

*Managing*

# **YOUNG FILBERT ORCHARDS**

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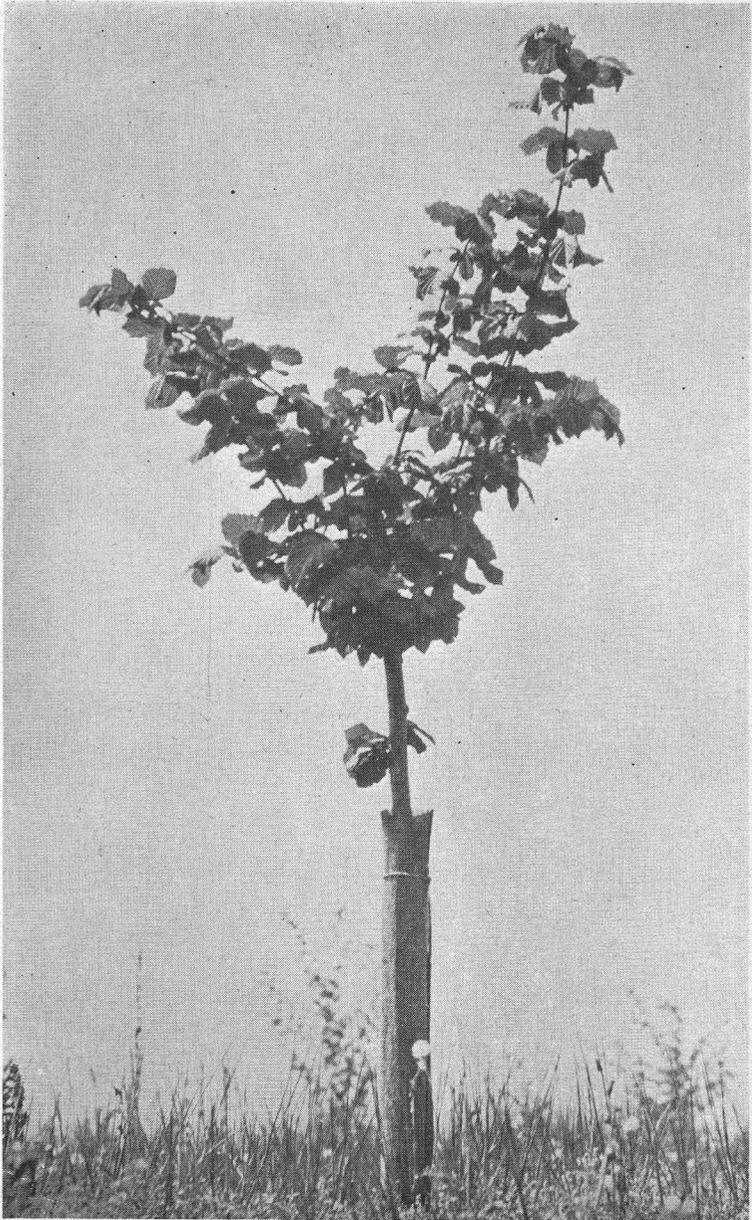


Figure 1. A Yucca board protector about the trunk of a filbert tree. Such a covering will prevent sun scald. (Photograph by O. T. McWhorter.)

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Cover picture shows results that may be expected from good management on fertile soil.

# Managing Young Filbert Orchards

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**T**REE losses in young filbert orchards from the time of planting to bearing age vary from less than 1 per cent up to 25 per cent. While the mortality fluctuates from year to year it is estimated that during the last decade about 10 per cent of the trees planted had died before they reached 5 years of age.

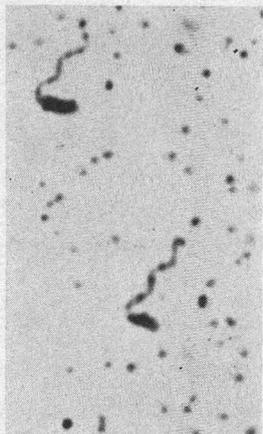


Figure 2. Photomicrograph showing the filbert blight bacterium.  $\times$  2300.

## CAUSE OF TREE LOSSES

A number of agencies are associated with the death of young filbert trees in Oregon. The various causal or contributing factors are discussed in the order of their relative importance.

**Bacterial blight** is a disease widely distributed in the Pacific Northwest. It has been found to a greater or less extent in practically every orchard and nursery visited in this region, except in a small area in the extreme northern part of Washington. It is caused by a bacterial pathogen\* (Figure 1).

The buds, leaves, branches, trunk, and occasionally the nuts are attacked by the blight† (Figures 3 to 6 inclusive).

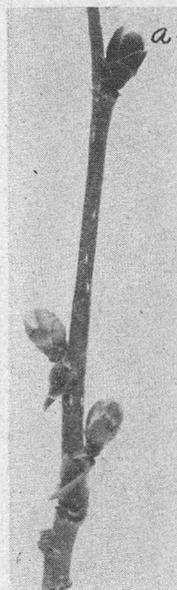


Figure 3. A filbert bud (a) infected with bacterial blight.

\* *Phytophthora corylina* Miller et al.

† For a detailed description of the effects of bacterial blight on the host organs, see Oregon Extension Bulletin 486.

The formation of cankers on the tree trunk is the most serious aspect of this disease, especially when these lesions girdle and kill the trees, as is often the case in young orchards up to 4 years of age (Figure 7). The trunk of the tree becomes increasingly resistant with age. After the fourth year, it is but rarely infected. Many

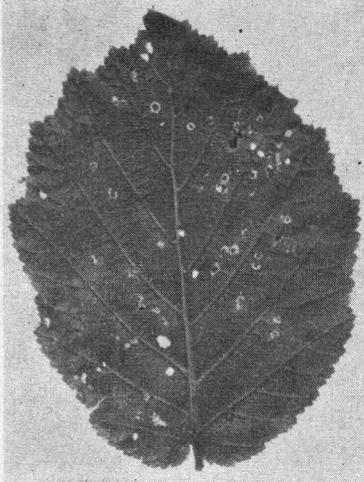


Figure 4. Blight infections on a filbert leaf.

buds and nut-bearing twigs in the tops of older bearing trees, however, are attacked and killed, thus reducing the yield (Figure 8). The average annual crop loss due to bud and twig blight is estimated to have varied from less than 1 per cent to 10 per cent in the past decade. In certain orchards the loss has reached 25 per cent.

The disease is brought into the orchard on nursery stock and then spread by cultural operations and rain. Shears or knives used in pruning or suckering may readily be contaminated with the blight bacteria by accidentally cutting through an active canker (Figure 10, A). Unless a disinfectant is used on the tools the germs are carried to adjoining trees where centers of infection are established from which the disease may be spread further by rain.

Young filbert trees are predisposed to bacterial blight infection by various factors such as sun scald, winter injury, drought, improper drainage, and other agencies that may injure or weaken the trees.

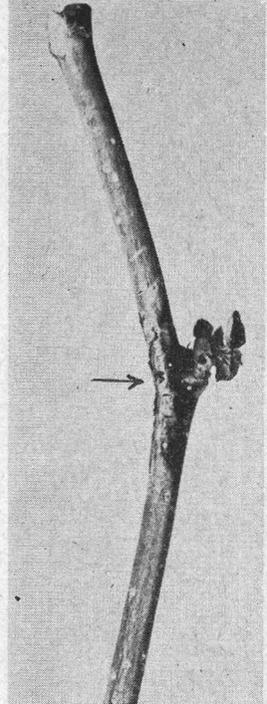


Figure 5. A blight canker denoted by arrow, on a 1-year-old filbert twig at the base of a blighted bud.

The tissues of devitalized trees offer but little resistance to infection and the subsequent extension of the diseased areas. It is important, therefore, that the trees be maintained healthy and vigorous to lessen the extent of damage in the event of infection.

Measures recommended for control of this disease fall into three classes, as follows: (1) ridding the trees of sources of infection by cutting out the blighted parts, (2) sterilization of tools used in pruning and suckering, (3) spraying with bordeaux mixture.

The disease could be absolutely eradicated if it were possible to remove *all* sources of bacteria by surgery. This is humanly impossible, however, because even the most careful examination will not disclose all sources of infection. The removal of all detectable sources of bacteria aids in control, and the extent to which it is helpful depends upon the thoroughness with which the sources of infection are removed. Blighted twigs should be removed from 1 to 2 inches back into the healthy tissues of the subtending branch to make certain that no bacteria remain to reinfect the tissues. In the case of cankers on the larger limbs or trunk, all of the discolored bark should be removed, the cut extended well back into the healthy bark, and the wounds disinfected (Figure 9). The sources of infection must be removed before time for the natural spread of the disease, that is, by early fall, if this measure is to be effective. The best time to remove blight infections is in midsummer when the disease is quiescent.

Tree losses from blight traceable to contaminated tools can be prevented by sterilizing the pruning and suckering tools with an efficient bactericide such as bichloride of mercury, 1 part in 1,000 parts of water. This chemical may be obtained in tablet form at most local drug stores. The solution should be kept in a glass container as it is corrosive and loses its germicidal properties shortly after coming in contact with metal. **WARNING:** *Bichloride of mercury solution is deadly poison to man or animals if taken internally and should be so labeled and kept in a safe place away from children.*

The use of a sterilizing solution on the pruning tools is particularly advisable when suckering and pruning young trees, 1 to 4 years of age, as lesions on the trunks during this period frequently result in the eventual loss of the tree. After a tree is 4 years of age the use of a disinfectant on the tools is not so necessary, as the tis-

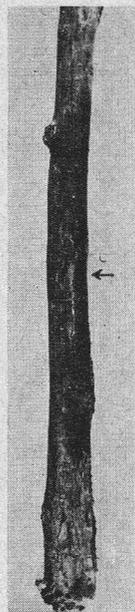


Figure 6. A blight canker on the trunk of a young filbert tree.

sues of the trunk become increasingly resistant with age. While it is not practical to sterilize the tools each time between cuts, they should at least be sterilized between trees.



Figure 7. A young filbert tree killed by bacterial blight. The trunk of this tree was encircled by a blight canker.

The incidence of bud and twig blight in bearing trees can be materially reduced by timely spraying with 6-2-100 bordeaux mixture (6 pounds of copper sulphate, 2 pounds of hydrated lime, 100 gallons of water). The addition of a small quantity of an efficient wetting agent to bordeaux mixture will increase its effectiveness. In a normal season, one application of bordeaux mixture, made in the late summer before the first fall rain, will control the disease satisfactorily.

In seasons of abnormal rainfall during the fall and winter, supplementary applications made in (a) the late fall when the leaves are about three-fourths off the trees, and (b) in the early spring when the leaf buds are breaking open may be necessary to hold the disease in check.

**Sun scald.** The bark of the trunk of a young filbert tree is relatively thin and especially subject to injury by the hot rays of the sun. Particularly is this true if the trees are planted shallower in



Figure 8. Bud and twig blight in a filbert tree. The killing of the buds and twigs has reduced the bearing area appreciably.

the orchard than they were in the nursery, in which case there is left exposed an area at the base of the main stem that is thinner and more tender than the remainder of the stem. Unless some protection from the hot rays of the sun is afforded this part of the tree it is very likely to be injured during hot weather (Figure 10, B). Trees that are suffering from drought are more susceptible to sun scald than are those having an ample supply of soil moisture. In addition to the direct effects of heat on the bark, the resulting cankers may serve as points of entry for the blight bacteria.

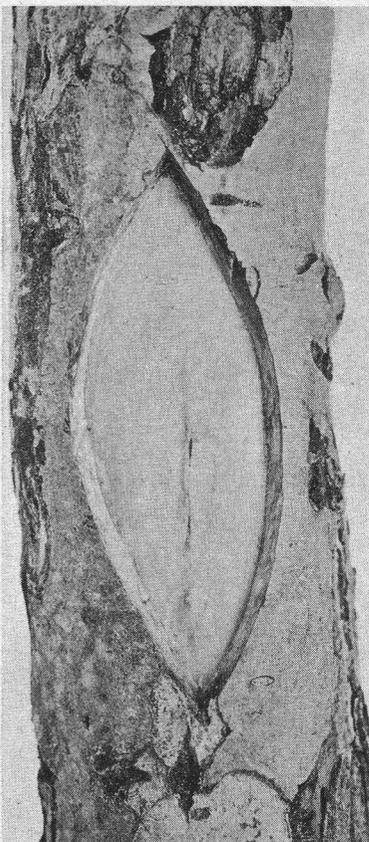


Figure 9. Proper shape to leave wound resulting from the removal of a canker or other bark injury. Notice the pointed ends of the wound and the perpendicular cut of the bark. Such stream-lined wounds heal best.

The placement of a covering about the trunk as soon as the tree is planted will ordinarily reduce losses from sun scald to a negligible amount (Figure 1). Among the materials that make good trunk protectors are newspaper mats, extra heavy wrapping paper, Yucca boards, and roofing paper. As a possible alternative, the trunks may be painted with a good exterior whitewash,\* which, while not as effective as the protectors suggested, will aid in reducing the severity of damage from sun scald.

\* A very satisfactory whitewash formula recommended by O. T. McWhorter, extension horticulturist of Oregon State College, and Wray Lawrence, county agricultural agent of Wasco County, Oregon, is as follows:

Quick-lime (do not substitute) .....	4 pounds
Skim milk .....	2½ quarts
Water .....	2½ quarts

Water slake the quick-lime; combine the skim milk and water and then add to the slaked lime while still warm; apply to trees with a brush.

**Poor drainage.** Excessive soil moisture due to poor drainage has caused the death of many young filbert trees. The importance of proper drainage is shown by the fact that the greatest loss of young trees ordinarily occurs in low, wet spots in the orchard. If

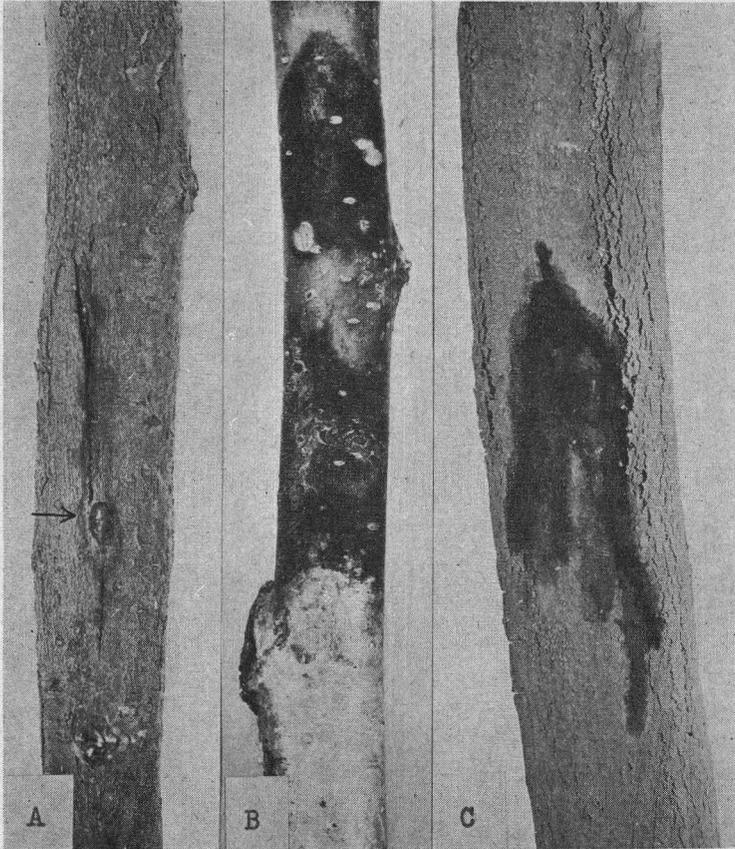


Figure 10. A, a bacterial blight canker on the trunk of a young filbert tree; the arrow points to a drop of bacterial exudate which is one of the sources of infection. B, a canker due to sun scald. C, winter injury on the trunk of a young tree. Note "sap" coming from the injured area.

poor drainage does not, of itself, kill the trees, it weakens them to such an extent that they are predisposed to infection by bacterial blight, or renders them liable to attacks by borers and other pests.

**Drought.** While filbert trees of bearing age seldom die from drought, young trees, 1 to 2 years old, may die, particularly if they do not possess a good root system to begin with and if they were not headed back when planted. Planting in the late spring frequently

increases the mortality from this cause, especially if the rainfall is below normal the first season. Irrigation of the trees will prevent losses due to drought. In many cases, however, the lack of sufficient water or an unfavorable terrain makes irrigation impractical if not impossible. The only other alternative is to conserve moisture that is present by disking or plowing the soil in the spring as soon as the soil is workable and by subsequent cultivations to kill the weeds.

**Winter injury.** While filberts are naturally hardier than most fruit trees, they are subject to injury by low temperatures, particularly if unusually cold weather should occur before the trees become fully dormant (Figure 11). The damage is often more severe when cold, drying, north winds accompany the low temperatures and when snow is on the ground than when the ground is bare. This is because the sunlight striking the snow is reflected to the tree trunks and warms the bark on the south or southwest side of the tree, thawing out the tissues during the day. During the night freezing again occurs. This alternate freezing and thawing often results in the death of the tissues in strips on the south or southwest side of the trunk (Figure 10, C). Besides interfering with the flow of the sap, the winter-injured areas may serve also as infection points for blight bacteria. Some varieties appear more susceptible to winter injury than others. The Brixnut and DuChilly varieties in recent years have been injured more than the Barcelona and Daviana.

While there is little, if anything, that can be done to prevent winter injury if the temperatures drop too low, partial protection from the injurious effects of alternate freezing and thawing can be obtained by shading the trunk, particularly the southwest side, with a protector such as Yucca board, heavy newspaper mat, or similar materials, or by painting with an adhesive exterior whitewash (see page 8). The whitewash reflects the heat rays of the sun, thereby diminishing the wide fluctuations in temperature of the tree trunks, which is the cause of much of the damage.

**Rodents** (rabbits, field mice, and squirrels) may be an indirect cause of the death of young filbert trees. During the winter when snow is on the ground, rabbits and field mice may gnaw the bark from the lower part of the trunk, and often girdle the trees. By burrowing beneath young trees and cutting off the roots, gophers and moles may also be responsible for the death of filbert trees.

**Insects.** Certain insects; namely, the snowy tree cricket,\* shot-hole borer,† and the Western flat-headed apple tree borer‡ may at-

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\* *Oceanthus niveus* (De Geer).

† *Anisandrus dispar* (Fabr.)

‡ *Chrysobothris mali* (Horn).

tack the trunks and branches of filbert trees and contribute to their death. (Figures 12 and 13). Borers attack the trees only after they are first devitalized by winter injury, sun scald, drought, blight, or other cause (Figure 13). The importance of keeping the trees vigorous and healthy is obvious.



Figure 11. A winter-injured filbert tree. This tree was predisposed to damage by wet, poorly-drained soil.

**Combined effect of two or more of the foregoing factors.** The greatest loss of young filbert trees takes place when one or more of the nonparasitic factors and bacterial blight become associated. Thus, following the severe winter of 1935-36, a great increase in the mortality of young filbert trees occurred the following spring and summer. Microscopical examinations and a number of isolations disclosed, in many instances, the presence of blight bacteria in the dead or injured areas on the trunks and branches of trees that were known to be free from blight cankers prior to the November 1935 freeze. The tissues were apparently so weakened by winter injury that they offered little, if any, resistance to infection and extensive invasion by the blight bacterium. Any other unfavorable factor, such as poor drainage, drought, or sun scald, that similarly lessens the vigor of the trees, predisposes them to infection and serious damage by the blight bacteria.

## ORCHARD MANAGEMENT PROGRAM TO REDUCE TREE LOSSES IN YOUNG FILBERT ORCHARDS

In the light of the foregoing information there is here suggested a detailed program of orchard management from time of selection of the site to the time trees come into bearing that, if followed, should result in a reduction of tree losses in young orchards.



Figure 12. Trunk of a young filbert tree girdled by a flat-headed borer.

### LOCATION OF ORCHARD

One of the most important factors determining the longevity and productivity of an orchard is its site. In selecting a suitable site, a number of factors must be considered, among the more important of which are depth, fertility, and drainage of the soil. The soil should be at least 8 feet deep and preferably deeper before any obstruction to root penetration is encountered. A deep soil supplies a greater reserve of moisture and fertility for the trees to draw upon than does a shallow soil. This is an important consideration particularly in unfavorable growing seasons. The soil should be fertile with a plentiful supply of organic matter and should be well drained. The site should have good air drainage.

### PLANTING STOCK

Only first-grade nursery stock should be planted. The trees should have an extensive system of lateral roots massed within a space of from 2 to 4 inches at the base of the trunk in order to reduce the amount of sucker-bearing wood\* to a minimum (Figure 14). Trees that have but few, or no, lateral roots should be discarded. The stock should be free from blight cankers as denoted by flattened or sunken areas in the bark of the trunk, for it is such stock that is responsible for the introduction of bacterial blight into a planting.

\* Suckers do not come from the roots but from the old wood between the base of the main stem and the roots.

## PLANTING THE ORCHARD

**Time of planting.** The trees should be planted in the late fall or winter, just as soon as dormant trees can be obtained from the nursery and the soil is in condition to be handled. Planting the orchard early will permit the root system to become established before top growth starts in the spring. Trees with a well-established root system planted early generally make a vigorous, strong growth the first season while trees planted late make comparatively little growth and are more likely to succumb to drought or other unfavorable conditions.

**Treatment of trees at time of planting.** Filbert trees should be cut back at the time of planting. In digging the trees in the nursery a great number of roots are broken off, thereby materially reducing the water-absorbing capacity of the plant. Unless the top portion of the tree is headed back, the root system remaining will be unable to provide sufficient moisture to take care of the needs of the tree. Trees should be headed back to a height of 24 to 30 inches. Low headed trees not only make a stronger, more vigorous growth the first season, but the foliage on the lower limbs helps to shade the trunk, thereby aiding in preventing sun scald.



Figure 13. Shot-hole borer damage in trunk of a devitalized filbert tree. (Photo by B. G. Thompson.)

Trees that are whips require no further attention after they are headed back. If there are branches present, they can be removed and the tree treated as a whip, or the shoots can be cut back to one or two buds and used as the foundation for the framework of the tree.

In pruning the trees it is advisable to sterilize the shears with bichloride of mercury after pruning each tree, as directed on page 5.

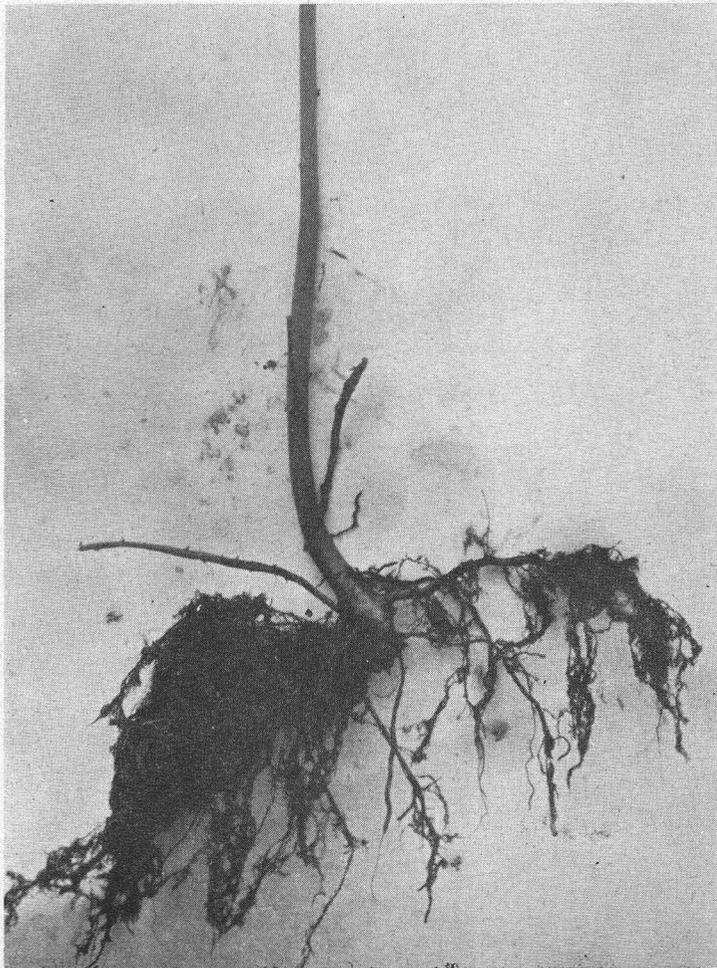


Figure 14. A properly grown nursery tree. Note that the roots are confined to a short space. If such a tree is set shallow with roots pressed downward, suckering is reduced to a minimum.

As an added precaution against chance blight infection, the tops of the trees may be dipped in a 6-2-100 bordeaux mixture before planting to kill any blight bacteria that may have come in contact with the pruning cuts. A coating of bordeaux mixture will also guard against bud infection during the following winter and early spring.

**Setting the trees.** In planting the trees a hole about twice as large as the spread of the root system should be dug and then re-filled half full with loose top soil. A mound of dirt should then be built up within the hole and the tree set on this mound, with the roots spreading in a circle and downward at about a 45° angle. The trees should be planted at the same depth as they were standing in the nursery. Then the roots are covered with soil packed down firmly to avoid air space around them. If the orchard is in a windy location, it is advisable to tie the tree to a stake until it is well rooted. A board or lath placed on the southwest side makes a good stake and, in addition, shades the trunk, thereby aiding in the prevention of winter injury and sun scald. After digging the trees and during the planting operation, care should be taken to prevent the roots from drying out by covering them with moist earth or wet burlap.

#### **CARE OF THE TREES THE FIRST YEAR AFTER PLANTING**

After the trees are planted and headed back, they should be sprayed with 6-2-100 bordeaux mixture, if they were not dipped in this fungicide prior to planting. Some one of the protectors specified on page 8 should then be placed around the trunk and left there for at least 2 years and preferably longer. As a possible alternative measure, the trunks may be painted with exterior whitewash which, while not as effective as the other trunk protectors, will aid in reducing the damage from winter injury and sun scald.

If rabbits are abundant in the vicinity of the orchard a closely woven wire guard may be placed around the lower half of the trunk to prevent them from gnawing the bark and girdling the trees.

The orchard should be disked or plowed in the spring as soon as the ground is workable. Subsequent cultivations in late spring or early summer may be found necessary to keep down weed growth and conserve moisture. Cultivation should not be performed too late in the season, however, as late cultivations may force late fall growth of the trees that is more susceptible to damage by winter injury.

During the middle of August it is advisable to make another application of 6-2-100 bordeaux mixture to the trees to guard against infection of the buds by the blight pathogen during the following fall and winter.

### CARE OF THE TREES DURING THE SECOND AND SUBSEQUENT YEARS

The program during the second and subsequent years is essentially the same as for the first year. Since moisture deficiency is one of the limiting factors in filbert culture in the Pacific Northwest, every effort should be made to conserve the supply by preventing weed growth through the critical summer months. The orchard therefore should be disked or plowed in early spring just as soon as the ground is workable. The number of late cultivations will be largely determined by the amount of weed growth.

During the first 3 years in the life of the orchard, suckering and pruning should be delayed if possible until late spring or early summer, after the critical period for blight infection is over, as wounds made during late fall and winter heal over very slowly. If such wounds are not protected by a wound dressing containing a fungicide, they may serve as points of entry for blight bacteria and wood-rotting fungi.

To prevent spread of blight bacteria by pruning implements that accidentally become contaminated by cutting through blight cankers on diseased trees, it is advisable to sterilize the pruning and suckering tools, between trees, with bichloride of mercury 1-1,000 as directed on page 5. Frequent sterilization of pruning and suckering tools is particularly advisable when pruning and suckering young trees, 2 to 4 years of age, as infections on the trunks during this period often result in the eventual girdling and death of the tree.

Pruning wounds, 2 inches in diameter or larger should be painted immediately with bordeaux paste,\* particularly if made in the fall or winter; later, after the wound is dry and has started to heal, a good wound dressing containing a fungicide such as bordeaux-linseed oil paint, should be applied to the surface to prevent the entrance of blight bacteria and wood-rotting fungi. Bordeaux-linseed oil paint is made by adding  $1\frac{1}{2}$  pints of raw linseed oil to 1 pound of a commercially prepared dry bordeaux mixture powder.

A cover crop should be sowed in late summer or early fall of the second year and yearly thereafter to help maintain fertility.

Trees should be sprayed annually in mid-August with an application of 6-2-100 bordeaux mixture to control bud and twig blight.

When the orchard reaches maturity it will probably be infested with the filbert worm that can be controlled by spraying. (See Oregon Agricultural Experiment Station Cir. of Information 231.

\* Made by mixing equal parts of dry bordeaux powder and water.