COMMERCIAL APPLE ORCHARDING.

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INTRODUCTION.

The apple is "king of fruits" wherever it may be successfully grown. It is found in almost every country that has a temperate climate. No other fruit succeeds over so wide a range of territory and under such diversified climatic conditions, and no other fruit brings so sure a return to the grower in proportion to time and money expended upon its production. With proper selection of varieties, location of soil, and subsequent intelligent management, there can be but little risk in planting the apple, which is now no longer a luxury but a staple article of food.

There is scarcely any limit to the choice varieties to select from, beginning with the early ripening Yellow Transparent, Early Harvest, Red June, Early Joe, Maiden Blush, etc., through the list of fall, early winter, and late keeping varieties, including the luscious Pearmain, Rambo, Dyer, Grimes, Jonathan, Spitzenbergs, Yellow Newtown, etc. Indeed, so wide is the range of season of the apple that it is the only fruit of the temperate climates that may be obtained and enjoyed in its natural state throughout the year. Its period of usefulness is being extended through modern methods of storage, and with rapidly increasing facilities for its transportation, its commercial value is greatly enhanced.

From a hygienic standpoint the apple has but few rivals among cultivated fruits. Its mild and pleasant acid is a panacea for many of the ills that the human race is heir to. What fruit can be more pleasant to the palate or more beautiful to the eye than the rich ripe Golden Pippin when plucked fresh from the tree, or what more luscious and healthful when cooked? Who does not remember with extreme delight the delicious baked apple served with sugar and cream or the apple dumpling or apple pie "that mother used to make?" What is more indelibly fixed in our memories and what more pleasing to recall than the happy days of boyhood when clambering into apple trees and filling pockets with luscious ripe fruit from bending boughs?

The apple has not, however, until recent years been grown in commercial quantities of magnitude. Formerly small family orchards of
50 or 100 trees were the average planting. The apple was then grown more for family use than for commercial purposes. But the vast progress and development of apple culture in area covered, the quantity and quality of product, together with the increased demand for home use and exportation, now places this industry in the front rank of commercial resources. Instead of orchards of 100 trees we now find orchards of hundreds and even thousands of acres each, and capital in large amounts is being invested annually, not only for home markets, but for extensive export to foreign countries in fresh and cured forms. The magnitude of the crop has become such that houses and store-rooms, refrigerators, evaporators, and places for expressing the juice have been constructed at all points in fruit regions required for economic disposition of crops.

**SECTIONS ADAPTED TO APPLE GROWING.**

Although the apple may be grown over a very wide range of country more or less suited to its cultivation, there are certain districts especially adapted to its successful growth. For instance, the elevated portion of southern Missouri and northern Arkansas, known as the Ozark region, and the elevated portions of North Carolina and Virginia, where similar conditions exist, are striking examples. The New England, Middle, and some of the Western States are especially favorable for producing fine crops of this fruit of highest quality, and certain sections of Idaho, Colorado, Oregon, and Washington are rapidly coming to the front in successful orcharding. Indeed, there is not a State in the Union in which the apple, in some of its varieties, may not be successfully grown. In addition to soil and climate the proximity to transportation by railroads and water routes is an important consideration in locating an orchard for commercial purposes.

**SITE AND SOILS SUITABLE FOR APPLE GROWING.**

In the selection of a site for apple growing, the injurious effects of exposure to intense heat and cold should be guarded against as far as practicable. This may in part be accomplished by selecting a northern or eastern slope which is quite safe against the direct rays of the sun. The site, if possible, should be elevated above its immediate surroundings, so as to give free air drainage and also ward off late spring frosts, which often kill the fruit germs in blooming time.

The apple may be grown on almost any soil, but the best results are obtained on soils from which native forests have been cleared. Here the physical conditions are such as to afford both ample surface drainage and subdrainage, and the soils are well supplied with the various kinds of plant food essential for a healthy wood growth and finely developed, well-matured fruit crop. Fruit from trees growing on such locations possess the richest quality and highest coloring. But other
locations may be successfully used if the soils receive the necessary preparation before planting and careful cultivation afterwards.

Clay soils require more labor in their preparation, and often need manuring and frequent cultivation and subsoiling. The soil should be frequently stirred during the summer months, and especially during continued droughts. Certain varieties of apples, like Rome Beauty, succeed best on sandy soils, but such lands require fertilizers to keep the trees in vigorous growth. The wood growth on loamy soils will be strong and vigorous, but may not be sufficiently mature to withstand the freezing of rigorous winters. Clay lands do not produce such vigorous growth, and trees on such land are not so liable to winter-kill. With a free subsoil underlying it a loamy clay soil will probably yield the best results, especially if it be well prepared by thorough cultivation and subsoiling before planting. Nearly all lands for orchards should have both thorough surface drainage and sub-drainage. No orchard will endure for a great length of time with stagnant water either upon the surface or within the soil. All surface water from excessive rainfall or other causes should be promptly removed by either surface drainage or subdrainage. If the natural formation of the land does not afford such ready drainage it must be provided artificially. Surface ditches or furrows between the rows of trees may afford temporary drainage, but they are undesirable, for the reason that an orchard thus drained will be difficult to get over in order to give necessary care and also to gather the fruit. Sub-drainage is preferable, and is much more thorough when supplied with well-laid tile. A breaking up of subsoil will afford temporary drainage in a clay soil, but in a few years the soil will again become compacted, when restirring will be difficult on account of the roots of trees. In all cases the planter should be the judge of the special requirements of his soil and location as to drainage.

**PREPARATION OF SOIL FOR PLANTING APPLE TREES.**

The autumn months are generally regarded as the best time to prepare all lands that are designed for apple orchards. The plowing should be as deep as possible, and if the subsoil is stiff clay it should be subsoiled by running a subsoil plow in the furrow made by the turning plow. A good plan is to back-furrow the land so as to leave the dead furrow where the rows of trees are to stand, thus leaving it in a condition for the ameliorating effect of frost. It would be beneficial to break up the bottom of this dead furrow by running the subsoil plow through it two or three times, giving it a good stirring. This method will afford deeper tilth under the trees and allow surplus water to pass off if the orchard is laid off with this object in view. If the autumn preparation is thoroughly done there will not be any need of more than a surface stirring of the soil in the spring.
If the land selected is not in a fertile state at time of plowing it should be enriched with thoroughly rotted stable manure, spread broadcast over the land before it is plowed. Manure is sometimes successfully used by applying it to the land in the fall as a surface dressing, allowing it to remain until spring, when it is thoroughly worked into the soil with a plow or heavy two-horse cultivator. Unleached wood ashes spread about the trees after they are planted afford an excellent fertilizer.

**VARIETIES OF APPLES VALUABLE FOR COMMERCIAL PURPOSES.**

In considering the apple as a commercial article it must be studied in all its features in reference to its fitness both in tree and fruit. Most of the varieties now under cultivation are in no wise commercial sorts.

The main point in the selection of a variety should be the determination of its valuable qualities as an article of commerce. This can best be determined by an inquiry in the markets as to what are the sorts that command highest prices and find readiest sale. Such an investigation will show that a fairly large, highly colored fruit invariably attracts the eye of the purchaser. A clear, bright red apple will be preferred by many to any other color, but to the commercial orchardist this is not the only desirable character, for some varieties of trees bearing bright red apples are not profitably fruitful, nor are the apples good keepers and shippers. The main points to be considered in the selection of varieties for a commercial apple orchard are medium to large size, attractive in color, good in quality, fair to late keeping, firm enough to handle and ship well, and adaptation to locality. The latter is especially important and cannot be too highly emphasized, for a variety may have all the necessary qualifications for a perfect apple, yet if the tree is not suited to its environment it will be a failure for commercial purposes.

One of the most common mistakes made by the commercial apple orchardists is in planting too many varieties. Having obtained a list of varieties that have been found by actual experience to be adapted to the locality where the orchard is to be planted, a careful selection from this list of a few of the very best should be made; the fewer the better, provided the varieties chosen are such as will meet the above-mentioned requirement in all points.

Out of a list of ten or fifteen varieties there must, of course, be a few superior to the others in desirable qualities. If so, why plant the less desirable ones? The fewer the number of varieties the less will be the trouble and expense in handling the crop.

In the list of varieties which are generally recognized as leaders in commerce the most prominent and most largely grown are such varieties as Baldwin, Ben Davis, Jonathan, Northern Spy, Rhode Island
Greening, Roxbury, Tompkins King, Winesap, Yellow Newtown, York Imperial, etc., all of which are grown more or less extensively in the various sections of country to which they are adapted. The character of the trees to be planted is a matter of equal importance with the character of the fruit. The trees must be hardy, to endure the vicissitudes of the climate in which they are to grow. They should be prolific, but not inclined to overbear. Trees that bear heavy annual crops are generally short-lived, and all such should be planted in a block by themselves or as alternates in rows of those of a more enduring character. Such trees are known by orchardists as fillers. The foregoing points are of the highest importance and should be strictly regarded in the management of a commercial orchard to make it a success. It is not possible to give a list of desirable varieties which will be safe for all planters to use, as climate, character of soil, and location are very different in the various portions of the country. It does not necessarily follow because a certain variety is adapted to one locality that it will succeed equally well in all other sections. Many mistakes are made in planting orchards by not observing this law of adaptation to locality. The safest means of determining what to plant is through an investigation of varieties already fruiting that have proved a success in near-by orchards which are on a similar soil and location to the one it is proposed to plant. It is far better in commercial orcharding to plant such varieties as have been tested and found to succeed than to risk new varieties that have not been tried. In other words, no commercial orchardist can afford to experiment with untied sorts if he expects to make his enterprise a profitable one. A vigorous, well-rooted, straight trunk, evenly branched 2-year-old tree is considered the most economical kind to plant. A 1-year-old tree is preferable to any tree over 2 years old. (Pl. LXXXVII.)

As to time of planting, the best authorities differ in opinion. Some advocate late fall planting; others advocate early spring planting. It is claimed for trees set in the fall that the ground becomes firmly settled among the roots, and that all cut and lacerated roots, becoming calloused before spring opens, are prepared to push out new roots with the appearance of the first warm weather. The objections to fall planting depend upon atmospheric and soil conditions. If there is a lack of moisture in the air and soil, the fall-planted trees do not become sufficiently established to draw the necessary amount of moisture to maintain their vitality, and in regions subject to sudden extremes of low temperature the newly planted tree is liable to burst its bark and even split open the woody layers, such injury resulting in the death of the tree or in weakened vitality from which it never fully recovers. Such injuries never occur to trees planted in the spring. These are a few of the points regarding the time of planting, but they have no
bearing in localities not subject to winter freezing. In such localities there can be no objection to fall planting.

In regard to the distance apart to plant the apple tree many practical orchardists differ radically. Some advocate a closely planted orchard, as they desire to realize several crops of fruit from the land before the trees will have grown to a size sufficient to interfere with each other, when every alternate tree in each row should be cut out. To this method the objection is made that close planting will interfere with proper cultivation after the trees have come into bearing. In such systems the trees are set 20 by 20 feet apart, and when thinned out the permanent orchard will be 40 by 40 feet between trees. Others lay out the rows 30 to 32 feet apart and set the trees in the rows 15 to 16 feet apart. Such plantation will leave this permanent orchard 30 to 32 feet apart between rows. The profitableness of this close system in planting is not in the long run regarded as reliable, and many extensive planters have settled on a space of 32 feet between all trees each way, with no fillers. This distance affords ample room for cultivation with a two-horse plow or cultivator, for hauling in manure, and for removing the fruit in time of gathering. To facilitate the work of setting out trees, the site or location should be marked off in such manner as to indicate the spot for each tree. This can be quickly done by setting a stake at the end of each row on each side of the plat to be planted and then, with a two-horse plow, opening out a deep furrow from stake to stake along the proposed tree row one way. If the plan, as previously mentioned, of preparing the land in autumn by leaving the dead furrow where the row of trees is to stand, it will only now be necessary to cross check these furrows the other way at right angles, guided by stakes set at the ends at the proper distance apart for the trees. In large plantations the land should be laid out in blocks of 10 to 20 acres each for convenience in planting.

Before beginning to plant, the trees should be hauled on to the land, distributed at convenient distances, and heeled in in bunches. After the holes have been properly prepared at the intersection of the furrows by simply leveling off the bottom of the furrow sufficiently to allow the roots of the tree to be placed in natural position, the trees should be set. Three persons are necessary to do the work of setting, viz, one to prune the roots and tops and distribute along the row, one to hold the tree in place, and one to shovel the dirt in around the tree. Some planters simply line off the tree rows with stakes and set the trees by measuring off the distance along the furrow. In such instances the tree rows are straight lines only one way, and subsequent plowing and cultivation is only given to the rows in the direction in which the trees were planted for the purpose of ridging the land against the trees for surface drainage and culture. This method is recommended more especially for land that is comparatively
BEN DAVIS APPLE TREE. HILLCREST ORCHARDS, KENTVILLE, NOVA SCOTIA.

[This tree, low-branched, planted halfway between standards four years ago, produced one barrel. Photograph taken by J. Craig seven weeks before fruit was picked.]
FIG. 1.—BALDWIN APPLE ORCHARD, 25 YEARS OLD. WESTERN NEW YORK.

[Condition of orchard after first plowing in spring. Photograph by J. Craig.]

FIG. 2.—BALDWIN APPLE TREE, 40 YEARS OLD. MONROE COUNTY, N. Y.

[Record: 18 barrels of apples, 1901 (off year), selling for $3 per barrel. Photograph by J. Craig.]
level and composed mostly of clay, in which if holes were dug basins would be formed that would retain water too long after a heavy rain-fall. Other planters resort to the method of carefully staking and lining the rows each way and keeping a fourth man engaged in sight-ing each tree into line with the stakes. In this case, the trees are set by a line stretched along the furrowed row, and the sighting is made across this row from stake to stake on opposite sides of the plat. Before setting the tree its roots should be shortened in and all bruised places pared off to sound wood, while the tops should be thinned out and cut back to offset the loss of roots occurring in transplanting. Straighten the roots to their natural position and fill in among them fine dirt, trampling firmly with the foot. The tree should be set from 2 to 4 inches deeper than when in the nursery, leaning it slightly to the south or southwest to brace it against the prevailing winds and so that the tops will afford protection to the other parts of the tree from the intense heat of the afternoon sun, which is liable to cause sun scald. An inspection of orchards in almost any portion of the country will show a large percentage of the trees leaning toward the north-east, and that their southwest sides are badly affected from sun scald, borers, and other injuries that might have been largely avoided by a little precaution at time of planting, as already indicated. After the planting is completed the open furrows between the trees may be filled up by plowing one or more furrows against the row.

**CULTIVATION OF THE APPLE.**

With the trees carefully planted, the management thereafter is comparatively easy, and should be successful with intelligent labor, which is applied mainly to cultivation, pruning, and protection from injurious insects and other enemies. Each tree should be carefully watched, and every means should be employed for giving it the best possible conditions for health and vigor, with a view to producing first-class fruit, which will command highest market prices. To accomplish this will require thorough tillage from early spring until midsummer, when all cultivation should cease and some cover crop be sown. This will cause the tree to close up its growth and mature its wood and buds and enable it to withstand a low degree of temperature. This is especially applicable to sections of country subject to extreme changes in climatic conditions. Among the desirable cover-crop plants are the clovers and legumes, such as cowpeas, beans, vetches, etc. These cover crops not only protect the roots of the trees from extreme cold and prevent the washing of the land by spring and fall rains, but afford a supply of humus so essential for the maintenance of the fertility of the soil and its physical condition; they also serve as a mulch, preventing the evaporation of moisture during drought. To obtain best results, cover crops should be turned under
early in the spring by plowing shallow, so as not to disturb the roots of the trees. All subsequent cultivation, which has primarily for its object the pulverizing of the soil to form a mulch for the retention of moistures, should be done with a two-horse cultivator, such as farmers use in corn culture, or a disk harrow, followed by a smoothing harrow. These implements should be used as soon as possible after every rainstorm, so as to maintain the surface mulch, which is essential for preventing the escape of moisture and for releasing plant food. If the land is level, all cultivation should be done so as to work the soil toward the tree row, which will leave the land gently sloping to an open center space between the rows, thus forming surface drainage. Cultivation in some form will be necessary each year until the trees have attained a size and age sufficient for bearing a crop of fruit, when the land may be seeded down with clover. This will have a tendency to change the buds of extension into fruit buds, and thus bring the orchard into bearing much sooner than it would if allowed to continue its rapid growth. Anything that checks the growth of the tree will produce the effect of causing it to bear fruit. In no case should any part of the clover crop be removed from the land, but it should be allowed to fall and decay upon the ground. By this treatment a large amount of decaying vegetable matter rich in plant food will accumulate upon the land and furnish protection from hot sun in summer and deep freezing in winter. Once in two or three years this may be plowed under, thus, to a great extent, restoring humus to the soil, which is very essential to the vigorous growth, health and longevity, and fruitfulness of the tree; besides such treatment saves the expense of using costly fertilizers. After one year of cultivation the land should be again reseded, and the treatment repeated from time to time the same as with the first seeding.

The practice of growing some kind of a crop on the land between the rows of trees has become quite common as a matter of economy. This may be done for a few years after setting the tree without any detriment to the orchard, provided the crop is of such a nature as to require thorough cultivation and fertilization, so that instead of taking from the soil that which is necessary to the growth of the tree it will enrich it. To grow among the trees the first year of planting there is no better crop than corn; it requires thorough cultivation and affords a shade to the newly planted tree at the season when it most needs protection from the sun’s greatest heat. Other crops, such as potatoes, cabbage, cucumbers, peas, beans, etc., may be grown to advantage, but in no case should small grain or grasses, which do not allow cultivation, be allowed. All the crops mentioned take from the soil plant food which will be needed in future for the orchard’s support, and which should be returned in the form of some kind of manure. This can best be done, as already stated, by using well-decomposed
barnyard manure, which not only furnishes three principal elements of plant food (potash, nitrogen, and phosphoric acid), but also improves the physical character of the soil by the addition of humus, which such manure contains, and for this reason it is preferable to commercial fertilizers, which do not furnish the humus that is especially needed on dry clay lands. Commercial fertilizers may sometimes be used to advantage when there is sufficient humus in the soil but a lack of the elements of plant food—potash, nitrogen, and phosphates; but in soils without the humus the benefit of such fertilizers is questionable. (Pls. LXXXVIII and LXXXIX, fig. 1.)

PRUNING THE APPLE TREE.

Pruning and training are important factors in the successful management of an apple orchard. The objects to be attained are (1) symmetrical and evenly balanced heads, and (2) the admission of sunlight and free circulation of air into all parts of the tree top while maintaining a sufficient density of foliage to protect the trunks, branches, and fruit from the direct rays of the sun, which are liable to scald and injure both tree and fruit. All pruning and training possible should be done while the trees are young and the wood growth tender, as the healing over is more rapid and complete and the tree suffers less injury by the operation.

If the trees are 1 or 2 years old when set they should be cut back to the height from the ground it is proposed to form the head of the tree. This cutting back will cause several of the upper buds to grow, which will form the head at the proper height. These should be watched and only such left to grow as are to form the main branches. Those left should be the strongest shoots at equal distances apart around the stem, and should tend to an outward growth to spread and make an open head. Much of this pruning and training if performed at the proper time can be done by rubbing off the buds or pinching back the tender branches with the thumb and finger.

In all pruning done to give the desired form to the head, and especially while the tree is young, the orchardist should keep clearly fixed in his mind the future form of the tree, that is, what it should be when old; for what may seem to be an open head when young may prove when the trees are older to be too dense and crowded and the branches too closely formed together for convenience in getting around the tree for gathering the fruit or in giving it the necessary pruning. If at any time it should become necessary to remove limbs of considerable size, the wound should be covered with some substance, such as grafting wax, shellac varnish, or paint, to prevent drying and checking of the wood, which admits moisture and causes decay.

During early springtime, or even late winter (when the wood is not frozen each year), every tree should be carefully looked over,
and all branches which are liable to interfere with adjoining ones should be cut out and the centers of the dense growth thinned out; side branches which are making a stronger growth than others should be checked by heading in the terminal or central shoots, and all parts of the tree should be cut back whenever necessary to maintain an evenly balanced head. Some varieties have an upright habit of growth and some make slender growth; such need close attention each year in cutting back one-half of last year's wood growth, leaving the top bud on the side of the branch facing the direction to which it is intended to divert the growth. By this treatment there will be no difficulty in shaping the tree into any desired form. Open spaces in the tree may be closed up, as, for instance, when the tree has been deprived of a necessary branch by accident or otherwise the loss may be recovered in time by pruning the adjoining branches so as to divert the growth into the portion made bare of branches.

There is a diversity of opinion among orchardists as to the proper height at which to form the top or head of an apple tree. Formerly from 4 to 5 feet was the common practice of training apple trees, but 2 to 3 feet is now conceded to be preferable.

The objection to low-headed trees on account of the difficulty in cultivating the land has been overcome by practical experience and improved implements. A careful teamster will do less damage to a low-headed tree than to one with a high top. With the improved implements now in use, thorough tillage can be performed as well among low-headed trees as among those with high tops. There is less danger from high winds with the low heads, and pruning can be performed with greater facility and ease, while the saving in expense of gathering the fruit is quite an item; but the more important advantage gained by the low head is the protection of the body of the tree from the rays of the sun, causing, as stated, what is known as sun scald, which is very prevalent in some sections of the apple-growing region. Another point gained by the low head is in conservation of moisture and lower temperature around the base of the tree. No arbitrary rule, however, should be laid down as to the height of a fruit tree. This may depend upon the locality, exposure, variety, and desire of the planter. Some varieties have an upright habit of growth, while others have a drooping or horizontal habit, each requiring a training according to its requirements; but whatever difference of opinion there may be on this subject, it is now generally conceded that the low top, all things considered, is preferable.

There are three forms that are generally adopted in this country. One known as the vase or goblet form, which prevails to a large extent in the Pacific coast region, where by long experience it has been found to be best suited to the conditions of that section.
form is obtained by cutting out the central stock or leader and training by a system of pruning into the shape of a vase or goblet. The pyramidal form is the opposite of the vase form, in that the main stock or leading shoot of the tree is allowed to maintain its upright growth and the side branches are shortened back so as to produce the form of a pyramid. There is, however, a modified form between the vase and the pyramid, which gives a round, symmetrical shape to the tree, sufficiently open to allow of free circulation of air and sunlight. This form is more generally adopted, and gives better satisfaction throughout the Central and Eastern apple-growing regions.

Protection from damage to young trees by mice and rabbits during the winter months should be provided. Anything that affords a harbor to mice, such as grass, weeds, or leaves, should be removed from around the trunks of trees. For preventing rabbits from gnawing the bark from young orchard trees, which is very important, many methods have been devised. The most effective plan is to tie some material around the body of the tree to the height of 2 feet or more. Cornstalks or rye straw, cut the desired length, serve the purpose very well. Building paper, plain or tarred, tied around the trees is effective and economical. This paper protection, by leaving it on the tree during the summer, may also serve to prevent the beetle of the apple-tree borer from depositing its eggs in the buds of the tree.

INSECTS AND DISEASES AFFECTING THE APPLE.

Among the obstacles and drawbacks with which the apple grower has to meet and contend are the numerous insect enemies and diseases to which the fruit is subject. From the very beginning of his planting of trees he must exercise eternal vigilance and warfare on these foes to successful orcharding. Even before planting the orchardist must be on the alert for root aphid, which may already infest the roots of the trees when taken from the nursery, and if discovered these enemies should be exterminated at once byimmersing the roots of the trees in a decoction of tobacco before planting. The next enemy encountered after planting will be the borers, of which there are two species—the round-headed and the flat-headed apple tree borers. These are very destructive to young orchards, and nothing but extreme watchfulness and vigilance will prevent them from working great harm to the trees. The use of the knife and the probe are the most effective remedies when the insect has once found lodgment in the tree. The orchard should be gone over twice or three

1 It is not the scope nor purpose of this paper to treat of insects or diseases in detail, but only to call the attention of the apple grower to some of the more important in a cursory way. For more complete information on this subject, the reader is referred to publications by the Entomologist and Pathologist of the Department of Agriculture, which may be obtained on application to the Department.
times during the growing season and diligent search made for the pest in its haunts, where it is readily found by observing the chips it has cast out of the trunk of the tree. In the case of the round-headed species the larva will be found either above or below the surface of the ground, and the borer may be removed or killed in its den by a piece of malleable wire for a probe, which will bend in following its burrows.

The use of some substance, as previously stated, wrapped around the body of the tree 2 or more feet in height will prevent the beetle from depositing its eggs in the tree; and the old saying here holds good, "An ounce of prevention is worth a pound of cure."

The root aphis and the borers have been mentioned first as affecting the trees, but the greatest enemy to apple culture is the codling moth, which damages the fruit to an alarming extent, and is more difficult to combat than most other insects. It is the most universally distributed of all the insects injurious to the apple. The loss to the commercial apple grower caused by this pest in this country can hardly be estimated. Where the proper efforts are made in the most intelligent and up-to-date way, codling moth damage may be kept down to less than 10 per cent, but in a large part of the country orchardists seem not to be willing to go to the expense or trouble involved in the operations. In the far Northwest the codling moth seems to be especially injurious, and the Department of Agriculture is now investigating the causes of this increasing injury.

In some of the Western and Northwestern States, where the climatic conditions seem to be most favorable for the propagation of this insect, it is rapidly on the increase, and nothing but the most stringent measures and constant vigilance will keep it under control. Spraying with some of the arsenites is the principal remedy and preventive now in use, but this alone is not a perfect success. Nature steps in to assist man in checking the increase of this insect by introducing its enemy, the Ichneumon fly. This fly lays its eggs in the codling moth, and these eggs hatch out grubs, which kill the insect.

Among other injurious insects to the apple are the tent caterpillars, which are easily destroyed; the cankerworm; also the several scale insects, including the San Jose species, which seems to be spreading over the country rapidly, and should be most vigorously guarded against, since its natural enemy has not yet been introduced or multiplied in sufficient numbers to hold it in check.

The apple scab and bitter rot are perhaps the two more important diseases to which the apple is subject, and they are deserving of close attention. They can be controlled or checked very much by spraying with formulas recommended by the Pathologist. All of the fungous diseases, in fact, are more or less checked when thorough spraying is practiced. (Pl. XC.)
Fig. 1.—Apple Orchard of F. H. Speakman, Neosho, Mo., September 18, 1901.
[Grimes and Jonathan varieties, with cowpeas between rows.]

Fig. 2.—Apple-Packing Outfit of Fred. Welhouse, Moore, Kans., September 20, 1901.
NORTHERN SPY APPLE TREE.

[Photograph furnished by J. Craig.]
The financial success of a commercial apple orchard depends largely upon the methods used in picking, sorting, packing, and disposing of the crops. These operations involve a large share of the expense of the enterprise; hence the owner should carefully study and investigate the most recent and economical methods in practice by others before he adopts any. If the crops are rightly handled there will be no difficulty in finding a ready market for choice first-class winter apples.

All fruit must be carefully hand picked, avoiding bruising or breaking of the skin or straining of the stem at its juncture with the apple, for a loosening of the stem at its base will induce rot to set in as quickly as the breaking of the skin. Some orchardists use for a picking receptacle a convenient-sized basket, lined or padded to avoid bruising, with an adjustable bale, so as to allow the fruit to be carefully dumped in piles under the shade of trees. To the piles barrels are hauled and distributed for packing, and a gang of sorters and packers follow, sorting and packing the fruit into the barrels. Another method is to use a 2-bushel grain sack which has its ends so fastened together with a strap or cord that it can be swung under the left arm, the strap crossing the right shoulder, and the open end of the sack, with a hoop in it to keep it open, resting on the breast, thus enabling the picker to use both hands.

A platform wagon filled with open-headed barrels follows the pickers between rows, and the fruit is emptied from the sacks into the barrels until filled, when the load is drawn to a packing house (constructed on the premises) provided with long sorting tables, where it is dumped. The fruit is sorted and packed direct from the tables into the barrels.

The time for picking the apple must be determined by its maturity or stage of ripeness, and not by any particular date. Some varieties should be picked much earlier than others, for upon the stage of maturity and time of picking depend largely the keeping quality of the apple. Sometimes a difference of one or two weeks in date of picking will show marked difference in keeping. If the apple is left on the trees after it is fully matured the ripening process will go on more rapidly than if taken off and placed in a cool room or cellar or taken at once to cold storage. It is better to be on the safe side and pick the fruit a little before maturity rather than to leave it until overripe. The common practice of allowing the fruit to remain in heaps under the trees for several days is a mistake. The sooner the apple is removed after picking to the cool cellar or to cool storage the better will it keep.

Careful and systematic sorting is an important matter in handling
fruit. The old adage, "Honesty is the best policy," will apply to this case. No imperfect, unsound, or blemished fruit should be allowed in the first-class No. 1 grade. The grading should be uniform. Any small specimens, as well as oversized ones, detract from the appearance of the whole lot in the package. The standard size should be an average of the variety when well grown; to be first-class it should be in regular form, free from fungous disease, and of clear color, to become attractive in the market. If the sorting and grading is honestly and faithfully done there will be no difficulty in finding a ready paying market for first-class winter apples. The requirements of the National Apple Shippers' Association on grading are worthy of consideration by the commercial orchardist, and are quoted, as follows:

The standard size for No. 1 apples should not be less than 2½ inches in diameter, and shall include such varieties as Ben Davis, Willow Twig, Baldwin, Rhode Island, and other varieties kindred in size. That the standard for such varieties as Romanitic-Russet, Wine-sap, Jonathan, Missouri Pippin, and other varieties kindred in size shall be not less than 2½ inches. And, further, that No. 1 apples shall be at time of packing practically free from the action of worms, defacement of surface, or breaking of skin; shall be hand picked from the tree, a bright and normal color, and shapely form.

No. 2 apples shall be hand picked from the tree; shall not be smaller than 2⅜ inches in diameter. The skin must not be broken nor the apple bruised. This grade must be faced and packed with as much care as No. 1 fruit.

Every orchard of considerable size should be provided with some sort of a storage house, either for temporary or permanent storage of apples, for without such place the orchardist is liable to loss and inconvenience. The storage house should have ventilation, and be opened by night and closed by day, so as to control the temperature in a manner to secure the right condition for preserving the fruit. It should also be constructed so as to have conveniences for sorting and packing the fruit as it is brought from the orchard. A fruit house, if properly constructed with air spaces in the walls, will serve to keep out frost, so that the grower may hold his fruit for a considerable length of time, thus giving him better opportunity for disposing of his crop.

Packages and packing are among the essential items of a well-managed orchard. (Pl. LXXXIX, fig. 2.) The package almost wholly in use in the Eastern, Middle, and Western States is the apple barrel adopted by the National Apple Shippers' Association, which is of standard size, 17½ inches in diameter of head and 28½ inches in length of stave, with bulge not less than 64 inches, outside measurement.

The box package is used entirely on the Pacific coast and in the States of the Northwest, and for several reasons this is preferable to the barrel. It is better suited for the retail trade, as small consumers can better afford to buy fruit in such a package than in a barrel. It is more convenient for handling, and occupies less space in shipping; it also carries the idea of a finer quality, doubtless on the principle that the
"best article is put up in smallest packages." Another advantage it has over the barrel is that it can be made much more attractive by use of display labels, such as are used for oranges, lemons, and other fine fruits. This kind of package will in time supersede all others for both the wholesale and retail trade. There is at present no standard size for the box package, but the one most commonly in use, and claimed by some to be the regulation size, measures inside 9 \(\frac{1}{2}\) inches high by 10\(\frac{1}{2}\) inches wide by 20\(\frac{1}{2}\) inches long, and holds about 1 bushel, or nearly 50 pounds, of apples, varying slightly according to variety. If this package is used, the fruit should be carefully graded to uniform size and packed in layers; if wrapped in paper similar to that used for oranges, it will be found to keep better and will command a higher price than the unwrapped fruit. A fancy display label bearing the name of the variety and the name and address of the grower or dealer should be put on each box.

If honest work is done in grading and packing, the owner can soon gain a reputation, so that as soon as his brand is seen the purchaser knows at once what he may expect to find all through the package when it is opened. A smaller-sized box, holding about one-half a bushel, would be still more convenient for the small purchaser in the retail trade.

If the barrel package is used it should be set on end, and after removing the upper head, firmly pack at the bottom two layers of apples, which should be a fair sample of the entire contents of the barrel; arrange the layers so that the stem end of the apples will face downward. Then fill the barrel loosely until about half full; gently but thoroughly shake the fruit down, then fill the balance of the barrel, rounding it up to a little more than full; the head is then put on and pressed down into place with a screw or lever and the hoops put on and nailed fast. The ends of the barrel are reversed, and on the end having the faced layers should be marked the true name of the variety inclosed and the name of the grower or packer; this label will indicate the end to be opened.

It is quite a common practice among many extensive orchardists to sell their entire crop of apples while on the trees, the purchaser doing all the work of picking, sorting, and packing. When the proprietor possesses sufficiently good judgment to be able to closely approximate a safe valuation of the crop, and a fair price is offered, this is an economical and satisfactory way of disposing of a crop, as there is much hard, vexatious work, and more or less risk to run in gathering, packing, and handling of the crop. But in case the owner chooses to handle his crop, an immediate sale, as soon as it is barreled and ready for the market, is considered the safest and surest way to dispose of it. The holding over for a better price in future is more or less risky, and oftentimes results in loss from shrinkage and sometimes
the necessity of re-sorting and packing, which would require more of an advance in the market price to make the loss good than often occurs.

All of the crop left after assorting out the No. 1 and No. 2 grades should be classed and treated as culls, and sold to evaporating and canning establishments or to cider makers, unless the owner has all the facilities at hand for working them up. For extensive orchards the profits on the by-products will justify the expenditure for buildings and machinery necessary for working them up. In some instances the by-products of the orchard have been known to exceed in value returned the receipts from the main crop. Of course, such were exceptional cases. It is also true that no permanent profit ever comes to the producer who would compel his good fruit to sell his culls for him.