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PRUNING OF DECIDUOUS ORCHARDS.

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There is probably no horticultural operation about which more ogmatic advice has been given than pruning. Among practical uit-growers there is much diversity of opinion, and this is due in ıost cases to the attempt to master all the details without previously btaining a true conception of the principles involved. The orchard- ıt who has recently arrived from the East, and who has been accus- ɔmed to rule-of-thumb pruning, finds himself totally at sea in the trange climatic and soil conditions of the arid Southwest. Let us, herefore, consider a few of the fundamentals of pruning before dis- ussing the incidentals.

THE PRINCIPLES.

In pruning trees, five main objects are sought, as follows: to ecure such shape and size as will permit the bearing of maximum rops without damage to the framework of the tree, which at the ime must be consistent with convenient and economical cultivation, praying and harvesting; to change the plant from a wood-bearing o a fruit-bearing habit; to produce larger and better fruit; to rejuve- ıate weak or declining plants; and to remove superfluous or injured ɔarts.

Every tree is composed of two parts, the top and the root, whose functions are necessarily cooperative. The root supplies water and

mineral salts, while the leaves collect carbon from the air and also act as a laboratory or kitchen where these materials from different sources are brought together and elaborated into starches, sugars, and other complex compounds necessary for the building of new tissue. Not only must the twig be supplied with mineral from the root, but the farthest tip of the longest root must await the return of prepared food from the leaves before it is able to push farther into the soil. In a healthy tree growing under normal conditions, a perfect balance is maintained between the top and the root. As fall and cool weather approach, the remnant food materials are withdrawn from the leaves and stored in the twigs and branches, after which the tree enters a period of rest during which its activities are almost dormant. Should a large part of the top be removed at this time and the roots remain untouched, it is quite evident that the balance between top and root is destroyed. When spring growth begins, the full amount of root supplies a smaller amount of top, furnishing a plethora of food to the remaining branches. It is but natural that under these conditions the tree, in the effort to regian its equilibium, should begin a rapid growth of the top accompanied probably by many watersprouts from the trunk. Hence we conclude that *heavy winter pruning tends to increase strong vegetative growth.*

As a corollary to this, it is evident that heavy winter pruning tends to rejuvenate weak and declining plants by forcing into the few remaining branches sufficient food to enable them to regain their health and vigor.

While winter pruning increases vegetative growth, summer pruning on the other hand produces very different results. During the growing season the leaves are charged with food materials and both roots and branches are growing rapidly. If a part of the top is removed, the supply of elaborated food for the growing roots is suddenly restricted and their growth is consequently checked. Whether or not the tree will recover from this check in time to push out vigorous shoots and regain its balance, depends to a great extent upon the time at which the pruning is done. Summer pruning is often resorted to with trees which are running to wood and not forming fruit buds. If done toward the end of the growing season, the check in growth will often induce the formation of flower buds as well as leaf buds. If done too early in the growing season, it may result in mischevous laterals and watersprouts.

Checking the growth in any manner, so long at the plant remains healthy, usually induces fruitfulness. By heavy pruning of the root

the food supply is restricted and the growth checked. Notching the bark, applying wires to or driving nails into the trunk are ancient practices, which in a crude way accomplished the same result, but which are now fortunately abandoned by all intelligent fruit-growers.

Winter pruning is often made to serve still another purpose—that of thinning the fruit. This is accomplished by what is known as "heading in." From one-half to two-thirds of the year's growth is cut from every shoot, thus removing a large proportion of the fruit buds. Such heading in also encourages annual bearing instead of biennial bearing, which is so often common in long-lived fruit trees, and which is characteristic of many Arizona orchards.

The pruning away of dead and weak branches is a necessity in all climates. A tree invariably puts out more branches than can survive in the struggle for life, and these dead and weak twigs and small branches must be removed from the tree in order to give more room to the fruit-bearing twigs and to facilitate the harvesting of the fruit. Watersprouts also are prone to rise from the base and trunk. These rob the fruit-bearing branches of sap; and their presence, moreover, gives the orchard an unkept appearance. They should be promptly removed.

The effect of pruning, as well as the necessity of it, depends to a great extent upon local conditions of soil and climate. Fruit-growers in the humid climate of the East find it necessary to prune for an open head in order to secure light and heat sufficient to produce fruit of good color. On the plains, however, such a course would lead to sun-scald of the bark and injury by winds. In California the trees tend naturally to fruit-bearing, and the chief objects in pruning are convenience of shape and the shading of limbs and trunk. Here in the inland arid Southwest the conditions are different. Our trees are prone to run riot with vegetative growth, especially when abundantly irrigated. This must be curbed and the trees thrown into bearing by methods which will not interfere with the proper shading of the limbs, trunk and the soil about the roots.

THE DETAILS.

Every fruit tree should receive its first pruning on the day it is planted. It is, of course, imperative that the top be cut back at this time to equalize the loss of root occationed by moving the tree. It is well to prune all bruised or broken roots back to sound wood. After the tree is set, the top should be cut back to from six to twelve inches from the ground, in the case of the drupe fruits, and to from twelve to twenty-four inches in the case of the pome fruits. I wish to espec-

ially emphasize the great desirabilitiy of this low heading under Arizona conditions. A long, bare trunk is almost sure to sunburn on the southwest side, and this will prove a serious handicap or perhaps the destruction of the tree During the first season's growth, the scaffold limbs—three to four in number—which are to make the main framework of the tree, should be selected. These should be distributed both laterally and vertically in such a way as to avoid Y-shaped crotches, which are apt to split under a load of fruit. They should be allowed to make their full growth, while all shoots not desired for branches are pinched off after growing out two or three inches, leaving a bunch of leaves to shade the trunk and contribute to its growth. During the following winter the season's growth is headed back to about twelve to eighteen inches from the trunk. Three to five healthy, well distributed limbs should be allowed to grow on each of the scaffold limbs, and during the winter season of the following year these should be cut back to within twelve or fifteen inches of the scaffold limbs. On account of the possibility of body blight of pear trees, it is well not to allow fruit spurs to grow upon these scaffold limbs. During the second summer the pinching out of undesirable shoots is continued, but always with an eye to the proper shading of the trunk. From this time on little heavy pruning is necessary, but the trees should be visited at least twice a year; once in winter for the purpose of cutting out old or weak branches, and once in summer for removing watersprouts and checking the too exuberant growth of the stronger limbs

Different varieties of the same class of fruits are characterized by different habits of growth. Some varieties tend to spread out with mostly horizontal branches, while in others the tendency is to run straight up and form a broom-like top. Every pruner should be familiar with these varietal traits, which may be overcome to a large extent by cutting to inside buds to encourage more erect growth, and to outside buds to cause the tops to spread out.

INCIDENTALS.

The Apple: Apple trees are usually vigorous growers and should be pruned every year for the first six or eight years, and at least ever other year subsequently. In the hot southern valleys they should be headed at from twelve to eighteen inches from the ground. From three to five scaffold limbs should form the foundation for the top, and all pruning should be done with the proper shading of the trunk in mind. At higher elevations, such as the Gila Valley, apple trees seem to grow too erect, producing a great number of long, bare, pole-

like limbs. This is very undesirable, and may be avoided by frequent heading back, pruning to outside buds to spread the top, and by resorting to summer pruning when necessary. Apples are borne mostly upon short spurs along the larger branches. It is therefore evident that when the top is composed of many short, stocky branches the load of fruit is carried near the trunk and propping is unnecessary.

The Pear. During the first few years pear trees should be pruned in much the same fashion as apple trees Some varieties, such as Bartlett, tend to send up many long, straight shoots very close together. These should be thinned out and the remaining ones headed back each winter to secure stocky branches. They should not be summer pruned before they reach bearing age. Some varieties send up many sprouts from the roots. These should, of course, be rigidly suppressed.

The Quince: The same general methods outlined for the apple and pear may be pursued with quince trees In the Eastern states they are often grown as a shrub with several trunks arising from the ground In the West, however, they should be pruned to a single trunk upon which the framework is arranged, and the growth controlled as with the pear.

The Peach: The peach, being a more vigorous grower than the apple or pear, is usually cut back to a whip when planted. It should be headed low and only four or five shoots allowed to grow and form the main framework of the tree. All others should be pinched soon after growth begins The peach is also unlike the pome fruits, in that the fruit is borne upon shoots of the previous year's growth instead of upon established fruit spurs. For this reason it is wise to cut the trees back each year while they are young, from one-half to two-thirds of the year's growth being removed from each shoot. Should this result in too exuberant growth, thus interfering with fruit-bearing, summer pruning may be resorted to as a corrective.

The Plum The method of building the framework of plum trees is much the same as for peaches. Unlike peaches, most varieites of plums bear upon spurs, and heading in does not thin the fruit to the same degree that it does with peaches. Our fertile valley soils, when well irrigated, are apt to cause plum trees to grow too much, and it is therefore advisable to head in both summer and winter, especially such varieties as Doris, Hale, etc.

The Apricot: Constant attention to pruning is very necessary with the apricot, especially while the trees are young. They are very vigorous growers, and will surely be broken to pieces by the

wind when loaded with fruit, unless pruned in such a way as to secure short, stocky branches attached to a short trunk. All young trees should be headed back in winter to secure short, strong limbs, and most apricot growers supplement this with summer pruning just after the fruit is gathered.

The Almond: Almonds should be headed low and pruned like the peach during the first three years. Thereafter heading in need not be so severe, and summer pruning of old trees is rarely necessary

The Fig: Fig trees are peculiar in that as a rule heavy pruning is an injury rather than a benefit. The fruit is borne in the axils of the leaves, upon the young wood. After the first shaping of the tree, very little pruning should be done other than the annual removal of sprouts from the roots. As the fig has considerable pith in the center of the shoots, stubs are very objectionable, and when it is necessary to remove large limbs the cut surfaces should be painted with melted wax. Limbs which are to be removed should be either taken out entirely or cut to a strong lateral.

The Grape: When we consider the pruning of grape vines, it should be remembered that the varieties of grapes most commonly and successfully grown in Arizona belong to the *vinifera* or Old World type of grapes, examples of which are the Muscat and Mission. The method of pruning these vines differs radically from that customary with native American grapes (such as the Concord and Niagara) in the Eastern states. American grapes are always trained upon supports or trellises of some sort, and pruned according to some renewal system Vinifera grapes on the other hand are rarely, except in the case of certain varieties, trained upon supports, but are pruned so as to assume the shape of a miniature tree and eventually support their own weight. During the first three years the entire energy of the vine is directed into the proper forming of the framework of the top, and all vines should be staked during this formative period. If the vineyard is started from cuttings, it is not necessary to place the stakes till the following winter. If rooted vines are planted, especially if the soil is moist and rich, it is best to stake the vines when they are planted. Strong stakes 1½ inches square and three feet long should be driven into the soil for one-half their length. This permits of the vines being headed at about fifteen inches. For Thompson's Seedless a six-foot stake driven two feet into the ground will be needed. The treatment during the first few years is of the greatest importance to the future welfare of the vine, and mistakes or neglect at this time will cause continual trouble. Well rooted vines on well

watered ground should make a very vigorous growth the first year, and upon the Station Farm we have found that a whole year may be saved by beginning the training at once. When planted, such vines are cut back to two or three strong buds. As soon as the shoots from these buds are two or three inches long, the strongest is selected and the others rubbed off. When the shoot which is to form the main trunk of the vine is twelve inches long, it should be tied to the stake with a strip of cloth or very coarse twine. At this time any suckers arising from below the ground should be removed. As soon as the shoot has grown ten inches beyond the top of the stake, it should be cut off even or an inch or two above the top of the stake. This will force out laterals where they are needed to form arms or spurs. If the growth of these is too rapid and succulent it is best to pinch them back. It should be remembered that the removal of many large leaves weakens the plant, and pinching the bud from a shoot when it is of the desired length is far better than to allow it to grow longer and then cut it back.

During the following winter, two, three or four of these laterals should be selected and arranged as symmetrically as possible near the top of the vine. They represent the first limbs or branches and should be pruned back to two or three strong buds. During the following summer the vines must be vigilantly gone over for the removal of suckers and the pinching back of wayward canes. Shoots which put out from the trunk in desirable places may be allowed to grow and form additional arms of the vine, all others being removed while still very young. Subsequent winter pruning should consist of cutting back the annual canes to two buds. At the same time, new shoots which are desirably placed should be left and so trained as to add to the symmetry of the goblet-shaped head. Some varieties will not permit of such a rapid development of the head, and it is necessary to use judgment in each individual case.

The Sultanina or Thompson's Seedless is not adapted to the above method of pruning on account of the fact that the upper buds instead of the basal ones produce the fruit-bearing shoots. It is necessary, therefore, to use long stakes or wire trellises for this variety. The three or four strong canes selected are cut back to about five feet in length. These are firmly ited to the stake at their middle and the upper ends then bent over and fastened at the crown of the vine. The bending tends to check the flow of sap and causes strong canes for the next year's use to push out lower down than would otherwise be the case. When the trellis is used, the canes are tied to the wire

in an almost horizontal position, and this brings about much the same result as bending the canes when tall stakes are used

After a vineyard is once established, the subsequent intelligent pruning of all kinds of grapes rests upon the fact that the fruit is borne near the base of the season's growing shoots which arise from wood of last year's growth.

Pruning tools: The operation of pruning involves the makin of wounds; and since these wounds heal over quickest when the cu is smooth and even, it follows that any tools which crush and tea the wood are objectionable. For all small branches and twigs a strong sharp knife is ideal. It is a fact, however, that for economy's sake, some form of hand-shears with one blade and a guard are universally used in commercial orchards. For larger branches, the two-handled lopping shears are most convenient. In some cases a saw will be necessary for removing large limbs, but the pruning saw with teeth upon both edges should be avoided, as it is too difficult to use without damaging the tree. It is hardly necessary to add that an axe should never be used in an orchard.

Wounds and dressing: All large limbs should be sawed off close up to the trunk in such a way that new bark will grow over the cut surface from all directions. Stubs are a source of danger to the tree, and reflects discredit upon the orchardist. In humid climates germs of decay are apt to gain entrance through wounds incident to pruning, and such decay extending into the heart of the tree soon brings about its decline. In arid climates the danger of decay is not so great, but on the other hand, wounds tend to dry out with constant checking of the wood. It is, therefore, wise, in order to encourage a rapid healing over of the wound, to protect all cut surfaces greater than two inches in diameter with some antiseptic dressing which will not only prevent decay, but will keep the wood from drying out. For this purpose there is nothing better or more convenient than good white lead paint. This should be of the same color as the bark of the tree, so as to render the wounds inconspicuous. Tar is often recommended for this purpose, but coal tar should be avoided, as it usually contains compounds which are injurious to the bark of the tree. Small cuts heal over quickly and are usually so numerous that it would hardly pay to apply the dressing.

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