaultii, will require very little. They should be fresh potted every season, in pots as small as they will conveniently go into; and as they fill them with roots, they should be shifted into larger, when they are growing very fast, which will be in April and May. They must be protected from rough winds, and will require a great quantity of water, for if suffered to flag, the ends of the leaves will wither, and make them unsightly. They should have as much free mild air as possible. The soil should be one-quarter rotten hotbed manure, and the remainder light sandy loam. The twining varieties (now called Bomaria), such as acutifolia, hirtella, &c., will require a rope or other convenient support.

201 Root Pruning. We now fulfil the promise to introduce our readers to a knowledge of the practice of Root Pruning unproductive Fruit Trees, of luxuriant growth, for the purpose of rendering them fruitful; a subject which will obtain the earnest attention of every thinking horticulturist. This practice has, long ago, been partially followed, but to Mr. Rivers, of Sawbridgeworth, belongs the merit of introducing it more prominently to public notice. It ought, however, to be mentioned that, several years ago, Mr. Errington, the gardener at Oulton Park, stated, in a communication to the Gardeners' Magazine (vol. 6, p. 693), the advantages he had obtained from Root Pruning his Peach, Pear, and Plum, trees.

This operation may be performed in any month, between the end of October, and the beginning of the following March; but that which has hitherto been recommended is November. Before this month be, as a matter of course, received as the best in which Root Pruning can be performed, we hope that some of our horticultural friends will, by direct experiment, establish its claim to superiority. We know that the roots of trees are not wholly inactive during winter, and if they form, in that season, a necessary reservoir of fluids, advantageous to the nutrition of blossoms, which, on account of the temperature of the atmosphere, cannot then ascend into the branches, it may be that a bleeding (as it is called) of the roots would take place, when wounded in winter, just as it occurs in the branches of vines when they are severely cut back in spring; and thus the blossoms, notwithstanding the exuberance of the branches, may be deprived of a requisite nutritive stimulus when active vegetation commences. The produce of blossoms is chiefly dependent on the concentrated juices of autumn and winter, and it would therefore seem desirable not to aim at depletion of these juices by autumn root pruning, but to enforce on the tree a rigid abstinence during summer, which will be effected by spring root pruning.

It must be remembered that blossom-buds and leaf-buds, in their incipient state, are identical in their organization; and that those buds which under favourable circumstances afford blossoms, would, if too much luxuriance be present in the tree, be driven, as it were, into the produce of leaves and branches only. Hence it becomes the study of the horticulturist to assist the tree in feeding its blossom-buds to a certain degree, so as to secure their healthy expansion; but to restrict it from conveying into them such an excess of nutriment as may divert them from their original purpose to that of the tree's enlargement. It will now be seen that the horticulturist has his trees completely under control; if they are impoverished, he can feed them; if too luxuriant, and thereby unproductive, he can, by reducing their roots, check that luxuriance to any extent he chooses.

We will now give the substance of a paper read before the London Horticultural Society, in April, 1841, by Mr. Thomas Rivers, jun. His experience is chiefly founded on the management of trees which were under his care, from the time of their being first planted; this, however, is unimportant, as every intelligent gardener will readily understand how best to avail himself of the advantages of root pruning, when its principles are so clearly developed. He says —

"Supposing a tree to be planted in November or December, it may remain untouched two years from that period, and then, early in November, if possible, a circumferential trench ten inches from the stem of the tree, and eighteen inches deep, should be dug, and every root cut with a sharp spade, which should be introduced quite under the stem at about fifteen inches in depth, so as completely to intercept every perpendicular root. The following year, the third from planting, a trench may again be opened, at fourteen inches from the stem, so as not to injure the fibrous roots of the preceding summer's growth, and the spade again used to cut off all the circumferential and perpendicular roots, that are getting out of bounds; the fourth year the same operation may be repeated, at eighteen inches from the stem, and in all subsequent root-pruning this distance from the stem must be kept; this will leave enough undisturbed earth round each tree to sustain as much fruit as ought to grow, for the object is to obtain a small prolific tree. I assume, that in the course of years a perfect ball of fibrous roots will be formed, which will only require occasional examination. But it must be borne in mind that this circular mass of soil will, in a few years, be exhausted; to remedy which I had left round each tree a slight depression in the soil, or in other words, the trench has not been quite filled in; this circular furrow I have filled with fresh night soil, which has had a most excellent effect; any other liquid manure would undoubtedly be equally efficacious, but my soil was poor, and I thought it required strong manure. As it did not come in contact with the roots, no injury resulted from using such a powerful raw manure. There is, perhaps, no absolute necessity for liquid manuring, as common stable manure may be laid round each tree in the autumn, and suffered to be washed in by the rains of winter, and drawn in by the worms. In mentioning liquid manure, I give the result of my own practice; the great end to attain seems (to use an agricultural phrase) to be able "to feed at home;" that is, to give the mass of spongioles enough nutriment in a small space, but not too much, so that a tree will make shoots about four inches long in one season, (for such I conceive ought to be the maximum of growth) and at the same time be able to produce abundance of blossom-buds and fruit; on trees of many varieties of pears the former will be in too great abundance; I think removing a portion in early spring, would be an improvement in pear culture. I have not mentioned the necessity of pruning the branches of pear trees thus brought into early fruitfulness; all that is necessary is the occasional removal of a crowded branch; the fact being that root pruning almost does away with the necessity of branch pruning. Sometimes, however, a root will escape the spade, and then, in the following summer, a vigorous shoot or two will make their appearance; these should be shortened in July, to within four buds of their base, and the following autumn the feeding root must be diligently searched for and pruned. All over-vigorous shoots should be shortened in July, as it tends so much to the formation of blossom-buds. To prune roots with a spade may seem a rough and ungarden-like operation, but to use a knife would be tedious. In defence of spade pruning I can only say, that it seems to answer perfectly well with my trees, and experience is generally a tolerable guide. I have also practised root pruning on apple trees for two years, and have reason to hope for perfect success. Some trees have been arrested in a most extraordinary state of vigorous growth, making, previously to their being root pruned, shoots from four to five feet in one season, having been planted about five years. From plums and cherries I have reason to hope for the same results.

I have not mentioned the possibility of root pruning fruit trees of twenty or thirty years' growth with advantage. Irregular amputation of the roots of fruit trees, too vigorous, is, I am aware, an old practice; but the regular and annual or biennial pruning of them, so as to keep a tree full of youth and vigour, in a stationary and prolific state, has not, that I am aware of, been recommended by any known author, although it may have been practised. In urging its applicability to trees of twenty or thirty years' growth, I must recommend caution; the circular trench should not be nearer the stem than three feet, and only two-thirds of the roots should be pruned the first season, leaving one-third as support to the tree, so that it is not blown on one side by the wind; and these, of course, must be left where they will best give this support. The following season half of the remaining roots may be cut, or, if the tree is inclined to vigorous growth, all of them; but, if it gives symptoms of being checked too much, they may, on the contrary, remain undisturbed for one or even two seasons. If, as is often the case, in pear trees, the roots are all perpendicular, the tree must be supported with stakes, for one or two years after complete amputation.

As regards the space required for each tree, when subjected to root pruning, planted in squares, or in rows by the sides of garden walks, six feet, tree from tree, will be found sufficient. For the form of the tree, the conical is indubitably the most agreeable, and generally convenient; but for facility of protection from spring frosts, or from birds by the cheap netting now so much used, trees trained as spreading bushes, the branches kept near the ground by hooked pegs, either of wood or iron ought to be tried. I feel confident the size and flavour of the fruit would be improved from being near such a radiating surface as the earth.

Apples grafted on the Paradise stock, are astonishingly fruitful when root pruned, but in dry and poor soils, I should recommend the crab as a preferable stock. From the experience of the last season, I can now confidently state, that Plums become equally prolific with other fruit trees when root pruned; and such esteemed Nuts, as the Cosford, the Frizzled Filbert, and the Dwarf Prolific Nut, may be made objects of much garden interest by being root pruned; the common Filbert might also be experimented on. The best form that can be given all the varieties of Nuts is the dwarf standard, with clear stems, two or three feet in height, and close compact heads, yet their shoots not too much crowded. It will not perhaps be out of place to enumerate here a few of the advantages of systematic root pruning.

1st. The facility of thinning, and in some varieties, of setting the blossoms of shy bearing sorts, and of thinning and gathering the fruit.

2nd. It will make the gardener independent of the natural soil of his garden, as a few barrows-full of rich mould will support a tree for a lengthened period, thus placing bad soils nearly on a level with those the most favourable.

3rd. The capability of removing trees of fifteen or twenty years' growth, with as much facility as furniture. To tenants this will indeed be a boon, for perhaps one of the greatest annoyances a tenant is subjected to, is, that of being obliged to leave behind him trees that he has nurtured with the utmost care.

4th. The possibility of netting over a complete miniature Orchard, so as to protect it from the nipping frosts of spring, and the depredations of birds in summer.

In conclusion I must again recommend caution; enough of vigour must be left in the tree to support its crop of fruit, and one, two, or three seasons' cessation from root pruning, will often be found necessary.

By beginners the following directions should be observed: If a number of established trees are to be operated upon, I should recommend them not to be all pruned in one season: thus, I would prune one third the first year, and the remainder the two seasons following; for it must be recollected, that trees in a state of uncontrolled luxuriance, suddenly and severely root pruned, will not be able to bring any fruit to perfection the following season. It is perhaps departing from the fruit garden rather suddenly, but I cannot forbear suggesting, how exceedingly ornamental, even to the smallest lawns, may be made (by root pruning) some of the most beautiful of our flowering trees; such as the varieties of the Hawthorn, Pyrus, more particularly Pyrus Spectabilis, a most splendid tree, but too luxuriant for small flower gardens; above all, the varieties of Robinia, which at present, owing to their rudeness of growth, and consequent liability to being wind-driven, cannot be planted in any flower garden, or on any lawn; with root pruning they may be made, (particularly as standards), objects of extreme beauty.

The varieties of the Horse chestnut, many of which are too rude for small lawns, may also be made to produce their flowers abundantly; and some of the climbing roses, such as the Banksian roses, varieties of Rosa Sempervirens, the Boursault and Ayrshire roses, may be checked by root pruning, so as to produce their flowers in incredible abundance. I need not point out to the rose cultivator the great advantage of keep-these too vigorous species of roses in bounds; if the soil is rich and they are trained to pillars, they soon get unwieldy and suffer much from the wind, and if the knife is used, it only induces an abundance of shoots, and checks all tendency to the production of flowers. Now radical pruning, at once remedies the evil, and pillars of roses from six to eight feet in height, may be kept at that height, producing every season thousands of their beautiful flowers, and never giving any annoyance from their over-luxuriant habits. Climbing roses should be root pruned every autumn, if cultivated as pillar roses on small lawns, and no floral ornament can be more interesting and beautiful; those who have had their pillars of roses prostrated by a high wind in June, will I flatter myself appreciate this hint, and be able by root-pruning, to make their climbing roses fit subjects even for a small rose garden.

Thus far have we followed Mr. Rivers through his paper, as read before the Loudon Horticultural Society, and the thanks of Horticulturalists are due to him for bringing the subject so prominently before the public. He has roused the attention of the cultivator to general principles; but further experience is required to enable us to pronounce on all its advantages, and to appreciate the methods of proceedure.

Root-pruning, in winter has succeeded admirably, but we are not sure that it is the best season, under all circumstances. Checkiug luxuriauce by cutting off large roots has been successful, but we are not sure that the practice should be indulged in without due attention being paid to the subsequent encouragement of the growth of small oues. Dr. Lindley has somewhere said that a rank growth in a tree is not better evidence of health than corpulence in mau. We think the comparison defective. Man is endowed with reason to guide him, and if he offends against its dictates, he is sure to meet punishment. Disease is the result of unfit indulgence. Whereas, if a tree be planted iu rich soil, it luxuriates aud grows, as naturc intended it should grow, till it arrives at maturity, and then it becomes fruitful. But wc are not content to wait for the period of maturity. We desire that it should producc fruit in its very childhood; therefore we starve it into extraordinary exertion; we alarm nature, as it were, and she, in this, as in hundreds of other instances, makes an immediate effort at re-production. In the vegetable world, when an individual is maimed, irregularly supplied with food, or subjected to other treatment that may endanger life, it will generally be seen, that the means of increase are thereby called into greater activity.

Root-pruning has hitherto been performed after the fall of the leaf, but to obtain flowers in the following spring, it may be reasonably supposed that if pruncd in August the trees would have a better opportunity of maturing blossom-buds for the following spring. Experience is yet wanting to show the different circumstances under which the process may be most advantageously executed; and as this is hereafter obtained we hope to convey it to the readers of the Botanic Garden.

202 Bulbs Propagated by Leaves. When writing the observations on the last article, regarding the re-production of plants, Mr. Herbert's success in propagating bulbs from leaves presented itself, as one not amongst the least interesting of that class of natural phenomena, Reproduction, by bulbs, we have occasionally noticed in the Botanic Garden, (See Nos. 21, 53), and their growth from a leaf is the less surprising when the true nature of the bulb is considered. Mr. Herbert says, in the Gardener's Chronicle, v. 1, 381. "In the year 1809 I first tried to raise bulbs of a Cape Ornithogalum by setting a cutting of a leaf. The leaf was cut off just below the surface of the earth in an early stage of its growth, before the flower-stalk had begun to rise; and it was set in the earth near the edge of the pot in which the mother plant was growing, and so left to its fate. The leaf continued quite fresh, and on examination (when the bulb was flowering,) a number of young bulbs and radical fibres were found adhering to it. They appeared to have been formed by the return of the sap which had nourished the leaf. Thereupon two or three more leaves were taken off and placed in like situations, but they turned yellow and died without producing any bulbs. It appeared to me then, and it was confirmed by subsequent experience, that in order to obtain a satisfactory result, the leaf must be taken off while the plant is advancing in its growth. I found it easy thus to multiply some bulbs that did not willingly produce offsets. I afterwards tried, without cutting the leaf off, to make an oblique incision in it under ground, and in some cases just above ground; attempting, in fact, to raise bulbs by layering the leaf. This attempt was also successful, and some young bulbs were formed on the edge of the cut above ground, as well as below. I tried cuttings of the stem of some species of Lilium, and obtained bulbs at the axil of the leaf, as well as from the scales of the bulb; and that practice has been since much resorted to by gardeners, though I believe it originated with me. I raised a great number of bulbs of the little plant which has been successively called Massonia, Scilla, and Hyacinthus corymbosus, by setting a pot full of its leaves, and placing a bell-glass over them for a short time. A bulb was obtained with equal facility from a leaf of a rare

species of Eucomis; and experiments with the leaves of Lachenalias were equally successful. I apprehend that all liliaceous bulbs may be thus propagated; but the more fleshy the leaf, the more easily the object will be attained.

203 Cabbage, Asparagus, Beans. The efforts of old stems of vegetables to produce young shoots, which may be useful for domestic purposes, are well exhibited in the following cases, which have been hauded to us on the authority of Mr. J. Paxton. In giving a new stimulus to the roots of plants which have been cut down, as described in the following cases, we think that too much stress cannot be laid on the application of liquid manure; and also on keeping the surface of the earth clean, and frequently stirred. Regarding Cabbage, the directions are, "When a head has been cut, the stump, with a few young leaves, should remain in the ground, that a new head may be formed at the setting on of each leaf, for the sap in its progress upwards to sustain the leaf, will also support the formation of the young head. Therefore the absurd practice of cutting off the leaves and leaving the stumps bare, being a great check to vegetation, ought to be entirely abandoned. Those stumps which remain in the ground all the winter, will probably produce heads earlier in the spring than the plants from seed sown between the 20th of July and the 5th of August. Some of the stumps, with their young leaves, might be removed into sheds, rooms, or other covered places, at the commencement of frost, hung up by their roots, and replanted in March. These probably will produce heads still earlier than the former. The running to seed of cabbage plants may be checked in due time, by placing a small twig through the stem of each plant, to impede the sap."

204 Asparagus. The following are the directions for obtaining a second crop of Asparagus in one season. "Towards the end of July, especially if it be rainy weather, cut down the stalks of the plants, fork up the beds and rake them, if the weather be dry, sprinkle the beds with liquid manure, and leave them rather flat, instead of the usual round shape, in order that they may retain all the moisture. In ten or fifteen days the Asparagus will begin to appear. If the weather continue dry, apply liquid manure three times a week. By this method you may cut Asparagus till the end of September.

205 Beans. It has been found an excellent plan to cut down the stalks immediately after the crop is gathered, as they will soon throw up young shoots, and if showery weather succeed, yield a better crop of beans than is obtained by late planting.

206 Pinks, to Propagate. It may seem to be unnecessary that we should call attention to any mode of propagating the Pink, (Dianthus plumarius,) seeing that it can be effected so easily. We think, however, that Mr. Mearns, of the Zoological Gardens, Manchester, to whose zeal and ability, horticulturalists owe much gratitude, has not only given us a more easy method of cultivating it than has hitherto been practised, but he has also, by his method, developed a principle which may prove of value. He uses no hand-glass, nor other covering, and observes that scarcely one in a hundred of his slips fail to grow. He says, "I had many years been aware, that shortening, or any way cropping the foliage of the Pink, previously to putting it in to strike, was a bad plan; it likewise suggested itself to me, that, (something after my principle of coiling the vine) if I doubled up the lower end of each slip, it would undoubtedly facilitate the emission of roots; and to enable me to accomplish it with the greater facility, I made the soil much firmer than is usually done in the general manner of piping. I do not use a dibber to plant with, but my fore-finger; I lay the lower end of my slip horizontally upon the surface of the soil, and so press it down into it; when, from the firmness of the soil, the slip is compelled to clip round the end of the finger; with the other hand I turn up the top to its perpendicular, and press the lower end down till the tail is about half an inch beneath the soil; I then make the soil firm, and the operation is complete. If the slips are too long, I cut them up to a joint, to a suitable length. I have slipped off hundreds, and have not even cut off the rag left on in slipping; and by the above process, not one cutting has failed; yet it is better that the ragged end be cut off, either with a sharp knife, or with scissars, which is generally the most expeditious method. I planted 1700 slips this last season, not twenty of which missed, and all my plants are firm and stocky. The first season that I commenced operations here, I used to shade them, when the sun was powerful, for the first fortnight, with fresh cabbage or rhubarb leaves, laid over some pegs, stuck diagonally amongst them, or a few hoops bowed

over them, placing the under side of such leaves at all times undermost; by which means a humid atmosphere is preserved, whilst the powerful sun is upon them. The last two years I have used no shading, as I have had no time to attend to it, and few plants have missed. The pipings are best left with no other attention after planting, besides occasional watering, in dry weather, and keeping them free from weeds till time for planting out, which may be done at any time after the plants are perfectly rooted: the usual season, however, to plant out for flowering in the highest perfection is September; and for propagation, all the month of June, even to the middle of July.

237 Propagation of Trees by Cuttings. The following experiments, made by the late Thomas Andrew Knight, are founded on a principle, which, if properly regulated, may greatly facilitate the propagation of such ligneous plants, as have hitherto proved difficult of increase. Many practical cultivators have thought that some cuttings emit roots more freely if not deprived of any of their leaves, still as the results of their experience have not been elucidated by physiological enquiry, they have hitherto gained but little attention. Many of our readers will have pleasure in following the close reasoning of Mr. Knight's philosophic mind through the following article, which was read before the London Horticultural Society in 1838; and we hope that some of them will carry out and perfect the practice to which it points with so fair a promise of success.

"When a cutting of any deciduous tree is planted in autumn, or winter, or spring, it contains within it a portion of the true, as it has been called, or vital sap, of the tree of which it once formed a part. This fluid, relatively to plants, is very closely analogous to the arterial blood of animals; and I shall therefore, to distinguish it from the watery fluid, which rises abundantly through the alburnum, call it the arterial sap of the tree. Cuttings of some species of trees very freely emit roots and leaves: whilst others usually produce a few leaves only and then die; and others scarcely exhibit any signs of life: but no cutting ever possesses the power of regenerating, and adding to itself vitally, a single particle of matter, till it has acquired mature and efficient foliage. A part of the arterial sap previously in the cutting assumes an organic solid form; and the cutting in consequence necessarily becomes, to some extent, exhausted.

Summer cuttings possess the advantage of having mature and efficient foliage; but such foliage is easily injured or destroyed, and if it be not carefully and skilfully managed, it dies. These cuttings (such as I have usually seen employed) have some mature and efficient foliage, and other foliage, which is young and growing; and consequently two distinct processes are going on at the same time within them, which operate in opposition to each other. By the mature leaves, carbon, under the influence of light, is taken up from the surrounding atmosphere, and arterial sap is generated. The young and immature leaves, on the contrary, vitiate the air in which they grow by throwing off carbon; and they expend, in adding to their own bulk, that which ought to be expended in the creation of shoots. This circumstance respecting the different operations of immature and mature leaves upon the surrounding air presented itself to the early labourers in pneumatic chemistry. Dr. Priestly noticed the discharge of oxygen gas, or dephlogisticated air (as it was then called), from mature leaves; Scheele making, as he supposed, a similar experiment upon the young leaves of germinating beans, found these to vitiate air in which they grew. These results were then supposed to be widely at variance with each other; but subsequent experience has proved both philosophers to have been equally correct.

I possess many young seedling trees of the Ulmus campestris, or suberosa, or glabra, for the widely-varying characters of my seedling trees satisfy me that these three supposed species are varieties only of a single species. One of these seedling plants presented a form of growth which induced me to wish to propagate from it. It shows a strong disposition to aspire to a very great height with a single straight stem, and with only very small lateral branches, and to be therefore calculated to afford sound timber of great length and bulk, which is peculiarly valuable, and difficult to be obtained, for the keels of large ships; and the original tree is growing with very great rapidity in a poor soil and cold climate. The stem of this tree near the ground presented, in July, many very slender shoots about three inches long. These were then pulled off, and reduced to about an inch in length, with a single mature leaf upon the upper end of each; and the cuttings were then planted so deeply in the soil, that the buds at the bases of the leaves were but just visible above the surface of the soil. The cuttings were then covered with bell-glasses, in pots, and put upon the flue of a hothouse, and subjected to a temperature of about 80°. Water was very abundantly given; but the under surfaces of the leaves were not wetted. These were, in the slightest degree, faded, though they were wholly exposed to the sun; and roots were emitted in about fifteen days. I subjected a few cuttings, taken from the bearing-branches of a mulberry tree, to the same mode of management, and with the same result; and I think it extremely probable that the different varieties of camellia, and trees of almost every species, exclusive of the fir tribe, might be propagated with perfect success and facility by the same means.

Evergreen trees of some species possess the power of ripening their fruit during winter. The common ivy and the loquat are well known examples of this; and this circumstance, combined with many others, led me to infer that the leaves of such trees possess in a second year the same, or nearly the same, power, as in the first. I therefore planted, about a month ago, some cuttings of the old double-blossomed white and Warratah camellia, having reduced the wood to little more than half an inch in length, and cut it off obliquely, so as to present a long surface of it; and I reduced it further by paring it very thin, at and near to its lower extremities. The leaves continue to look perfectly fresh; and the buds, in more than one instance, have produced shoots of more than an inch in length, and apparently possessing perfect health and much vigour. Water has been very abundantly given; because I conceived that the flow of arterial sap from the leaf would be so great, comparatively with the quantity of the bark and alburnum of the cuttings, as to preclude the possibility of the rooting of these.

The cuttings above described present, in the organization, a considerable resemblance to seedling trees, at different periods of the growth of the latter. The bud very closely resembles the plumule; and the leaf, the cotyledon, extended into a seed leaf; and the organ which has been and is called a radicle, is certainly a caudex, and not a root. It is capable of being made to extend, in some cases, to more than two hundred times its first length, between two articulations; a power which is not possessed in any degree by the roots of trees. Whether the caudex of the cuttings of camellia, above mentioned, have emitted or will, or will not, emit roots, I am not yet prepared to decide; but I entertain very confident hopes of success."

238 Half-hardy Plants, preservation of. Most cultivators of half-hardy or frame plants sometimes meet disappointment; and, as America suffers more the extremes of climate than England, we here give the observations of one of America's best Horticulturists — Mr. Downing, of the Botanic Garden and Nurseries, Newburgh, New York, as they appear in Hovey's Magazine of Horticulture, vol. 5; conceiving that any practice which is useful in the United States for the preservation of plants, will be an exceedingly safe guide in England. He says, "The amateur of fine flowering shrubs or plants will often find himself thwarted in his attempts to cultivate, in the open air, many beautiful ligneous and herbaceous species, which thrive, perhaps with all their wonted vigour and luxuriance, during the warm and cloudless days of our almost tropical summer, but which the severe and protracted cold of our winters either partially or wholly destroy. Such trees and shrubs as are not originally from the tropical regions (which latter require the aid of the greenhouse or stove) will, many of them, bear our winters in the Middle States with but a slight protection afforded, either by situation or actual covering, during the most inclement season. How in the best manner to apply this protection, so as to insure success, is a question of some importance to the novice in such matters.

It is a very common practice, even with many who consider themselves somewhat experienced horticulturists, when they wish to place a tender or half-hardy shrub in a very favourable location, to choose some warm sheltered nook, fully open to the sun's rays during winter. Here, they flatter themselves, the concentrated warmth of the aspect and the many genial thaws which will take place in so comfortable a position, cannot but ensure the preservation of the individual shrub or plant. In the spring it is with much surprise they behold their favourite blackened and dead in all its leading shoots; and their astonishment will be still greater, should they have chanced to leave a duplicate of the same species under the shade of some cold north wall or building, where it will most probably be found perfectly green, fresh, and uninjured in its wood or branches.

The rationale of the foregoing facts seems to be as follows. In our cold and protracted winters, when the thermometer is depressed below the zero of Fahrenheit, the sap vessels of all half hardy plants become completely frozen. At the same time our sun, during many days in winter, shines out with an almost undimmed brightness and warmth, and, rapidly thawing the fluids in these sap vessels, the latter are so distended by the sudden melting and perhaps subsequent freezing, as in many places to be completely burst and incapacitated from performing the functions for which they are intended. Those plants, however, which are protected from the sun's rays, and, consequently, from the deleterious effects of this rapid change in the sap from partial fluidity to congelation, but which are, on the contrary, restored to their former state by means of a gradual thawing, as, for example, by the slowly increasing warmth of returning spring, they will, in most cases, be found to have sufferred little or nothing by the severity of the cold to which they have been exposed.

Acting in accordance with this, we may protect many tender plants, simply by placing them out of the reach of the sun's rays during winter. On this principle, a northern exposure will, in most cases, be found greatly preferable to a due south aspect. After the unparalled rigor of the winter of 1836—7, peach and other tender fruit trees, planted on the northern sides of hills, were found to be but little injured, whilst those on warm southern knolls were almost universally destroyed throughout the Middle and Eastern States.

Carnations, monthly roses, and many other plants of similar habits, suffer severely in the more northern parts of the United States, if left in the open ground without covering; but, as many culturists are aware, the trifling shelter of a little straw, salt hay, or stems of decayed plants, thrown over them to protect them (not from the cold, but from the injurious influence of the sun) they are almost as perfectly preserved, as in a more temperate climate.

Cold frames, which are pits for the preservation of tender plants, without fire, are constructed upon this principle. A friend of ours has succeeded in preserving a very considerable collection of camellias in the open air in a thin board frame without artificial heat, and with only the slight covering of the common frame lights and a few layers of mats above them. During winter this was scarcely ever opened, except occasionally, to admit the air, but never the sun, and, at the approach of spring, the frame was again subjected to the full influence of the sun and air in the most careful and gradual manner.

Such half hardy trees or shrubs as the Acacia julibrissin, the white European jasmine, &c. may be kept in fine condition, simply by sheathing them with straw at the approach of winter. Even the Lagerstræmia indica, and Aucuba japonica, may be kept in full vigour in the open air, in this latitude, by this practice. Some of the more tender magnolias require and amply repay this trifling care, and almost every half hardy shrub, or tree, may be carried through the most inclement portion of our year, in a state of comparative security in this manner.

It is well known to those who have made many experiments in the naturalization of half hardy trees or shrubs, that the success with which they withstand the effect of intense cold depends mainly upon the complete maturity of the young wood. Should the shoots of the current year, even of our more hardy trees, be caught by an untimely frost, before they have ripened, they will suffer greatly by the combined action of the frost and sun upon the well filled and immature sap vessels; while, on the contrary, even comparatively tender trees will withstand very severe cold, if they are furnished only with sound mature wood. This will point out to the culturist the necessity of placing the half hardy shrub or tree upon a dry and warm subsoil, where it will not be likely to be urged into late growth by excessive moisture of the soil. In such situations, naturalization of tender trees may be carried on with the best hopes of success.

Nearly all half hardy trees will require the sheathing of straw before mentioned, over the whole of their exposed stems and branches while they are yet young; as the tree advances in size, only the upper branches will probably need protection until, in a few years, if the specimen is favorably situated, the covering may perhaps be dispensed with altogether, the wood having become sufficiently hardy, and the tree so much acclimated as to bear the full rigor of the season.

209 PITS AND FRAMES FOR HALF-HARDY PLANTS. Connected with the above subject is that of pits and frames for the protection of such plants as do not really require to be kept in a greenhouse, but still demand some shelter from the rigor of severe winters. Pits, from two to three feet deep, are the most conveniently protected from the effects of frost, inasmuch as their sides, at a little distance from the surface, would be in no wise exposed to it; and as its elevation would be inconsiderable, the top could be readily covered over with straw, mats, or other suitable materials. Pits however, are more damp than frames on the surface of the ground, and many of the more succulent plants are liable to damp off in them. Hence frames are best, if due attention be paid to covering them properly in severe frosts. Whether pits or elevated frames be used, we strongly recommend that the pots be plunged to their rims in dry sand, this will prevent the immediate penetration of cold to the roots of the plants; and also equalize the moisture of the soil in which they are planted.

Very frequently a situation for a frame can be found outside a house, or its offices, against a wall, that is kept dry, if not warm, by a fire within; the advantage of this is incalculable. Here plants may be kept in an atmosphere sufficiently dry to prevent the baneful effects of damp, which is generally more destructive than cold. When a plant begins to flag from drought it can be watered; but till it exhibits such want, it is safest without being watered; indeed, water is rarely required in a cold frame during winter. The expense, and the casualties attending glass, is not unfrequently an obstacle to the use of winter frames in flower gardens; this, however, may be dispensed with altogether. Oiled paper is oftentimes used in lieu of it, and used successfully; but a better substitute by far, is varnished calico. So cheap is calico that it may be purchased of good quality for the purpose, thirty inches wide, for threepence the yard. This, when stretched on frames, which an ingenious gardener would make himself, and brushed over with varnish, which may be bought for eighteen-pence a pint, would afford light and protection to the plants, at a most trifling cost.

All who can afford a border for the growth of flowers may provide themselves with such convenience, and surely nothing in floriculture affords greater pleasure than the possession of numerous plants in this class; such as the beautiful species and varieties of Verbena, Pentstemon, Fuschia, Petunia, Salvia, Phlox, Calceolaria, Primula, and a host of other beauties; many of which cannot be kept with any degree of certainty but with the assistance of this or some other mode of protection.

In addition to this plan, it should not be forgotten that every dwelling house offers itself as a place of safety for these plants of delicate constitution. No young lady has a bedroom, or family a living room, but may be made, without inconvenience, a winter refuge for a good collection. If one plant of a sort only, be kept through the winter, it can be readily increased in spring, and abundance thereby possessed.

It would be unnecessary that we should here enter on the detail of the management of any of these species as window plants; this we intend doing as opportunity offers, and as various suitable subjects are introduced into the pages of the Botanic Garden; it should, however, be mentioned that to winter half-hardy plants in the house, they should not be kept too warm, but merely from frost, and their soil which must be light and sandy, should be kept as dry as the plants will bear, without withering.

In our recommendation of frames, made of varnished calico instead of glass, we should not omit to mention their utility during summer as well as winter. Early in spring the gardener may avail himself of their assistance in the propagation of annuals; for these are always the most successfully raised in pots, and with such protection may be obtained two or three weeks earlier than if sown in the open ground. Again, if the advantage of a hotbed be at command for raising annuals, it is quite requisite that for a week or fortnight after their removal from the hotbed they should have a slight protection during the night; and also shade from the direct rays of the sun during day. Here the convenience of these economical frames will be experienced, even in establishments where expense would be a secondary consideration; for the ameliorated light and heat admitted within them has advantages superior to glass, not but air must be given during mild days, to seedlings within them, and shade also may sometimes be required.

Another purpose for which these cottage frames, as they may be called, will be found useful, after the young annuals have quitted their fostering care, is that of striking cuttings. In this department they may be used more or less during the whole of the summer. Many cuttings would strike readily, when enclosed in these frames, which would not root in the open ground; and others which will generally strike root in a shady border, will be much forwarded, and success be more certain when they are employed.

The following plants, amongst others, we may mention as generally requiring to be propagated every year, and for which the assistance of these cheap frames will be found exceedingly useful; viz., various species and varieties of Fuchsia, Verbena, Carnation, Pink, Wall-flower, Pansy, Pelargonium, Dahlia, Salvia, Phlox, Petunia, Helianthemum, Iberis; and a variety of more tender plants, also, may, with their assistance, be readily propagated, and kept in the house during winter, for turning into the borders in May. In pursuing this subject of protection to such plants as are of too delicate a constitution to bear the rigour of our winters, but on which much of the attraction and gaiety of a flower garden at the present day depends, we may add an article, from the Gardeners' Chronicle, probably from the pen of Dr. Lindley, which contains some valuable hints on —

210 Acclimatising Plants. "In former days men entertained the most exaggerated ideas concerning acclimatising, and seemed to believe that all the productions of the tropics might be had in England, if we could but gradually inure such productions to the climate. As the negro could be acclimatised, so it was thought could plants from Negroland. We were told that the course to follow was to accustom tender plants to cold climates by slow degrees; to introduce the productions of the tropics to Madeira, and there to save their seeds; then in Spain or Portugal to sow those seeds, and when the plants thus obtained produced their fruits, to commit them to the earth in the warmer counties of England, or the

yet milder districts of Ireland; and, at last, to sow in Middlesex the seeds so saved in Devonshire or Ireland. We do not believe that the experiment in this form was ever tried; and, if it had, we have no doubt that it would have failed; for experience tells us that the constitution of plants is not affected by such means. On the contrary, we find, what it is rather disheartening to know, that the constitution natural to a species of plant is almost unchangeable. When we look around us at the cases which a half-informed person might regard as instances of acclimatisation by seed, we find they are all unfavourable to the supposition, that species may be rendered less tender by art. Take, for example, Kidney-beans, Onions, Potatoes, and Mignionette — all plants of the most extensive cultivation, for many years, and perpetually reproduced by seed: are they at this day in one single degree more hardy than they were in the first year of their introduction? All experience says — no. The first frost of autumn destroys the Potato with as much certainty as in the days of its discoverer, Raleigh.

To be sure, we are occasionally reminded of apparent exceptions to this, and are told that the Larch Fir was originally treated as a greenhouse plant; and we believe that there are those who infer from such a circumstance, that the Larch is become hardier than it was. This is, however, a mistake: the Larch was originally as hardy as it now is, only we did not know it, and put it into a greenhouse from ignorance of its real nature.

But, although to acclimatise plants by seed-saving, seems a hopeless task, means certainly do exist of rendering half-hardy species less tender, and these we proceed to explain. One of the principle causes of the destruction of exotic plants, in the open air, is not so much the actual amount of cold to which they are exposed in our winters, as their being ill prepared to resist it. We know, from experience, that a low temperature acts injuriously upon plants in proportion to their watery contents; that young shoots filled with watery sap perish in winter, while the old and drier branches are unhurt; and that succulent herbage, of whatever kind, is the first to indicate the action of frost. Means therefore should be taken to cause an exotic to prepare itself for winter, by getting naturally into as dry a condition as circumstances will permit. But the only means we possess of effecting this consists in choosing a thoroughly well drained soil, and an elevated situation; the first preventing a plant filling itself with moisture during winter, or over-growing itself in summer, so as to be unable to ripen its wood; and the latter securing it from the action of those early frosts of autumn, or late frosts of spring, which are so pernicious even to our own wild trees. In an elevated situation, a plant also escapes the risk of being stimulated into growth by a few days' warmth, succeeded by nipping cold, which so often occurs in our variable climate. This was very remarkable in the hard winter of 1837-38, when so many exotics perished: on that occasion the Araucaria Fir was killed in warm and sheltered valleys, but stood unscathed on the hills of Hampshire; and all over the country the same fact was remarked in other species.

Where perfect drainage cannot be secured, it is scarcely worth attempting to naturalise an exotic tree; for, in the first place, it cannot ripen its wood — and secondly, the water that surrounds the roots in winter is absorbed by them incessantly, and gradually gorges the branches so as to render them susceptable of an amount of cold which would be unfelt in a drier state. On the other hand, we find that wherever great success has attended the preservation of tender plants in the open air during many years, it is invariably connected with a soil completely deprived of its superfluous moisture, either by nature or art.

In selecting the station in which an exotic should be planted, it will always be found better that the place should be shaded than exposed to the full influence of the sun. One reason is, that a plant, even if frozen hard, may be recovered if it thaws very gradually, although it will certainly perish if the thaw is sudden. Now in a southern aspect a plant is in the most disadvantageous position possible with respect to this circumstance. We received the other day from Owston, near Doncaster, a branch of the tender shining-leaved variety of Laurestinus, which has lived for many years in a situation where it never sees the sun for an instant in the course of the year, and it stands frosts which are fatal to the same species elsewhere in the sun. Another reason is, that in a warm sunny place a plant is stimulated into early growth, and subsequently suffers from the late frosts of spring; while, in a situation to which the sun does not reach, a plant commences growth later, not earlier, than elsewhere, and thus avoids getting into a tender condition at an unfavourable season. We have seen this remarkably exemplified in the Tree Pæony, which flowers abundantly on the border of a shrubbery facing the north, and has its blossoms as regularly cut off by frost in the warm nooks of a southern exposure. Two things are evident, if these observations are just. The first is, that it is extremely difficult, if not impossible, to acclimatise exotics in low gardens incapable of drainage; the second is, that some situations are naturally so favourable for this purpose, that skill is scarcely necessary to produce success."

Generally speaking, small town gardens are ill calculated for acclimatising plants. Even if care has been taken to drain them properly, and the soil has been made light and friable, by the admixture of old building rubbish, sand, and decayed leaves, all of which are excellent for the purpose; still such gardens seem to possess a moisture of atmosphere, and want of ventilation, during winter, that is uncongenial to such purpose. On the other hand, we have seen many of our friends, in country towns, with a few yards square of land attached to their houses, so contrive to cultivate it, during summer, as to abash the very nobility of their neighbourhood. Beds and stands of florists' flowers; groups of brilliantly flowering half-hardy herbaceous plants; with walls and trellis-work clothed with climbers, all of which have flowered to admiration, and produced a fairy scene where least expected. Not unfrequently is a small greenhouse attached to such gardens, which affords winter protection to very many of the choice plants, which in more congenial situations bear full exposure, or find ample protection in the cold frame. For the information of those who may be desirous of garnishing their gardens with some of the more rare specimens of nature's dainties, we will add the practical results, from exposing half-hardy plants, obtained by several cultivators, which may fall under the head of

211 Acclimatisation proved. At Prestonkirk, so far north as near the 56th degree of latitude, and not very near to the

sea, Mr. Street of Biel, says (Gardeners' Chronicle v. 1, 309) "I planted out in the open border, here, four large plants of the Agapanthus umbellatus, early in the spring of 1825, in different places, and slightly varying earths. They were planted in a southern aspect, and are all thriving well. At approach of winter, I put some leafy mould, moss, or decayed bark, over the surface; and stick firm over all, some evergreen branches of Red Cedar or Cypress, which is cleared away in April. They flower every year, from July to October or November. In 1835, one plant, set deeply in rich earth, with a clayey subsoil, at about 170 feet above the level of the sea, produced 12 stems, which bore 891 flowers. Calla æthiopica, in pots, produces ripe seeds here, some of which were sown in the open ground, on a hill, in the end of March, 1822. They were protected with an old broken frame, and in about six or seven weeks fifteen seedlings appeared. In the autumn they were taken up, with some earth about them, put then into pots, and kept in a glass-house during the winter, and one of them flowered at about thirteen months old. In the spring of 1823, a seedling was planted out under a high wall, in a western aspect, where the sun cannot shine on it until mid-day, in an argillaceous soil, on a decayed rocky substratum; this plant continued to grow and flower freely every year, at the end of May, and in June; it generally produced 4 flowers. In June, 1828, it produced 11 flowers, and perfected a few seeds. In 1824 and 1828, I found 8 seeds in one berry. This plant remained undisturbed till the spring of 1838; it was then dug up, and a large mass of rootlets was found, which would have made a great number of plants. It was replanted in the same place, and is now going on well; at the approach of winter it is covered over with old tan or leafy mould; and early in the spring the earth about it is stirred up. There are here seedling plants, growing in other situations, which I expect will bloom this season. Oxalis floribunda was planted in the open border, rather deep; it survived the last two winters well, and begins to flower in June, continuing till December, but it has not yet produced seeds. It is now (April 15th) springing up healthily. Oxalis crenata survived the last winter, notwithstanding that the frost was severe."

Piptanthus Nepalensis (Botanic Garden, No. 418), grew, as we are informed by Mr. Cameron, to a considerable sized shrub, in the Birmingham Garden. It flowered several years, both in peat and light sandy soil, suffered little in winter, produced abundance both of flowers and seeds, until the winter of 1837-8 killed the whole.

Salvia fulgens, in the same garden, lived for four or five years, sometimes but little injured, at other times destroyed to the ground. Some of the plants were a considerable size, but they all perished in 1837-8.

Many years ago, plants of Melaluca hypericifolia, Metosideros saligna, Edwardsia microphylla, and Edwardsia grandiflora, and some other smaller plants, were trained against the wall of the dwelling house of a nursery, at Edinburgh, where they were covered with mats, in severe weather; but probable that care was unnecessary, as, during five or six years, they never seemed to be in the least injured by frost: the soil was of middling texture, well drained.

Cineraria maritima, in Surrey, stood uninjured for years, in a garden in an elevated situation, in a strong stiff clayey soil, mixed with pebbles; while, in a much lower situation, and with a light soil, it would not survive a moderate winter, although only a mile intervened between the two situations,

Acacia julibrissin, in the same county, in a low, but airy, situation, attained the height of 10 to 12 feet, against a west wall, and flowered freely; but in an adjaceut garden it never survived the winter, although all apparent circumstances were equal.

Calla æthiopica is perfectly hardy when immersed in water, from 12 to 18 inches in depth, the frost never reaching the roots, although the tops may be destroyed.

Aponogeton distachyon (Botanic Garden, No. 559), when kept in water, in a stove or greenhouse, as it formerly was, seldom flowered; but when placed in an open pond, it not only flowers nearly the whole year, but also increases rapidly, either by runners or by seeds; probably the latter

Alstrœmeria acutifolia has been against the east end of a stove, in the Birmingham Garden, ten years; never having suffered from the weather, flowers freely every year; the soil deep, light, and dry.

Fuchsia macrostemon, variety discolor, from its being a shy flowerer, is nearly discarded from gardens. A plant has been out of doors, in the Birmingham Garden, for about three years, has proved deciduous; and, last season (1842), flowered splendidly, and also ripened seeds. As the plant is now become large, it resists the effects of frost, and is become one of the most ornamental shrubs.

Berberis empetrifolia would appear, by the Botanical Register, to require the protection of a frame. This must be owing to the soil it is grown in; here, in peat, it may almost be termed a weed.

Gardoquia betonicioides proves perfectly hardy, as a herbaceous plant, in a middling soil.

Fuchsia virgata becomes, as it were, herbaceous, being cut down every year, but springs up vigorously every spring, and flowers in profusion.

The Mignionette, on light soil, comes up plentifully every season from self-sown seed, proving that the seed is hardy enough. Potatoes, also, come up freely from self-sown seed, even when potatoes, accidentally left in the soil, perish. Other instances of seeds vegetating, might be given, to prove that seeds are more hardy than the plants.

Leycesteria formosa has become very ornamental as a hardy shrub, in a light soil.

A light, dry, deep, soil, and elevated situation, are most favourable for many plants; light sandy peat for others, whilst a few of the more tender plants do best in a stiff damp soil. The soil ought to be loosened up before, and sometimes during, winter. Close covering is worse than none, unless carefully attended to, by being removed to give light and air often. Again, after long-continued frost, caution must be observed in admitting light and air. See Auctarium, section 184.

Deep planting has been recommended by some, for the preservation of the roots of tender plants; the good, however, is counterbalanced by the puny growth of those planted too deeply.

It does not appear to be the intensity or continuation of frost that does the greatest injury. Many plants that will bear frost with impunity, are killed readily by the alternations of our climate, particularly when vegetation has commenced.

Messrs. Pope and Sons, of Handsworth — a locality whose temperature ranges below the average of that of the midland counties, report to us that with them Pinus lanceolata has stood out several years, in an exposed situation, having been rather injured during frost, from its contiguity to water. It grows in rather a moist clayey earth. Aralia Japonica, in the same situation, appears to be hardy.

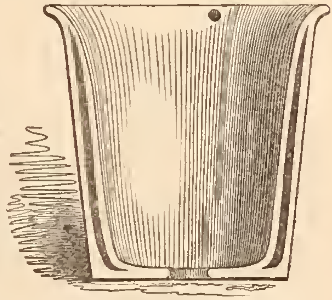
Calitra spinosa has withstood the frosts of several winters, in a cold northern exposure and light soil, but was much injured in 1837-8; as were some Leptospermums, which had been in the open ground several winters, and were grown into bushes, and flowered abundantly.

Rhododendron arboreum album grows well on a dry border, exposed to the south, but suffered much in 1837-8; and a plant in a moist situation perished.

The following plants, which are accounted tender, lived in a south border, in the front of a greenhouse, in the Handsworth nursery, during the winter of 1841-2;—Chlidanthus fragrans; Coburgia incarnata; Relmannia Sinensis; and Malva concinna. The old double red Camellia has stood, without protection, on a south border, for many years. It retains its foliage, but never blooms.

The gaiety and variety of plants displayed in the open flower borders, are now so much an object of attention with every person possessing a garden, that it becomes important to know what amongst our greenhouse or frame plants are likely, with a little extra attention, to bear full exposure. Generally speaking, no great change takes place in the constitution of plants; indeed with some of those propagated, from generation to generation, by one mode or other of division, there is none at all. Amongst those, however, which are propagated from seeds, considerable variation does exist. The hardihood of hundreds of plants in cultivation, has never been tested; but when it has, and any prove more hardy than was anticipated, it is desirable that the fact should be known, since, hereby, it may be considered that a fresh accession to the open parterre is obtained. It is evident, that by such experiments, many valuable plants will be lost, therefore few persons are willing to make the sacrifice. It shall be our duty, at a future time, to give a further list.

212 POTS, HOLLOW-SIDED. It being difficult, by words, to describe even simple instruments or apparatus so clearly as is desirable, we present our readers with a delineation of Mr. Brown's patent double-sided flower-pot. It resembles one pot within another, a hollow space being formed between the two, for water; with an aperture by which it may be filled. As the inside pot is bevelled off to meet the exterior one, a thin edge is formed, preventing any clumsiness of appearance when in use.



It has been said that "In the multitude of counsellors there is safety;" we will therefore take the liberty of transcribing the remarks of Dr. Lindley, as they appear in the Gardeners' Chronicle, of December 3rd, 1842; and those of a Correspondent, in the same paper; and then offer a few observations founded on our own experience. The Doctor says, "We regard this as a contrivance of very great value. Everybody knows how much plants suffer during summer, from the heat and dryness of the pots in which they are growing, and how frequently it is required to obviate the inconvenience, by placing one pot within another, or by surrounding them with moss, or by plunging them in soil. All this is rendered unnecessary by the contrivance in question; for, if the sides of the pot are left empty, the stratum of air contained in them will prevent the earth from becoming heated; and, if they are filled with water, the inconvenience of over-watering, on the one hand, or over-drying, on the other, will be prevented in summer, because water will be continually filtering slowly through the inside lining as the roots require it. The latter reason will make it invaluable for striking cuttings, and for window gardens, where it is almost impossible to keep plants duly supplied with moisture, even if the servants entrusted with the duty would give themselves the trouble to attend to it." His correspondent says, "If water be introduced between the sides of this kind of pot, its inner surface will be always wet: and so the young roots will receive too much fluid, so that they will rot, and the plant will die: but, if the empty space be permitted to remain empty, the inner portion of the pot receiving moisture only from the watering required for the well-being of the plant, the outer side having water occasionally poured on it, or the pot being immersed for a few minutes in it, he feels assured that the sides of the pot will be kept so fully saturated by these means, that they will be constantly giving out into the empty space a vapour, by which the inner portion of the innermost pot (towards which the young roots always incline, and with which they are in contact) will be kept sufficiently cool and moist, and the roots will be preserved from injury."

We presume Mr. Brown never contemplated making a pot that would supersede all others, but one that should meet certain circumstances in cultivation; and in this he has, doubtless, succeeded. Where flowers, in pots, are required to decorate balconies, terraces, or other similarly exposed situations, in summer, these will be exceedingly advantageous, inasmuch as they will save care and labour. As regards the value of the principle, we think that neither has Dr. Lindley, or his Correspondent, carried out his observations quite far enough. They have treated the subject as if all plants were alike in habit and constitution; as if every vegetable being would be alike either killed or cured by this new hydropathic mode of treatment. Scores of people have rejoiced in the wet sheets of the Silesian Peasant, but many also have suffered for their boldness in trusting to the cold-water doctors. So would Mr. Brown's cold-water pot be health to hundreds of plants, but disease to others.

Early in our gardening career, we had hard Staffordshire flower-pots in common use, but soon discovered that these were too retentive of moisture; that the soil in them continued too long wet, and that when laid by, without attention, it soon produced a crop of liver-wort; many plants in them were, also, much injured by the continual moist state of the soil. We then obtained Bristol pots, of a very porous nature, which are well adapted for general use, but not for all. Having now both hard and soft pots at hand, it would seem impossible ever to use the one or the other without thinking of the suitableness of the tenement to the tenant. The florist, in potting his pinks, would take those pots which were softest, that his plants might be kept tolerably dry; but, for his polyanthuses, he would use the hard ones, for the advantage of continued moisture. Again, his lobelias would, of course, occupy the hard pots—they cannot be kept too moist; whilst for his chrysanthemums he would prefer the more porous description, for with undue moisture the leaves of these would become yellow and fall off.

It will be no contradiction to these observations, should we be told that all these circumstances may be properly met by the use of soil of more or less sandy and pervious quality, combined with proper attention. We readily admit that a plant may be kept in health and luxuriant growth, in a glazed pot, or even in an iron vessel without a drain hole. Nice attention to the quality of soil, and a supply of the precise quantity of water required by the plant, would surmount all inconveniences that would otherwise arise from the quality of the pot; but this sort of accurate and exact management should never be expected; therefore, for common purposes, we should look out for that flower pot which will prove the most useful under all the circumstances which influence its employment—that offers the smallest amount of inconvenience under the common attention, or rather inattention, that more or less must inevitably prevail in every garden.

At present, we have no clear and definite data from which deductions, otherwise than conditionally, can be drawn. Indeed, this must always be more or less the case, inasmuch as it is, we presume, impossible to burn pots, so as to produce them always alike pervious to moisture. A hard pot, cased with water, may transmit insufficient fluid to the plant; whilst a soft one, under similar conditions, may admit it so rapidly as to be injurious. Therefore after all, it is pretty evident, that efficient cultivation is not to be effected without discrimination —without the application of common sense, to vary its operations according to circumstances.

We are favoured with a letter from Ægæon, the correspondent of the Chronicle, above alluded to, advocating the moist atmosphere system; that is, by closing the aperture of the cistern, and depending on the moisture of the included air, which he thinks may be rendered more or less humid by the exterior application of water. Now, we cannot object to this, as one mode of employing the cistern pot; but we cannot advocate any one particular method of use, in preference to all others. Mr. Brown claims, and we believe justly, the invention of a surrounding cistern, which may be completely closed at pleasure; and this addition greatly increases the facilities of varying the degree of moisture about the plant; and with such precision, that every variety of circumstance may be met. For instance, in the first place, if the cistern be left dry and open, the protection of the inner pot from atmospheric influence will be very slight. Secondly: If the cistern be corked, a more humid atmosphere will be preserved in it, by the partial retention of the moisture that will be transmitted from the soil, through the side of the pot with which it is in contact. Thirdly: If an inch or two of the bottom of the pot were to be dipt in a glazing, or by other means rendered impervious to water, this part of the cistern would then hold a small quantity of water, which, in warm weather, would add much to the moisture of the enclosed air. Fourthly: If the cistern be filled with water, it would filter through the pot, and be imbibed by the soil, in a greater or less degree, according as the pot was more or less porous, giving to the plant the greatest degree of moisture afforded by this contrivance.

In conclusion, it may be added, in commendation of Mr. Brown's cistern pots—as these may be called, plants cannot be so readily injured by inattention, as if in common pots; and furthermore, by using them with strict attention, any required degree of moisture may be more perfectly secured, than by any method with which we are at present acquainted. So far we have pursued the subject theoretically, and theory must precede practice. At a future time we hope to give our readers the results of experience. We would refer to one idea which we have dropt in considering this subject; it is that respecting the glazing of the bottoms of pots. Now, as a stratum of drainers should occupy the bottom of every pot, if that part of it, in contact with the drainers, were glazed, and did not assist in carrying off the moisture from them, some advantage would be occasionally afforded. Besides which, the pots would be less objectionable when placed on shelves without pans; which sometimes happens, even in the sitting room. We leave the idea with Mr. Brown, and the curious in these matters.

213 MANURES. GUANO. So much has of late been said, and written, about this celebrated manure, that enquiries become more and more frequent, regarding its intrinsic qualities, and the methods of best and most profitably employing it. Some use it in a liquid state; some, mixed with earthy ingredients; and others apply the pure Guano alone. Some too, work it into the soil, either generally or partially; others apply it to the surface. Regarding quantity, the practice has been equally variable; Guano having been used from one cwt. on an acre, even to ten. These discrepances puzzle plain practical men, and induce them to neglect that which is worthy of attention. Such circumstances are, at present, inseparable from the subject; not alone because this is a newly-introduced article, but because we are all young in the knowledge of manures in general.

The compounding of various manures together is a subject of much importance; one that has scarcely been thought of, excepting a few of the rudest processes, which have been adopted without the guidance of a single idea as to the effect likely to be produced. It is well known that the drugs of our pharmacopœia greatly assist, or ameliorate, each other in their effects on the human body. So, also, is it of the food which we ourselves eat; and so it probably is with the food of living vegetables; but, at present, in the science of the nutrition of vegetables, men, generally speaking, are merely empirics,—knowing almost nothing of the "mode of operation" of the food of plants; even whether from the atmosphere or the earth, the vegetable collects the greater portion of the elements of its solids. It is, however, a gratifying fact, that rays of light are darting through the crevices of ignorance, and it cannot be doubted but that ere long, although we may not be walking in broad sun-shine, we shall be emancipated from the darkness which has so long invested this department of natural science. Liebeg has risen as a star of the first magnitude; and promises, by his light, to guide us on our way to regions of comparative brightness.

Although our intention, in this place, is chiefly to bring together the leading practical facts which have been elicited by the use of a newly-introduced substance, as a manure; still we cannot pass over the imaginings which naturally arise on approaching the subject; and these general observations may, we trust, the better prepare some of our readers, for carrying into successful practice, the experiments of their predecessors; although they may be unable to investigate those laws and processes essential to the development of organic nature.

The importance of attention to this subject will be better understood by looking through its effects. These are an increase of organic, out of inorganic, matter;—of vegetable, and hence animal, life, out of the inorganised substances of the earth. In regard to animal or vegetable life, Liebeg's general remarks on nutrition are appropriate. He says, "The continued existence of all living beings is dependent on the reception by them of certain substances, which are applied to the nutrition of their frame. An enquiry, therefore, into the conditions on which the life and growth of living beings depend, involves the study of those substances which serve them as nutriment, as well as the investigation of the sources whence these substances are derived, and the changes which they undergo in process of assimilation. A beautiful connection subsists between the organic and inorganic kingdoms of nature. Inorganic matter affords food to plants, and they, on the other hand, yield the means of subsistence to animals. The conditions necessary for animal and vegetable nutrition are essentially different. An animal requires for its development, and for the sustenance of its vital functions, a certain class of substances which can only be generated by organic beings possessed of life. Although many animals are entirely carnivorous, yet their primary nutriment must be derived from plants; for the animals upon which they subsist receive their nourishment from vegetable matter. But plants find new nutritive material only in inorganic substances. Hence one great end of vegetable life is to generate matter adapted for the nutrition of animals out of inorganic substances, which are not fitted for this purpose." Hence, we recognise the necessity of vegetable life, before animal life can find support. On the third day of creation the Almighty clothed the earth with vegetables; He subsequently created animals to exist upon them.

We shall now bring under notice, numerous facts which have arisen out of the use of Guano as manure; and from these, draw general conclusions for the guidance of future practice.

Some of our readers may not, however, be aware of the origin of this substance, therefore the history of an article which is now become so important in commerce, and so useful in rural economy, should be known. The Spanish author, Antonio di Ulloa, published his voyage to South America, in 1748, and in 1758 an English translation appeared, in which a clear statement of the benefits enjoyed by the Peruvians from the use of Guano may be seen. These statements seem to have been lost sight of, till the celebrated traveller and naturalist, Von Humboldt, visited South America, and further described its abundance, its qualities, and uses; and from whose account most that we know has been collected.

Its name, Guano, or Huana, in the language of central Peru, signifies manure; and, from the existence of this substance over a certain district of that country, chiefly included between the fifteenth and twentieth degrees of south latitude inclusive, several places have taken their names. Guano is not, by any means, a newly-discovered manure; its use, amongst the Peruvians, in the culture of maize and capsicums, on their sandy plains, is traced back five or six hundred years; and, without it, cultivation there would seem to be useless,— the land would be a mere arid expanse. Hence a regular trade, between the Guano islands of the South Sea, and the coast of Peru, has for centuries past existed. A vessel employed in this trade is called a guanero, and so offensive is the effluvia, arising from it, that it produces nausea and sneezing in the passengers of a ship merely sailing near it. Indeed, one small island, expressly called Islan di Guano, is said to emit so intolerable a stench, that vessels are deterred from approaching its shores.

The excavation of mountains of this substance, where it has been found fifty or even sixty feet thick, gave rise to the belief that it was a peculiar sort of earth there deposited — that it was impossible for such an accumulation to have arisen from the droppings of birds; but that such is the fact is beyond doubt. This has given rise to much speculative opinion. It is asked, "Has it originated in the same islands where it is now found, or has it been accumulated there by some revolution of the earth?" Does it point back to an era when the deluged globe was provided with a greater number of aquatic birds than at the present time, in the same manner as the coal formation refers us back to a vastly luxuriant vegetation? Or, was the Guano formed under circumstances perfectly similar to those now existing; and was nothing required to produce such immense stratification, but a long succession of ages?" When we look back to the countless years that must have passed away before such accumulations could have taken place, simply by the presence of flamingos and cormorants, it certainly gives rise to unbounded astonishment. One fact, related by Garsilaso, a Spanish author, should be stated. He acknowledges the importance of Guano to Peru, and says that under the government of those rulers called incas, in the fifteenth century, it was made a crime, punishable by death, to destroy any of the sea-fowl that inhabited the Guano islands. This law has, long ago, been laid aside; it indicates, however, the estimation in which the substance was held; and also throws a gleam of light on the means of its accumulation.

It may be asked, why the manure from sea-fowl, which abounds in considerable quantities on some of the rocky islands in the north of Britain, may not equal Guano? or why the products of our own pigeon cotes and hen roosts may not be of equal value? Each of these is known to be a powerful stimulant to vegetation, a circumstance which arises mainly from the combination of the solid and liquid excretions of birds; but that which has been exposed on rocks in Europe has its most valuable portions washed away, by repeated rains; whereas, in that immediate part of the globe whence Guano is brought, it never rains. The manure is deposited stratum on stratum, where it consolidates, dries, and retains all its powerful amoniacal and other ingredients. Again, a wide distinction exists between the excrements of carnivorous and granivorous animals; between that of marine birds, which live on fish, and poultry, which live on vegetables. Who amongst us does not know the difference between the offensive gasses arising from decaying animal matter, and that of hay, or similar vegetables? These gasses, which have hitherto been suffered to escape, and are thereby lost, but which it should be the object of the agriculturist to retain — to fix, as it is called, are the very essence of manures, and that which, more than any thing else, is required for the luxuriant growth of agricultural crops.

As Guano is found spread over an immense extent of country, it is likely that it will vary much in quality, from a circumstance already mentioned — that of deterioration by washing. It is found beyond the boundaries of those extremely dry districts, in which rain is almost unknown; and, when brought to us from a humid and wet climate, it will be greatly weakened in its effects. It is also found on low rocks and promontories on the American coast, where sand may drift over it, and be mixed with the genuine manure. These circumstances demand the attention of the purchaser.

We shall forbear to enter on the chemical analysis of Guano; it is more our province to show its effects, and to inform our readers how it may be most efficiently employed in horticulture. We have, in progress, various experiments to assist in proving its value; and, as far as these have gone, they have, in general, been most satisfactory. We have already proved that it may be used too freely, and that injury may thereby be produced. In a liquid state, four ounces to a gallon of water, applied twice a week for three weeks, to beds of STRAWBERRIES, it has occasioned an amazing growth of foliage and blossoms, but its influence on the crop of fruit remains to be seen. On the other hand, a bed of seedling alpine strawberry plants, which had been up about a month, was thinly sprinkled with unmixed Guano in powder, and it destroyed every plant where it was applied. The half of a bed of ONIONS, which were six inches high, were sprinkled over, a month ago, with pure Guano, at the rate of two ounces to every square yard, being upwards of five cwt. to the acre; the season has been rainy, and the Onions, treated with Guano, are double the size of those not so treated. POTATOES, which were six inches high, had Guano sprinkled along the rows, amongst their stems, at the rate of an ounce and a half to every yard; and these are now (five weeks subsequently) far superior to those in parts of the rows purposely left without Guano. Nine parts of light soil were mixed with one of Guano, and half a spadeful of the compost was put into each of the holes regularly made to receive it, in a prepared bed of light soil; in the midst of the compost, in each hole, a plant of BRUSSELS SPROUTS was put, and then well watered. This was done a month ago, and, at the present time, more than half the plants have dwindled and died. GERANIUMS were watered, at intervals of a week, five times only in the whole, with Guano water, four ounces to the gallon of water, their leaves then began to curl, and, although the use of the liquid Guano has been discontinued two months, it is unlikely that the plants will recover till they are potted in fresh soil. Plants, of various sorts, in pots, watered only with Guano water, half an ounce to a gallon, have flourished astonishingly — none have failed. These are lessons which cannot be mistaken.

In a pamphlet by Cuthbert W. Johnson, Esq., on Guano as a Fertilizer, which may be referred to by those who are interested in the enquiry, we observe a communication from Henry Bland, Esq., of Liverpool, a late resident of Peru, in which is described the method of using this manure in that country. The practice is, doubtless, founded on experience, and indicates the propriety of applying it sparingly to young plants, and increasing the quantity in proportion to their strength. In allusion to the cultivation of maize, or Indian corn, Mr. Bland says, "When the plants are six or eight inches above ground, a pinch of Guano, as much as can be easily held between the thumb and two fingers, is placed around each bunch, and the whole is usually irrigated immediately afterwards. Guano is again applied when the plant is about throwing out its fruits; a handful is then applied to each bunch, and irrigation immediately follows. The next succeeding crops, potatoes and wheat, are produced without any further application of manure."

From amongst observations and experiments published by Messrs. Gibbs and Son, on Guano, and from private sources, we select the following information. In the growth of Potatoes, two and a half cwt. to the acre, put into the drills, which probably would not be more than an ounce to the yard, its effect was superior to a regular supply of stable manure. Sown on Grass, at the rate of an ounce to the square yard, which, let it be recollected, is, in round numbers, 300lbs. to the acre, its effects have been proved to be highly productive. It has been used on Grass land, even to the amount of a ton per acre, and with still increased success. We have not yet discovered the extent to which it may be applied to Grass land, without its becoming injurious from excess of quantity. Whenever Guano is intended to be spread broadcast over land it will be the most convenient mode to effect its regularity by first mixing it with three or four times its bulk of fine dry loamy earth; and, of course, using a proportionably increased quantity of the mixture. Sir T. F. Buxton, Bart., applied to grass Guano at the rate of 2 cwt. to the acre; and Soot 4 cwt. to the acre. The produce was 56lbs. from a rod, manured with Soot, and 114lbs. from the same quantity, manured with Guano.

We shall not, here, recapitulate various experiments minutely, but notice their general results; not, however, omitting any particulars that may seem desirable to guide our readers in the use of Guano.

Mr. Banton, of Siesdon, had a field of wheat, sown in October, which through the winter, he says, was thick and strong, and, in April, rather forward for the season. On the 23rd of April he had six plots, of a quarter of an acre each, accurately measured off, and to these respective lots he applied the following manures, at the rate per acre mentioned, and obtained the produce per acre as stated against each experiment respectively; viz. —

1. Guano, $1\frac{1}{4}$ cwt.	produce, 45	bushels.
2. Guano and Nitrate of Soda, equal portions, $1\frac{1}{4}$ cwt. of the mixture,	44	,,
3. Nitrate of Soda, $1\frac{1}{4}$ cwt.	41	,,
4 White caustic Lime, 4 tons,	$42\frac{1}{2}$	,,
5. Lime 10 cwt., Salt 5 cwt., mixed a week previous to its application,	39	,,
6. No manure,	39	,,

It may be only necessary further to remark that the quantity of straw grown on the plot manured with Guano alone considerably exceeded that of either of the others; the wheat, also, was of equal weight per bushel.

In another experiment, at Wraxall, Somersetshire, 2 cwt. 2qrs. 29lbs. of Guano was tried against 12 tons of stable manure, and also against 20 bushels of Bones. Here the Guano was sown after the wheat had been drilled in, and harrowed at once. The produce from the Guano-manured ground was greatest.

An experiment with a crop of Swede turnips, at the same place, shows the following results. $2\frac{1}{4}$ cwt. of Guano, mixed with a like quantity of mould, and half as much powdered charcoal, produced 17 tons of turnips per acre, each ton of the produce costing 2s. 1d. for manure.——20 tons of Stable Manure produced 16 tons of turnips, each ton costing 5s. 11d. for manure. ——32 bushels of crushed Bones produced 15 tons of turnips, at a cost of 5s. 9d. for each ton of the produce. The Guano compost was laid in rows, covered with the plough, and the seed drilled in upon it.

Mr. Skirving, of Walton Nursery, Liverpool, has used Guano extensively, and says, which is important for the farmer to know, that it is not a temporary stimulant; good crops having been obtained, without any manure whatever, from land where Guano had been used and good crops produced in the preceding year. He further states, "In the gardens and nursery grounds I have used it in a liquid state, and in that manner it has surpassed every manure yet discovered. Its effects on young fruit and forest trees, is wonderful; also, upon hothouse and greenhouse plants of every description; even the exotic heaths, to which manure of every kind has been considered injurious, seem to flourish in a manner beyond precedent, when watered with it. About 4lbs. to 12 gallons of water are enough for the liquid. The water should stand twenty-four hours before use; and, when drawn off, 12 gallons more may be put to the same Guano." From our own experience, we object to the proportion of Guano used in water by Mr. Skirving, for applying to plants in pots. Even if an ounce only be added to every gallon of water, we doubt the propriety of using it oftener than once a week. We still require further experience to guide us in the use of this powerful ingredient; it will, however, have been collected from our own experiments, stated in page 245, that caution in its application is necessary. That uniformity of strength may be obtained, any undissolved Guano remaining at the bottom of a liquid cask, should always be cleaned out, for garden use, and the requisite proportions again mixed.

In a preceding page we mentioned the luxuriant growth of strawberry plants, from the use of Guano; we can now state the effect on the crop of fruit. Its application to Williams's Vigornian, occasioned too much foliage, and the plants appeared as if drawn up under the shade of trees. We fell into the usual error of over-dosing them, and the crop was not improved. The other variety of strawberry on which it was tried, was Myatt's Pine; here the result was different; the plants assumed no more than a healthy luxuriance, and the crop was a very abundant one. It is quite evident that the luxuriant growth given by Guano to this shy bearing Strawberry, is highly advantageous to its fertility. Most persons agree in acknowledging Myatt's Pine Strawberry to be the finest-flavoured and the most difficult to cultivate successfully, of any in our gardens; we believe, however, complaint against its fertility need no longer exist. If runners be planted as early as they can be obtained—certainly not later than July, and the beds be supplied with Guano-water, four ounces to the gallon, once a week for four weeks, commencing as soon as the blossom buds are visible in the hearts of the plants, we believe they will not fail to bear abundantly; and, by maturing the latest flowers, will continue longer in bearing than many other sorts. Probably it would be advantageous to apply a little Guano to the plants in September; but, if greatly stimulated at this season, the plants may, possibly, be driven into flower, to the prejudice of the spring blossom. The Roseberry Strawberry is much less desirable than it would otherwise be, were it not for the shortness of its fruit stalks, whereby half the produce is mixed with the soil, and spoilt. Now, there appears reason for believing, if liquid Guano were, perhaps twice, applied, when the fruiting stems have fairly appeared from the crowns of the plants, that an impetus may be given to their growth, and that they would be thereby lengthened, very much to the benefit of the crop of fruit. This, however, is but theoretical—we have not yet tried it.

Since our observations on Guano have been published in the foregoing pages, we have to thank many friends for their communications on the subject; and we hope to receive many more. One gentleman tells us that when his turnips came into the rough leaf, and were almost destroyed by the fly, he put two ounces of Guano into a two-gallon garden pan full of water, stirred it up, and then, through the rose, well watered the young plants over head. He left some of the turnips unwatered, to prove the effect of the experiment, and he observes that he is unable to express his astonishment at the vigorous growth of those supplied with Guano. The fly left them immediately, whilst the remainder were half destroyed, and those left were of weakly growth. Another gentleman says, that, from our remarks, he had been induced to make a cask of liquid manure, by putting four ounces of Guano to every gallon of water. Of this mixture he put a pint to every gallon of water, and applied it to his plants once a week. His Fuchsias, Pelargoniums, Myrtles, in fact, every plant to which he has applied it, has flowered most exuberantly. At one of the Cornwall Royal Horticultural Society's exhibitions, Mr. W. E. Rendle, of Plymouth, stated that, in his nursery, he had for some time used Guano, but he had fallen into the common error of using it too freely, and he found that it destroyed the plants; but experience had taught him that when used in a liquid state, half an ounce to a gallon of water, it formed a very valuable liquid manure.

We have before us many statements from practical men, on the application of Guano, to almost every description of produce, both of the farm and garden; and in all instances, where it had been used discreetly, it has proved the most valuable ingredient that has hitherto been tried, as manure. From our own experience, and that of numerous agriculturists and horticulturists, with whom we have corresponded, we infer that the practice of the Peruvians, in the use of Guano, has been duly founded on experience, and is that which proves the most beneficial; we mean the application of it to the plant when in a growing state, in preference to its mixture with the earth before, or at the time of, sowing the seed. Again, the Peruvians are correct in applying water immediately after its application, without which it cannot enter the earth, and be taken up by the roots of the plant. Hence, the advantage of applying it in a liquid state, when convenient, or in showery weather. Mixing it with other manures seems to be unnecessary; but, for the convenience of equal distribution, it may require mixing with some pulverized ingredient, for which purpose dry light earth of any sort will suffice.

In consequence of our account of Guano having been written and published at monthly intervals, it has assumed a somewhat desultory form; these intervals have, however, supplied much additional information, but which it would be useless to state here in detail; suffice it to say, we have seen, or been informed of, its application to almost every species of farm and garden crop, and when properly applied, has, in no instance, failed to produce the most beneficial results.

The foregoing subject has been treated at some length, on account of its more than usual importance. We shall now sum up the whole by giving practical deductions for the guidance of those who may be induced to use Guano; recommending that in experiments, a portion of each crop be left unmanured, that a proper comparison may be made.

1. Guano rapidly absorbs moisture, therefore attention should be paid to the state in which it is observed to be when about to be purchased; or much water will be paid for.

2. It loses ammonia by exposure, therefore it should be kept in close boxes or casks.

3. As it is sometimes found in hard lumps, it should be properly powdered before being used.

4. If Guano be applied to the surface of the soil, as a top dressing, its effects will not be developed, without rain or artificial watering.

5. It should not be sown in an unmixed state, in immediate contact with seeds. By drilling it in with seeds it has been found, in some instances, to destroy them as soon as germination commenced.

6. It may be mixed, for application, in a dry state, with any convenient powdery substance, as sand, dry peat, dry loamy soil, ashes, powdered charcoal, powdered gypsum, malt-dust, &c. and in such state will be more convenient for equal distribution.

7. It should not be mixed with lime, nor wood ashes, nor bones; if combined with any of these, some decomposition would ensue, and a portion of its valuable properties would be lost.

8. Experience seems to indicate that Guano is the most beneficial when applied to plants in a growing state, and as a top dressing, whether in the powder, or a liquid state. When used with potatoes this rule may, probably, not so strictly apply; but here, the plant, whilst very young, has a protected reservoir of nutriment of its own, therefore the Guano may be mixed with the soil in contact with the potatoes plauted.

9. To the Gardener we would say, keep a small box of Guano always at hand; you can then sprinkle a little round a plant, stir the soil, and water at once, by way of experiment. Also, about a meat spoonful may be put into a large watering pan of water, stirred about for a few seconds, and used at once, if the ready-made liquor be not at hand.

10. Rub together, on a plate or stone, a little fresh-slacked lime, with four times the same quantity of Guano; put it into a wide-mouthed bottle; you will then have evidence, from the smell, not only of the abundant quantity of Ammonia which it possesses, but also of the impropriety of mixing lime with it, for use; seeing that the ammonia is liberated, and would be lost in the atmosphere.

Lastly. It is better to use too little than too much.

214. ALKALIES; THEIR EFFECTS. Since the alkali, called Ammonia, is found so abundantly in Guano, the following article, which we copy from the Records of Science, may not inappropriately follow the preceding subject. A correspondent of that work says, "During last summer I performed a series of experiments, with a view to ascertain what effect various substances had in supporting vegetable growth. For this purpose I procured several plants, and placed them in vessels of water, adding to each, various proportions of alkaline salts, and other matters. Now, I found that *more* than one-thousandth part of potassa, soda, or their salts, would prove injurious, rendering the plant sickly or destroying it, according to the strength of the solution. By adding a thousandth part *only*, I found the plant invigorated and decidedly more healthy than those plants which were in water alone. Some of these plants existed in these vehicles for six or eight weeks, and to all appearance would have lived longer had I prolonged the experiment, but they required renewing with the stimulants after the space of twelve, twenty-four, or thirty-six hours, according to the size of the plant; for water rendered alkaline by carbonate of soda, for instance, to the strength above mentioned, although it would at the time turn reddened litmus paper blue, and display its presence on turmeric paper, yet, after a lapse of some hours, the water ceased to possess these properties, and even the plants, if cut transversely near the lower part, although the alkali had been absorbed, would denote the presence of a free acid. Beneficial as were the alkalies, still more visible developement ensued from those vessels wherein I had placed the oxide of iron and of zinc, these would bear a larger quantity than the former, as they are less soluble in water, and not so abundantly absorbed — still, after some time standing, it seemed their solubility was increased, probably from the secretion of some acid from the plant

converting the oxide into salt, soluble in water, consequently, more readily absorbed into the plant. The plants are capable of secreting an acid, or that water is capable of abstracting one, cannot be doubted, as the alkaline waters, after some time standing would produce an acid effect on the tests.

215 PLANTS, GROWING IN SITTING ROOMS. It is an unquestionable fact that some plants may be seen flourishing more abundantly in the window of a dwellinghouse, under the care of an uninitiated individual, than in many well-managed greenhouses; whilst under the charge of others, they only linger out a miserable existence. This is frequently occasioned by the plants being kept standing in pans, into which the water is poured when the plant is supposed to require watering. As it is indispensable to have pans under the pots in rooms, smaller pans should be turned, upside down within them, upon which to place the plant. Whenever water is given, it should be gently poured on the top of the earth in the pot, and the precaution, here recommended, will prevent such water as may percolate through the soil from again reaching the pot in which the plant is growing. Plants in rooms are generally over watered. It is impossible to say how often Fuchias, Pelargoniums, &c., should be watered, or how much at a time should be given them, as the same plant would require more or less according to circumstances; that is, in regard to the temperature of the room; and also the degree of activity with which it may happen to be growing. To all cultivators of window plants, we would say, it is by far safer to give too little water than too much, as the plants themselves will give notice when they are in want of water, by their leaves beginuing to droop; but the effects of over watering is oftentimes not discovered till the health of the plant has been seriously affected. Ou this head, which is the most important of all others, in window gardening, it is justly said, in the Gardeners' Chronicle, "The best, and only general rules that can be adopted are, in winter, keep plants not growing fast, rather dry; iu spring, increase the quantity with their activity, and the sun's power, keeping them in a mediun state of moisture; in summer, water daily; and in autumn, decrease with the length of the day, and the returning torpidity of the plants, until the dry state of the winter is again reached. All this resolves in the following: — Plants when growing fast

may have free supplies of water, which must be lessened as their growth approaches maturity; and cease, or nearly so, when that is attained, until the return of their growing season." In winter they are frequently kept in too warm a part of the room; they need not be removed from the window during frost, unless it be very severe; and then, being placed on the floor, near to the window, will be sufficient; they will be safe where water placed beside them merely begins to freeze. Camellias will even bear the soil being a little frozen; the cause of their frequently losing their blossom buds is occasioned by their being kept in too warm a part of the room in severe weather. Plants should not, after the window has been long kept closed, have it opened widely at once; but the plants should be inured to the air, by degrees. Placing them out in the sun, without their being thus gradually inured to much light and air, is very injurious to them. Many cultivators are quite unconscious of the injury plants receive by a sudden change from that state in which they have been long kept, to one of an opposite tendency. Heaths will bear as much frost as the Camellia.

Pelargonium, Fuchsia, Rose, and similar plants should be potted in rich loamy soil, mixed with manure that is rotted to soil; whilst those requiring peat soil, such as Ericas, Epacrises, &c., must not have any sort of rotted manure put to the soil, nor ever be watered with liquid manure. A very good compost for potting those requiring rich soil, may be obtained from old hedge rows, which have been enriched by the decaying leaves of the hawthoru, &c., and also sweetened by long exposure to all sorts of weather. A word should be said on the state of the soil in pots. Watering in the usual way will, unavoidably, render the earth close, and when dry, also hard; therefore it should be loosened, with a sharp stick, kept for the purpose. Plants requiring to have larger pots may be shifted at any season, for if they are turned carefully out of their pots, not a root need be disturbed during the operation. Another tribe of plants, with thick fleshy stems or leaves, termed succulent plants, are well adapted for window cultivation, but they require a different kind of treatment from that above recommended. Amongst them are Mesembryanthemum, with its huudreds of species; Cactus, Aloe, Mammillaria, Sempervivum,—all plants of interest; many amongst them of the most grotesque forms;

and, which is important to young nurses, capable of putting up with perpetual neglect, without drooping a leaf, or offering a look of reproach. We will, ere long, give instructions for the management of this interesting tribe, and also an enumeration of those species best adapted to window culture, both as respects their habit and their appearance.

216 FUMIGATING PLANTS. We have, sometimes, occasion to recommend the Fumigation of plants, an operation which is not unfrequently indispensable, even although the best attention be paid to them, to keep them in health. It is true, that one of the chief encouragements of the aphis, is the unhealthy condition of a growing vegetable; still it will be seen that these insects sometimes abound where there is no disease apparently present, to invite their visitation. Under any circumstances, as the presence of these visitors is both unsightly and prejudicial, it is important that they should be timely eradicated. To inform our readers how to effect this in an easy and effectual manner, will now be our business.

For the fumigation of plants, tobacco has long been the substance used; and as it proves efficient for the purposes intended, without being injurious to the plants, we need not seek for nostrums or novelties. Tobacco paper has been used by some persons—paper charged with, we presume, an infusion of tobacco, and sold in London, by Tobacconists. This has been approved by some cultivators, whilst others have thought it less desirable than tobacco. If plants are to be fumigated in frames or greenhouses, it is simply necessary to close the lights, and fill the building with the fumes of the tobacco. If single plants require to be fumigated, they must be placed under hand-glasses, within boxes, casks, or an enclosed situation, capable of containing the fumes, and retaining them about the plants. The next consideration is the burning of the tobacco, in order to produce the fumes. When fired, without the admixture of other material, more combustible than itself, it will not continue to burn; therefore the common practice has been to take clear lighted embers, or gleeds, as they are called in some counties of England, in a chafingdish or pot, and on this to place the tobacco. Further to facilitate the same object fumigating bellows were invented; which are, in many cases, useful as well as elegant appendages to the garden. By these the smoke may be forcibly directed against any plant that especially requires such attention. A cheap instrument of this description may be made by any tinman, to fit on the tube of a pair of bellows; or, which is better, that of a patent blower, on account of its continual blast. It consists simply of a tube of any convenient length and size, having an enlargement near the end that fits on the bellows, formed as a box, made to part, and receive the lighted tobacco. A finely perforated piece of tin or fine wire lattice, placed on the one side of the tobacco, will be useful to prevent the smaller portions from being blown through the tube. When the tobacco is set burning, and a steady blast of air blown through it, any enclosed place may soon be filled with smoke.

Another method of burning tobacco has of late been practised, that of connecting it with touch-paper; that is, soft paper, soaked in a strong solution of salt-petre, and then dried. If a layer of tobacco be laid on this touch-paper, and both be rolled up slightly, into sizes somewhat larger than cigars, so that the paper and tobacco be intermixed, they will burn together freely; the salt-petre (nitre) contained in the touch-paper, being sufficient to sustain combustion. In order to keep these rolls together the outer edges of the paper should be pasted up their sides. A modification of this plan is mentioned in the Gardeners' Chronicle, which is to roll the touch-paper up into tubes, like sky rockets, and then fill them with tobacco. When lighted, the case of touch-paper burns gradually, and the tobacco also, from the assistance it thus obtains.

In these latter experiments, where salt-petre is used, it should not be forgotten that both nitrogen and oxygen will be evolved during combustion. The quantity will be small, and should be rather beneficial to vegetation than otherwise; still an overdose, may perhaps, be inadvertently administered. When plants have been thus fumigated, they should continue closed up till the following day, that the full effect of the effluvia may be obtained; then it will be desirable to syringe and thoroughly wash the plants from the dead insects. If any happen not to be destroyed, they will be found, if the fumigation has been properly performed, so weak as to yield to the washing, and the plants be left thoroughly divested of these troublesome intruders on the florists' pleasures.

217 Soils, improvement of. Agriculture and horticulture are now seen to be entirely dependent on a code of scientific principles, which, time ago, were never dreamt of as necessary to their successful application. We should be wanting in attention to our readers did we not introduce to them a portion of that scientific knowledge which is now-a-days so greatly disturbing the equilibrium of old prejudices. Chemistry must lend its aid in the cultivation of a garden or a farm, and we doubt not but its application will, ere long, be brought within the reach of every one. Not that we expect all to become chemists, any more than we expect all to become lawyers or doctors; but, doubtless, chemical knowledge will be brought to market just as is legal or medical; and the farmer or the gardener will, ere long, administer, according to the prescription of the chemist, proper remedies to the clay he cultivates, just as by the prescription of his medical man he now applies remedies to the clay he wears.

Our countryman, Sir Humphry Davy, promulgated the first hints regarding the necessity of analyzing soils, and guiding agriculture by the laws of chemistry; but it remained for Liebig, the celebrated Professor of chemistry in the university of Giessen, to make a decided advance in this department of science. His first work, on Agricultural Chemistry; and his second, on Animal Chemistry, are eminent examples of acute research,—they are in advance of their day, which has, perhaps, been felt by their author; and induced him to publish a short series of "Familiar Letters on Chemistry," which will command the attention of the learned and unlearned. That the value of this little work may be known, we will here extract the leading features of two of the Letters, relating equally to agriculture and horticulture. The author says: —

"Experience in agriculture shows that the production of vegetables on a given surface increases with the supply of certain matters, originally parts of the soil which had been taken up from it by plants—the excrements of man and animals. These are nothing more than matters derived from vegetable food, which, in the vital processes of animals, or after their death, assume again the form under which they originally existed, as parts of the soil. Now, we know that the atmosphere contains none of these substances, and therefore can replace none; and we know that their removal from a soil destroys its fertility, which may be restored and increased by a new supply.

Is it possible, after so many decisive investigations into the origin of animals and vegetables, the use of the alkalies, of lime, and the phosphates, any doubt can exist as to the principles upon which a rational agriculture depends? Can the art of agriculture be based upon anything but the restitution of a disturbed equilibrium? Can it be imagined that any country however rich and fertile, with a flourishing commerce, which for centuries exports its produce in the shape of grain and cattle, will maintain its fertility, if the same commerce does not restore, in some form of manure, those elements which have been removed from the soil, and which cannot be replaced by the atmosphere? Must not the same fate await every such country which has actually befallen the once prolific soil of Virginia, now, in many parts, unable to grow its former staple productions—wheat and tobacco.?

In the large towns of England the produce both of English and foreign agriculture is largely consumed; elements of the soil indispensable to plants do not return to the fields — contrivances resulting from the manners and customs of English people, and peculiar to them, render it difficult, perhaps impossible, to collect the enormous quantity of the phosphates which are daily, as solid and liquid excrements, carried into the rivers. These phosphates, although present in the soil in the smallest quantity, are its most important mineral constituents. It was observed that many English fields, exhausted in that manner, immediately doubled their produce, as if by miracle, when dressed with bone earth imported from the continent. But if the export of bones from Germany is continued to the extent it has hitherto reached, the soil of Germany must be gradually exhausted, and the extent of loss may be estimated, by considering that one pound of bones contains as much phosphoric acid as a hundred-weight of grain.

A field in which we cultivate the same plant for several successive years becomes barren for that plant in a period varying with the nature of the soil; in one field it will be in three, in another in seven, in a third in twenty, in a fourth in a hundred years. One field bears wheat, and no peas; another beans or turnips, but no tobacco; a third gives a plentiful crop of turnips, but will not bear clover. What is the reason that a field loses its fertility for one plant, the same which at first flourished there? What is the reason one kind of plant succeeds in a field where another fails?"

"These questions belong to science. What means are necessary to preserve to a field its fertility for one and the same plant? — what to render one field fertile for two, for three, for all plants?"

"These last questions are put by art, but they cannot be answered by art. If a farmer, without the guidance of just scientific principles, is trying experiments to render a field fertile for a plant, which it otherwise will not bear, his prospect of success is very small. The most exact observations prove that the method of cultivation must vary with the geognostical condition of the subsoil. In basalt, graywacke, porphyry, sandstone, limestone, &c., are certain elements indispensable to the growth of plants, and the presence of which renders them fertile. This fully explains the difference in the necessary methods of culture for different places; since it is obvious that the essential elements of the soil must vary with the varieties of composition of the rocks, from the disintegration of which they originated."

"Wheat, clover, turnips, for example, each require certain elements from the soil; they will not flourish where the appropriate elements are absent. Science teaches us what elements are essential to every species of plants by an analysis of their ashes. If therefore a soil is found wanting in any of those elements, we discover at once the cause of its barrenness, and its removal may now be readily accomplished."

"In the effects of time, in what in agriculture are technically called fallows—the repose of the fields—we recognise by science certain chemical actions, which are continually exercised by the elements of the atmosphere upon the whole surface of our globe. By the action of its oxygen and its carbonic acid, aided by water, rain, changes of temperature, &c., certain elementary constituents of rocks, or of their ruins, which form the soil capable of cultivation, are rendered soluble in water, and consequently become separable from all their insoluble parts. By their influence the necessary elements of the soil become fitted for assimilation by plants; and it is precisely the end which is obtained by the mechanical operations of farming. They accelerate the decomposition of the soil, in order to provide a new generation of plants with the necessary elements in a condition favourable to their assimilation. It is obvious that the rapidity of the decomposition of a solid body must increase with the extension of its surface; the more points of contact we offer in a given time to the external chemical agent, the more rapid will be its action." (Hence arises the advantage of frequently stirring the soil, and exposing fresh portions of it to the action of the atmosphere.)

"All plants, cultivated as food, require for their healthy sustenance the alkalies and alkaline earths, each in a certain proportion; and in addition to these, the ceralia, or corn tribe, do not succeed in a soil destitute of silica, or sand, in a soluble condition. The combinations of this substance, found as natural productions, namely, the silicates, differ greatly in the degree of facility with which they undergo decomposition, in consequence of the unequal resistance opposed by their integral parts to the dissolving power of the atmospheric agencies. Thus the granite of Corsica degenerates into a powder in a time which scarcely suffices to deprive the polished granite of Heidelberg of its lustre."

"Some soils abound in silicates so readily decomposable, that in every one or two years, as much silicate of potash becomes soluble and fitted for assimilation as is required by the leaves and straw of a crop of wheat. In Hungary, extensive districts are not uncommon where wheat and tobacco have been grown alternately upon the same soil for centuries, the land never receiving back any of those mineral elements which were withdrawn in the grain and straw. On the other hand, there are fields in which the necessary amount of soluble silicate of potash, for a single crop of wheat, is not separated from the insoluble masses in the soil in less than two, three, or even more years."

"The term fallow, in agriculture, designates that period in which the soil, left to the influence of the atmosphere, becomes enriched with those soluble mineral constituents. Fallow, however, does not generally imply an entire cessation of cultivation, but only an interval in the growth of the ceralia. That store of silicates and alkalies, which is the principal condition of their success is obtained, if potatoes or turnips are grown upon the same fields in the intermediate periods, since these crops do not abstract a particle of silica, and therefore leave the field equally fertile for the following crop of wheat."

"The preceding remarks will render it obvious to you, that the mechanical working of the soil is the simplest and cheapest method of rendering the elements of nutrition contained in it accessible to plants."

"But, it may be asked, Are there not other means of decomposing the soil besides its mechanical subdivision ? — are there not substances, which by their chemical operation shall equally well or better render its constituents suitable for entering into vegetable organisms ? Yes : we certainly possess such substances, and one of them, namely, quick-lime, has been employed for the last century past in England for this purpose : and it would be difficult to find a substance better adapted to this service, as it is simple, and, in almost all localities, cheap and easily accessible.'

"In the month of October the fields of Yorkshire and Oxfordshire look as if they were covered with snow. Whole square miles are seen whitened over with quick-lime, which, during the moist winter months, exercises its beneficial influence upon the stiff clayey soil of those counties. The fertility of the soil is increased by the lime. The ceralia require the alkalies and alkaline silicates, which the action of the lime renders fit for assimilation by the plants. If, in addition to these, there is any decaying organic matter present in the soil supplying carbonic acid, it may facilitate their development ; but it is not essential to their growth. If we furnish the soil with ammonia, and the phosphates, which are indispensable to the ceralia, with the alkaline silicates, we have all the conditions necessary to ensure an abundant harvest. The atmosphere is an inexhaustible store of carbonic acid."

"A no less favourable influence than that of lime is exercised upon the soil of peaty land by the mere act of burning it, this greatly enhances its fertility. We have not long been acquainted with the remarkable change which the properties of clay undergo by burning. The observation was first made in the process of analysing the clay silicates. Many of these, in their natural state, are not acted on by acids, but they become perfectly soluble if heated to redness before the application of the acid. This property belongs to potters' clay, pipe-clay, loam, and many different modifications of clay in soils. In their natural state they may be boiled in concentrated sulphuric acid, without sensible change; but, if feebly burned, as is done with the pipe clay in many alum manufactories, they dissolve in the acid with the greatest facility, the contained silica being separated like a jelly in a soluble state. Potters' clay belongs to the most sterile kinds of soil, and yet it contains within itself all the constituent elements essential to a most luxurious growth of plants; but their mere presence is insufficient to secure this end. The soil must be accessible to the atmosphere, to its oxygen, to its carbonic acid;—these must penetrate it, in order to secure the conditions necessary to a happy and vigorous development of the roots. The elements preseut must be brought into that peculiar state of combination which will enable them to enter into plants. Plastic clay is wanting in these properties; but they are imparted to it by a feeble calcination."

"At Hardwicke Court, near Gloucester, I have seen a garden (Mr. Baker's) consisting of a stiff clay, which was perfectly sterile, become by mere burning extremely fertile. The operation was extended to a depth of three feet. This was an expensive process, certainly; but it was effectual."

"The great difference in the properties of burnt and unburnt clay is illustrated by what is seen in brick houses, built in moist situations. In the town of Flanders, for instance, where most buildings are of brick, efflorescence of salts cover the surfaces of the walls, like a white nap, within a few days after they are erected. If this saline incrustation is washed away by the rain, it soon re-appears; and this is even observed on walls which, like the gateway of Lisle, have been erected for centuries. These saline incrustations consist of carbonates and sulphates, with alkaline bases; and it is well known these act an important part in vegetation. The influence of lime in their production is manifested by their appearing first at the place where the mortar and brick come into contact."

"I have now, I trust, explained to your satisfaction, that the mechanical operations of agriculture,—the application of lime and chalk to lands—and the burning of clay, depend upon one and the same scientific principle: they are means of accelerating the decomposition of the alkaline clay silicates, in order to provide plants, at the beginning of a new vegetation, with certain inorganic matters indispensable for their nutrition."

Attention to the preceding pages will show the gardener how important it is that he should frequently stir the surface-soil of his garden, that it may the more readily form new combinations with the gases of the atmosphere; besides this, we believe that the very form alone of the surface has an influence in the attraction of electric fluid. Nature furnishes plants with innumerable points, in one form or other, and it is more than possible that these are intended as the immediate recipients of electricity. Again, lime, applied to old moist garden ground, we confidently recommend as highly beneficial, not only for its mechanical effect in pulverizing the soil, but also on account of its bringing into immediate action, as manure, the organic matter that may have there accumulated in a state unsuitable for the food of those plants with which the ground had been cropped. It should be remembered that lime must not be mixed with animal manures, as it would liberate their most valuable property, its ammonia.

218 Charcoal. The late numbers of the Auctarium have been devoted to the subject of manures, and none can be investigated which is of greater importance to the horticulturist, for it is mainly on this that he is dependent for success in his operations. The last seven years have shown horticulture and agriculture to be so far dependent on chemistry and the sister sciences, that they have assumed a new character. Hence it is that manures have been so generally brought under consideration. Liebeg, whose views have been quoted above, has introduced Charcoal to notice as a manure, and various experiments with it have consequently been tried. Its useful properties seem to depend mainly on the carbonic acid which it supplies to plants, its retention of ammonia, and the advantage it produces by keeping the soil open for the ready extension of their roots. That carbonic acid is important to plants, will be readily admitted, when it is considered how great a quantity of charcoal, or carbon, all vegetables contain. The increased facility of burnt soil depends, in part, on the carbonised roots of vegetables which it contains. Liebeg has stated that "plants thrive in powdered charcoal, and may be brought to blossom and bear fruit, if exposed to the influence of the rain and the atmosphere;

the charcoal may be previously heated to redness. Charcoal is the most unchangeable substance known, it may be kept for centuries without change, and is, therefore, not subject to decomposition. The only substance which it can yield to plants, are some salts which it contains, amongst which is silicate of potash; it is known, however, to possess the power of condensing gases within its pores, and particularly carbonic acid. And it is by virtue of this power that the roots of plants are supplied with Charcoal, with an atmosphere of carbonic acid, which is received as quickly as it is abstracted."

Liebeg seems to have founded this theory of Charcoal "condensing gases within its pores," on its indistructibility. Its durable quality, however, is but comparative, and English chemists admit its decomposition, to which may be attributed its powers which have produced such beneficial effects in the hands of the gardener. "Plants do not, however, attain maturity under ordinary curcumstances, in charcoal powder, when they are moistened with pure distilled water, instead of rain or river water. Rain water must therefore contain within it one of the essentials of vegetable life; this is the presence of a compound containing nitrogen, the exclusion of which entirely deprives Charcoal of its influence to vegetation." The admission of this fact presents no incoutrovertable argument in support of the theory before alluded to, since rain or river water may contain the requisite ingredients to facilitate the decomposition of Charcoal.

The experiments of Lucas, which are set forth by the abovementioned eminent man, were carried on in the Botanical Garden of Munich. In the hothouse, powdered Charcoal was used instead of tan, in which the pots of plants were plunged; the requisite warmth being maintained in it by a hollow space beneath, which communicated with the fire. The roots of some of the plants having descended through the drain hole of the pots, soon afforded evidence of their possession of a new stimulus, which seems to have first led to the experimenting, in the above garden, with charcoal. It was mixed in various proportions; sometimes with an equal quantity of earth, and sometimes with only a third part, and in each instance the results were highly satisfactory. It was then used alone, instead of silver sand, to receive cuttings, and, when thus employed, its influences appear to have been even more beneficial than in the growth of plants.

The Charcoal of firs and pines, as far as any difference was seen, proved most suitable for use, and was improved by being exposed during winter to the action of the atmosphere. That, however, obtained from calcined bones seems to have been preferable to all others. Mr. Lucas says, "It is superfluous to remark, that in treating plants in the manner here described, they must be plentifully supplied with water, since the air having such free access, penetrates and dries the roots, so, that unless this precaution be taken, the failure of all such experiments is unavoidable. The action of Charcoal consists primarily in its preserving the parts of the plants with which it is in contact — whether they be roots, branches, leaves, or pieces of leaves — unchanged in their vital power for a long space of time, so that the plant obtains time to develope the organs which are necessary for its further support and propagation. There can scarcely be a doubt also that the Charcoal undergoes decomposition; for, after being used five to six years, it becomes a coaly earth; and, if this is the case, it must yield carbon, or carbonic oxide abundantly, to the plants growing in it, and thus afford the principal substance necessary for the nutrition of vegetables. In what other manner indeed can we explain the deep green colour and great luxuriance of the leaves and every part of the plants, which can be obtained in no other kind of soil, according to the opinion of men well qualified to judge? Its porosity, as well as the power which it possesses of absorbing water with rapidity, and, after its saturation, of allowing all other water to sink through it, are causes also of its favourable effects. These experiments show what a close affinity the component parts of Charcoal have to all plants, for every experiment was crowned with success, although plants belonging to a great many different families were subjected to trial."

Mr. Carlton, a correspondent of the Gardeners' Chronicle, visited the Botanical Gardens at Munich, and his evidence in favour of the utility of Charcoal is worth repeating. In describing a propagating pit, he observes that "Nothing can be more simple than the whole apparatus. It is nothing more than a common pit, with a flue along the middle, on which is a reservoir of water, the steam from which passes through the bed of Charcoal which is placed above it. Upon the Charcoal, small glass frames, of the commonest kind, are placed, to exclude the air from the cuttings in their early age. It may be suggested, and indeed would immediately strike any one who examines the apparatus, that the success may be owing to the moist heat in which the cuttings are constantly kept. No question it is so in part, but I am quite satisfied the extraordinary results I witnessed are quite as much owing to the menstruum of propagation as to the decided advantage above stated; and I doubt whether peat and sand, under any circumstances, would cause the quantity of roots to be produced which I saw there at the end of three weeks' insertion in the bed. It is necessary that the Charcoal should be fine, but not in dust, which will consolidate and prevent the fibres penetrating in every direction, as they do when it is of the proper size. In some part of the process, fine peat is mixed with the Charcoal; but I think this is rather in the rooting afterwards, and that the first process of striking, in most species, succeeds best in the pure material. From what has been stated, it is clear the necessary apparatus is simple of application, and of little cost; a part of any flued pit, or one heated by hot water, would answer every purpose; though in any nursery, or even gentleman's establishment, the making one on purpose would be of trifling expense, compared to the results, as, owing to the rapidity of the operation, a very small bed would suffice. With respect to the virtues of Charcoal itself, producing the results we are considering, I have little doubt that they consist principally in the porous and perfectly permeable nature of it. The heat and moisture are constantly present and passing through, without any saturation or stagnation, or induration, taking place. There may be something in the vegetative powers of it, but I imagine this to be the true cause of the superiority over any other material as yet known for propagation."

It is certain that plants of every sort are chiefly composed of Charcoal; for, if burnt, the residuum will always be Charcoal, provided combustion be not carried so far as to dissipate the carbon, its chief ingredient, and leave only ashes. This being the case, the question arises, whence do they obtain it? Some assert that it is wholly absorbed, in the form of carbonic acid, from the atmosphere; others imagine that its chief portion is taken up by the roots; again, others believe that the entire surface of plants is absorbent, and that carbonic acid gas is taken in both from the atmosphere, and from the earth in which the plant grows. The latter opinion is by far the most probable, and no contradiction can be given it, merely because a plant has grown in earth and water, both of which were believed not to possess it. This is an uncertain criterion, for carbonic acid is more or less every where present; it is, as Dr. Lindley truly says, "A kind of air, compounded of carbon and oxygen, found in the atmosphere, incessantly expelled from the lungs of animals, and produced by the decay of vegetable and animal bodies. On this invisible, untouchable, substance plants feed; out of this they help themselves to the charcoal, returning the oxygen to the air. And thus the vast forests of the earth, and all the herbage at their feet, are gradually built up, and fashioned into the beautiful green mantle of our planet."

The evidence in support of the beneficial influence of Charcoal, as a manure to plants, is so convincing that we cannot for a moment doubt its validity. It is natural enough that the zealous advocates of any novelty should sometimes over-rate its advantages. We are always prepared to meet this, but, from the statements of respectable persons, and from our own experience, we are convinced that Charcoal, independently of its mechanical action in keeping composts light and pervious, is an active stimulant to vegetation; and when kept in contact with the roots of growing plants, it has been found to lose thereby a portion of its weight, which is tolerably clear evidence that the plant must have appropriated some of its ingredients to its own use. Still, whether it be from its own decomposition, or by its attraction of certain gases from the atmosphere, as stated by Liebeg, is to the practical man of little importance. In some respects it is superior to other manures which have been of late brought prominently under notice; for it is not likely to prove unsuitable to any variety of soil; nor is it likely that it can be used in excess, since it can, as previously shown in the experiments of Mr. Lucas, be used advantageously by itself. On the contrary, Guana and Salt have been used incautiously, and proved injurious, and the latter, it is now known, is unsuitable to moist stiff land; still, both the one and the other of these are certainly, under proper management, of inestimable value to the agriculturist and horticulturist.

Charcoal, as shown in the preceding pages, has, under certain circumstances, been used alone; we may now further notice its having been used in various proportions, mixed with soils of various sorts, and with great success. It has, on the contrary, in the estimate of one or two cultivators, been considered of little use. This may have arisen from the liberal use of other stimulants, either with, or in comparison with, it; and forms no criterion, on which to found an opinion, unless proper data were given. To form a compost for cucumbers it has been successfully used, in equal proportions with fresh loam; without other manure. For orchidaceous epiphytes it has proved peculiarly applicable; blocks of wood being charred, the plants have been secured on them, and have grown with the most gratifying luxuriance. Mr. Barnes, the gardener at Bicton, Devonshire, the seat of the Right Honourable Lady Rolle, appears to have used Charcoal more abundantly than any other person. He does not found his admiration of it on a few experiments, or the uncertain operations of a season or two, but on the liberal use of it for fourteen years, on, as he says, thousands of plants, without meeting with one that did not delight in it. In a mixture of loam and Charcoal only, he seems to have succeeded to admiration in the culture of pines and other stove plants, palms, &c. Musa sapienta he mentions as having been planted out in this mixture, in March—a young plant, four feet high ; at the end of the following September it was fourteen feet six inches high, with leaves reaching to the very top of the house, thirty-three feet high ; the base of the stem being three feet three inches in circumference. The removal of the surface soil, and supplying its place with Charcoal and loam, seems to have produced the most striking effects. Amongst which may be noticed the growth of Cycas revoluta, with seven hundred fruit on it; Luculia gratissima seven feet high; Doryanthes excelsa, flower stem sixteen feet high; Cactus speciosissima twenty feet high. Mr. Barnes says that every plant under his care has Charcoal used about it; this assertion from a practical man, will go far to dissipate the fears that may have arisen in the minds of those who have indulged too freely in the use of other newly-introduced manures. We have, ourselves, had a small proportion of rather finely powdered Charcoal mixed with sand, for propagating plants in, and never have we previously seen cuttings make such rapid growth in the stems, even before roots had been emitted, indicating an atmospheric influence beneath the bell-glasses. Mr. Rivers, in his cultivation of Roses in pots, has successfully used turf, roasted an hour on an iron plate. This, he says, chars the underside, and acts most beneficially. It is well known that clay, by being burnt, loses its tenacity; and, as Dr. Lindley has suggested, the roots of grasses, &c., being charred within the turf may contribute much to the benefits that usually arise from its use.

In America experiments have been tried with Charcoal, in the culture of plants, and it has been there considered a valuable manure. In Italy also, it has been used in the vineyards with success, and apparently, from the statement in the Biblioteca Agraria, for agricultural purposes, for some years past, where the same quantity to the acre is considered to be sufficient as is employed of rags or bones. In Germany, at Munich, where horticulturists are fully aware of the advantages promised by the use of Charcoal, a regular course of experiments has been instituted, the results of which, we hope, ere long, to present to our readers. The leaves of Gesnera, Gloxinia, Crassula, and others, of similar character, have struck root in Charcoal, and made plants. The seeds of some species of Ferns, which have been found to be of difficult growth, have germinated quickly in powdered Charcoal.

In addition to the advantages that have been derived from the growth of plants in a mixture of Charcoal and earth, and also in striking cuttings, and raising seedlings, in pure Charcoal, this substance has been tried at Munich, with considerable success, as a preservative of plants. Thus, plants of various sorts, as Ferns, Calceolarias, Salvias, &c., were packed in a box in dry or very slightly moistened Charcoal, the box was then closed down, and laid by for a month. On being opened most of the plants were in a tolerably good state of preservation, and only some very succulent ones had decayed. Cut flowers also, similarly treated, were pretty well preserved for spaces of time varying from a week to a fortnight.

235. AUCTARIUM.

To test the quality of Charcoal, prepared from wood of different sorts, M. Seitz, the inspector of the Royal Garden of Munich, had Charcoal made from Oaks, Limes, Ashes, Beeches, Alders, Willows, Elms, and Firs. These were kept separate, and placed in compartments in a hotbed. Their effects in the culture of plants under circumstances exactly alike, was then proved, and scarcely a difference could be discerned. If a difference was perceptible it was in favour of the Fir Charcoal. Bone Charcoal, however, excelled them all, when used for striking plants.

Charcoal will be easily obtained in any part of the country, and in any state of pulverization that may be required for horticultural purposes, when a demand for it has been created; still some persons, who possess offal wood, may be desirous of making it. The operation is a very simple one, requiring only that the wood be burnt without exposure to the atmosphere, just as coal is burnt for obtaining common gas. As a correspondent of the Gardeners' Chronicle (J. Lowder) has given a plain account of his practice, we will copy his description of it from that useful publication for the benefit of our readers. He says, "I cut up a quantity of wood into billets of about eighteen inches long, and placed three or four wheelbarrowfuls upon a handful of straw and a few dry sticks, and set fire to the straw. As the wood began to ignite I surrounded it with sods from the side of the road, tolerably dry, and common road dirt (throwing on the latter in lumps, so as not completely to exclude the air), until the wood was covered all over. Soon the whole heap was burning together, and, as the fire made its appearance through the dirt, or rather as the dirt became burnt, I threw on more dirt. At night I added as much as I thought would be burned by the morning, and thus the heap was kept burning for several days. Upon clearing away the burnt earth, I found the wood I had used for lighting the fire completely charred, but not a stick consumed. Thus, I have accomplished two objects by one operation; I have made Charcoal as well as a regular professor of that art; and have also prepared a capital compost of burnt earth and sods, which I intend to enrich by dosing it with liquid manure. I have made several heaps since I first made the attempt, and have not failed in a single instance. The wood I used is Black Poplar, as I happened to have a quantity by me, which was cut last winter. I also gave the preference to this material from having read lately in the Chronicle that the lightest wood made the best Charcoal."

It is the more important that the principle of making Charcoal should be understood, inasmuch as great quantities of vegetable refuse, of one sort or other, may be used for the purpose, and rendered valuable. Amongst this we may mention the offal stakes and stems of the garden, sawdust, tan; and in cider countries it is probable that the refuse of apples from the cider mill may prove another source from which Charcoal may be obtained.

Since the preceding part of this article was printed, further evidence of the powers of Charcoal has arisen; and as it is our object to present the readers of the Botanic Garden with facts as their guide, rather than with theoretic speculations, we will copy a communication of the Earl of Essex to the Gardeners' Chronicle and Agricultural Gazette, which has thrown new light on our subject. His Lordship says,—

"Herewith I send you three plants of Turnips, (Skirving's) sowed on the same plot of ground, at the same hour of the same day. In the case of the largest specimen, No. 1, the seed was well mixed with about twelve times its bulk of charcoal-dust. In that of the next size, No. 2, the seed was mixed with five times its weight of common salt, and nine bulks of Charcoal; and in the case of the plant just come up, the seed was put in quite alone. In all three cases the seed was put in drills in soil which last year bore Mangold Worzel in seed, and the year before wheat, and no manure has been applied since. My object in using the Charcoal and Salt was from the consideration that both substances are powerful absorbents and retainers of moisture, as well as direct food for plants."

"Numbers 1 and 2, in spite of the parched state of the ground, (the 3rd of June) came up strong in five days, and continued growing; No. 1, however, soon and rapidly taking the lead. At the end of a fortnight all three rows were once watered, which however failed to bring up the seed sown without anything. When our first rain came heavily, ten days ago, No. 1 grew almost visibly, and three or four days after No. 3 just began to show. I may also state that I sowed Belgian Carrots with Charcoal only, the first week in May, and though the soil then was quite dusty, and so continued until ten days ago, the plant came up well in three weeks, which is, at least, ten days sooner than Carrot seed usually comes up, even under favourable circumstances as to rain. I sowed one more row of the Turnip, with a double quantity of salt, which seems to have destroyed the seed, as none has yet appeared. If you think these experiments worth noticing in your excellent Journal, you are quite welcome to do so, and I shall feel happy if so simple a substance should prove of use in forcing a plant of Turnips, or other roots."

On the three turnips received the editor remarks,—"Of the specimens sent, No. 1 appears to be a plant which has had about six weeks' vigorous growth; No. 3 has not yet acquired its rough leaf; and No. 2 is of a medium size. This extraordinary difference in plants sown at the same time, on the same plot of ground, appears to be wholly owing to the simple means adopted, as described above, which, from his Lordship's experience, certainly appear to be well worthy of extensive trial."

219 Lime, its action. In considering manures, it is not unimportant that we understand the rationale of their action; and, as lime is one amongst the most generally used inorganic substances for fertilizing the soil, we will give Sir Humphrey Davy's opinion on this subject. He says, "When lime, whether freshly burned, or slaked, is mixed with any moist fibrous vegetable matter, there is a strong action between the lime and the vegetable matter, and they form a kind of compost together, of which a part is usually soluble in water. By this kind of operation, lime renders matter which was before comparatively inert nutritive; and as charcoal and oxygen abound in all vegetable matters, it becomes at the same time converted into carbonate of lime. Mild lime, powdered limestone, marls or chalks, have no action of this kind upon vegetable matter; by their action they prevent the too rapid decomposition of substances already dissolved; but they have no tendency to form soluble matters. It is obvious from these circumstances that the operation of quicklime, and marl or chalk, depends upon principles altogether different. Quicklime, in being applied to land, tends to bring any hard vegetable matter that it contains into a state of more rapid decomposition and solution, so as to render it proper food for plants. Chalk, and marl, or carbonate of lime, will only improve the texture of the soil, or its relation to absorption,

acting merely as one of its earthy ingredients. Quicklime, when it becomes mild, operates in the same manner as chalk; but in the act of becoming mild, it prepares soluble out of insoluble matter. It is upon this circumstance that the operation of lime in the preparation for wheat crops depends; and its efficacy in fertilizing peats, and in bringing into a state of cultivation all soils abounding in hard roots, or dry fibres, or inert vegetable matter. The solution of the question, whether quicklime ought to be applied to a soil, depends upon the quantity of inert vegetable matter that it contains. The solution of the question, whether marl, mild lime, or powdered limestone, ought to be applied, depends upon the quantity of calcareous matter already in the soil. All soils are improved by mild lime, and ultimately by quicklime, which do not effervesce with acids; and sands more than clays."

220 Liquid Manure, to Plants in Pots. The late president of the London Horticultural Society was a really practical horticulturist, and all his experiments were guided by principles so philosophic that they will not cease to be useful, even if his practice be obsolete. In carrying out our intention of gathering all useful knowledge on the subject of Manures, a paper of Mr. Knight's claims attention, although written many years ago. He was in advance of his contemporaries. His reasoning and practice will encourage horticulturists in the use of Liquid Manure, which seems to us most desirable. He says:—"The quantity of earth, which the most firm and solid parts of trees afford by analysis, is well known to be very small; and even the species of these earths have been proved, by the younger Saussure, to be dependent, to a great extent, upon the component parts of the soil, in which the trees happen to have grown. A large extent and depth of soil seem therefore to be no further requisite to trees than to afford them a regular supply of water, and a sufficient quantity of organisable matter; and the rapid growth of plants of every kind, when their roots are confined in a pot to a small quantity of mould, till that becomes exhausted, proves sufficiently the truth of this position."

"I have shown that a seedling plum-stock, growing in a small pot, attained the height of nine feet seven inches, in a single season; which is, I believe, a much greater height than any seedling tree of that species was ever seen to attain in the open soil. But the quantity of earth, which a small pot contains, soon becomes exhausted, relatively to one kind of plant; though it may be still fertile relatively to others; and the size of the pot cannot be changed sufficiently often to remedy this loss of fertility; and if it were ever so frequently changed, the mass of mould, which each successive emission of roots would enclose, must remain the same."

"Manure can therefore probably be most beneficially given in a purely liquid state; and the quantity which trees growing in pots have thus taken, under my care, without any injury and with the greatest good effect, has so much exceeded every expectation I had formed, that I am induced to communicate to the Society the particulars and the result of my experience."

"I have for some years appropriated a forcing-house, at Downton, to the purposes of experiment solely upon fruit-trees; which, as I have frequent occasion to change the subjects upon which I have to operate, are confined in pots. These were at first supplied with water, in which about one-tenth, by measure, of the manure of pigeons, or domestic poultry, had been infused; and the quantity of these substances (generally the latter) was increased from one-tenth to a fourth. The water, after standing forty-eight hours, acquired a colour considerably deeper than that of porter; and in this state was drawn off clear, and employed to feed trees of the vine, the mulberry, the peach, and other plants. A second quantity of water was then applied, and afterwards used in the same manner; when the manure was changed, and the same process repeated."

"The vine and mulberry tree, being very gross feeders, were not likely to be soon injured by this treatment; but I expected the peach-tree, which is often greatly injured by excess of manure in a solid state, to give early indications of being overfed. Contrary, however, to my expectations the peach tree maintained, at the end of two years, the most healthy and luxuriant appearance imaginable, and produced fruit in the last season in greater perfection than I had ever previously been able to obtain it. Some seedling plants had then acquired, at eighteen months old, (though the whole of their roots had been confined to half a square foot of mould) more than eleven feet in height with numerous branches, and have afforded a most abundant and vigorous blossom in the present spring, which has set remarkably well; and those trees which had been most abundantly supplied with manure have displayed the greatest degrees of health and luxuriance."

"A single orange-tree was subjected to the same mode of treatment, and grew with equal comparative vigour, and appeared to be as much benefited by abundant food as even the vine and mulberry tree."

"An opinion generally, though I think somewhat erroniously prevails, that many plants, particularly the different species and varieties of heath, require a very poor soil in pots; but these might, I conceive, with propriety, be said to require a peculiar soil; for I have never seen the common species of this genus spring with so much luxuriance as from a deep bed of vegetable mould, which had been recently very thickly covered with the ashes of a preceding crop of heaths, and other plants that had been burned upon it. And I believe, if the branches and leaves of the common species of heath were placed to decompose in water, and such water were afterwards given to the tender exotic species, that these, how heavily soever the water might be loaded with organisable matter, would be found as little capable of being injured by abundant food as the vine or mulberry tree, though the species of food which would best suit those plants might prove to every species of heath destructive and poisonous."

The advantages arising from the supply of liquid manure to plants in pots is too obvious to require recommendation. It is this practice, more than any other, which is now placing one cultivator so eminently above another. We hope that our readers will avail themselves of the benefits of this knowledge.

221 CAOUTCHOUC OR INDIA RUBBER TREE. One of the deficiencies of education, in this country, appears to be the absence of all regular study of the works of nature, — of the communication of knowledge in immediate connexion with those objects which every where surround us. Knowledge of these is not simply a medium through which mere curiosity might be gratified; indeed, a moment's reflection will open to us a view of our great—almost entire, dependence on the vegetable kingdom, either directly or indirectly, for our food, our raiment, and our pleasures; hence, the more intimately we make ourselves acquainted with its productions, the more profit shall we derive

from it; whether our views be confined to the narrow limit of worldly interests, or extended to those which exalt the mind to better considerations. In several parts of the European continent natural history is a study of the schools; hence it has been that we owe to our continental neighbours the discovery of many useful products, particularly in connection with medicine. The discovery of that most important material, India Rubber, has added much to our comforts; and as the milky sap of the tree which forms it, may for ages to come have passed unnoticed, it is but reasonable to infer that useful properties may, sooner or later, according to the activity of our researches, be discovered in numerous others, capable of administering to our pleasures or our necessities.

That our readers may be informed of the simple mode adopted by an uncultivated people, to administer to their comforts, we will copy a communication from the Brazils, to an American journal: —

"The Caoutchouc tree grows, in general, to the height of 40 or 50 feet without branches, then branching, runs up 15 feet higher. The leaf is about six inches long, thin, and shaped like that of a peach tree. The trees show their working by the number of knots, or bunches made by tapping; and a singular fact is, that, like a cow, when most tapped, they give most milk or sap. As the time of operating is early day, before sunrise we were at hand. The blacks are first sent through the forest, armed with a quantity of soft clay, and a small pickaxe. On coming to one of the trees, a portion of the soft clay is formed into a cup and stuck to the trunk. The black then striking his pick over the cup, the sap oozes out slowly, a tree giving daily about a gill. The tapper continues in this way, tapping perhaps fifty trees, when he returns, and with a jar, passing over the same ground, empties his cups. So by seven o'clock the blacks came in with their jars, ready for working. The sap at this stage resembles milk in appearance, and somewhat in taste. It is also frequently drunk with perfect safety. If left standing now it will curdle like milk, disengaging a watery substance like whey, Shoe makers now arrange themselves to form the gum. Seated in the shade, with a large pan of milk on one side, and on the other a flagon, in which is burned a nut peculiar to this country, emitting a dense smoke, the operator having his last, or form, held by a long stick or handle, previously besmeared with soft clay, (in order to slip off the shoe when finished) holds it over the pan, and pouring on the milk until it is covered, sets the coating in the smoke, then giving it a second coat, repeats the smoking, and so on with a third and fourth, until the shoe is of the required thickness, averaging from six to twelve coats. When finished, the shoes on the forms are placed in the sun the remainder of the day to drip. Next day, if required, they may be figured, being so soft that any impression will be indelibly received. The natives are very dexterous in this work. With a quill and a sharp-pointed stick they will produce finely lined leaves and flowers, such as you may have seen on the shoes, in an incredibly short space of time. After remaining on the forms two or three days, the shoes are cut open on the top, allowing the last to slip out. They are then tied together and slung on poles, ready for the market. There pedlars and Jews trade for them with the country people; and in lots of 1,000 or more they are again sold to the merchants, who have them stuffed with straw, and packed in boxes to export, in which state they are received in the United States. In the same manner any shape may be manufactured. Thus toys are made over clay forms. After drying, the clay is broken and extracted. Bottles, &c., in the same way. According as the gum grows older, it becomes darker in colour and more tough. The number of caoutchouc trees in the province is countless. In some parts whole forests of them exist, and they are frequently cut down for firewood. Although the trees exist in Mexico and the East Indies, there appears to be no importation into the United States from these places. The reason, I suppose, must be the want of that prolificness found in them here. The caoutchouc tree may be worked all the year; but generally in the wet seasons they have rest, owing to the flooded state of the woods; and the milk being watery, requires more to manufacture the same article than in the dry season."

222 Wireworms. The numerous insects which continually make their appearance amongst our plants for the purpose of preying upon them, call forth all the ingenuity of the gardener, either to slay them by human force—making the lovely parterre a field of battle; to create a famine amongst them by withholding their natural food; to scare them away by offensive odours;

or to overcome them by the encouragement of their natural enemies.

To effect any one of these purposes efficiently, we should first make ourselves acquainted with our liliputian enemies in their various characters, and then, if we cannot conquer them in one shape, we possibly may in another. The insect kingdom come forth as performers in one general pantomime. They are sometimes ugly and crawling; sometimes gay and flying, or bounding from place to place with the utmost alacrity; even the troublesome little animal with whose popular appellation we commenced, although it be a mere crawling, twisting, hairy, thread-like, voracious pest to the farmer, gardener, and florist, it ultimately assumes the more important character of a grave-looking, abstemious, sombre beetle, having fresh parts to perform; consisting of running, flying, tumbling, pretending to be dead, and then jumping, like a clown in a pantomime off its back, and alighting on its feet. The fact is,—a fact which may surprise some of our readers, the common Wireworm becomes, in its perfect state, a well-known brown beetle, which is sometimes, from its antics to which we have alluded, called Skip-jack; and from a snapping noise which it produces by a little apparatus when it leaps, it is sometimes also called Click-beetle.

Mr. John Curtis, the author of British Entomology—a work of great labour and talent; and as regards its plates, which are also executed by Mr. Curtis, unrivalled at the present day, (these could be produced only by the hand of him who united the character of naturalist and artist) this gentleman has written a memoir on Wireworms, in the Journal of the Royal Agricultural Society; and as that work will not meet the eye of the generality of our readers, we will extract from it a few of the leading particulars.

"Of all the insect enemies with which the farmer has to contend, there are none which are more fatal in their effects, and more difficult to overcome, than the Wireworms. The larvæ of many insects are not unfrequently attached to one species of plants, or at least to one particular tribe or 'natural order;' thus the ravages of the Turnip-fly are confined to the Cruciferæ, of the Black-caterpillar to the turnip, of the Hessian-fly to corn, &c.; but in the Wireworm we have an example of a larva which may almost be termed omnivorous, as far as regards the productions of the field and garden, for it will feed upon corn, turnips, mangold-wurzel, potatoes, grass, and cabbages, as well as upon the roots and stems of the choicest flowers; its operations therefore being so extensive, the mischief done by these formidable little animals must be incalculable."

"It is true that every grub and worm found at the roots of their crops by the farmer and gardener has been hitherto stigmatized with the appellation of 'the Wireworm,' which has no doubt contributed to add to the amount of mischief complained of; nevertheless, the true Wireworms have enough to answer for on their own account, and the great ignorance that has existed regarding them renders a narrative of their natural history very desirable."

"It will probably surprise the general reader to learn that there are nearly seventy species of beetles in this country which are the parents of Wireworms; many of them however live in decaying trees or under the bark, and the number that affects our crops of corn, vegetables, and flowers is very limited; of these we shall treat as far as we have been able to obtain data for their histories, but their economy appears to be very similar. The female beetle lays her eggs; the eggs produce little larvæ called Wireworms, which grow and change to pupæ or chrysalides, and from these again emerge the beetles. The eggs which are nearly globose or slightly oval, yellowish white, and very minute, are laid in the earth close to the root of a plant, or between the enveloping leaves or sheaths near the base of the stalk, which I am unable to determine; it is a very desirable part of their economy to be ascertained, but hitherto I have endeavoured in vain to detect a female depositing her eggs or to find any, except by dissection, when I have observed them close to the base of the oviduct; the little worms produced from these eggs must be almost invisible to the naked eye; they grow very slowly, and eventually attain the length of three-quarters of an inch, rarely eleven lines. These are the true Wireworms, so named from their cylindrical form, smooth surface, and extreme toughness. In this state they live five years, as proved by Bierkander, casting off their skins thrice, probably, like other larvæ, as they increase in stature. I have examined many of these exuvia, which are brown; and the animals perform this extraordinary moult like other caterpillars, by splitting the horny skin along the thorax, and drawing themselves out at the aperture, leaving (like a snake) a perfect exuvia of every part, including eyes, horns, feet, and it is believed also of the internal organs. Immediately after this operation, the Wireworms are very tender, and of a whitish colour; but as soon as they recover from this great effort of nature, they move about with the greatest facility, gliding along and soon burrowing into the earth when dug up and laid on the surface, their horny coats being well adapted to their subterranean habits."

"When the Wireworm has arrived at maturity, (five years of age) it descends a considerable depth into the earth, forms an oval cell there, entirely composed of the surrounding particles of soil, and not even lined with silk as in the Turnip Saw-fly; it then casts its skin again, and becomes a pupa or chrysalis, generally, it seems, at the end of July or beginning of August; it is long and narrow in form, like the perfect insect, but is of a yellowish white. They remain in the pupa state two or three weeks, but many no doubt pass the winter buried and protected from casualities and the rigour of that inclement season; when, however, the appointed time comes, they burst from their shrouds and the earthly tombs they inhabit, and rising through the soil arrive at the surface, changed to perfect beetles, but of a whitish colour, soft, and extremely tender; exposed to the air and light, their bodies harden and their colour gradually changes, so that in a few hours they have attained the horny coat which covers them, and assumed the tints which the Author of nature has assigned to the species."

"The parts of the animal which were lately indistinctly seen as through a veil, are now distinctly visible; and all the members are liberated to give action to its body and animation to all its senses. They walk and run like dogs, with their heads and trunks declining, their noses close to the ground; when they leap, their legs are applied closely to their bodies, and by the same means they fall down when the plants are approached upon which they are resting. Its habits are now quite altered; instead of the ravenous and destructive Wireworm it is now become an active beetle, running up the grass and readily flying to flowers, to which it resorts for food." Thus do we witness a metamorphosis instructive to all,—a subject which will be continued in a future number.

THE

BOTANIC GARDEN.

INDEX

TO THE

AUCTARIUM.

PART I.

MAUND, PRINTER, BROMSGROVE.

THE AUCTARIUM

OF THE

BOTANIC GARDEN;

CONTAINING

MISCELLANEOUS INFORMATION,

CONNECTED WITH THE

CULTIVATION OF A GARDEN,

AND

NATURAL HISTORY.

PART II.

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AUCTARIUM

OF

THE BOTANIC GARDEN.

223 WIREWORMS, THEIR DESTRUCTION. In the previous part of the AUCTARIUM we have given, after Mr. Curtis, some interesting particulars regarding the Wireworm; still, before we proceed to the consideration of means for destroying this enemy of the gardener, we cannot omit alluding to the remarkable power given to the Click-beetle—the parent of the Wireworm, of recovering its natural position when turned on its back. Its possession of a small apparatus to assist in this operation, has been mentioned, but to clearly describe the apparatus, and its action, would be difficult, without the assistance of engraved figures. Our readers should examine the insect itself, which in summer, most persons will think, is by far too readily met with. It may be observed, that the beetle, when on its back, raises itself as an arch, by which one part of the apparatus mentioned slips out of the other with a snap,—the centre of the back which was before raised, is depressed with a sudden jerk on the substance that supports it, the animal thereby springs upwards, turns in the air, and alights on its legs.

"Difficult as the Wireworm is to deal with, so much attention has been paid to the subject by the suffering farmer and gardener, that numerous methods of arresting its ravages have been tried, some of them with great success; and let not any one be discouraged because he cannot clear his land entirely, or at one blow sweep away a nuisance; for extermination amongst these minor works of the creation is not permitted, it is against the laws of the Creator; for although such intervals of absence may occur as to lead us to think that a noxious animal is annihilated, it will in due time return, and again require all our efforts and vigilance to contend against it. We are sometimes deceived by appearances, and it is true that by persecuting the higher order of animals they may be driven from a favourite spot or locality, and take shelter, so far from the haunts of man as to relieve him from their inroads, and dispose him to imagine that the species is lost; and in some instances we know that a country has been freed from races of animals, as the wolf and eagle, but they are not exterminated; and the latter, under favourable circumstances, would return: I think it therefore probable that by perseverance insects may be driven from a locality, for persecution is not agreeable to any animated being; and this knowledge ought to encourage the cultivator not to relax in his efforts to free his land from destructive insects, but to be certain that those efforts are well directed."

"Great benefits may be derived by selection of crops, by modes of cultivation, by manures and dressings, but, above all, by manual labour. Animals also whose economy tends to diminish destructive insects ought to be encouraged, and no doubt we are benefited, to an extent which it is impossible to conceive, by the parasitic insects whose instincts lead them to prey upon the eggs and caterpillars of our enemies: they are, as we have shown in former memoirs, multiplied to an almost incredible extent, and labour incessantly in their vocation. These are discoveries which have been gradually developed by the industry, perseverance, and research of the naturalist, for the improvement, amusement, and benefit of his fellow creatures; and I concur entirely with Mr. Hope that 'Agriculture may derive valuable assistance from the science of Entomology; and I feel fully convinced that we can scarcely do a greater act of kindness, or be of more service to the farmer, than by pointing out the nature and habits of those insects which destroy his crops.'"

"Mowing oats, and of course other corn, is considered the best method of getting rid of the Wireworm by Kollar, and other continental writers; but they assign no reason, and it is difficult to explain the cause. It may be, that when corn is reaped, the stubble being left long, rooks and many other birds will not resort to such fields, and consequently the Wireworms revel without molestation. This is worth the consideration of the farmer; and whatever may be the cause, if the statement be true, it ought not to be neglected. Long stubble certainly harbours many injurious insects, and amongst them, it is believed, the turnip-beetle, which resorts to the long hollow straws for shelter during the winter."

"Many other applications have been recommended, and amongst them spirits of tar and chloride of lime. One correspondent in the 'Gardeners' Chronicle' says, 'Spirits of tar is the most effectual remedy with which we are acquainted for destroying the Wireworm. We should therefore recommend any one to saturate some sand with that compound, and mix it with the soil in the beds of ranunculus and anemone when they are turned up in autumn,'" J. W. C., having lost his crops from Wireworms, also says, "Thinking that spirits of tar might do good, when I sowed dwarf French beans again, before covering in the rows, I watered them with a strong solution of it; and the result was that they came up very strong and healthy, and the produce was enormous, whilst the first crop gradually dwindled away, and died a premature death.'" 'The refuse lime of gas-works is stated to be efficacious in banishing these pests from the garden. Previously to the crop being planted, a thin covering of thelime should be spread over the ground, and it must be well mixed up with the soil in digging.'" F. H. B. "had been using some chloride-of-lime water, and poured it over some grass, when it immediately killed the worms. From this success he was induced to try it on some very sickly carnations infested with Wireworms, and had the satisfaction to find them recover rapidly. The proportion used was about a table-spoonful to a pint of water, but that of course must depend on the quality of the soil.'" It seems necessary to employ it with caution, in the flower garden at least; for in the same journal it is asserted, 'We have great doubts whether chloride of lime, although considerably diluted, would not be injurious to picotees, and commit as much havoc amongst them as the Wireworm. We recommend you to spread some of the refuse lime from the gas-works over the surface of the bed, the effluvia of which will probably drive them away.'"

"As the Wireworms will live upon potatoes—as I can testify by having fed them on nothing else for many weeks together—there cannot be a better bait to catch them in the flower borders than slices of that tuber, as recommended by Sir Joseph Banks, which has been fairly tried by a friend in Hants, who tells me it is the only method by which he can save his carnations and other flowers. I have now before me communications from several contributors to the 'Gardeners' Chronicle,' all concurring in recommending slices of potato, &c., as the best mode of freeing the garden at least from this troublesome visitor. One of these I will transcribe: 'I send you an account of destroying the Wireworm, which I have adopted for some years, my ground being full of them, so that I could neither grow sweet-williams, picotees, bulbs, lettuces, nor indeed any succulent plant, without their boring, running up, and eating the hearts out. Near these plants I now place half a potato, with the eyes cut out to prevent its growing, and run a pointed stick through the middle of it, and peg it into the ground, covering it over with about an inch of mould; and in a day or two I have pulled out by the tail from fifteen to twenty of them from one piece of potatoe.'" Slices of turnip, brocoli, cabbage, beet-root, parsnip, carrot, apples, and young lettuce-plants, will answer the purpose where potatoes are scarce or not to be obtained; and it is very probable, if such vegetables were scattered over infested corn fields, that considerable numbers of the Wireworm would be decoyed to them, and might be collected and destroyed; for it is even recommended by some persons to lay the slices of potato on the surface, although there are others who consider that they may be buried two or three inches deep; but these variations in the mode of application arise, in all probability, from differences in the soil."

"Excellent as many of the foregoing remedies may be, I must confess I think highly of hand-picking; its effects are certain, it is comparatively not expensive, especially when it is borne in mind that it gives employment to the children of the labourer. The following fact shows the advantages of this system, and requires no comment. 'A striking instance,'" says Mr. Spence, 'of the use of hand-picking (in most cases by far the most effective mode of getting rid of insects) appeared in the 'West Briton,' a provincial paper, in November, 1838, stating that Mr. G. Pearce, of Pennare Goran, had saved an acre and a half of turnips, sown to replace wheat destroyed by the Wireworm and attacked by hosts of these larvæ, by setting boys to collect them; who, at the rate of 1½*d.* per 100, gathered

18,000; as many as 50 having been taken from one turnip. Thus, at the expense of only 1*l.* 2*s.* 6*d.*, an acre and a half of turnips, worth from 5*l.* to 7*l.*, or more, was saved; while, as the boys could each collect 600 per day, thirty days' employment was given to them at 9*d.* per day, which they would not otherwise have had.'"

We shall, at a future opportunity, recur to the important subject of Insects, which are injurious to vegetation, seeing that so much of the success of gardening is dependent on due attention to the best means of preventing the ravages of some of the smaller enemies of the cultivator.

224 APPLE-TREES, THEIR DURATION. The cultivation of the various species of fruits, which now so much occupies the attention of horticulturists in every part of Europe, is becoming more and more a scientific pursuit, and its importance every where acknowledged. We, therefore, intend occasionally to give the opinions, and detail the practice, of eminent fruit growers, and also extracts from the writings of those authors whose experience has rendered them worthy of record. The very first amongst such authors we rank the late president of the Horticultural Society — Thomas Andrew Knight; whose numerous experiments, carried out as they were by industry and acuteness of observation, have advanced this department of horticulture in a greater degree than have the labours of any other individual. His treatise on the Apple and Pear contains much curious as well as important information, and from this we will copy some of the leading portions of his theorics, and their practical elucidations. These, we are quite sure, may be made advantageous to our readers, whether they cultivate ten acres, or only the tenth of one acre; for the one portion as well as the other is available for the cultivation of the most useful of all fruits — the Apple and Pear.

"The Apple is not the natural produce of any soil or climate, but owes its existence to human art and industry; and differs from the crab, which is a native of every part of England, only in the changes which cultivation has produced in it. The first varieties which were cultivated in England were, no doubt, imported from the continent; but at what period is not, I believe, known. Many were introduced by a fruiterer of Henry the Eighth, and some at subsequent periods; but I am inclined to think that we are indebted to the industry of the planters of the seventeenth, and the end of the preceding century, for most of those we have at present, and probably for all the old fine cider fruits. Of these they have left us a sufficient number; but the existence of every variety of this fruit appears to be confined to a certain period, during the earlier parts of which only it can be propagated with advantage to the planter. No kind of apple, now cultivated, appears to have existed more than two hundred years; and this term does not at all exceed the duration of a healthy tree. Vegetable, however, like animal life in individuals, appears to have its limits fixed by nature, and immortality has alike been denied to the oak and to the mushroom; to the being of a few days, and of as many centuries. The general law of nature must be obeyed, and each must yield its place to a successor. The art of the planter readily divides a single tree into almost any number that he wishes; but the character of the new trees, thus raised, is very essentially different from that of a young seedling plant; they possess a preternatural maturity, and retain the habits and diseases of the tree of which they naturally formed a part."

"All efforts which have hitherto been made to propagate healthy trees of those varieties which have been long in cultivation, have, I believe, been entirely unsuccessful. The grafts grow well for two or three years, after which they become cankered and mossy, and appear, what I cousider them really to be, parts of the bearing branches of old diseased trees."

"When I first observed the unhealthy state of all the youug trees of these kinds, I suspected that it arose from the use of diseased grafts taken from old trees, and that I should be able to propagate all the valuable varieties by buds taken from young newly-grafted trees, as these can scarcely be said to take any of the wood of the old stock with them; but to remove still farther every probability of defect which might be communicated from the old trees, I inserted the young shoots and buds taken from newly-grafted trees in other young stocks, and I repeated this process six times in as many years, each year taking my grafts and buds from those inserted in the year preceding. Stocks of different kinds were also used; some where double grafted, others obtained from the branches of apple-trees which had emitted shoots from cuttings, and others from the seeds of each kind afterwards inserted in them, under the idea that there might be something congenial to the fruits in stocks of this kiud. The grafts grew tolerably, and equally well in all; but there was a want of hardness and elasticity in the wood, and at the end of three or four years all began to canker."

225 Apple-trees, Canker. "The canker, however, which constitutes their most fatal disease, often arises from other causes. It is always found in those varieties which have been long in cultivation, and in these it annually becomes more destructive, and evidently arises from the age of the variety; but it often appears to be hereditary. A gravelly or wet soil, a cold preceding summer, or a high exposed situation, adds much to its virulence. It is most fatal to young free growing trees of old varieties, and I have often seen the strong shoots of these totally destroyed by it, when the old trees growing in the same orchard, and from which the grafts had been taken, were nearly free from the disease. The latter had ceased to grow larger, but continued to bear well, not being of very old kinds of fruits; the young stocks, by affording the grafts a preternatural abundance of nourishment, seemed in this instance to have brought on the disease; and I have always found that transplanting, or a heavy crop of fruit, which checked the growth of the tree, diminished its disposition to canker. In middle-aged trees of very old kinds, a succession of young shoots is annually produced by the vigour of the stock, and destroyed again in the succeeding winter; the quantity of fruit these produce is in consequence very small. In this disease something more than a mere extinction of vegetable life appears to take place. The internal bark bears marks of something similar to erosion, and this, I believed formerly to be the original seat of the disease; but subsequent observation has satisfied me that the canker is a disease of the wood, and not of the bark. It does not appear to me to be ever a primary, or merely local disease, but to arise from the morbid habit of the plant, and to be incurable by any topical application."

226 Apple-trees, young seedlings not prolific. "Being satisfied, after much unsuccessful experience, that those varieties of the apple, of which the original trees had long perished from old age, could not be made to grow. I suspected that grafts, taken from very young seedling trees, not yet in a bearing state,

could not by any means be made to produce fruit. Having taken cuttings from some of these of two years old, I inserted them in stocks of twenty years old, which had already produced fruit. I afterwards frequently transplanted, and took every means in my power to make them produce blossoms; but though they grew in rich ground, which probably tended to accelerate their maturity, I did not succeed till the seedling trees were twelve years old; and then other grafts of the same kind, which had been inserted but three years before, and the seedling trees themselves readily blossomed. Other cuttings were inserted in very old stocks, which were regrafted; these grew with excessive vigour, but did not produce blossoms so soon as the others."

"In these experiments I observed that the leaves of the young seedling plants annually changed their character, and became more thick and fleshy, assuming more the appearance of those of the old cultivated kinds. These external changes evidently indicated some internal ones in the constitution of the plant, which are probably similar, in their nature, to those which take place in animals between their infancy and the time when they become capable of propagating their species."

"The periods, which seedling apple-trees require to attain sufficient maturity to produce fruit, appears to admit of more variation than my first experiments induced me to suppose. Some, which I raised, did not produce blossoms till they were sixteen years old; others have blossomed in the ninth and tenth year; and two plants at only five years old; I consider these as extraordinary instances of early maturity, as these two only have occurred in more than twenty thousand seedling trees that have come under my observation, The rapid change of character in the leaves of these plants attracted my observation when they were but two years old, and I then inserted grafts from one of them in older stocks. These did not blossom in the last spring; but the form and character of their buds already indicate that they possess the habit and maturity of the tree from which they were taken, and that an abundant blossom is forming for the succeeding season. In this instance the grafts, which were inserted in older stocks, produced blossoms one year later than the seedling tree: in a few other instances the grafted trees have preceded the others a single year; but this has been the greatest variation I have yet observed; and the original tree, and the grafts taken from it, have most frequently produced their first blossoms in the same season."

227 Age and Propagation of Fruit Trees. Notwithstanding Mr. Knight's recorded opinion as mentioned in section 224, respecting the age of Apple Trees as they are usually cultivated, still he does not think it impossible but that such trees might be grown through many centuries, under management suited especially to the purpose of a prolonged existence. He has drawn a marked distinction between the roots, the trunk, and the branches of trees; and has shown that the latter exhibit indications of decay, whilst the roots show signs of their possessing the untamed nature of immaturity. "The roots," he says, "and the trunk adjoining them, appear to possess in all trees a greater degree of durability than the bearing branches, having a power of producing new branches, when the old have been destroyed by accident, or even by old age; and I have found that grafts taken from scions, which have sprung out of the trunks of old ungrafted apple and pear trees, grew with much greater luxuriance than those taken, at the same time, from the extremities of the bearing branches. The former in their growth assumed the appearance of young seedling stocks, and the shoots of the pear were, like those, covered with thorns. Those propagated from the bearing branches frequently produced fruit the second year, but the others remained long unproductive."

"Other grafts, which were taken from shoots out of the large boughs of the pear tree, in the intermediate space between the trunk and the bearing branches partook, in their form of growth, of the character of each of the foregoing kinds, producing a much smaller quantity of thorns than the one, but not being entirely free from them like the other. Whence it appears to follow that there is a progressive change from the roots to the extremities of the bearing branches, and probably an increasing tendency to decay; for the life of every tree is known to be greatly prolonged, when its branches are frequently taken off, and it is compelled to reproduce its buds, or to make use of the reserved buds with which nature has provided it."

We are not enabled to conclude from Mr. Knight's experiments, that by grafting from root shoots a complete renovation of a superior worn out variety may be effected, still these hints are valuable, to guide the operations of future experimentalists. This able naturalist soon turned his active mind to the raising new varieties of fruit from seed, and we will give a few of the results of his experiments, to guide the young fruitist in his path, and to shorten the distance he may have to travel to favourable results. He says :—

" When I first began to suspect that my endeavours to propagate the old fruits would not be successful, I selected the seeds of some of the best kinds, with an intention to propagate new ones. But I soon found that many of the young plants, (particularly those from the Golden Pippin) were nearly as much diseased as the trees which produced them. I several times raised three or four plants from seeds, taken from one apple, and when this had been produced by a diseased tree, I have had not only as many distinct varieties as there were seeds, but some were much diseased, and others apparently healthy; though the seeds were sown on the same soil, and the plants afterwards grew within two feet of each other in the nursery. Grafts having been inserted from each, retained the habits of the tree from which they were taken. Few, however, if any of them appeared to possess a sufficient degree of vigour to promise me much success in their cultivation (except in very favourable situations) should their fruit be such as answered my wishes."

"Having before observed that all the old fruits were free from disease when trained to a south wall, I thought it not improbable that seedling plants raised from them would be equally healthy; and that this would not be the sole advantage attending this mode of propagation; as the trees in this situation would enjoy all the benefits of a better climate, whilst their blossoms, being expanded before those of the neighbouring orchards, would escape all chance of being impregnated by the farina of inferior kinds. With a view to try the effects of this experiment, I prepared stocks of the best kind of apple I knew, which could be propagated by cuttings, and planting them against a south wall, in extremely rich mould, I grafted them with the Stire, Golden Pippin, and a few other fruits whose time of ripening suited the situation in which I wished to plant. In the course of the ensuing winter the young trees were dug up, and (their roots having been retrenched) were again planted in the same places. This mode of treatment had the desired effect of making some of them produce blossoms at two years old. I suffered only one or two fruits to remain on each tree, which in consequence attained nearly three times their common size, with a very high degree of maturity and perfection; and the appearance of the plants I raised from their seeds, so much excelled any I had formerly obtained from the same fruits, taken from the orchard, that, I think, I can confidently recommend the method I have adopted."

227 True office of the Earth in relation to Plants. It is of the first importance that, in all scientific pursuits, we obtain correct knowledge of the materials with which we have to deal. This is more especially necessary in chemistry; and to chemistry, it is now evident, the agriculturist must resort, to acquire just views of his proceedings—to know the why and the wherefore—to be enabled to draw just conclusions, and to apply them to his own profit, and the welfare of his country. The farmer and the gardener have usually exercised their skill empirically. Practice, practice, has been extolled as affording all wisdom; and true enough it is, that practice, that is, a knowledge of results, has put them in possession of all the learning of their contemporaries. But the time has arrived in which practical knowledge — the mere knowledge that the application of farm-yard manure will assist in the production of a crop of wheat or potatoes, is not considered sufficient information to satisfy the inquiry of the cultivator. If the one produce the other, the inquiry is now made—what ingredients do they possess in common? what are the qualities of these ingredients? and can they not be supplied to the living vegetable by other substances than those usually employed? The answers are not sufficiently evident, for we are now but just emerging from a state of darkness; and it behoves every one to assist in the general search after facts, instead of pertinaciously adhering to old practices, an adherence to which we are sorry to observe too general an inclination. We have been naturally led into these reflections from reading some observations which many advocates of improvement will think too extravagant. Their main features will, however, be recognised ere long, and we will extract them as antagonistic to the too pertinacious attachment to old customs, which prevails with some of our best friends. The observations alluded to are by

Mr. Newman, well known as the author of an excellent work on British Ferns, and given in an interesting periodical—the Phytologist. Mr. Newman's article is given under the title with which we commenced. He says, "Although so much has been written on the subject of gases evolved and absorbed by plants; on the form and functions of the stomata or mouths of plants; and on the obvious numerical preponderance of the stomata in the leaves and branches over those in the roots; yet the broad assertion that the office of the earth in relation to plants is precisely equivalent to its office in relation to animals—namely, to maintain them in the position best suited to their well being—has, I believe, never yet been made in print. Almost as long ago as I can recollect, this phytological fact was impressed forcibly on my mind by seeing how beautifully hyacinths blossom with their roots immersed in water and without a particle of earth that they could possibly reach. I have constantly asserted my belief on this point, but have always been laughed at as a visionary and theorist. It is, however, with infinite satisfaction that I see my views slowly gaining ground. Each succeeding year diminishes the number of those who assert that plants feed on the earth as we feed on meat and bread and potatoes: still, by far the larger portion of conversing mankind religiously believe this, and most of our farmers look on a rich soil as being as directly food for their wheat, as a sack of barley meal is food for their pigs. Now the truth is the very converse of this: the earth feeds on plants—is increased by plants — owes what is called its richness and good properties to plants. These facts are not only interesting in themselves, but the ends to which they are applicable would furnish almost a new era in existence. It can scarcely be doubted that nature has provided, in the earth, the best possible receptacle for the roots of plants; yet even this position will admit of considerable modification, for we have first to consider whether our object in cultivation is to carry out the designs of nature, or to make nature subserve our artificial requirings; if the latter, it is quite certain that art can be advantageously applied: we have but to call to mind our commonest fruits and vegetables as examples. Thus, although plants may best achieve their destined ends when rooted in the earth, it may reasonably be doubted whether in turning their good properties to our uses a more advantageous receptacle may not be found. But without extending the inquiry so far as this, if it be once admitted that earth is in no wise the food of plants, then, *cæteris paribus*, the most unproductive sand, for instance, the heaths of Surrey, may be rendered as productive as the Golden Valley: we have only to make use of this sand, as nature intended it, for a receptacle of roots, and then having learned what is the true food of plants, to supply that food in the most profitable way. It is now generally admitted that carbonic acid gas is the food of plants; but leaving even this question to those more competent to decide on it correctly, it is quite certain that their food, whatever it may be, is evolved in greater quantities from certain chemical preparations than from the richest and most highly manured earth. Poverty of soil thus becomes a nonentity: rotation of crops a mere amusement: once admit that earth is simply a receptacle for roots, and you invest it with a property which you cannot wear out. Every common and heath may be made to produce wheat at the will of the cultivator, and the supply must ere long greatly exceed the consumption; that very description of food, the supply of which causes such difficulty to all our legislators, becoming more abundant than our most zealous philanthropists could desire.

228 Pear-trees, to make fruitful. As we proceed with the Fruitist, the subjects of which it is destined to treat, branch out and exhibit more and more the importance of increased attention on the part of the fruit grower. Although it may be but a single tree that he has to manage, even this, in proportion to his knowledge and attention, will be made matter of pleasure and profit. The following paper, submitted to the Horticultural Society by its late president, T. A. Knight, Esq., indicates principles, of the advantages of which the cultivator may avail himself in other ways than those to which they are applied in the experiments detailed.

"The pear-tree exercises the patience of the planter during a longer period before it affords fruit, than any other grafted tree which finds a place in our gardens; and though it is subsequently very long-lived, it generally, when trained to a wall, becomes in a few years unproductive of fruit, except at the extremities of its lateral branches. Both these defects are, however, I have good reason to believe, the result of improper management; for I have lately succeeded most perfectly in rendering my old trees very productive in every part; and my young trees have almost always afforded fruit the second year after being grafted; and none have remained barren beyond the third year."

"In detailing the mode of pruning and culture I have adopted, I shall probably more easily render myself intelligible, by describing accurately the management of a single tree each."

"An old St. Germain pear-tree, of the spurious kind, had been trained in the fan form, against a north-west wall in my garden, and the central branches, as usually happens in old trees thus trained, had long reached the top of the wall, and had become wholly unproductive. The other branches afforded but very little fruit, and that never acquiring maturity, was consequently of no value; so that it was necessary to change the variety, as well as to render the tree productive."

"To attain these purposes, every branch which did not want at least twenty degrees of being perpendicular, was taken out at its base; and the spurs upon every other branch, which I intended to retain, were taken off closely with the saw and chisel. Into these branches, at their subdivisions, grafts were inserted at different distances from the root, and some so near the extremities of the branches, that the tree extended as widely in the autumn, after it was grafted, as it did in the preceding year. The grafts were also so disposed, that every part of the space the tree previously covered, was equally well supplied with young wood."

"As soou, in the succeeding summer, as the young shoots had attained sufficient length, they were trained almost perpendicularly downwards, between the larger branches, and the wall, to which they were nailed. The most perpendicular remaining branch upon each side, was grafted about four feet below the top of the wall, which is twelve feet high; and the young shoots, which the grafts upon these afforded, were trained inwards, and bent down to occupy the space from which the old central branches had been taken away; and therefore very little vacant space anywhere remained in the end of the first autumn. A few blossoms, but not any fruit, were produced by several of the grafts in the succeeding spring; but in the following year, and subsequently, I have had abundant crops, equally dispersed over every part of the tree; and I have scarcely ever seen such an exuberance of blossom as this tree presents in the present spring. Grafts of eight different kinds of pears had been inserted, and all afforded fruit, and almost in equal abundance. By this mode of training, the bearing branches being small and short, may be changed every three or four years, till the tree is a century old, without the loss of a single crop; and the central part, which is unproductive in every other mode of training, becomes the most fruitful. I proceed to the management of young trees."

"A young pear stock, which had two lateral branches upon each side, and was about six feet high, was planted against a wall early in the spring; and it was grafted in each of its lateral branches, two of which sprang out of the stem about four feet from the ground, and the others at its summit, in the following year. The shoots these grafts produced, when about a foot long, were trained downwards, as in the preceeding experiment, the undermost nearly perpendicularly, and the uppermost just below the horizontal line, placing them at such distances, that the leaves of one shoot did not at all shade those of another. In the next year, the same mode of training was continued, and in the following, I obtained an abundant crop of fruit, and the tree is again heavily loaded with blossoms."

"This mode of training was first applied to the Aston-Town pear, which rarely produces fruit till six or seven years after the trees have been grafted; and from this variety and the Colmar, I have not obtained fruit till the grafts have been three years old."

"In the future treatment of my young pear-trees it is my intention to give them very nearly the form of the old tree I have described, in every respect, except that these will necessarily stand upon larger stems, which I think advantageous; and I shall not permit the existence of so great a number of large lateral branches. In both cases the bearing wood will depend wholly beneath the large branches which feed it; for it is the influence of gravitation upon the sap which occasions the early and exuberant produce of fruit."

"I scarcely need add, that where, in old trees, it is not meant to change the variety, nothing more will be necessary than to take off wholly the spurs and supernumerary large branches, leaving every blossom which grows near the end of the remaining branches, or that the length of the dependent bearing wood must be different in different varieties. The Crassane, the Colmar, and Aston-Town, will require the greatest, and the St. Germain probably the least length."

229 Curl in Potatoes. Horticulture is now taking its place amongst the sciences. Chemistry, on the one hand, is lending assistance; whilst, on the other, vegetable physiology is guiding experiment to successful results. In a work written by G. W. Johnson, Esq., on the "Principles of Gardening," a work full of useful information, where treating of the diseases of plants, the author states the result of his own experiments, which corroborate his reasoning relative to the cause of the Curl in Potatoes. The subject is of much importance, connected as the patato is with the daily food of all grades of society, and here it is in the hands of a scientific experimentalist.

Mr. Johnson says:—"No disease appears to me to arise from impared vital energy in the plant more clearly than the curl, that of late years has made such extensive ravages upon our potato crops. Any one can insure the occurrence of this disease, at least I have found it so in the county of Essex, by keeping the sets in a situation favourable to their vegetation, as in a warm damp out-house, and then rubbing off repeatedly the long shoots they have thrown out. Sets that have been so treated, I have invariably found produce curled plants. Is not the reason very apparent. The vital energy had been weakened by the repeated efforts to vegetate; so that, when planted in the soil, their energy was unequal to the perfect developement of the parts; for the curl is nothing more or less than a distorted or incomplete formation of the foliage, preceded by an imperfect production of the fibrous roots."

"An equal number of whole moderately-sized potatoes that had been treated in three different modes, were planted the last week of March."

"No. 1. Twenty sets that had been carefully kept cold and dry throughout the winter, firm, unshrivelled, and with scarcely any symptoms of vegetation."

"No. 2. Twenty sets that had been kept warm and moist, and from which the shoots, after attaining the length of six inches, had been thrice removed."

"No. 3. Twenty sets that had been kept warm and moist for about half the time that No. 2 had, and from which the shoots, three inches in length, had been removed only twice. All the sets were planted on the same morning, each exactly six inches below the surface, and with an unsprouted eye upwards. The spring was genial. Of No. 1, nineteen plants came up. The twentieth seemed to have been removed by an accident. Of the nineteen not one was curled. The produce a full average crop. Of No. 2, all came up, but from ten to fourteen days later than those of No. 1, and three of the plants sixteen days later. Fourteen of the plants were curled. Of No. 3, all came up, but from ten to fourteen days later than those of No 1. Four plants were as severely curled as those in No. 2, eight were less so, and the remainder not at all; but of these the produce was below an average, and a full fortnight later in ripening. Dickson, Crichton, Knight, and others have found, that tubers taken up before they are fully ripened, produce plants not so liable to the curl as those that have remained in the ground until completely perfected; and, I believe, under ordinary treatment, this to be the fact, for it is rational. The process of ripening proceeds in the potato, as in the apple, after it has been gathered, and until that is perfected it is accumulating vigour, shews no appetency to vegetate, consequently is not exhausting its vitality, which is a great point, considering the careless mode usually adopted to store them through the winter; for this energy commences its decline from the moment it begins to develope the parts of the future plant Tubers taken from the soil before perfectly ripe, never are so early in showing symptoms of vegetation. Crichton, Hunter, and Young, in some of the works before referred to, have also agreed, that exposing the sets to light and air, allowing them to become dry and shrivelled, also induces the curl in the plants arising from them. This result of experience also confirms my conclusion, that the disease arises from deficient vital energy; for no process more than this drying one of exposure to the light and air, tends to take away from a tuber the power of vegetating altogether."

Evidence in favour of this theory is given from the practice of a farmer, who it is stated "employed rather small sets; cutting a moderate-sized potato into at least two pieces. Unfavourable weather, other business, and a somewhat dilatory habit, caused him to leave those sets upon a barn floor, drying for more than a week. He planted with them a two-acre field, and not more than three-fifths vegetated; of which three-fifths a fourth was in various degrees curled. Similar results were obtained in the experiments of a market gardener When the sets were allowed to ferment in a heap, allowed to sprout, &c., he had a crop one-fifth of which was curled. Every one acquainted with the cultivation of the potato, is aware of the great difference existing in the varieties as to their early and rapid vegetation; those that excel in this quality are, of course, the most easily excitable. A consequence of this is, that they are always planted earliest in the spring, before their vital power has become very active; and of all crops, practice demonstrates that these early ones are least liable to the curl. But what is the consequence on the contrary, if an early variety is planted for a main crop later in the spring, when extraordinary pains in keeping them cold and dry have not been employed to check their vegetation, and consequent decrease of vital energy? Such crop then is, more than any other, liable to the disease; and a good preventive has been suggested by Dr. Lindley, namely, that of planting the tubers in autumn, immediately after they have ripened."

"The results of my view of the disease, sustained by numerous experiments, are that it will never occur if the following points are attended to:—First, that the sets are from tubers that exhibit scarcely any symptoms of incipient vegetation. To effect which, they ought throughout the winter, to be preserved as cool, and as much excluded from the air as possible. Secondly, that the tubers should be perfectly ripened. Thirdly, that they should be planted immediately after they are cut. Fourthly, that the manure applied should be spread regularly, and mixed with the soil, and not along a trench in immediate contact with the sets. Fifthly, that the crop is not raised, for several succesive years, on the same area."

In the extract we have here given, Mr. Johnson has well and practically borne out his theory. The subject is one we confess never to have investigated, perhaps on account of never having had potato crops affected by the disease in question. It may be that the practice we pursue of planting fair-sized whole potatoes, in rows a yard apart, affords protection from the disease, and further evidence of the truth of Mr. Johnson's opinion on the subject. Weak sets, close planting, and the usual method of moulding up into high narrow ridges, we repudiate as practices which are the offspring of ignorance, perpetuated by the habit of the thoughtless.

230 FORSYTH'S COMPOSITION. The name of Forsyth is so well known to fruit growers; and his composition, his pruning, training, and mode of renovating fruit trees, so frequently referred to, without much knowledge of their merit, that it may be gratifying to our readers to know something more of the man; and also useful to be made acquainted with the leading features of his practice.

Forsyth was a Scotchman, employed for several years by Miller, in the Chelsea Botanic Garden, whom he ultimately succeeded as curator. This situation he held about fourteen years, and was then chosen to superintend the Royal Gardens of Kensington and St. James's. Whilst so engaged he received a pecuniary grant from Parliament, for his improved mode of renovating fruit trees, by the excision of diseased parts, heading down weak and decrepit trees, and the application of his composition to all wounds thereby occasioned. Much of Forsyth's practice has been approved by his successors; and every one that is interested in the growth of fruit should be acquainted with his composition, the preparation of which, for several years, was not disclosed to the public. This composition may truly be said to have been, at the time it was made known, as much esteemed for curing the cuts and bruises of maimed trees, as Marshall's Cerate ever was for its healing virtues on the human body. It having been considered by the Commissioners of the Land Revenue that Forsyth's composition could be advantageously applied to broken trees, in the Royal Forests, a representation to that effect was made to the House of Commons, and twelve gentlemen, headed by the Marquis of Abercorn, were appointed as commissioners to make inquiry whether the composition in question was efficacious for the purpose of restoring the bark to injured oak trees; and preventing or curing injuries and defects in timber, arising from the cutting or breaking off of limbs or branches. Forsyth had, for several years, employed it in the Royal Gardens at Kensington, where its effects were shown to the commissioners; this proved satisfactory; and a recompense was granted by Parliament to Forsyth for making known the preparation, and mode of application of his celebrated composition. The document which unfolded Forsyth's secret was dated from Kensington Gardens, May 11th, 1791; and having been esteemed of so much importance, we give it verbatim, as follows: —

"Take one bushel of fresh cow-dung, half a bushel of lime-rubbish of old buildings (that from the ceilings of rooms is preferable) half a bushel of wood ashes, and a sixteenth part of a bushel of pit or river sand; the three last articles are to be sifted fine before they are mixed; then work them well together with a spade, and afterwards with a wooden beater, until the stuff is very smooth, like fine plaster used for the ceilings of rooms."

"The Composition being thus made, care must be taken to prepare the tree properly for its application, by cutting away all the dead, decayed, and injured part, till you come to the fresh sound wood, leaving the surface of the wood very smooth, and rounding off the edges of the bark with a draw-knife, or other instrument, perfectly smooth, which must be particularly attended to; then lay on the plaster about one-eighth of an inch thick, all over the part where the wood or bark has been so cut away, finishing off the edges as thin as possible: then take a quantity of powder of dry wood ashes, mixed with a sixth part of the same quantity of the ashes of burnt bones; put it into a tin box, with holes in the top, and shake the powder on the surface of the plaster, till the whole is covered over with it, letting it remain for half an hour, to absorb the moisture; then apply more powder, rubbing it on gently with the hand, and repeating the application of the powder, till the whole plaster becomes a dry smooth surface."

"All trees cut down near the ground should have the surface made quite smooth, rounding it off in a small degree, as before mentioned; and the dry powder directed to be used afterwards should have an equal quantity of powder of alabaster mixed with it, in order the better to resist the dripping of trees and heavy rains."

"If any of the Composition be left for a future occasion, it should be kept in a tub, or other vessel, and urine of any kind poured on it, so as to cover the surface; otherwise the atmosphere will greatly hurt the efficacy of the application."

"Where lime-rubbish of old buildings cannot be easily got, take pounded chalk, or common lime, after having been slaked a week at least."

"As the growth of the tree will gradually affect the plaster, by raising up its edges next the bark, care should be taken, where that happens, to rub it over with the finger when occasion may require (which is best done when moistened by rain), that the plaster may be kept whole, to prevent the air and wet from penetrating into the wound."

"WILLIAM FORSYTH."

"Sworn at the Land Revenue Office, in Scotland Yard, the Eleventh Day of May, 1781, before Us,

CHARLES MIDDLETON.
JOHN CALL.
JOHN FORDYCE."

This Document, verified as above, became the property of the public. Subsequently, Forsyth found that his Composition could be used more advantageously in a liquid form, and he published the following "Additional Directions for making and using the Composition."

"To the foregoing directions for making and applying the Composition, it is necessary to add the following."

"As the best way of using the Composition is found, by experience, to be in a liquid state; it must, therefore, be reduced to the consistence of a pretty thick paint, by mixing it up with a sufficient quantity of urine and soap suds, and laid on with a painter's brush. The powder of wood-ashes and burnt bones is to be applied as before directed, patting it down with the hand."

"When trees are become hollow, you must scoop out all the rotten, loose, and dead parts of the trunk till you come to the solid wood, leaving the surface smooth; then cover the hollow, and every part where the canker has been cut out, or branches lopped off, with the composition; and, as the edges grow, take care not to let the new wood come in contact with the dead, part of which it may sometimes be necessary to leave; but cut out the old dead wood as the new advances, keeping a hollow between them, to allow the new wood room to extend itself, and thereby fill up the cavity, which it will do in time, so as to make as it were a new tree. If the cavity be large, you may cut away as much at one operation as will be sufficient for three years. But in this you are to be guided by the size of the wound, and other circumstances. When the new wood, advancing from both sides of the wound, has almost met, cut off the bark from both the edges, that the solid wood may join, which, if properly managed, it will do, leaving only a slight seam in the bark. If the tree be very much decayed, do not cut away all the dead wood at once, which would weaken the tree too much, if a standard, and endanger its being blown down by the wind. It will, therefore, be necessary to leave part of the dead wood, at first, to strengthen the tree, and to cut it out by degrees as the new wood is formed, If there be any canker, or gum oozing, the infected parts must be pared off, or cut out with a proper instrument."

"By using the Composition in a liquid state, more than three-fourths of the time and labour is saved; and I find it is not so liable to be thrown off as the lips grow, as when laid on in the consistence of plaster: it adheres firmly to the naked part of the wound, and yet easily gives way as the new wood and bark advance."

Much negligence has hitherto existed regarding the injuries to which fruit trees are liable, both from accident and old age; but having now explained Forsyth's Composition, which, although it may not possess any superlative healing properties, is on the whole acknowledged to be a very useful protective; and as trees which, with unheeded injuries would be destroyed, may oftentimes by timely attention be restored to kind growth, we shall, at a future opportunity, give further directions on this subject.

231 Selection of Fruits. As the addition of the Fruitist to the Botanic Garden has excited an increased attention in the country to the cultivation of superior varieties of Fruits, we have thought it desirable to give a Selection of those which are most valuable to cultivators on a small scale; and from this class of fruit growers no person should exclude himself who possesses a garden of even a few yards square. The extensive experience and knowledge possessed by Mr. Thompson, of the London Horticultural Society's Gardens, places him at the head of the list of English fruit growers; and as a Selection, prepared by him for Loudon's Encyclopædia of Gardening, is

perhaps superior on the whole to any which we could offer to our readers, we will give his catalogue from this work. A few new sorts, of superior excellence, will take the place of some of those enumerated, but they shall be noticed as we proceed in figuring them in the due course of publication.

For Cottage Gardens. Where the soil and situation are favourable for the production of the Apple, the following sorts are recommended by Mr. Thompson.

Where the space will admit of only one tree, the best is the Ribston pippin.

Where two, the Ribston pippin and Dutch mignonne.

Where three, the Wormsley pippin, Ribston pippin, and Dutch mignonne.

Where four, the Wormsley pippin, King of the pippins, Ribston pippin, and Dutch mignonne,

Where five, the Wormsley pippin, King of the pippins, Ribston pippin, Old nonpareil, and Downton nonpareil.

Where six, the Wormsley pippin, King of the pippins, Ribston pippin, Alfriston, Old nonpareil, and Downton nonpareil.

Where seven, the Wormsley pippin, King of the pippins, Ribston pippin, Alfriston, Dutch mignonne, Old nonpareil, and Downton nonpareil.

Where eight, the Wormsley pippin, King of the pippins, Ribston pippin, Bedfordshire foundling, Court pendu plat, Alfriston, Brabant bellefleur, and Scarlet nonparcil or Downton nonpareil.

Where nine, the Wormsley pippin, King of the pippins, Ribston pippin, Bedfordshire foundling, Court pendu plat, Alfriston, Brabant bellefleur, Scarlet nonpareil, and Downton nonpareil.

Where ten, to the preceding add Pennington's seedling.

For Training Against Cottages. "It often happens that one or more trees can be trained against a cottage wall or roof, or against some wall appertaining to a cottage; in these cases the proper sorts are Ribston pippins, Old nonpareils, and, if a large garden Apple be required, the Bedfordshire foundling."

In situations liable to Spring Frosts "Which so often kill the blossoms of the generality of Apples, the Court pendu plat is recommendable, as its blossoms expand very late in the season."

Under Less Favourable Circumstances, "Where the Ribston pippin may not succeed, the Bedfordshire foundling will be a hardier substitute; or, the King of the pippins, which is still hardier; the Northern greening may be planted for late kitchen use. For an autumn kitchen Apple, perhaps, none in this case is more to be recommended than the Keswick codling. The Hawthornden comes into an abundant bearing state at an early age; and, were it not liable to die off in some soils, it might be preferred to the preceding."

A wet Soil, "And a cold bleak situation, are what the cottager has the greatest difficulty in contending with; a poor soil he can enrich. In some instances it may be possible for him to remedy a wet soil by drainage; but in other cases, he may find this beyond his means. He should, however, take care to plant the tree very shallow, or even place it entirely on the dug surface, and then cover the roots with the best mould he can collect. This he should afterwards keep mulched if the weather becomes very dry; but otherwise, he should only keep the soil slightly stirred occasionally by a fork; or, if this cannot be done without injuring the roots, merely hoeing it will be better. In short, every thing should be attended to that will encourage the roots to run near the surface; the latter should therefore be trod upon as little as possible. Rotten manure should be applied; even leaves should be collected and applied in a state approaching to vegetable mould."

232 Sorts of Pears to be recommended, "Where the space is very limited; or for cottage gardens. Jargonelle, Marie Louise, Beurré de Capiaumont, Beurré Diel, Glout Morceau, Easter Beurré, Beurré Rance. These are all of first-rate excellence, deserving the protection of walls, where such can be afforded; but, with the exception of the Jargonelle, they are all hardy enough for standards, in any climate tolerably good, as regards the growth of this class of fruits. It would be difficult to select fewer sorts than the above, because some might prefer a sort which would come fit for use in autumn; others in winter or spring. Several sorts may, however, be worked on the same tree; and, it may be farther remarked, that the Beurrê Diel requires to have the branches kept rather thin, as otherwise its large and abundant foliage becomes too dense for the admission of sun and air to the fruit."

233 Rats, to Destroy. This subject, not unfrequently, becomes one of troublesome importance to the gardener and farmer, and more or less so to every housekeeper. In the Journal of the Royal Agricultural Society, and the Gardener's Chronicle, several successful methods of either destroying or driving away rats, have been published; and attention has been called to the employment of phosphorus for the purpose. The first communication of its use was from Captain Carr, residing in Germany; who, after mentioning the excessive annoyance he had experienced, says:—

"Several plans were tried for entrapping and poisoning, but our iugenuity fell so far short of their marvellous sagacity, that no sensible impression was made upon their hosts, notwithstanding an unremitting perseverance. However, having declared a war of extermination against the whole race, I rejoice in being now able to communicate to my agricultural friends in England an easy and certain mode of getting rid of this intolerable nuisance. A little manœuvring may be judiciously used to attract the enemy to a suitable position—suppose any unoccupied room in an outhouse, where they particularly abound. Here they should be fed with any favourite food—fish or malt I believe they are fond of; and then with, not a preparation of arsenic, which they are much too clever to touch, but pills, the size of peas, made of equal portions of wheaten flour and powdered sugar, intimately mixed with one-sixtieth part of that weight of dissolved phosphorus—say a quarter of an ounce of phosphorus to one pound of flour and sugar; cold water should be added to make the mass manageable, and the pills finely rolled in dry flour, and kept secluded from light and air. A couple of pills may be thrown into each rat-hole, or any quantity left on a plate in a dark situation, by which the double object is obtained of attracting the animals by the luminousness of the phosphorus, and preserving it from too rapid evaporation. The pills should be replaced as often as eaten, and that without grudging; as, although all the slain may not be found, it may be relied on that 'every bullet has had its billet.' Still, in a day or two, many rats will be seen running to water, where they die from excessive drinking. No domestic animal appears to be in danger of eating this preparation except fowls. Dry weather is most favourable to its successful application, as damp, whether of situation or atmosphere, dissolves, and consequently weakens, the phosphorus."

A method of preparing the phosphorus pills superior to that which has been practised on the continent, and described above, has been made known by Dr. Ure, who says:—

"In the Journal of the Royal Agricultural Society there was published, several months ago, a prescription for preparing a poison for the above purpose, by an English gentleman resident in Germany. That preparation consisted essentially of phosphorus mixed with flour and sugar. It has been tried by a friend of mine, in Derbyshire, who has a most extensive farm, and found to answer the purpose well; but there is a great difficulty in preparing it, from the insolubility, and even immiscibility, of phosphorus in water, attended with no little danger of fire. The process I have found to succeed perfectly is as follows:— Melt hogs'-lard in a bottle plunged in water heated to about 150 deg. Fah.; introduce into it half-an-ounce of phosphorus for every pound of lard; then add a pint of proof-spirit, or whisky: cork the bottle firmly, after its contents have been heated to 150 deg., taking it at the same time out of the water-bath, and agitate smartly till the phosphorus becomes uniformly diffused, forming a milky-looking liquid. This mixture being cooled, with occasional agitation at first, will afford a white compound of phosphorus and lard, from which the spirit spontaneously separates, and may be poured off to be used again, for none of it enters into the combination; but it merely serves to comminute the phosphorus, and to diffuse it in very fine particles through the lard. This fatty compound, on being warmed very gently, may be poured out into a mixture of wheat flour and sugar incorporated therewith, and then flavoured with oil of rhodium, or not, at pleasure. The flavour may be varied with oil of aniseed, &c. This dough being made into pellets, is to be laid in rat-holes By its luminousness in the dark, it attracts their notice, and being agreeable to their palates and noses, it is readily eaten, and proves certainly fatal. They soon are seen issuing from their lurking places to seek for water to quench their burning thirst; and they commonly die near the water. They continue to eat it as long as it is offered to them, without being deterred by the fate of their fellows, as is known to be the case with arsenical doses. My friend in Derbyshire bought a pot of Mr. Meyer's rat-poison, and found it to be an analogous phosphoric preparation. The present mode of preparing it is the result of my own experiments, made with the view of diffusing phosphorus through a mass of flour and sugar, &c., without the risk of fire. It may be an easy guide for those members of the Society who are desirous of following Dr. Ure's prescription, and may not have a thermometer at hand, to know that a temperature of 150° of Fahrenheit is equivalent to a degree of heat midway between that at which white-of-egg coagulates, and white wax melts."

Rats possess an instinctive fear of any new arrangement about their runs, and of the smell of their enemies; hence they are said to be very sagacious. Be this as it may, it is indispensable that, to be successful in capturing these animals, much caution be employed. Traps should be made clean, and not unnecessarily handled with the bare hands; and, in regard to setting them, or laying poisoned food about, this should never be attempted till the animals have been familiarized to the instruments, and will eat freely from the trap in an open unset state, such food as is similar to that intended ultimately to contain poison. About forty years ago, a resident of the county of Hereford was extremely successful in catching rats, and obtained (we believe) one hundred subscribers, at a guinea each or more, as a remuneration for his secret. The success of his plan was mainly dependent on the caution we have recommended. He used the wooden box trap, with sliding or spring ends; this was, at least, the principle adopted. He fastened it open, laid within side it a little malt, and a little straw which had been drawn through the hands after rubbing them with a drop of oil of aniseed. The least imaginable of this scent suffices, as much of it produces disgust. The rats soon discover the bait, and are regularly fed in the open trap with malt, till they will come, where they happen to be abundant, in droves, to consume it. When this is the case, the trap being set, several at a time will be taken, till the premises are relieved of the pest. Practised with caution this method proves exceedingly efficient.

234 Fruit Trees. (R. Errington.) Having promised explicit directions for the management of fruit trees in general, I must first deal with those general principles, which are common to all our hardy fruits, then explain such as apply only to

certain species; as also narrate facts of importance that have presented themselves to me during a long course of practice.

SITUATION AND SOIL of an orchard or fruit garden. First, the hill-top is too bleak, and the valley too damp. Hoar frost, which is soon dispersed, or with difficulty accumulated, on the higher grounds, is mischievous to the tender blossoms on the low. Hence it follows, that gentle slopes, at moderate elevations, are the most eligible. As regards ASPECT, I prefer a trifling inclination to the west, on the principle of slow thawing after frost; by which, without doubt, its effects are greatly mitigated. Sloping ground also facilitates DRAINING, which sometimes is of much importance.

The SHELTER of a range of hills is, of course, considerable; nevertheless proximity of shelter is of no mean value; such as the dense plantation, that intercepts the blast of the north, north-east, and north-west. If such shelter do not already exist, no time should be lost in establishing it. To which end the selection of quick-growing trees, thorough draining the site, and manuring, if necessary, should each of them have due attention.

The SOIL for the majority of fruit trees should be a sound, unctuous, rather friable loam; exceptions there are, which I will duly notice. Should, however, the intended site possess either an inclination to clay or peat, or to a weak sandy loam, these should be ameliorated. A FREE SANDY LOAM being suitable, if it be deep, to the vegetables of a kitchen garden, it would be easier, and more economical, to form stations for all fruit trees, than to undertake improving or rather altering the staple of the whole. The subject of "STATIONS" will be thoroughly discussed under that head, in its place. I may, however, observe, that marl, the scouring of ditches from clay soil, or even pond-mud, are all excellent improvers of such soil; more especially with regard to its adaptability to fruit trees. STUBBORN CLAYS are somewhat expensive to correct, and they are not, if thoroughly drained, very unsuitable to some of the commoner fruits, provided the trees are planted high. The "Platform" mode of planting should be adopted; abundant æration, or exposure of such soils to the action of the atmosphere, with subsequent liberal dressings of sand, lime-rubbish, or ashes, which will ultimately alter their consistence.

Peaty Soils. These being generally damp and low, are seldom chosen for either the orchard or garden. When such, however, is the case, thorough draining is the first step; and burning, if their be a good depth of peat, is the next; after which, dressings of marl, loam, sand, ditch scourings, or in fact almost any refuse matter, will improve it by increasing its tenacity. It would be well, however, after all this general improvement, to plant on stations. More care is required, perhaps, with peaty soil, than with that of any other quality, when it is intended as the site for fruit trees. Without due admixture, it is generally ill calculated for giving due strength to the strong-wooded trees. The Apple-tree, like the Oak, flourishes most in a strong sound loam, approaching to clay or marl; the Pear-tree, again, like the Elm, luxuriates on a somewhat lighter soil, and where gravel and a dry pervious bottom prevails.

Subsoils. A deep and strong loam, on a gravelly bottom, is, above all, to be preferred, either for the orchard or kitchen garden. Marl or clay ranks next in importance, where the surface has a good slope; affording thereby facility of draining. It is not by any means uncommon to make such a bottom artificially, to what I term stations; therefore if the natural subsoil partake of this character, its eligibility for an orchard is evident. One caution, however, is necessary, which is applicable to all retentive soils, viz. that is to plant above the ordinary ground-level. In which case it will follow, that in the adoption of platforms, they should be raised so as throw the most influential roots clear above the subsoil altogether, and perfectly within reach of the ameliorating power of the atmosphere. Peaty Subsoils are to be rejected at all times, as the site of an orchard or kitchen garden. Such are a constant source of malaria, if I may so use the term, to the vegetable world in general.

I now come to the consideration of the Platform mode of planting; by which I mean, making separate Stations for each tree, in preference to the expense of attempting to correct or improve the staple of a whole garden. Under the dwarfing system, it is surprising what a small quantity of soil is sufficient, provided it be of a proper texture. On cold clays, the bottom of the platform may, for general purposes, be fifteen to eighteen inches; but on upland, or sandy soils, it may be allowed three inches more. By the bottom of the platform, I mean the surface of the brick or rubbish stratum.

STATIONS, for general purposes, should be made from six to eight feet square; any material, of an impervious character, will be suitable. My practice is to cover the bottom with broken bricks, which are placed a single layer thick on dry and sandy subsoils; but if clayey and stagnant, six to nine inches thick. On these, when levelled at the surface, I sprinkle a good coat of cinders, to fill up the interstices; thereby securing drainage. One general observation I must here make, viz.—that, as to depth, it is a great error, on shallow soils, to make the soil any deeper than the natural depth of the ground; the roots, in such a case, on reaching the outside of the prepared stations, would find an impenetrable breast-work of subsoil, which they could not, and ought not, to enter. When the natural soil is thus shallow, the platforms should be prepared a foot wider on each side, and elevated six inches higher, and should accordingly have a sounder or more clayey soil.

In preparing the soil for the stations, I must be understood as advising, not the most perfect mode of all, but the most economical; and one within reach of the amateur, on a small scale, who may not, at all times, be willing to go to the expenditure of those who possess extensive domains.

First, then, the hole over the station ought to be half filled with new turf, from sound loamy soils, if possible. This turf may, if the staple be good, be cut six inches thick; each turf cut in four quarters with the spade, and tumbled into the hole, in a rough state. Above this, the remaining part of the hole should be filled with materials not quite so porous; one half the volume composed of peat soil, of as sound a character as can be obtained. If the fresh soil be rather clayey, chopped sticks, or the bottoms of a faggot pile, might be strewed in alternate layers: these will serve to secure a readier access to the atmosphere.

The above general rules, as to the preparation of the stations, if carried fully out, will be sufficient to command a tolerable share of success. They will be generally adapted to the Apple, the Plum, and the Pear. With regard to the Vine, the Fig, the Peach, &c., more special directions will be required; which I will endeavour to furnish in due course.

With regard to the new Flemish Pears, however, I may here offer a few remarks on the character of soil, &c., requisite in order to enable the amateur to carry out a dwarfing system successfully, and with as little trouble as possible. Most of these are far superior to the old sorts, whether we regard their free fruiting, their qualities for the dessert, or their eligibility for the dwarfing system. They are thus, in a peculiar manner, adapted to the limited garden of the amateur. In order to obtain some of these valuable fruits, such as Beurré d'Aremberg, the Winter Neilis, the Passe Colmar, &c. &c., of first-rate quality, a south, south-west, south-east, or due east or west aspect of wall is, of course, superior to an espalier station. Such aspects, however, are commonly wanted for the Peach and Nectarine, the Apricot, Vine, or Fig: these, if cultivated at all, must, of necessity, possess such situations, and many of these Pears must submit to an improved espalier mode of management; and a thorough control over the roots, is the basis on which such management must take its stand. One remark I may be allowed to make, before proceeding with the detail of Root Management, viz.—That such a plan cannot be expected to succeed equally all over Britain. In the southern half of England, success would, generally speaking, be certain; but as we proceed northerly, a compromise must gradually take place. For instance, the Winter Neilis, which would succeed on properly managed espaliers, in Worcestershire, would require an east or west wall in the county of Durham, and a south wall in Scotland. Moderate and steady action of root, is the point to be aimed at; and this will be best attained by using a portion of hard and impenetrable material in the neighbourhood of the roots.

I find, by reference to the former part of this paper, that I have recommended fifteen to eighteen inches, in depth of soil, over the platforms, as a general rule: this is, however, too deep for most of the northern counties; and as a rule whereby to regulate the depth of all borders, for tender trees on a dwarfing system, I would say,—Decrease one inch in depth for every degree of latitude. Thus, assuming London to be 51°, I would commence at fifteen inches; at Newcastle on Tyne, I would give eleven inches; and at Edinburgh, which is about 56°, I would allow ten inches only. This will be found, in dwarfing systems, a very safe rule, providing due care be taken to secure a proper staple of soil. Ripening of the Wood is the foundation of the whole matter; and this will be always best attained by keeping the main portion of the roots near to the surface of the soil. Of course no digging can ever be allowed over the roots of trees thus situated.

Mr. Hoare, who has lately written on Vine Culture, recommends a compost for the cultivation of the Vine out of doors, composed of rough bricks, plaster, charcoal, and bone waste, without any soil, if I remember correctly. This is, indeed, practising in extremes; and the plan has, I believe, in part failed. He will, however, have done much good; as it is, I conceive, a movement in the right direction.

The atmosphere of Britain is moist and sunless, as compared with that of France and Belgium, where most of these Pears attain a high degree of perfection. With us these valuable fruit-trees are frequently found in deep and rich soils, rapidly increasing their young wood at the end of August; whilst those on the Continent are concentrating all their energies for the perfect ripening of their wood, and the flavouring of their fruit. Hence the rationale of the platform system. Everybody must have observed how grass lawns "burn," as it is called, over the covering of shallow drains. The soil loses its moisture sooner in such places, and moreover becomes sooner heated through by the sun's rays; and this, applied to the Pear, or other tender fruit tree, leads to an early cessation of the growth; besides a continual tendency to produce short-jointed wood during the growing season.

I will now proceed to consider the subject of Compost, for the more tender kinds. To obtain as perfect a control over the roots as possible, the soil should be of a sound loamy character, and rather adhesive in its nature. If a light sandy loam were used, it would be so likely to participate in the vicissitudes of the atmosphere, that the trees on such shallow beds would make scarcely any wood in dry seasons, and the fruit would be liable to crack. As much turf as possible should be included; and it should, by all means, be filled into the station in a dry state. Stations, for very superior kinds, should be made entirely of fresh pasture soil of this character, excepting where it can be mixed with any half-decomposed vegetable refuse, such as old leaves, old thatch, &c., which would be beneficial by its rendering the loamy mass somewhat more porous. I sometimes introduce new and tough straw in this way, when I consider the loamy material too adhesive.

255 Peaches and Nectarines. These require a south aspect, in most parts of England: I have known them, however, succeed tolerably well on an east or west, more especially against the end of a house, the wall of which was warmed by a fire at the back. They delight in an unctuous, but free, loam; which should be used in a mellow state, rough chopped, and fresh, or nearly so, from an old pasture. My plan is to mix straw, or fresh long stable litter, in alternate layers, all through the mass,—merely a sprinkling, to prevent undue adhesion in the soil, and to preserve an elasticity in the mass, which is extremely serviceable in securing a free admission of the atmosphere. Such stations are also less liable to receive injury from treading, which is apt to close newly prepared soil in a most prejudicial degree. When planted, they should have a wheelbarrow-full of prepared compost, in contact with the roots, as a kind of extra assistance; which may be composed of equal parts of crumbling loam, and old leaf soil, with a little sharp sand. Finally, a barrow-full of fresher manure, should be applied to the surface, to prevent the roots from becoming suddenly dry. The depth, and general preparation of the stations, to be the same as for Pears.

256 The Apricot. This valuable fruit prefers a sound loamy soil, from old sward, if possible, the turf incorporated with it. On replanting a situation, previously occupied by a fruit tree, none of the old soil should be used again for the Apricot; indeed the same may be said of the Peach and Nectarine, and, in fact, of any other fruit tree. Where a scarcity of "maiden loam" exists, it is better, in making the station, to exchange the old soil for some of the ordinary soil of the garden, which has been occupied by vegetables. From one-half to two-thirds of this may be blended with the fresh loam, taking care, as before observed, to mix plenty of new straw, or long stable litter, with the whole mass. Considerable precaution should be taken to avoid a gross or over-luxuriant growth; such a habit in the Apricot, frequently leads to a premature decay in the main shoots of the tree, a disadvantage to which the Apricot is known

to be peculiarly liable. This tree delights in abundance of light, and heat, and generally succeeds best on the south wall of a dwellinghouse, more especially if there be a chimney on that side of the house; which circumstance points directly to the propriety of artificially heated walls, for this most valuable fruit, where a liberal supply is of importance. It is worthy of remark here, that some of the best bearing and ripening Apricots I have ever known, had a stone pavement over their roots; thus evincing their partiality to warmth at the root, and protection from that meddling weapon, the spade.

257 THE FIG. This fine fruit which ought to be within the reach of every one, is, perhaps, less understood, as to its habits, than any other of our edible fruits; a circumstance to be lamented, as most of the failures to which it is liable, are traceable to over cultivation. Short-jointed wood, so general a criterion of fruitfulness in most trees, is eminently so in the Fig; and whatever course of culture produces this, will also bring fruitfulness in its train. This being admitted, limitation of root becomes absolutely necessary; and of so severe a character, that even practical men, in general, can scarcely reconcile themselves to such an extreme. It must however be borne in mind that the Fig is most impatient of drought, and that a constitution of soil that will ensure short-jointed wood, through all seasons, will be liable, in excessively dry summers, to cause the trees to cast their fruit, unless precautions are taken to provide against the drought. Now this is easily overcome by what is termed "Mulching," of which I will say a few words in their proper place. The Fig will thrive—and thrive too fast, in almost any ordinary garden soil; as, however, severe limitation is necessary at the root, I would recommend a loamy soil, of a sound character. If the root is to be closely confined, and in a shallow soil, that soil must be slightly retentive, in order to enable the tree to withstand the vicissitudes to which it will be liable. Some good cultivators build a solid wall at two feet from that on which the Fig is trained. When this mode is adopted, however, the soil should be somewhat deeper, say fifteen inches; but if no retaining wall be employed, then a foot in depth will be amply sufficient. The Fig is very partial to old mortar, or lime rubbish; and is also known to succeed well in a dark alluvial soil; a mixture in equal parts, of these two, with a third of sound tenacious loam,

would be an excellent compost, and it would be a good plan to coat the surface over, (if not paved,) with a very dark soil, in order to aid in the accumulation of heat. On propagation, training, &c., I will speak in due course.

258 THE VINE. The cultivation of the Vine, out of doors, can only be expected to succeed in the southern portions of the kingdom; and there only with good management, and in warm situations. I need scarcely observe, that a south aspect is almost indispensable. Certainly even an east or west aspect will sometimes be found to answer, providing there is, as observed with regard to the Apricot, a fire behind it; such cases however are not frequent. Much depends on a proper mode of training and "stopping," which I will again advert to in its proper place. With regard to soil, one of a light and sandy character will be found the best. These soils, although "poor" as it is termed, in comparison with adhesive loams, are quite sufficient for the cultivation of Vines out of doors, in Britain, and if they fail it will assuredly not be for lack of nourishment, providing they have a tolerably free range at the root. As to depth, however, great moderation should be observed; and the platform mode, described previously for Pears, will do extremely well for the Vine. The most important item with regard to their safe and successful culture, consists in the adopting of a thorough drainage, without which all other preparations will be found of little effect. Borders, for Vines out of doors, should be formed considerably above the surface of the ground; one-half of the volume of soil should, if possible, be above the level of the adjacent ground.

Mr. Hoare, who has written on Vine culture, recommends a compost of old mortar, pounded bones, and charcoal, without, I believe, a particle of soil. That they may be grown in such, under peculiar circumstances of culture, I do not doubt; but I should pause before I ventured to recommend such a course to the amateur. It will be well, however, to take a leaf out of Mr. Hoare's book; for although the Apple pie could not be made entirely of Quinces, yet one or two impart a generous flavour. I have no doubt that at least half of the volume of compost, for the Vine border, may be composed of Mr. Hoare's materials, with the best effect. However, to simplify the matter, a fine sandy loam, with a sprinkling of fresh stable litter, on a sound

258. AUCTARIUM.

and thoroughly drained bottom, and elevated as above described, will, with good after-management, ensure success.

259 Raspberries. These will thrive in almost any ordinary soil, provided it be permanently moist—not wet. In this respect they are in habit similar to the Black Currant. The finest I have ever known, were growing in a dark and unctuous staple; rich, I presume, in humus, and of considerable depth. Where the site intended for them is of a loose, shallow, or gravelly, character, it should be well dressed with pond mud, ditch scourings, peat, or marl, or all of these blended; without this, or a similar addition, all manuring will be in vain. Old cow manure is very suitable for them. The ground should be thoroughly trenched and the materials well blended. It is a very good plan to plant these and the Black Currant together, in alternate rows, as their habit, in regard to soil, is similar. The rows should, if possible, run north and south; and if Black Currants alternate with them, about six feet should be allowed from the row of Raspberries to the row of Currants. In making a new plantation, the month of February may be chosen, although they will succeed nearly or quite as well if removed in the early part of November. My practice is to put two young canes in each hole, nearly close together. When planted, they may receive a good watering, and also a top-dressing of rotten manure. About modes of staking, summer and winter dressing, &c., I will say a few words in the proper place.

260 Black Currants. As before observed, with regard to Raspberries, a permanency of moisture in the soil is indispensable; let me not, however, be misunderstood. If the ground be absolutely stagnant they will not succeed—it must be drained; they will, however, endure more moisture than Raspberries. The same mode of improving the staple for a new plantation, as recommended for Raspberries, may be adopted with success. The farmers and cottagers of some parts of Cheshire, not unfrequently plant the ditch sides with them; and some, who are bad œconomists of manure—suffering their surplus fold-yard liquid to escape by an open ditch, obtain excellent crops from the Black Currants planted on the banks of such ditches. Young plants, of about three years from the cutting, with half-a-dozen shoots, are most eligible for planting. The middle of

October is an excellent time to accomplish this, and a little top-dressing may be added to induce them to make rapid progress. Each plant requires an area of about six feet diameter. Modes of pruning, &c., will be adverted to in due course.

261 Red and White Currants. The Red is much hardier in constitution than the White; the latter requiring richer soil. A free loam, of a sandy character, suits them best, and it should be two spades in depth. Thorough drainage is, of course, the first step, if the soil is of too retentive a character. Young plants, three years from the cuttings, may be planted in November, or from that period to the end of February. The Red will require an area of five feet diameter for each plant, whilst four will suffice for the White.

262 Strawberry. This delicious fruit, which may be called Everybody's Favourite, is cultivated under a greater variety of modes than any of the preceding fruits. Whatever mode be adopted a considerable depth of soil is requisite, iu order to ensure permanent success. They delight in a sound and somewhat unctuous loam; and if the plot intended for them be of a sandy or gravelly character, it should be improved by such materials as the furrowings from wet soils, ditchings, pond mud, marl, &c., &c. In making a new plantation which is intended to endure for a few years, in order to save the trouble consequent on shifting the site, a good dressing of rather fresh manure should be trenched in; this will keep them in vigour for a considerable length of time, provided the top management be good. A new plantation may be formed any time in the course of the summer, whilst young runners can be obtained; the earlier, however, the better. The commercial gardeners, who plant great breadths, generally plant in July, and take a crop of some other kind off the interval between the rows the same autumn. I would recommend the amateur, possessing a moderate-sized garden, to transplant young runners into beds, about eight inches apart, as soon as they can be obtained, and to remove them to their final destination in the middle of October, or from that time to the middle of February. They should, by all means, be removed with large balls of soil, which is easily accomplished by the use of a large trowel.

The larger sorts, if planted in rows, will require much room.

Such as the British Queen, the Old Pine, and the Kean's Seedling, should be in rows, three feet apart. These, if planted as here recommended, may be placed, at the planting time, only nine inches apart, in the row; they will do thus for the first season, or in fact until the fruit is gathered, when every alternate plant must be destroyed, which will leave them, in the second year, eighteen inches apart in the row.

Some of the smaller sorts are better, or at least quite as well, cultivated in beds. Such as the Alpines for autumn use, the Old Scarlet, the Grove-end Scarlet, the prolific Hautbois, &c. The Elton is a valuable Strawberry for late purposes. Strawberry walls have been much in request, and most deservedly so; but the difficulty of renewing the plants in this position has been, in part, a hindrance to their more general adoption. I hope to be able to show, however, in some future paper, how this difficulty may be overcome. This, with other practical remarks, relating to Strawberries, must be reserved for a future communication.

263 Window Flower Culture. (By R. Errington.) Soils, Composts, &c. Having completed the first division of the Fruit Tree culture, the top management, training, &c., of which will shortly be resumed, I now offer a few practical remarks on the culture of pot plants in windows, frames, &c. A good system, even of window culture, cannot be pursued without attention, in the first place, to soils and composts. Time was, when some twenty or thirty articles were amalgamated as necessaries for one compost, by those whose interests or ignorance kept the matter veiled in universal mystery. The progress of science however, has now somewhat dissipated those mystic notions; and people have at last began to discover that it is not the number of articles in a compost that constitute its efficiency, but a judicious mixture of simple soils, which are within the reach of every cultivator; such as may sustain a steady and uniform transmission of moisture, and contain a due amount of the necessary pabulum to feed the extending fibres.

A large assortment of soils are unnecessary; four things, however, are indispensable, to furnish compost sufficient to guarantee the good cultivation of window flowers; viz., turfy loam, heath soil, charcoal, and sharp sand. I need hardly include rotten manure, as it is to be presumed that this is always at hand; an old cucumber bed is sufficient. A good loam, neither too sandy nor too clayey, but of the two, inclining to the latter, is certainly a great desideratum; for on this, in the main, depends the durability and support of the compost. Nevertheless it may be well to mention, that either heath-soil or peat constitutes the chief portion of the soil used for those fine plants which so justly attract public notice at floral exhibitions.

This kind of loamy turf may be procured from old rest pastures, ditch sides, road sides, or lanes; but must possess the requisite degree of tenacity, or soundness; and should abound in vegetable fibre. If covered thickly with coarse grass, or other vegetable matter, so much the better. It should not, by any means, be cut or worked in a wet state; but should be either housed or piled up in a ridge, and slightly thatched if out of doors, or a portion of its organic matter will, on decaying, be carried away by the rains. After remaining thus for a few months, it will become mellow, and proper for use; and may be chopped small with the spade as it is wanted, but should not be riddled.

264 Heath Soil. This, which is so often confounded with peat, is altogether of a different character—the chief points of resemblance consisting in their being decayed vegetable matter. Here, however, the resemblance ends, their texture being very different; for whilst Peat is very retentive of moisture, Heath Soil parts with it freely; and this is indeed the grand distinction, and points out the propriety of caution in the choice of those materials for plant culture. Thus, for Fuchsias, plants requiring much moisture, I would allow the peaty character to predominate; whilst for Ericas, heath soil should prevail.

Heath soil, however, varies much in various districts; some heaths producing a profusion of moss amongst the stems of the heaths, which, in decay, produces a rather retentive earth, deficient both in sand and vegetable fibre. Where such is the case, the mossy upper surface should be rejected, as also that part in contact with the subsoil; the middle layer, full of heath roots, being reserved for pot plants. The best heath soil contains a considerable amount of sharp silvery sand, with abundance of roots, fresh, and in various stages of decay; the sand should, if possible, constitute a fourth of the mass. It may be in turfs, and piled up in a sharp ridge out of doors, and if well managed with regard to keeping out the rain, there will be no necessity for thatching, as the wet penetrates this kind of soil with difficulty. If housed, it becomes totally desiccated, and is very awkward to manage in such state on the potting bench. It should lie for several months before being used, as the fibre of heath is unusually tough. If well piled up it will be preserved for several years; and when used it should, like loam, be well chopped with the spade, but not riddled.

265 CHARCOAL. Any sort of charcoal will do for potting purposes, as almost everything depends on the size of the particles, which should be regulated in a considerable degree by the size of the "shift" given to the plant. Thus, for a three-inch pot, I would use charcoal in the compost in pieces of a quarter of an inch or less; in seven-inch pots, their size may be nearly half an inch; and in very large shifts, say pots of thirteen or fourteen inches diameter, I would increase them to nearly an inch. The species of plant under culture will, however, vary these circumstances.

Charcoal is said to act as a manure, by condensing carbonic acid gas within its pores. Be this as it may, it is extremely useful as a mere transmitter of moisture, and its chemical characters are, doubtless, considerable. I burn my own, and prefer it from its mixture with the ashes; it is readily produced by covering up with earth the smouldering heap of brush-wood with all the weeds, hedge prunings, and other refuse of the kitchen garden, which is reserved for the purpose. See Auctarium 218. After burning, I pass the whole through a very fine sieve, to separate the dust or wood-ash, which I reserve by itself for dressing onion, carrot, and turnip ground, in the kitchen garden. The whole should be kept under cover until wanted.

266 SHARP SAND. I need say little on this head, as most persons are familiar with the kind of sand used by gardeners, or rather nurserymen, who are sure to select the best. Everything depends on its sharpness and cleanness, and in order to ensure the latter quality, if pit sand, it should be washed, to divest it of all extraneous matter, as it is wanted chiefly, if not entirely, for its mechanical properties, in facilitating the steady and uniform escape of moisture. Two kinds should be kept if possible, the one extremely fine, for cuttings and plants in very small pots, and the other very coarse—as large as grains of raddish seed, if it can be obtained. Both should be equally sharp.

I have now described the only soils which are indispensable for the amateur, who aims at good culture, in a small greenhouse; or at growing window flowers with success. Before leaving this division of the subject I will, however, just glance at a few other articles, which are requisite in the potting shed of a larger establishment; these are—

267 MANURES. Amongst these I may mention guano, bone, soot, old and well-rotted cow manure, half-rotted leaves, and old tan; and, as mechanical agents, pounded crocks of various sizes, and pounded stone. Some other things are occasionally used, but these constitute the chief articles in general use. GUANO needs little description; the Peruvian is the best. This I use almost entirely for liquid manure, of which I will say a few words under that head, as I conceive no system of plant growing complete without a regular mode of making and administering this powerful stimulant. BONE —The kind I use is boiled bone; and is, I believe, chiefly composed of phosphate of lime. This is of great utility in composts for plants which have to remain a considerable time in their pots or tubs, and require durable fertilizers. Lumps of bone will continue to give out their fertilizing properties for twenty years, at least. SOOT.—This too is a powerful stimulant; we must not, however, trust it to any extent in composts, as it will close up the pores or breathing places. It is far the best used as a liquid fertilizer, in which state it shall be noticed. OLD AND WELL-ROTTED COW MANURE.—This needs little description, it having been in use for centuries; and has ever been a favourite soil with the florist, and as being esteemed a "cool manure" I am inclined to think that the amateur might rely on this, to the exclusion of hotbed manure, in the culture of window flowers. Confined as these are to sitting rooms, they have to endure a dry atmosphere, which extracts the moisture from the pots; and this points out the propriety of using cool composts. HALF-ROTTED LEAVES.—These are extremely useful for general purposes, and I should have placed them in the first section of this paper, but that I thought them not at all times within the reach of those who cultivate window flowers; they are, however, somewhat capricious in composts as to durability; they are, nevertheless, useful in composts for plants of short duration. OLD TAN.— Old and spent tan, as it comes from the pine pit, is excellent

for the drainage of pots, intended for plants of an annual or temporary character. It is, however, necessary to subject it to a half-inch riddle, that left in the riddle being proper for such purposes. It would be a great improvement in this article to slightly char it, thus rendering it less absorbent of moisture, and more durable. POUNDED CROCKS AND STONE.—Such plants as Ericas, Pimelias, Epacrises, Boronias, with a host of the New Holland plants, will not attain the size and age sometimes desirable, on account of loss of texture in the soil; the only way to obviate this difficulty is to introduce, in a liberal way, imperishable materials, of an angular or irregular character. Long after the organic matter in the soil has become soluble, these act as steady transmitters of moisture, and atmospheric action. I need scarcely add, that these porous materials should, in crushing, be separated into sizes, and the dust separated, which is very good to mix with the compost of any plant. The larger the "shift" any plant receives, the larger should these inorganic matters be; whether as drainage at the bottom of the pots, or blended with the compost.

268 WINDOW FLOWER CULTURE. Drainage of Pots. Having given practical remarks on the use of soils and composts, we proceed to the next division, viz.—the drainage of pots, &c. A few years ago it was deemed sufficient drainage that a single potsherd or oyster shell were placed at the bottom of the pot, beneath the soil; the soil too was subjected to the severe ordeal of the riddle, by which much of the organic matter, containing the necessary elements of food for the plants, and which also produces a peculiar mechanical condition of the soil, which can scarcely be supplied by other means, was rejected. These matters, however, have, in later days, been closely investigated; and the result is, that plants which some twenty years since were considered most difficult to cultivate, are now produced in the very highest degree of perfection, as is sufficiently attested by the splendid specimens produced at numerous horticultural exhibitions. The safest material for drainage, with which I am acquainted, is broken or pounded potsherds, from flower pots. Charcoal is also excellent—I had almost said indispensable; and should always be at hand. These two materials, for general use, may be mixed together in equal parts; and three distinct sizes should be kept ready for use. The largest should be of

the size of walnuts, the smallest about the size of pease, and the other intermediate. These materials are intended to insure free drainage, in the absence of which the soil in the pot would become surcharged with the stagnant fluids, and unfit for the support of tender plants. For plants of robust habit, or those termed "gross feeders," there is no occasion to be quite so particular; but when the subject is a plant of delicate root-action, such as an Erica, or an Epacris, it is impossible to use too much precaution to secure the escape of water. Two or three potsherds (broken pot or crock) of considerable size, placed at the bottom of the pot, overlapping each other, so as to permit the escape of water; these protected by a size of the pounded material of proportionate size, and these again by a smaller, will be found a perfect and durable drainage.

It is the practice of most cultivators to put a layer of moss or other fibrous material over this stratum of drainers. The principle is good, and moss is suitable for plants requiring much moisture, and which remain but a short period in their pots; but for delicate and slow-rooting plants, which have to remain for a considerable time undisturbed, moss is not to be recommended. Fibrous turf, of some age, is by far the safest material; and for such plants, as the Geranium, which prefer a loamy soil, fibrous loamy turf will be found suitable. For those inclined to peat, or bog, nothing can exceed fibrous turf in a mellow state, from upland heath or moor. The turfy materials here alluded to should be piled up, out of doors, for six months, in such a heap as will exclude rain; after which it may be removed to the potting shed.

269 Potting Plants. This is a division of the subject very important to window culture; so much so, indeed, that without care and method both good drainage and excellent composts may be rendered quite nugatory. I will submit the following six maxims as the chief essentials in good potting, viz.—

1st. Never use composts in a wet state.

2nd. Never use them quite dry.

3rd. Let the pressure used in potting be in proportion to the dryness of the compost.

4th. Introduce lumpy turf nearly all through the mass.

5th. Let the size of the lumps be in proportion to the mass of fresh compost in each pot.

6th. Use sharp sand, or other non-absorbent material, during the process of potting. Having premised these maxims, they should be considered in order.

270 1st.—WET COMPOSTS. No mode of potting, however scientific, can obviate the evils which must arise from using wet composts. The conviction of this has, in later years, induced many gardeners to keep a quantity of soil under cover, in a mellow state; this, however, has its attendant evils, as will be explained in the second maxim. The necessary consequence of using wet soils is stagnation, technically termed sourness, produced by an undue cohesion and closeness of the particles, by which the ameliorating agency of the atmosphere is in a great part prevented.

271 2nd.—DRY COMPOSTS. When soils have lain too long under cover they become dessicated, and in this state are almost as unfit for potting purposes as those which are too wet; they do not, however, lead to such serious results, the chief evil being that it is most difficult to equally moisten them through. There is such a volume of dry air in the interstices, that before it can be displaced by gravitation of the water, or capillary attraction, the upper portion of the roots will be saturated and probably injured.

272 3rd.—PRESSURE. This principle, in one shape or other, is applied by all practical men; one preferring a "ramming stick," a second depending on his fingers, a third giving the pot bottom a rap or two on the potting bench, a fourth, the wisest of all, adopting all or either of the above modes according to circumstances. The drier the soil, and the more lumpy, the more pressure may be admitted. The rationale of the practice is this—water carries off, by gravitation or otherwise, the soluble and finer particles of the soil; the more cavernous or porous the line of passage, the greater the robbery. But by a proper compression of the parts of a compost, no large cavities are left open, consequently no great amount of the nutritious properties of the soil can be readily carried downwards.

273 4th.—LUMPY TURF. After all the recommendations as to mixed composts, this material occupies, and probably ever will, the most important consideration in the compost shed. When about six months old, having been piled in a ridge out of doors, and thatched or otherwise covered from rain, as described in the early portion of "Window Culture," it is fit for removal to

the potting shed. For general purposes, lumps of this may be recommended to be introduced, systematically, through the mass of soil in the pot, with the exception of an inch or two of the surface. Turfy soils, or rather turfs, of this age, and thus managed, may be readily pulled into irregular lumps, and by tossing them round in a riddle, about one-part of the mere soil may be displaced and rejected; what remains in the riddle, thus rendered exceedingly porous, will furnish abundance of food for plants, and will at all times transmit and equalize moisture, with the utmost facility. As a general rule, I would advise it to be used in lumps of from half an inch to two inches in bulk. Let, however, about half an inch or so of the finer compost be used over them, to "surface" the pots; this acts as a regulator, in preventing the too sudden transmission of the water when applied. I may here remark, that the fifth maxim, is merged into the fourth; there seems however no reason to regret it.

274 6th.—SHARP SAND. It is convenient and advantageous to keep at all times a pan of sharp sand, on the potting bench; and although this material is used amongst the compost, I make a point of introducing it rather liberally, when the pot is about half full; more especially, near to the stem of the plant. This will be found to facilitate the passage of moisture, better than the same amount diffused through the whole mass. Although not producing food for plants, it is well known to promote a rapid action of the root, and in the case of delicate plants, just potted off, this is of importance. In shifting tender plants, it is sometimes indispensable to introduce lumps of stone, charcoal, &c., as the potting proceeds, this is a safe process with the Erica, Epacris, and others that have hair-like roots.

275 WATERING POT PLANTS. Much care is necessary in watering plants; the best growers consider it a most important process. The watering of newly-potted stock should always be accomplished by using a very fine-rosed pot for the first fortnight; several light sprinklings should in the first place be given, in succession, until the whole body of soil is moistened through; subsequently, the open spout may be used. If a newly potted plant be flooded with water, until the fluid begins to stand on the surface of the pot, the consequence is, that much of the soluble and finer particles of the compost, more especially the vegetable

matter, is carried away to the drainage; whereas, by the quiet sort of sprinkling here recommended, these particles are equally fixed through the whole mass, whence they cannot easily be displaced but through progressive decay. In watering plants in an ordinary state, which are tolerably well established in their pots, it is only necessary to be cautious not to water them before they become somewhat dry, and then to give them sufficient. Air bubbles will frequently arise through the soil of established plants; as long as these continue rising, water must be applied; at least to plants of strong habit.

Over Watering. It will sometimes happen, that a plant of tender habit, will accidentally become saturated with water. I find it a good plan, to turn such out of their pots immediately, roll a single turn of old garden mat round the balls, and place them in an airy situation in-doors, until much of the moisture has evaporated, when they may be returned to their pots. If such happen to a newly potted plant of difficult cultivation, the better method is to repot it, adding entirely fresh compost.

276 "Pot-bound" Plants. Some plants, as the Camellia, when cramped for a long time without "Shifting," become what gardeners term "Pot-bound;" when thoroughly dry, no ordinary watering can be efficient, and until they are shifted, a necessity will exist, for soaking them over head in water occasionally, for a quarter of an hour at a time. Such a course is necessary before shifting, for if potted in a dry state, the newly added compost, would become "soured," before the old ball could be penetrated.

277 Liquid Manure. This is well known, to be of considerable utility to plants in a growing state, where much vigour is required. Too much caution however, cannot be exercised in the application of it, for if used of too strong a quality, it impairs the tone and energy of the tender fibres; and used in a turbid or muddy state, it ultimately chokes up the interstices of the soil, thereby excluding the necessary operation of the atmosphere. It appears that no certain rule can be laid down at present as to the strength most desirable, we all want more experience in so nice a matter, I will however venture to recommend for the present my own practice, in this way, which has proved very successful. I have two stone cisterns, side by side, the one is used for making the soot water, the other for the general mixture. The drainings of the cowhouse are collected and left to ferment for a fortnight,

they are then transferred to the cistern for the general mixture, adding three times the quantity of soot water. Guano after the rate of four ounces to a gallon, is then stirred well into the mass and when settled, and perfectly clear, it is fit for use. My maxim is to merely colour the water with this mixture, using about half a pint to a large three-gallon water pot. Clean water should, I think, alternate with it about every third watering; but above all, let the mixture be rendered clear.

278 WINTER PRUNING. (R. Errington.) Before we proceed with directions for training, disbudding, stopping, &c., of fruit trees in general, we may, perhaps, not inappropriately offer a few simple and practical remarks on winter pruning, which will at least be seasonable. There are certain principles, in winter pruning, which are applicable to all our hardy fruit trees intended for a dwarfing system in the kitchen garden; there are others also, peculiar to the same trees, in a more advanced state; more especially, if trained on walls, or espalier rails. Under a dwarfing, or kitchen garden system, the young shoots must be shortened back annually, at the winter pruning, in order to furnish the whole of the tree with natural spurs as it extends; such trees, however, in ordinary orchards, will do, in the main, with a slight thinning, to prevent suffocation; or rather to enable the tree to produce fruit equal in quality, and size, in all its parts. Here, size or extension of the tree is the primary object; not so the espalier or dwarf tree, in the kitchen garden, which if permitted to extend widely would soon become barren in the lower parts, besides injuring the vegetables or flowers around it. To lay down rules for shortening back young shoots is impossible, so much depending on the strength, degree of ripeness, and general character of the tree. From nine inches to a foot, as a general rule, may be allowed until the tree attains the maximum height. The thinning of the branches or young sprays, must keep pace with the shortening; this, however, must not be carried to a great extreme, for a few years at the first, as mere provisional branches may be suffered to remain for four or five years, bearing a tolerable amount of fruit, and may then be removed. Early autumn pruning is, doubtless, much to be recommended; for the action of the root, even in deciduous trees, being continuous, (perhaps not dormant a day if in health,) there is a rising current of sap, more or less,

through the whole of the apparently dormant season, in order to refill the cells, which have been somewhat emptied by the summer's sun. This current first supplies the upper portion of the shoots, and thus it is that we find, in most cases, a few buds "breaking" at the extremities, whilst the lower portions of such shoots remain dormant.

With regard to pruning fruit trees on walls, or espalier rails, we have adopted a plan for the last seven years which has been eminently successful, and cannot be too extensively adopted; being moreover founded on the natural habits of the trees. It is well known that Pears especially, and, I may add, most of the other fruit trees, are more disposed to form blossom buds at their extremities, or on the two-year-old wood, than on their spurs; such being the case, I make a practice of reserving all the very short-jointed young shoots of moderate growth, at the general disbudding, or stopping, in July. Such shoots, in the Pear, for instance, will be found, towards the beginning of August, to have assumed a dark brown colour, and to be about completing their summer's growth; these are tied down on the main branches, and carefully preserved at the general winter pruning. By these means, each and every part of the tree, from the stump to the extremities, becomes duly clothed with blossom buds, instead of a few branches at the extreme points. In order, however, to secure abundance of light, on all parts of the tree, and in the case of wall trees, to promote the absorption of the solar rays by the wall, I take care to train the leading shoots a good distance apart, in general, six to nine inches. A line of wall between each two leaders is thus distinctly exposed to the solar rays, which becoming heated, radiates a warmth for hours after sunset. Pears, Plums, Apricots, and even Cherries, may be treated in this manner. About once in three years I cut all the ties that surround the branches, and give a general pruning of all exhausted, or barren, wood; cutting away, also, those of the lateral shoots which, from their size, are becoming unmanageable.

Peaches and Nectarines should be encouraged to bear on the annual wood; for although they will (especially when old) produce spurs, such should not be depended on. To obtain clean young wood, it is only necessary to prune rather freely; more especially the lower shoots.

279 Winter Pruning Orchard Trees, &c. The pruning of large, or orchard, trees, consists in merely thinning out over-crowded or decaying shoots, and in removing unnecessary sprays from the old stems; encouraging, at all times, fresh and growing extremities. When such trees become much exhausted, through sheer old age, and yet produce sufficient to induce the owner to keep them a little longer, the best plan is to cut away large whole branches, submitting, of course, the worst to the knife or saw. By such means the amount of sap hitherto appropriated to them will flow into the remaining branches. Pruning of Gooseberry bushes consists in merely thinning away superfluous shoots, especially those from the interior, which should be almost entirely removed. When the bush is properly pruned, no two shoots should touch. If, in the pendulous kinds, the branches begin to reach the ground, as much should be cut away as will prevent contact with the soil. The Black Currant requires much the same treatment in this respect as the Gooseberry. The Red and White Currants are quite different; these bear on spurs, and should have the young leading shoots shortened a little every year, in order to cause them to develope such spurs. The remainder of their dressing consists in shortening back the young side shoots, leaving about a quarter of an inch of the base of each. Vines must be pruned rather severely, thinning freely and shortening back to plump and well-ripened buds, disposing the bearing shoots equally. The pruning of Figs should not take place till April or May; when the true bearing wood can be distinguished.

280 Root Pruning. This operation is of great importance to over-luxuriant trees; it is, however, difficult to lay down rules for the inexperienced, as to the extent of such operations. Some very good and plain advice will be found in the Calendar, on the wrapper for March; the guiding principle there being the diameter of the stem. I may here add another, which may perhaps be still surer. It is generally admitted that the roots of trees extend quite as far as the branches; they will be found, however, to extend somewhat farther, especially under a severe pruning system. Assuming this as a guide, it may be recommended that one-fourth of the circle, defined by the branches, be cut away. The trench soil, thrown out, should never be returned, but in lieu thereof, some fresh unmanured earth.

A TABULAR VIEW OF FLOWERS SUITABLE FOR WINDOW CULTURE.

KINDS.	Habit, Duration, &c.	Time of Flowering.	Lowest Temperature.	GENERAL OBSERVATIONS.
ACHIMENES, various,	herbaceous perennial,	May to November,	40	When at rest, dry; pot successively, in February, March, and April; rather partial to shade.
ALOYSIA Citriodora	deciduous shrub,	April to November,	32	Prune back early in spring; succeeds, planted out in a warm border, or against a wall, the roots covered in winter.
AZALEA, Indica,	half decid. shrub,	February to May,	32	Keep in a warm room until growth is completed; may be placed out of doors through September.
ACACIA, various,	evergreen shrub,	February to August,	35	May be kept out of doors from June to October; much moisture, whilst in growth: armata, beautiful; easily grown.
CAMPANULA, grandis, pyramidalis, garganica,	herbaceous perennial,	March to September,	30	Pyramidalis and grandis, hardy; grandis a good border plant; garganica rather tender, pendulous, looks well in a basket.
CAMELLIA, various,	evergreen shrub,	November to June,	32	Treatment, during growth, as Azalea Indica; also, placed out of doors for a month after; water freely when full of roots.
CACTUS, various,	evergreen shrub,	February to August,	35	Plenty of water and heat, when growing; afterwards checked by drought progressively for months; abundance of light.
CHRYSANTHEMUM, Indicum, various,	herbaceous perennial,	October to January,	30	Cuttings, in April, grow quickly, liberally water, pot when struck, three in a small pot, afterwards one large shift.
CORONILLA, glauca,	evergreen shrub,	October to June,	32	Ordinary treatment; fragrant by day, almost scentless by night, nearly hardy in a warm situation, loves turfy loam.
CORRÆA, various,	evergreen shrub,	October to June,	35	A delightful winter family; should, if possible, be removed, when out of bloom, to a pit or frame.
CYTISUS, various,	evergreen shrub,	October to June,	32	Ordinary treatment; several quite hardy; fragrans, a variety of Laburnum, has a delightful scent.
CALCEOLARIA, various,	evergreen perennial,	February to November,	35	Much vegetable matter in the soil; also much sand; the pots well drained; plenty of light when flowering.
CYCLAMEN, various,	tuberous perennial,	November to June,	35	Persicum delightfully scented; rather tender: Coum, high coloured; Europæum hardy; dry when at rest
CHOROZEMA, various,	evergreen shrub,	November to June,	35	Ordinary treatment, in a light soil; Chorozema varium is an excellent winter or early spring flowerer.
EPACRIS, various,	evergreen shrub	November to June,	35	Pure sandy peat, its pots should be thoroughly drained; impatient of either extreme moisture or dryness.
ERYTHRINA, Crista-galli,	deciduous shrub,	May to September,	40	May be kept as a Fuchsia; rather dry when at rest; late in February prune back to a few buds.
FUCHSIA, various,	deciduous shrub,	March to November,	32	Ordinary treatment; may be stripped of their leaves, in November, and placed in a shed or cellar, till February.

GESNERA, various,	tuberous perennial,	May to October,	40	Suffer to become quite dry, when the leaves turn yellow, and keep so until February.
PELARGONIUM, various,	evergreen shrub,	February to November,	35	Moderate watering in winter; pruned rather close in August; give a little clear liquid manure, whilst in flower.
HYDRANGEA,	deciduous shrub,	March to August,	32	Plenty of water when growing, very little whilst at rest; may then be placed in an outhouse.
HEMIMERIS, various,	half shrubby,	February to November,	35	Delights in much light: impatient of water in winter; produces seed, which should be sown in spring.
HELIOTROPE,	half shrubby,	February to November,	35	Much light; plenty of water whilst growing fast; strike cuttings in spring.
LOTUS, Jacobæa,	herbaceous perennial,	February to November,	35	Flourishes in a dry atmosphere that is light; impatient of moisture in winter; easily increased from seeds.
LOBELIA, various,	herbaceous perennial,	February to November,	32	Fulgens and similar species delight in water, and rich soil; keep water in pans whilst flowering.
MIMULUS, various,	herbaceous perennial,	March to November,	32	Almost as greedy of water as Lobelia, and requires a rather free supply even in winter.
MIGNIONETTE,	imperfect perennial,	March to November,	33	May be trained to small trees, by pinching off the lower side shoots; to strengthen, pinch off flowers.
PETUNIA, various,	imperfect perennial,	February to November,	35	Renew by cuttings or seed in August; good border plants; spring-struck cuttings flower later.
PRIMULA, Sinensis,	imperfect perennial,	January to December,	35	Light vegetable soil; renew by seed in April; obtain late flowers by destroying early buds.
POLYGALA, various,	evergreen shrub,	November to May,	35	Water freely; often pinch off young shoots when growing fast in July, to concentrate the growth.
ROSE,	evergreen shrub,	February to December,	33	Tea-scented, dwarf China, crimson China, and hybrid perpetuals, are the most eligible; lay the lower shoots.
RICHARDIA, Æthiopica,	evergreen perennial,	February to July,	32	Succeeds as an aquatic; hence must have abundance of water. separate offsets whilst young.
SALVIA,	half shrubby,	February to November,	35	Renew yearly by cuttings, in July; good border plants; spring cuttings flower in autumn.
VIOLET, tree,	evergreen perennial,	January to August,	32	Formed into a tree as the Mignionette; interesting without training; leaf mould and little water suits it.
VERBENA, various,	evergreen perennial,	February to November,	33	July cuttings are most healthy through winter; early spring cuttings flower freely in the borders.
VERONICA, speciosa,	evergreen shrub,	June to November,	35	Should be kept rather pot-bound; have plenty of water and light; and be kept free from dust.

282 Window Flowers. The foregoing table of plants, suitable for window culture, contains some which are peculiarly eligible for cultivation in masses in the open garden, or for producing gaiety in the borders during the summer or autumn months. The following may be particularly noticed as adapted to this purpose. The Chrysanthemum, Calceolaria, Fuchsia, Pelargonium, Hemimeris, Heliotrope, Lotus, Mimulus, Mignionette, Petunia, Rose, Salvia, and Verbena. The Chrysanthemum, being preserved from severe frosts, after blossoming, may be planted in a warm border or against a wall or trellis, in March. Cuttings taken from the old stocks, in April and May, will make blooming plants for the following autumn, either in pots or the borders. The others, with the exception of Mimulus, Mignionette, and Rose, may be propagated by cuttings or suckers, soon after midsummer, and preserved, by placing several of the young rooted plants together in middle-sized pots, and merely keeping them from frost, until the following March or April. Mimulus, for the most part, is a hardy family, and is propagated by dividing the roots, Mignionette, for flowering in pots in March, as a window plant, should be sown in the middle of September; kept rather dry, safe from frost, and well exposed to light and air. Roses are so various in their habits that it is difficult to convey really useful information in a few words. It is desirable, however, to propagate annually, in July, as many at least as may be required for window culture. Choose half-ripened shoots, of an early growth, possessing healthy leaves; and these may be struck after the manner of Pinks, or plants may be propagated by layers. They will be rooted by the end of August, and may be kept, several in a pot, out of the reach of severe frosts, until the following February, when such as may be wanted for the window should be potted singly; those remaining will do for the garden. The following are peculiarly house plants, viz.:—Achimenes, Azalea Indica, Acacia, Camellia, Cactus, Coronilla, Corrœa, Cytisus, Chorozema, Epacris, Gesnera, Primula Sinensis, Polygala, and Veronica speciosa. Erythrina, although partial to heat, has been known to thrive for years in the front of a hothouse, well protected during winter. Hydrangea succeeds well under similar circumstances. Lobelia fulgens, and similar species, endure much cold; but such as bicolor require protection.

283 Fruit Trees, Training, &c. (By Mr. Errington.) Before proceeding to describe some of the best modes of training Fruit Trees, it will not, I hope, be considered superfluous to make a few observations of a general character; and which will be found to apply, less or more, to every mode which may be adopted. Increased heat, free exposure to light, and economy of space, I presume to be the leading objects in view, under all the varieties of training. Now it must be obvious, that so strict a limitation of the branches, in artificial training, must, unless the root be held in check by some means, produce such a body of unnecessary spray, as will tend to defeat one of the purposes, and that the most important, with which we set out — viz., free exposure to light. It is therefore necessary here to remark, that no permanent success can be expected, under what we may for the present term a dwarfing system, if the trees are planted without due preparation; or what is much worse, if the soil be over-prepared, by which I mean, too deep and too rich. I think I have previously shown, that the application of manures for such trees as the Pear, the Cherry, the Peach, &c., is quite unnecessary, or rather injurious, if they are intended to undergo a training process, unless it be a top dressing when exhaustion occurs. The best plan that can be had recourse to, when trees are thus overcharged with juices, is either to cut away a portion of their roots, or to take them entirely up, and replant them; there is not, however, always time or convenience to carry out such operations.

I will now proceed to remark on some of the best modes of training, practised at present; to examine them all would occupy too much space, and indeed be quite superfluous; some of them having no better claim to utility than many of the changes of fashion in a garment.

284 Training on Walls or Fences. Two modes of training on such structures claim preference to all others, on account of their simplicity, and the success which is known to attend them; these are the old fan mode, and the horizontal. The first is generally applied to Peaches, Plums, Cherries, and Apricots; the latter to Pears. There is not the slightest reason, however, why the Pear should not be subject to the fan mode of training, which most assuredly, in a general way, excels all others. When the Pear is trained on the principle of tying down the

young spray, instead of cutting it all away at the summer disbudding, as will be hereafter explained, there is no reason to adopt any other mode; unless dictated by fancy, or peculiarity of situation.

If the wall be of very rough stone, a trellis of wire or wood will be necessary, to which the shoots must be tied. The trellis must be placed within about two inches of the wall; for, although a much greater distance has been advocated by some theorists, it has been proved in practice that trees in such positions possess but very slight advantages over the ordinary espalier. In commencing the training of young trees, on the fan system, to which I deem it expedient to confine myself, in the present case, the main point is to continue pruning back the young shoots, for a couple of years, or more, in order to obtain the requisite number of main leaders, whether the subject be a Apricot, Pear, Plum, Peach, or in fact, any fruit-bearing tree.

The distance apart at which the leaders ought to be ranged. must be determined by the size of the leaf. Since the elaboration of the sap in fruit trees, especially those from warm climates, depends so much on a due exposure of the foliage to light, independently of the question of heat, it is obvious, that the shade produced by the rivalry of leaves, in juxtaposition, is somewhat inimical to one of the chief principles from which we set out — viz., the free admission of light. As soon then as the requisite number of leaders is obtained, to produce the "fan," the pruning must be regulated by other principles, which will be explained in due course.

We come now to the subject of Espaliers, or trees placed under a dwarfing system, without wall or fence. Many fancifully trained forms of such trees are adopted in practice, and in truth many more are needed, than for those on walls. The principal modes, however, or rather the most useful and distinct, may be comprised under the following heads —viz.,

1st. Upright rails, or treillage.
2nd. Horizontal rails, or table trellis.
3rd. Pyramidal, or upright training.
4th. Quenouille, distaff, or down training.
5th. Trellised arcades.

In casting a glance over these forms of training, it may readily be seen that by the 2nd mode, or horizontal rails, if placed near to the earth's surface, the tree will be in a position to enjoy more warmth in the aggregate, than if trained by any of the other methods. This must be esteemed a matter of the very first importance, as regards tender fruits. I have proved, for at least fourteen years, that this mode of training is peculiarly adapted to the tender Flemish Pears, for which a good situation on a wall cannot always be supplied. I will now proceed to make a few practical observations, on these methods, according to the order in which they are here placed.

285 1st. Upright Rails, or Treillage. These are generally placed about three feet from the margins of walks, and if fruit trees are properly trained on them, and kept in good order, they produce fruit of a character superior to the ordinary dwarf standard. They, moreover, add much to the effect of the garden, and admit of a small border for the cultivation of dwarf flowers. Many such are to be met with in old gardens, having been long in use, but, generally, with a very moderate amount of success. Want of success should not, however, be imputed to the principle, but to imperfect management; and to soils too damp and rich. The trees are thus continually excited to make succulent growth; which, if closely pruned, does but the more increase; and, if left unpruned, occasions barrenness, by shading and robbing the blossom spurs. By the platform mode, explained in section 234, the trees will be totally altered in character; they will produce much less wood, and this will be of a more sturdy and short-jointed growth. This mode is well adapted for many of the Flemish Pears. For those which are tender, the trellis should run east and west; thus furnishing a southern face for a superior amount of light. For such a trellis, the Glout Morceaux, the Winter Neilis, the Passe Colmar, the Beurré Rance, and the Ne plus Meuris, may be recommended. For trellises running north and south, the Jargonelle, the Dunmore, the Marie Louise, the Althorp Crassanne, and the Easter Beurré, would be suitable.

This treillage has been much used for training superior kinds of Apples upon, and is quite as suitable for these as for Pears; especially for those trees which produce slender and short-jointed wood; such as Hicks's Fancy, Kerry Pippin, Padley's Pippin, Pearson's Plate, Scarlet Crofton, Lamb-abbey Pearmain, Ribston Pippin, and the various Nonpareils.

Trellises of this kind are generally of iron; the uprights, or supporters, about six feet apart, and the horizontal wires nine inches asunder, for Apples and Pears. The uprights are sometimes fixed in oak stumps, or what is much better, in stone bases. Such trellises are peculiarly adapted to the mode of training described in section 278 of the Auctarium; and which consists of tying in, instead of cutting away, a regular portion of young wood of a fruitful character.

286 2nd. Horizontal Rails, or Table Trellises. These, like the upright trellis, are by no means a new invention. They have, however, not unfrequently failed in producing the proper amount of success; for the reasons given in the preceding section. The advantages they possess, as to a warmer atmosphere, over every other mode of training, with the exception of walls or fences, justify me in recommending them to the particular notice of owners of small gardens. I have used table trellises extensively for the last fifteen years, and can bear ample testimony to their complete efficiency, when under proper management. Like the upright treillage, they are a suitable accompaniment to the garden walk; but do not, like those, admit of an accompanying flower border. The best height of such trellis from the ground, according to my experience, is about one foot; with a horizontal width of four or five feet. They may be either metallic, or of wood; and for Apples and Pears of the tender kinds, should possess parallel rails or bars, running in all cases north and south, at about ten or eleven inches apart. The soil beneath them having been duly prepared, according to the platform mode, as detailed in the Auctarium, section 234, the surface of the soil should be covered, if possible, with slates, to absorb heat; these, however, are not indispensable under this mode of training, but they assist in perfecting both wood and fruit. If such a trellis were fitted up to receive a canvas covering during frosty nights, in the end of March or beginning of April, a crop of fruit might always be calculated on; and such protection may be readily accomplished, by placing a slight rail on each side of the trellis. The canvas would again be advantageous, at the end of September, for covering the trellis, from about three o'clock in the afternoon, especially after a sunny day, when the warmth of the atmosphere in the vicinity of the branches and fruit, would be kept up for some

hours after sunset; thus promoting the ripening of the fruit, as well as of the wood for ensuing crops.

287 3rd. Quenouille or Conical Training. This consists in carrying up a main stem to any desired height, (about six or eight feet being the most desirable) and, by annual pruning, to cause the stem to produce abundance of side shoots in its progress upwards. The side shoots require pruning back until the necessary height and full development of the side buds are accomplished; after which a selection of the shortest jointed shoots of the current year, are annually tied down, in a reversed position. This mode, although it has proved tolerably successful with the French gardeners, is seldom adopted in Britain, for it could, by no means, become an efficient substitute for a wall, which, on the continent, may be the case. The trees are, moreover, thought to wear out prematurely; owing, no doubt, to the continual check on the vital principle, by stripping the tree of its most active members, to keep it close and prim. If such a mode be adopted, I would again urge the propriety of connecting it with the platform method of planting; even if a system of top dressing should be rendered necessary.

288 4th. Down Training from a Main Stem. This mode may be more confidently recommended than the former, inasmuch as it is more simple; and the down training of the current year's shoots may commence as soon as the desired height is obtained, without any further sacrifice. Some persons carry the main stem six feet high, some are content with three feet. I would suggest about four feet as very eligible; it being necessary, with tender kinds, to keep the shoots near the surface of the earth, in order to secure a warmer atmosphere. This mode, with that of the preceding section, is also admirably adapted for the margins of walks, promenades, drives, &c., in small gardens; and the latter mode, well carried out, would not be altogether unworthy a place on small lawns, as their effect, when properly managed, resembles that produced by a weeping willow. Some persons drive pegs or stumps in the ground, in a circle, four or five feet from the stem of the tree, to which they tie the shoots; others suspend a ball of clay to the extremities of the young wood. For this mode, and that of the preceding section, some of the hardier kinds of Flemish Pears should be selected; such as the Althorp Crassane, Fondante

d'automne, Thompson's, Marie Louise, Louis bonne of Jersey, Beurré diel, Hacon's Incomparable, &c.

289 5th. TRELLISED ARCADES. As to the effect produced, these are exceedingly ornamental; they are made to stretch over a walk, which, to do justice to the plan, should, by all means, run north and south; one side will thus enjoy the morning's sun, and the other that of the afternoon. Care should be taken to carry them high enough, in order that tall persons may not come in contact with the fruit, which will occasionally hang through the trellising. The uprights which carry the arch should, at least, be six feet in height at the sides. The same mode of training, as to disposition, distance, &c., may be preserved here, as with the horizontal trellis; allowing, however, more width between the principal shoots, as it is more difficult to train them; a foot to fourteen inches will be amply sufficient.

It may be reasonably hoped that what has now been advanced in regard to training, will be sufficient to direct persons of small experience, or those about to make new gardens, in their choice and adaptation of the most efficient methods. I will next proceed to offer advice on the principles of disbudding, both general and special; a process of far greater importance than is generally imagined. In carrying out any, or all, of the above modes of training, it will at once, I think, be obvious, that unless the root be placed under control, all training, however scientific, must inevitably end in disappointment. In fact, the absence of due regard to this one circumstance, has been the sole cause why trained fruit trees have so generally disappointed the expectation of the horticulturist. And how should it have been otherwise? If the principle of reciprocity between root and branch,—more especially with regard to fructification, be admitted (and it can but be recognised by every vegetable physiologist), how is it possible that so severe a limitation of the branches should be compatible with unlimited power of the root? Prevention is better than cure; and I have always found, that fruit trees, planted in sound maiden loam, not too deep, have invariably produced shoots of the most fruitful character. The method of planting, moreover, which I here call the platform system, supersedes the necessity of root pruning, or, in fact, any other root operation, with the exception of top-dressings when the tree becomes exhausted by age or over-bearing.

290 FRUIT TREES, SUMMER DISBUDDING AND STOPPING. This, if not the most regular, will at least be the most seasonable, mode of proceeding with our subject. Disbudding, although in itself a simple operation, is one, it may be readily conceived, of such power that a tree may be quickly destroyed by pushing the operation to an extreme. It would appear that its immediate effect is to paralyse the action of the root, and consequently is antagonistic to over luxuriance. It will also be found to limit, in some degree, the ultimate size or extension of the tree; and therefore is a necessary operation in carrying out a dwarfing system; or, in other words, to produce a maximum amount of fruit, in a minimum degree of space.

One object, however, of greater and more immediate importance, is the free admission of light to all parts of the tree; and I think it will suffice for the present, to confine my observations principally to this view of the subject. It will be obvious, on the slightest consideration of the subject, that without much sunlight on the leaf, there can be no properly elaborated or ripened fruit buds. Now this degree of light is more especially required to act on the leaves belonging to the embryo buds or spurs, which are ultimately to produce the fruit. The Plum, the Apricot, the Pear, the Apple, and the Red and White Currants, are instances of fruit trees bearing principally on spurs; whilst the Raspberry, the Black Currant, the Vine, the Peach, and the Morello Cherry, produce the chief of their crop on the young shoots. Hence it becomes manifest, that those trees which produce their fruit on spurs, and are trained artificially, must have a very considerable portion of their annual shoots removed, or stopped, in order to admit light. I may digress to observe, that the old maxim, "prevention is better than cure," is especially applicable here. By the platform mode, so well adapted to a dwarfing system, in small gardens, the trees will make a very small amount of superfluous wood; it therefore saves much trouble in this respect; and, in a great degree, supersedes the necessity of violent operations, which must certainly be considered in the light of sheer necessity. These preliminaries being established, I will now proceed to offer a few words of advice about disbudding; and for the sake of simplicity, will generalize the matter, as the whole in detail would occupy too much space.

270. AUCTARIUM.

In the first place, I would suggest, that the operation be of a progressive character; this is my own practice, and is very successful. In the second place, I would recommend a general stopping of all misplaced gross shoots, sometime previously to their final removal. This will gradually enable the sap to find other channels, and will not produce so great a stagnation in the system as a sudden removal. In the Peach, I have known a sudden and heavy disbudding arrest the swelling of the fruit; therefore great caution is necessary. Little and often is the best maxim. A stopping—previous to a thorough disbudding, is of great utility here: no tree suffers sooner than the Peach. My own practice is, to thin out, at the first operation, those shoots only which arise from the same eye, or base, as those intended to be reserved. In the second operation, about a fortnight afterwards, to stop or pinch the tops off the intermediate shoots, some of which may, possibly, at the final thinning, be required to produce a succession of young wood for the next year. The fore-right shoots, however, should, by all means, be rubbed entirely away. These points observed, there need be little more disbudding until the early part of June, when the growing shoots, intended to produce the next year's crop, should be nailed to the wall; this then is the time wholly to remove all superfluous wood. In its removal, however, it is not always expedient to rub off the shoots; they are better, when stubborn, cut with a sharp knife, leaving a joint or two at the base to cut away at the winter pruning. Some little difference requires to be made with regard to the Pear. In all cases we must keep steadily in view, the circumstances, or conditions, of their fruiting habits, whether on the young wood, or on spurs. These two principles will classify the whole of our fruit-bearing trees. My practice with regard to the Pear is detailed in the earlier part of this subject, and need not be here repeated. The previous stopping may also be applied here. I treat the Apricot exactly as the Pear, with regard to disbudding; taking care to tie, or nail down, all moderate and short-jointed shoots, and to remove, in a progressive way, all those of a succulent or watery character. The Plum will submit to the very same treatment as the Apricot. The Cherry requires an intermediate course of treatment; indeed the Morello may be treated in every respect as a trained Black Currant—relying almost entirely on the production of a regular series of annual shoots for the next year's produce of blossoms and fruit.

Another stopping, of a somewhat different character, will be required towards the middle of August, about which I will give a few words of advice shortly. In the mean time I would strongly urge the great importance of paying the utmost attention to these matters, in due time; for no system of winter pruning, however complete, will be long successful without good summer management. Indeed, if trees were properly treated during the growing season, it would matter little what the winter operations were, except as far as neatness is concerned. Together with judicious stopping and thinning, may be urged the very great importance of keeping down insects on trained trees. No pains must be considered too great in this respect, if permanently useful, handsome, and dwarf trees are desired.

291 Preparation for the ripening period of Fruit Trees. Mulching. Those who adopt the platform mode of planting, will sometimes find it necessary to spread a thin coat of manure on the surface of the soil over the roots, usually called Mulching. Indeed, whether on the platform mode or not, this is a most useful proceeding; for it must be remembered, that the atmosphere of a garden is much hotter, at times, than that of the ordinary orchard, especially in the vicinity of its walls. To newly-planted trees, mulching may be considered indispensable. It is not well, however, to apply too heavy a coat; about three inches will suffice. If dry weather prevail, the mulching should receive a thorough watering, whether the case be that of a newly-planted tree, or of one laden with fruit; and the operation should not be delayed after the fruit begins to swell; for the root being then in full action, much extra nourishment is thrown into the system of the tree, and the fruit by swelling more freely is sooner past the depredations of insects.

Some of our best Pears, as well as others of our fruits, are liable to crack, and become coarse and gritty; the Old Crasanne, and the Gansel's Bergamot, may be mentioned as instances. The Melon is well known to be liable to crack, when the treatment is not of uniform character. The first swelling may be performed under a deficieucy of root action, or of moisture. Subsequently the roots insinuate themselves into the linings or body of the bed, whereby a new stimulus is given them, and a great influx of sap takes place, whilst the rind of the Melon having become indurated and prepared for the ripening process, cracks and bursts, through a surcharge of fluids. It is just so with Pears. They are seldom or never found to crack during the first swelling, or in the ripening process. If the trees are in sandy soil, and a dry period takes place in June, they become what gardeners term "hide-bound"—and the July rains, in many cases, become a severe test of their soundness. This, then, points to the propriety of choosing sound or somewhat tenacious loams; as also of laying on a mulching betimes, especially with those kinds which are so liable to crack.

Having adverted to the spring disbudding of fruit trees, rather at large, in section 290, little on this subject need now be said. It may, however, be added, that all disbudding on the principles there laid down, should now be completed at once. Not a moment's delay can be permitted. For, although young spray may remain in a crowded state with impunity, during the early summer months, such cannot be permitted in July and August, without perilling the welfare of the blossom in the ensuing spring. Light, — abundance of light, admitted to the leaf and the bud, is the great desideratum with all fruit trees. This is proved by the abundant blossom on most of our fruit trees, that usually follows a long bright summer. By this it is, —much more than by mere heat, that our continental neighbours succeed so much better than we do, with the tender sorts of Pears, to say nothing of the Vine.

Disbudding, then, having been duly carried out, the next main point to attend to, is to stop, or pinch all luxuriant shoots; shoots; more especially on trained trees. These gross shoots are merely symptomatic of a powerful root action, and need only the assistance of a practised hand to divert their extra energies into the proper channels. Such shoots, if permitted to ramble at large, will divert the juices from the original fabric of the tree; and create a fresh series of gross shoots, which will reciprocate by the increased production of wild spray. These, then, should be constantly topped during the summer; and the consequence will be, that the true bearing wood will be strengthened, and a succession of young shoots will be provided to the bottom of the tree.

The above processes will bring us up to the middle of July, and the next thing I would suggest, is to commence a stopping or pinching of all the superior parts of the tree, commencing with the extremities, and proceeding progressively downwards, and suffering the operation to extend over a month or more. This we have long practised, and find it important. It accomplishes three very essential points, with most of the tender fruit trees. First, it has a continual tendency to equalize the sap. Secondly, it increases the action of the leaves in the neighbourhood of the fruit, by thoroughly feeding their sap vessels. And, thirdly, it tends to check an over-late root-action, which is somewhat antagonistic in northern climates, to what is, by practical men, termed "ripening the wood."

292 Ripening Period. Under this division of our subject, we wish to be understood as including the ripening of the wood as well as the fruit. Indeed, with regard to artificially trained trees, of tender habits, the former is even of more importance than the latter; inasmuch as not only the next year's produce depends in the main on this process being duly completed, but the very stability and permanency of the tree itself. Having described the modes of disbudding and stopping gross shoots, or robbers, as they are called, we will assume that we have arrived at the middle of July. By this period trained trees, in general, will be found to have produced three-fourths of their annual increase of wood, and the impulse to further extension will be much lessened, in consequence of the solar heat and light having, in a high degree, induced the elaborative process. Added to this, the trees become liable to temporary drought at the root; which performs at this period a very necessary part, and produces a check of a far more genuine character than either root cutting, or ringing. This period then should be seized on, especially if the weather be dry, in order to reduce the whole of the superfluous spray, and to select, and nail or tie down, in a careful way, the whole of the young wood intended as permanent. As, however, from fresh excitement, by showery weather or otherwise, there will still be danger of those trees which produce their fruit on spurs, bursting some of their embryo blossom buds, it is necessary to retain a portion of the unnecessary shoots for a week or two, when the whole of the superfluous summer growth should be removed, which process shall be explained in the next section. The Pear and the Plum

come more especially within the class of trees regarding which this caution is necessary ; and in respect to spur-bearing fruits, in general, our own practice shall be described.

In the first place, with regard to Pear-trees, trained either horizontally or by the fan mode, it is well known to all who are acquainted with their habits, that they have a continual tendency, during the growing season, to produce succulent or watery shoots, near the points at which the branches diverge from the main stock. This is nature's own course, and the tree, if left to itself, would, in the course of three or four years, run into its own native character —that of a standard, or tree with several stems. These would ultimately starve the trained shoots, according to a law which, with few exceptions, pervades the vegetable kingdom—that of causing the earliest formed, (and now inferior) shoots to perish first. These watery shoots, then, are the very first on which we commence operations, and this we do by pinching off their points, when they are six or eight inches in length. This will in general occur when the fruit is about the size of an acorn ; and the necessary consequence of the operation is, that the sap, which the "robbers" would, by their rapid extension, have consumed, is propelled into the fertile branches, for the nourishment of the fruit. In June and July, a thinning out of the grossest shoots is to be gradually effected, and the remainder shortened to about six or eight inches in length, taking care to leave several growing unstopped at the extremities, to decoy the ascending sap. Care must now be taken, that light be admitted freely amongst all the branches ; and, by the end of July, sufficient shoots should have been removed to admit sun light through the whole fabric of the tree. Apricots may receive similar treatment.

Peaches and Nectarines, in our northern climate, do not succeed so well by the above system of spurring back. In these, every shoot not required for the next year's bearing, should be totally removed by the middle of July. As soon as their fruit can be perceived to have commenced its last swelling, pinch or stop all the strongest shoots. By these means the size of the fruit is increased, and the wood so stopped, is rendered more perfect for the ensuing year. The weaker shoots, and those placed in an inferior position, may be left growing until the end of the season.

293 Fruit Trees. General autumn management, and revision of the collection, preparatory to the planting season.

Having now laid down the necessary directions for Fruit-tree management, through the growing season, we arrive at the beginning of September; and the principal object will now be to facilitate the ripening of the wood, and to prevent the ravages of the red spider, on the Peach and Nectarine trees. This insect frequently makes sad havoc, at this period, taking the unwary by surprise. Those who do not perfectly understand the offices of the leaf, in relation to the blossom of the ensuing year, might be led to infer that plenty of sound wood having been obtained, nothing more would be needed. The Peach and Nectarine, however, are so sensitive to the attacks of insects, that one sure result of suffering the red spider to commit its ravages, during the autumn, will be an imperfect development of the blossoms in the following spring. The fruit of the current season, however, will be sure to suffer in a corresponding ratio, both in size and flavour; and how should it be otherwise, when the insects, in myriads, are devouring the very pabulum out of which both the quality of the fruit, and the fabric of the future blossom, are at once compounded.

My practice is, if the red spider be gaining ground, to ply the engine or syringe, several times a day, for about three successive days; making choice of dull or even rainy weather, if possible, in which to carry out the operation. The trees, during such time, should not be suffered to become dry for an hour, if possible. If, however, bright and continued sunshine intervene, the operation had better be suspended; at least during the hotter part of the day. After this, I apply sulphur, with much care, to the affected leaves, being cautious not to blemish the fruit. If the autumn prove cloudy, Pears on the cooler aspects, or espaliers, should have some of the "snags," or stumps of the foreright shoots, shortened still farther back, and many entirely removed, in order to admit sunlight on the embryo fruit buds; for not a single chance of the kind should be lost at this late period, especially if the previous summer has not been of a genial character. All waste spray, or late growth, as well as root suckers, must be stripped entirely away; and loose leaders or shoots, requiring to be reserved, should be trained closely to their respective situations.

By the end of the month steps may be taken towards making provision for the introduction of any fresh kinds of fruit trees, or for the removal of such as may have failed. One of the first proceedings, in this case, is to lay in a sufficient stock of fresh turfy or fibrous soil. September is a most eligible month for this, whether for fruit trees, or for general purposes. The next business is to examine the whole stock of fruits, to see whether they form a complete set for the wants of the family ; or whether any are wanting to complete a proper succession. The renewal of old sorts, falling into decay, and the introduction of new kinds, of established reputation, must not be lost sight of.

Great caution should be exercised in making such arrangements ; selection, and not collection, should be the guiding principle. For, after all, how few of the novelties of the day will succeed in every situation ? Therefore, in proportion to the limitation of garden room, should be the severity of the scrutiny in the selection. In planting new fruit gardens, arrangements should not be left to the moment of planting, but a complete list of fruit trees, from safe authorities, should forthwith be prepared, and the stations all numbered and entered in a garden book. This will be a guarantee against the possibility of error ; and will also serve as a guide to the operator, in determining the size of the station, character of composts, &c.

I would here beg to offer a remark on the selection and preparation of trees, preparatory to planting. "First come, first served," is a maxim which applies to this business. Those who desire to plant good trees, should, if to be procured from a nursery, have them selected and marked betimes in the autumn. If any large fruit trees are to be removed, I strongly advise what I have often practised ; viz., the making of a trench around one half of the tree, in the end of August; cutting, of course, through the extremities of the roots, and suffering the trench to remain excavated until the tree is removed. The remaining half of the circle may be excavated towards the end of September, in like manner. This process will produce an early cessation of growth, and consequently a more perfect maturation of the wood in tender trees ; together with plenty of fresh fibres, by which the newly-planted trees will be speedily established. Such trees may be removed towards the end of October, but of this, more in the following pages.

294 **Fruit, Gathering and Storing.** Fruit gathering is a process which requires much attention, more especially the tender kinds of Pears; for on the amount of care exercised in this process will depend, in no small degree, the length of time they will keep in perfection. Where many sorts are to be gathered, at one period, time will scarcely permit their being brought, one sort at a time, to the fruit room, and there placed in single layers, as would otherwise be desirable. To meet circumstances, and to save time, place on an ordinary handbarrow, several hand baskets, each with a little hay in the bottom; and place the fruit in layers, with cap paper between each layer of fruit. Three layers in thickness may in this manner be carried with safety, provided it be done with steadiness of hand and foot.

As well as on the care in gathering fruit, much depends on the suitableness of the fruit room, for success in preserving it in the most perfect state, and for the greatest length of time. This room should have a northern aspect; this will greatly assist in preserving an uniform temperature, which is of the very first importance. It should never descend quite to the freezing point—32 degrees; nor rise above 45 degrees. This equable temperature is the most easily obtained by choosing, as we have said, a northern aspect, and sinking the floor about three feet below the surface of the earth about the room. As well as excess of temperature, excess of moisture must be avoided. A brick floor is found to answer exceedingly well, provided the bricks are well burned. If, however, the earth below the floor be damp, it can, in no way that we know of, be so advantageously regulated as by first paving the floor with pebbles, before the bricks are laid. This we have practised, with admirable effect, for cottage floors and domestic offices. If an accumulation of water takes place, in consequence of the sinking below the ordinary water level, a drain must be laid near to the building, making it, at the least, a foot deeper than the floor of the room. These advantages may not be every where attainable, but it is not the less important that they be stated, in order that each horticulturist may make as near approach to them as circumstances will permit. No injury can be inflicted by holding up the best model for imitation.

The shelves may be made of narrow bars, or solid boards, using white deal or other scentless wood; red deal is objectionable, on account of its strong odour of turpentine. A portion of solid shelving should be fitted up, if possible, with lids, for keeping the superior late Flemish Pears. Fruit, of all kinds, keeps extremely well placed on a layer of cap paper, provided the room is pretty dry; this, in the case of very superior kinds, may be laid double. The cap paper forms a soft bedding for them, and will prevent decaying fruit from staining the shelves; it will, also, prevent any unpleasant flavour being imparted to the fruit, from its contact with the wood. The room in general should be freely ventilated, on fine days, for some weeks; the degree of ventilation being regulated by the amount of condensed steam on the inner surface of the windows. As soon as this condensed moisture declines, the room should be kept more close; but after the early part of November, the fruit room can rarely be ventilated with advantage, unless it be for an hour or two in a dry windy day. Darkness certainly seems to be of importance; how the exclusion of light acts we are not aware, unless it hinder the spread of destructive fungi. This advantage is readily obtained, by keeping the shutters generally closed; and when hard frosts occur, mats must be nailed over the shutters, inclosing a coating of hay, six inches thick. An excellent account of these fungi may be found in the Gardeners' Chronicle, for 1842, page 739, by Arthur Hill Hassall, Esq.

These instructions should not be closed without mention of other methods practised by some good pomologists for the preservation of the finer fruits. One of them is, to place the fruit in boxes, with alternate layers of cleanly-washed dry sand; so that each single layer may be kept completely apart from that above or below it. Fruit kept in this way, with due precaution as to temperature, &c., retains, in an admirable degree, all its freshness of flavour and appearance: but two disadvantages accompany it; the one is, that it precludes convenient examination as to the decay of the fruit; and the other, that the usual care bestowed on it, before being brought to table, will not completely clear it from the sand. In the eye, and in the cavity of the stem, sandy particles will be left, which, even with careful paring, will be liable to attach to the fruit, and produce in eating very disagreeable sensations. To avoid this inconvenience, some fruit growers wrap every Apple or Pear singly in paper, and then proceed as mentioned. Others wrap them singly in the same way, and in this state fill earthen vessels with them, and close them up, omitting the sand altogether. This latter method is an admirable one; but would, of course, be applied only to the finest dessert varieties. One fact must however be mentioned. Although fruit, when kept in sand, or closed vessels, has a fresh and nice appearance, its flavour we have never thought equal to that which had been exposed on shelves.

295 PLANTING OPERATIONS. The remaining portion of the trench around large fruit trees, intended to be removed, adverted to at page 66, may now be excavated, and by the end of the month, the trees may be removed. Little need here be said on the mode of preparing the stations for them, as that has been fully explained in preceding pages; it may, however, be repeated, that loam—sound and rather adhesive loam, of from a foot to fifteen inches in depth, is the soil most suitable for nearly all fruit trees. And here we should correct a typographical error, which crept into page 30 of the Auctarium, eleven lines from the bottom. For PEAT soil, which there occurs, FRESH soil should be read; by which was intended, any sort of ordinary garden soil, which had been used in vegetable culture, and not contaminated or weakened by having fruit trees grown in it previously. This was suggested as a matter of economy, under the conviction that all parties could not procure good loam.

In planting fruit trees, in the latter part of October, it will frequently happen, that the leaves are only partially shed; this, however, matters not, unless the season be very late indeed, and the leaves still green on the trees; when the operation should be delayed for another fortnight. The system of root cutting, by means of a trench thrown out at the end of August, as previously advised, will, in general, enable the operator to remove his trees by the second week in October. Newly planted trees, should not, at this early period, be pruned the moment they are planted; they may be left until the middle of November, when the sooner they are pruned the better; and in the case of Peaches and Nectarines, the wounds should be instantly stopped with white lead, at least this is our own practice.

From long experience, as well as from the concurrent testimony of some of the best gardeners of the present age, we are fully persuaded that the last fortnight in October, and the first fortnight in November, are the four best consecutive weeks that can be chosen from the whole year, for planting in general. There is, at this period, much of the summer ground heat remaining; which, by affording some stimulus to the roots, will assist them in "laying hold of the soil," as it is technically called, in their new residence. In the next place, this particular season has usually a very moist atmosphere, from which the trees possess the advantage that cuttings are afforded by their enclosure beneath a bell-glass; that is, they are protected from a drying atmosphere, which would carry off the juices of their foliage, and the bark of the young shoots, and thereby exhaust and shrivel them, at a time when they are without roots to absorb and keep up a proportionate supply. A newly-transplanted tree or shrub is, for a short time, in nearly the same condition as a cutting; inasmuch as many of the spongioles, or points of the minute fibrous roots, will have been broken, and others disturbed from their former close contact with the earth, thereby occasioning much interruption to absorption, which always requires time to repair. When transplanting is, from necessity, effected in a warm and improper season, puddling the roots, as it is called, that is, first mixing the earth with water to the consistence of treacle, where they are to be planted, and placing the roots therein, is a practice which cannot be too forcibly insisted on. Much has been said of late about steeping seeds in stimulating solutions, before sowing them; but we believe that more good would arise from dipping the roots of trees or plants, on removing them, into a rich mixture of loam and manure, in the form of a thin paste, so that every fibre and spongiole would be cased therein before being planted. In reference to autumn planting, it is well known that newly-planted trees, with which proper care has been taken, will continue to produce fresh fibres through the winter; and will, consequently, be in a position the better to withstand the withering effects of a March sun and east wind. These things being admitted, planting should be completed as soon as possible. Where ground is of a damp character, proper drainage should be immediately effected; and in the ordinary orchard, open gutters may be made, to assist in carrying off the surface-water. It would be superfluous here to say anything more about the platform mode of planting; abundant advice on that head having been given, under section 234 of the Auctarium. One piece of advice is, however, necessary; and that is, to reject all soil which has become exhausted by fruit or other trees. Where abundance of loamy soil is not to be had, the next best plan is to exchange such excavated soil for some of the ordinary vegetable garden soil. Another point of some importance may be here urged; which is, that the larger and older the trees are, which it is intended to remove, the richer the soil should be. In advocating the use of sound loam alone, in the preceding parts of the Auctarium, as amply sufficient in itself for a dwarfing system, such advice was only intended to apply to young trees. The older and larger the tree, the greater reluctance it has to form new fibres, and must be "coaxed," as gardeners say, by using some old vegetable matter, thoroughly blended with the loam, and by the addition of manures, in a mellow and decomposed state.

Trees, when planted, should receive, at least, six inches in depth of mulching over the surface of their roots; this is a proceeding of more importance than might at first sight be imagined. To say that it tends to enrich the soil, without altering, in any material degree, its texture, is not to recount one half of its merits. It acts in a more important manner, as a regulator; it will neither permit the soil beneath it to heat or to cool so readily, and, consequently, is important to newly-planted trees, both during the hottest seasons and the coldest. Our business is now with the coldest; and by mulching immediately, much of the remaining summer heat is arrested, and retained to facilitate rooting. Indeed, with six inches of mulch, it is probable that nearly 50° will be retained through the whole of the winter. This mulch should not be of a rotten character, but in a mellow and rather loose state; such will prove the best non-conductor, which is what we require, when the earth is losing instead of acquiring heat. Root-pruning should be immediately performed, where necessary; directions will be found under the 280th section of the Auctarium.

Winter pruning of trees may commence immediately, beginning with the ordinary bush fruit; but, as it will be more judicious to prune some of our fruit trees in the spring, it will be convenient, for general purposes, to throw the whole into broad classes;—they will then stand thus.—

276 AUCTARIUM.

Autumn pruning :— Gooseberries, Currants, Raspberries, Cherries, Apples, Plums, Vines.

Spring pruning :—Peaches, Nectarines, Apricots, Filberts, Pears, Figs.

The above stand nearly in the order in which they may be pruned; the reason is obvious. The bush fruits cast their leaves first, then the Cherries. The blossom buds, moreover, of all the first section, can be as well distinguished in autumn as in the spring; not so, however, the latter section. In this division, the Apricot, the Filbert, and the Pear, cannot be distinguished, with sufficient certainty, until they begin to bud; for many of the new Pears bear freely on the young wood,—especially under the platform mode. The Fig is well known to be late, and therefore brings up the rear. It should, also, be borne in mind, that the future success of the gardener depends much on getting everything of the sort completed as much as possible before the month of March; for the rapidity with which the business of spring then presses is notorious.

Before proceeding further in pruning affairs, we would direct especial attention to one or two of the great points in general fruit tree management, on which alone a permanency of success can be based; more especially the tender kinds; for which, under ordinary circumstances, our summers are too short; or, perhaps it may be said, too much atmospheric moisture is present in proportion to the amount of light. We would, in the way of recapitulation, urge the importance of beginning with the root; that is to say, of contriving to keep it under as much control as possible. As before stated, however, shallow soils will not endure sufficiently long without their necessary adjuncts—viz., sound and rather adhesive loams, and timely top dressings, or mulching.

A due exposure of all parts of the tree to light, is the next great point; indeed this will follow, after the trees are thoroughly established, as a matter of course. By the platform mode, very little superfluous wood, comparatively speaking, will be produced; and hence a saving of labour, as well as a greater certainty of success.

In the following pages we will endeavour to give directions for pruning; and we hope so to classify things, that the most inexperienced will understand them at a single glance.

296 PRUNING AND SPECIAL DETAILS. By referring to page 72 of the Auctarium, it will be seen that the pruning of fruit trees in general was thrown into two sections, termed Autumn and Spring pruning. This classification, although not absolutely necessary, was made in order to simplify the subject. It will now be well to pursue the original order of the matter, by treating the subjects in succession, as they stand in the Auctarium, commencing at page 33.

PEACH AND NECTARINE. A thorough ripening of the wood, is the prime object in Peach culture. With this and a healthy root action, pruning becomes reduced to a very simple process; without it, no system however elaborately carried out, can long be serviceable. When the young maiden tree is procured from the nursery, it is in general composed of only one shoot, in fact, having been budded, it consists of the shoot of one season's growth. This shoot, at planting time, must of necessity be shortened back, to about nine inches in length; this is necessary, in order to furnish the bottom of the wall. The wound thus made, is of course large, as such plants are, in general luxuriant; and our practice is, in this case, (and indeed all others where wounds are made in succulent or free-growing shoots,) to close it up with thick paint, for no tree is more readily susceptible of damage from the atmosphere, than the Peach.

In the first season the young tree should produce at least four good shoots, two on each side of the tree, and although more may be produced, yet it is well to encourage only this number; all above this may be disbudded, as soon as the four are established. We always form the centre of the tree last, carrying subordinate branches right and left into it; or at least frequently resorting to summer stopping, if any main leaders are trained in a central direction, during the first two years of training; by the end of which period, strong side branches will have been formed, which cannot be subsequently robbed, by central shoots, to any prejudicial amount. To revert to the four young shoots of the first year, our practice then is to pinch off their points in a progressive order, commencing in the end of August. The strongest must be stopped first, and the others in due succession, according to their strength. By these means the four shoots, by the autumn, will be rendered perfectly equal; for any

277. AUCTARIUM.

amount of control may be exercised over the branches individually, as well as over the system generally, by summer stopping; and when fruit cultivators, generally, can be brought to understand this matter in all its bearings, then, and not till then, will a dwarfing system be carried out, in its simplicity and perfection.

In the second year, during the month of February, the four shoots, out of which the future fabric of the tree is to be formed, must be again shortened back by pruning. A foot in length of each should now be left, or if the wood be thoroughly ripened, fifteen to eighteen inches may be allowed. In the course of the succeeding summer, if the tree be in a thriving state, its whole fabric will be formed, or nearly so; and the same course of stopping the young wood must be pursued, beginning with the strongest, and proceeding at intervals, in the ratio of strength.

Any shoots at the lower part of the tree, of inferior character, must be left growing until the autumn, both at this stopping, and that of succeeding years; always bearing in mind, that when a gross shoot is pinched, that not only is the over-rapid enlargement of that shoot arrested, but the nourishment thereby previously engrossed, is, advantageously transferred to a weaker neighbour.

In future years the pruning will be of a very simple character, provided the wood is well ripened. Thinning out is the first principle, in order to admit light equally over the tree; and for this reason two young shoots can seldom be left side by side, their whole length. The next great matter is to shorten back in a very liberal way, all the lowest placed shoots, on any given branch all over the tree; this is done to secure a succession of young shoots from the lower parts of the tree, as a guarantee against nakedness. The third point is to shorten back most of the young shoots of the preceding summer; this is done for two reasons: first, in order to induce the tree to furnish the wall efficiently with side shoots, as extension takes place; and secondly to prune away all badly ripened wood. The length to which the shoots are left, must be determined by their hardness, or ripeness, nothing more need be cut away than immature or late growth, and this is readily determined by the sponginess of its texture. When the wood is very weak, it is sometimes necessary to leave it the whole length, as not unfrequently every bud is merely a blossom bud, with the exception of the terminal one; such shoots if pruned, do serious mischief to the system of the tree; for they very generally set their fruit, which always drop off at the stoning period, after considerably exhausting the tree.

297 The Apricot. This invaluable fruit requires less winter pruning than most other wall trees, when properly planted; that is to say, in maiden soil, without manure. Like most of our wall fruits, top dressing, in due time, will afford it sufficient stimulus. Over luxuriance is very prejudicial to the Apricot; perhaps more so than to any other fruit tree, especially in the northern parts of the kingdom; causing the spurs, which in a healthful state, are small and numerous, to run into the character of gouty foreright shoots; which, on being pruned back, are but too apt to produce again the same character of wood.

The warmest situation in the garden should be allotted to the Apricot; no wall tree more enjoys warmth, not even the vine; indeed, there is little doubt, that in the northern half of Great Britain, walls should be artificially heated for them, to obtain the greatest amount of success.

Like the Peach, it would be well to obtain it as a 'maiden' plant from the nursery; and great care should be taken that the stem is perfectly clean and uninjured, as the tree is liable to gum: if this take place, it can be no longer considered sound; and the probability is, that when the tree comes to a bearing state, whole shoots will die away.

The young tree having one straight shoot, similar to the Peach, must be headed or pruned back to about nine inches in length; and thick white lead should be applied to the wound thus made; as we have little doubt that disease and premature decay, very frequently arise from the neglect of this necessary precaution. It is well known to all good cultivators of the stone fruits, that air and moisture, entering at such wounds, are very prejudicial; and the more luxuriant the tree had grown, the more open the vessels, and of course, the more serious the consequences. In the course of the ensuing summer, the tree, with a little timely attention to watering, in May or June, will have produced, at least, four shoots — two on each side; any more may be pinched back to a couple of leaves (not pruned away,) four well formed shoots, being quite as many as can be well matured.

In the following February, each of these four shoots must be pruned back, to about a foot in length; and with another summer's kindly attention, a complete fan will be formed. If any more leading shoots are required, they may be obtained in the course of the ensuing summer, from the middle, or centre of the tree; which, as observed, regarding the Peach, should be filled up last, and for the most part with subordinate shoots.

During the second summer's training, some foreright shoots will be produced, together with spray of varied character; this should be pinched back when from two to three inches long, which will cause embryo fruit spurs to protrude at its base, and if the tree be not too gross, such will become permanent fruit-bearing spurs for years to come,—clothing the tree from the collar to the extremities.

After this period, no winter shortening of the main shoots will be necessary, unless, as sometimes happens, the extremities are of a very late and unripe growth; in this case they may be merely cut back to the part which appears firm and of a dark colour.

The pruning, in subsequent years, will be chiefly confined to the summer stopping of all foreright shoots, as soon as they are two to three inches long. It cannot be doubted but that many of the failures experienced in the culture of this very delightful fruit, occur through neglect of this summer stopping. The superfluous leafy shoots not only shade the fertile spurs, for which, even when fully exposed, all the direct rays of the sun, in our climate, are insufficient, but they prevent the formation of young embryo fruit spurs, which may be seen in great numbers, even on very old trees, if well managed, protruding through the bark, no larger than the head of a small pin, and of a pinkish hue. Coarse foreright shoots, suffered to remain, produce also another serious evil; they bring on a corresponding amount of root action, (through reciprocity) of a totally unnecessary character, which tends to force embryo buds designed by nature for fruit spurs, into barren shoots. Thus, evil begets evil.

A little winter pruning will, however, be at all times requisite, for, be the management ever so complete, some superfluous wood will have to be removed. This pruning should not be accomplished until February, at which period blossom buds can be readily distinguished. The business now, is to remove all remaining stumps, or remains of foreright shoots, which appear gross, or likely to produce coarse wood shoots; and to prune away decaying spurs; shortening those a little which, through age, have grown too far from the wall.

By the platform mode of planting, the trees, when ten or a dozen years old, will perhaps appear rather too much reduced in strength; if so, they must have suitable top dressings. A coating of rotten turfy loam, containing a little manure, may be placed over their roots, four inches in thickness, at least; and a top-dressing of manure from the stable yard over this, of three inches more. Whenever the trees appear to want vigour, it will be well to apply a good soaking of liquid manure once in each summer, in the month of June; this will give the necessary stimulus, at the season it is most required.

298 THE FIG. By referring to page 34 of the Auctarium, it will be seen that unless Figs are induced to grow short-jointed, no success can be expected; and to effect this, it becomes absolutely essential to limit their extension of root. These things having been duly carried out, young plants may be obtained from any respectable nurseryman, in pots, and planted in the beginning of April; if on the open walls, they may be about three feet apart. As the balls of soil will be composed of matted roots, such should be uncoiled, spread out, and a little decayed vegetable matter sprinkled amongst them, to induce rapid growth for the first two seasons. If cuttings of strong shoots are at hand, they may be stuck in of considerable size, instead of young plants; indeed, if carefully shaded and nursed for a few weeks at first, stems of considerable size may be planted. If unbranched, the terminal bud should be broken off or pruned away, to cause the emission of a sufficiency of side shoots. If the succeeding summer prove unusually dry, a top dressing of litter, and occasional waterings, will be requisite.

In the second year they will have produced several shoots, besides a host of embryo buds; and, this being the case, a permanent mode of training should be decided on. Whatever that mode may be, it should be taken as a maxim that the main shoots should be, on an average, nearly a foot apart. Some persons train them in the fan form, this we disapprove, as too unsystematic for producing equality of distance amongst the shoots. We would rather recommend main shoots to be trained in parallel lines, perpendicularly, a foot apart. These will permanently remain, and all eligible young shoots, of a very short-jointed character may be, for years, tied to these main stems, which will thus stand as a sort of trellis, to fasten the young spray to.

The trees being established, we come to the general management; which is simple. In summer, this demands only the selection of the bearing spray for the next year; and in winter, the re-examination of such spray, together with protection from frost. We will commence with what must, for distinction's sake, be termed winter pruning. This must not, however, be performed until the buds are swelling, which takes place towards the middle or end of April; for then alone can the superior bearing wood be selected.

The business then is, to select as many of the young shoots as will clothe the main stems (when tied to them) from top to bottom; no two young shoots, however, being permitted to grow side by side, for the Fig leaf being so large, the light would be too much excluded, and the consequence would necessarily be barrenness, or inferiority of fruit. A thin succession of such having been tied down, and the rest pruned entirely away, the tree will want no attention until the early part of June, when disbudding must commence. Although the main stems are one foot apart, the tree will soon become entire confusion, unless this process be attended to. In the first disbudding, all long-jointed young shoots must be rubbed off; this will, in general, comprise at least three-fourths of the young spray. Soon after this, the leading shoots will require nailing, and when this is done, which will in general be about the end of June, or early part of July, as many young shoots as may be of proper character, and long enough, should be tied to the main stems. In the course of three weeks more, another selection and disbudding of laterals should take place—again tying down any of fruitful character, for which there may be room. All that will be necessary after this, will be to look over them again towards the end of July, and rub off entirely every young shoot not wanted for the succeeding year.

Protection from severe frosts is the only thing that remains, and for this purpose we find nothing better than old mats, nailed loosely over them. If the weather prove unusually severe, a second mat may be applied, or some loose hay or straw stuffed inside the single mat. Instead of this, some fig growers stick spruce-fir boughs in all directions amongst the branches of their Fig trees, which we are told answers exceedingly well; indeed, the fronds of the common fern, and also straw, have been used with equal success.

299 THE VINE. In offering observations on the general culture of the Vine, the reader is referred to page 35 of the Auctarium, where some observations concerning soil, &c., will be found, which require particular attention. No mode of training or pruning can be expected to succeed, if the Vines are planted in stagnant soil. A sound bottom therefore, either naturally, or rendered so by drainage, must form the foundation of all good Vine cultivation. Rich soil is by no means necessary; indeed, we are persuaded that ordinary soil, if fresh, will be found sufficient of itself, without the addition of stimulating manures, excepting a little, in a decomposed state, to encourage the young plant to fill its station; and the aid of top-dressings in the case of old or exhausted trees. Vines luxuriate when their roots become firmly imbedded in a sound soil, oftentimes beneath pavement, and not unfrequently in the ruins and rubbish of old buildings. Somewhat similar to this, too, is their free growth amongst the ashes, lava, and scoria, of Mount Vesuvius. These circumstances naturally suggest that one-half the volume of the border or bed of soil, should be composed of broken bricks, mortar, &c.; or in fact, any rubbish which comes to hand in pulling down old buildings or walls.

The Vine is preferred, by all experienced persons, when raised from what are termed "eyes"; that is to say, single buds. These are cut from young mature wood of established Vines; that well ripened in the hothouse may be preferred. Eyes of this description, potted in single pots, and placed in an ordinary hotbed or plant-house, will make free-growiug plants, in the course of one season. The nurserymen, however, always keep an established stock of young plants on hand, and it is quite as economical to select from the stock of a regular Vine cultivator, as to devote time to their propagation.

In planting them on the prepared soil, no other care is requisite, than to unravel the roots; for if the plant be well established in the pot, the roots will have made many convolutions. The month of March, or early part of April, is the most eligible period for planting, and a slight top-dressing of half-rotten manure, should be laid over the surface, in order to prevent the injurious effects of drought, and to supersede the necessity of watering.

We may now proceed to treat on the work of training. Many elaborate processes of the kind have been proposed in horticultural publications, which have little to recommend them when subjected to the analysis of experience. They are in some cases, very complicated, and occasion much trouble; although they may appear very fascinating on paper. The old fan mode will be found perhaps more eligible, for Vines against dwelling houses, than any other; but for the garden wall, we would train shoots right and left, six inches from, and parallel to, the ground level, to the desired distance; and carry up permanent leaders from them, perpendicularly, to the top of the wall. These leaders should be a foot apart, for any attempt at crowding together a greater number of principals, will assurely defeat the end in view, by shading the principal leaves; for which, when even fully exposed, the light of our fitful climate is perhaps less sufficient than the heat itself. From these principals, subordinate shoots must be encouraged to proceed at regular distances; making it a point not to suffer two together, as in the case of the Fig. The production of these side shoots must be caused by an annual shortening of the young shoots, as they proceed from the base upwards; and to this end (however much they may grow in a season,) they should be shortened back to about two feet, at each winter's pruning, until they reach the top of the wall.

The subsequent winter pruning will be of a very simple character; merely shortening back the young shoots of the preceding summer, to about two or three eyes or buds; or in fact to any bud that appears very protuberant. The side shoots may then be confined by matting, to the main stems, as in the case of the Fig; or nailed close beside them; always keeping a naked space of wall between the parallel shoots, for the absorption of solar heat.

With regard to the winter pruning of Vines, on dwelling houses, and trained on the fan principle, rather more superfluous young wood has in general to be removed at the winter's pruning; in consequence of fan training being less systematic than the perpendicular mode. The shortening back is however, similar; and the same precaution must be exercised with regard to the bearing shoots,—leaving, if possible, no two, side by side.

The most important part of Vine cultivation, is the proper attention during the growing season; these labours must commence with the germinating period itself. As soon as the young shoots expand, a selection of bearing shoots for the current season must take place; and, if any vacant spaces threaten, shoots must occasionally be reserved, even though barren ones, with a view to cover the whole surface of the wall with a due amount of foliage. Disbudding, therefore, must be persisted in, until not a single shoot is left but what is requisite. The next process is termed "stopping," and consists of pinching out the terminal point of the growing shoot, an eye or two above the bunch of blossoms. If the wall be naked above, the shoot may be suffered to grow as high as necessary, and then stopped.

The subsequent management now becomes reduced to the stopping, at frequent intervals, of all rambling spray, which threatens to shade the principal leaves; for one of the main points is to keep the larger or first-formed leaves fully exposed to the light. Towards the beginning of September, or rather when the berries are in their last swelling, the whole of the mere lateral shoots, which had been frequently stopped during the summer, may be entirely removed: this will forward the ripening of the fruit, and assist its colouring.

300 The Raspberry. This is a highly useful fruit, much in request for preserves, as well as for immediate use; and we shall endeavour to show how Raspberries may be obtained, for at least three weeks longer during the summer, than by the ordinary mode of cultivation. At page 36 of the Auctarium, the subject of soil was a chief consideration; we shall now describe what for many years we have found a most successful course of practice.

It may, however, be here repeated, that neither peculiar modes of training, nor top-dressing, will ensure success, unless a soil of good staple be provided, and that of considerable depth. In the first place, due regard must be paid to the difference, between the Antwerp or Fastolff Raspberries, and what is termed the double-bearing kind; the latter being so pruned as not to bear in summer, but instead thereof, to yield its fruit in September and October. And although at that period the latter are not so full flavoured as summer Raspberries, they are of some importance where it is necessary to produce much variety in the dessert. To proceed with the details of culture, we will commence with the new plantation: strong suckers, or canes, as they are termed, may be planted any time, between the fall of the leaf and the beginning of April, presuming the ground to be in a due state of preparation. If they occupy a plot of ground to themselves, the rows should be from four to five feet apart, and the plants a yard apart in the row.

They should be pruned back previously to planting, to about thirty inches in length; less would scarcely set the root in action, more would rob the suckers of the ensuing year. With some care as to watering, in dry weather, and the top-dressing, recommended at page 36, they will yield some good fruit in their first season: the main object, however, is to ensure good suckers or canes for the ensuing year. In the month of August, or as soon as the fruit is entirely gathered, the shoots which have borne a crop may be entirely cut away, provided some good suckers are prepared to supply their place. This will ensure maturity and perfection in the canes for the succeeding crop. The young canes may now be tied to the stakes — not, however, too closely. When very luxuriant, they will have a tendency to grow to an unusual height; and, if so, in the early part of October, they should be reduced to within six feet of the ground.

We come now to the winter dressing. In the middle of November we pare away the surface-soil over the roots, about two inches in depth, in order to apply a coating of good rotten manure, as far as the roots extend; which will be about a foot on each side of their stems. The parings, of course, form a ridge between the rows, and are dug in, as they are sometimes of a weedy character; the spade, however, must not approach nearer than eighteen inches to the canes. This leaves plenty of room for spade operations; and when the intervening space is dug deeply, some of the newly-turned soil serves to cover the top-dressing. This mode of top-dressing must be repeated annually. Winter pruning now demands attention. The length at which canes may be left depends much on their strength ; five feet, however, may be given as an average to which they should be reduced, in November. No further attention is required till April, or at least until the shoots have budded an inch in length; when the bands should be untied, preparatory to a completion of the pruning, and all superfluous suckers cut away.

We consider four canes sufficient at all times ; five, however, should be the maximum. At this pruning we cut all the canes, but one, back to various lengths : thus, one remains of its full length, as left in November; the second is reduced six inches ; the third, one foot; and the fourth, eighteen inches. By this method, the young fruiting shoots are more equally distributed, from the bottom to the top of the bushes ; besides which, their fruit is produced in succession three weeks beyond the ordinary season. The double-bearing kinds are very liable to be crowded with a profusion of suckers ; all superfluous ones must therefore be weeded out during the summer, leaving only those required for bearing. Their culture differs materially from that of the large kinds, inasmuch as the old canes must all be cut away, close to the ground, in April; and the suckers rising at that time must be thinned considerably ; this annual wood becomes the bearing wood, indeed this constitutes their chief merit.

301 The Black Currant. A soil permanently moist, but not wet, is, as observed previously, the prime desideratum in the culture of the Black Currant: a dark-coloured unctuous loam is peculiarly adapted to its culture. We have, however, seen it succeed to admiration in highly decomposed peaty or boggy soils, after the superfluous water has been drained away. Such boggy lands require an application of marl or clay, in a powdered state, to give them consistence, and to provide against the vicissitudes in regard to moisture, to which boggy soils are well known to be liable. Dry gravelly, or sandy soils, are the least suitable, and it is in vain to plant the Black Currant on such, unless they are previously improved by those substances which are at once retentive of moisture and furnish nutrition, such as marl, adhesive loam, and old vegetable matter. In such soils, or

indeed in any, if plenty of water be close at hand, it would be well to provide a system of irrigation; this would be easily and economically accomplished, by planting a little below the ordinary ground level, on an inclined plane; and by laying a line of common draining tiles, or pipes, from a head water. Whether irrigation, or watering by other means, be performed, it should be known, that when the fruit is in its earlier stage of swelling, is the time, above all others, to apply it; for, if they are subjected to drought at this period, they will assuredly lose a considerable portion of their fruit. A system of annual top-dressing is also of the greatest service; although such dressing be mere soil, or rotten leaves. A little manure applied is, of course, beneficial. One circumstance connected with the Black Currant should be particularly noticed; which is, its aptitude to produce an abundance of fibrous roots, close to the surface of the ground. Hence, it is evident, that spade culture carried close to their stems, is highly injurious; and hence, also, their impatience of drought, and the great importance of top-dressings.

The Black Currant may be propagated either by cuttings or suckers, taking care to cut away the buds which are below the ground level, or the plants will be liable to that common inconvenience and injury—the production of numerous suckers. Cuttings may be planted in a half-shady aspect, any time from the fall of the leaf, until the end of February. In the succeeding summer they will make shoots of six or nine inches in length; and these, at the ensuing pruning season, must be shortened to about four inches. In the following summer they will make good bushes, and will be fit for removal to their final situations in the succeeding autumn or winter.

As, however, young bushes can be so cheaply procured from the nurseries, it is perhaps as economical, where the garden is small, to purchase them; in which case the buyer has the power of selection. The Black Naples, a very large-berried variety, is, in general, most approved. It is indeed a noble berry, but for general culture, in upland or dry soils, we should prefer the old or Common Black; for its produce, in such situations, will be greater in the aggregate, in an average of seasons. This preference may appear strange to many, but when it is considered (borrowing an illustration from the animal kingdom) that the far-famed Leicester sheep would prove inferior if fed on the Downs, to the native breed of such district, the matter will, by no means, appear unreasonable. One more affair remains to be noticed, and that a serious one; the Black Currant is very liable to the attack of an aphis. Tobacco water, made by putting half a pound of strong shag tobacco to a gallon of warm water, and freely applying it to the foliage, will certainly destroy them; but this is a somewhat expensive process. Prevention being accounted superior to cure, we would rather advise extra care in the preparation of the soil, as well as subsequent culture; more especially to provide against sudden droughts; during which periods, these destructive pests multiply exceedingly.

302 Red and White Currants. These two varieties of the Currant are so very distinct in habit, that it will be well to treat of them separately. In adverting to their culture, at page 37 of the Auctarium, it was observed, that they prefer a soil of sandy character; or, in other words, a soil in the constitution of which the sandy principle predominates over the clay. In this respect they are the very opposite of the Black Currant, which we described in the preceding section. This much premised, we will proceed, first, to lay down a system of culture, adapted to the ordinary Red Currant. As observed with regard to the Black Currant, it may be propagated by cuttings of the young shoots of the previous summer, any time between the fall of the leaf, and the end of March. Every bud, on that portion of the cutting below the ground level, must be cut out, or, as practical men term it, "blinded."

The omission of this important item in their cultivation, will prove most tiresome, by the perpetual production of a crowd of suckers; a bad habit, which a moment's attention, at the proper time, would wholly obviate; but if neglected, will only terminate with the life of the plant itself. The cuttings should possess, at least, one foot of stem above the soil, and four buds, or eyes, as they are termed, will suffice to form a head. A shady situation should be selected for them, and by the succeeding autumn they will be such plants as may either be planted in their final destination, or according to the more usual course, remain another year in the nursery bed. In either case, they must be pruned back to about three buds on each of the young shoots. We would here observe, that, from the very cutting state onwards, the White Dutch, (which is, indeed, a very superior berry) will require double the amount of stimulus in the soil to that of the Red Currant. The Red Currant, in the final planting, will merely require deep digging, in ordinary cases; if, however, the soil be poor, some manure may be added; always remembering, that the Red kinds—naturally inclined to gross growth, will develope less of the fruit-bearing side spurs when over-grown, than when of moderate strength. The White Dutch, on the contrary, will prove fruitful, as well as luxuriant, with a most generous soil; and no marvel, for we have had a crop of berries of this kind, which would, doubtless, have weighed nearly as much as the bush itself. They are generally, moreover, so thoroughly swollen and fed, that the most unpractised eye would readily perceive that the constitution of the plant must be heavily taxed in perfecting them. The Red and White kinds, therefore, should always be planted on separate plots.

Their general treatment, as to pruning, is very similar; both requiring a summer's pruning; and we need scarcely add, both a winter's dressing. The white Dutch, however, will not, under ordinary circumstances, require more than half the amount of curtailment, whether summer or winter, that the red kind requires. The Dutch or larger variety of Currant, is very apt to grow unwieldy in the young shoots,—especially where manure is used. In such cases, the annual shoots are very liable to be broken by sharp gusts of wind and rain, which so frequently occur, in our variable climate, in the latter part of June, or early part of July. It is, therefore, far better to put the bushes under a course of summer pruning betimes, in order to prevent such denudation, and disarrangement of the young spray. Our practice is, to pass the shears over them, in the middle of June, merely cutting away the points of the over-grown shoots, which form the summit of the bushes. This, termed "stopping," has been hitherto very imperfectly understood; but it has been growing in favour for some time, with most of our best fruit cultivators. In another fortnight we reduce the extremities of the side spray in like manner; taking care, however, not to admit too much sunshine on the fruit. This practice should be understood as applicable to strong growing bushes only; for when the bushes are old, or of very moderate growth, such stopping is, in many cases, superfluous. The White Dutch, in fact, seldom requires summer stopping, with the exception of leading shoots, of robust habit.

The winter pruning, or dressing, is pretty well known. The bushes having been originally "set out," or, in other words, formed in a proper way, by early training, will be, in general, composed of some six or eight main leaders, at the distance of a foot apart. Their pruning will now comprise the reduction of all that remains of the side spray, of the preceding summer; pruning all such back to within barely an inch of the main stems, for at the base of these side shoots, will be found a nucleus of embryo blossom buds, out of which the future crop must be produced. The points or leading shoots, also, must be shortened; about eight inches may be considered the maximum to be left. The only further attention required, will be the top-dressing of such bushes as may become somewhat exhausted. In this process a couple of inches of soil should be drawn from the surface of the roots, and as much half-rotten manure substituted; finishing the whole by a thin coating of soil over the manure, to prevent waste of its properties.

303 The Strawberry. No fruit is cultivated under a greater variety of methods than the Strawberry. Some persons prefer growing them in beds, some in single rows, and occasionally they are used as edgings. They not unfrequently flourish under each of these modes of culture, when it is conducted with due attention; but in recommending a plan, which shall combine the greatest produce, together with the best flavour, we recommend rows, at considerable distances, in preference to beds. It so happens that the period when Strawberries ripen is very frequently unpropitious: July, in this country, is oftentimes a rainy month, hence the advantage of widely separated rows, on account of their more complete exposure to all the sunshine that occurs.

We can do little better than pursue the mode of culture adopted by our commercial gardeners around the metropolis; the main feature of their cultivation being as follows; — First, to frequently renew the plantations; perhaps three years should be the maximum. Secondly, to select a loamy soil of sound staple, if possible, and to trench or dig it deeply: this will be better than over-forcing the plant with exciting manures. Thirdly, to take care that they are well watered in dry seasons, when the young fruit is swelling. These three points constitute the chief mysteries of Strawberry cultivation; and, it should especially be borne in mind, that frequent removals of Strawberry plantations, afford fresh plots in the kitchen garden, for the various species of the Brassica tribe; which, from their variety, recur so frequently, as often to puzzle the gardener in attempting to plan a judicious rotation of cropping.

The best season for planting is July; indeed young runners cannot be obtained much earlier, and every tyro knows the impropriety of using old plants. The ground having been duly trenched, and some half-decomposed manure incorporated, the rows may be marked out; the larger kinds, as the British Queen, Keen's Seedling, Elton, &c., at from thirty to thirty-six inches apart; whilst those of smaller habit, as the Grove End Scarlet, the Hautbois, &c., may be planted as near as twenty-four inches from row to row. A distance of two feet is necessary between the plants of the larger kinds, in the row; and about eighteen inches will suffice for those of smaller habit. We usually have planted a double quantity in each row for the first year, making it a point to hoe up, or otherwise destroy, alternate plants, as soon as the first bearing season is over. With regard to their subsequent cultivation, we hold it essential to destroy, or at least keep under, all superfluous runners. These frequently grow so luxuriantly, that they shade the principal leaves; and, in that event, tend to produce barrenness in the parent plant.

A winter dressing is, of course, necessary; and we would here observe, that as some protection is necessary to the crowns, during severe frosts, it is much better to allow all the old and decaying leaves to remain on until the early part of February; thus they afford protection; for we find, by experience, that the plant becomes completely paralysed after a severe winter; especially if sprucely trimmed, as some persons advise, in autumn. Our practice is, and none can meet with greater success, to cut away all decayed and decaying leaves, at the end of February: then to apply a slight amount of manure between the rows, and to dig the dressing in; merely a spade's width in the centre between the rows. This has a tendency to check over-luxuriance in the leaf, and by the time the flower truss is rising, a new series of roots will be formed in the freshly cultivated soil, which proves of immense benefit to the swelling fruit. We would here remark, that some material should at all times be placed beneath the fruit. Some persons use the mowings of the lawn for this purpose; clean straw is, however, greatly to be preferred, as the grass is apt to encourage the wire worm, which frequently proves a pest. The wide row system of planting affords facilities for introducing this litter, which are not possessed by the bed plan; and this alone is a recommendation.

Some persons recommend the tops to be mown off in the autumn: thus treated, we have, at times, known them bear pretty good crops; not however, we should say, through this unscientific mutilation, but in spite of it. Common sense, and science, seem to us equally opposed to such a proceeding; and were there no other use for the foliage, it should, at least, be spared to protect the crowns during the winter; for, as before observed, the Strawberry, although a hardy plant, is sometimes so paralysed by a severe winter, especially when closely trimmed in the autumn, as scarcely to rally with the returning spring; and, indeed, it is sometimes entirely destroyed. Each plant should occupy such space that its leaves, without mutilation, may spread their full amount of surface to the light, and a well-organized bud will be formed for the future crop.

Strawberry walls have been highly recommended, as producing a superior-flavoured fruit; this is perfectly correct. One great drawback, however, to their more extensive adoption, is the labour incurred in watering, and a frequent removal of the soil. It would be well, we think, to make a point of removing such walls annually, adding a little fresh soil each time. In such a case, very early runners should be secured, with as much care as gardeners take over those for forcing; these, "pricked out," on rich soil, in an exposed situation, would make strong buds, and might be removed with a trowel in October. A rich and rather adhesive loam should at all times be used as soil for the Strawberry wall: light soils cannot be expected to endure in so elevated a situation. As truly useful kinds, although not novelties, we recommend Keen's Seedling, the British Queen, and the Elton; the latter is most valuable for late purposes. We plant them in a north border, five feet from the wall—and, by these means, generally continue gathering until the end of August.

We must now advert to a favourite mode of cultivation with many persons, and indeed a very excellent one, where circumstances are suitable. We do not practice it ourselves; but this is not from objection to the principle, but because we cannot spare ground, sufficiently early in the season, to lay down a fresh plantation of Strawberries. The pressure of vegetable culture compels us to take a summer crop or two off the ground intended for Strawberries.

The plan is this;—to obtain runners as early as possible, the earlier the better; indeed, it is well to assist a portion to root for the very purpose, by pegging down the wires at the first joints; and, if this be done in pots, they can be transferred to the beds without disturbance of the roots. The ground being duly prepared, the runners must be planted with care, from six to nine inches apart in the row. Attention must now be paid to their rapid growth, by watering and high cultivation; indeed, a liberal supply of liquid manure should be given, if the young plants seem to require stimulus; for on early and high cultivation the bulk of the crop entirely depends. Those who pursue this mode, never take more than two crops; and, for the second year, one half of the plants, alternately in the row, must be taken out, to give proper space to the increasing size of those left. By these means a good crop of fruit, of the very finest description, is secured in the first season after planting.

The Alpine Strawberry is much esteemed by some; and indeed is very desirable in the autumn dessert. It is very advantageously propagated from seed. This should be sown in the early part of February, in a lively heat; and when the young seedlings have formed a few leaves, they should be planted singly in very small pots, in a rich loamy compost. They must continue to have protection until the latter part of April, when they must be hardened off, as flower plants, for bedding out, preparatory to their final removal. Early in May they must be planted out, on rich loamy soil; and it will be of great advantage to place slates, tiles, or stones, beneath them, in order to preserve the fruit clean. By this method abundant autumnal crops of fruit may be obtained. But similar advantage may be secured by another mode of proceeding, although not always with the same degree of certainty, unless especial care be taken, in very hot seasons, to keep the plants in free growth by watering.

304 THE PLUM. This valuable fruit, from the ordinary Damson up to the Green Gage, is highly serviceable in the culinary department. When we consider the various modes by which the Plum is rendered of service, both dried and preserved in various ways, in wine, pastry, sweetmeats, &c., the importance of paying some regard to the cultivation of its numerous varieties becomes obvious. They are, however, produced under various modes of culture; for the standard Damson thrives abundantly in our northerly counties, where the Green Gage requires a wall to bring it to perfection. Again, the Orleans, the Wine sour, &c., succeed well as ordinary bush espaliers.

It is indispensable, where a long succession for the dessert is required, to place even the same kind in a variety of positions; thus, we have the Green Gage on an east, west, and even north aspect; and also on ordinary espaliers. By these means Green Gages are produced for six weeks in succession. To have the Plum continued long in the dessert, it is necessary to make a prudent selection from amongst the numerous sorts, and to appoint them to their situations with a correct knowledge of their habits and kinds. Indeed, we do not know of any fruit that has been less studied by even gardeners themselves: the proper order of succession, (and, of course, the benefits to be derived from it,) is scarcely ever observable, even in the best arranged gardens. At the close of this article we will endeavour to assist the reader, by giving a selection, together with their aspects, times of ripening, &c.

It is, in the first place, necessary to consider what soils are the best suited to the culture of the Plum. A mellow but strongish loam, is decidedly the best. The Plum will always be found to flourish where there is a little approach towards the clayey principle, providing such sound materials are thoroughly drained. In common with the Pear, Peach, Apricot, and indeed most fruits, manures are worse than useless in the early growth of the tree, if it is to be subjected to a course of training; unless the soil be what is termed "lean"; when top-dressings must be resorted to betimes.

The Plum is generally grafted or budded on the Brussels stock; this is more gross in its habit, and consequently a nearer match as to capacity of sap vessels, for the Plum, than the Mussel stock, which, as before observed, under the article

Peach, is the stock in ordinary use for that fruit and the Nectarine. The young plants are trained precisely in the same way as the Apricot, Pear, &c.; with the exception of standard trees, as the Damson; the latter indeed being raised from suckers or from seed. We may therefore pass by the detail of training, for the sake of more important advice.

In training on walls we advocate the tying down of the young shoots, annually and systematically, all over the tree; a mode of training which we have practised, with the utmost success, for the last twelve years, and which every year increases the value of the trees; if accompanied, we must add, by a peculiar mode of disbudding, which has been frequently set forth in these pages. We claim not to be the original inventors of this method, but the first to systematize it; for, although partially adopted by others, no one evinced the courage to venture on it as a system, or to apply it generally to Plums, Apricots, and Pears. Indeed, it can but be matter of surprise that the system is so little appreciated by even very intelligent gardeners of the present day.

The fabric of the future tree having been formed, and the trees placed in their final situations, whether for wall or espalier training, the ordinary means of pruning must be annually resorted to, in order to guide the young tree into a proper form; and if on a wall, to preserve a due equilibrium, in point of strength. To effect this, the usual stopping, disbudding, &c., must be practised, in addition to the tying down of the young shoots, before alluded to: the shortest jointed annual shoots, are in this, as in all other cases, the most fruitful.

The Plum, trained as an ordinary espalier or dwarf standard, has a particular tendency, in its earlier stages, to produce excessively luxuriant shoots; more especially such as the Orleans, the Washington, the Magnum Bonum, and the Royale Hative. These must be stopped with the finger and thumb, when about a foot in length. This course will equalize the strength of the tree, and throw a greater amount of light amongst the embryo blossom buds of the ensuing spring. We may here observe, that means must at all times be taken to keep the aphides, and other insect enemies in check. To these the Plum family is particularly liable, during May and June. Some of the kinds are often attacked by the red spider; we have seen even the Damson almost destroyed by it, whilst the owners were totally unconscious of the presence of such an enemy. Sulphur, dusted liberally under the leaves, in the early stages of their progress, will arrest their depredations.

305 The Filbert. The cultivation of the Filbert is very simple; indeed, in the majority of gardens, Filbert bushes are left altogether in a state of nature, as to pruning. It has, however, been long since shown, that they are very superior in point of cropping when put under a course of training; indeed, we should say, no fruit better repays attention than the Filbert. We would not confine the cultivation to the red and white Filbert; there are other excellent varieties, which make a desirable addition to the dessert; of such are the Cosford, which is remarkable for the thinness of its shell, and, moreover, is an excellent bearer; the Frizzled Filbert, also a great bearer; and the Spanish Nuts, which are of the Cob character, and sometimes used as stocks to graft the other kinds upon, as they are not so liable to produce suckers. Grafting of nuts, however, is rather troublesome, and not a necessary process.

Suckers, in abundance, may be obtained from stocks neglected in their cultivation; and these should be taken during the season for planting deciduous trees, any time from November to March; but we prefer November. As they are by far more under control, when trained on a single stem, the young stocks, whether suckers or cuttings, should have all the eyes stripped away, which are below the ground level, after the manner of Gooseberry or Currant cuttings, technically termed "blinding." Above ground, the axillary buds may be suffered to produce side shoots, for a year or two; these strengthen the stem, providing they are what is termed "snagged" in at the winter's pruning; that is, shortened back to a single bud in their first season's growth. This is a practice which has, for many years, been applied to standard Apple trees, in nurseries, in order to obtain a firm stem; the "snags" must, however, be totally removed in the second year, whilst the healing powers are active, and the wound will quickly become cicatrized.

The clear stems of Filbert trees must not be less than a foot high, and the centre shoots should be cut away to form the tree into a bowl-shape. This is done to admit plenty of light amongst the branches. It is found that Filberts, growing in a neglected or untrained state, produce their fruit for the most part on the extremities of the branches only; whilst those put under a course of cultivation, yield liberally from all sides of the leading shoots. In training the young shoots, therefore, regard must be had to these circumstances; and the young shoots trained accordingly. In doing so, it is merely necessary in pruning to leave a series of leading shoots in a circular form, at nearly equal distances; about six, well placed, would form a good tree. These will produce plenty of laterals, which must in their turn be subjected to a severe thinning, at the pruning period, especially in their earlier stages. The fruit of the Nut is produced on the wood of the previous year, and, like other fruit trees, it will be sought in vain on luxuriant or gross shoots. In addition to thinning out, shortening must be had recourse to; and when the tree has acquired a little age, the main shoots, shortened, will produce axillary shoots, which, under proper circumstances, will produce blossoms. It is well known that the best period for pruning is when the Nuts are in blossom, which is commonly about the end of February; in fact, when the catkins, which are the male blossoms, are shedding their fertilizing dust At this period, both male and female blossoms may be detected, and much of the wood which produces neither may be pruned away; especially if towards the interior of the bush. All the stronger shoots at the extremities should be shortened, in order to force out axillary shoots, for the succeeding year, which, if the trees be in a proper state, will, in the main, be of a fruitful character. At this period, if there be a deficiency of male blossoms, or catkins, it is necessary to bring some shoots, laden with catkins, from the wild Hazel, and suspend them amongst the Filberts: these will perform the indispensable office of impregnation. It may here be observed, that the female blossom is of a very obscure character, merely tipping the fruitful buds with a little crimson brush.

We may here advert to the distance at which Filbert bushes should be planted. If they are for a single row, eight or nine feet will suffice. If in parallel rows, they require at least twelve feet between the rows; and about eight between the plants. They succeed well when alternating with the Apple and other fruit trees; occupying, in fact, the position frequently assigned to Gooseberry or Currant bushes. It is most important that all suckers be cut away as they rise. The Filbert is not fastidious regarding soil, it succeeds best, however, in a fine loam, especially in sandy loam. Unless the soil be of a sterile character, manures always produce gross growth, and unfruitfulness. The ground should be deeply dug, or even trenched, before the plantation is made.

Root pruning has been found to answer exceedingly well with the Filbert, when over-luxuriant; which condition, in their earlier stages, very often causes disappointment in their culture.

306 The Cherry. We come now to a fruit which certainly occupies no mean position in the dessert; but it must be admitted that the cultivation, or rather the conservation, of Cherries, has its difficulties. Coverings are indispensable, in order to preserve such noble fruit as the Bigarreau or Graffion; which is so tempting even when only three parts ripe, that birds, wasps, earwigs, and flies of all grades, seem to vie with each other in cheating the proprietor of his treasure.

If the cultivator of the Cherry has the choice of soil, sandy loam should be preferred; but it flourishes in almost all sorts. For cultivation purposes they may be divided into four distinct groups. First, the Morello and its congeners. Secondly, those of the Bigarreau character, which generally have large leaves; and may include such valuable kinds as the Elton, the Florence, the Tartarian, &c. Thirdly, the early class, generally known as the May Dukes, to which may be added the early Purple Guigne, Royal Duke, Late Duke, &c. Lastly, the various Hearts, as the old Black Heart, Black Eagle, and many others.

Before proceeding further we would point to the eligibility of the Morello for a much more extended cultivation. It may be safely averred, that it is the surest cropper of any out-door fruit we possess. Any cold northern aspect will produce this fruit in perfection, especially for a late dessert, for tarts, and for the various modes of preserving.

All the Cherries may be cultivated as ordinary standards, with the exception of some of the very late kinds, such as Buttner's October Morello, the Florence, &c., which would not succeed well in our northern counties. The Kentish, which is so much esteemed for drying, need indeed be grown in no other way. Most of the finer sorts are, however, grown on walls or fences; and for such purposes a variety of aspects are, if possible, chosen, in order to provide a long succession in the dessert. Thus, there should always be a tree of the early May Duke in a southern aspect. We have known fruit gathered in May, when thus situated; especially when the tree was on a gable which contained a chimney. The eastern or western aspects are equally eligible for a succession; for which purpose, in a limited garden, the following might be placed to succeed the early May Duke before alluded to:—Elton and Bigarreau for the middle of July; Florence, for the end; and the late Duke, for August. The Morellos would, of course, occupy, principally, the northern aspects. Where walls or fences are not to be had, they may be grown as dwarf standards or bushes; and for this purpose will require precisely the same kind of training as is adopted with a Red Currant bush; excepting that when once the requisite number of leaders are obtained, they must not be annually shortened like the Currant. It is generally necessary under this course of treatment to fasten each principal leader to a stake, at least during the earlier stages of growth. These should be set out, at equal distances, in a perpeudicular form; for the advantage of placing netting over them with facility. About six leaders, occupying a circle of about three feet diameter, is a very convenient form; the centre of the tree entirely open; and in this case, it would be well to set the young leaders out with a hoop or two. The mode of training on walls, is conducted on the same principle as that of the Plum or Apricot—the fan form being generally adopted. The young plauts must have their leaders shortened back for a year or two, in their earlier stages; in order to obtain shoots enough to fill the wall: after which the leaders are not shortened. The subsequent pruning consists of the ordinary summer dressing of superfluous spray, which may be pruned or pinched back about midsummer; leaving, in all cases, a few joints at the base, with the leaves uniujured, round which a nucleus of blossom buds will be found. Very short jointed shoots may be tied down to the main stem, as recommended for Pears. It is usual to lay in the Morello shoots very close, as the leaf is smaller than those of the other kinds; indeed, the size of the leaf must in a special way rule the distance of the young shoots. On a south wall the Morello becomes exceedingly rich: in such a situation, it should have a rich loamy soil.

SIMPLIFICATION OF PROTECTIVE STRUCTURES IN OUT-DOOR GARDENING. (R. Errington.)

In consequence of the rapid advances made in horticulture, during the last few years, many gardening luxuries have been brought within the reach of the middle classes of society, which used to be confined almost exclusively to the domains of the nobility. This we conceive is in no slight degree attributable to our periodical gardening works. Such, in our time, are so numerous, that every week and month has its record — prepared, if we may use the expression, in the most digestive form. In many of these, sound practice is made to attemper theory; whilst the latter elevates practice to a much higher level than it could possibly have attained without the aids of science. Thus, half an hour to a man of business, will generally suffice to introduce him to a tolerably clear view of his subject of enquiry.

Progression, therefore, must continue to be the maxim; and, for our own parts, we feel persuaded that even our labouring classes will, before many years have passed, be able to avail themselves of several of the little gardening comforts, now termed luxuries; more especially as the Potato disease still lurks around: this, indeed, has already had the effect of diverting the course of cultivation somewhat out of its original channels. In the midst of all these improvements, however, we find little advance made in protective structures; the energies of the age, as to gardening affairs, seem to have been chiefly directed to the building and heating of hothouses, By protective structures we here mean portable covers, or screens, which may be removed with facility to any part of the garden; and which will either serve, without artificial warmth, to preserve half-hardy plants, to protect or accelerate vegetables, or even to be used for Cucumbers and Melons, as the seasons come round. There are, however, a multitude of objects to which such portable and inexpensive affairs are applicable; and we shall take some pains to classify the objects, and show how a much improved system of the kind can be carried out. It becomes necessary, therefore, as a preliminary step, to show some objections which exist as to the old structures, such as the ordinary Melon frame, the various pits in use, hand-glasses, &c.

Before proceeding with our remarks, it may be well to observe, that we do not wish it to be inferred that the simple structures about to be recommended should altogether supersede the old-fashioned pits or frames in the extensive gardening establishments of our nobility. Our aim is to enable the proprietors of small gardens, by more moderate expenditure, to enjoy many of the luxuries of their wealthier neighbours; and if, under such circumstances, they cannot quite compete with them, at least to closely follow them in fair and honourable rivalry: this much as an argument. We now proceed to show our objections to some existing structures of this kind.

THE ORDINARY MOVEABLE FRAMES. We would first suggest that these are too cumbrous for the general purposes of the amateur, or owner of a small garden. Such are generally formed into what are termed one, two, and three-light boxes. They are very expensive in their original construction, and being, where of good size, rather unwieldy, no sooner become half-worn, than they show a tendency to fall to pieces by their own weight. We are of opinion that such can never prove economical if measuring above three feet in width, by about seven feet in length; or, in other words, being what would be termed a very small two-light box. The ventilation, moreover, of these cumbrous affairs, is conducted, we conceive, on an erroneous principle. When half-worn, their joints become considerably loosened; and many and frequent are the breakages of glass when in this state, through the mere process of giving air. They are also very unmanageable for locomotive purposes, generally requiring four persons to remove them. Again, they are only adapted to face the south — at least, such is the general usage with regard to them, and we shall presently show that there are numerous occasions in which it will be found expedient to depart from this rule. Another serious fault is, that their width prevents the due co-operation of the linings of fermenting materials, which it is sometimes necessary to apply in very severe weather. Lastly; they are but an awkward structure at best, especially for the amateur, who performs many of the necessary operations with his own hands. We come now to what is termed

THE BRICK-BUILT PIT. We need scarcely say that these are fixtures; and, certainly, when contrived so as to form a decided part of a forcing plant-house system, with some determiuate character about them; they are by no means unimportant; and as forming adjuncts of a complete forcing system in gardens of great magnitude, we by no means object to them; but to the amateur, in a small way, they are not so eligible. Indeed, unless for a regular wintering pit or hibernatory for half-hardy things, such in small gardens are most unaccommodating affairs. We now close our list of complaints, and will endeavour shortly to point to some simple structures, specially adapted to the possessors of small gardens.

Outlines of Proposed Simplification. It will be necessary before pointing to the size and character of protective structures, to classify, in some degree, the principal objects for which such structures are designed. We will, however, first offer a few observations of a general character. Our object is two-fold: not economy of structure alone, but an extension of the objects which form, by means of acceleration, or long succession, the dainties of the culinary or floral department.

Indeed, the great boon of a much cheaper, as well as of a mucher clearer glass, must, of necessity, constitute a special era in horticultural affairs, in all their bearings; and we are assured that our own humble labours in this respect are but the prelude to a much greater extension of the objects in view; whether in the floral or vegetable department; and that the day is near at hand, when tropical fruits will be brought much closer to our own doors than the world imagines. As Pioneers, therefore, we will proceed to show the policy proposed.

We scarcely need remind those of our readers who possess but one small greenhouse, how often they have desired to cultivate other tribes than merely tender flowering plants, but saw many attendant difficulties which it appeared impossible to surmount: not merely through want of space, but as much for want of a classification of such things; based as such ought to be, on the general habits, or periodical movements, of the objects of culture.

To another class of readers, we would also address ourselves. These are, it may be, a step in advance of the latter; and have, perhaps, more than one house, together with a pit or two, or frames. With this extension of glass structures, the objects and desires usually expand; and here we still meet with hinderances; objects too broad for the system are undertaken; the greenhouse is crammed, the plants drawn, whilst one or two merely of our protectors, which we will shortly describe, would so far relieve the houses of their superfluities, as to ensure well-grown stock.

We must here observe that the suggestions we make, relate principally to small gardens; they will, nevertheless, in the main, be applicable, as a subordinate branch of a system of forcing and plant structures, in the most extensive establishments.

We have five forms of protective or accelerative structures to offer, which we consider to be all that is requisite: two of them are already pretty well known; for the other three, we must coin titles, in order to distinguish them.

1st, Portable opaque protectors.
2nd, Portable glass protectors or accelerators.
3rd, Portable drill covers.
4th, Portable sashes.
5th, Hand glasses.

We may just premise, that for the first two structures we intend to propose some light brick pits, which will, in divisions, receive at any time, any of the opaque or glass protectors, which may happen to be at liberty;—our prime object being, that not a day shall be lost, but that they be constantly employed. They will all be so very light, that a lady amateur, assisted by her maid, may, at any time, remove one of them without further assistance. This we consider a most important affair, for the old three-light frames are so cumbrous as to preclude any attempt to move them about by lady gardeners.

Objects in general attainable by the proposed means.

1. Bulbs accelerated.
2. Deciduous shrubs accelerated.
3. Seeds in beds accelerated.
4. Asparagus accelerated.
5. Rhubarb accelerated.
6. Sea Kale accelerated.
7. Bulbs and herbs dried.
8. Violets accelerated.
9. Lily of Valley accelerated.
10. Chrysanthemums protected.
11. Mignionette protected.

12. Lobelias protected.
13. Half-hardy plants wintered
14. Cape bulbs protected.
15. Mushrooms cultivated.
16. Cyclamens protected.
17. Camellias protected
18. Oranges protected.
19. Ericas protected.
20. Cauliflower and lettuces protected.
21. Roses in pots, protected.
22. Roses accelerated.
23. Endive protected
24. Succulents, Cacti, &c. protected.
25. Carnations protected.
26. Potatoes accelerated.
27. Early Carrots accelerated.
28. Early radishes accelerated.
29. Parsley protected.
30. New Holland tribes protected.
31. Kidney beans accelerated.
32. Fuchsias protected.

The above are the chief of the objects for which such structures are in general required; and as their coverings are not all required at one period, we hope to show how a set of covers of this kind may be kept in constant employ. To illustrate the matter we will suppose Sea Kale for the early crop forced, ready for table by the middle of November, and all cut at Christmas. Early potatoes might be accelerated here with the remains of the bottom heat, and be ready for use by the middle or end of March, and cleared off by the end of April, when Cucumbers might be introduced; or the Protector might be made to receive surplus plant stock from the greenhouse, which at this period, is sure to want relief; thus preventing, as before observed, many a valuable plant from becoming drawn and spoiled.

Before we proceed to place a sketch of each of these simple protectors before our readers, we must beg to draw attention to one most important consideration, which at first sight, to the inexperienced, might seem but a trifling affair, but which in reality is a matter of consequence. We mean the relation which any such structure should be made to bear to the ordinary ground level; or, in other words how much of it should be above ground and how much below.

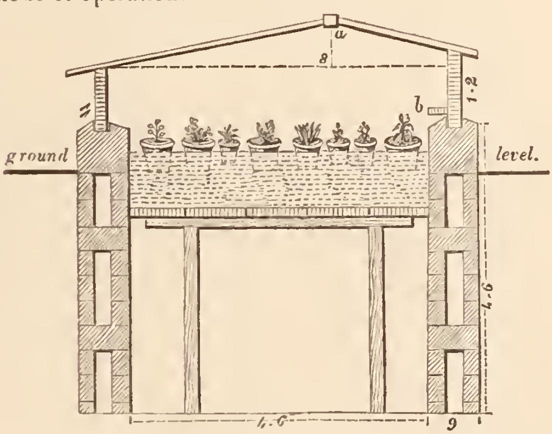
We must at once then observe, as a general principle, that the lower any such structure can be kept, the warmer it will be, as to the average temperature, and by consequ^nce it will thus tend to economise heating mateiials, whether fermenting vegetable matter or coal. In examining into the merits of this question, it must be remembered that it is not a question of solar heat and light alone; the winds also must be taken into consideration, for to these, more than to frosts, must be ascribed most of those capricious alterations, and injurious depressions, which occur in our variable climate, more especially as affecting elevated beds warmed by fermenting materials.

In illustration of this, it is only necessary to look at what passes in an ordinary dung heap, whilst fermenting for, perhaps, the early cucumber bed, during December or January. Every one conversant with this simple process knows, that unless it be of considerable bulk, one of our sharp north-easters will very suddenly arrest its fermentation. In this dilemma, the gardener has recourse to linings, or an extra protective coating on the windward side. Now, the same amount of fermenting material below the ground level, would, perhaps, in the first instance, not heat quite so rapidly; but once heated, it would not be so liable to capricious changes; for the ordinary average temperature of the soil, at a little more than a foot below the surface, has been proved to be a degree or two above the mean atmospheric temperature. It is almost needless to multiply arguments on this view of the question; but we may add, that our very best gardeners, when building protective structures, with a view to economy, generally make them low and compact in their proportions; and that when such structures as the justly celebrated Chatsworth or Kew Conservatories are built very lofty, their projectors are fully aware that economy is out of the question.

It is, however, true that heat, when applied below the ground level, meets a neutralizing influence which must not be neglected; we mean the ready conducting power of the surrounding damp earth, which would, without due attention being paid to it, prove even as great an enemy as wind itself on an elevated bed. In nature there is a continual effort to equalize extremes, whether it be the high temperature of the hotbed, or the low of the ice-house; and to counteract such action requires all the skill of the forcing gardener. Under such circumstances, therefore, we have been induced to plan a pit, which, with the accompanying box or frames, is about two-thirds below the ordinary ground level, and one-third above it: this we shall here illustrate by a sketch, with details.

Before proceeding farther, we would premise that at page 99, in glancing at the outlines of our proposed simplification, we addressed ourselves to two classes of our readers; and in order to be distinctly understood, by conveying definite ideas, we think that it will be most expedient to explain the use of these structures in very small gardens, where, at the most, only two or three of them would be employed; we can then enter into the spirit of the subject; and show how, as we observed at page 100, they may be made applicable 'as a subordinate system of forcing and protection in the most extensive establishments.'

We now submit a sketch of one of our protectors or accelerators, placed on the pit; and will then describe its character, and mode of operation.



It must first be understood, that both the opaque and glass protectors or accelerators, are precisely of the same size in every respect; for the brick pits being fixed structures, the portable frames or protectors are designed to be capable of easy removal from pit to pit, or place to place, according to the requirements of the cultivator, as they are equally adapted for all purposes. We deem it necessary now to explain the reasons which induced us to plan the structure, somewhat differently from the ordinary garden frame. First, the pit, the walls of which are nine inches thick, and hollow, are built with brick, placed edgeways, with headers (as the cross bricks are called) at intervals, which hold the work together with firmness; thus the desired object—a flued wall, is obtained, and materials are economized. Hollow walls are well known non-conductors of heat; they are also averse to the transmission of moisture, which spreads, as is well known, through brick walls, by capillary attraction, especially if they are formed of soft materials. By means of these double walls, then, chilling damps can scarcely enter from without, neither can warmth escape from within, but at a much slower ratio than through solid masonry.

The sketch here given represents the pit as employed in wintering half-hardy plants in pots; and for this purpose it will merely be necessary to introduce a couple of trestles to support a few boards cut to the length of the pit, to carry a little sand, ashes, or sawdust, in which to plunge the pots of plants: or they may be set on the boards themselves, with moss placed between them, which, if regularly salted a little, before use, will be found to be as disagreeable to slugs as any material that can be employed; at the same time it is a good protection against frost, and pleasant for use. Of course, while thus employed, one of the glass protectors will be made use of; and if the inmates can be turned out by the second week of May, a good bed of cucumbers or late melons may be produced, before the arrival of the usual wintering or housing period, say the middle of October. In anticipation of the pit being thus employed, the amateur must, on building it, determine on the mode of applying fermenting material, for it will be very desirable, although his pit may be intended mainly for protection in winter, that he should make it an efficient source of enjoyment in the summer; and this will be best effected by applying a little heat from stable manure, or from tan, as explained in section 56 of the Auctarium, or decaying leaves, section 60. A single pit of this sort may stand as an independent object in a small flower garden; in which case, of course, the heat must be obtained from the material being placed within the pit. This is readily effected by the removal of the trestles and boards, and a common hotbed will then take its place; which, in its turn, gives place in autumn to the former fittings, whilst the manure is applied to the borders.

If the pit or pits to be thus employed, occupy such a situation as will admit of heat being applied by linings of manure, then the exterior walls should be pigeon-holed as it is termed; that is, have holes left through them, of the size of a single brick, so that they may be closed or opened at pleasure. Again, if a pit can be placed with convenience, with its back or northern side against a wall, at the back of which manure can be used without inconvenience, an opening may there be made and manure put into it; which, as it cools, may be changed at pleasure; whilst the bed above, supported on the boards, remains undisturbed and efficiently heated. We, here, throw out these hints, that those unaccustomed to their consideration, may be assisted in availing themselves, in the most efficient and convenient manner, of the numerous gratifications that are derivable from expedients so simple and inexpensive. These, however, are but one or two out of a multitude of purposes to which such erections and frames may be applied; as will be shown on further consideration of this subject.

We may now offer a description of the glazed and opaque protectors. By referring to the sketch it will be seen that they rest on a small stone coping, placed on the brickwork, which forms a finish to the pit and strength to the fabric. Two things may be noticed as being novel in these matters: the one, that the protector has a north sloping light or sash; and the other, that the roof to the sash has a very flat inclination or pitch. In the first place, as to the north sash, we were anxious that the amateur, and especially lady amateurs, should be able to give air with the utmost facility. We are aware that lady gardeners are averse to have any thing to do with the old hotbed frame; the lights of which are, for the most part, cumbrous to lift and adjust as may be desired. Moreover, in giving air, how frequently does destruction befal the glass of loose lights? Now this north light moves on hinges, from the point *a* of the protector. The north light, therefore, is made to lift up as easily as the lid of a box; and its opening for the admission of air may be graduated by any of the simple means in common use. Another point is involved in the principle of a north light. We are anxious to prevent what is termed "burning"; for most of the evils which happen to glass structures in small establishments, occur through the want of air being given betimes in the morning. Now we are persuaded that quite as much sunshine, on the average, will enter the space of the southern portion, as the amateur can manage,—especially with our improved glass; and through the north slope will enter a subdued light, which will be found exceedingly beneficial to the inmates of the frame—especially to the row of pots which may occupy the shelf marked *b*. The flat roof was also planned for similar reasons; for, however fine it may sound, to discourse about the principle of light abstractedly considered, many indeed are the cases in which it would be far better for the amateur to possess a modified amount of this necessary, yet powerful, element.

We may here add to the foregoing description, that we intend the front sash also to lift up to any required height; this, in reality, being the workman's side of the pit; where all the operations of filling or emptying may be carried on with convenience. Both this and the north slope may be made to lift by means of bolt hinges, which are very simple and durable. Some little management will be requisite, in order to prevent drip occurring at the apex; this, however, will be readily accomplished, by the use of a strip of thin oil-cloth, or similar material, impervious to water.

It will now be necessary to say a few words regarding the brick pits, which, as before observed at page 103, are of a fixed character. As shown by the section given, a portion thereof will be above the ground-level; and if protection in the character of warm manure, or even straw, be used, a somewhat unsightly effect will be produced, unfitting any portion of the garden which is in high keeping. Those who adopt these structures, therefore, should set out with definite plans, in order to avoid disappointment. We shall, in the course of our remarks, so far glance at the culture of the objects ennumerated at pages 100 and 101, as to be able to assist amateur gardeners in carrying out such objects. We now offer a few remarks on

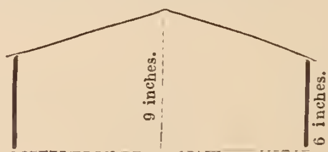
Opaque Protectors. In point of size it is obvious that these must be exactly of the same width as the glazed protectors, and we would advise that they be the same length also; for if the brick pit be so built as to receive two or more in a line, it becomes necessary that they should thus correspond. In form of roof, too, we prefer that they should also correspond; for, although structures of a very similar character have been used for years, with regular span roofs, and which always answered the purposes intended (being entirely confined to the forcing of asparagus and sea-kale) we consider that by giving them the same form of roof as the glazed protectors, we shall enable the amateur to appropriate them to a variety of objects at certain seasons, for which glazed structures are generally used; thus considerably extending the objects of culture.

We are not aware that they can be made of better materials than feather-edged deal boards. We have some span-roofed protectors, thus made, which, having been well tarred over, have been in constant use for fifteen years, and are now perfectly sound. The opaque protectors being made to work with bolt hinges, similar to the glazed ones, every facility will be afforded for carrying on the necessary operations within. We now proceed to the consideration of

Portable Drill Covers. The drill cover is by no means a novel affair, and we claim no particular amount of novelty for the protectors here described. We would merely urge that where structures, somewhat similar, have been used, their purposes have been so much narrowed as to render them comparatively unimportant; and it will be one part of our labours so to extend their scope as to impart to them a much greater amount of importance. The drill covers, too, of former days, were so small as to be only adapted to one or two crops; we are desirous of recommending drill covers which shall be easily transferable, and applicable through the year for the production of a variety of dainties, for which, as before observed, we must provide a special course of culture, more particularly in point of distances in planting and arrangement of cropping.

Some years ago, a drill cover, of two sloping sides only, was recommended by Mr. M'Intosh, as adapted to the protection of early Pease; and is thus described at page 65, of his Practical Gardener:—"The front is glazed with small pieces of glass, to transmit light; and the back is composed of a board, the third side or bottom is open. Upon the top it will be convenient to have a handle, for the purpose of removing it as circumstances may require. Glass cases of this sort might be in every garden, and will be extremely useful for protecting all sorts of crops, and can be procured at a very trifling expense." Thus far Mr. M'Intosh. Now, although we are proceeding on precisely the same principles as Mr. M'Intosh, (but with a much greater extension of the objects sought) we have to differ in some of the details. For instance, although Mr. M'Intosh's drill-cover may suit early Pease, yet it would scarcely be capacious enough for forwarding Cauliflowers, or for forcing Sea-kale and Asparagus, besides many other things which we shall hereafter suggest. The mere union of two sides, thus Λ is not the very best form, although certainly the most simple; and we think we shall be justified in our proposed course of alteration, by the much greater capacity we trust, and general eligibility, which our improved drill-covers will be found to possess.

We now give a sketch, which, with the accompanying description, will thoroughly explain the matter.



Now, as we propose to cultivate many things in double drills, especially for early work, it will be readily seen how much more room will be afforded by the adoption of two upright sides, be-beneath the span roof, although only a few inches in height. Indeed, in Mr. M'Intosh's drill cover it is only possible to cultivate a single row with any chance of success; and it scarcely seems worth while to institute such proceedings, without a prospect of producing what might be considered a remunerating crop. And now for the construction of the protector we have sketched. Like the other protectors before described, it would be good policy to have them made in two sets; the one opaque, the other containing a small amount of glass on each side of the roof. They ought to be in lengths of about five feet, in order that lady gardeners, who are daily becoming more numerous and ardent in horticultural pursuits, may be enabled to shift them with facility from one part of the garden to another.

Ventilation must, of course, be provided in some way, whether the drill cover be glazed or opaque. Indeed, in the latter case it would be advisable to cause a portion of the roof, nearest the apex, to open from one end of the drill cover to the other, longitudinally. By this arrangement, light would be uniformly admitted, as well as air, when mild weather occurred. The roof may, in that case, be composed of two feather-edged boards, of about five or six inches each in width, the upper over-lapping the lower one; the upper having a hinge at each end, and, of course, opening perpendicularly to the apex. The two ventilating lids in giving air would thus meet above the apex, and might be secured by a hook and staple. This would indeed be perhaps the most economical mode that could be devised, and we do think that every small garden in the country should possess at least half a dozen. As an adjunct to the little greenhouse too, they would at certain seasons be invaluable. Half-hardy plants might, with facility, be wintered in them, merely by having them well established in store pots, and by keeping them dry; the addition of a mat, or some coarse litter, would thus carry the inmates through the hardest frosts. They would be well adapted for a small mushroom bed also; and, in this case, it would be very easy to apply a warm dung lining on each side, when the weather was severe. Many other things belonging to the greenhouse will readily suggest themselves; even when the Vines commence their growth, when extra warmth becomes essential, and when so many good plants are thereby sure to become 'drawn,' a considerable amount of stock might be thinned out and placed beneath the drill covers, thus affording more room for good specimens, as well as for manual operations in the greenhouse.

With regard to the glazed drill covers, we need scarcely urge their general superiority, at least during the growing season, for it must be always understood that the amount of light must, in nearly all cases, bear a strict relation to the rapidity of growth. When such relations are disturbed, or the light intercepted from an active vegetation, what is technically termed 'drawing' takes place. This is, we conceive, familiar to every one; a potato left in a comparatively dark cellar, late in spring, will afford a pretty good illustration of this. Although there are cases, especially in the wintering of plants, when the opaque drill cover would even prove superior to the others; yet on the whole, we must give a much greater amount of importance to the glazed covers; nevertheless, there should, doubtless, be a set of each in every gardening establishment; for the opaque covers, in many cases, would forward crops for the glazed ones, the latter, perhaps, being all engaged at the time.

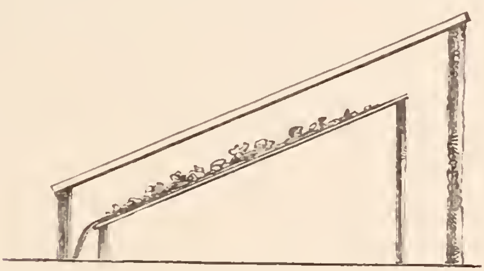
In preparing ground to receive the drill covers, some special culture will be necessary, of which more shall be said by and bye. It will not be improper, however, to observe here, that as the sides of our drill covers are but six inches (and it being only nine inches to the apex from the ground level perpendicularly) a little ingenuity will be requisite in forming the plot to receive them; we name this by the way, in order to anticipate an objection which might be raised, of their being short of depth. We can show in the sequel how the objection can be shorn of its weight; our intentions in planning them thus shallow, were merely to render them as portable as possible, and to economise expense.

Before concluding with the drill covers, we must say a few words about the ventilation of those which are glazed. Whether they should have much or little glass, depends, of course, in some degree, on the strictness of economy with which they are made. As a matter of principle we should say that it would be well to have the whole of the span roof glazed; the sides and ends, of course, being of wood, for lightness and economy's sake. If this plan be adopted, we do not see why the whole of each side of the roof should not open to ventilate the interior. It is, nevertheless, only of second-rate import to have these arrangements so carried out; we may merely say that a copious ventilation must be provided; and that no doubt many of our readers are in a positiou, equally qualified with ourselves, to carry out such results.

It may here be observed that, whatever the mode of ventilation may be, it is essential that the flaps or ventilating portion open upwards from the shoulders of the drill covers towards the apex; in fact, in a similar way to that suggested for the opaque drill covers. This will prevent the injurious effects of hail storms, and of cutting winds; and moreover will be found of immense benefit, under the course of culture here proposed, in warding off the perpendicularly acting white frosts in the months of March or April; when it will occasionally be expedient to have the ventilating apertures open all the night.

PORTABLE SASHES. Under this head may be included all ordinary garden sashes, which may be thrown at liberty from houses, pits, or frames; and as their size not unfrequently varies much, it is not easy to plan any fixed mode of culture which may receive benefit from them. Moreover, such are seldom at liberty until July or August, when they can be of little use, unless placed before vines or peaches on the open wall, in order to accelerate the ripening of both wood and fruit. We therefore advert to them here, merely as forming, when available, one item in the category of Protectors.

We may now be permitted to draw attention to a very economical mode of cultivating the peach and nectarine under glass; and for which the title of "Ker's protective system" has been suggested. It is the invention of H. B. Ker, Esq., of Cheshunt; and, as he has established one or more in his own garden, and the Horticultural Society have also done the same in their grounds, we shall, in a short time, find out whether they are successful. In dealing with this division of the subject it will be desirable that we place a sketch and description of it before our readers. It consists merely of a screen of glass, placed over a trellis, on which the peaches or nectarines are trained; sides are dispensed with, also front and ends; with these it would, of course, be a regular pit or frame; herein then consists part of the economy.



The above sketch will, at once, convey an idea of its formation; and, as regards proportions, every cultivator will doubtless, make these subservient to his own taste and the space he has to spare. Mr. Ker's sashes, or lights, are six feet eight inches long, as stated by Mr. Rivers, in the detail of their cost, hereafter given.

The posts and rafters are made of larch poles, sawed in halves; and the frames or sashes for the glass are of deal, unplaned; constructed without the usual dove-tailed joints—being simply fastened across each other. This simplicity of structure, of course, saves expense and labour, without interfering with the efficiency of the sashes. The posts which carry the roof, and also those which sustain the trellis, are charred at the lower end; this will cause them to last many years, without giving trouble. The whole, when complete, is dressed over with gas-tar, of which Mr. Rivers, the celebrated nurseryman, has a very high notion, as applied to out-door gardening structures. He, moreover, points to the eligibility of 'yellow pine varnish,' for a similar purpose. Mr. Ker thinks that cherries and plums may be cultivated at the back of the peach trellis — that is, trained at the back of the frame which supports the lights, but still beneath their shelter. He has used a covering of leaves, two feet in depth, over the peach roots, in order to keep them warm.

Mr. Rivers plants his peach trees in a slanting direction, so that their branches fit readily to the trellis, without any bending. They are planted six feet apart, and he intends removing every alternate tree, after three or four years, to another trellis; then they will be left twelve feet apart.

To show the economical character of this structure, we beg to subjoin the expense, as stated by Mr. Rivers. Each light is 6ft. 8in. by 3 ft. $2\frac{1}{2}$in., and contains 2 bars, $2\frac{1}{2}$in. by 1in.; 2 sides, $2\frac{1}{2}$in. by 1in.; 1 cross-bar at bottom, $2\frac{1}{2}$in. by 1in.; 1 cross-bar at top, $2\frac{1}{2}$in. by 1in.; and 1 cross-bar in the middle, $2\frac{1}{2}$in. by 1in. This gives about $1\frac{1}{2}$ cubic feet of timber; this, for one light, will be —

	s.	*d.*
$1\frac{1}{2}$ feet of timber, at 1s. 6d., ...	2	3
3 rows of glass, 20ft. at 3d., ...	5	0
Sawing, about	0	9
Labour and nails, ...	1	0
Glazing and Putty, ...	0	9
	9	9

Mr. Rivers remarks that pine varnish is the cheapest and most durable for rough unplaned wood; three-pence would be the outside cost for two coats. Mr. R. uses sheet glass, one foot wide, and about two feet long.

Thus far Mr. Rivers's account of the matter; — we may now be permitted to offer a remark or two of our own. We frankly confess that we fear the effects of the winds, which will frequently assume the character of eddies, or chilling draughts; these are well known to be inimical to the successful culture of tender fruits. We would, therefore, by all means, hang some waterproof or other material round the sides and ends, leaving a portion at the upper part of the back, capable of unfolding, in order to let the heat escape, when too great. With this provision, we have no doubt that Peaches, Nectarines, Apricots, and our tenderest Flemish Pears, might be grown to great advantage; and why not? the structure would then possess all the advantages of a peach-house, and more; — it could be more thoroughly ventilated, and this at certain periods, would be found a decided advantage.

We are very glad to see that the experiment is likely to have fair trial, and we hail it as, at least, a step in the right direction; being persuaded that, before long, much greater simplicity and, of course, economy, will be introduced in this department of gardening; which, aiming at utility alone, should be as much as possible unfettered by anxiety about appearances.

Having worked up our subject, according to the original propositions, to the conclusion of portable sashes; we may offer a few brief remarks on Hand-glasses, which constitute the last of the series. These have been in pretty general use for very many years, and people may naturally enough suppose that they cannot be dispensed with. To say that they ought to be done away with altogether, would be saying too much, in the present position of gardening affairs; nevertheless, it may here be remarked, that those who adopt our Protectors will have small occasion for them; nay, it would soon be tolerably manifest that they could be entirely dispensed with, except for the propagation of cuttings, or for the commercial gardener, for whom they are peculiarly adapted; his objects being so much more simplified than those of the amateur, who may fairly take for his motto "multum in parvo." Our market gardeners have little more than two prime objects in view, as to the application of the hand-glass; and these two occupy the glasses by a most simple course of culture most of the year. Thus, with these cultivators, they will be found occupied from October until the ensuing April, with Cauliflowers, which obtain high prices in the metropolitan and other markets. No sooner are these nursed out of danger, through the March winds, than preparations are systematically made to receive them on a plot of ground devoted to Cucumber culture. Here they are at once removed, and constantly occupied, from April until July, or even much longer. Some other occupations are, at times, found for them, but they are, for the most part, subordinate to these two objects. Euough, we trust, has now been said to show that the horticultural proceedings of the amateur and the commercial gardener, do not lie precisely in the same way; and, therefore, the arguments, pro or con, as to the economical bearing of any given structure, are not, by any means, equally applicable. Certainly, for the propagation of half-hardy, or bedding plants, as they are now popularly termed, hand-glasses, or small striking glasses, are very eligible; and may, in that case, prove useful auxillaries to the protectors.

We need hardly descant here on the forms and sizes of the common hand-glass, our readers being, doubtless, thoroughly acquainted with those every-day affairs; we must now advert to some other matters, to which we ought to have poiuted at page 100 of the Auctarium, where the programme of our suggestions will be found. We do intend, after a description of these structures, to show how all forcing or protective affairs, as far as the amateur is concerned, may be carried out; pointing to modes of culture as identified with this system. In the course of these remarks we shall have to deal with the forcing of asparagus and sea-kale; but as the forcing of these dainty esculents, in the opaque protectors, will be chiefly confined to the old mode of removing roots from the open ground, we beg to say a few words on an old system of forcing the before-named vegetables, where they grow; in which case a sort of protection is already in use, somewhat different in character from that which we shall propose. We here allude to span-roofed opaque frames, with brick walls about the beds, which have been in use for many years; but we do not hence wish to be understood as urging the absolute necessity of this kind of structure; for brick pits being established, to fit and receive either the glazed or opaque protectors, as the case may be, it will be quite eligible to plant asparagus in a portion of the pit, corresponding in length to one or more of the protectors; according to the desires or means of the proprietor. We merely point to this frame, in order that those who are about remodelling their garden establishments, as to accelerative or protective matters, may have the power of selection, by our bringing every truly useful thing of the kind into view.

The span-roofed frame of old usage, here alluded to, we have employed for years, with success; and may here describe the method as applied to the forcing of asparagus. The asparagus is planted in brick pits, four feet in width in the clear. The pits contain two rows of asparagus, the rows two feet apart, and plants ten inches apart in the row. One foot, therefore, is allowed between each row of asparagus and the pit wall nearest it; this is "pigeon-holed" from bottom to top. These beds, then, are placed in parallel lines, having a trench twenty-seven inches in width between each two pits, and thirty inches in depth; which depth is indeed the same as the depth of the prepared soil in the pit. In forcing, the span-roofed frame rests on the walls of the pit, and the space between the pits is filled with hot fermenting material; the roof of the frame also being covered with straw, litter, or mats.

This protecting roof consists merely of an exterior frame, formed of deal, about four inches square, to correspond with the size of the walls forming the asparagus pit. This supports the skeleton of the span-roof, which is formed with feather-edged boarding: a coat of gas tar completes the structure. We must, however, observe, that one of the feather-edged boards which constitute the span-roof, is made to draw out easily: this becomes necessary in order to examine or cut the produce; and in fair weather, to give air when necessary, and to give colour to the asparagus,—that sure indicator of flavour and quality.

Having now fully described our proposed 'simplification of protective structures,' it will be necessary to enter into some analysis of the objects in view; and in doing so, it will be well, perhaps, to classify them, in order that our readers may have the matter in a digestible form; and that a specific character may attach to each of the protectors, or accelerators, which we have suggested. In thus proceeding, we do not wish it to be understood that we are rash enough to advise parties to do away with the frames or pits which they already possess, and to forthwith adopt, at a considerable sacrifice, the forms of structure we have recommended. This is assuredly not our aim ; those who possess an establishment already, considered tolerably complete, will do well to abide by it ; for it is not, after all, merely this or that form of structure, but good principles of culture, attentively carried out, which ensures success in the main. To accomplish all this it is necessary that the cultivator thoroughly understand first principles ; these must be kept distinctly in the mind's eye — once thoroughly established and confirmed, every point of mere practice must be subjected to their strict analysis. We think, therefore, that we cannot better discharge our duty, than by adverting to, and explaining, those principles of culture ; simplifying them as much as possible. In doing this, we must, as a preliminary step, turn back to page 100 of the Auctarium, at which is given an ennumeration of some useful matters ; the forcing, culture, or conservation, of which may be carried out, in the most perfect way, by the system of protectors or accelerators here proposed.

We must now, in recapitulating the objects named at pages 100 and 101, take the liberty of transposing the order of them as they there stand ; they were thrown down as they occurred to the mind, as fitting objects ; we must now, however, endeavour to arrange them according to their habits ; and this, we trust, will at once prove a guide both to the amateur, and those who are merely in the beginning of horticulture.

Classification of the Objects.

1st division. Opaque protectors, employed for accelerating in the earlier stages, such as the following things : —

Dutch and other bulbs.
Deciduous shrubs.
Asparagus.
Rhubarb.
Sea Kale.
Mushrooms.
Lily of the Valley.
Deciduous Roses, &c.

2nd division. Opaque protectors, employed as mere shelter from severe frosts to such as follows: —

Cape bulbs.
Chrysanthemums.
Lobelias.
Cyclamens.
Roses, various, in pots.
Fuchsias.
Endive, when blanched.
Lettuces, when blanched.
Parsley.
Violets, &c.

3rd division. Glazed protectors employed in wintering such as the following: —

Ericas.
Oranges.
New Holland plants.
Succulents, Cacti, &c.
Carnations.
Mignionette.
Half-hardy bedding plants, &c.

4th division. Glazed protectors, employed in accelerating such as the following: —

Potatoes.
Early horn Carrots.
Radishes.
Kidney Beans.
Cucumbers.
Melons.
Strawberries, &c.

5th division. Drill covers, employed on such as follow;—

Early Pease.
Early Cauliflowers.
Lettuces.
Kidney Beans.
Radishes.
Endive.
Parsley, &c.

We do not wish it to be understood that we consider the above enumeration as by any means comprising all that may receive assistance from these simple structures; many others will occur, but these form, we conceive, some of the principal objects, at least in moderate-sized gardens, and they will serve to illustrate our plans.

It will also be found in the detail we are about to give of their culture, &c., that plants from one division will be transferable to another, under certain circumstances; and also that many things will be common to two or more of the divisions. Thus much by way of explanation, we will now proceed to their culture, taking them in detail in the order in which they stand.

1st Division.

Opaque protectors employed as accelerators.

Dutch and other Bulbs. We come now to treat, in detail, the objects mentioned at page 116, which we purpose doing consecutively as there enumerated; pointing, as we proceed, to the main features in their culture, more especially in reference to the employment of the structures already described. It is a well known law in the vegetation of most bulbs, which annually become deciduous, that the blossom of one year is generated in the year preceding. Hence it follows, that the blossom of a bulb, being duly organized, and in an embryo state, merely awaits circumstances favourable to its development. This is rendered manifest by the circumstance of bulbs growing in water-glasses; for, although the blossom may be produced in very high perfection, by such means, yet no one has ever shown that a mere offset can be thus grown into a strong and healthy flowering bulb. Bulbs, when placed in water-glasses, are usually, by good cultivators, kept in comparative darkness, for the first two months, or thereabouts: this clearly shows that any opaque frame or protector will suffice as well as a glazed one, at least during the early stages of their vegetation. And, indeed, such a condition is precisely what happens with a bulb planted six inches deep in the open ground. Here in the dreary season, from October to January inclusive, the earlier stages of development progress very slowly, and in darkness; together with constant moisture about the stem, preventing, any important amount of perspiratory action, which indeed, in this stage is unnecessary. When, however, the bulb has produced leaves in the full possession of their agencies of absorbtion and perspiration, then indeed an elaborative process again commences, which is of much service in promoting the strength of the present blossom ; and decidedly of benefit as laying the foundation of future vitality in the bulb ; to say nothing of its forming material for the blossom of the ensuing year.

It will be readily seen, then, that our opaque protectors will furnish the necessary conditions up to the period of the bulbs possessing leaves, when they may be transferred either to the glazed protectors, to the greenhouse shelf, or to the drawing room, as the case may be. It may here be observed, that what are termed "forcing bulbs,"— such as the Hyacinth, the Narcissus, early Tulips, the Double Jonquil, the Persian Iris, Crocuses, &c., require a small amount of bottom heat, at certain stages: 70 degrees is amply sufficient for this purpose; and it so happens that precisely the same amount of bottom heat will suit every plant enumerated in this division. We do not mean to say that the whole division must have precisely this temperature, but that all the objects sought by this application of the opaque protector, may be most effectually carried out by this moderate amount of heat. For bulbs, however, we should say any where between 60° and 70°, is the most congenial root temperature ; observing to keep down atmospheric heat, by ventilation or otherwise, to 55° or 60° at the highest. In order to guard those of our readers who are inexperienced in bulb forcing, we must observe, that for successful forcing, they should be obtained and potted early in September, and then plunged over head in ashes, old vegetable soil, or indeed common soil, until the roots are peeping through the bottoms of the pots. This process will, in general, require about two months, so that by the end of October the pots will be nearly full of roots ; and then, and then only, should they be introduced to bottom heat, with the course of culture before described. They will require no water through the whole process, provided they be potted in moist soil; and when introduced to the protector, should be plunged four inches deep: when the bud, or rather the leaves, are fairly above the plunging material, they may be safely removed to the drawing room or greenhouse, observing to inure them gradually to the light, and then to water them rather liberally, in order to counteract the sudden effects of the drier atmosphere to which they are in their new habitation exposed.

Deciduous Shrubs. In pursuing our subject in a consecutive order, we now come to the acceleration or forcing of shrubs in general; such as the various American Azalias, the Moss and Cabbage Rose, the Persian Lilac, the Sweet Briar, and a variety of others. Such will probably continue in request for many years to come, notwithstanding the introduction of novelties, some of which being naturally winter or spring flowerers, are a great disideratum in horticulture; still, we would not that such pets as the old Moss Rose should be supplanted.

Most of these shrubs, like the bulbs we before spoke about, organize their blossom buds in the preceding summer, and only await a gradual excitement, by means of heat, after a period of rest. During the first stages of their excitement, or acceleration, the primum mobile of successful culture must be sought in what is termed bottom heat. Now, although a very moderate amount may be permitted, especially during the earlier stages of acceleration, yet that amount must be some degrees in advance of the atmospheric warmth. Persons iuexperienced in gardening affairs, will naturally ask what this amount of bottom heat is, on which so much depends; and before we conclude our advice about deciduous shrubs, we will endeavour to inform them.

A bottom heat, then, being provided, for which the ordinary brick pits, before alluded to, will be admirably adapted, these shrubs will be quite at home in the opaque protectors, until their leaves begin to unfold, when light becomes absolutely essential; and all they need will be a removal to a glazed protector, which, of course, must have a similar bottom heat provided.

It must not here be inferred that we intend giving the amateur the trouble of making up a fresh pit or division, every time a group of plants needs a transfer, from the opaque to the glazed protectors. Our prime object, if we can succeed in perspicuously defining our views, is to induce the amateur to keep one, two, or more of such protectors, both glazed and opaque, always provided with a bottom heat; either by fermenting material, or what would be by far more systematic, (and indeed economical in the end) a permanent bottom heat from hot water piping. Such being the case, the opaque and glazed protectors would be continually providing for and assisting, each other; and, indeed, when the amateur is made fully aware of how many dainties and gratifications, he could procure, by a systematic use of these protectors, and at so very moderate an expense, compared with the expensive structures we sometimes meet with, his protectors would be in constant occupation, and we will engage that it would be most difficult to find a spare corner in them.

Bottom Heat for Deciduous Shrubs. Of course we do not presume to say that the very same amount of bottom heat is equally suitable to all the shrubs, that may find a place here. from whatever clime. Nevertheless, we know, by experience, that a medium point, a kind of compromise between the extremes, will, under judicious management, lead to general success. For shrubs, in the opaque protectors, during the first stages, from 65 to 70 degrees will be proper; when they are beginning to expand their leaves, and are removed to the glazed protector, an advance of 5 degrees may be allowed. We may here advise about the atmospheric temperature also, which must, in all cases, bear some relation to the amount of bottom heat; and this should be at least 10 degrees lower than the bottom heat in the opaque, and about 5 degrees average in the glazed, accelerator.

Let it, however, be observed, that it is not proper to adhere to so precise an amount on all occasions; bottom heat has other relations besides those which relate to the root action. Nature has so established the order of affairs, that solar light is the cause of a much increased amount of atmospheric warmth; and what takes place out of doors, must be imitated within. When, therefore, what in termed fair weather prevails, which in general, is only another form of expression, for more solar light, the temperature must be supposed to rise in due proportion; remembering one thing, that as a plant in a pot has not the liberty to range for food, that the same has in a state of nature, such is not equally able to bear extremes of temperature; too copious and too sudden a perspiration is frequently prejudicial. Under general circumstances, an advance of five degrees above ordinary atmospheric heat, may be permitted. For these shrubs a very moderate amount of ventilation will suffice: when, however, they come into leaf, there must be a progressive increase, in order to facilitate the necessary elaborations.

301. AUCTARIUM.

Asparagus Forcing. Next in order, we have the Asparagus, for which the opaque protectors, placed on the brick pit, before alluded to, will be peculiarly well adapted. We may here allude to the fact, that there are two very distinct and rival modes of forcing Asparagus; the one, forcing it in the beds where it grows, and the other removing the roots to a prepared bed of fermenting material, or bottom heat provided by other means. The plan of removing roots for forcing, probably originated through the necessity for destroying what are considered worn-out beds, and planting fresh ones, and it seems to be a practice of long standing. In breaking up old beds, of course the idea naturally occurs, that it would be well to cause the roots to develope what remaining buds they possess; and hence it would be necessary to provide bottom heat, to give the requisite stimulus, without which they would scarcely be in advance of those in the ordinary soil.

A very mild degree of heat is the best for Asparagus forcing; from 70 to 75 degrees is amply sufficient ; a bottom heat having been provided by means of any fermenting material, or otherwise. The roots must be taken up with as little damage as possible, reserving a moderate ball of earth about each ; such, indeed, in the case of full grown roots, will necessarily occur. The surface of the bed must have a few inches of rotten manure, or old vegetable soil, for the fibres to root into ; and on this the crowns or roots must be set as thickly as it is possible to pack them, space being valuable. The fibres will thus overlay each other, which is quite immaterial When they are all thus placed, some fine old vegetable soil, old tan, or even ordinary soil, must be shaken into the interstices, until level with the crowns.

The opaque protector may now be put over the bed thus prepared ; and if it be a cold period, hot linings may be applied immediately, even covering the roof with litter, if necessary. A bottom heat of 70 degrees, at the least, must, by some means, be maintained for the first fortnight; and by that time the buds will begin to sprout, when a less amount of bottom heat will suffice. It becomes necessary now to use water for the first time, not because they are dry, but in order to wash the soil into every crevice; and the water thus applied, will, of itself, cool the fermenting material, although applied lukewarm. When the soil is thus regularly distributed between the roots, a layer of fine soil or sand, of nearly six inches in thickness, must be spread all over the surface of the crowns, in order to give length to the Asparagus, and to prevent the toughness which would occur, through sudden depressions in the temperature, if left uncovered.

In early forcing, the protectors will still require the addition of litter, or even a renewal of the linings; and as soon as the Asparagus begins to peep through the soil, as much air as possible must be given, in order to impart colour and flavour to the Asparagus; colour is, indeed, indicative of flavour, and cannot be obtained without the influence of both air and light. Light sufficient, however, may be obtained in the opaque protectors by means already described; and every care must be taken, daily, to ventilate as much as possible, as long as the Asparagus can be kept free from frosty air. We would advise those who contemplate an annual supply of forced Asparagus, which, it must be confessed, is one of the greatest culinary dainties we possess, to keep a good breadth in cultivation; indeed, without this it is impossible to carry out such a system. Our practice has been, for years, to force the very best we have, and to continue planting a good stock annually.

Our old beds of course we force, in preference to the off-hand destruction of the roots; the produce, however, is usually small in size, and is converted by the cook's art into what is by them termed "Asparagus Peas."

It should be remembered here, by the amateur, that the forcing is merely developing the latent bud; the size and succulency depending mainly, if not entirely, on high culture in the open ground during the preceding year.

Rhubarb Forcing, in opaque protectors. Following out the classification at page 116, we have now Rhubarb to deal with; the forcing of which is so extremely simple, that we need not dwell long on it. Rhubarb has much improved of late years, through its tendency to sport when raised from seed; and has not only gained in size and succulency, but in precocity: indeed, as to the latter point, some new varieties are so excitable, that as soon as the new year arrives, little more is needed than a tall chimney-pot, placed over the crowns, to ward off the cold winds. Still, however, the Rhubarb tart may be enjoyed before the approach of the new year; its production, too, is easy and inexpensive.

The chief point in successful Rhubarb forcing, is the possession of strong roots, which should not have been much gathered from, or plucked, in the previous season. Indeed, for very early forcing they should remain in the nursery beds, and their growth be encouraged, till required to be placed in the protector. Some persons lay much stress on the superiority of this or that fancy kind, and on the usual degeneracy of seedlings. That such are liable to degeneracy may be true, yet we esteem this but a secondary consideration, when young plants are required merely for forcing. We grow the Victoria kind entirely, and doubt whether there is, at present, a better. Sow seed in March, in drills, thin the plants, giving abundance of room, and keep them free from weeds. In the succeeding February, they should be transplanted into well manured drills, eight inches apart in the drill, and in the succeeding November they will be first-rate plants, admirably adapted for forcing. Our earliest crop is generally forced in the mushroom-house, in pots: here, however, we will point to their culture in the opaque protector of the amateur.

A bottom heat, of some kind, must be provided: we use tree leaves and manure, mixed. From sixty-five to seventy degrees must be ensured to them, for about three weeks, or until they begin to shoot; when the sooner the heat declines, the better: the bottom warmth, therefore, need be but of a temporary character. The roots must be taken up as entire as possible, and placed close together, just as explained for Asparagus; and like it, must have some fine old tan or vegetable earth shaken into every crevice. Little more is requisite than to keep light from the roots; this our opaque protectors will do; and, in severe weather, it may be necessary to protect both the walls at the side, and also to cover the protector over-head.

If the heat becomes too strong—that is to say, above eighty degrees, cold water must be liberally applied until it be sufficiently reduced. Thus a supply of Rhubarb will be secured for several weeks, or indeed until a supply is ready to succeed it, as before observed, from beneath chimney-pots or other out-of-door shelters; this again will be succeeded by plants on a warm slope.

In seasons when Apples and Gooseberries are abundant, Rhubarb is, by some persons, lightly esteemed; but when these are scarce, it becomes acceptable to all; being, as it is, one of the most certain crops, of the easiest culture, and exceedingly wholesome.

307 Forcing Sea Kale. Of all the succulents produced by the forcer's art, none is of more general utility than the subject of these remarks. We may also add, that we have no forcing vegetable so completely within reach of all classes of society. Although its forcing strongly resembles that of Rhubarb and Asparagus, yet having some peculiarities, we must here point them out, being fully persuaded that when the highly simplified mode of culture we are about to propose is well understood, that hundreds will, at once commence its culture; for we see no reason why even the cottager who keeps a cow, and who, of course, possesses warm manure, should not force Sea Kale as early as the middle of January, either for his own use or for carrying to market, if he prefer doing so.

The opaque protectors are peculiarly eligible for this purpose. A bottom heat of 70 degrees, as nearly as possible, being amply sufficient. The bottom heat need only be of a temporary character, for as soon as the Kale has sprouted from two to three inches, the heat should be much checked, or the consequence will be a drawn and worthless produce. It is indispensable that this habit of Sea Kale be attended to; the continued effect of brisk heat upon it induces a more rapid growth than is compatible with the production of strong leaf-stalks; therefore, when vegetation has been forced into action, the heat must be moderated; in other respects, the application of the Protectors may be the same as for Rhubarb,

Sea Kale may be conveniently forced in a mushroom house, where from a bin, about eight feet in length by three in width, almost a dish per day may be cut from the beginning of November till the middle of March, when the open ground will continue the supply. Once a fortnight introduce about a dozen strong roots, making up a bottom warmth beneath them, of stable manure and leaves mixed together. This mixture should be prepared a week or two previously to its use in the pit. Our bin, or pit, is three feet below the floor level, and a boarding rests on the floor, of one foot in depth, and this is surmounted by a lid, hinged to the back wall. Thus the whole appearance, when shut down, is that of a long and huge box. At least two feet of the hot manure is introduced, and on this the crowns or roots are placed as thickly as they can be packed; these, in general, average about a foot in depth, and thus their heads are just level with the floor, having one foot of head room. As soon as the buds have grown two to three inches, we cool down the bottom heat immediately by applying cold water, in each can of which a handful of salt is dissolved, applying it until the heat is greatly subdued, and adding more in a few days, if necessary. The lid, of course, is kept closed at all times, and thus the Kale becomes beautifully blanched. It matters not, however, how cleverly the forcing is carried out, unless the roots are strong and sound, we therefore offer a few hints on its culture.

Sow in the early part of March, in a very rich drill, and when the plants are up, thin them to about two inches from plant to plant, and keep them clean through the summer. In the following February a highly manured, and deeply trenched plot must be prepared for their further culture: here they are to be planted in rows, three feet apart, and at one foot distance in the row. A cleanly course of culture is, of course, carried on through the summer; and, in the end of July, a good soaking of liquid manure should be given, adding a handful of salt to every three-gallon can of the liquid. This is done to cause the leaf to become boldly developed, for as the size of the leaf is, so will be the strength of the crown, By the latter end of October the leaves will begin to perish; and, at that period, trench out the whole stock intended for forcing, and "lay it in by the heels." From this stock the quantity can be drawn, as wanted for forcing. This, then, completes the whole process; but, we may add, that the Kale being a marine plant, and growing principally in saline sands, stiff clayey soil is not well adapted for its culture. Such soils should be thoroughly drained, and a vast amount of sand or ashes incorporated with it. The bed, moreover, in which it is planted, may, in that case, be raised nine inches above the ground-level.

308 MUSHROOM CULTURE. An important portion of the delicacy of forced Mushrooms, whether appearance or flavour be the consideration, depends on their being whitened, or blanched,

especially when used in the button state. As efficient assistants in producing this advantage, our opaque protectors are most appropriate structures. Gardeners in extensive establishments, who possess mushroom houses, and the adjuncts of roomy sheds, generally make their beds principally of what are termed horse droppings; but, for the amateur, we think it scarcely safe to recommend a material which runs into so violent a heat. The gardener, in the former case, is not obliged to ferment his manure; drying it in an open shed for a few weeks, with now and then a turning, will render it what is technically termed sweet. The amateur, with small appliances however, will in general, be compelled, previous to its use, to get rid of some of its noxious gases by fermentation; added to which, it is necessary to reduce its texture in some degree, in order to facilitate the spread of the spawn, which will neither luxuriate in mere straw, nor in a highly decomposed body of a rotten character. He may, therefore, use fresh manure from the stable door, merely shaking out with the fork, and rejecting, the longer straw. This then must be thrown into a heap, until it becomes very hot, and smokes considerably; by which time, say about a week, most of the more volatile gases will be dissipated, and a sort of partial desiccation will be produced. This is necessary at the first sweating, as a part of the end in view, is to dry up extra moisture, as well as to remove noxious gases. It must now be turned and thoroughly shaken to pieces, placing the outsides in the middle. This done, it may lie four or five days, never suffering it to become so hot again, but merely warm, and one more turning will make it fit for the bed.

The brick pits, as suggested for the protectors, will be very proper places to make the bed in; and here, in a week from the last turning, the bed may be built. It must be about a foot in depth, not less, and the manure must be trodden, as hard as possible, in the process of filling. As soon as the bed is made, the opaque protectors must be placed on it to exclude rain, which would nullify the whole proceeding. In about three days the heat will rise, when it is the best plan to bore holes immediately, for the spawn, in order to prevent the heat rising too strongly; the spawn, however, must not be introduced for several days. In another week or so, the heat will have been at its highest point, and begin to descend again, and this is the critical moment at which to introduce the spawn. When spawned, a little litter may be strewed over the bed, inside the protector, to prevent a too sudden decline of the heat, and in about a fortnight the spawn, if good, will begin to spread. The bed may then be soiled over, about two inches thick, any ordinary garden soil will suffice for the purpose; and the soil must be pressed down firmly with the back of the spade.

The spawning temperature should range from seventy to eighty degrees; the subsequent heat of the bed, from sixty to sixty-five; and the atmospheric temperature from fifty to sixty. In winter some covering on the outside of the protector will be needed.

309 Lily of the Valley. This delightful gem of spring is an especial favourite with the flower-loving world; and the more particularly so when forced; for forcing, if rightly conducted, seems to add to its grace and delicacy. A bouquet, composed of white Camellias, Orange blossoms, and the forced Lily of the Valley, is a present worthy the acceptance of a queen, and almost indispensable at nuptial ceremonies, in early spring.

Our opaque protectors are perfectly adapted to their culture, until the blossom bud appears, when they must be gradually inured to the light; avoiding all sun-shine until they are in full blossom. They must, therefore, conformably to our system, be forced in pots or boxes.

We will first point to a few principles, which require attention in the process, and next allude to preparatory culture.

A small bottom heat is requisite; we use from sixty-five to seventy degrees; of course it is immaterial whether it be produced from tanks, or from fermenting materials: if the latter be used, shrub or tree leaves will suit the purpose, with which, a little sweetened, that is, partially fermented, manure, should be mixed. The pots, when introduced, should be plunged completely over head; but as the buds, in rising, would be crushed and deformed by the unequal pressure of the flakes of leaves, little mounds of finely-riddled old tan, leaf mould, or light soil, should be piled over the roots. In about three weeks the buds will begin to emerge through the soil, and then it becomes necessary to expose them to a slight amount of light and ventilation, in order to cause them to rise in compact heads. The pots had better now be placed on the surface of the bed, or only half plunged, and sprinkled with tepid water occasionally, for they love moisture; or, at least, are very averse to dryness. In another week they should be removed to the glazed protectors, or to any shady portion of the greenhouse, where they will gradually unfold without any further difficulty. As before observed, they must be kept from sun-light until in full blossom; for a sudden exposure of them to its influences, when they first emerge from the soil in an etiolated state, would prove fatal to them.

A little preparatory culture will render the forcing of this flower more convenient as well as more successful. A few buds should be planted for this purpose every year, in order to preserve a regular system of supply, and in the middle of March they will require two seasons' culture to make them sufficiently strong. A damp spot should be chosen, such as the back or north border of the kitchen garden; and this should be set out in four-feet beds, making it very rich with well-decayed manure, and adding some boggy heath soil to it. On this, well-blended, mark out circles at fifteen inches apart, the circles about eight inches in diameter, which may be impressed on the soil with an eight-inch pot, held in an inverted position. Within this circle dibble in the roots, putting them very thick, perhaps about two dozen good buds in the whole to each circle, and as soon as planted, cover the whole of the crowns with two inches at least of mellow manure.

Nothing further will be necessary but clean culture, and the picking away of all blossom buds before they expand, for this strengthens the plant much. After two summers' culture in the buds, pot them about the last week of October; and in doing so, merely cut round each circle with a sharp spade, and sink it into a pot large enough, first placing a potsherd or oyster shell, at the bottom, and on it a layer of ordinary leaves, half decayed. The whole stock must then be placed in the "plunging ground" and covered over head a foot deep, with old tan to keep out frost. From this place of safety they may be successively removed to the protectors according to the supply of flowers required; and by such means, abundance of the delightful Lily of the Valley, may be obtained from the early part of December, until they flower in the open soil.

310 Forcing Deciduous Roses in Protectors. We shall not

feel called upon to enter largely into this branch of our subject, although in former days, it was one of the most important connected with the spring decorations of the plant house. Now that such a variety of hybrid Roses are in cultivation; many of them possessing by nature an aptitude for early blossoming, far superior to the old Moss, and Provins or Cabbage Rose; the latter are, and will continue to be, in a considerable degree superseded. Still there are those who will ever esteem those companions of their childhood, and to such we will offer a few cultural hints.

We need scarcely say, that our protectors will afford every facility for forcing them, so as to have them in blossom at the end of February, and a succession until the end of April, if necessary; by which time their congeners in the sheltered border will be giving promise of a continuation of these charming flowers. Like most forcing plants of deciduous character, previous good culture and a due preparation of the plant, are the only sure foundations of success. It requires two summers to produce them in superior order for forcing. Fine clear and young plants should be obtained in the end of February, and planted three in a pot; if strong bushes, laden with blossoms, are desired: the pots about eight or nine inches in diameter. The compost should be two-thirds rich turfy loam, slightly adhesive, and one-third rich manure and vegetable matter, only half decomposed. To this may be added a little charred material and sand, to ensure a free passage for water, for some three or four years to come. When potted they must be plunged in an open spot, (unless a pit or frame could be spared) and here they should be slightly shaded for a few weeks, if the days be sunny. The pots may be covered over with half-decayed rich manure, in the latter part of May, by which time the ground will have become somewhat warm; and nothing more is wanted but to keep them free from weeds and frosts. Early iu the following spring they should be turned round in their holes, to break whatever roots have issued through the bottom of the pots, aud now they must be pruned back with the intent of causing them to thicken. All ground suckers may be cut entirely away, for these seldom produce blooming wood until a second year. By the following November they will be in first-rate order for forcing, and will merely require a slight shortening of the longer shoots, before being introduced to heat. In pruning, the best blooming buds may be readily distinguished from the mere wood buds, by their plumpness, even when in a state of dormancy. Watering, with a liberal hand, is necessary during their preparatory course, and syringing, occasionally, with tobacco water; half a pound of shag tobacco to the gallon, if the Aphides appear.

During the forcing process, a bottom heat of sixty-five degrees will suffice, whilst the plants are in the opaque protector; when, however, the leaf begins to unfold, they must be removed to the glazed protector, where a bottom heat of from seventy to seventy-five degrees will be beneficial. Plenty of atmospheric moisture, liberal syringings, a free ventilation, and a freedom from Thrips and Aphides, are the necessary conditions.

Second Division.

Opaque Protectors employed as mere shelter from severe frost.

311 Cape Bulbs. To endeavour to describe thoroughly the culture of the numerous species of these interesting "Lilies of the field" of the Cape, would lead us far too wide of the objects contemplated at the commencement of these papers. We must therefore rest content, in some cases, with merely pointing to the eligibility of the protectors, for at least wintering numerous half-hardy bulbs; occasionally showing also, that through the whole year, such economical structures would, for very many things, supply the deficiencies arising from the absence of a greenhouse; the latter involving more labour, and much greater expense.

It is, of course, familiar to most of the readers of the Botanic Garden, that the seasons are very different at the Cape from those of our own country; and that a much greater amount of aridity, from a hot dry atmosphere, prevails during a great part of the year. Hence the propriety of providing some kind of cover for the plants of such a climate. Moreover, the wintering such things in cold structures, must be viewed in the light of a retarding process: for the latter part of our summer is the spring of the Cape, and many of these gorgeous flowers are springing into a renewed existence, at the very period that we in Britain are securing a long rest for them. With those who possess stoves or other houses of high winter temperature, the case is somewhat different. Here the Amaryllis, Sparaxis, Ixia, and other lovely families, may be had in blossom at a period identical with their native clime.

We have now, therefore, merely to offer advice to the uninitiated on wintering them ; either for borders or for the spring decoration of the plant house; and also as a relief to the overburdened stages and shelves of such structures. Most of these bulbs are adapted to withstand intense dryness in the soil, for many weeks together; and dry soil suitable for use in the protectors, being a bad conductor of frost, constitutes a favourable feature in the employment of structures, from which it is not possible to keep out frost at all times.

In the opaque protectors, and plunged in dry saw-dust, ashes, tan, or even soil, Cape bulbs, in pots of light compost, will be found to keep remarkably well ; and if a small bottom heat, of tan or otherwise, should happen to be provided, so much the better. In the latter case, they would spring into activity at an earlier period ; and where there is a plant-house, requiring early decoration, this would be a good course to pursue, as they might be removed in succession, according to the state of their growth, to the greenhouse shelf.

The pots, during the winter, should be covered with something to preserve the crowns of the bulbs ; and perhaps nothing is better than the dust of charcoal. Ordinary chaff, too, would be excellent ; and either of these should be applied six inches thick, in the middle of November. Clean dry straw would answer well, or even hay, but great care must be taken that wet does not penetrate through the covering. In very severe weather the protector may be covered with mats, well fastened to the side of the frame, incasing a layer of litter ; and thus they may be closed down for several weeks, without fear of injury.

Some caution is requisite in applying water to these tribes when they awaken with the returning spring. A very little must be given at first, and indeed, until they are perfectly safe from frost, they should not receive any. Most of them will commence growing freely with returning warmth, in their dry soil, especially those possessing solid and substantial bulbs. Many of the smaller bulbs, such as the Ixias, Sparaxis, &c., succeed better if disengaged from the old soil before they commence rooting: repotting them in a mixture of peat, loam, and leaf soil, and placing them in a comfortable situation. Indeed our nurserymen treat many of these tribes as the Crocus; and they may be purchased from their shelves in a dry state, as other bulbs.

It is well for the amateur to remember, that many of what are termed Cape bulbs, may be grown out of doors, in well-drained and snugly-situated borders; but all the larger kinds, as the Brunsvigias and the stronger Amaryllids, must be planted six or eight inches below the surface; it being understood that this is congenial to their habit, and is assuredly a protective plan. Good cultivators generally re-pot them when they have some fresh green leaves, well expanded, and are advancing towards luxuriant growth; and, when in full vigour, they enjoy liquid manure.

312 The Chrysanthemum. We come now to a flower of so popular a character, that no person possessing a greenhouse, frame, or pit, should think it complete without at least a few varieties of these harbingers of winter. Chrysanthemums are much increased in value and interest from the circumstance of their coming in to fill up the gap occasioned by the loss of the Dahlias; for these generally fall the victims of a single night's frost in October; which comes, as it were, in advance of the great enemy, that lingers in ambush till later in the year. The latter plant, in gorgeous show, has delighted us in our out-of-door walks; and now, in autumn, when we are seeking the comforts of the house, the other attends us within doors, and compensates for the loss we have sustained.

The Chrysanthemum is grown by a variety of methods, occasionally not unmixed with whim; some persons endeavouring to grow them as gigantic as possible; others, with Chinese propensity, aim at dwarfing them; and a third party, regardless of size, seek only a prominent display of their beautiful flowers. Those who possess conservatories, or other such structures, generally follow out the first practice; whilst those who possess but a small house, or pits, resort to the dwarfing system; which indeed is in part practised for the conservatory, as small plants are required for front situations, as also for furnishing baskets, stands, or vases, in the drawing room, or balconies. As the dwarfing system offers many conveniencies, and for which

307. AUCTARIUM.

the protectors are admirably adapted, we will deal principally with this mode.

Some growers propagate by cuttings, some by suckers, and others by layering. We recommend that by cuttings, as the most certain; nevertheless, the most dwarf plants of all, can be produced by the layering system. To begin with the old plants, from a selection of which, of course, the next year's plants are to be produced. Such being gradually hardened, and inured to out-of-door work, may be turned out of their pots, into a bed of very poor soil, in the course of February. We say very poor soil, for the suckers have always a tendency to grossness; and, consequently, when in rich soil, they become "long-jointed." This is opposed to the end at which we aim. By the early part of April, or it may be a few weeks later, suckers will be six or eight inches in height, and cuttings may be put out forthwith.

An ordinary hand-glass, out of doors, will certainly suffice to preserve them, but a moderate amount of bottom heat will be advantageous; and such being available in the glazed protectors, they can be propagated with facility; especially if propagating glasses can be placed over them. About soil, and the mode of making cuttings, we need say little: the cuttings, however, should be short, about four joints are enough. As soon as "struck," they should be "hardened off," and may remain for a few weeks, in pots, without disturbance; observing to keep them as cool and airy as possible; and in order to render them dwarf, a low temperature is absolutely necessary, and, of course, a free exposure to light. In a short time they will attain a stout and somewhat stunted appearance, and must be "potted off." A good plan is to place three in a five-inch pot; this we think far superior to a single plant: soil we will advert to anon. Thus potted, in about three weeks they will be well established, and, in fact, will be growing freely; and at this period we pinch off the top from every plant. Liberal waterings will be necessary through the whole course of culture, more especially when the pots become filled with roots.

When the five-inch pots are filled, give them, at once, their final shift; the size of the pot employed must in some degree be influenced by the situation they are finally to occupy. A seven-inch pot will grow them in tolerable perfection; but the larger the pot, of course, the finer the blossoms will be. It now becomes necessary to place them in an open situation in the garden, and to water regularly: nothing is more injurious than drought, although but for an hour. Towards the end of September they may be placed under cover, observing to give all the air possible: liquid manure will now be of much service, and henceforth, all suckers must be trimmed away, until the flowering is past; this indeed must be practised through the whole course of culture. For compost we use rather more than one-half of sound loam, the other half being composed of leaf-mould and rotten manure; adding a little sand and charcoal siftings.

313 Lobelias. It must be borne in mind, that we are giving a mere epitome of the culture of the plants, enumerated at pages 116 and 117. This must be an apology for not entering into those minute particulars, which, in general, garnish the details of culture, as expounded by those, whose whole life is spent in examining the exact dimensions of a Dahlia, or the orthodoxy of a notion, as to the correctness of outline in a Pansy blossom.

These papers are intended to point to a few simple principles; not merely the highest point of culture in a specimen or two, but by which those, who taking a close interest in gardening, through leisure and taste, may conduct or dictate the necessary operations. We therefore feel it a duty to point to a few features in culture which, whatever may be added, must not be forgotten.

The subject of our present remarks, however, is familiar to most persons; and before proceeding farther, it may be well to state, that these observations are not intended to apply to the annual Lobelias, or to the trailing perennial kinds of the greenhouse. It is to those glowing scarlet and crimson kinds (of which the old Lobelia fulgens may be considered the type), that we would direct attention. These, it is well known, die down, as gardeners term it, every autumn, and long before the decay of the annual shoot, nature has provided a numerous progeny in the character of underground suckers, from which the plants for the future year must be selected. The best plan is to take them up in masses, without disturbing the roots, and to sink them into roomy pots or boxes. This must be accomplished in the early part of November, and no water should be given: they merely require some mellow soil, almost dry, packed closely round the balls. They may thus be immediately transferred to the opaque protectors, for they will require no more light than the protectors afford, until the beginning of the succeeding February, when they will require to be put under a course of high culture. If the winter prove very severe, some dry and clean litter or dry sawdust, may be placed over them inside the protector; these materials, however, must be removed the moment the severe weather has passed away.

We now feel tempted to offer a few brief remarks on their early spring culture; and, indeed, we feel it a duty, not only that our directions should conduct them into the opaque protectors, but also out again, for they will probably demand a refuge in the glazed protectors.

In the beginning of February our practice is to remove these store pots of Lobelias to a warmer atmosphere, to cause them to awake from their torpidity. Thus they remain in their store pots or boxes until suspended animation is restored, when they are broken to pieces, and each young plant separated, and planted three in a three-inch pot, for we consider that these threes, well-cultivated, form a fine group; one single stem alone not being calculated to produce the desired effect, in modern gardening.

A warm and moist atmosphere now becomes necessary, and nothing can be more suitable than a bed of fermenting materials if at hand. The shady part of a cucumber or melon frame is particularly suitable; effectual shading will be indispensable for a week after their removal, if the weather prove very bright. As to compost, equal parts of sound loam, decayed manure or vegetable matter, and sand, will be excellent: or half ordinary garden soil, and half manure will suffice, or such a material as an old mushroom bed. In about three weeks the pots will be filled with roots, and it will then be necessary to commence the process, termed by gardeners, 'hardening off.' We need scarcely say, that the glazed protectors, or any ordinary frame, will assist in accomplishing this: no plan is better, however, than the ordinary greenhouse, or a vinery, or peach house; as they must be placed where there is no artificial heat whatever.

By the end of April they will be fit to plant out in the flower garden, and a rich soil is most desirable; as the more luxuriant they become the more blossoms they produce. Above all the elements which conduce to their successful culture, water is the most essential; the waterpot, therefore, must be frequently in request.

In planting them out it is well to keep the ball of soil a little below the ordinary ground level, in order that moisture, when administered, may lodge permanently about their stems; for they produce innumerable surface fibres, which, as the season advances, may be nursed with a top dressing of manure.

Before closing our remarks on the Lobelia, it is well to observe, that they form no mean objects in the summer decoration of the conservatory. Such need never be "hardened off," as previously, but may be inserted in large pots, on the "one shift" system, betimes in the season. A liberal drainage must be given, and the plants placed much below the surface of the pot rim. As they advance in growth, they may thus receive a top dressing, and, of course, liberal supplies of water.

314 CYCLAMEN. Here we have an interesting family, to the culture of which the means of the amateur, whose establishment is somewhat limited, are peculiarly adapted. Some of its species, moreover, are perfectly hardy, and therefore do not form legitimate subjects for our present papers; which, of course, are in the main, intended to explain the use of the protectors we have recommended, or the ordinary frame, as the case may be. The Cyclamens are, for the most part, early spring flowerers; indeed, nearly all, with the exception of Europæum, which is one amongst the most interesting of autumnal flowers that we know; although somewhat difficult to procure true, hederæfolium being sometimes substituted for it, by ignorant or interested dealers. Both Cyclamen Europæum and hederæfolium, are British or indigenous plants, and called weeds, simply because they are British, a distinction which we cannot admit. An exotic, or foreign plant, is as truly a weed when it becomes injurious to a crop, as a native one; and, on the other hand, a useful British plant, under cultivation, cannot, with propriety, be termed a weed.

We will now elucidate the culture of the tender kinds of Cyclamen, and in doing so, we may as well take Persicum as the type; for whoever can grow this in perfection, need not doubt of success with the rest. Being all natives of the south of Europe, they of course require from the hand of the careful cultivator some protection from the harsh usage of a more northerly climate. The Cyclamen Persicum should be raised from seed, although it may be increased by division of the root or tuber. The latter plan, however, is not to be recommended; we have often tried it, but the mutilation occasioned in dividing them is so severe that they never fairly recover. Nothing but the most urgent necessity should induce the cultivator to adopt such a method of increase.

The seed of Cyclamen Persicum is generally ripe about April or May, and should be sown immediately. A shallow pan or box will be eligible, and above all things the drainage must be complete; for they cannot endure the least stagnation of moisture. Much care must be taken to cover the seeds thinly, yet securely; and, as they will not germinate for several weeks, we would advise that they be covered with wet sphagnum, or moss of any kind; and if this can be kept damp, without pouring water on the soil, the seeds will be safe; for, in all probability, they will not vegetate until the period at which the dormant roots of the parent plants begin to awake from their torpidity.

In the mean time, place the seed pan on any shady shelf of the greenhouse; and when the young plants begin to appear, regular attention, in regard to gentle waterings, &c., must be given them; and they may subsequently be left to enjoy a light and warm shelf in the greenhouse, or in the glazed protectors. The soil in the pan containing the seed must be kept somewhat moist, and must, of course, be occasionally watered; for a desiccated, dusty compost, will assuredly, not be suitable. About soil we will make mention in due course. We now come to the subsequent treatment of the young plants.

The best plan is to keep the seedlings in a state of high culture, as long as they show signs of a tendency to active vegetation; and to this end, a temperature of sixty degrees, or nearly so, a light shelf, under glass, and slight but regular waterings, are the requisites. Towards the month of June or July, these young plants will evince their desire for their annual rest, which although partial in character, is still a cessation from active growth; and, under such circumstances, it is necessary to withhold, in a great degree, the amount of water they have heretofore received.

In the third year the seedlings will be strong flowering plants; indeed, by high culture, and the best appliances, they will sometimes attain to this state in the second year. Their subsequent treatment is, of course, that of the mature plants; viz., warmth, and a regular supply of moisture during the growing and blossoming season, and a partial withdrawal of moisture and other exciting causes during the period of rest.

When the plants are strong with age, it is the best plan to turn them out of their pots, with their balls whole, every June, into an elevated bed, made for the purpose, in the kitchen or reserve garden. They will thus make strong roots, and much finer plants, than by keeping them continually imprisoned in pots. Of course, they will require to be re-potted with balls of earth about their roots, early in September, each year; and they should then be placed in the glazed protectors, or frame, or on a shelf in the greenhouse.

For compost, take of open sand one part, charcoal dust one, light soil or sandy loam two, fibrous bog or heath soil two, and of half-decomposed leaf soil three parts. We may here observe, that the tender kinds must have protection; during the growing season the glazed protectors, the greenhouse shelf, or the drawing room window, are all eligible situations; during rest, the opaque protectors. The Europæum and hederæfolium, and we may, perhaps, add coum, are, of course, perfectly hardy.

315 Roses, various, in Pots. Here we have a noble and varied group of universal favourites; for, whilst many of our popular flowers have succumbed to the dictates of fashion, the Rose not only maintains its ground, but seems destined constantly to advance in our estimation. In offering remarks on the eligibility of an opaque protector, for furnishing a hybernatory for the more tender kinds, we must of necessity allude to the classes into which they are divided, with their respective habits. We will, of course, not include the Moss, the Provins, or indeed any of the strictly deciduous Roses; for they, in general, need no protection, beyond plunging up to the rims in any open situation out of doors. But many of the Tea, the Bourbon, and the China Roses, with the various hybrids of either class, require some slight protection, whether in pots or out; and, indeed it is well as to those in pots, to make a point of housing all that are truly valuable during the early part of October. We here

merely allude to pot Roses, intended for the future decoration of the flower garden: but another object frequently exists, which is, a desire to preserve those late growths on some of the perpetuals; which with a little assistance in a greenhouse, the glazed protectors, or a forcing pit, will serve to embellish the plant house or the drawing room in February.

Such, however, cannot be expected to succeed very long in the opaque protectors; and we name these by the way, merely to show that even these may find an asylum in such structures, for a few weeks, if room cannot be spared for them in glazed structures. Whilst in such a situation, they must have all the air possible, merely protecting them at night from severe frosts.

But to return to pot Roses in general: every one desirous of having abundance for bedding purposes, and for the general decoration of the borders, should propagate liberally by cuttings during June and July. All kinds will root freely, provided the wood is in proper condition; more especially the Teas, Chinas, and Bourbons, which, in the main, contain our best bedding varieties. The shoots used for this purpose, should be those first produced in spring, or rather early summer; because a long and genial season lies ahead — a season affording abundant time for both facilitating their rooting, and for potting off, and thoroughly establishing the plants. Such in the hands of a good cultivator, may be well established, in five-inch pots, by the middle of September; and if housed, at that period, in any of the protectors, or in frames, will constitute a capital reserve stock for the ensuing summer; whether for beds, borders, for specimen plants in pots, or for autumn decoration in the plant house.

It is well known to the gardening world, that much controversy has been for some time carried on, respecting the kind of stock most suitable for budding Roses upon. Some prefer the Dog Rose stock, some the Boursoult, whilst others give all praise to the "Manetti" stock—a new kind made public by Mr. Rivers. Now, without assuming anything in the way of arbitration, in so delicate a matter, we may just observe that it would be well, probably, to take into consideration the kind of soil into which the worked Roses are ultimately to be planted. Every body knows that the ordinary Dog Rose luxuriates in an adhesive soil; whilst the Boursoult and Manetti would appear fitted for our lighter soils. We may, however, just observe, that some of the finest pot Roses we have ever seen exhibited, as to size of flower, were grafted on an ordinary apple-tree shoot, this spring, and plunged immediately in a propagation pit: at least so said the gardener who produced them. The kinds were Smith's Noisette, Devoniensis, Eliza Sauvage, Saffrano, Souvenir de la Malmaison: the blooms were enormous.

316 Endive, blanched. For the preservation of this, the opaque protectors will be admirable. If they are used for this purpose, there will be no necessity for blanching it previous to introduction, unless wanted speedily for use. Endive, of course, will not keep so long after this process has commenced; therefore it will be well to insert a quantity of full-grown plants in the protectors, towards the end of October, placing them close together, and, of course, removing a ball of earth with each. These can be tied in succession, but the bands must not be very tight; for through the opacity of the protectors, and close planting, they will nearly blanch without tying. The only requisites will be all the air possible, complete security from frost, and even the slightest shower of rain.

317 Lettuces. These, if already in course of blanching, or commencing that stage, will keep in opaque structures; but if they are to grow and enlarge in the protectors, light is absolutely necessary. Those blanching may be taken up, before being injured by frost, and treated as Endive.

318 Parsley. It is a common practice, of late, to put some superior Parsley in pots, in order to provide against a severe winter. Of course, such will keep admirably in the opaque protectors, with plenty of air, although it will become somewhat pale, if kept in many weeks.

319 Violets. The Neapolitan is the safest winter-flowering kind; the new perpetual Tree-Violet is, however, very handsome and sweet. The single Russian succeeds well out-of-doors. If Violets are required all the winter, a glazed protector will be necessary; and the greatest amount of success is obtained by using a slight bottom heat, say 55 to 60 degrees. Give liberal ventilation, and protect from rain and frost.

320 Ericas. These may be protected in the glazed structures by having ample covering. They are, however, very subject to mildew, through a stagnated atmosphere, and must have abun-

dance of air, on all possible occasions. They should be on a stage, if possible; otherwise, coarse cinder ashes will make a very good bottom. They will require very little water during winter; when indispensable, give it liberally.

321 Oranges. If there should not be room enough, during winter, in a glazed structure, Oranges may be preserved in an opaque one, for a month or so; for they bear partial deprivation of light better than most plants. Frost must, of course, be excluded.

322 New Holland Plants. Such, with a few exceptions, may be wintered in the glazed protectors. Comprising, however, not only genera, but species, differing much in habit and degrees of hardihood, caution is necessary. Let them have abundance of light and ventilation. They may stand on a stage, as the Ericas, or on ashes: frost, of course, excluded.

223 Succulents. These, as a class, are certainly not quite at home in the protectors, inasmuch as they are averse to damp air, if accompanied with a very low temperature. We have, nevertheless, kept the tall Cacti, for many winters, as a matter of necessity, in a cold pit, taking care that the soil in their pots and the interior of the pit were perfectly dry when they were housed. Of course, rain should not be permitted to reach them; and the structure must be a glazed one. Exclude frost and withhold water, until the middle of February, when they ought to be transferred to some greenhouse shelf, if possible.

224 Carnations. If these are not taken under cover until the middle of November, they may be preserved tolerably well in the opaque protectors, providing they are kept dry, and allowed to freeze slightly when frosts occur. They will require much air, and when frozen ward off sunshine.

325 Mignionette. This may be treated as Violets. A little tepid water will be necessary, once a week, but avoid wetting their leaves.

226 Bedding Plants. Here we have an extensive group, differing much in habit. Most of them, however, may be well preserved in the glazed protectors. Such as Senecio, Anagallis, and some of the trellis climbers, as Maurandia, Lophospermum, &c., must be kept in the greenhouse, or they will be almost sure to perish. As belonging to this group we may mention Lobelia, Salvia patens, &c., these, if dry, may be stored away in almost any situation, where frost cannot reach them. As to bedding

plants in general, if they are from an early propagation, and consequently well established in their pots, they may be preserved with facility, in any ordinary structure, without artificial heat, providing they are tolerably dry in their pots, and kept free from all moisture of an extraneous character, until the end of January, by which time some few may require a little water. Every means must be taken to dispel accumulating damps, by a most liberal amount of ventilation. During very severe weather, they must be not only covered with mats, but have a thick coating of litter over the mats, and it is well to add another course of mats over the litter. The sides of the protector, or frame, too, must be protected with soil, or lining of some kind.

If they should be slightly frozen, they must be carefully scrcened from suushine till the frost ceases, and then gradually thawed : this is best done by tilting the lights about a couple of inches, leaving the shading on until the next day at least.

327 Potatoes. We now come to an article which, to produce early, requires a little artificial bottom warmth. Potatoes may be forwarded in the first stage, without any special provision of the kind; and, indeed, it is the very best plan with the ash-leaved kidney, which is by far best, when established in pots before planting. Our practice is to insert single whole tubers of the middle size, in five-inch pots, about Christmas. These are placed in any dark room or structure, where a fire is kept occasionally, covering the pots over with moist litter, to prevent the soil drying up in the pots. In less than a month they will be up, with strong shoots, and may at once be planted in a prepared frame, or the protector, with a bottom warmth of about 70°. If this be made of fermenting material, it should be old and half-spent, for the sooner the bottom heat declines, after the Potatoes are six inches high, the better. Of course, when once above ground, they must have plenty of light and air, and be well protected from frost.

328 Carrots, Early. Their treatment is simple, and similar to the Potato; the opaque protectors, if at liberty, will forward them a little, without bottom warmth. Sown, however, in a glazed protector in January, with a slight bottom heat, they will be obtained very early.

329 Radishes, May be sown in alternate drills with early Car-

rots; or even between the early Potatoes. Being of secondary consideration, no special provision need be made for them.

330 Kidney Beans. We cannot recommend an attempt to produce these at a very early period in the glazed protectors. Few without a greeenhouse can sustain the desired warmth, for they require as high a temperature as Cucumbers to insure success. Any one commencing with a glazed protector in the early part of February, with a bottom warmth of eighty degrees, may succeed very well. If any warm shelf in a house is at liberty they may be sown in pots and turned out subsequently.

331 Cucumbers. The glazed protectors will be most admirably adapted for those who, desiring an early bed, wish it also to continue in bearing all the summer, for this saves trouble and expense. In such case young plants should be reared, if possible, in a small frame; and if ready to plant out by the first week in February, they will be early enough to give the amateur a safe chance. A bottom warmth of seventy-five to eighty degrees should be guaranteed them through their earlier stages, and an atmospheric warmth never sinking below sixty-five, nor rising above eighty, If fermenting material be used, great care must be taken in thoroughly fermenting and turning it.

332 Melons. The treatment of these is so similar to that of the Cucumber, that we need add little here. Five degrees of heat in advance of the Cucumber will be found beneficial.

333 Strawberries, Whether planted out in pots, the glazed protectors, or even ordinary frames or pits, answer well, providing they are not required particularly early. Strawberries enjoy a steady bottom heat of seventy degrees, whilst the atmospheric may commence at an average of fifty degrees, advancing weekly about three degrees, until sixty is attained; at which point they will succeed better than at a higher temperature. They require abundance of air whilst in blossom, and a liberal amount whilst ripening, and during the latter period they must be kept rather drier than previously.

FINIS.

THE

BOTANIC GARDEN.

INDEX

TO THE

AUCTARIUM.

PART II.

FINIS.