

AGRICULTURAL EXPERIMENT STATION

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DEPARTMENT OF HORTICULTURE.

PRUNING FRUIT PLANTS.¹

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INTRODUCTION.

General Requirements of Modern Orchardng.—Modern orcharding involves three principal production operations: Spraying, pruning, and soil management. A good deal of misunderstanding is current regarding the relative importance of these three primary operations, and results are frequently credited to one or another of them that cannot be so ascribed under controlled conditions. But it may be taken as a general rule that lack of care regarding any of these three will greatly reduce the value of the orchard and the crop. These three operations go hand in hand and demand the grower's constant attention, each in its proper degree and season. All being essential to the success of the undertaking, none can be placed in a dominant position over any other. Good spraying and careful soil management combined with skillful pruning constitute the only sound foundation for successful fruit production.

Definition of Pruning.— Pruning may be defined as the removal of a part of a plant for the purpose of increasing the economic value of the remainder. This increase in value may be merely the greater probability of the plant's living; it may consist in the build-

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ing of a larger or stronger tree or bush; or it may be merely an aid to other orchard operations, as spraying and harvesting. Without exception, however, the grower does better pruning when he understands the particular purposes toward which his efforts are directed and the physiological effects which are likely to follow whatever cutting he does.

Bearing Habits of Fruit Trees.—The grower must understand, also, something of the method of fruit bearing of the plants which

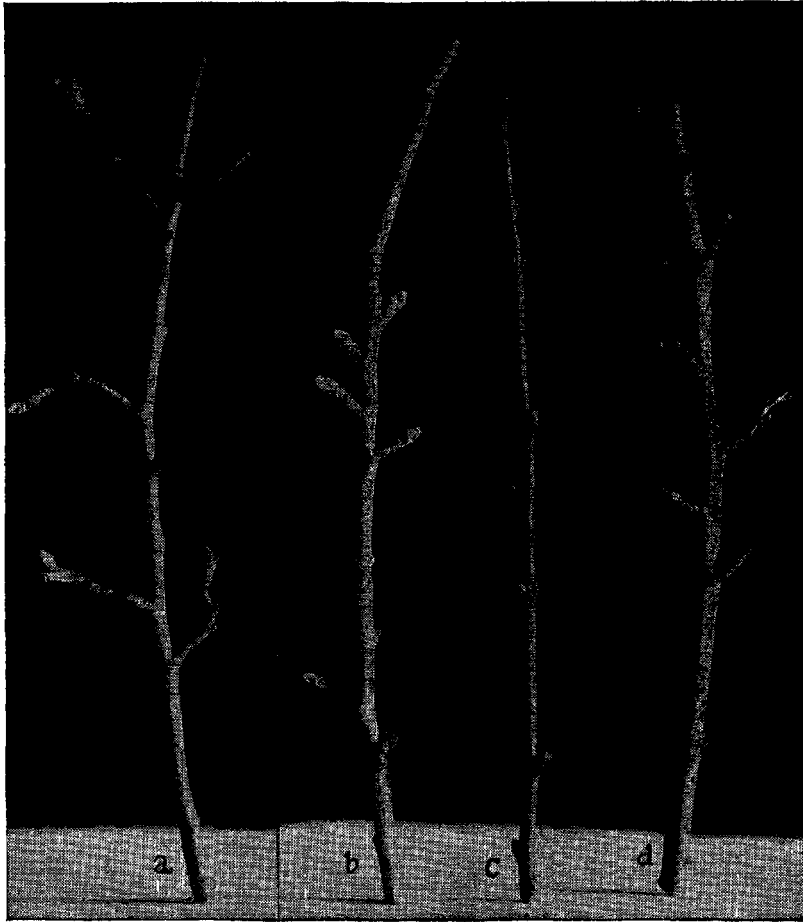


FIG. 1.—Fruit-bearing parts. (a) Apple spurs which have borne fruit. (b) Vigorous apple spurs which have not borne fruit. (c) Peach fruiting twig. (Note the fruit buds at the third node.) (d) Straight fruit spurs on Montmorency cherry.

he prunes. He should know apple and pear fruit spurs and realize that they are the tree's machinery for fruit production; that two or more years are required for their development; that they will be unfruitful, or even die, if overshadowed; and that when once lost on any part of the tree they can never be replaced there but must be produced further out on the tree and, therefore, be less valuable. In contrast with this habit, that of the peach and of some of the sour cherry varieties may be mentioned. With them the principal part of the crop is borne from buds on the twig growth of the preceding summer, and so the production of twigs must be encouraged. Still another method of fruit bearing is to be found in the case of the grape, the bramble, the persimmon, and the quince. None of these plants carry any fruit buds over winter, but all bloom and bear their fruit on shoot growth of the current season, which arises from lateral vegetative buds of the previous summer's growth. An accurate conception of such facts is a necessary part of the working knowledge of one who would prune fruit plants intelligently. Some of these methods of fruit bearing are illustrated in figure 1.

Individuality of Fruit Trees.—A clear understanding of the fact that both varieties and trees within the variety have individuality and that each requires special treatment is of great use to the pruner. A system which proves successful with the Jonathan apple might not apply in the case of an upright-growing apple tree like the Rome; so, although something resembling a system of procedure in pruning may well be adopted, the worker must constantly keep in mind the necessity of adapting his "system" to the peculiarities of varieties and even of individual trees.

Some Definitions.—In order to learn about pruning from the printed page the writer and the reader must agree regarding the meaning of terms used in describing the process. The collar of the tree is the point of union between the root and the trunk. The trunk extends from the collar to the first subdivision of branches. Framework or scaffold branches are the first series above the trunk and subdivide into the secondary branches. The leader in a fruit tree is the central, upright-growing shaft, a direct continuation of the trunk through the framework. In general, the bearing wood of the fruit tree is beyond the secondary branches. It may be fruit spurs borne laterally on wood two or more years old, or it may be twigs. Twigs may be defined as the last season's terminal growths, and, aside from spurs, they are the only leaf-bearing organs. Figure 2 will serve to illustrate these definitions.

There are three principal operations connected with pruning: Heading back, thinning out, and the removal of large branches. Heading back consists of cutting off a portion of a twig or branch. It more commonly applies to twigs and is a part of the pruning of young trees to induce stockiness. Thinning out refers to the removal of twigs or small branches which are growing too close together. It is practiced throughout the life of the tree. Branches are re-

moved when they become broken, diseased, or are crowding, and in rejuvenation pruning.

Heavy pruning of fruit trees may be considered as any pruning in which wood equal to one-fourth or more of the annual twig

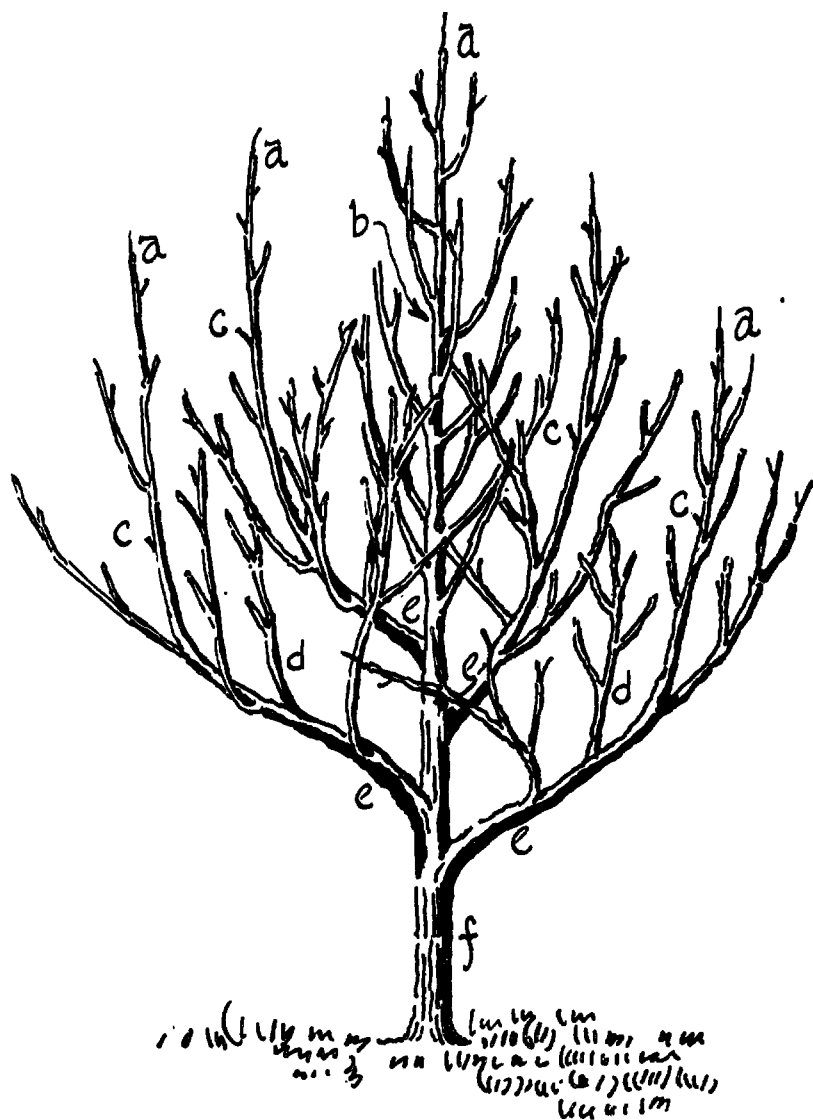


FIG. 2.—Diagrammatic sketch showing the important parts of a fruit tree. (a) Twigs. (b) Leader. (c) Fruit spurs. (d) Secondary branches. (e) Framework or scaffold limbs. (f) Trunk.

growth is removed, while light pruning would be the removal of wood amounting to less than one-fourth of the annual twig growth. A third class, medium pruning, might be made, and would include all cases in which wood is removed equal to between one-eighth and one-fourth of the annual growth. These last definitions are somewhat arbitrary and the amounts named relate to trees which have had regular attention in the way of pruning and are making normal growth.

Moderation Recommended in Pruning.—Fruit growers have suffered severe losses due to using extreme methods in pruning. Too heavy pruning upsets the balance between the top of the tree and the root system and results in various ill effects such as unduly delaying the establishment of fruit production, the dwarfing of the tree, and, usually, its earlier decline and death. Neglect of pruning and too light pruning are no less injurious. They lead to over-height of trees, making picking and spraying more expensive; to undue density of top and subsequent poor color of fruit; to over-bearing, a cause of small fruit, and, possibly, of the biennial habit; and to a general dominance of the vegetative over the reproductive functions of the trees during the middle period of their lives. For these reasons the medium course in pruning is recommended.

Large trees are desirable but they must not be so large as greatly to increase the expense of the orchard operations. Vigorous-growing trees are the most valuable, but they must not be so vigorous in wood growth as to defeat the object for which they are grown; *i. e.*, fruit yield. Productive, heavy-bearing trees are requisite for profit, but not so fruitful that they bear themselves to death in a few years, as occasionally happens.

Regular annual pruning is of vastly greater value than spasmodic spurts of this work. The best pruning is that which is done in the light of a knowledge of its probable results; of the physiological principles which underlie the work; of the local climatic and soil influences; of kind and varietal peculiarities; and of the significance of the regular, well-planned application of this knowledge. Pruning so done assumes a value which entitles it to rank as equal in importance with spraying and soil mangement.

GENERAL DIRECTIONS.

The art of pruning fruit trees can be best comprehended if the discussion of it, as well as the actual work, be divided into two rather definite parts. The first of these, which would include all pruning done between the time the trees are set and the time they come into bearing, may be called "Pruning for Tree Building." This process is, in many ways, in sharp contrast with the subsequent phase, which may be termed "Pruning for Tree Maintenance and Fruit Production."

PRUNING FOR TREE BUILDING.

Building the Framework.— The object which should be in the mind of a grower while pruning for tree building should be the production of trees that are strong; that are large though low; and that will come into bearing at a proper age. The mechanical strength of a tree, its ability to support a heavy load of fruit, depends on two principal features: (1) The correct formation of the framework,

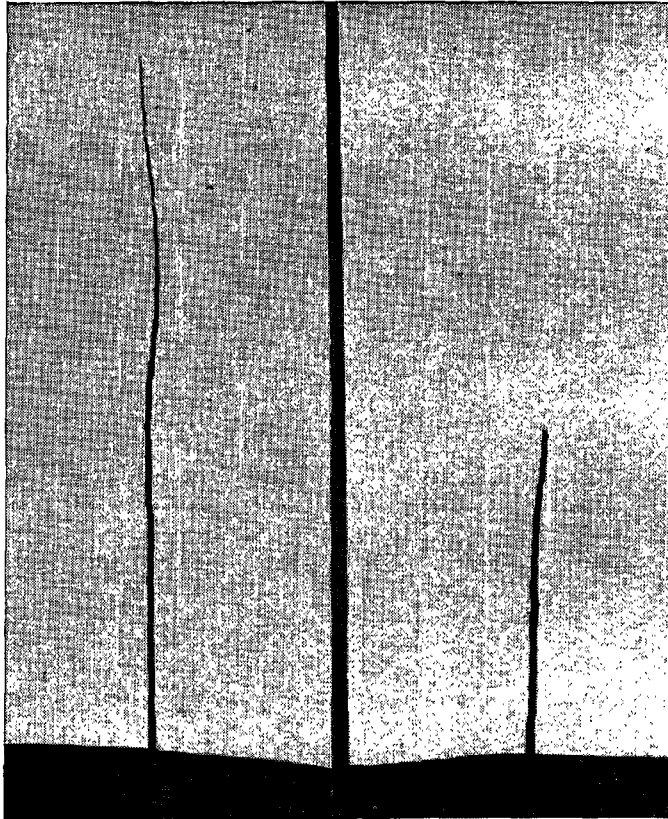


FIG. 3.—An apple tree when planted; before and after pruning.

and (2) the stockiness of the wood. The arrangement of the framework limbs is usually determined at the time of the second pruning following the graft. Care at this pruning to select branches that are evenly spaced around the trunk and that are distributed over a vertical distance of eight inches or more usually will yield a tree which will not split at this point. However, the preservation of a central leader for a number of years still further strengthens this weakest part of most fruit trees. Stockiness of branch is encouraged

by heading back combined with any treatment which will increase the vegetative activity of the tree.

Pruning for Size.—Heavy yields of fruit are obtained only from large trees. The avoidance of over pruning is the principal precaution to be observed in order to produce such trees, provided the soil is fertile. It is probable that no pruning at all would be the treatment which would result in the largest trees, but they would be defective in so many ways that this practice has little else to recommend it. Persistent heavy pruning dwarfs fruit trees because it greatly reduces the total leaf area of the tree and, consequently the elaboration of plant food. Large trees must be prevented from becoming too high by judicious heading back of upright-growing branches and by encouraging, through lighter pruning, those which tend toward the horizontal.

Pruning and Fruit Bearing.—The age at which fruit trees begin to bear is largely an innate characteristic and can be influenced by pruning within only rather narrow limits. In a general way, heavy pruning delays the beginning of fruit production because it diverts the activities of the tree to the production of wood to replace that removed, and especially so if this heavy pruning is done during the dormant season. However, light pruning, or even no pruning, seems to have but little effect in hastening fruit bearing—the kind of fruit, variety, soil, and climate probably being the principal factors governing early maturity.

The First Pruning.—The majority of fruit growers prefer to set one-year-old trees in the orchard. Apple and pear trees of this age will be straight switches, but others, as the peach and cherry, will have put out lateral branches. In all cases the root system of the transplanted tree will need attention. Broken or badly injured roots should be cut back to sound wood, and if one or two roots are of much greater length than the others they should be cut back to average length.

Straight-switch trees require only heading back at the time of setting. A glance at figure 3 will make this operation plain. The cut should be made at a height of about 30 inches, thus allowing for a trunk of 18 to 24 inches and sufficient space above it for the distribution of the framework branches. The pruned switch must bear a number of good strong buds on the upper 12 inches. In case these buds are rubbed off or weak, the tree should be thrown away.

If two-year-old trees or branched yearlings are planted, they are headed back at about the same height as unbranched trees, though the leader may be left somewhat longer if the branches below it are vigorous and stocky. The framework branches are then chosen and are headed back severely, to but one plump bud if the trees show any signs of weakness, and all other branches are cut away close to the main stock. Strong two-year-old trees having good root systems may be pruned in the manner described for "the second pruning," except that the lateral branches should be more severely headed back.

The Second Pruning.— After making its first summer's growth the young tree is again pruned during the dormant period. This is the most important pruning that the tree will undergo. It involves the choice of the framework branches of the future tree. These should be three to five in number, of about equal strength, and well

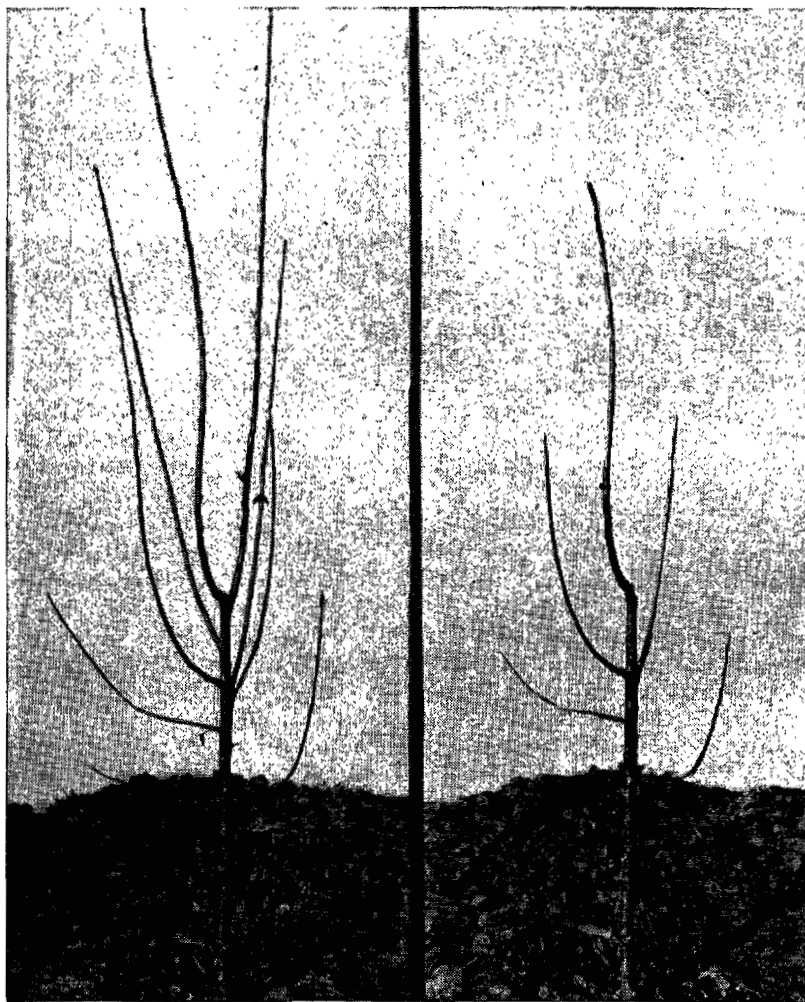


FIG. 4.—An apple tree after one year's growth in the orchard;
before and after pruning.

distributed both around and up and down the main stem. After selecting those to be left all other twigs are cut off close to the central stem. Those preserved are then headed back one-third or even one-half of their length. The central one of the twigs left on the tree is

likely to be upright in its growth and will become the leader in the tree. It should be left somewhat longer than the other branches at this pruning. Figure 4 shows this operation.

The Third Pruning.—One year later the tree will receive its third pruning. This will be similar to the second and consist of both thinning out of twigs and heading back of those which remain. These latter will be about twice as numerous as the first series from which they arise, and are known as secondary branches. They should be headed back in proportion to the growth they have made. Great care must be exercised to space the branches as well apart on the scaffold limb as is possible and to head them back to unequal lengths. Many of these pairs of branches would form acute angled and weak crotches if headed back to equal lengths. This difference in length should be as much as six or eight inches. The secondary branches arising from the leader must be more severely cut back than the others to prevent their filling the space needed by some of the framework branches. The method of the third pruning is shown in figure 5.

The Fourth Pruning.—The fourth pruning will follow the third year's growth in the orchard. It is, in general method, similar to that of the preceding year and will result in an approximate doubling of the number of branches in the tree. The same degree of care must again be exercised in choosing the new twigs which are to become permanent parts of the tree, to avoid weak crotches and to induce a symmetrical growth of the whole top. The leader will still be allowed to persist but its tendency to outgrow the other branches must be counteracted by heavier heading back and by leaving a larger number of small twigs on it.

Later Prunings.—Subsequent prunings are similar to those described except that, as the time when the tree should begin to bear fruit approaches, the general heading back of the twig growth will be discontinued and the thinning out of branches will be restricted to those which are superfluous, grow across the tree, are diseased or dead, or tend to throw the top of the tree out of balance by too exuberant growth. At this stage the tree begins to develop fruit spurs, if apple or pear, and will begin to set fruit buds, if peach.

The years between the ages of four and seven for early-bearing kinds and varieties and six and nine for those which are later in coming into bearing are critical periods in the development of the trees. Most growers wish to have the orchard come into bearing at the earliest possible age, and under most climatic and soil conditions this is to be desired. There is, however, a general rule that a close correspondence exists between the time at which a fruit tree begins to bear and the length of its productive life. Early bearing is coupled with early decline and late bearing with a long productive period. A gradual change from pruning methods adapted to young trees to those more fitted to bearing trees should be made at this time. It involves the substitution of branch removal for almost all

heading-back and a general decrease in the relative amount of wood removed.

Influence of Climate and Soil.—The fact that different kinds, and even different varieties of the same kind, of fruit trees require pruning methods adapted to their individual peculiarities, especially while young, has been mentioned. Reference must also be made to two other factors which may still more strongly affect tree growth habit; *i. e.*, the climate and the soil.

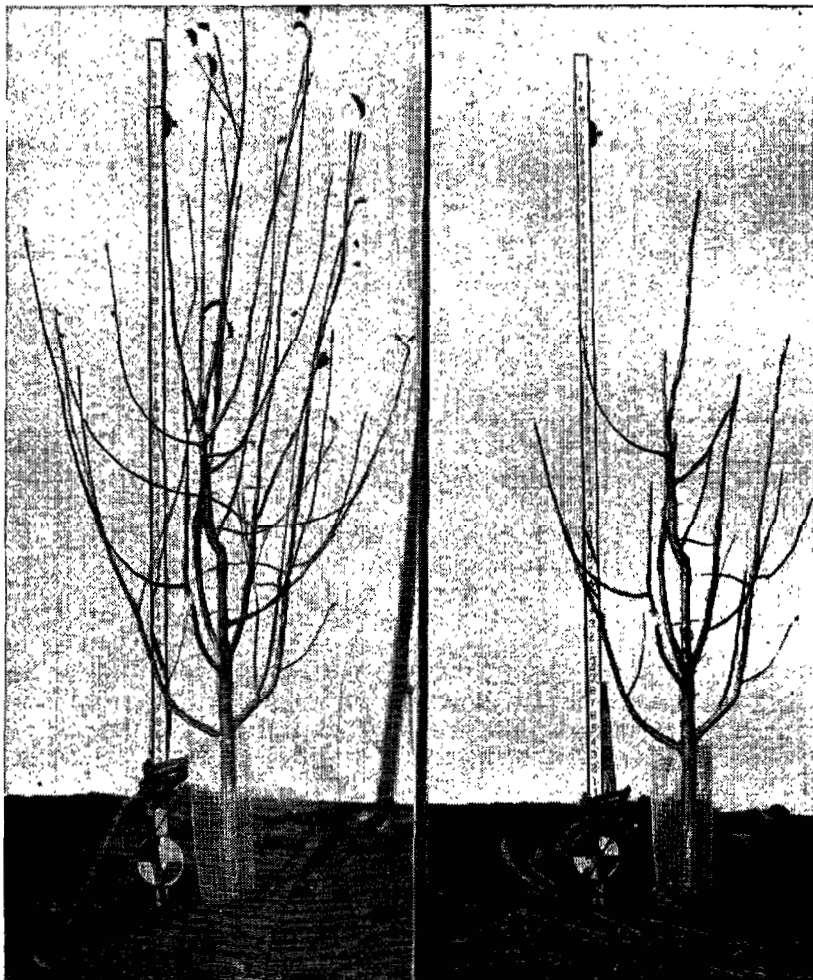


FIG. 5.—An apple tree after two years' growth in the orchard; before and after pruning.

Pruning to counteract deformity due to wind has been given much study, but the opinion now seems to be general that a windbreak is a better solution. Sunscald on the trunks and large branches of young trees can usually be prevented by low heading and the avoidance of too heavy pruning. Soil exerts a dominant influence over the shape of young trees. If the soil is fertile and the moisture supply adequate the tree will make a rapid, vigorous wood growth and may then be shaped at the pruner's will. But no amount or any system of pruning can rectify bad shape in a tree which is making but a feeble growth due to infertile soil. The first step in correcting a poor habit of growth of a tree so situated is to supply it with an abundance of plant food. After such treatment has stimulated the tree into vigorous growth the usual pruning practices may be expected to succeed in bringing it to a proper shape.

PRUNING FOR TREE MAINTENANCE AND FRUIT PRODUCTION.

This portion of the discussion of pruning relates in point of time to the productive years in the life of the tree. The juvenile period has passed and the objects which the grower then had in view no longer govern, the vegetative stage has given way to the reproductive stage and pruning methods must be varied to correspond.

The New Objects.—Now that the fruit-bearing habit has been established, the objects sought through pruning have taken on a different character. First, maximum production of high-grade fruit is desired. Second, the trees must make sufficient annual twig growth to produce the needed leaves to nourish the fruit and maintain the vegetative vigor of the tree. Third, the size, including the height, and the density of top of the tree must be regulated.

Pruning for Fruit Production.—The relative value of winter and of summer pruning for the promotion of fruitfulness cannot be fully discussed here. Results of experimental work on this problem, carried on in many parts of the country, have been conflicting. It seems best in the light of our present knowledge to do most of the ordinary pruning while the trees are dormant. If summer pruning is done, the time should be soon after the principal twig growth has been completed and the method similar to that employed during the dormant period. Pruning, whenever done, should be so performed as to raise the grade of the fruit. It may assist in thinning the fruit, thus increasing the average size, and careful work in this particular will result in much better color on apples and peaches, due to the more even admission of sunlight.

Pruning to Promote Vigor.—The use of pruning for the purpose of increasing the vigor of fruit trees is limited. It forms a part of the rejuvenation work but must be combined with soil improvement measures and general good care to result in any lasting benefits. That heavy pruning promotes vigorous wood growth is generally true, but it should be remembered that it may at the same time do many other less desirable things.

Pruning to Regulate Size and Shape of Tree.—Maintenance pruning is done, in large part, to keep the trees in proper size and shape for both maximum and economical fruit production. The size, in spread of branches, which orchard trees may be allowed to attain is governed by the planting distance and the natural development of the variety under the soil and climatic conditions prevailing in each orchard. The planting distance should permit the trees to attain their full horizontal growth without any interlacing of their branches or undue interference with orchard operations, such as harvesting and spraying. When such interference does arise the pruning year after year must include some heading back of horizontal terminals to confine each tree to its own area. The height must also be controlled. This is done by cutting the upright growing leaders back to strong lateral growing branches. This prevents the formation of a higher story in the tree, and should be so managed as to bring all of the fruit-bearing wood within 20 feet of the ground.

Methods of Maintenance Pruning.—The actual operation of maintenance pruning will differ from that previously described for tree building in two main particulars; namely, the heading back of twigs will have almost entirely ceased and the removal of large branches will occasionally be necessary. In the latter work, care must always be exercised to make a neat, smooth wound and at the proper place. A large wound, smooth and so located that the sap flow of the tree will reach all parts of its margin freely, will heal over more quickly than a smaller one poorly made and located too far from an abundant supply of food. Pruning “stubs” should never be left. Care must also be taken when removing an upright-growing branch to make the angle of the cut such as not to weaken the wood to the extent that the weight of the lateral branch just below the wound will later cause the main stem to split and break down at this point. A light thinning out of small branches one, two, or three years of age will be needed at each pruning. This must be done to prevent the crowding of branches and to remove dead, diseased, broken, or misplaced wood. These cuts should be made carefully and close to the wood from which the branch is removed. The removal of all watersprouts and sucker growth requires attention also. The latter must be cut off close to the collar of the tree and never at the surface of the ground.

Relation of Pruning to Disease Control.—General directions on pruning always recommend the removal of diseased branches. This is usually good policy and needs emphasis but cannot be fully explained in this circular. It may be stated, however, that the more important diseases the control of which involves pruning are fire blight of the pear and apple, blister canker of the apple, and black knot of the plum. Wood infected with any of these diseases should be removed well below the site of the lesion and the prunings quickly and carefully burned. Bulletins which discuss the control of these diseases should be consulted.

PRUNING TOOLS AND THEIR USE.

Necessary equipment in the way of pruning tools need be neither complex nor expensive. It pays, however, to get the best when buying such implements and then to take good care of them.

The Implements.—A supply of pruning tools for each workman should include one swivel-back saw and a number of spare blades,

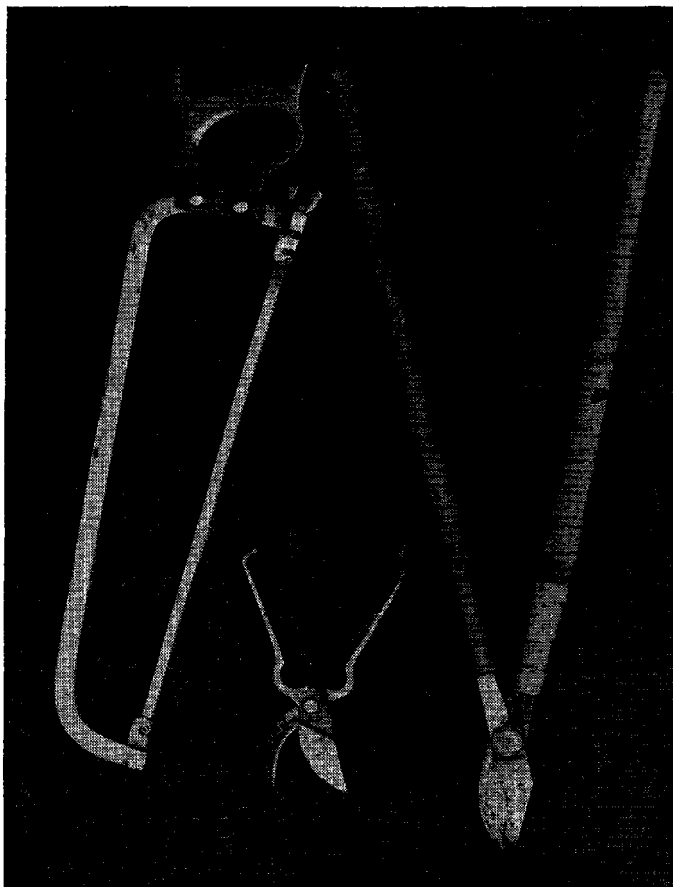


FIG. 6.—Good types of the necessary pruning tools.

one pair of hand pruning shears, one pruning knife, a ladder, and a disinfecting kit. Careful, experienced workmen may also find the pole pruner or a pole saw a time-saving tool. Two-hand lopping shears are popular tools with many pruners. Their use much expedites the removal of branches as large as one and one-half inches in diameter. The best types of the tools are shown in figure 6.

The Proper Use of Pruning Tools.—The hand shears and the knife are used to remove branches not more than three-fourths of an inch in diameter. With either of these implements the work can be better and more easily done if the left hand assists in making the cut by keeping the tissue just ahead of the edge of the blade under a strain. The knife is also used to smooth off rough wounds made by the saw or lopping shears. The saw may be used in removing all larger branches. The blade should be kept sharp and tight and every care exercised to make smooth, even wounds, nearly parallel with and close to the limb from which the branch is being removed. Branches as large as one and one-half inches in diameter may be removed by the lopping shears. The pole pruner is used for branches high in the tree or out at the tips of the horizontal branches. It should never be used in cutting branches more than three-fourths of an inch in diameter. Practical pruners differ regarding the use of the ladder, but one of the self-supporting type is a convenience and lessens injury of the trees.

The Sterilizing Outfit.—Equipment for the sterilizing of wounds and pruning tools should always be at hand if the presence of fire blight or blister canker is even suspected in the orchard. The outfit will consist of a wide-mouth bottle containing a 1 to 1,000 solution of corrosive sublimate (in water) and a swab made by wrapping a number of thicknesses of cloth around the end of a 12-inch stick. The swab is dipped in the disinfectant and the blade of the pruning tool, as well as the wound, is thoroughly moistened after removing a diseased limb and before starting work on a new tree. This is much less bother than a description of it indicates, and should never be omitted. The chemical may be obtained at any drug store and will have attached directions for making the proper dilution. It is a violent INTERNAL POISON and must be handled accordingly, but it will not injure the skin of the hands by contact.

SOME SPECIFIC DIRECTIONS.

PRUNING THE APPLE TREE.

The foregoing discussion relates, in the main, to the pruning of all kinds of deciduous fruit plants, although the apple has been more particularly in the thought of the writer than have the others. Because of this, the statements applying specifically to the apple may be made brief.

Apple trees are vigorous-growing plants, under proper environment, and require moderate annual pruning. The work is usually done during the dormant period, at any convenient time after the leaves have fallen and before the spring flow of sap.

Fruit-bearing Habit.—The apple tree bears its fruit on short crooked growths known as spurs. These are produced laterally on branches at least two years of age, bear the fruit from terminal buds, and, if not starved or too heavily shaded, will continue to produce for as many as ten or twelve years. Individual spurs are

biennial in fruit bearing and when all the spurs on a tree produce blossoms the same season the tree as a whole is likely to assume the alternate habit. Pruning should be so managed as to prolong the productive life of the fruit spurs by keeping the tops of the trees reasonably open to the sunlight. These spurs should never be pruned off as long as they remain fruitful, except in case they are situated directly on a large branch when the danger of their transmitting fire blight to the framework of the tree may make it advisable to remove them. Any pruner who insists on making the tree look neat by removing the fruit spurs should be given a thorough course of instruction, or at once dismissed.

Trunk and Framework.—Under Kansas conditions 18 to 24 inches seems to be the proper length for the trunk of an apple tree. The frame work branches should be distributed over a distance of about 12 inches above the trunk and should consist of three to five well-placed limbs. If a choice is possible, those branches should be preserved which form a rather wide angle with the trunk of the tree and are properly distributed around the trunk. Living ties to assist in strengthening weak crotches may be made in young trees by twining together interior twigs from opposing limbs. The ends of these twigs should not be cut off until after strong union has taken place between them.

Maintenance Pruning.—The pruning of bearing apple trees need not be further discussed, as the preceding general remarks on that topic apply particularly to this fruit. Moderate annual pruning such as will admit the light to the center of the tree, prevent too great height growth, assist in sustaining the vigor of the tree as indicated by annual twig growth of six to twelve inches, and tend to promote abundant fruit production, is what is required.

PRUNING THE PEAR TREE.

The pear is a close botanical relative of the apple and bears its fruit in much the same manner. Consequently, the same general methods of pruning apply. Two differences do exist, however. The habit of growth of most pear varieties is more upright than among the apples and the fruits do not develop red color as do many of the apple varieties. The first variation indicates that greater care must be exercised to prevent the trees becoming too high and the second allows a somewhat more dense top to be tolerated. The danger of shading out valuable well-placed fruit spurs is to be avoided as with the apple, however, and heavy pruning such as would tend to promote a soft, vigorous twig growth is never desirable because of the increased danger of fire blight attacks.

PRUNING THE PEACH TREE.

The culture of the peach differs in many respects from that of the apple, and at no point is this difference wider than in pruning. The peach orchard should not be considered a permanent improvement like an apple orchard. It should be pushed into early and heavy

bearing and a new one started as soon as the old one begins to decline. The tree also differs from the apple in its general habit of growth, the age at which it begins to bear, and in its fruit-bearing habit.

Bearing Habit.—The peach tree, in general, bears its fruit from axillary buds on twigs of the preceding summer's growth. If spurs are produced, as does occur under some conditions and with some varieties, they differ from apple spurs in that they are straight and bear from lateral instead of terminal buds. Terminal buds on peach trees always produce twig growth. This difference in fruiting habit indicates one of the principal distinctions between the pruning of the apple and the peach. In the former the twigs are of value only in the general vegetative economy of the tree, and any specific treatment of them does not immediately affect fruit production. But with the latter the twigs are both vegetative and fruit-bearing in their functions, and their removal or their failure to grow directly affects the yield of fruit by the plant. (See figure 1 in this connection.)

The location of the fruit buds on the peach twig is variable. On most young trees, and on some varieties at any age, they are developed well toward the tips of the twigs. As the trees become older the fruit buds are found lower on the twigs or distributed throughout the greater part of their length. The effect of this on pruning operations is manifest; the thinning out of twigs always thins the crop, but whether heading back does so or not depends on the location of the fruit buds, and must be made a matter of study in each orchard at pruning time.

Early Pruning.—Peach trees are usually bought from nurseries at one year of age. At that time the weak ones may be straight switches, but the more vigorous ones are likely to have lateral branches. The pruning at the time of setting will consist of heading back either type of tree at a height of 18 to 24 inches. Care must be taken to make sure there are good strong buds on the upper part of the stub which is left, and this requirement will sometimes necessitate leaving lateral branches bearing two or three buds, or occasionally, higher heading.

During the dormant period following the first summer's growth the trees should be given their second pruning. This will agree with the general directions (page 8) but will involve more severe heading back of the framework branches than with other kinds of fruit trees. The length left need not be more than one foot. Should the second or third season's growth of twigs show a set of fruit buds, which will be found as additional buds in the axils of the leaves and on one or both sides of the branch buds, the grower has a choice in methods of pruning. All twigs not needed for permanent parts of the tree may be cut away and those left severely headed back. This will build up the strongest tree possible but will sacrifice nearly all of the first crop of fruit. The other method is to leave a considerable number of twigs which are not needed as permanent parts of the tree and

head them back but slightly. These excess twigs will produce fruit that season and should be cut out entirely the following winter. Permanent branches left at the same time should be headed back, usually below the region where they bear fruit buds, and thus prevented from moving the bearing wood of the future too far from the ground.

The exact extent of heading back to be practiced in pruning young peach trees must be determined through local experience. The principal point to bear in mind is that too severe heading back delays fruit-bearing while too light produces high, "leggy" trees (fig. 7) which make all orchard operations more expensive. Making a correct decision in this dilemma constitutes the real test of the pruner's skill.

Pruning Older Trees.—As the peach trees approach maturity constant care must be exercised to keep the top of the tree open to the sunligh. If this is done by judicious annual thinning out of young wood, the tree will be kept low in stature and vigorous bearing wood will be retained in the lower interior parts of it. Low-hanging peach branches are of but little value. The fruit they may bear is poor in quality and color. Hence the pruner's attempt should be to keep the shape of the tree such that the framework, branches will be somewhat upright, forming an angle of about 45 degrees with the central shaft of the tree. The top should be kept well open to sunlight and spray materials. All leaders should be subdued and their vigor directed into more horizontal growths.

Deheading.—Under certain conditions money has been made by "deheading" old peach trees and inducing them to grow new tops. This is usually done following a severe winter which kills the fruit buds. It consists in cutting all of the top of the tree back to the secondary branches as is illustrated in figure 8. The growth the following summer may be abundant and vigorous, may be confined to only certain branches, or may fail entirely. When abundant, it will require severe thinning out and heading back during the dormant period and probably will produce fruit buds the second summer following the deheading. Because of this certain loss of two crops and the possibility of the death of the trees, serious consideration should always be given the question whether it would not be better to grow a new orchard and, upon its reaching bearing age, remove the old one entirely without attempting to rejuvenate it.

PRUNING THE SOUR CHERRY TREE.

Of all the deciduous fruit trees the sour cherry requires the least expenditure in the form of pruning, especially when it is grown on Mahaleb stocks and when the low spreading varieties are planted. However, the sweet cherry and the more upright growing sour varieties on Mazzard stocks require constant attention in order to prevent their becoming too tall for economical fruit harvesting.

Pruning Practice.—One-year-old sour cherry trees are likely to have developed lateral branches in the nursery and the choice of

the framework limbs is made at the time the tree is planted in the orchard, which should be as early in the spring as is possible and on fall-plowed land.

The principles underlying the choice of framework branches for these plants do not differ from those already described except that it is customary to leave a larger number than with other fruit trees,



FIG. 7.—A high peach tree. Its badly broken condition is due to over bearing.

some growers recommending as many as seven. A trunk not more than 18 inches in length is best. The branches left to form the framework may be rather severely headed back if the trees show signs of weakness. Subsequent pruning throughout the life of the tree will

consist of thinning out clusters of twigs which develop near the tips of the preceding year's growth, the removal of crossing, rubbing, and parallel branches and all water sprouts and suckers, and the suppression of any branches which show a tendency to grow too high. This, with the removal of diseased or dead branches, is usually all that is needed, though some heading back of the twigs may be desirable while the trees are young.



FIG. 8.—The peach tree shown in figure 7, after deheading.

Fruit-bearing Habit.—The sour cherry bears fruit on spurs and also in the axils of the leaves on one-year-old wood. The spurs, however, are straight, the terminal bud being vegetative, in contrast with the crooked spurs and terminal fruit buds of the apple. The distribution of fruit-bearing between these two types of organs is a characteristic of varieties and should be given study by the grower.

If fruit is borne on the twigs any heading back is a thinning process. The maintenance of the vigor of the spurs through keeping the top of the tree open is also important.

PRUNING THE PLUM TREE.

Plum trees bear their fruit on both spurs and twigs, the relative amounts produced in each location being characteristic of the variety. This fruit does not require intense sunlight for the development of its color, but the top of the tree must be kept fairly open to maintain the vigor of the lower and interior branches.

The Method.—Five or six framework branches are usually developed on the plum tree. These are headed back as are also later permanent branches low in the tree, but after a well-balanced tree has been grown the need for heading back or, in fact, any save corrective pruning, ceases. A top not too dense but low and broad in shape is desired.

PRUNING AND TRAINING THE GRAPE VINE.

In order that any brief discussion of pruning the grape may be of value certain facts regarding the growth and fruiting habit of this plant must be understood.

Growth and Fruit-bearing Habit.—The grape is a vine, not a tree, and makes an indeterminate growth of canes. Its natural tendency is to produce each year canes far in excess of the length needed for the maximum fruit bearing of which the vine is capable. Consequently, throughout the life of the vinyard large quantities of cane growth must be removed each year. The grape also differs from most tree fruit plants in that it carries no fruit buds through the winter. It blooms and bears fruit laterally on shoots of the current season's growth, the shoots themselves having developed from over-winter buds on the preceding summer's cane growth.

The bunches of grapes are produced near the base of the shoots and vary in number per shoot on different varieties. A common number is three. Knowing this characteristic of the vines the grower can determine at the time of pruning the number of bunches of grapes which the vine will bear the next summer. A large yield from American varieties is 30 pounds of fruit per vine. If the bunches average one-half pound in weight, this quantity would be produced from 60 bunches or from 20 shoots, which in turn would grow from 20 over-winter buds. If the bunches are small but the capacity of the vine equally great, a larger number of buds can be left at pruning time—40 for one-fourth pound bunches.

Pruning and Training.—The distinction between pruning and training the grape vine should be kept in mind. Pruning is wholly based on the principle stated in the preceding paragraphs and consists in cutting away each year all cane growth in excess of that needed for fruit production. Training, on the other hand, is the disposition made of this remaining wood on the vineyard trellis. It affects the choice of the canes to leave on the vine, their length,

and their number, but not the total number of bearing buds, which is determined by the vigor and fruitfulness of the vine. The fruit produced will be practically the same in quantity whether it grows on one cane bearing twenty buds or on ten stub canes each but two buds long, with the exception, that in some varieties the basal buds, one to three in number, produce sterile shoots. This requires that the varieties be studied and allowance made for such variation if found.

Many systems have been devised for training American grapes. Those more commonly used are the fan, the two-cane Kniffin, and the Munson. These all give good results in the vineyards of competent growers. Pruning and training an acre of bearing vineyard costs about \$6 per year. Figures 9 to 12 illustrate two of these methods.

Pruning Young Vines.—At the time the one-year-old or two-year-old vines are set, the roots should be cut back if broken or too long and all but one of the canes removed close to the original cutting. The one cane left should be cut back to two strong buds, both of which are allowed to develop into canes. Should additional canes begin growth the first summer they should be removed at once. The second pruning should be given during the dormant season and is the same as the first—cut to two strong buds on one cane. At the third pruning a cane bearing 10 to 15 buds is carried up onto the trellis and the disposition of the wood which best fits the system of training adopted is made.

PRUNING THE BUSH FRUIT PLANTS.

The pomological group known as the bush fruits includes blackberries, raspberries, gooseberries, and currants. With reference to their fruit-bearing habit and methods of pruning used with them, they fall into pairs, the first two and the last two belonging together.

Fruit-bearing Habit.—Blackberries and raspberries bear all their fruit on canes of the preceding summer's growth. These canes carry no fruit buds over the winter but bloom on shoots of the current season's growth. The fruit of the currant and the gooseberry is borne principally on spurs which are found on wood of considerable age but which remains vigorous and productive for only three or four years.

Pruning Methods.—All of the small fruit plants should be pruned back severely when they are set out, but more especially the raspberry and the blackberry, on which but one cane bearing two to five buds should be left. Two or three canes may be saved from the first summer's growth if the plants are vigorous, but weak plants should again be reduced to a single cane. The annual pruning during the remainder of the life of the patch will include: (1) The removal of all the canes which have borne fruit; (2) the reduction of the number of new canes to that which the plant can support through fruit production—between five and ten, depending

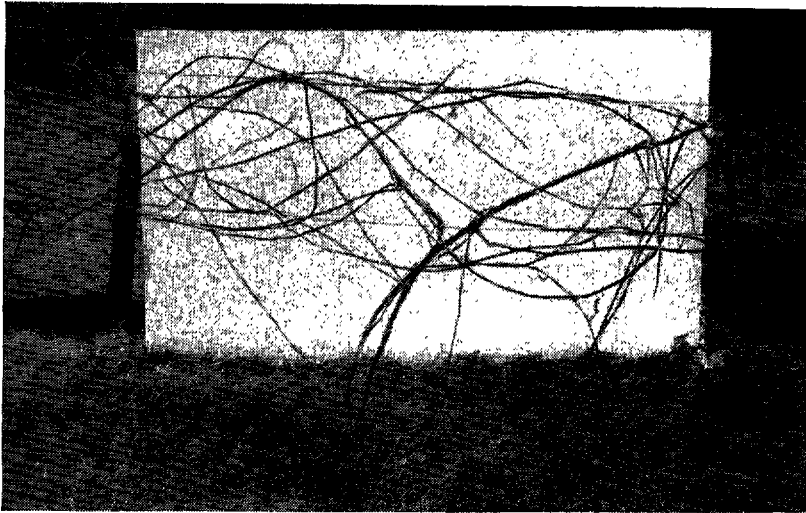


FIG. 9.—A grape vine on a two-wire trellis.

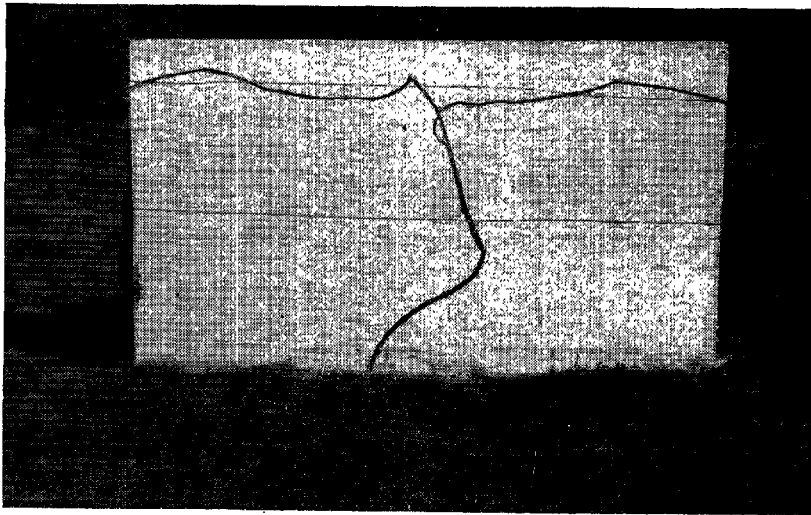


FIG. 10.—The vine shown in figure 9, after pruning and training; two-cane Kniffin, 15 buds left on each cane.

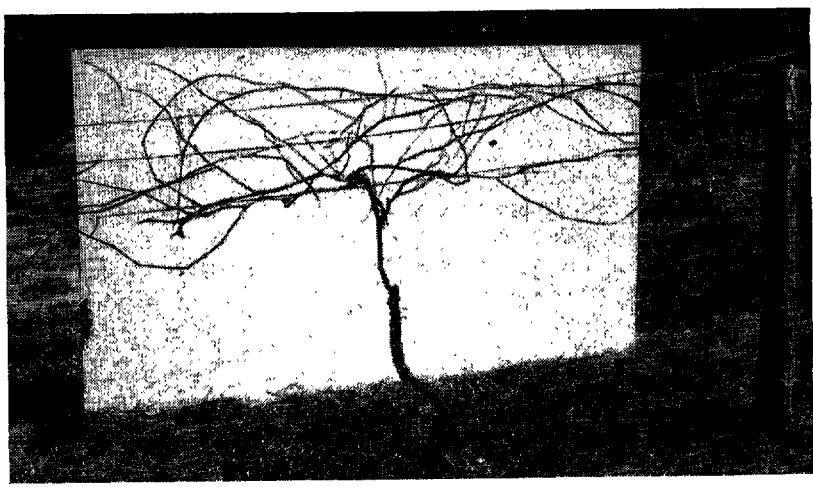


FIG. 11.—A grape vine on a Munson trellis.

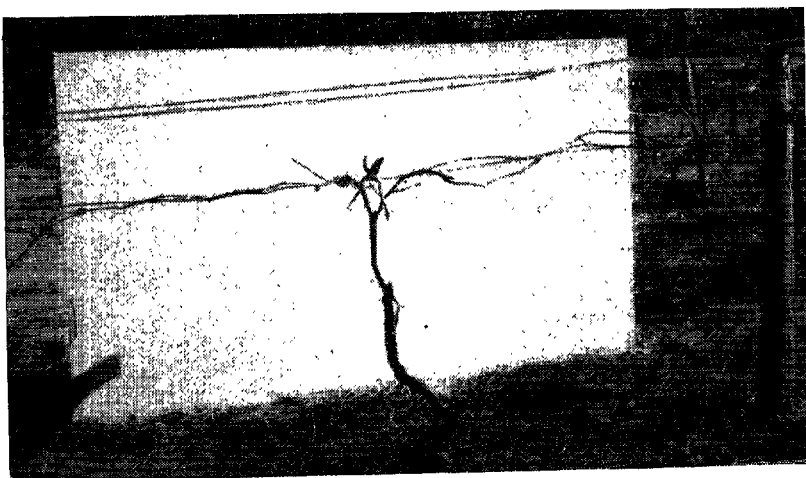


FIG. 12.—The vine shown in figure 11, after pruning and training. Eight buds are left on each of the four canes.

on the fertility of the soil and the moisture supply; (3) the heading back of these canes to adapt them to the system of training followed; (4) the pinching out of the growing tip of the canes just when they reach a height of 18 inches if no trellis is used and the plants are to be self supporting. All suckers which arise from the roots between plants must be dug out, but this is a cultivation problem rather than one for the pruner.

The general system of pruning the gooseberry and currant plants is similar to that sketched above except that the old bearing wood is removed each third year instead of each year. Each plant may contain about six canes, the oldest two of which are annually cut away and replaced by two new shoots of that year's growth, these to be allowed to bear three crops when they in turn are removed. All new shoots in excess of those needed to replace old canes are pruned out close to the crown of the plant.