

# Growing Tree Fruits on t

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by E. M. HUNT

AGRICULTURAL EXTENSION DIVISION • UNIVERSITY OF MINNESOTA

# Growing Tree Fruits on the Farm

E. M. HUNT

**P**URCHASE of food continues to be the largest item of cash outlay to farm families. It is now recognized that fruit, one of the most expensive kinds of food, must be present in generous amounts in a healthful diet. Many rural families spend a larger part of their income than necessary for fruit or do without an adequate diet because they do not grow their own supply of fruit.

Tree fruits such as apples, plums, and cherry-plums should occupy a prominent place in the home fruit garden. They should, of course, be supplemented by bush fruits and strawberries. To satisfy home needs the fruit garden need not be large. A complete fruit garden for the average family, if well planned, can be planted on a half acre of ground.

Fruit can be grown in every part of Minnesota. Climatic conditions in certain northern and western parts require careful selection of varieties and cultural methods, but they do not prevent successful home fruit production.

Farm orchards in the past usually consisted of from 6 to 60 trees of many varieties. These orchards, for the most part, received no special care. Most of them produced a high proportion of inferior fruit and were short-lived.

Since a constant fruit supply makes for better and more economical living, most farmers will be interested in improved practices. The following is a discussion of the factors to be considered in establishing and maintaining the tree-fruit portion of the garden.

## WHERE TO PLANT

If the orchard is to receive good care, and if the crop is to be utilized to the best advantage, it should be convenient to the house. Thus it is important both for convenience and protection to place the orchard within the protected area of the farmstead if possible. Provision for orchard space between the windbreak and the buildings should be made when the windbreak trees are planted.

## The Soil

Although fruit trees may be grown on a wide range of soils, a deep loamy clay soil is the most suitable. The condition of both sandy and clay soils may be much improved by green manure crops or liberal dressings of barnyard manure or peat plowed under in preparation for orchard planting. In selecting the site for fruit trees, the type of soil and its fertility is not so important as certain other considera-

tions such as depth of soil, drainage, and wind protection. The condition of the topsoil can be changed rather easily, whereas the other characteristics are difficult to alter.

### Select Sloping Ground

A sloping site, although not absolutely necessary, is desirable. Fruit trees must have well-drained soil. A slope provides water drainage and may also give some protection against spring-blossom injury by draining off the cold air. Wind protection throughout the season is necessary. If the site chosen is not protected by a slope, a dense windbreak should be established before the fruit trees are planted.

Planting sites sloping toward the north or east may also give some protection against drouth and sunscald. In the northern half of the state, however, north- and east-facing slopes should probably be avoided since in this region the somewhat shortened growing season may cause immature crops and winter-tender tree growth.

### SIZE AND PLANTING ARRANGEMENT

For the average farm orchard, 10 trees each of apples, plums, and cherry-plums will be ample since the supply of fresh and stored fruit will be supplemented by various small fruits.

Orchards that are larger than necessary are usually neglected and do not produce efficiently. The local market will absorb a small amount of

good fruit but is easily glutted with inferior grades. The commercial orchard, unless fairly large, will not justify the overhead for equipment necessary to produce good quality fruit. The home grower usually finds it advisable to plant only those few trees which adequately supply the family needs and which can be conveniently given proper attention.

### Don't Crowd Trees

Crowding trees has been one of the greatest causes of failure of farm orchards in the past. Trees must have plenty of room if they are to produce good fruit and escape an early death from starvation, drouth, and disease. Trees receive all their energy for growth and the production of fruit from the sun. They must be spaced so that a large amount of leaf area is exposed to sunlight. The standard distance between trees is listed on page 4. The spacing actually used will be influenced somewhat by the varieties selected and the climatic conditions. Apple varieties such as Whitney and Dolgo, which have an upright growth habit, may be planted slightly closer than indicated.

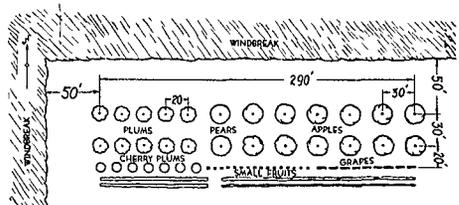


FIG. 1. SUGGESTED PLAN FOR A HOME ORCHARD—SIZE ABOUT SIX-TENTHS ACRE

Since climatic conditions in the northern fruit districts do not favor the growth of large trees, spacing distances may be slightly reduced without danger of crowding during their useful bearing life.

### Standard Spacing Distances

KIND OF TREE	DISTANCE BETWEEN TREES
Apple.....	30 feet
Pear.....	25 to 30 feet
Plum.....	20 feet
Cherry-plum.....	12 to 15 feet

### PLANTING SYSTEMS

When only a few trees are planted, little attention need be given the planting system. However, for large orchards one of the systems illustrated in figure 2 should be followed. The square system has the advantage of being easy to mark out in the field. The trees are planted at the corners of squares, the size of which depends on the type of trees being planted. If desired, a "filler" tree may be planted in the center of each square. This temporary

tree, however, must be removed before it seriously crowds the permanent trees at the corners.

In the triangular system, trees are planted at the corners of equal-sided triangles. This system allows a few more trees to be planted per acre without using filler trees. It is more difficult to lay out than the square system and does not lend itself as easily to cross cultivation.

### The Orchard Plan

The actual orchard plan for any home will depend on many factors such as available space, soil, wind protection, and nearness to the house. In planting the trees it should be remembered that they will need cultivation for many years, and so unusual sites and tree arrangements that make cultivation difficult should be avoided.

In hilly orchard sites it may be advisable to plant in curving rows following the contours of the hill. If considerable washing of the soil is likely, the rows should be planted far enough apart to allow for permanent sod strips between them.

The planting plan in figure 2 is merely a suggestion and may be altered to fit the individual case.

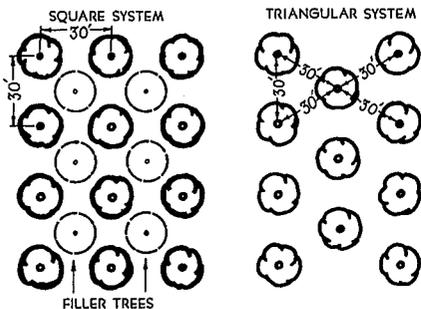


FIG. 2. SYSTEMS FOR PLANTING FRUIT TREES

### WHAT TO PLANT

Only varieties known to be sufficiently hardy for Minnesota conditions should be planted. In selecting varieties for a home orchard, early and late

fruiting types, as well as cooking and eating types, should be considered.

In the northern fruit districts it is difficult to grow apple varieties of a late-maturing or winter type. Haralson, one of the best winter apples for Minnesota, is recommended except in the Lake Superior region. In this area late varieties do not mature properly, so only fall or early-maturing varieties should be planted.

The following varieties and the number of trees of each to be planted are listed for each fruit district merely as a suggested selection for the average farm orchard. If a more complete list of varieties recommended for Minnesota is desired, consult the list published by the Minnesota State Horticultural Society, University Farm, St. Paul.

Table 1. Suggested Varieties\* for the Home Orchard

	Apples	Crab Apples	†Plums	†Cherry-Plums	Pears
Districts 1 and 2	1 Red Duchess 1 Beacon 2 Wealthy 1 MacIntosh 2 Northwestern 3 Haralson	Whitney Dolgo	2 Underwood 2 Superior 2 Kaga 1 Monitor 1 Elliot 2 Ember	1 Oka 2 Opata 2 Sapa 1 Compass 1 Zumbra	Parker Patten
District 3	1 Erickson 1 Red Duchess 1 Beacon 2 Wealthy 2 Wedge 3 Haralson	Whitney Dolgo	2 Underwood 2 Superior 2 Kaga 1 Monitor 1 Elliot 2 Ember	1 Oka 2 Opata 2 Sapa 1 Compass 1 Zumbra	Parker Patten
District 4	1 Erickson 1 Red Duchess 2 Beacon 1 Wealthy 2 Wedge 3 Haralson	Whitney Dolgo	2 Underwood 2 Waneta 2 Kaga 2 Monitor 1 Elliot 1 Fiebing	1 Oka 2 Opata 2 Sapa 1 Compass 1 Zumbra	
District 5	1 Anoka 1 Red Duchess 1 Erickson 2 Beacon 2 Hiberna 3 Wedge 1 Haralson	Whitney Dolgo	1 Radisson 2 Underwood 2 Waneta 2 Kaga 2 Monitor 1 Fiebing	2 Opata 2 Sapa 2 Compass 1 Zumbra	
District 6	1 Anoka 2 Beacon 1 Erickson 2 Red Duchess 3 Hiberna 1 Haralson	Dolgo Virginia	2 Radisson 2 Underwood 2 Hennepin 3 Waneta 1 Fiebing	1 Tom Thumb 2 Opata 2 Compass 2 Zumbra	

\* Varieties for each district are listed in order of ripening, beginning with the earliest.

† Pollenizers are needed for plums. In every planting of plum varieties such as those listed above, at least one tree of a pollenizing variety should be included. Surprise is a good pollenizer of plums in all districts. Kaga is good except in district 6. Compass is a good pollenizer of cherry-plums.

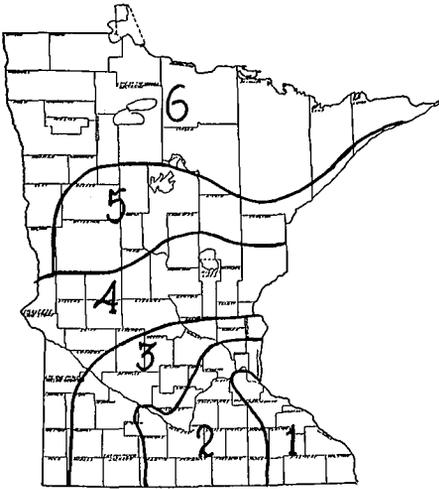


FIG. 3. FRUIT DISTRICTS OF MINNESOTA

### Nursery Stock

Whether or not a fruit tree was northern grown is of little importance in itself. Northern nurserymen, however, are more likely to have the recommended varieties propagated by the methods suited to this climate. This is extremely important for northern orchards. Patronizing the closest reputable nurseryman is usually advisable since he is usually in the best position to furnish the proper kind of stock and give prompt delivery service.

### Size of Stock

Most nurserymen offer 2- and 3-year-old trees which are somewhat branched. Apple, plum, and pear trees of this age may be from 4 to 6 feet in height and cherry-plums, 2 to 4 feet. Smaller and unbranched "whip"

trees, when procurable, are less expensive and may be satisfactory if properly cared for the first year. The main consideration in selecting the planting stock, however, is not so much the size as the condition of the trees. They should be vigorous and healthy with well-developed root systems.

### Buy Dependable Stock

Stock offered at bargain prices is often of the wrong variety, improperly propagated, low in vigor, or otherwise inferior. Since no amount of cultural skill can remedy a wrong start, examine "bargain" stock critically and purchase only if it is of good quality and from a dependable source.

### HOW AND WHEN TO PLANT

Prompt and vigorous growth is important in establishing an orchard with the fewest possible tree failures. Good survival can be encouraged by putting the topsoil in good condition thus providing food and water for the immediate needs of the trees. In most cases, preparation should begin a year or more before the trees are to be planted. A good procedure is to fall plow a clover crop and then follow with a manured cultivated crop such as corn. The organic material thus provided by the sod and the manure, well-mixed and rotted by a year's cultivation, increases the water-holding capacity and provides readily available food for the trees. A thorough disking and

harrowing just before planting will put the soil in good condition to receive the trees.

Do not plant trees in newly plowed sod. Drouth and grub worm injury is apt to occur unless the sod is allowed to rot thoroughly. If it is necessary to replace trees in an established sodded orchard, thoroughly prepare the soil in a 6-foot circle where the tree is to be set and keep free from weeds and grass for 3 or 4 years after the tree is planted.

### Plant in Early Spring

Early spring planting is recommended under most Minnesota conditions. Fall planting may be successful if the soil is sufficiently moist and if a good snowfall follows. There is always some danger, however, that in fall planting some trees may be killed or stunted through drying out and winter injury to the roots before they have become established in the soil.

Spring planting should be done as soon as danger of severe freezing of the ground is past. Early planting allows the roots to establish good contact with the soil before the buds open.

### Handle Stock Carefully

When the trees are received in the nursery package, unwrap and examine at once to see if they are moldy or dry. Do not accept them from the transportation agency if the stock is not in good condition. If necessary, sprinkle the roots with water and keep

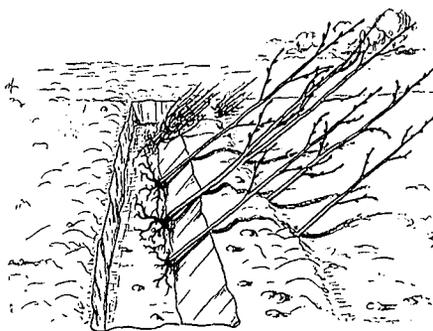


FIG. 4. HEEL IN TREES AS SOON AS BROUGHT HOME

them covered. Even short exposure to heat or dry air will greatly damage the roots of the trees. If they cannot be planted within a few hours, heel in as soon as brought home. In all handling and planting operations keep the roots covered, cool, and moist.

### Set Trees Properly

In digging the hole, it is sometimes advisable to pile the surface soil separate from the subsoil. This should be done especially when the topsoil is shallow. Make the hole to accommodate the mass of roots without crowding. The hole should be deep enough so that the tree will be about one inch deeper than it stood in the nursery. Fill in the topsoil first, shaking the tree up and down after each two or three shovelfuls to settle the soil around the roots. Tramp the soil with the feet occasionally as the hole is filled. Leave the top 2 inches of dirt loose to act as a mulch to catch rain. A 2-inch depression the width

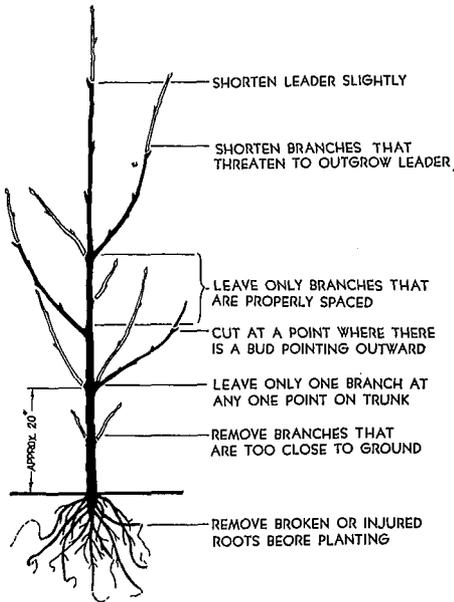


FIG. 5. PRUNING A YOUNG FRUIT TREE

planting, some of the top of the tree should be removed to compensate for the loss of roots. This is a very important step and should not be done in a haphazard manner. Avoid leaving short, stubby branches which will later cause a poorly shaped tree. Take this opportunity of removing weak or crowded branches cutting them close to the trunk. Attempt to space the branches which are saved 3 to 6 inches apart along the trunk selecting only those which have a strong wide-angled crotch. It may be necessary to cut off all except three or four side branches. This will not cause any serious setback and is necessary for the development of a well-shaped and long-lived tree. The illustration in figure 5 shows the pruning of a young tree.

of the hole will also help to direct surface water to the roots. If the soil is dry at planting, pour a pail of water into the basin.

Do not put fresh manure or commercial fertilizer in the hole at the time of planting. Manure or other fertilizers coming into direct contact with the roots are apt to injure or kill the tree. If the soil is very light, a small amount of well-rotted manure or peat may be mixed into the soil with which the hole is filled.

### Prune the Trees

In the handling operations, some of the roots may be broken or otherwise damaged. These should, of course, be removed before the tree is set. After

### CULTIVATION AND MULCH

While the trees are small, they should be cared for the same as any other cultivated crop. Weeds must be controlled and the surface soil must be kept loose. Avoid deep cultivation which may dry out the soil and injure the roots.

Because of the wide spacing, it is possible to intercrop with garden crops or small fruits the first 4 or 5 years. Planting "filler" trees to utilize the wasted space during the early life of the orchard is recommended only for locations which are not suited for growing garden crops. Few people will remove the temporary trees before they have caused a great deal of damage to the permanent trees by crowding.

### Stop Cultivation in Late Summer

Proper fall ripening of the wood or slowing up of the growth rate is a very important factor in the prevention of winter injury to trees. In order to hasten maturity all cultivation should be stopped by mid-July in the northern half of the state and slightly later in the southern half. In wet years it may be advisable to plant a cover crop. At the time of the last cultivation, oats, rye, barley, buckwheat, or some other quick-growing crop may be broadcast. In addition to using up the excess moisture and food, this growth will hold snow during the winter and will add humus to the soil when worked in by cultivation the following spring.

### Sod for Older Orchards

As apple and pear trees approach bearing age, that is 6 or 7 years from the planting date, it is necessary to give some attention to the vigor or the rate at which the trees are growing. Annual growth at the tips of less than 6 inches indicates that clean cultivation with the addition of fertilizers should be continued. Under some conditions of rich soil and clean cultivation, however, the annual growth may be 18 to 24 inches or more. If the trees are allowed to continue at this rate, bearing may be delayed. Rank growth of this kind is also more susceptible to winter injury and fire-blight disease than normal growth. It may be necessary, then, to establish a permanent grass or clover sod in the orchard to use up

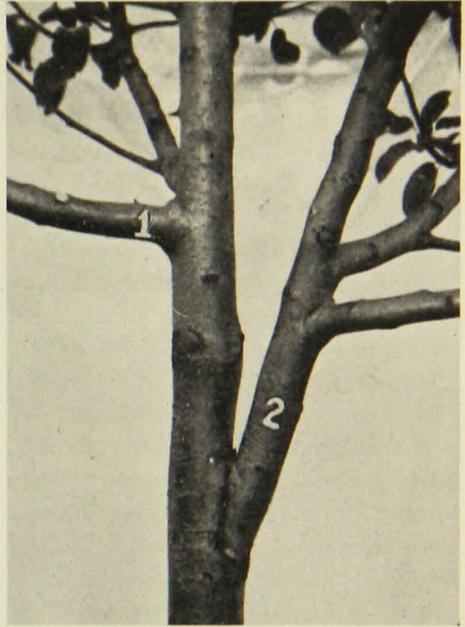


FIG. 6. IN PRUNING YOUNG TREES, LEAVE STRONG, WIDE CROTCHES SUCH AS NO. 1 AND ELIMINATE NARROW-ANGLED CROTCHES SUCH AS NO. 2

some of the plant food and water thus retarding the trees to normal growth rate.

Where apple orchards are planted on steep slopes, it is desirable to establish sod culture as early as possible to prevent the washing away of soil.

### Plums Need Cultivation

Plum trees have a bearing habit somewhat different from apples. They are the most productive when cultivation is continued throughout bearing life, and should, therefore, be planted only in locations which will permit continuous clean cultivation.

### Use of Mulches

Where clean cultivation is not practicable, moisture can be retained and weeds discouraged by the application of a layer of hay or strawy material 8 to 10 inches deep. This mulch should extend somewhat beyond the outermost branches of the tree. Since there is danger of injury from mice, a bare space 18 inches or more in diameter should be maintained around the trunk.

Additional mulch must be applied each year to replace that which decomposes and leaches into the soil. After the mulch is first applied to an orchard, 2 or 3 years will be required before enough plant food will be formed by the rotting mulch to maintain fertility. During this period supplementary nitrogen fertilizer may be needed.

If sod has been established in the orchard, the hay crop should not be removed but should be cut and allowed to form a mulch on the ground. Usually this is not adequate to maintain the fertility of the soil, and additional mulch or fertilizer must be hauled in and placed around the trees.

### Humus

Decayed plant materials or "humus" is an essential part of a good soil. High humus content makes soil easy to cultivate and allows it to absorb and retain water. As humus decomposes it releases valuable nitrogen to the soil. No orchard under any cultural system can be maintained indefinitely without the addition of humus to the soil in some form. In well-cultivated

orchards it is added in the form of manure. In sod orchards it is added in the form of manure or strawy mulch material.

## FERTILIZERS

Stunted growth and small yellowish leaves usually indicate a lack of plant food. Trees in this condition cannot long escape injury from disease or winterkilling. If they do escape death, they cannot be expected to bear well.

Nitrogen is the food element which is most apt to be lacking. In some cases there may also be a shortage of phosphorous and potash, although most Minnesota soils have enough of these elements for normal tree growth.

### Manure is a Practical Fertilizer

Annual spring applications of barnyard manure will usually take care of every fertilizer need. Manure contains humus as well as the three essential food elements mentioned above. A heavy application can be made to the soil the year before planting the trees. In the following years, the trees can make efficient use of smaller yearly applications.

### Commercial Fertilizers

When manure is not available, the three food elements may be supplied with commercial fertilizers. Commercial fertilizers do not supply humus; therefore, provision for replenishing

this important soil constituent must eventually be made through the use of mulch or manure.

Since nitrogen is more apt to be lacking than phosphorous or potash, applications of a nitrogen fertilizer alone, such as ammonium sulphate or sodium nitrate, will usually give the best results for the money spent. If there is some reason to believe that the other elements are also seriously lacking, a complete fertilizer with some such formula as 4-8-6 or 5-10-5 may be used.

### Apply Fertilizers Properly

Best results will be obtained through early spring application at least 2 weeks before blossoming time. Applications after early summer should be avoided as they encourage soft growth subject to winterkilling. Late fall applications may be made although there is some danger of loss through leaching in the case of commercial fertilizers.

The proper amount of fertilizer to apply will, of course, depend on many factors. The age of the tree, the type of fertilizer, and the condition of the tree, as indicated by its manner of growth, should all be considered. In the case of manures, annual light applications will be better than less frequent heavy dressings. This is particularly true in northern regions where too heavy applications may delay maturity of the new growth and aggravate winter injury. An average load of manure should be sufficient for four bearing trees of medium size.

If commercial fertilizers are used instead of manure, trees older than 3 years may receive ammonium sulphate or sodium nitrate at the annual rate of approximately one-half pound for each year of age, per tree. Complete fertilizers may be applied at a slightly greater rate.

Fertilizers should be spread on the ground under the trees beginning 2 or 3 feet away from the trunks and covering a broad circle slightly beyond the outermost branches. Never put fertilizer in contact with or near the trunks. Dry commercial fertilizer can be broadcast by hand. Both commercial fertilizer and manure should be applied to the surface and allowed to leach into the ground with the rains.

### PRUNING

The pruning of young trees consists mainly of directing the growth so that the trees, when mature, will be strong and well shaped. Young trees have a tendency to send out too many branches close together along the trunk. If some of these are not removed while the trees are small, the trunks will be seriously crowded. As the trees reach maturity, this crowding causes the main frameworks of the trees to weaken, and they may break down before their bearing lives are over.

Proper spacing of branches at planting has already been discussed. Each year following planting, some of the new side branches, arising from the central shoot or "leader" as it continues to grow upward, will have to be

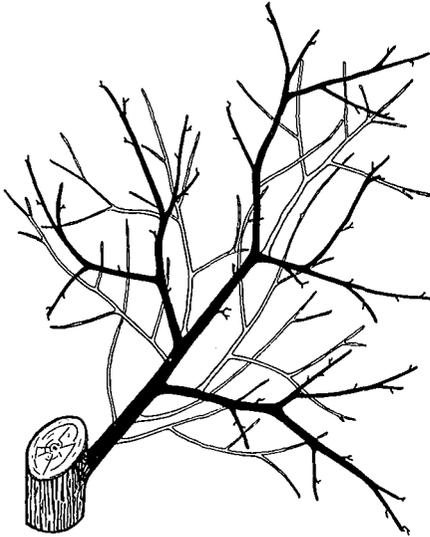


FIG. 7. IN PRUNING A BEARING FRUIT TREE, REMOVE BRANCHES TOO CLOSE TO TRUNK, WEAK SHOOTS CROWDING BEARING BRANCHES, AND BRANCHES IN CROTCHES OF OTHER BRANCHES

removed. Occasionally the leader itself may be shortened slightly to prevent the tree from becoming too tall.

### Prune Mature Trees Lightly

As a tree reaches bearing age, its formative period is nearly past. The yearly pruning now should be mainly to keep the branches of the tree in a clean untangled condition. It would be a mistake to cut out large branches at this stage in an effort to shape the tree. Overpruning of any kind is apt to interfere with fruit bearing and make the tree susceptible to injury from fire blight and winterkilling.

The main objective should be to remove small, crowding branches espe-

cially from the central portion of the tree. Soft, whiplike shoots which may arise from the trunk or larger branches should be removed as well as the broken, dead, or diseased parts. The bearing tree needs some pruning every year. Remove only enough wood each year to allow the sunlight and air to penetrate thoroughly.

### Making the Cuts

A sharp pruning shears and a narrow-bladed saw are the only essential tools for pruning. Make clean cuts tightly to the main trunk or branches. When cutting off limbs, do not leave stubs. If it is necessary to make any wounds larger than  $1\frac{1}{2}$  inches in diameter, they should be covered immediately with white lead and linseed oil paint or asphalt paint. In shortening side shoots or branches, always make the cut just beyond a bud or shoot heading toward the outside of the tree.

In thinning out bearing branches to allow better penetration of light, remove only shoots that appear weak and slender. Save the thicker and sturdier shoots and the stubby, crooked spur growth. These are the fruit-producing parts of the tree.

### Renovation Pruning

Many people have the false impression that trees which do not bear can be "pruned into fruitfulness." Many trees are in poor health because of long neglect. Much so-called "renovation pruning" done in cases of this kind does more harm than good. The trees are

probably suffering from overcrowding and lack of food. If these conditions can be remedied, careful renovation or "cleanup" pruning, done over a period of years, may be helpful.

Pruning may produce some vigorous growth on old, neglected trees, but it must be accompanied by proper cultural practices to be worthwhile.

### When to Prune

Pruning should be delayed until the trees are dormant. Late winter or early spring before growth starts is the recommended time. There is no serious objection to late fall or winter pruning except that the wounds made at this time may dry out more and delay healing.

An exception to dormant pruning may be made in case water sprouts occur in the trees during the summer. These soft whiplike growths are especially susceptible to fire blight. Their removal during the summer to avoid the possibility of infection and spreading disease to the rest of the trees is recommended.

## SPRAYING

Trees denied proper cultural care cannot be made healthy by spraying. The main object of spraying is to protect the fruit crop made possible by the previously discussed cultural practices.

Some of the more common pests which annually rob the home fruit grower of much of his crop and which can be controlled by a good spray program are listed.

### Spraying Controls These Pests

**Codling moth:** Wormy apples. Fruit breaks down in storage because of tunnels in flesh or core even though no outside injury is apparent.

**Apple scab:** Produces corky patches and scabs on the surface of the apple sometimes deforming the whole fruit. Also affects the leaves.

**Apple maggot:** Causes breakdown of fruit because of worms tunneling under the surface of the skin.

**Curculio:** Causes scars and deformities on the surface of both apples and plums. Plum curculio tunnels to the center of the fruit.

**Brown rot:** Fungus causes plum and cherry fruits to turn brown and rot on tree at or just before ripening time.

**Caterpillars and other leaf-eating insects:** Entire leaves eaten or holes eaten in leaves preventing tree from producing good fruit; sometimes kills the tree.

### Spraying is Good Insurance

Occasionally a good fruit crop can be produced without spraying the trees. The results are so uncertain, however, and the production over a period of years will be so low in quality that yearly spraying becomes a cheap form of crop insurance. The average cost per tree for spray materials should not be more than 50 cents each year.

Sanitation measures, such as clean cultivation in the case of plums and the picking up of drops and windfalls in the case of all fruits, and a generally neat and well-cared-for orchard will reduce the injuries from pests immensely. No amount of sanitation will prevent injury from certain pests, however, and a regular spray program is necessary for the consistent production of good fruit.

Table 2. Pest Control Program\*

Time of Application	Material	Pests Controlled
<b>APPLES AND PEARS</b>		
First spray (pre-pink) — Any time after the buds break until the flower buds are exposed but not yet separated in the cluster.	5 quarts of liquid lime-sulfur or 5 pounds of dry lime-sulfur to 50 gallons of water	Apple scab
†Second spray (pink) — When the blossoms show pink	Same as for the first spray plus 1½ pounds of lead arsenate to 50 gallons of water	Scab, curculio, canker worm, and other leaf-eating insects
†Third spray (calyx) — After most of the petals have dropped but before calyx closes	Same as for the second spray	Black rot, codling moth, and those listed under the second spray
†Fourth spray — Two or three weeks after the third spray	Same as for the second spray	Scab, black rot, codling moth, curculio, apple maggot (railroad worm), and leaf-eating insects
Fifth spray—About July 20	Same as for the second spray	Scab, black rot, apple maggot, and codling moth (second brood)
Sixth spray—About August 1 to 10. (For orchards badly infested with apple maggot in previous years or those not sprayed in previous years.)	Same as for the second spray	Scab, apple maggot, and leaf-eating insects
<b>PLUMS AND CHERRY-PLUMS</b>		
First spray — Just before the flower buds open	5 quarts liquid lime-sulfur or 5 pounds dry lime-sulfur plus 1½ pounds lead arsenate to 50 gallons of water	Plum pocket, leaf gall mite, brown rot, and curculio
Second spray — Just after the petals fall	Same as for first spray	Brown rot, curculio, and shot-hole
Third spray—When the fruit is the size of a small pea	Same as for first spray	Brown rot, curculio, and shot-hole
Fourth spray—When the fruit of early varieties starts to color	5 quarts liquid lime-sulfur or 5 pounds dry lime-sulfur to 50 gallons of water	Brown rot and shot-hole

\* For detailed "Pest Control Program for Fruits in Minnesota," write for Extension Folder 69 from which the above is adapted.

† The application of these sprays will give fair control if it is not feasible to follow the complete schedule.

### Plant Lice

If the trees are infested with plant lice, add one-half pint of nicotine sulfate to each 50 gallons of the spray mixture or use alone with 3 pounds of soap to 50 gallons of water.

### Spraying Equipment

The period during which each spray can be effectively applied is very short. Spraying is a waste of time and materials unless it is done thoroughly and exactly at the right time. This means that where a large number of trees must be covered, a rather expensive, large-capacity spray outfit must be used. In the home orchard, consisting of only a few trees, a good job can be done with a small inexpensive outfit of the barrel, wheelbarrow, or knapsack type if the operator first makes sure that the nozzle delivers a fine mistlike spray, and if he takes pains to cover each tree thoroughly.

In some localities home fruit growers have organized "spray rings" cooperating in the purchase of high-pressure spray rigs of sufficient capacity to quickly spray several home orchards. Spray rings have been successful in many cases, but careful organization is essential.

## PREVENTION OF TREE INJURIES

### Winter Injury

The first step in escaping winter injury is, of course, to select hardy varieties to plant. A good windbreak will

also reduce injury from drying out of the twigs during the winter months. Trees that are starving to death are in no condition to resist winter injury. Cultivate and fertilize in the early part of the growing season so that they will have ample food reserves. In applying fertilizer do it at the proper time so that the trees will approach winter with properly matured wood. Be conservative in the pruning of older trees as overpruning encourages rank growth which is apt to winterkill.

### Sunscald

Tree trunks unprotected from the sun during the winter months may alternately freeze and thaw on the southwest side. Bark thus injured provides an entrance for rot organisms that may greatly injure or kill the tree. Protect



FIG. 8. WRAP THE FRUIT-TREE TRUNKS WITH BURLAP OR HEAVY PAPER TO PREVENT SUNSCALD

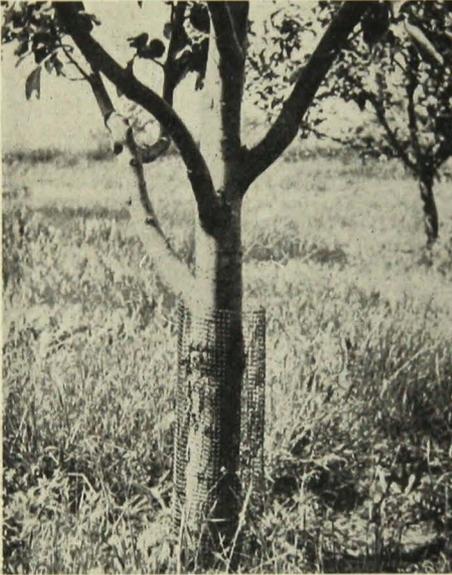


FIG. 9. USE WIRE GUARD TO PREVENT RABBIT AND MOUSE INJURY

the trunks during the winter by wrapping with heavy paper or burlap. Avoid tar papers as some of these contain oils injurious to the bark. Remove wrappings after freezing danger is past.

Keep livestock out of the orchard. They pack the soil, break off fruiting spurs, and eat vegetation which should be returned to soil as humus.

### Rabbits and Mice

Rabbits may cause severe injury by chewing bark from the trunks and lower branches. No completely satisfactory method of protection is yet known. One of the best methods, however, is to place cylindrical guards of window screen or hardware cloth

around the trunks extending from the ground line to the lower branches. For large orchards this is expensive and is ineffective when the snow is deep. Various paint repellents applied to the trunks and lower branches have been experimented with. The most effective of these is a "copper soap" paint.

The screen or mesh guards mentioned above will also protect the trunks against girdling by mice if the protectors are fitted closely to the soil at the base. When wire guards are not used, some protection will be afforded by mounds of soil 8 inches high placed around each trunk before the soil freezes in the fall. The mounds should, of course, be removed in the spring.

**Fire blight** is a bacterial disease which causes drying of the leaves on the succulent shoots of apple and pear trees. In the advanced stage it affects the larger branches and trunks resulting in severe injury or death. Spraying has no effect on this disease other than to control the insects which may carry it from tree to tree. Soft rank growth is more susceptible to fire blight than slower growing shoots. Therefore cultivation and heavy fertilization are withheld from trees that are growing too fast or have shown considerable infection. Once the tree is infected, the only treatment is to prune out the diseased parts. For detailed information on fire blight, write for Extension Folder 71, Bulletin Room, University Farm, St. Paul.

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