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APPLE CULTURE

In planning a commercial apple orchard, one should be careful to consider the extent to which the apple industry will develop in the immediate neighborhood; the probable magnitude of the industry throughout the entire section tributary to the markets in which he expects to sell his fruit; and the distance from a good local market and the condition of the roads during the hauling season.

Climate. Throughout portions of the State where water is available for irrigation at elevations exceeding 2500 to 3000 feet, may be found the more perfectly developed, highly colored fruit. Throughout the warmer portions of the State, few varieties succeed well, the fruit produced being small, of poor color and extremely low quality. It is hardly advisable to attempt to grow apples, for other than home use or local consumption, in the warmer portions of Arizona. Commercial production of the apple may be undertaken, however, throughout those areas in which the climatic and other conditions are more favorable.

Soil: The apple will grow in almost any soil. The soil best suited, however, is a deep, porous type, that will absorb and hold a large percent of moisture. The soil should be four to six feet in depth, and should be underlaid with a well drained subsoil. When dry farmed or where there is water for supplemental irrigation, the soil should be uniform, deep, of good physical structure, high water absorbing power and retentive of moisture. Any location in which the water will collect and stand is undesirable. A still less desirable condition is one in which the water table rises to within a foot or so of the surface during the winter, and subsides slowly during the growing period. A covering of irrigating sediments on the soil is adverse to the growth and development of fruit trees. Such deposits usually prevent the penetration of water and air during irrigation, influencing the vitality of the trees.

Alkali: Apple trees are only weakly resistant to alkali salts, especially black alkali (sodium carbonate). Should alkali appear after the

trees have been planted, the ground should be well cultivated to prevent the rise of salts as much as possible. Cover crops should also be grown that will till the ground quickly with roots to a depth of several feet; and large volumes of water applied to wash the salts down into the subsoil. In case of the presence of black alkali, gypsum should be added at the rate of two pounds for every pound of sodium carbonate that chemical analysis reveals present in the soil.

*Elevation** In selecting land for planting, high ground is preferable, where good air and water drainage are assured. The elevation of the orchard with respect to the adjoining lands should be such as to insure drainage from the area.

Exposure: In the cooler portions of the State the exposure may slope gently in any direction. Rather abrupt south, or southwest, exposures are to be avoided. In the warmer localities, however, the exposure should be a north one, the slope being gradual and not too abrupt, to admit of ease in caring for the orchard during irrigation, spraying, thinning and picking fruit. North exposures are desirable because of less absorption of heat by the soil and slower evaporation of water from the surface. The loss of humus and nitrogen is therefore somewhat less than from warmer exposures; and trees come into bloom later, remaining in bloom for a longer period of time. This permits more abundant pollination and setting of fruit.

Preparing the land. To prepare virgin soil, care should be taken to destroy the surface rubbish, and to dig out all roots to a depth of a foot below the surface. The soil should then be tilled until it is in the best physical condition. Should it need humus or nitrogen, or both, it is then advisable to grow leguminous crops, for one year at least. In setting an apple orchard, one is establishing plants whose roots will occupy the entire soil to a depth of several feet for many years, making it quite impossible to improve the condition of the soil with ease and at low cost, at a depth greater than a few inches below the surface.

Varieties: With our meagre knowledge of the adaptability of different varieties to local conditions, the selection of varieties for planting, is rather difficult. It is only possible to suggest a number of varieties that probably will prove suitable for various sections. Objectionable characters, such as shedding the fruit throughout the entire season, shy bearing, or failing to produce fruit of commercial size, may, nevertheless develop. The Bismarck, Duchess of Oldenburg, Golden Russet, Gravenstein, Red Astrachan, Rhode Island Greening, White Winter Pearmain, and all varieties of crab apples, may prove to be fairly good producers at elevations below 3000 feet. At most elevations exceeding 3000 feet may be found the Arkansas Black, Stayman's Winesap, Jona-

than, Missouri Pippin, Delicious and Spitzenberg, as well as a large number of the more common apples of the red or striped varieties. Among the yellow varieties, the White Winter Pearmain, the Yellow Newtown and Grimes' Golden are apparently the leading sorts.

In this list only a few of the varieties that have proven to be good sellers on the general apple markets have been named.

The home orchard: Selecting varieties for the home orchard is an easy task. One should select several, securing the most desirable sorts that mature in succession during the entire season. The winter or long keeping sorts should predominate, in order to have a sufficient supply to store for use until the trees are again producing fruit large enough to cook.

Should space for planting limit the number of trees, the entire assortment of varieties desired may be grown by top working each tree to two or more varieties. The Early Harvest, Red June, Ked Astrachan, Gravenstein, Rhode Island Greening, Jonathan, Missouri Pippin, Delicious, White Winter Pearmain, Stayman's Winesap and Grimes' Golden make a good selection for the home orchard.

The commercial orchard: In developing a commercial orchard, one should confine his plantings to a few of the very best varieties. These should produce long keeping, ready selling fruit, that may be placed on the market in good condition during a long period of time.

The number of varieties to plant in a commercial orchard varies with conditions. In general, a live acre orchard, unless the fruit is to be sold on a local market, should contain only two or three varieties. A ten acre tract, or a still larger area, may contain up to seven or eight varieties. To ship long distances and compete with the same varieties from other apple growing districts, the volume offered for sale must be large, the package neat and attractive, and the pack equal to the competing product. Volume usually makes it possible to establish trade, and for this reason the greater the quantity, the greater the possibility of securing reasonable returns.

Varieties in the orchard should be planted in two, four or six rows etc. in order to facilitate spraying, thinning and packing the fruit.

Ordering nursery stock: Having decided which varieties to plant, it is quite essential to place the order with some reliable person or firm, who will fill the order as given. To plant and care for an orchard until it comes into bearing, only to find the varieties other than those you intended to grow, causes much financial loss, as well as much delay in bringing the orchard into bearing, since it then becomes necessary to top work the trees to desirable sorts.

Such a loss may be prevented by personally propagating the stock,

or by arranging with some reliable person to do the work for you. Apple trees of all sorts show great variations in character, and it is necessary to make a study of individual trees, so that propagating stock may be selected to the best advantage. Propagate only from healthy specimens of a variety true to type, producing heavy yields of fruit, with characteristic physical qualities also true to type.

Budded stock is preferable to grafted stock, since it is less apt to be infested with crown gall and hairy root.

It is generally conceded that nursery stock will give the best satisfaction when secured from a section having about the same climatic conditions as those under which the orchard is being planted. The method of handling the nursery stock from the time it is dug until it is set in the orchard is of still greater importance. Unless dug properly, packed and shipped correctly, heeled in or planted at once and otherwise given the care necessary to keep the stock in healthy condition, the results during the first year, and possibly thereafter, will not be very encouraging.

Kind of trees for planting: In ordering nursery stock, it is best to specify one-year-old stock. Such stock usually has two or three year old roots, generally three years of age, with a top one year old, grown from the bud or cion. Trees of this age are preferable, a majority of them being free from branches. They should measure about five eighths of an inch diameter at the collar, stand four to six feet high, and have good strong buds from the base upward. Planting such a specimen makes it possible to start the head of the tree correctly, and to give one complete control during subsequent training.

Systems of planting: The common systems of planting are the rectangular (trees planted in rectangles or squares); quincunx (planted in fives—rectangles or squares with a tree in the center of each) and the hexagonal (trees in groups of seven, six in a circle with one at the center of the circle). The rectangular is the most commonly used. This system permits of intercropping and the greatest ease in caring for the orchard. The quincunx is the ideal system for planting with fillers. The fillers may be removed later, and the trees then stand in rectangles or squares. The hexagonal system gives good spacing, all trees being equal distances apart in all directions, consequently equally exposed to light and other conditions. Small varieties whose top development is slow, require about twenty-five feet of space. Rank growing varieties may need as much as forty-five feet of space. Twenty-eight to thirty-six feet are good averages.

Planting: The size of hole for planting the tree depends upon the nature of the soil. The more compact the soil, the greater should be

the diameter of the hole up to thirty inches. Soil should be removed to a depth of fifteen to eighteen inches.

Previous to, or at the time of setting, all trees should be examined very carefully to detect all diseased or otherwise infected ones, so that they may be discarded. The roots should be trimmed, in order to remove all broken and mutilated portions of branches and thin out the thicker ones, providing good space for the remainder. Shovel loose soil into the bottom of the hole, preferably top soil; place the tree in this loose soil with the roots spreading out in their natural position; work the dirt under the crown and around the branches with the fingers, being sure that the soil comes in contact with every root, and all spaces are tilled, excluding the air. After the roots have been covered to a depth of two to three inches, soil may be packed by trampling with the feet. The upper three or four inches of soil should be left loose, in order to form a mulch that will conserve the moisture. When the tree is set, it should stand erect, and two to three inches deeper than it stood in the nursery row. Immediately following setting, cut off the top about thirty inches above the ground. This cut should be slanting, and about one quarter of an inch above the bud.

Training the tree: During the first growing season, remove or arrest the growth of all the branches that will not be needed in building the framework of the tree. Three to five scaffold branches should be saved. All growth below the lowermost scaffold branch should be rubbed off as soon as it starts. Should the growth be very vigorous, which is apt to occur in the warmer sections, the scaffold branches may be cut back during the middle of the summer, so as to induce them to rebranch and make a growth that will mature before the advent of winter weather. In cutting back the scaffold branches during the summer, enough of each branch must be removed to induce laterals to form at the points where the scaffold branches should be forked.

Training during the second season consists in removing a few cross limbs, and shortening the branches, which work may be done either during the winter or summer, or both, depending upon the rate of growth. Training must be done frequently enough to insure a proper framework, yet at the same time, moderately, so as not to interfere with the development of proper fruiting habits.

General field practice has shown that the open or vase-shaped top permits of the greatest ease in cultivating, pruning, spraying, thinning and picking the fruit. Red varieties of fruit color best when exposed to the light. The tops of such varieties, therefore, should be open. The tops of the yellow varieties may be allowed to develop more brush within the interior, since the fruit develops perfectly with less exposure.

Pruning: When grown under the most favorable conditions, the apple tree requires very little pruning. The training of the tree secures the desired framework and shape. Where there is a tendency for the tree to begin bearing at an early age, and overbear thereafter, with a tendency to accelerate wood growth, winter pruning is generally practiced. Conversely, if there is a rank growth of top, and the tree is prone to produce fruit, the habits of the plant may be corrected by pruning during the summer. A serviceable method for determining this time is to note the development of the terminal pair of leaves on the young wood. Pruning should be done at the time these leaves are turning from light to dark green. The parts and amounts of the trees to be removed must be determined by the pruner, since each individual of a variety, as well as each variety, presents very different problems, even grown under the same conditions.

Bracing trees: During the bearing period, it not infrequently happens that a tree produces more fruit than it can carry without additional support. In all cases where injury to a tree is apt to occur, additional support should be given it, in order to relieve the strain. Weak crotches may be strengthened by putting bolts through the branches above them, and wires extended to the upper portions of the tree. The same object may be accomplished by placing props from the ground at needed points, or by carrying the weight of a branch on a rope from a temporary mast, set alongside, and tied to the trunk of the tree.

Cultivation: Cultivation in the young orchard should be continuous until the trees come into bearing. During the years preceding fruiting, it is necessary to promote the growth of the plant by giving it a uniform supply of food, which results are best accomplished through clean cultivation.

Irrigation: The apple tree requires a constant supply of moisture during the growing season. Either with natural rainfall or irrigation, an over supply of moisture, alternating with periods of great deficiency, damages the plants severely. Under irrigation, the time for applying the water can best be determined by testing the soil with an auger, noting the moisture conditions to a depth of 4 to 6 feet. Applications of water should be made at intervals frequent enough to keep the soil constantly moist. During the application the amount should be of sufficient volume to wet the soil to a good depth, after which time water should be withheld until a subsequent irrigation is necessary.

Intercropping: During the period that it takes to bring the orchard into bearing, the utilization of the ground lying outside of the area occupied by roots of the tree is desirable. Unless the fertility of the soil is utilized, much of the unused portion will be lost. Garden track,

small fruits, bush fruits or any other hoed or cultivated crops may be grown, provided the care given the ground occupied by the intercrop does not interfere with the proper growth and development of the trees. It is quite possible to produce crops between the rows that will pay all or the greater part of the running expenses of the orchard. During intercropping, one should bear in mind that trees will occupy a space three to four feet outside the spread of the top; therefore the intercrops should be planted beyond this area.

Pests and diseases: A large number of diseases of the fruit and tree are controlled through the proper use of fungicides and insecticides, or a combination of them. The intelligent and successful control of an organism causing injuries to the orchard requires a good knowledge of the life cycle of the organism, the orchard practice required to control or eradicate it, and proper spraying methods.

Most fungi causing diseases of the apple tree and fruit are internal parasites, only controllable by removing and burning the diseased portions, or by applying substances to the surface as protective coats. Bordeaux mixture, lime and sulphur, and atomic sulphur are the leading fungicides.

Insects are of two general types, classified by feeding habits. Insects that chew and swallow their food may be poisoned by coating the food plants with some stomach poison, such as arsenate of lead, or arsenite of zinc. Insects that suck the juices from plants cannot be poisoned but fortunately they have soft walled bodies, and are usually exposed, making it possible to kill them by coating the body with an external irritant. Black Leaf 40 and other tobacco products, soap solutions, lime sulphur, and miscible oils are the most useful of the external irritants.

Spraying: To secure the best results from spraying requires a good pressure pump, and an extension rod 8 to 10 feet in length, equipped with an elbow coupling and a good nozzle. For general orchard work, a driving spray nozzle, such as the Blizzard or the Bordeaux, are more desirable than any type of mist spray nozzle. Under high pressure, and with a driving spray, every crevice and angle of the tree will be filled with the spray. While spraying, it must be borne in mind that *only* those portions of the tree sprayed with a fungicide are protected against the ravages of fungi; *only* those portions of the plant coated with poison, when consumed by an insect that chews and swallows its food, will kill the insect; and *only* those soft bodied sucking insects are killed that are actually coated with the spray.

Thinning the fruit: In order to secure well formed fruit of uniform size, it is necessary to remove by hand as many of the young apples as

we judge necessary to permit the remaining ones to develop to a good commercial size. With the fingers, or a good pair of thinning shears, remove all the diseased, wormy or otherwise damaged or mutilated fruit. Also thin to one apple to each alternate spur, if the set of the fruit is very heavy, otherwise leave one apple to each spur. Where fruit only sets on a portion of the tree, two apples may be left on each spur, provided the bearing spurs are not too close together. The bearing spurs should stand at least six inches apart. At the point of contact the color of a red variety will be rather light. Yellow apples mature much better, since the color of the fruit develops more uniformly. A serious objection to two apples on a spur is the loss from the codling moth, the point of contact forming an ideal place for the worm to force an entrance into the fruit. The worm has a habit of eating into each, perhaps to take his choice by flavor, mining both specimens.

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