The Art of Propagation.

A HAND BOOK FOR

NURSERYMEN,

Florists, Gardeners & Everybody.

Price, 50 Cents.

PUBLISHED BY

JENKINS' GRAPE AND SEEDLING NURSERY,

WINONA,

COLUMBIANA COUNTY, OHIO.

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THE ART OF PROPAGATION.

Jenkins' Grape and Seedling Nursery,

Winona, Columbiana, Co., Ohio.

By J. JENKINS.

PREFACE.

IT has not been the design, in this little work, to produce anything elaborate, or exhaustive of the subject, but rather a brief digest, concise, practical in its bearings, combining much in little. Covering the points of greatest interest to the practical nurserymen, avoiding, as far as may be, technicalities, and giving clear hints and directions that would have been worth hundreds of dollars to us in our own early experience.

ART OF PROPAGATION.

There are, in reality, but two ways in which trees and plants multiply themselves.

1st. By seeds.

2nd. By buds.

A Seed

Is the ripened ovule, the product of the fertilized flower of the plant and consists of an outer covering, be it one or more coats, and the kernel.

The kernel is the living organism, with food in store, and consists of the embryo, a miniature plantlett, with the life-principle and the albumen which nourishes the plant until the time that it can feed itself from the soil. The embryo consists of a stemlet and seed-leaves (Radicle and Cotyledons) lying dormant, but ready to burst forth into life when surrounded by the proper conditions of heat and moisture.

A Bud

May be compared to a seed, but is more completely developed, more intimately connected with, and carries within itself a more intense image of the parent.

Buds broken from our forest trees and sown with care, can often be made to grow.

Some plants naturally multiply themselves by throwing off buds of some kind. The potato tuber consists of buds with a store of nourishment, all formed and thrown off from the roots, or rather from underground stems connected with the roots of the potato plant. Similar instances are found in the artichoke, dahlia, the bulbs and corms of the lily, the crocus, etc. The strawberry throws off buds from its runners; the blackcap raspberry from

the tips of its canes; other raspberries and blackberries from buds formed on the roots. The seed in all plants produces an individual which, though of the same species, differs to a greater or less extent from the parent; whereas the bud plants are a simple and exact reproduction; being, indeed, a part of the original plant, but separated and self-supporting. The seed propagates the species, the bud, the individual.

A branch cut from a tree, in its main features, resembles the tree entire, and the analogy may be traced to the twig and to the leaf.

A skeletonized leaf forms a miniature picture of the tree on which it grew. Even a fraction of a plant-leaf is made to produce an entire plant in the hands of the florist.

Seed Propagation. Raising of Forest Trees.

Seeds to germinate must have the proper conditions of heat and moisture. These conditions vary greatly with different seeds. The moisture in which one kind of seed would flourish would be destructive to another class, causing them to rot instead of forcing growth; and the heat necessary to start one class of seeds would dry up and utterly destroy the germ of another class. So that experience and close attention are necessary to successful propagation. The propagator should be an earnest student of nature, a close observer of the wants and habits of trees, and plants, and able, constantly, to draw hints and instructions from what he may see. Most of our forest trees ripen their seeds in the Fall. When the autumn winds blow, and the rains come, they fall to the ground. Then the leaves, having accomplished their mission on the tree, loosen their hold, fall to the ground with the seed, and in their death cover and protect the young germs of the new life.

As a general rule, forest tree, and many other seeds should be planted in the Fall soon after they ripen, or, if reserved for Spring planting should be mixed with earth, moss, leaves, or other material to prevent drying, imitating, in a measure, the conditions and protection as observed in nature.

Seed of the Nut-Bearing Trees.

For seeds of this class, as acorns, chestnut, hickory, black and white walnut, &c., the open field, if of mellow, rich soil, makes a good and sufficient seed bed.

After the ground is thoroughly cultivated mark out with a plow as for corn or potatoes, planting the seeds closely in the light furrows or drills.

The drills may be made at any convenient distance. If cultivated with the hoe they need be but a foot apart; but, unless cramped for room, they had better be sown in broader drills, and the drills three or four feet apart so that the space between them may be stirred with the horse hoe or cultivator.

If the planting is done in the Fall it is better to mulch the ground with straw, leaves, marsh-hay, or any like material; this will prevent baking of the soil after the spring rains, and keep it in a nice mellow condition. The mulching should be removed in the Spring, or, at least so much, that it will not interfere with the growth of the young seedlings.

The Smaller Seeds.

Such as maple, white ash, tulip, linden, magnolia, etc., require more care in planting.

Let the soil be thoroughly pulverized, then throw up into beds a few feet wide, and any desirable length. Mark out and plant in drills by placing a board across the bed and making the drill along the edge of the board with a sharpened stick, or, with the corner of the hoe; then sow the seed in the drill as you would peas, or beet seed; cover lightly, and then turn forward the board for a new drill. The width of the board regulates the distance apart of the drills, and as such seedlings are not usually allowed to grow more than one year before transplanting the board need not be more than eight or ten inches wide. Mulch with straw if planted in the Fall, removing the same in the Spring.

Magnolia Seed.

There are a few kinds of seed that require special treatment. Those having a pulpy, oily covering will not grow well unless this

pulp is removed. After the red seeds of magnolia are gathered from the pods put them in a tub, or bucket, with enough water to barely cover them. Stir occasionally. In a few days the red, pulpy covering will be softened and may be rubbed from the black seed, or seed proper, in the hands; or, place the seeds in a coarse sieve and rub the pulp through the meshes into a running stream. The meshes of the sieve must be fine enough to retain the black seed. Then mix lime or wood ashes with the seed to cut the oily matter that appears to interfere with germination, and they are ready for the soil.

Another Method.

The pulpy seeds may be mixed immediately with a quantity of ashes, unleached; then if set in a cellar and kept moderately moist the pulp will be found by Spring mostly removed from the seed by the alkali.

White Ash Seed

Will seldom grow the first season after planting, unless subjected to special treatment. The theory is, with this and many other seeds difficult to propagate, that there is a gummy, resinous, or oily epidermis that interferes with the action of the air necessary to produce germination. Excellent results have followed the immersion of such seed in an alkali, in acetic, or dilute sulphuric acid. Care must be used, however, that the acid, or alkali does not destroy the integuments of the seed in addition to this air-proof covering.

Red and Silver Maple, Elm., &c.,

Ripen their seed late in the Spring, or early Summer. They will keep but a few weeks, and should be planted immediately. Silver maple seed planted in June will often make a growth of fifteen or twenty inches by the last of October. Birch seed can be kept in sand in a cool place and planted the following Spring.

Gathering of Seeds.

Seeds of the nut-bearing trees are easily gathered, but with maple and other small seeds the operation of gathering from the ground is exceedingly tedious.

Seed of Maple.

If the tree can be spared it may be cut down when the seed is nearly ripe and first begins to fall. They can then be

rapidly stripped from the branches by hand. On small trees they may often be gathered from the branches without cutting the tree. In gathering, after they have fallen on the ground, the leaves must first be raked off, and the seed gathered up mainly, by hand picking.

Tulip Seed

Is gathered when the cones first begin to open. The cones, which are made up of seeds, are usually picked from the tree by an active climber. Our northern

Magnolia--Acuminatta--Seed

Grows in pods, closely resembling a young green cucumber; hence the name cucumber tree. These pods may be gathered after they have turned a red or pink color, and begin to open, showing the red seeds. Spread them out in the air after they are gathered. In a few days the seed is readily shelled out.

Preservation.

Seeds are kept in various ways. Some kinds preserve their vitality for years; others, but for a few days, or weeks. Some must be kept entirely dry, as the least moisture starts the germ and they are spoiled, unless planted at once. Others, as the chestnut, will be ruined if allowed to dry to any extent. Evergreen seed, rich in oily, resinous matter, must be kept dry, and in an airy situation. Generally it is safe to follow nature's method as nearly as we can; by placing the seed in thin layers on the ground, and covering them with partially decayed leaves, or mixing them with moss, or sand, moderately moist, and keeping them in a cool place.

Shipment.

Seeds having an outer covering, or pulp, as magnolia, dogwood, &c., should have the pulp removed, or be partially dried to prevent fermentation. Then pack in sacks with dry moss or charcoal. Chestnuts may be packed in moss, only damp enough to prevent drying. Walnut, hickory, etc., with the hull removed, may be shipped in bulk, in boxes, or sacks, without packing material, but should be mixed with sand to keep them fresh and ready for growth as soon as received. Evergreen seeds must be dry, and care used to keep them dry while in transit, and, indeed until near the time of planting.

Evergreen Seedlings.

The seed of evergreens is always found in cones, with the exception of the juniper, and yew, which produce small berries; hence, the general name applied to evergreens of coniferrae, or cone-bearing. The seeds are found at the base of the shells composing the cone, and instead of the two seed leaves, (cotyledons) and primary stem, (radicle) as usually found in other seeds, the coniferrae is composed of a whorl of from two, to as high as fifteen seed leaves. The seeds are composed largely of a resinous, or oily matter, which is liable to become rancid. Hence, great care is needed to preserve the vitality of the seed, and they will keep best in their natural receptacles, the cones.

The Soil

Most suitable for raising conifers is a light sandy loam, rich in vegetable matter, but entirely free from rank manures. The soil should be deeply spaded and thoroughly pulverized. Then lay off in beds four feet wide, and any desirable length, with alleys of one foot between. The beds should be rounded in the middle, the sides being but little higher than the alleys. The seed is usually sown broadcast and then carefully and lightly raked in; but some prefer sowing in drills a few inches apart, then rolling, or pressing with back of the spade, and sifting over them a very light covering of soil (never more than one-eighth to one fourth of an inch.) The seeds are sown thickly; one-pound of Norway Spruce should cover a space of twenty to thirty feet in a bed four feet wide. The ground should be prepared the Fall before, and the seed put in at the earliest possible moment in the Spring. Some propagators do not wait for the frost to leave the ground when they can find sand or soil to sift over the seed. Most failures arise from not having the seed beds partially shaded. If hot sunshine falls on them while the seeds are swelling, and cold follows, a large proportion will rot before they appear above the ground. When seedlings are raised extensively artificial arbors are made high enough to work under, by driving posts in the ground and nailing on them boards or poles, thus mak-

ing a trellis several feet above the beds, then putting slender poles across, and covering all with bushes and branches of trees with the leaves on. This arbor should be constructed the previous summer. Where the growing is carried on on a less extensive scale, stakes are driven at convenient distances along the sides of the beds to which boards six inches wide are nailed, to support screens for shading the young seedlings. The lower edge of these boards should be but four or five inches above the surface of the ground, thus allowing the air to circulate freely over the beds.

Lath Screens

Are made of plasterer's lath, placed one to two inches apart, and fastened by nailing to a lath across each end. They form a convenient, portable shade where the space to be covered is not too great, are light, easily removed and replaced, and, with care, will last a number of years.

The Germination of the Coniferae

Often requires from thirty to sixty days, they being slower in swelling and bursting their coats than many other seeds. Sometimes they will lay dormant one season and come up nicely the next; hence if they fail to grow the first year it is well to examine the seed, and, if it remains plump, with fresh-looking kernels, keep the beds weeded for the next season.

Damping off.

The critical period for the young seedlings extends over six or eight weeks from the time they make their first appearance, or, until they form their secondary leaves. They are extremely sensitive to external influences, a little excess of drought, heat, or moisture proving ruinous, rotting the stem off at the surface of the ground.

Rainy, hot weather, or a warm rain saturating the beds after they have become very dry, will often cause them to damp off by thousands. The destruction may often be arrested by sifting dry sand over the bed.

Protection for Winter.

In the Fall the young seedlings should be covered with leaves, straw, or marsh-hay, which will prevent them from being drawn out by the frequent thawing and freezing.

Fruit Tree Seeds.

As these are liable to vary from the parent they are usually planted by the nurserymen for stocks, on which to bud or graft particular varieties.

Apple Seed.

Is usually obtained from the fresh pomace at the cider mill. The seed is separated by washing in water; having a greater specific gravity it settles to the bottom, while the pomace floats. The hand washing process is very tedious, but where there is a running stream of water they may be separated more rapidly.

Ordinary Seed Washing Arrangement.

Sink a long box in the bed of the stream, (say two feet wide by eighteen inches high) nail a board across three feet from the upper end, ten inches high, or about one-half the height of the sides of the box, and every two feet to the lower end nail across still narrower boards, or cleats. Throw in and stir the pomace in the upper end. This separates the seed, which settles to the bottom while the pomace floats over with the running water. Some of the seeds will be washed over the first division but will be caught by the lower cleats. After the pomace is washed off the seed must be panned out, that is, shaken up with water in a pan, or other convenient vessel, the fine pomace and other impurities that have settled with the seed will thus be shaken to the surface and easily separated.

A very simple and effective apparatus has been invented, which separates the seed at one operation, and far more rapidly than by any other known process. It entirely dispenses with the

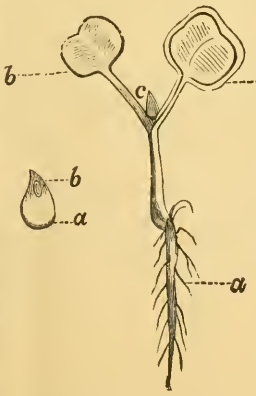
panning off process, and enables the operator to get out seed at a tithe of the expense of other methods. See page 2 of cover.

Drying.

The seed should be spread out to dry in an airy situation, but not exposed to the full rays of the sun. It should be frequently stirred to avoid mildew and heating. The process will be hastened by spreading very thinly on floors or shelves where the air has free circulation.

Planting.

If the seed is for home use the tedious process of drying may be avoided. If sown in the Fall mix enough dry plaster or sand with the seed to take up the moisture, and to allow it to run freely from the hand or drill. If sown in the Spring thoroughly mix the seed with four or five times its bulk of sand, then keep in a cool, shaded place through the winter. Freezing and thawing will not injure it while in the sand, and is, by many considered an advantage. The seed and sand may all be sowed together in the Spring. Seed kept in this way sprouts very early and should be put in as soon as the frost is out and the ground can be prepared.



Apple Seed and Young Plantlet.

Preparation of Ground

Is much the same as for other seeds. Some plant in beds as recommended in the management of the smaller forest tree seeds. But they are usually planted in drills 15 to 20 inches apart in the open field, and cultivated with a narrow horse-hoe or cultivator designed for the purpose. The best soil is a deep, rich, clay loam. Sandy soil encourages the growth of too many lateral roots instead of the long tap root desired in stocks. To encourage length of root the ground should be sub-soiled and deeply and thoroughly pulverized before planting.

Fall and Spring Plantings

Each have their advantages and drawbacks. Fall planting is more easily managed; the extra care of keeping and re-handling the seed is avoided and a start is made on the Spring work—Spring being a time full of care and perplexity for the nurseryman. On the other hand, the ground, unless very sandy and porous becomes baked and solid before Spring so that the little seedlings cannot break through to the light, being literally smothered. This difficulty is avoided if the ground is mulched with coarse manure or straw immediately after planting in the Fall.

The Planting of Pomace

Directly from the press is sometimes successful. It is scattered in broad drills and covered lightly with soil. This process is not very popular, however, as the pomace sours the ground. The seedlings often come up irregularly and appear to be stunted in their growth.

Sprouting Apple Seed.

When the seeds are dry they should be put to soak a week or ten days before planting; change the water daily, pouring warm water over them, if it is desired, to hasten the process.

They may then be mixed with sand and exposed to the heat of a hot bed, stirring frequently to prevent fermentation and to secure an even start.

As soon as they show signs of piping, or sprouting, they should be immediately planted. Sometimes a thin layer of seeds are placed between wet blankets and put under the stove, or near the flue in the Green House. This causes them to sprout very quickly.

Digging Stocks.

If the seedlings have made a good growth they are loosened late in the Fall by running a sub-soil plow close to the rows and then pulling them out.

If they have made a poor growth the largest should be pulled while the ground is soft with Autumn rains, leaving the smaller sized seedlings to grow another year. When all are dug

they are heeled-in closely, so the leaves are sweated, as it is termed, and will readily fall off from the stocks. They are then assorted into three or four sizes and put up in bunches.

Extra Size—Thicker than a lead pencil, and will make three or four cuts to the root.

No. 1.—Somewhat smaller; will make two or three cuts to the root.

No. 2.—For collar grafting with small scions, and for budding.

No. 3.—For transplanting.

They are kept by packing them away in the cellar in moist saw-dust, or moss. For shipping, the tops are cut off near the collar which can be rapidly done by taking a bunch at a time and chopping them off with a hand-axe.

Pear Seed

Is for the most part obtained from France and Germany, where quantities of Perry are made, and the seed separated in much the same manner that we have described in the case of apple seed.

Pear seed is found to be much more difficult to manage than apple; it very frequently lies dormant the first season, and comes up nicely the next.

Some French writers advise washing and rubbing the seeds together, to rid them of a sort of mucilage that surrounds them, like a water-tight coat; and claim that if this is removed by continued washing and stirring, the seed will grow the first season.

Stratification.

Le Vassaur, of Ussy, France, in a letter to C. Raux, says, that the main point is to stratify the seed, which is done by placing it in layers on the ground and covering it with moss and turf. A sheltered place is selected, with an eastern exposure. The layer of seed may be several inches thick. If the ground is very dry, a hole should be dug and the layer of seed placed in this, thus retaining a greater amount of moisture. The seeds are

kept constantly moist. They also should be soaked several days in water before being stratified. Another method of stratification is to dig a hole into which the seed is placed after being mixed with from one-half to two-thirds its bulk of sand, then covered with moss and turf as before. If the time to plant has nearly come, and the stratified seed do not show signs of piping, they may be placed on a hot bed as recommended for apple seed.

The general cultivation and care of seedlings is much the same, be they Pear, Apple, Cherry, Plum, or others.

Seed of Cherry, Plum, &c.

When separated from the fruit should be packed immediately in sand or moss to prevent drying and shrivelling of the kernel. The Plum will bear more drying than the Cherry, and the Peach more than either; yet the greatest care should be exercised to keep the kernels fresh and plump.

Peach Seed

Are usually stratified by placing a layer of seed several inches deep on the ground, and then covering with a layer of soil in a place where the seed will be kept moist, allowing them to freeze during the winter. Or the pits may be mixed with one-half to two-thirds their bulk of sand in a box out of doors and exposed to freezing during the winter. Leaves, moss, or saw-dust may be substituted for the sand. Some persons place the seed under the eaves of a building that they may be kept wet with the rains, and fully exposed to the action of frost. By Spring most of the shells will be found to have burst open; those that are not opened are cracked with a hammer. The kernels are then planted in drills, three or four feet apart, and from three to six inches apart in the drill. If the season is favorable they are usually ready for budding in August and September following. We find many prefer planting their Peach seed in the Fall, depending on the moisture of the ground and the action of the frost to open them during the winter. Although the stocks of the stone fruits are

usually worked by budding, they may be taken up in the Fall and grafted during the winter, the same as the Apple; but not with as great success.

Osage Orange

Is extensively grown for Hedge Plants. The seed is gathered in large quantities in North Eastern Texas, and in Arkansas. The seeds are about twice as large as those of the Apple or Pear and its appearance doubtless is familiar to most readers.

The Orange is round and from two to five or six inches in diameter, and resembles a melon, in having a thick outer rind, enclosing a gummy pulp, in which the seeds are imbedded. Each Apple or Orange contains from 100 to 300 seeds. In one process of saving the seed the Oranges are pared down with a knife, then crushed, and allowed to ferment until the gummy pomace will separate by washing. By another process the whole Oranges are crushed in a mill made for the purpose. The pomace is then placed in pools of water where the ground has been hollowed out as receptacles for it. Here it is allowed to soak until it will separate from the seed by stirring. Another simple and effective method is to bury the Oranges in the ground as soon as ripe, by the following Spring the pulp will have mostly rotted and the seed will be found in fine condition for germination.

Sprouting the Seed.

It is usually soaked from one to three weeks, either in a box, sunk in a running stream, or in a tub or cask containing water, which should be changed every twenty-four hours. When it is desirable to hasten the germination, hot water should be used. The general directions of planting and care given under the head of Apple Seed, will apply equally for Osage.

Honey Locust,

And seeds having such a hard bony covering, will not grow unless treated severely with boiling water. Put them to soak the same as Osage, and constantly renew the boiling water, until they become quite soft. One would think that the germ would be killed

by such heroic measures, but it does not injure them in the least. It will sometimes grow well, if kept moist, and exposed to severe freezing during the winter.

A Novelty in Grape Culture.

Pieron of France describes a method of "sowing the vine on the vine." He makes a small hole with a gimlet in the lower part of the stock, in the Spring when the sap is flowing. Into this hole he drops a grape seed of the kind desired, which will germinate: being kept moist by the sap, and will incorporate itself with the old vine, and grow up as one of the branches. At a proper time the old vine may be cut away.

DIVISION SECOND.

Propagation by Buds.

This method of propagation, as was intimated in the opening section, covers by far the greater proportion of the operations of the Nurseryman, and may be subdivided into—

1. Propagation by cuttings or slips, including root cuttings and division.
2. Propagation by layers, including runners and sprouts.
3. " " budding.
4. " " grafting, including inarching.
5. " " bulbs, corms and tubers.

Cuttings

Are usually made in Autumn, from the last season's growth; many of the fruit and ornamental trees, plants and shrubs are thus multiplied. A heel of the old wood is often left on the cutting and is supposed to facilitate growth. Some plants throw off buds more readily from the roots than the tops, and are propagated by root cuttings. Some that can not be raised readily from ripened wood, not emitting roots freely, are propagated by using slips of the green wood, called Green Wood cuttings. These seldom succeed in out-door propagation, but often do better than any other in the Green House.

Propagation by Division is instanced in box-edging where each stem is split off and down, and carries with it a few of the roots belonging to the plant entire. The daisy, aster, marjoram, &c., are often increased by division. These differ from ordinary cuttings only in retaining a few roots of the original plant.

Cuttings are made of various lengths but as every bud, under favoring circumstances, may unfold into an independent existence, it is unnecessary with many plants to use more than single joints or nodes.

Two-Bud Grape Cutting, the lines show how the cut may be made across the node, utilizing every eye.

Propagation of Grape from Cuttings.

The cuttings should be made in the Fall or early Winter; buried in the ground, or packed away in moist sawdust or moss in the cellar.

Grape Vine from Single Eye.

Cuttings were formerly made a foot or eighteen inches long, but so great length is of doubtful advantage, as they do not usually make vines as symmetrical in appearance nor as well rooted as do the shorter cuttings. Two bud cuttings are made by severing the cane immediately below the lower bud and from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inches above the upper bud. Two and three bud cuttings are the most popular.

When the variety is rare and rapid multiplication is desired, single eyes may be used and the advantages of a two-bud cutting retained by making a slanting cut across the node of each bud. The beginning of the cut being opposite and below the direct line of the bud, and the terminus $\frac{1}{8}$ to $\frac{1}{4}$ inch above. We have seen beds of cuttings prepared in this way that grew fully as well as others having two and three buds.

Preparation of Ground and Planting.

Beds are thrown up six or eight feet wide, with alleys a foot or more in width and depth between them. Let the soil be thoroughly spaded and pulverized, and the top raked nearly level from side to side. Place a board one foot in width across the bed and open a shallow trench with the spade along the edge of the board, this trench is usually slanted forward that the cuttings may more readily lie in their places. In this the cuttings are placed one or two inches apart, the upper bud just below the surface; the dirt is then drawn up and pressed against them and the board turned forward its width for a new trench. After the beds are planted they may be mulched with rotten sawdust, leaves, cut straw, or other material. Our practice has been to irrigate by damming an adjoining stream and running water through the alleys between the beds.

Feterman's Method.

Cuttings of two and three eyes are used and the bark is pared off to within an inch of the top bud. The cuttings are then coated with a sort of mortar or groat made of clay loam. A line is stretched in the open field along which a trench is opened: the cuttings are laid in the trench with the top buds ½ an inch or more above the surface, and the soil drawn up and pressed against them. The rows are made three or four feet apart and cultivated with a horse-hoe, &c. The groat or mortar on the cutting keeps it moist after planting, thus assisting its growth. We doubt whether enough is gained by paring off the outer bark to pay for the extra trouble.

German Method.

Cuttings are prepared about one foot in length. A line is stretched in the open field to make the row straight. The planter takes a sharp spade and plunges it perpendicularly into the ground at right angles from the line and to a depth about equaling the length of the cutting; the handle is then thrown back to make a a wider opening, and the spade withdrawn; two or three cuttings are put into this opening at the sides and in the middle, the top buds being an inch above ground. The spade is now plunged in an inch or two forward of the first cut and as the handle is thrown

back it firmly presses the soil against the cuttings while it makes an opening for the next, and so the operation is repeated to the end of the row.

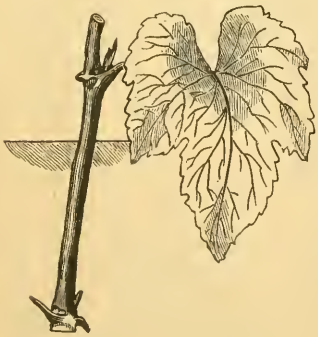
This is an excellent plan. The work is finished up. The soil, from the very nature of the operation, is pressed firmly against the cuttings. It forms a broad row of vines. These rows being placed three or four feet apart are worked to a great extent with the cultivator.

THE CALLOUSING PROCESS for single buds or longer cuttings positively secures the growth of nearly every one. See page 2 of cover.

Green House Propagation.

In this case single eyes are used with half an inch of wood above and one or two inches below each bud. These are planted in pots and placed in borders immediately over the flues or hot water pipes so as to receive bottom heat, or sometimes the border is filled with sand and they are planted in this without using pots. When they reach the height of two or three inches they are transplanted into three-inch pots and from these to the open ground. By the use of the patent transplanting boxes (see page 3 of cover), these operations are greatly facilitated and eighteen or twenty vines are planted as quickly as one can be from a crock.

Green Wood Cuttings



Green Wood Grape Cutting.

Are used only for in-door or Green House propagation. Slips taken from vines that have made their growth under glass succeed the best; two joints of the cane are taken, cutting immediately below the lower bud and $\frac{1}{4}$ inch above the upper bud leaving a leaf attached to the latter. These are then placed closely in the propagating beds, the glass shaded and the atmosphere kept moist until they have rooted and commenced growth. The operations of potting, transplanting, &c., being the same as for single eyes of old wood.

Rose Cuttings.

These are made early in the Autumn from the same season's growth. They are from four to eight inches in length, and preferred with a heel of the old wood, and are planted in a cold frame or border in much the same way as grape cuttings. Late in the Fall, after the ground has begun to freeze, cover them heavily with straw, so that the frost will not reach them. The following Spring this covering is removed, and usually the greater proportion of the cuttings grow. We have followed nearly the same plan with the Currant and Gooseberry, and with abundant success.

Evergreen Cuttings

May be made of Siberian Arbor Vitæ, Irish Juniper, etc., in the early Fall months. They are planted in a cold frame or hot bed after the heat is about spent. They usually callous before heavy freezing. When winter sets in cover them with straw so as to protect from frost: this is removed in the Spring and the larger proportion of the cuttings make a vigorous growth.

Well-ripened shoots should be used for cuttings: the unripe wood, known by its lighter appearance, nearly always fails from damping off.

Cuttings may also be made in the Spring, and as late as July, from the previous season's growth, and planted with a fair prospect of success. Other Evergreens, as the Norway Spruce, etc., that grow readily from the seed, are seldom raised from cuttings.

Root Cuttings.

As a general rule, all plants that throw up sprouts and suckers from the roots, are readily multiplied by root cuttings. These are made by carefully taking up the roots and cutting them in pieces two to four inches long; these are then planted in drills, covering $\frac{1}{2}$ to one inch deep, when they soon develope buds. Each piece of the root forming a plant. Pyrus Japonica; the Raspberry, exclusive of the Blackcaps; the Blackberry; and sometimes the Plum, Cherry, Pear, &c., are propagated in this way.

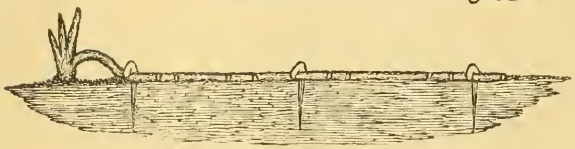
PROPAGATION BY LAYERS.

Plant Layer.

This is a very certain and often a very convenient method of multiplying many of the fruits and flowers. Some plants emit roots very readily, the mere contact with the ground being sufficient: nature often accomplishing the layering process, as in the case of the Raspberry, Strawberry, &c.

Some persons object to layering, claiming that layers weaken the parent plant; the return of the elaborated nourishment and life circulation from the leaves back to the roots being arrested. But if a portion of the original plant is left without layering this objection loses its force.

Definition of Layers.



Cane Laid Down.

Layers are branches or portions of branches that have been placed in contact and covered with the soil and thus caused to throw out roots, after which the rooted layer is separated from the parent.

Sprouts Growing up from Layered Cane.

Stool Layers.

Stool Layering of the Quince.

Some trees or bushes may be encouraged to throw up a large number of branches or canes near the ground by severe cutting back, and may then be layered by simply making a mound of dirt around them. This method, which is called Layering by Stools, is frequently followed in propagating the Quince, especially the Angers.

Where roots are not readily thrown out, the operation of tongueing is resorted to; this is simply cutting into the cane or branch where it is bent down into the ground and making a slit forward through the center for an inch or two. The cut is usually commenced just below a bud and may be above, below, or at the side. After pegging down the branch at the point where it is tongued, cover with fine soil several inches deep. Often a slight twist given to the branch where it is bent into the ground is sufficient without making the tongue, as either process checks the flow of sap and thus encourages the formation of roots. In some cases where it is desirable to obtain layers from branches that can not be made to reach the ground, a box of earth is elevated on stakes and the branch passed through the box and soil.

Sprouts and Suckers

From the roots are a kind of layers, though the process seems reversed, the branch in the former case emitting roots and in this case the root throwing up a branch. Some plants multiply themselves very readily in this way, so much so, as often to become a nuisance, as for instance, the Silver-Poplar, Locust, etc. Many Roses and other shrubs throw out long underground shoots or stems on which roots are formed and which may be separated from the original shrub or bush.

The Morello Cherry, some Raspberries, Blackberries, Plums, Pears, and other fruits, multiply themselves by sprouts from the roots.

A great advance in the art of propagating from layers has been made by the use of the Layering Tube, by which the growth of every bud is secured, and the plant or vine multiplied with the greatest rapidity. See page 3 of cover.

PROPAGATION BY BUDDING.

This is a favorite method with nurserymen of multiplying particular varieties.

Its main advantages are: The facility and rapidity with which it is performed; its certainty when the conditions are properly regarded; and the rapid multiplication of distinct varieties by thus securing the growth of each bud.

Objections have been urged on account of the limited time in which it can be successfully performed, and the unsightly crook near the base which a young budded tree usually presents.

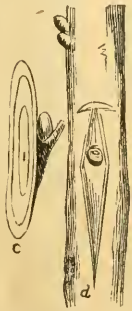
The conditions necessary for successful budding are: 1st. The stock in which the bud is inserted must be in active growth so that the bark will run or slip. 2d. The new growth of the tree or plant to be propagated must be sufficient to make full, plump, well-matured buds.

In some stocks the sap appears too watery early in the season. In these cases the budding should be deferred until it thickens and is depositing its annual ring of "pulp" or woody fiber immediately under the bark. Then the implanted bud will the more certainly unite and incorporate its growth with the stock.

The Season of Budding

Is usually midsummer and early autumn though the bark will run on many stocks when the leaves unfold in spring; budding performed at this time is called Spring Budding.

In this case the buds must be taken from the new growth of the previous year. They should be kept dormant in an ice house until used. Often they will force a strong growth, and buds of this growth can be again used for Fall budding. This is called double working, and is sometimes resorted to where it is desirable to increase a new variety very fast. For summer budding the full development and maturity of the buds may be accelerated by pinching back the growing shoots.



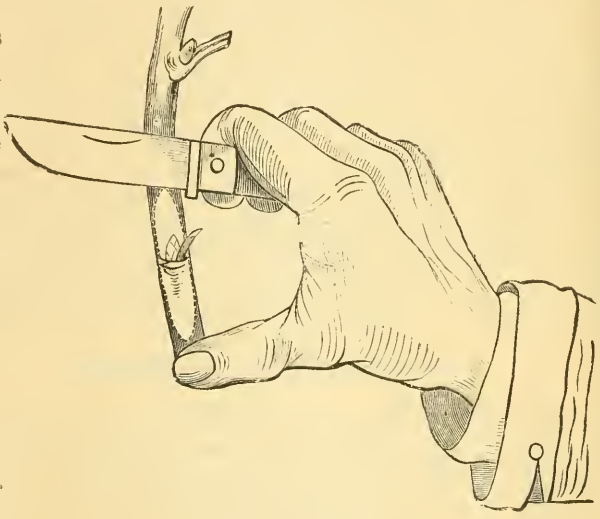
Vance's Method. Inserting bud c where a bud has been cut out of the stock.

The Process of Budding.

When the buds on the young shoots are sufficiently developed the stocks are gone over and all side-shoots or sprouts are rubbed off for a few inches above the ground, this is usually done a few days before budding them.

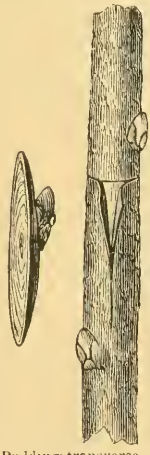
A transverse cut is made at a smooth spot on the stock and a perpendicular slit downward from this for a distance of one or two inches. The corners of the bark being slightly elevated with the point of the knife. (See cut.)

The operator then takes the stick of buds and entering the knife above, brings it out ½ an inch below the bud or eye. A little wedge of wood is thus cut out with the bud and bark, the removal of which is advised by some nurserymen, but as it does not seem to interfere at all with the uniting of the tissues,

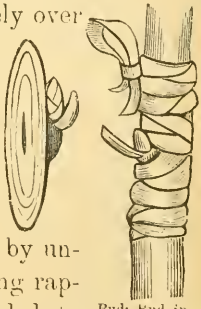


Cutting a Bud.

and the removal is tedious and fraught with some danger to the eye of the bud, it is usually omitted. Into the cut previously made in the stock the bud is now inserted and pressed downward under the bark, then tied by passing strings of bass matting or cotton yarn around the stock thus pressing the bark closely over the bud: care must be used not to allow the ligature to rest on the eye of the inserted bud.



Budding; transverse cut and slit and bud ready for insertion.

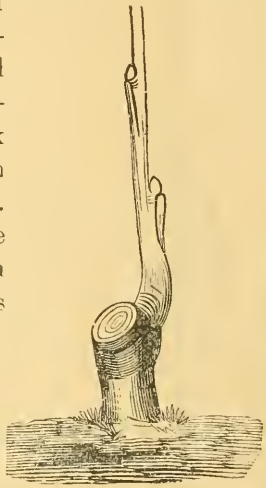


Bud; Bud inserted and tied

In ten days or two weeks the ties are removed by passing a knife over them at the back of each stock: thus severing them at one cut, or by unwinding. When the stock is growing rapidly the operation must be attended to earlier to avoid injury to the stock and bud by strangulation, and if the bud is found not fully united it must be tied up again.

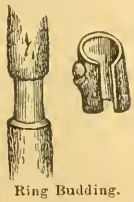
In early budding the stocks are often headed back immediately after the buds have "taken," and the ties are removed, thus forcing the growth of the young bud immediately. But in later budding the operation is left and the inserted bud remains dormant until the following Spring The heading back is accomplished by a clean cut commencing an inch or more above the bud and passing backward and upward, severing the stock. All sprouts must be removed whenever they appear after the stock is headed back, so that the growth may go exclusively to the bud. Some prefer leaving more of the old stock as a support to which the young shoot is tied, but this is not often really necessary.

Tying bud growth to stump of old stock.


First Season's Growth from Bud.

Ring Budding

Is accomplished by taking off a ring of bark from the stock ¼ inch wide, more or less, and replacing it by a similar ring containing the bud to be propagated. This offers no advantage over the other methods except in the case of the Grape, which sometimes succeeds better budded in this manner.


Ring Budding.

GRAFTING.

The principles involved in both budding and grafting are the same.

The circulation, nutrition and growth of plants is carried on by a system of cells, which make up their structure in a great measure, and by the exosmosis and endosmosis between these cells, an interesting botanical study; but will not be taken up in this work, which is designed to be brief and practical rather than theoretical.

However, it is found that tissues or cellular formations of like nature, placed in contact readily unite and form a continuous growth; hence the process of grafting, etc. The cellular growth is carried on immediately beneath the outer bark in all except the endogenous plants, hence the cambium layer or annular ring generally known as the inner bark of both stock and scion should come in close contact in order to unite in growth.

Natural Grafting

By inarching may be frequently observed in our native forests, where one branch or tree has come in contact with another, and, swayed by the wind, the inner bark of each has been exposed by the continued friction and the cellular growth being homogeneous, they have united. Sometimes we see trees of entirely different natures which appear to be joined, but in these cases it is found to be merely a sort of dove-tailing, the cell circulation not uniting or crossing from one to the other. The nurseryman in selecting scions and stocks chooses those of like nature; thus the most perfect union for the apple is the apple, though it will form a union with other fruits bearing similar seeds, as, for instance, the quince and pear; but the union is not so perfect, often dwarfing the tree and producing precocious fruiting. This is taken advantage of in dwarfing the pear on the quince. Hence fruits bearing seeds are grafted on fruits of similar nature and bearing similar seeds, and stone fruits on stone fruits.

The plum is frequently budded or grafted on the peach, and vice versa, and the apricot, nectarine, etc., flourish on either.

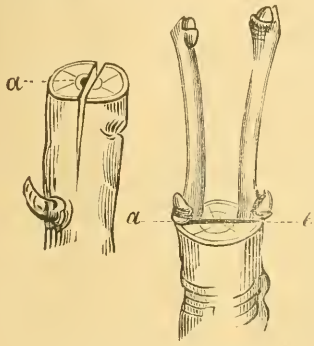
In the case of stone fruits, as the peach, plum, and cherry, most nurserymen prefer working them by budding, limiting the operation of grafting to the seed fruits and mainly to the apple.

The usual methods of uniting stock and scion, are known, as splice, whip, cleft, side, and saddle grafting.

Splice Grafting is the simplest form. The stock and scion, which should be the same size, are shaved down to a like angle or slope, and then fitted and bound together.

Whip Grafting is a modification of splice, and differs only in splitting or tongueing the stock and scion midway on the sloping cut of each as shown in the engraving, and thus locking them together; it also gives a more extended surface of the cambium or growing tissues.

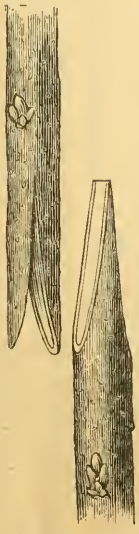
Whip Grafting.



Cleft Grafings. Stock cut and split, and Scions inserted.

Cleft Grafting is preferred when the stock is much larger than the scion, as in renewing the tops of orchard trees. The stock, in this case, is cut square across, then split, and the scions, having been shaved down to a wedge shape, are inserted as shown in the cut. Success depends on having the inner bark of the stock and scion contiguous.

In Crown or Side Grafting; the stock is cut square across as in cleft grafting, a slit is made through the bark and the scion, shaved down on one side only, and having a shoulder to rest on the cut surface of the stock, is inserted between the bark and wood similar to the inserting of a bud.



Saddle Grafting.

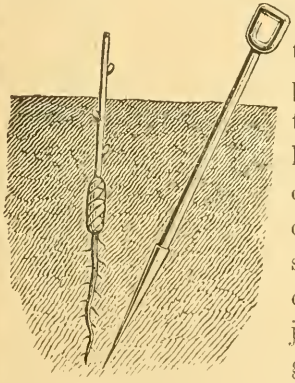
The same operation may be performed without cutting off the top of the stock by cutting a notch transversely, and a downward slit from this, then inserting the scion and tying it like a bud. Another plan of side grafting is to plunge a knife at an angle, downward through the bark, and into the wood of the stock. The scion is inserted into this puncture. The cut surfaces must be covered with grafting-wax to protect them from drying winds or excess of moisture, and to hasten the cellular formation by the exclusion of air.

In Saddle Grafting the operation of cleft-grafting is reversed, the stock being shaved to a wedge-shape, and the scion split and pressed over it.

Grafting of Apple Stocks, Etc.

The nurseryman's grafting on stocks is usually performed during the Winter, and fills up the time when there is little else on hand.

The stocks which have been stored away in the cellar, packed in moss or saw-dust the previous Fall, are cut into pieces 3 to 6 inches long, the tops having been removed down to the collar, or junction of the root with the top.



Planting of Root Graft; pressing dirt against with a dibble.

Many prefer the upper or first cut of the root, claiming that the union is more perfect, and natural, at the collar. Be this as it may, we know that most excellent trees are produced from the lower cuts, and the grafts show little, if any, difference in their relative growth. The scions are prepared like the roots, i. e., cut into lengths of 4 to 8 inches, and joined usually by whip-grafting. A good grafter will put up over a thousand a day. After the parts are locked together they are tied with waxed-thread, or covered with melted grafting-wax at the point of union, and then packed away in the cellar in moist saw-dust, moss or soil. The Waxed Thread is made by drawing cotton yarn (about No. 3 is generally used) through melted wax. It may be wound on a reel, or cut into lengths ready for tying.

Grafting-Wax is made of equal parts of rosin, bees-wax and tallow melted together. Though various formulas are given the above is good as a general rule. When the wax is applied hot the proportion af rosin should be greater; but in making wax for covering the thread a larger proportion of tallow should be used, that it may be more pliable. The operation of grafting may be greatly facilitated by the use of the device noted on page 3, of cover, by the use of which the novice can cut and join the grafts with as great precision and rapidity as the experienced workman.

Grafting the Vine

Is a difficult operation, the inner bark being very thin, and the flow of sap so profuse as to prevent the uniting of the cellular growth.

The scions should be kept in the ice house until the vine to be grafted has come out in leaf. The sap is now thickened, and depositing its annual ring of growth, and the graft will more readily unite. In Cleft Grafting the stock is cut off and the scions inserted close to the ground and then covered with soil to the top bud.

Side-Grafting is performed by plunging a knife at an angle, downward toward the root, and then inserting the scion. Or a cane may be laid down, the buds at each joint cut out, plunge a knife directly through the nodes and insert the scions through the joints, the buds having been removed, their place is supplied by the scions, or grafts, and a cell circulation is soon established. The scions are prepared as for cleft grafting, except that a shoulder is left on either side which rests on the cut surface of the cane. The cane and the inserted scions are then covered with soil to the upper buds.

The advantages of this new method of grafting the vine are, 1st: the scion more readily unites, owing to the greater deposition of the cellular growth, or cambium at the joints. 2d: the split closes tightly over the scion and renders tying unnecessary.

Inarching the Vine.

Owing to the difficulty encountered in forming a union with the Grape by the processes of ordinary grafting and budding, inarching is resorted to and appears to be the only really certain method of changing one variety to another.

Inarching may be performed either on ripe or green wood. If on ripe wood, the new variety should be planted beside the vine it is to be inarched upon, or may be set beside it in a box or crock. It is better to keep the vine back so that when the operation is performed the buds may be just swelling, while the vine used as the stock should have opened its leaves. A slice of

Inarching. The dotted lines below show where the new variety is cut off and removed after the union is perfected; and above, where the wild vine is severed.

wood 2 or 3 inches long is then removed on both stock and scion. The scion may be tongued upward and the stock downward, though they will unite very well without tongueing. The two cut surfaces are now brought together closely as in grafting, are bound with muslin or wrapping yarn, and protected with moss, or clay. In about a month the union will be perfected. The bandage should be loosened, but not removed, and the stock should be frequently pinched back in order to throw the growth into the inarched branch, and finally in the Fall, the stock should be cut off entirely immediately above the junction with the new vine, and the new vine severed and removed below.

The operation on green wood is virtually the same, and is performed in June, July and August. Greater care must be used in joining the young growth and in protecting the union with moss or clay; and it is better to have this point well shaded from the direct rays of the sun. The tender varieties, such as the Rebecca, etc., will succeed much better if inarched on strong-growing stocks, like the Concord, or Clinton.

A curious and useful application of the principle of inarching is sometimes made by bending in a cross-branch from fork to fork of a tree to prevent its splitting. A young branch of the same tree is bent across from limb to limb, the bark is pared off from branch and limbs where they join, and the joints closely tied. The farther joint should be higher than the first to give some circulation of sap in the young branch. If properly done and circumstances favor, the cross-piece will unite the two halves of the tree by a brace of nature's own workmanship, thus effect-

ually preventing the tree from splitting by the action of the wind or the weight of a heavy load of fruit.

Hyacinth Bulb.

Propagation from Bulbs, Tubers, &c.

We have a familiar example of propagation from tuberous roots in the sweet potato. The Dahlia and Peony are the same in their arrangement of roots and in propagation. The Irish Potato differs in being an enlargement of an underground stem thrown off from the root proper. The Iris, or Flower-de-luce, has a long, irregular underground stem (Rhizoma) emitting roots below, and throwing up leaves above, and is propagated by division. The Crocus, the Daffodil, Hyacinth, and Lily, are propagated by corms and bulbs. The corm is a thickened, root-stem, supplied with buds in the transverse wrinkles along its sides where the axils of the leaves joined it the previous summer, as the Crocus. The bulb is formed almost altogether by the bases of the leaves of the previous season, overlapping each other in the form of scales, and the buds which produce the new crop of bulbs are protected within these scales, as the Hyacinth, Lily, &c. The Lily of the Valley forms little bulbs, or bulblets, in the axils of the leaves above ground.

The tuberous roots, &c., are often started in the Green House, or hot bed, the same as the sweet potato; and as the buds constantly start the rooted stemlets are separated and planted, and thus multiplied indefinitely.

Bulbs are usually planted in Autumn, though they may be kept over in a dry, frost-proof cellar, and planted in the Spring, if preferred. They are largely imported from Holland by nurserymen every Fall.

Florescence, Hybridization, Etc.

Flowers are the organs of re-production of plants.

Flowers are perfect as far as fertilization is concerned if stamens and pistils only are present. Perfect is used here in the sense of completeness.

All plants of the higher orders produce flowers which generate the fruit and the seed.

The flower produces the fruit, the fruit the seed, the seed the individual of the species.

Flowers are perfect and imperfect.

A perfect flower has its stamens, pistils, petals and calyx perfect.

The stamens and pistils are alone concerned in re-production.

The pollen, or fertilizing powder is produced on the anthers of the stamens.

The pistil receives and absorbs the pollen from the stamen and generates the fruit and the seed.

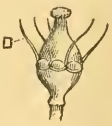
A flower is imperfect when some of its parts are lacking.

Where the stamens are lacking, or have been removed, fertilization can only take place from other flowers of the same species having these organs perfect.

The fertilizing pollen may be carried long distances to the pistils by winds or insects.

Grape Flower. C, pistil, B, anthers.

In hybridization the anthers are removed from the stamens when the flower first opens, and before the pollen is shed, as shown in the cut of a grape flower.



Grape Flower. D, stamens with anthers removed

When the flower is fully developed the pollen from another plant-flower of the same species is carried to the pistil.

The dust may be carried on a camel's hair pencil, or a flower plucked and the stigma of the pistil touched with its anthers.

This generates a seed which is presumed to perpetuate the marked characteristices of both parents.

In this way a choice, delicate fruit not possessing hardihood, may be crossed on a coarser fruit that is vigorous and hardy. The resultant seed is presumed to produce a fruit possessing both delicacy and vigor.

Jenkins' Layering Tube,

For the rapid multplication of vines by Layering can be made at a cost of less than a quarter of a cent by any one of ordinary ingenuity, or will be supplied in quantity by the inventor. By their use every bud is insured to grow, unless previously winter-killed or injured ; and the variety can be multiplied to any extent.

Price of Model (credited on future order for right) by mail, pre-paid..... .50.
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