

COOPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
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The Apple and Pear in Oklahoma

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The purpose of this Bulletin is to discuss in a popular way
the various problems encountered by the person who plans
to produce Apples and Pears.

THE APPLE AND PEAR IN OKLAHOMA

INTRODUCTION

In many states fruit growing is found in three different stages of development. These are the home orchard, the semi-commercial orchard, and the strictly commercial orchard. Some of the general principles which have to do with orchard work apply to all of the different types. The home orchard is an orchard the purpose of which is to furnish fruit for the home. This orchard may contain ten varieties of apples and may have from one to several trees of a kind. It would be far better to have a family orchard of about fifteen trees made up of four or five varieties which are suited to the location and which will furnish apples for the longest possible season. The semi-commercial orchard is one which may have fifty trees and up, the purpose of which is to furnish fruit for the home and at the same time have some fruit which can be sold as a cash crop. The strictly commercial orchard, while it will furnish fruit for the family, has as its primary object the production of fruit to provide an income, just the same as livestock farming or grain farming. This orchard may consist of twenty acres up to several hundred.

THE LOCATION AND SOIL

The first requisite for any orchard, regardless of whether it is for home purposes or for commercial purposes, is a suitable site. A good site means a location on which is found the right kind of soil, and if a commercial orchard, it should have a ready access to market or have shipping points such that the fruit can be conveyed to the loading platform with sufficient ease and rapidity so that excessive cost and loss of time will not prevent economical production. The site must have sufficient slope to provide good air drainage and water drainage. A slope which has a 3 per cent fall usually will be sufficient for this. The direction of the slope is important in Oklahoma, for a south or southwestern slope will cause fruits to blossom out earlier and increase the danger of loss due to frosts. This is particularly true in case of peaches and some varieties of plums.

While the slope is quite important it is also a fact that the soil and particularly the subsoil very often is a limiting factor. It is well recognized that in many parts of Oklahoma one cannot tell the nature of the subsoil by merely examining the surface soil. In the experimental orchards at the college a part of one plot has good surface soil 8 inches deep, while the subsoil is of such a nature that the roots of the trees cannot penetrate it, and the result is that during a part of the year there is an excess of water around the roots of the trees, and during another part of the year the trees are suffering for the want of moisture.

A good orchard soil should have a surface soil at least a foot deep, and a subsoil which is rather open and porous for not less than 3 feet below the

surface and preferably 6 feet. In order to determine whether or not the sub-soil is of the nature as described, tests should be made at a number of places over the location where the orchard is to be planted. It should be noted here that while trees of the various fruits may grow on a soil which is not particularly fitted for orchard work, yet if fruit growing is to become a profitable business, care should be taken to select the proper soil, and the site should not be determined by the price which is asked for the land.



Fig. 1—A Result of a Poorly Drained Soil.

The point is that cheap land, if not suited to the business, is dear at any price. Furthermore, the fertility of land is not so important in selecting the site for an orchard as are the physical qualities. Persons who are contemplating planting an orchard should secure the services of a county agent or of the extension horticulturist before starting the preparation of the land for the orchard. A mistake made at this time can never be corrected.

There are many examples where one orchard has been a success while another has been a failure, even though the distance between the two orchards is less than 500 feet. In fact, the trees shown on pages 4 and 9 are from the same orchard, yet one spot is not suited for growing fruit while the other one is.

The next step after the location has been selected, which should be a year before actual planting is to be started, is the preparation of the land. This is quite important for, regardless of what care may be given the orchard after it is planted, there will be no more cultivation of the soil in the spot where the tree is planted. Therefore a good cultivated crop should precede the actual setting out of the orchard. It is poor practice to have a grass crop precede the orchard. Indeed a sod turned under the year that the orchard is to be planted may cause considerable loss of the young trees and will greatly add to the expense of planting by requiring extra labor to plant the trees well. Furthermore the unrotted sod will interfere with cultivation the first year, which will make it much more difficult to grow intercrops.

PURCHASING AND HANDLING OF NURSERY STOCK

One of the important factors in orchard success is the planting of good first-class nursery stock. It should be emphasized that the trees must be true to name, that they be thoroughly healthy, properly matured and full of life. By the latter is meant that the trees should be entirely dormant but in strong living condition when they are received by the grower and not be shriveled or discolored, nor show any other evidence of improper handling. It means, moreover, that there must be no evidence of "crown gall" and that there should be a good root system.

For general planting it is as a rule admitted that one year old trees are preferable, and that trees in no case should be older than two years from the bud or the graft. The one-year trees generally cost less, they are more readily shipped and transplanted and besides the head of the trees can be formed as the grower decides. It is true that, in the case of persons who are inclined to neglect the young trees, a two-year tree might be better for the head is already formed.

It is best to buy directly from responsible nurseries and to order early, submitting your list to a number of firms for bids. Indeed if you are at all close enough to the nursery it would pay to make a personal visit to observe the trees as they are growing in the nursery row.

When the trees are received they should be taken from the package in which they were shipped and should be heeled in. It will pay to dig a trench, or where there are a great many to be heeled in, a trench can be plowed and then the trees should be spread out so that there is sufficient space for each tree, rather than pile one on top of the other, which might result in the loss of some trees. The roots and a third or more of the top should be covered with earth, which should be well worked in around the roots. A second layer then can be laid on top of this one, whereby the second layer of trees helps to

protect the first layer. The place where the trees are heeled in should be sufficiently drained so that water will not stand on the trees and it should be free of all vegetation to guard against damage by mice.

LAYING OUT THE ORCHARD AND PLANTING

There are two systems of arranging trees in an orchard. The first is the square or rectangular system and the second is the one known as the hexagonal or the equilateral triangular. Practically all of the commercial orchards today are laid out on the square system. It allows more space for intercropping and it is more desirable where fillers are to be used. The following plan suggests how fillers might be used and shows which trees can later be taken out:

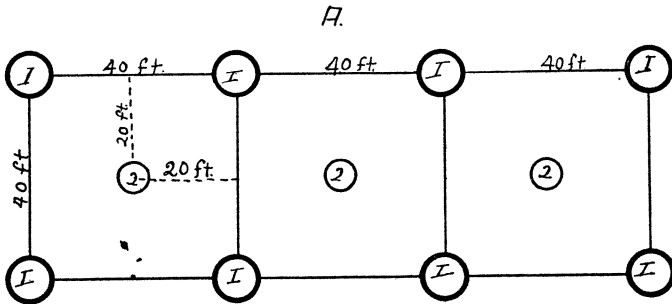


Fig. 2—Plan "A"

This plan is one of the best for all persons. By placing the permanent trees 40 feet by 40 feet and putting one filler in the center of four trees, the land is utilized and yet crops can be grown for the first four years.

B.

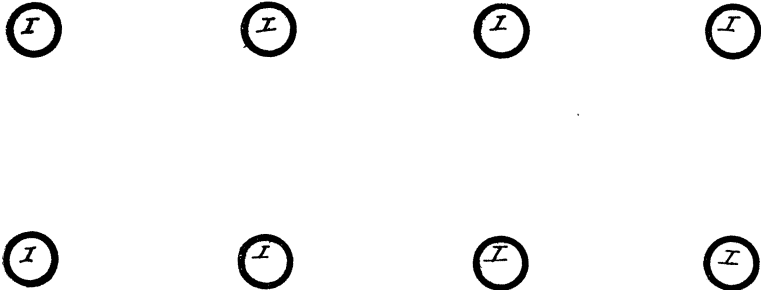


Fig. 3—Plan "B"

This is the square system with no fillers. Where land is cheap, and where there is capital to carry the orchard till it gives returns, this method will develop good symmetrical trees. As shown on page 8.

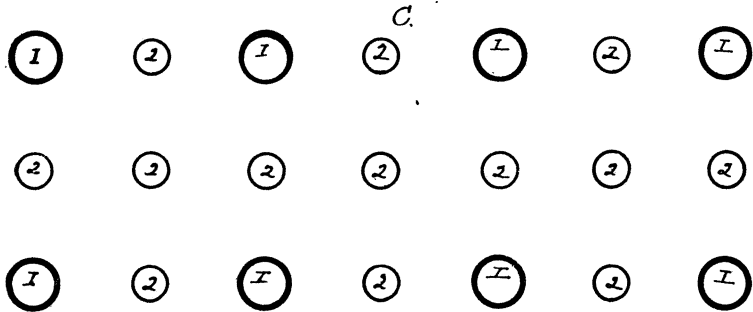


Fig. 4—Plan "C"

This plan has three times as many fillers as permanent trees. It is not recommended for it crowds the trees too early and while larger crops may be secured earlier in the life of the orchard, yet in the long run it will be found to be undesirable. The trees will grow tall as shown on page 9, Figure 7.

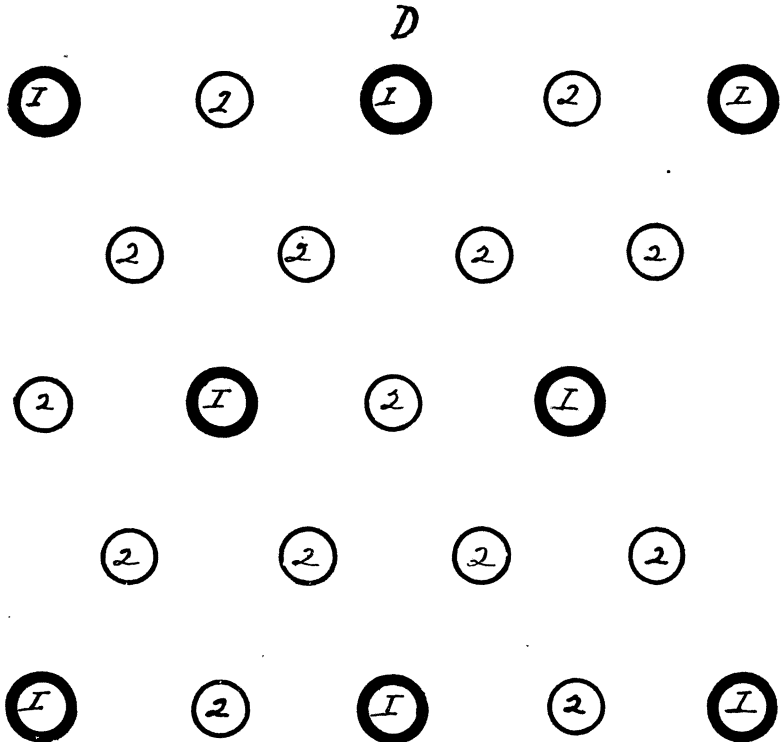


Fig. 5—Plan "D"

This is the hexagonal system and at the same distances between trees as the square system will permit 15% more trees to be planted to the acre. If permanent trees were planted with as many fillers as permanent trees and have them placed in the permanent row, this system would be very good. However, where there is a double system of fillers used, then the objections of Plan "C" are more evident, that is, there are too many trees.

Where land is at all suited to orcharding one of the best ways to lay out the square system would be to establish two lines, the one at right angle to the other one and then set stakes such that a man with a team of horses can draw the rows say east and west and later can draw cross rows north and south so that at the intersection of these rows the trees can be planted.

The planting distance is a point upon which many people do not agree. It is very easy to plant too close. Permanent apple trees should be planted 40 feet by 40 feet on the square system. This seems like a great deal of space when the little yearling plant is first put out. However, when the tree is twenty years of age it will be found that a great deal of the space has already been taken up. Fig. 6 shows a 22-year-old apple tree which has a limb spread of over 40 feet.

There has been a gradual tendency to plant further apart, even where moisture is not so much of a limiting factor as it is in parts of Oklahoma. A

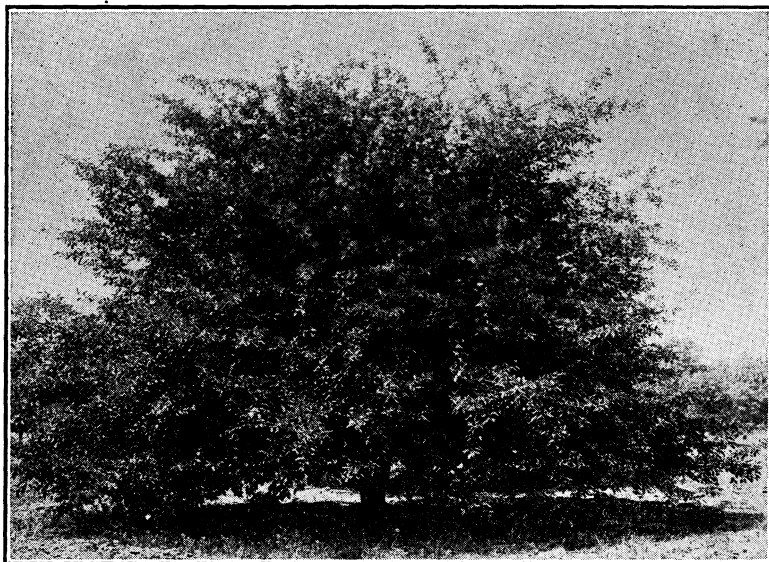


Fig. 6—A twenty-two year old apple tree with a spread of over 40 feet.

consideration of the distribution of rainfall by months, and also by the days of the month, show that there is particular need of having fewer trees per acre if success is to be more certain. Twenty-eight mature apple trees will take all of the available moisture from an acre of good fruit land. While more trees than this will live and produce fruit yet there will be loss of fruit due to dropping and small inferior fruit. Indeed, the next year's crop may be entirely limited by the amount of moisture present during the previous season.



Fig. 7—Close planting has caused this 22-year old tree to make an upright growth, and has caused all the lower limbs to die.

Where fillers are used a less distance might be given for them with the understanding that they must be taken out when they begin to interfere with the permanent trees. In many parts of Oklahoma moisture is the limiting factor, and it is only natural that seventy-five trees to the acre will pump out of the soil more water than twenty-eight or thirty. Cultivation can be carried on somewhat easier when the trees are farther apart. This further distance of planting will not appeal to many but if they will take the time and trouble to look into the best commercial orchards of this state and other states, it

will be found that the distance which is here recommended is better than a less distance.

SPRING VERSUS FALL PLANTING

There is much discussion as to whether or not the trees should be planted in the fall or in the spring. The fact of the matter is that it makes little difference providing there is sufficient moisture in the soil and the trees are well planted. However, if planted in the spring they should be put out early enough so that they will be able to form new roots before they begin to grow. Where there is sufficient moisture it is very often best to plant in the fall. Trees can be successfully planted even in December, providing the weather is not freezing and there is enough moisture in the soil. The cherry tree should be planted in the fall or by the first of March, for it so happens that this tree is slow to form feeding roots, and at the same time begins to grow the first warm days. The result is that the tree leafs out before there is sufficient root system to supply the necessary amount of moisture, with the result that a great many of the trees die the first season. It should be mentioned here that in case the trees are planted in the fall no pruning of the top should be done until spring. It seems that the loss of moisture from the wounds made by pruning is much greater than it would be if no pruning were done.

Digging the holes for the tree is an operation which cannot be slighted. It is poor economy to try to save time and money by digging a small hole. No one would recommend that the tree should have a hole 3 feet by 3 feet, but it is a good practice to see that the opening is large enough so that the roots can be well distributed without being doubled up, and at the same time that there be plenty of space for the one who is doing the planting to pack the ground well about the roots. This is generally done by tramping the soil. Some persons prefer to use a tamping rod such as is used for setting posts. This is not necessary and very often serious injury is done by crushing the roots. If the trees are planted in the fall it is a good practice to mound the earth up around them 6 or 8 inches. This serves as some protection against mice and also helps to prevent the tree from becoming loose, due to the wind. This should be taken away in the spring.

A few years ago it was customary to prune off a great deal of the already depleted root system which resulted from cutting the trees in the nursery row. This was very poor practice and no one today would recommend any root pruning except where the roots are broken or bruised or diseased. It has been found by experiments that trees which had their roots pruned at planting time grew far less the first five years than those which were not pruned. Also, the loss the first year was far greater with the heavily pruned roots than with those having no root pruning.

Where there are a number of trees to be planted it has been found quite successful to have the holes dug just previous to the planting and have the trees hauled to the field in a half barrel or a barrel containing sufficient water to keep the roots well covered. Sometimes the trees are hauled to the field



Fig 8—Shows a twenty-year old unpruned tree. Compare with Fig. 9.

in a wagon. Several layers of gunny sacks which have been well soaked with water are covered over the trees. This keeps the roots moist and allows no chance for drying out. The greatest loss comes between the time that the tree is dug in the nursery row and the time it is planted in the field. No fertilizer will need to be applied at planting time unless the land is very poor, little or none need be applied the first few years of the life of the tree.

When fertilizer is applied to a young tree it should never be placed against the tree but should be scattered around the trunk so that it will not wash into the roots of the tree directly. Otherwise, damage may result from the use of one-fourth pound per tree, of nitrate of soda, which is the proper application. It is a common practice in setting the tree to incline it a little to the southwest. This is the direction of the prevailing wind which has a tendency to make the tree lean toward the northeast.

TRAINING AND PRUNING

There are three general systems for training trees. A few years ago all trees were trained to what is generally known as the open center. During the last ten years the pendulum has swung to the modified central leader system of training. The third system is known as the central leader. Each one of the systems still has its followers but the great mass of horticulturists and fruit growers have accepted the second one, namely, the modified central leader.

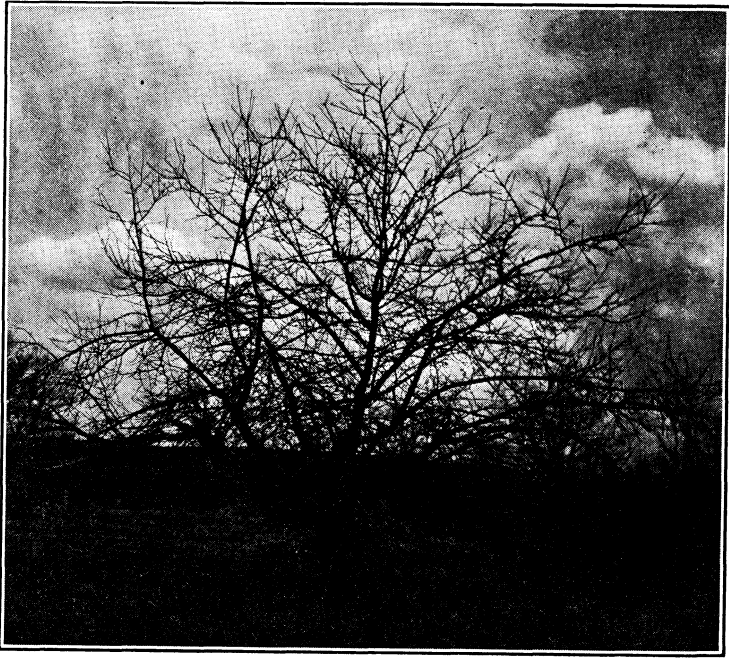


Fig. 9—A twenty-two year old tree given a moderate amount of pruning.

Even with the peach tree, where the open center has been used so very largely, we are now coming to a more or less modified central leader system.

If the modified central leader is the most desirable form for the orchard fruits, and especially the apple, it is then necessary that definite amount of thought be given to this when we start to prune the young tree. If we plant one-year old trees these will be a whip about 4 to 5 feet long. A great deal is said about heading a tree low, but it might just as well be understood that extreme low heading does not necessarily make a low tree. It should be borne in mind that the care given in training the tree, together with the conditions under which the tree is grown, largely determines whether or not the tree will be spreading or upright, although it is also true that trees which are inclined to grow high will tend to do so regardless of the treatment.

The first step in growing a modified central leader apple tree is to plant a good one-year old nursery tree. It is well to have the first branch start at about 2 feet from the ground. Inasmuch as the first four or five buds just

below where the cut was made are the only ones that start to grow it becomes necessary then to head the tree about 30 inches. This should give lateral branches with good angles and proper spread. The first year's pruning should be made with the idea of selecting three to five branches well placed and well spaced. There should be no two branches directly above one another. Also as much space should be given between the limbs as can be secured, and at the same time the top bud of the tree should be left to produce a branch which will always be longer than any of the so-called scaffold branches. It is a well-known fact that the longer the branch the faster it grows. Moreover the more cutting we do on any branch the more it is retarded. The pruning at the end of the second-year's growth should be largely limited to corrective pruning. By this we mean prune only those limbs that have a tendency to out strip other limbs, or where certain limbs will grow so that they will interfere with the growth of others. It is very important to keep in mind that after the first year's pruning, that is after the tree has made one year's growth, there should ordinarily be very little pruning until the tree comes into bearing. A second

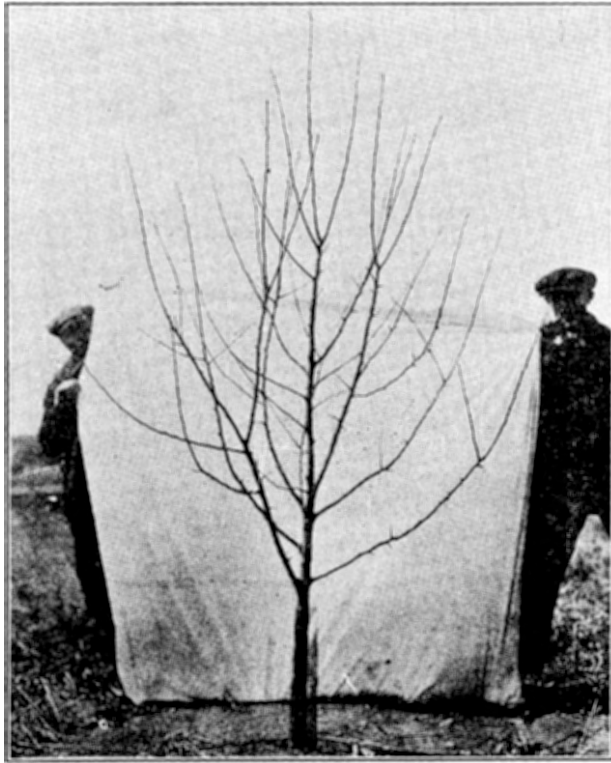


Fig. 10—The Modified Central Leader.

principle must be stressed and that is that where two limbs come out of the tree both of the same size, a weak crotch will be developed. This can be overcome by pruning one of the two limbs more severely than the other. This results in one of the branches becoming a lateral off of the main branch. The central leader should not be left longer than a foot above the tops of the side branches. By exercising care, as has been suggested, the first five years of the life of the tree, a spreading tree can be produced which will come into bearing reasonably early and will have good strong crotches. It will be found to be of some benefit to cut the lateral limbs to an outside bud. This will cause the new branch to start in the direction in which it should grow. Even with the central leader this will be some service in helping to keep the leader near the central part of the tree.

If the two-year old tree is being planted it will be necessary to train quite carefully. Select about three main branches, keeping the same idea in mind as has been discussed for the one-year old tree. That is, keep the branches well spaced, select limbs on the various sides of the tree and cut the heavier limbs back more severely than the smaller limbs and allow the top to be at least a foot longer than any of the other branches. It will be necessary then, whether it be a one-year or a two-year tree, to select additional branches such that there may be as many as eight or more by the time the tree is ready to bear. It should be noted that when there are sufficient limbs developed the leader can then be handled as one of the branches of the tree.

Inasmuch as the tree grows a good deal like the apple tree the former discussion will apply to the development of the pear tree. It will require some time before the older growers can accept this form of training but they will finally come to it just as they have in practically all of the fruit growing sections of the United States. All of the future pruning of the apple tree will be largely to keep the tree balanced, cut out diseased and crossed limbs and to thin out the growth to admit air and sunlight. This will require some little attention each year but will never require much to be done at any one time.

ORCHARD SOIL MANAGEMENT

There are two systems of soil management for the orchard with many modifications, viz: clean culture with a cover crop, and sod mulch. The first means that the orchard will be cultivated throughout the entire summer and in the fall a cover crop will be sown. At the present time the College is recommending about a bushel of rye and twenty pounds of winter vetch seed per acre. This combination has proved superior to any one of the number of combinations which were used.

It has been found that cowpeas sown from July 25th to August 1st have given good results as a cover crop. The sod culture can be used in parts of the state where there is either sufficient rainfall or where there is subirrigation. This system is handled by having grass grow in the orchard and then mowing it at certain intervals. The grass is raked up and placed around and under the tree, keeping it 4 or 5 feet beyond the spread of the branches. Each

system has its advocates and each system has its good points and its poor ones. My own experiences and the experiences of many others, lead me to say that at least for the first ten years in the life of the apple orchard clean cultivation, with a cover crop, should be practiced.



Fig. 11—The above picture shows a young apple orchard growing under clean cultivation.

With the pear the number of years that cultivation is practiced should be reduced to about one-half, due largely to the fact that the pear blight attacks the pear tree more severely when it is growing fast.

A good deal of the success in keeping trees growing well depends upon the humus in the soil. Cultivation tends to burn out the humus, but cover crops keep up the supply. Just here it might be said that crops can be grown between the rows of trees for the first few years. With the apple this could be continued for as much as six years, but with the peach it should not be carried on longer than two years. In either case it must be borne in mind that it is the development of the orchard that we are after and not the pro-

duction of the crop grown between the rows. If the land is sufficient and if there is financial aid it will be far better to grow no crops whatsoever. In the end it will be found that the extra value of the orchard will more than compensate for the amount that might have been received from some crop or other. Clean cultivation gives larger apples than those grown in sod.

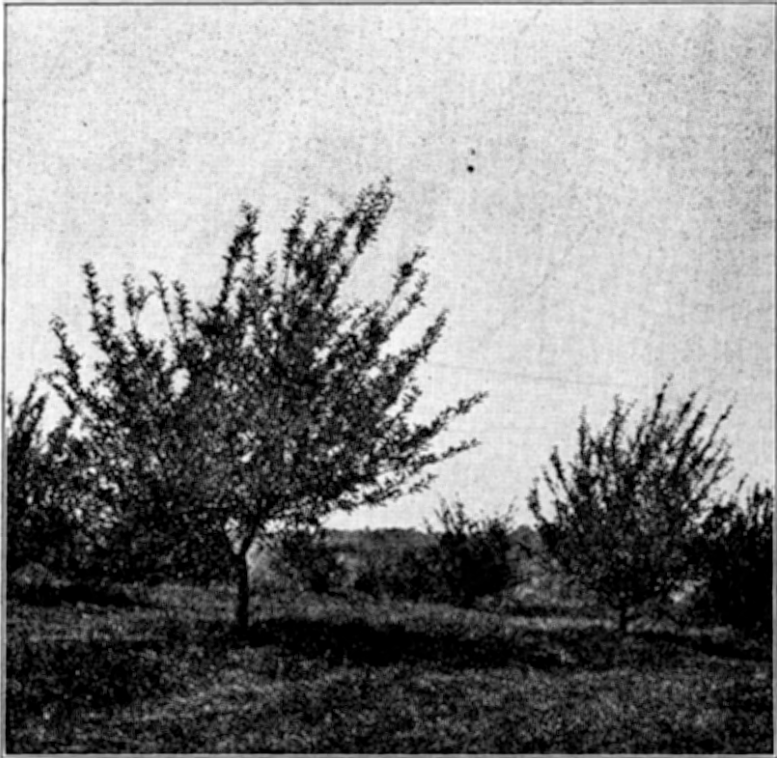


Fig. 12—A part of the same orchard as shown in Fig. 11 but grown under the sod mulch system.

FERTILIZERS

The subject of fertilizing fruit trees has received a good deal of attention from the experiment stations as well as from the grower. The result of the experiments as well as the results secured by the growers are such that the best growers are now using commercial fertilizers, especially in the bearing apple orchards.

Where the soil is reasonably fertile there will be no need of applying commercial fertilizers in young orchards, especially where a system of cultivation with cover crops has been carried out for a number of years. However,

where the trees are not making a good annual growth then top dressings of stable manure or fertilizers containing liberal amounts of nitrogen such as sodium nitrate or ammonium sulphate, combined with acid phosphate, should be used. Indeed for the first season the commercial fertilizers mentioned are more desirable than the manure inasmuch as the fertility of the manure becomes available less quickly. About one-quarter pound of nitrate of soda and about one-half pound of super phosphate should be applied to a circle two feet in diameter as soon as the buds start into growth in the spring. This application of fertilizer should be followed by a dressing of manure. If there can be applied a liberal application of manure each year for four or five years there need be no more commercial fertilizer applied during that time. However, where manure is not applied then commercial fertilizers should be used, and let it be said that the increase should be about three ounces of nitrate and five to six ounces of super phosphate per tree per year till an application of five pounds of nitrate and eight pounds of phosphate is being applied. The growth should govern the amount of fertilizer used.

In the bearing orchard the need of fertilization may be determined by observation and of the vigor and productiveness of the trees. If the trees are growing rapidly and bearing poorly they may not need fertilizers. If they are growing vigorously and bearing well they require only enough fertilizer to replace that which the crop uses from year to year and should be fertilized only enough to maintain the existing healthy condition. If on the other hand they are making only a small growth and bearing poorly then the trees need a generous amount to increase their vigor and encourage production.

It is a pretty safe conclusion to say that if the trees need fertilizers nitrogen is the first element to be supplied. This can be supplied in the form of sodium nitrate or ammonium sulphate at the rate of five pounds per tree. If ammonium sulphate is used it should be applied earlier. If phosphorous and potash is thought to be needed, apply six to eight pounds of super phosphate and about five pounds of muriate of potash to each mature tree per year. The application should be made when the buds begin to swell, and should be spread over all the surface except close to the trunk of the tree. The soil should be cultivated just following the application.

The following table is a general recommendation for a bearing apple orchard:

A General Fertilizer for Apple Orchards
(Amount per Acre for Bearing Trees)

Nitrogen 30 lbs. (N)	(P ² O ⁵) Super Phosphate 50 lbs.	Potash 25 to 50 lbs. K ² O)
Carried in— 150 lbs. dried blood 100 lbs. nitrate soda and or in 150 lbs. sulfate of ammonia	Carried in— 350 lbs. super phosphate or in 200 lbs. bone meal or in 300 lbs. basic slag	Carried in— 50 to 100 lbs. muriate or in 100 to 200 lbs. low grade sulfate

Pear trees need little or no fertilizers other than what might be liberated by cultivation. The pear blight is much more serious where the trees are growing fast.

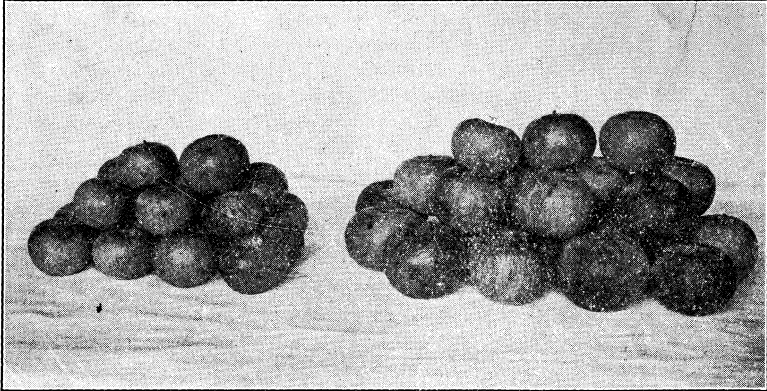


Fig. 13—Apples at left produced from the orchard in sod; at right, in clean cultivation. (Courtesy of Purdue Experiment Station).

ORCHARD IMPLEMENTS

Frequently we are asked to recommend the best tools for cultivating the orchard. It is very doubtful if there is one best tool. Where a cover crop is allowed to grow to the height of a foot it becomes necessary to use a plow for turning under the vegetation. Hence one of the first tools needed will be a plow. Where the land is not stony a disc harrow is quite important. When buying such a harrow one should be purchased which is known as the "orchard disc harrow." By means of this it is possible to cultivate within a foot of the tree and yet have the horses walk at some distance from the tree. Where land is inclined to be stony a spring-tooth harrow will be found to be of a great deal of service. A harrow of the Forkner type is very serviceable. These are the most important tools, together with the smoothing harrow, and are about all that one will have to buy for orchard cultivation.

SPRAYING AND SPRAY MACHINERY

Ten years ago it was generally thought that pruning was by far the most important orchard practice. Today with due regards for the benefits of pruning, there is no question but that of the three fundamental orchard practices, namely, pruning, spraying and orchard cultivation, it is the least important. It should be borne in mind that we are speaking of the mature tree at this time.

In the case of the young tree pruning is quite important. It is a fact that no amount of care given the orchard in the way of pruning and soil management will take the place of spraying. It is absolutely true that he who would produce clean fruit must spray. Since this is true a number of problems which

have to do with the preparation for the performing of this very necessary work must be met. Of the great number of diseases and insects which must be controlled, it so happens that a spray schedule can be followed whereby these pests can be pretty well kept in check. If it were necessary to think about each one separately, the most enthusiastic fruit grower might well despair.

The spray schedule which is published elsewhere will give good control. Indeed while a great deal is generally written and spoken concerning the diseases and insects and the materials with which they can be controlled, too little is generally said concerning the machinery that is used for controlling them. In the commercial orchard where there are from ten acres up, it becomes quite important that the spraying should be done in a very limited time. Furthermore, it must be done thoroughly. This requires not only sufficient equipment, but such as will do the work efficiently. Today the commercial fruit grower cannot hope to compete with other growers without the use of a good power spray rig. There are a number of firms who manufacture these outfits and who will be glad to furnish information to persons who are interested in buying one. It might be said here that there is no one best spray rig, but as they vary in size and in cost it might be well for the grower to consult the various firms. The department of horticulture will be glad to give information on the type of outfit best suited to the individual need of the fruit grower. A few years ago a great deal of publicity was given to the spray gun. This was considered as a very great improvement over the spray rod. While it has its advocates today and while it has its good points, it will be found that for most growers the double nozzle and the spray rod, 8 or 10 feet long, will be best. It might be mentioned here that the angle disced nozzles are without any doubt the best. It is very important that the rod has a cut-off such that in passing from one tree to another material can be saved. No less than 35 feet of hose should be used and many prefer 50 feet. With old trees that have gotten quite high, a tower is used on top of the spray rig such that the tops of the trees can be well covered. When this is used there should be another man on the ground.

AMOUNT OF SPRAY MATERIAL NEEDED

The amount of diluted material needed to cover a tree is generally underestimated rather than over-estimated. There is a great deal of difference between the amount of material it really requires to cover a tree and the amount that will be used in spraying a given tree. The Oregon station found that it required for best results for a dormant application, the following amount:

- 11 yr. old tree, 4.1 gallons
- 12 yr. old tree, 4.5 gallons
- 13 yr. old tree, 5.16 gallons
- 14 yr. old tree, 7 gallons
- 15 yr. tree, 7.2 gallons
- 17 yr. old tree, 8 gallons.

On three hundred apple trees, 21 years old, we used three thousand gallons for a dormant application. While for the summer application it required a little over twelve gallons per tree. This may seem like using a good deal of material but if one wishes to do a thorough job he will find that these amounts are none too high. Persons thinking of spraying should not be deterred by this figure, for there is no other orchard operation that will give the returns on the amount spent as will money wisely spent for spraying.

THE WATER SUPPLY

A great deal of time is often wasted by the lack of a supply of water for mixing the spray material. This generally becomes evident after one season's experience. However, this time can be saved if preparations for a supply are made before actual spraying is begun. Where the amount of material is quite small a little inconvenience may mean nothing, but where as much as a thousand gallons of material is required for one application it means a considerable saving in time and money if the supply of water is easily secured. One of the best ways to meet this problem is to have a tank elevated so that the spray tank can be driven under the supply tank and thus filled in a few minutes. This allows the spray machine to be kept in operation more steadily. By actual check it has been found that nearly half of all the time used in spraying an orchard has been taken up in going to and returning from the supply of water. Where a barrel outfit is used it has been found to save time to load on two or more barrels of water with the barrel outfit and thus refill from the same wagon upon which the barrel is being hauled. While this adds to the weight that is being hauled to the orchard, yet the time that is saved more than pays for the extra cost in hauling. In a large orchard where a great deal of material is used a tank wagon has been found to be of much service. This is merely a water tank mounted on a wagon in such a way that the water from the tank can be gotten into the spray tank in a very short time. It should be borne in mind that if the spray tank holds two hundred gallons the tank wagon should hold at least two hundred and twenty-five gallons for there is always some waste in transferring the water from the tank to the spray rig. It requires about forty minutes to apply two hundred gallons of spray. This means that it should be so planned that the tank wagon can make a trip to the spray rig at least once an hour. Various growers may have different methods for securing the water supply, but the important thing is to keep the spray rig as nearly as possible in constant operation.

CARE OF SPRAY MACHINERY

The depreciation of the spray rig varies pretty much with care that is spent upon it. The power spray rig with ordinary good care will give good satisfaction for eight to ten years. However, a single year's neglect will so impair the general condition of the outfit that it will not be more than fifty percent efficient and even may put it in such a condition that it will be of little service until it is overhauled. It seems almost useless to say that the spray rig must be kept well oiled, yet it is not uncommon to find persons running the engine

without sufficient oil. The materials used in a spray machine have a tendency to corrode the metal parts. It is therefore quite important then when one application is finished the entire rig should be gone over and thoroughly cleaned. This means that water should be pumped through the machine until it comes from the spray hose entirely clear. The pump should be drained. Water allowed to remain in the cylinders and in the various pipes may freeze in a sudden cold spell and burst the cylinders. The result is not only additional expense but inconvenience and delay. A few drops of oil should be allowed to go into the cylinder of the engine and then it should be turned over by hand. This will allow good lubrication for the cylinder and the piston. This should leave the engine in good condition when it is wanted for the next application.

The barrel outfit requires the same general care that the power outfit does with the exception that there is no engine to care for. However, in all cases the outfit should receive a thorough cleaning and the hose should be drained and either put in a position so that it will not form kinks, or else be rolled up and so placed that it will not be walked over or damaged. It is poor economy to put off the care of the rig until the time when it is to be used again. Even though the proper care has been given after using, it will be found that it will pay to go over the entire outfit and especially the hose connection and the nozzles to see that they are all in good shape before starting to work again. More than half of the unpleasantness of spraying comes from poor equipment and from improper care of good equipment. The same care that is given an automobile should be given a spray outfit in order to secure success in controlling the various orchard pests.

RENOVATING THE OLD ORCHARD

In Oklahoma there are scarcely any old apple orchards. There are a considerable number of orchards that have been neglected and yet some of these orchards are well worth the time and expense it would require to put them in condition to pay a good return. Before anyone should decide to renovate an orchard he should make a very careful survey to determine whether or not the orchard will be worth the time and money required to put it into good condition. In making this survey there are three very important points that should be carefully noticed. The first is the site and the soil on which the orchard is planted. If the soil is unsuited to growing apples, regardless of what the other conditions might be, it will not pay to put any more time on the orchard. A good soil and a poor site will give returns some years, but, will not be a consistent money maker. The second point that should be emphasized is that of varieties. If these are such that they have little or no commercial value, then it is likely that the orchard would not pay for renovation. It is a question in Oklahoma whether it will pay to top work an orchard more than ten years old. When this is attempted sun scald occurs which allows disease to set in. The result is that the tree hardly ever makes a top that is entirely satisfactory. Diseases and insects should be given due consideration. However, if neglect has gone so long that the trees are in a weak condition the orchard should be

discarded. Where the trees are still in a more or less vigorous condition, a clean up campaign can be put on which should take about the following order: Prune the trees, spray them thoroughly, and practice good cultivation. It will likely pay the one contemplating orchard renovation work to consult some experienced horticulturist or a good practical fruit grower. Time spent in studying the situation before actual work begins may prevent disappointment later on.



Fig. 14—A Twenty-year old Apple Tree that has been Neglected. A light pruning is best the first year.

RECOMMENDED VARIETIES OF APPLES AND PEARS FOR OKLAHOMA

The question of varieties of apples is one that must be considered with a knowledge of the purpose for which they are to be used. If we are planting merely for home use, more varieties and ones with different qualities are selected. Where a commercial orchard is the end in view, then the question of market value must be considered.

For both home and commercial use, the Yellow Transparent is one of the most desirable varieties. It comes into bearing early and bears annual crops. Where markets are available, this is a good commercial apple. It will blight somewhat, and is subject to blotch canker formation, but the fruit is not readily attacked by the fungus. It ripens in late June and early July.

The Winesap is without doubt the best variety of winter apples for Oklahoma. It is a heavy annual bearer, forms a good tree, bears earlier than Stayman, and the fruit keeps in common storage till late winter. It has a tendency to overbear and unless it is pruned and given good care in the orchard it will produce small fruit. It is usually quite free from blotch canker.

The Stayman is one that seems, from what we can gather from persons who have fruited it in this state and in surrounding states, to be a very promising variety, but the fruit should be picked before heavy frosts occur. It can be kept in common storage till early in December. It has a tendency to crack rather severely around the stem before ripening if rains follow a season of dry weather. Sometimes it does not color well. The tree is a fast grower and during the first years presents somewhat of a straggly appearance. It begins to bear paying crops at about eight years after planting. The tree is quite resistant to blotch.

The Grimes, when well grown, is without doubt one of the best varieties of apples. There is a tendency for the tree to die from a condition known as collar rot. This is prevented by buying "double worked" trees. This means that the Grimes wood is grown on Delicious, or some other wood which has been grafted on seedlings. There should be two feet of wood between the seedling and Grimes wood. The tree is well shaped, bears early and produces annual crops. The fruit ripens as a late summer or early fall variety, but can be kept in common storage until late fall.

The Delicious apple has been planted very generally throughout many states. There are a number of plantings in this state, some of which are beginning to bear. It has hardly been tested long enough to warrant a wholesale recommendation. On the experiment station grounds the tree has grown well, but has been late coming into bearing. The trees are 15 years old and have borne only one good crop so far. They show a tendency to drop their fruit badly before it is ready to harvest. In the northeastern part of the state the apple is better suited than in the central and western parts.

The Jonathan is one of the best as far as quality of fruit is concerned. It comes into bearing early and produces heavy annual crops. The tree blights badly, and for this reason, together with its coming on the market at the same time of the King David and Grimes, makes it less desirable.

The King David is quite similar to the Jonathan but has not established itself sufficiently in this state to receive an unqualified recommendation. The season carries over longer and in our observations the tree does not blight nearly as badly as the Jonathan. This variety, for an apple following the Jonathan in season, is worthy of further trial. It likely will be a desirable filler, bears early and is a heavy, sure cropper.

SECOND CHOICE APPLE VARIETIES

The Rome, often known as Rome Beauty, is a variety that ripens in early fall, and therefore comes on the market in competition with a number of other varieties. A good deal of the fruit is borne on the ends of the limbs, which is undesirable for this state. I would class it as a second-rate apple for Oklahoma.

The Willow Twig was a favorable variety some years ago. It has lost its place but seemingly is being replanted in some states. It is a hardy tree, bears early and is productive. The quality is not high, but the length of season is a redeeming feature.

The Oldenburg, also known as Duchess of Oldenburg, variety is best suited for fillers. The tree is short lived and is very subject to diseases. The season overlaps that of the Transparent and extends perhaps two weeks longer. The fruit is large, handsome and is particularly suited for culinary purposes.

The Golden Delicious is a variety which from our trials on the Station grounds, together with reports from over the state, makes us of the opinion that it should be planted as one of the best varieties for Oklahoma.

The Mammoth Black Twig (Arkansas), on account of being a shy bearer, has lost its place which it once held. The tree is a good healthy grower and sometimes bears heavy crops. The fruit keeps well and is of good quality. It has been pretty well established that heavier crops are secured when this variety is planted with such varieties as Delicious, Jonathan, and Grimes.

The Gano and Ben Davis varieties have been planted very extensively. Due to their susceptibility to blotch they are not recommended as varieties to plant. However, they bear heavy annual crops, grow well in the orchard and come into bearing early. They are late keepers. The idea that Gano and Ben Davis are varieties that can be grown without any care is a mistake. The quality of both varieties is poor, especially under poor care. Only one of them should be planted and then sparingly.

VARIETIES RECOMMENDED FOR TRIAL

There is a good demand for summer apples in Oklahoma. The shipment of such apples is a commercial possibility. In Experiment Station tests over a series of years, the following varieties have proven to be desirable: Early Ripe, Yellow Transparent, Star, Fanny, Wolf River and Summer Champion.

The Transparent has been mentioned and described in previous paragraphs. This variety and the Star seem to offer the greatest possibilities for the production of summer apples because they are hardy and productive and the fruit is ready for market before the emergence of the second brood of Codling Moth.

The Early Ripe is a yellow apple ready for market a few days before either the Yellow Transparent or the Star. However, it blossoms early, making it subject to frost injury. In our experimental tests it has proven to be a rather shy bearer.

The Star is a green apple especially good for cooking. It may be harvested and sold as soon as it reaches sufficient size.

The Fanny, Wolf River and Summer Champion are all splendid varieties but probably not adapted to commercial production in this state because of the difficulty of protecting them from Codling Moth and at the same time put the apples on the market not carrying an undesirable amount of spray residue. The Fanny is a medium sized, red variety of good cooking and dessert quality. The Wolf River is a large striped, red apple, good for cooking and baking. The Summer Champion is a large red apple ripening over a long season and desirable for cooking. Fanny is ready for market about the first of August; Wolf River and Summer Champion from the first to the middle of August.

VARIETIES OF PEARS

There are but three varieties of pears generally recommended for Oklahoma. These are the Kieffer, the Garber and the Seckel. The first is the most popular for they are easily grown in the nursery, and grow uniformly in the orchard, most vigorous, fruitful, endure heat well and are not very susceptible to blight. They seem to withstand best the ravages of the San Jose scale. The tree is sometimes self sterile and on strong, heavy soils may set a light crop of fruit. This pear is poor in quality as a dessert fruit, but is quite satisfactory as a culinary fruit. It gives best results when grown on a sandy soil. If it is harvested when hard ripe and each fruit wrapped in a paper and stored in a cool place, it keeps well and gives a fairly good fruit for dessert.

The Garber is very much like the Keiffer, but ripens a week or two earlier. They are thought to be a little better in quality. It is used as a pollinizer for the Keiffer.

The Seckel pear without doubt has the best quality of all pears. The tree is productive, hardy, and nearly free from blight. The fruits are small but their high quality makes them desirable for the home orchard.

POLLINATION OF THE APPLE AND THE PEAR

The question of securing a good set of fruit is of vital importance to the fruit grower. One of the factors that may cause trees to set little or no fruit is the lack of fertilization of the flower. This means that immature fruit will fall before it is any size.

Varieties of apples seem to differ in the different area where they are grown. However, it seems pretty well established that the Winesap family of apples which includes the Winesap, Stayman, Arkansas, etc., are not only self-sterile but are inter-sterile. This means that the pollen from the Stayman cannot fertilize the Winesap, nor can the pollen from the Winesap fertilize the flowers of the Stayman. A list of apples that are classed as barren or partly barren is as follows: Arkansas Black, Gravenstein, King, Arkansas, Maiden Blush, Missouri Pippin, Rome, Ralls, Winesap and York. These varieties may frequently prove to be self-fruitful. The following list of varieties are classed

as comparatively self-fruitful: Baldwin, Ben Davis, Gano, Jonathan, Oldenburg, Grimes, Yellow Transparent, and Willow Twig. However, in some sections these varieties have been reported more or less self-sterile. From the evidence that can be collected it seems that the Grimes or Jonathan is a good variety to plant with the Winesap, Ben Davis and Gano. It has been found that the Delicious apple is best to plant with the Arkansas.

When apples are planted merely for the sake of furnishing pollen then one tree to twenty should be sufficient. It is a good plan to plant four rows of a variety and then two rows of a variety that will not only furnish pollen but is valuable as a market variety. The Grimes is an apple that makes a good combination with the Winesap group or the Ben Davis group. The Jonathan might be used instead of the Grimes or with the Grimes.

In the case of the pear it has been shown that the Kieffer is self-sterile in some places, while in other localities it was found to be self-fertile. In order to make one safe it is well to plant one Garber pear to about every fifteen Kieffer trees.

HARVESTING AND STORING

Harvesting is an important orchard operation from the standpoint of the fruit grower. Commercial orchardists prepare for this work but in case of the home orchard it often happens that there are no provisions made for it. Picking is necessary not only for profit but also to keep diseases and insects from accumulating. This is an essential point in the case of the home orchard. Disease and decayed fruit may make a breeding place for pests which will attack the tree or the fruit or both the following season. Where fruit is grown for commercial purposes equipment such as good ladders, baskets, or especially prepared picking bags are provided. The apples should be picked sometime before full maturity while still firm and before the flavor has completely developed. They should have good color for the variety and should be of mature size. Pears on the other hand should be picked decidedly before complete maturity, while still very firm and allowed to mellow off the tree, for they will rot at the core if allowed to hang too long on the tree. The Kieffer pear is characterized by the formation of gritty cells if allowed to become too ripe before they are harvested. However, where they are harvested at the proper time and stored in a cool, dry place most of the gritty cells will disappear.

One of the difficult things for the person who grows fruit for home use is to keep it after harvesting so that there will be a supply for use throughout the winter season. If what has been said concerning the harvesting of the apple and the pear is followed, and if only fruit that is free from bruises and insect and disease injuries are placed in a common storage there is no reason why the proper varieties of apples as they are grown in Oklahoma cannot be kept until March. Perhaps the best varieties for keeping are the Winesaps, Arkansas, York, Ralls, Willow Twig, Ben Davis and Gano. In a number of places the writer has found growers storing their apples by making a pit about

as follows: A well drained spot is selected and on this is placed some straw or wild hay. The apples are then placed on top of this hay so that they form a cone shape pile. These are then covered with straw or hay and later covered with about a foot of earth. It is very important that some form of ventilation be provided. This is accomplished by taking one or more joints of stove pipe and placing them in the top of the pit. This ventilator should be opened during the night so that the fruit will cool off, and it should be closed in the morning. When the weather gets cold enough such that there is danger of freezing then the ventilator should be closed. There is one objection to this method of storing the fruit and that is that it is somewhat difficult to get fruit out of the pit. However, even though it is inconvenient it is far better than not having the fruit.

On many farms there are locations where a storage cellar might be built. This will keep the fruit quite well and makes it much more accessible. The same storage can be used for other fruits and vegetables so that the expense is distributed and will not need to be considered as a charge against the fruit crop alone.

It will be found very often that apples can be kept better if they are put in baskets or boxes, rather than piled in bulk in a bin. This affords a circulation of air and at the same time prevents disease from spreading as far as they might otherwise.

SPRAY SCHEDULE FOR APPLES

Name of Spray and When to Apply	What to Spray For	Materials and Amounts
Dormant. Late winter or early spring.	San Jose Scale and other scale insects.	Lubricating oil spray, scale-cide, commercial lime sulphur and other proprietary mixtures according to direction on containers.
First Summer Spray. When flower buds show pink but before they open.	Scab, blotch, curculio, canker worm, aphids.	Bordeaux mixture 4-4-50 plus 1½ lbs. powdered arsenate of lead, plus ½ pint nicotine sulphate to 50 gallons water if aphids are present.
Second Summer Spray Begin spraying when two-thirds of the petals have fallen.	Scab, blotch, curculio, and codling moth.	Lime-sulphur 1¼ gals to 48¾ gals. of water and 1½ lbs. of arsenate of lead.
Third Summer Spray. Two weeks after petals have fallen.	Scab, blotch, bitter rot, curculio and codling moth.	Bordeaux mixture 3-4-50 plus 1½ lbs. arsenate of lead
Fourth Summer Spray. Four weeks after the petals have fallen.	Blotch, bitter rot, black rot, codling moth.	Bordeaux mixture 3-4-50 plus 1½ lbs. arsenate of lead.
Fifth Summer Spray. Eight weeks after the petals have fallen.	Apple blotch, bitter rot, black rot, codling moth and leaf hoppers.	Bordeaux mixture 3-4-50 plus 1¼ lbs. arsenate of lead and nicotine sulphate ½ pint to 50 gallons.

SPRAY SCHEDULE FOR PEARS

If San Jose scale is present use the Dormant Spray as recommended for apples. Otherwise, the First, Second, and Third Summer Sprays as listed under the spray schedule for apples will give good control.

