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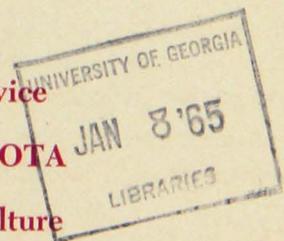
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FRUIT FOR THE HOME

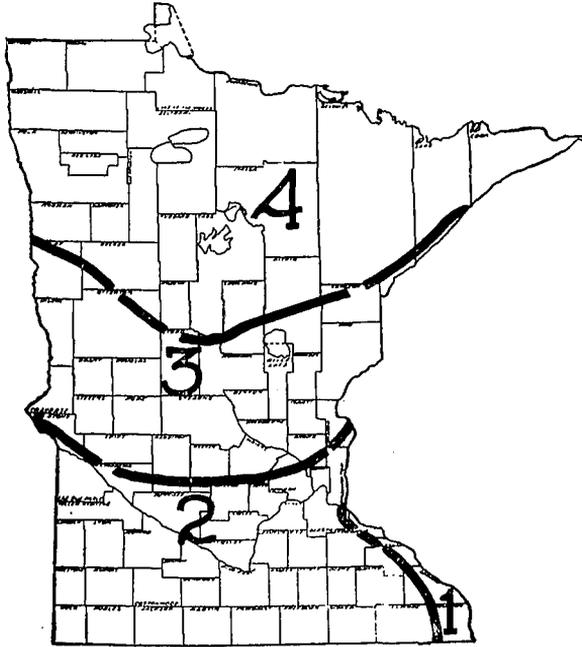
E. T. ANDERSEN

L. C. SNYDER

Agricultural Extension Service
UNIVERSITY OF MINNESOTA
U. S. Department of Agriculture



Minnesota Fruit Zones



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On the cover—The Regent apple (Minn. #1430) is a 1964 introduction by the Department of Horticultural Science, University of Minnesota. For more information, see Miscellaneous Report 54, *Regent Apple*.

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Fruit For The Home

E. T. Andersen and L. C. Snyder

Growing fruit in your garden and home orchard can be an interesting hobby, as well as a profitable venture. By proper planning you can enjoy luscious vine- and tree-ripened fruits throughout the year. Strawberries—one of the first fruits to ripen—are soon followed by currants, raspberries, cherries, apricots, cherry plums, plums, grapes, pears, and apples. And besides being good to eat, fruits furnish bulk and many body-building minerals and vitamins essential to health.

Your success in growing fruits will depend on four things:

1. Planting site selection.
2. Choice of varieties adapted to your locality.
3. Pest control.
4. Cultural care.

Since good fruit can be grown in every county in Minnesota, you should be able to grow your own supply of fruits for fresh use, freezing, and canning—if you have sufficient space.

This bulletin presents information on the cultural requirements of each commonly grown fruit.

Selecting The Site

Selecting the proper site for your fruit planting is of utmost importance in many parts of Minnesota. The soil should be fertile and well drained for most fruits. Air drainage is also necessary because protection against late spring frosts may mean the difference between a good crop and no crop.

For small fruits and tree fruits that require cultivation, such as plums and cherry plums, select a comparatively level site. However, for air drainage purposes, there should be some slope over the area leading to a lower level. Then the cold air can drain during frosty spring periods. If your site is on a slope, plant the rows on the contour to prevent erosion. Grapes de-

E. T. Andersen is an associate professor and L. C. Snyder is a professor and head, Department of Horticultural Science. The authors gratefully acknowledge the contributions of J. A. Lofgren, extension entomologist, and H. G. Johnson, extension plant pathologist.

The map of Minnesota fruit zones was prepared by the Fruit List Committee, Minnesota State Horticultural Society, and was adopted on September 27, 1949.

Table 1. Planting distances, time intervals from planting to fruiting, approximate yields, and ripening dates

Fruit	Distance between rows	Distance between plants in row	Time from planting to fruiting	Approximate yield per plant	Ripening period
	feet	feet	years		
Small fruits					
Currants	8	5	3	2-3 qts.	July
Gooseberries	8	5	3	2-3 qts.	July
Grapes	8	8	3	4-6 qts.	Sept.-Oct.
Raspberries	6-8	2½-4	1¼	1 qt.	July-Oct.
Strawberries	3-4	1½-2	¼-1¼	½ qt.	June-Oct.
Tree fruits					
Apples*	30	25-30	4-10	5-10 bu.	Aug.-Oct.
Crabapples	30	25	3-7	5-10 bu.	Aug.-Oct.
Apricots	20	20	2-4	1-2 bu.	July-Aug.
Cherries (sour)	16	16	3-5	1 bu.	July-Aug.
Cherries (Nanking)	8	6	2-3	2-4 qts.	July
Cherry plums	15	15	2-4	1-2 bu.	Aug.-Sept.
Plums	20	20	3-5	1-2 bu.	Aug.-Sept.
Pears	30	30	5-10	4-8 bu.	Sept.-Oct.

* Apples on dwarfing and semidwarfing rootstocks can be planted much closer together than standard trees. See section on "Dwarf Apples," page 14.

mand a southern exposure to aid ripening fruit.

Also, for convenience, consider proximity of the site to your house. You can plant small fruits, such as strawberries and raspberries, at one end of your vegetable garden.

If a natural windbreak is not present, provide one on the north, south, and west sides of the orchard. You can accomplish this by locating the orchard site within the farm shelterbelt. For small fruits like strawberries and raspberries, protection from hot south and west winds is probably most important. But avoid planting fruits too close to windbreak trees because of root competition and shading. A safe distance is 50 feet from the inner row of the shelterbelt trees to the fruit trees.

The Planting Plan

Since the fruit planting represents a considerable expenditure in time

and money, follow a carefully considered plan. Give thought to spacing, number of plants, selection of varieties, and arrangement.

With the aid of the accompanying charts on spacing, yields, and suggested varieties, draw up a plan that meets your own conditions and requirements. Remember that a small well cared for planting gives more fruit than a large neglected planting. Allow ample space for tree fruits to develop without crowding. Then you will have low spreading trees that are easy to spray and harvest.

Care Before Planting

Fall or early winter is the best time to plan your fruit planting and place your order for nursery stock. But order only varieties that are adapted to your area. And order early so you will get the varieties you desire.

It is best to purchase plants from a local reputable nurseryman. This

Table 2. Suggested varieties*

Fruit	Varieties	Fruit zones (see map, page 2)			
		1	2	3	4
Crabapples	For jelly, pickles, and sauce:				
	Dolgo (jelly only), Hyslop, Northland, Red River	H	H	H	H†
	For fresh dessert, sauce, and pickles:				
	Chestnut, Whitney	H	H	H	H†
Apples	For fresh dessert:				
	Centennial, Rescue	H	H	H	H†
	Early and midseason:				
	Mantet, Oriole	H	H	H†	T†
Cherries	Erickson, Charlamoff			H	H†
	Beacon, Duchess, Lakeland, Minjon, Wealthy, Melba	H	H	T†	T†
	Late:				
	Fireside, Connell Red, Haralson, Victory, Redwell	H	H	T†	.....
Red currants††	McIntosh, Regent (Minn. #1430)	H	T	T†	.....
	Delicious, Jonathan, Yellow Delicious	H	T†	.....	.....
	Nanking:				
	Drilea, Orient, Seedlings	H	H	H	T
Gooseberries††	Pie:				
	North Star, Meteor	H	H	T	T
Grapes	Cascade, Red Lake	H	H	H	H
	Pixwell, Welcome	H	H	H	H
	Beta	H	H	H	H
	Red Amber, Blue Jay (needs pollinizer)	H	H	HP	HP
Pears	Worden	H	HP	.....	.....
	Concord	H†	.....	.....	.....
	Bantam, Golden Spice	H	H	H†	H†
	Parker, Flemish Beauty, Mendel	H	H†	H†	.....
Plums	Hybrid:				
	La Crescent, Underwood, Tecumseh		H	H†	H†
	Pipestone, Redglow, Superior	H	H	H†	H†
	Pollinizer (see page 16):				
Apricots	South Dakota, Toka	H	H	H	H†
	Prune type:				
	Mount Royal, Stanley	H	H†	T†	.....
	Cherry plums:				
Raspberries§	Compass (pollinizer), Sapa, Sapalta	H	H	H	H†
	Opata .....	.....	.....	H	H
	Moongold, Sungold	H	H	T	T
	Red:				
Strawberries§	Chief .....	.....	H	H	H
	Latham, Newburgh, Boyne	H	H	H	H
	September, Durham (autumn fruiting)	H	H	H	H
	Purple:				
Raspberries§	Sodus	H	H	H†	H†
	Black:				
	Bristol, Cumberland, Black Hawk	H	H	H†	H†
	June-bearing:				
Strawberries§	Beaver, Premier, Earlimore, Trumpeter, Dunlap, Robinson, Sparkle, Cyclone, Redcoat	H	H	H	H
	Arrowhead .....	.....	.....	H	H
	Everbearing:				
	Superfection, Gem, Brilliant, Red Rich, Ogallala, Ozark Beauty, Luscious Red	H	H	H	H

* Varieties suggested for any zone are indicated by the following code:

H = Home orchard or garden.

T = Suggested for trial.

P = Winter protection desirable.

† Plant in protected sites.

†† In white pine blister rust areas, you must obtain a permit from the Forest Pest Control Office, Centennial Building, St. Paul, Minnesota 55101 before planting currants and gooseberries.

§ Winter protection recommended for all varieties of strawberries and raspberries.

See Extension Bulletin 224, *Fruit Varieties for Minnesota*, for complete list and descriptions.

See Horticulture Fact Sheet No. 3 for a more complete list of variety recommendations.

reduces shipping costs and assures delivery of the stock in the best possible condition. Generally, order from a northern nursery rather than one too far south or east; a northern nursery is apt to have adapted varieties grafted upon hardy rootstocks. This is vital—a tree can be no hardier than its root system.

The size of nursery stock is less important than the condition. Plants should be vigorous and healthy with well developed root systems. A 2- or 3-year old tree that is well branched usually bears fruit earlier than a 1-year old whip. In northern and western Minnesota, where a low-headed, bush-type tree may be desired, a small tree that can be cut back severely when planted gives the best results.

Early spring is a good time to plant most fruits. When the nursery stock arrives, wrap and carefully examine it. If roots are dry, plunge them in water for several hours. Plant immediately if the weather is satisfactory. If not, heel the plants into moist soil on the north side of a building or other cool shady spot.

You can hold nursery stock, carefully heeled in, for a week or longer

if necessary before planting. Be careful to keep roots moist and covered at all times.

Why Trees Fail To Bear

This is a common and often perplexing problem. Of course, a tree must attain some size and age before it flowers and fruits. The time required varies with the kind of fruit, the variety used, and the growing conditions.

Generally, pears take longer than apples, apples longer than crabapples, and crabapples longer than plums—although some plums may be much slower than crabapples. The time interval between planting and fruiting may range from 10 years for some pear and apple trees to 1 or 2 years for some crabapples and plums.

If you induce a tree to make rapid vegetative growth by applying excessive nitrogen fertilizers or manure, overwatering, or pruning heavily, it will be delayed in flowering. Trees growing in the shade may also be greatly delayed.

One common reason for failure to bear is lack of proper pollination and fertilization of flowers that are produced. Many fruit trees are self-sterile; others produce defective pollen. If bee activity is low at the time of bloom because of cool or wet weather, or because of a lack of bees, pollination may be insufficient.

Plant more than one variety of apples, pears, and apricots in order to guard against a lack of good pollen. Hybrid plums produce defective pollen so always include a pollinizer variety in the planting. (See discussion on pollination under stone fruits.)

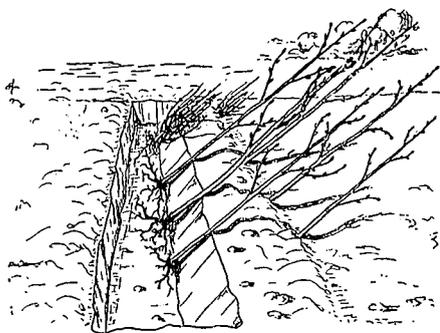


Figure 1. Heel in nursery stock if it cannot be planted immediately.

Culture Of Tree Fruits

Apples and Pears

PLANTING. If the area is sufficiently level to prevent erosion, thoroughly prepare the soil for your apple and pear orchard during the season before planting. On a steep slope, start the trees in an established sod. In this case, during the previous summer, spade and work the soil in a 3-foot circle where each tree is to be planted.

Plant trees in the early spring as soon as the soil can be worked. Make the hole large enough to accommodate the root system without bending the roots, and deep enough so the newly planted tree is about 1 inch deeper than it was in the nursery.

When making the hole, place the topsoil in a separate pile from the subsoil. Prune any broken or long straggly roots. Then place the tree in position with the first strong wide-angled branch toward the southwest. Work the topsoil around the roots and tramp to compact the soil and remove air pockets. Add a bucket of water if soil is dry. Finish filling the hole, using the subsoil on top.

Leave the surface 2 or 3 inches loose with a shallow depression around the tree to catch and hold water. Prune the young tree carefully, selecting strong wide-angled branches to form the framework (figure 2). These "scaffold" branches should be at least 6 inches apart up and down the trunk.

When planting apples and pears, allow ample room for the trees to develop without crowding. In southern Minnesota a minimum spacing of 30

feet is needed between trees; in northern Minnesota, where growth is slower, a minimum spacing of 25 feet might be sufficient. Close planting results in upright trees that are difficult to spray and harvest.

SOIL MANAGEMENT. On level or nearly level ground, clean cultivation is advised for the first 4 or 5 years. To use the ground to best advantage, grow garden crops between the trees during this period; this practice does not injure trees. Generally, as trees approach bearing age, you should establish a grass sod. Bluegrass makes a good ground cover for the mature orchard.

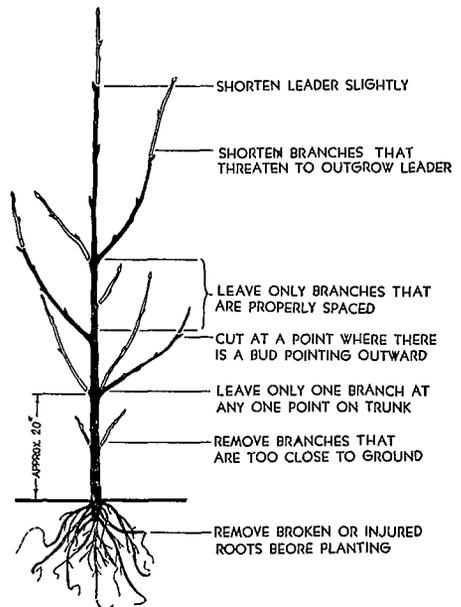


Figure 2. Prune young fruit trees when you plant them.

In drier parts of the state it may be advisable to continue cultivation in the mature orchard if the new growth at branch tips is less than 8 inches. In moister sections, however, it may be advisable to establish the sod earlier if the terminal growth is extensive. Rapid succulent growth is more subject to winter injury and fire blight.

On steep slopes you can successfully plant apples and pears in sod. But keep an area around the base of the tree worked and add fertilizers as needed.

Mow the orchard grass two or three times each season; allow clippings to remain on the ground. Also use an additional mulch of straw or strawy manure under trees. Start about a foot from the trunk and spread the mulch materials out beyond the branch tips.

The mulch should be about 6 inches deep or deep enough to smother weeds. You should replenish this mulch each fall. If the grass is tall when cut, you can rake it up and use it for mulching under trees. This mulch aids in moisture penetration and weed control. And as it decomposes, the mulch adds to the soil's mineral content. Since the mulch may increase the fire hazard in dry periods, take special care to prevent fires.

Use commercial fertilizers as needed. If the growth is satisfactory and leaves appear vigorous and dark green, it is not advantageous to use fertilizers. But if growth is slow and leaves are small and light green, fertilizers are beneficial.

A high nitrogen fertilizer generally is best. Some successful orchardists use only ammonium sulfate or ammonium nitrate. Probably a complete fertilizer such as a 10-10-10 is better.

Some orchardists apply fertilizer in a broad ring starting about 2 feet out from the trunk and extending beyond

the branch tips. Others use a fertilizer spreader and cover the ground uniformly between trees. In the latter case, a heavy grass growth is encouraged over the entire area; sufficient mulching material can then be grown in the orchard.

The application rate varies with the size of the trees and the application method. Apply ammonium sulfate or ammonium nitrate at the rate of about one-half pound for each inch in diameter of the trunk. A young tree, 2 or 3 years old, requires about one-half pound while a mature tree might take 4 to 6 pounds. If you use a complete fertilizer, such as 10-10-10, double the rate.

If you fertilize the entire area between the trees, apply about 300 pounds of ammonium sulfate or ammonium nitrate per acre or about 600 pounds of a complete 10-10-10 fertilizer.

The best time to apply fertilizers is either in late fall or early spring before growth starts. Late spring or summer applications may encourage late growth with resulting winter injury.

PREVENTING WINTER INJURY.

By planting hardy varieties, you will reduce losses from winter injury. If less hardy varieties, such as Jonathan and Delicious, are grown in southeastern Minnesota, they should be top-worked on a hardy tree such as Hibernal. Proper cultural practices that encourage vigorous growth early in the season, and the use of fall cover crops to help ripen the wood in the fall, also reduce winter injury.

Sunscald, another type of injury, normally occurs in late winter on the southwest side of the main trunk and larger branches. The bark, being brown or gray in color, absorbs the sun's rays in midafternoon and often

warms up to 20° F. above the surrounding air temperature.

So bright sunny days in late winter may activate the cambium and bark tissues on southwest stem exposures. This reduces their cold resistance and may result in injury due to cold night temperatures. The bark then dries and splits; wood-rotting fungi enter and may seriously weaken or even kill the tree.

To protect the tree from sunscald, shade the southwest sides of the main trunk and larger branches. Simply tie narrow boards to the branches and main trunk or wrap the stem with strips of burlap or aluminum foil. Or, hang evergreen branches on the southwest side of the main branches and trunk. Painting the trunk with whitewash may lower the temperature by reflecting the light and so reduce sunscald.

A tree which is headed low and has a heavy growth of branches on the southwest side has some natural protection against the sun's energy. Such a tree is usually less damaged by sunscald.

MICE AND RABBITS. Many young trees are lost each year because of girdling by rabbits and mice. To prevent this, enclose the trunk's base with a cylinder of $\frac{1}{4}$ -inch mesh hardware cloth. Make this cylinder at least 6 or 8 inches in diameter and extend it from about an inch below the soil level to the first branch. A less permanent protection method is to wrap the trunk's base with heavy aluminum foil locker paper.

These safeguards should successfully prevent mouse damage and reduce rabbit damage. But when the snow is deep, rabbits eat the branch tips. So try to reduce the rabbit population—trap and shoot where permitted. Leaving pruned branches ly-



Figure 3. Protect the fruit tree with a cylinder of hardware cloth to prevent rabbit and mouse injury.

ing on the ground also reduces damage to living trees; rabbits chew the bark from these branches and leave trees alone.

Many chemical sprays and paints are recommended as rodent repellants. Among these, Castle Chemical Company's "Peter Rabbit Repellant" and Ringwood Chemical Corporation's "Ringwood Repellant" usually are effective. You can make a similar preparation by dissolving 1½ pounds of crushed rosin in 1 quart of ethyl (grain) alcohol. A paint brush may be used to apply these preparations to the trunk and lower branches.

Some orchardists, by putting cinders around the base of the trunk to a depth of about 6 inches, greatly reduce losses from mouse injury. Remove all leaves and trash from around the base or stem in the fall for added effectiveness from any mouse control. Baiting mice with poison grain also

effectively reduces the mouse population.

LIVESTOCK INJURY. Too often the farm orchard is used as a pasture for livestock. There is no surer way of ruining your orchard. Besides damaging the trees by browsing and rubbing, livestock pack the soil and eat the vegetation needed to mulch the soil. Even chickens can do a great deal of damage by scratching up the grass and exposing the soil to the sun.

PRUNING. Your pruning job helps to shape the young apple or pear tree and to give it a strong framework. Pruning at planting time consists simply of removing all side branches, except those selected for the permanent framework, and heading back the selected branches. You also have to prune during the 2nd and 3rd years

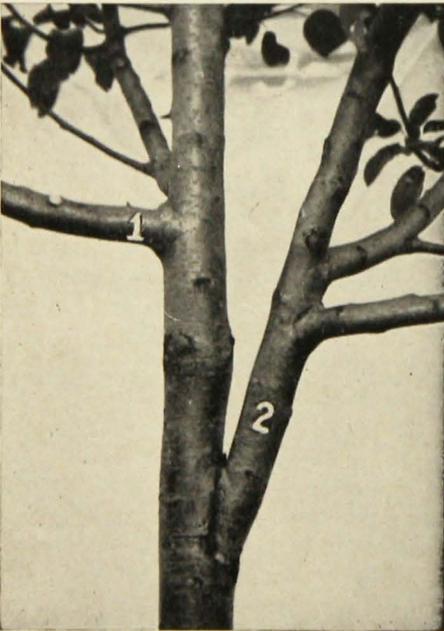


Figure 4. When pruning young trees, leave strong wide crotches (No. 1) and eliminate narrow angled crotches (No. 2).

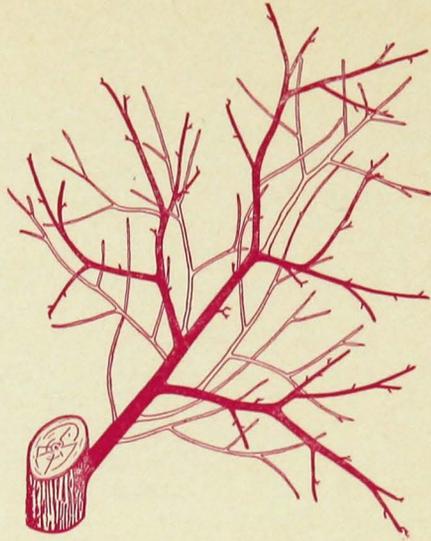


Figure 5. When pruning a bearing fruit tree, remove branches that are too close to the trunk, weak shoots crowding bearing branches, and branches in crotches of other branches (white branches in figure).

to remove narrow crotches and select additional scaffold branches.

The ideal tree has a central leader and six to eight well spaced scaffold branches. These scaffold branches should come from the main trunk at a wide angle and be uniformly spaced around the trunk. If any side branches grow upward and overtake the leader, head them back.

Make all cuts as close to the main stem as possible to insure rapid healing; use a sharp knife or pruning shears. When it becomes necessary to cut a branch back from the tip, always make a smooth cut just beyond a side branch or lateral bud. Remember, pruning is a dwarfing process. Continued heavy pruning of a young tree lengthens the time before the tree bears.

As the tree approaches maturity, a light pruning each year proves bene-

ficial. Remove any dead or diseased branches such as those showing fire blight cankers. Make the cuts as close to the main stem as possible. If the branch is large, first undercut to prevent tearing the bark when the branch falls. Paint large scars, 2 or more inches in diameter, with orange shellac, grafting wax, or some special tree paint. Remove all water sprouts (fast growing, upright branches) and branches that cross and rub.

Remove small branches near the center of the tree that have ceased to grow more than a few inches in length each year; they produce only small, poorly colored fruits. Little pruning should be necessary at the top and sides of the tree.

It is better to prune a little each year than to prune heavily at infrequent intervals. Severe pruning upsets a tree's balance. It also often results in production of an abnormal number of water sprouts which may increase the danger of fire blight.

Early spring, before growth starts, is the best time to prune your fruit trees. Complete heavy pruning by mid-April. You can remove water sprouts and weak branches during summer months.

THINNING. Many varieties tend to be "alternate bearing"—they may set a heavy crop 1 year and lay off production the next.

Formation of fruit buds for the following year's crop begins a few weeks after flowering. A heavy crop of developing fruits at this time frequently prevents such bud formation. So early removal or thinning of the fruits during the "on" year may reduce the tendency to alternate bearing. Thinning also results in larger and better colored fruits.

Chemical thinning of apples by spraying shortly after bloom with

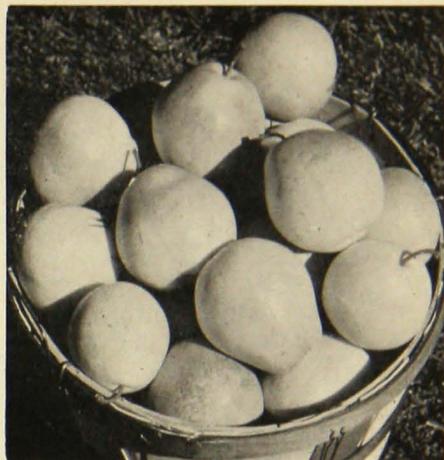


Figure 6. The Parker pear is a popular variety in Minnesota.

naphthalene acetic acid or naphthalene acetamide has more effectively prevented alternate bearing than has hand thinning.

Hand thinning is done after the June drop or about July 1. Where fruits are clustered, remove all but one fruit in each cluster. Space the fruits from 5 to 8 inches apart, removing the small insect- and disease-injured fruits first. Fruits can be spaced closer together on the outside and top of the tree than in the center, because such branches receive full sunlight. Thinning actually takes little time—the improved yields and quality more than repay the expense.

HARVESTING AND STORING. Apples and pears are very perishable, so handle them with extreme care. If you plan to use summer apples for pies and sauce, you can harvest them before they reach full maturity. Generally, these are picked when they are needed.

Harvest fall and winter apples and pears when they reach the proper stage of maturity—when they sepa-

rate readily from the fruit spurs and before they drop. You may want to pick the tree several times in order to get all fruit at the right stage of maturity.

Grasp the fruit and lift up to “unhinge” the stem from the spur. Handle fruits carefully to avoid bruises and stem punctures.

To prevent shriveling, store apples at a constant low temperature and in a room with a high moisture content. Storing fruit in crocks, barrels, or plastic-film lined containers helps reduce shriveling. The best storage temperature is near 32° F. At higher temperatures the fruit does keep—but for a shorter time.

Pick pears a little on the green side and allow them to ripen in a cool basement. Such pears are juicier and have fewer gritty stone cells than do tree-ripened fruits. Pears do not keep for long periods, so eat or can them when they are ready.

INSECTS AND DISEASES. Apples and pears suffer from about the same insect and disease pests. Growing clean fruit requires a careful program of sanitation and spraying. Since many insects and diseases overwinter on dead twigs and fallen leaves and

fruits, a thorough fall cleanup greatly reduces infection the next year. Follow the spray schedule given in Extension Pamphlet 184, *Home Fruit Spray Guide*.

The following are the important insects and diseases:

Codling moth is the familiar apple worm. You can recognize it by the brown excrement forced out of the tunnels. Affected fruits generally break down in storage and should be used at once. A thorough spray program controls this pest.

Apple maggot, also known as the “railroad worm,” is a troublesome and destructive pest of apples. The maggots tunnel through the flesh and finally destroy the fruit entirely.

In the early stages of injury, it is necessary to cut the apple open to see the tunnels. But in later stages you can see brown tunnels through the skin. The maggots continue their destruction after the apples are harvested and stored. What appears to be a normal fruit when picked may break down completely in a few weeks.

The maggot flies lay their eggs mainly during July and August so keep fruits covered with spray during this period. Destruction of infested

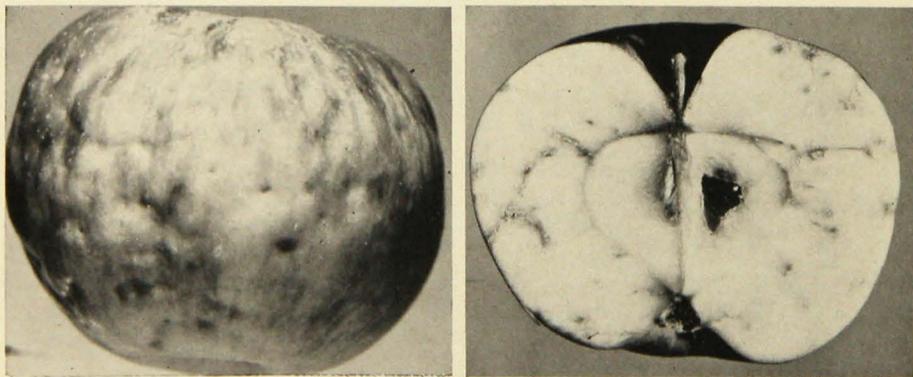


Figure 7. Fruits showing apple maggot injury.

fruits helps control the apple maggot. See Extension Pamphlet 184, *Home Fruit Spray Guide*, and Entomology Fact Sheet 20, *The Apple Maggot*.

Plum and apple curculios cause considerable damage to apple fruits. The apple curculio—a dark-brown snout beetle—feeds and lays eggs on young fruits. The resulting pits are shallow, funnel-shaped depressions, quite unlike the damage caused by the plum curculio. Most infested fruits drop during June. Destroy these fallen apples.

The plum curculio, a snout beetle, is about one-fifth of an inch in length. Adult beetles feed on expanding leaves and flowers but turn to the young fruits when they form. Soon after the petals fall (when the shucks shed on stone fruits) you can see round feeding punctures on the newly formed fruit.

Egg laying starts when fruits are about one-fourth inch in diameter and is almost completed by the time they are one-half inch in diameter. You can distinguish egg-laying injury from feeding injury by the crescent-shaped cuts made by the females around the area where they lay eggs. Affected fruits either drop prematurely or remain on the tree and become distorted and covered with scars.

Although a thorough sanitation program aids in the control of plum and apple curculios, spraying with diel-drin insecticide about a week after petal-fall is usually effective.

Scale insects, small sucking insects, develop under a hard protective scale that clings tightly to the twig. When these insects are numerous, they may completely coat the surface of twigs on old, neglected apple trees. By sucking the juice from twigs and branches,



Figure 8. Curculio on apple.

they weaken growth; the affected branches usually die.

To control scale insects, apply wettable DDT with the first cover spray. Dormant lime-sulfur sprays or a dormant D.N. (dinitro) or oil spray are other recommended controls. See Extension Folder 207, *Recognition and Control of Scale Insects on Trees and Shrubs*.

Cankerworms often feed on unsprayed trees—eating leaves, blossoms, and young fruits. Tent caterpillars and webworms cause similar injury during the summer months. DDT, methoxychlor, or carbaryl (Sevin) offers satisfactory controls. See Entomology Fact Sheet 21, *Cankerworms*.

Apple scab is a serious disease of apples in Minnesota, particularly during a wet season. Scab is caused by a fungus which produces dark-green or gray velvety spots on leaves and fruits. These spots are usually first seen soon after petals fall. At picking time scabby apples are deformed and cracked. A thorough spray program is necessary for control.

Fire blight, a bacterial disease, appears during the spring and early summer months. Affected flower clusters and blighted twigs turn black. Affected leaves wilt, turn brown, and remain attached to the twigs all summer. The bacteria overwinter in cankers which develop on infected branches.

Fire blight is most serious on vigorous succulent growth. So for control, adopt a cultural system that reduces such growth. Sod culture reduces fire blight since trees are less succulent and harden off better for winter. Prune out all diseased branches and cankers. Disinfect cut surfaces and pruning tools between cuts.

Dwarf Apples

Dwarf apple trees are standard apple varieties grafted onto dwarfing roots or grafted so that a dwarfing stem section is inserted into the normal tree stem. In either case, trees of small stature can be maintained which produce fine quality fruit.

The most popular dwarf trees for the small home garden are those grafted onto East Malling IX rootstocks. Mature trees on E.M. IX are usually no more than 6 to 7 feet high and 6 to 8 feet wide. They start fruiting 1 or 2 years after planting; fruits are usually of fine color and quality. Because of their small size you can do a thorough spraying job to control insects and diseases with small inexpensive knapsack sprayers.

Unfortunately, the roots of E.M. IX are rather weak and brittle. To avoid having trees on these roots break off near ground level, tie them securely—but not tightly—to a stout stake driven into the soil close to the trunk.

Trees grafted on East Malling VII rootstocks are also popular. They reach a mature size of about 15 feet in height. Trees on Clark dwarf interstems have been widely planted and are usually somewhat smaller than trees on E.M. VII. Trees on Clark interstems have been weak and subject to breakage near the interstem in some cases; these may not prove satisfactory in Minnesota.

Limited trials with trees of E.M. IX and VII showed the trees to be reasonably hardy, at least in southern Minnesota. However, in the extremely dry snowless winter of 1958-59, these two rootstocks were killed or severely injured where they were growing under clean cultivation. Trees which were in sod mulch or had other organic mulches over the roots survived without injury.

These dwarf trees, because of their real advantages in the home garden, seem worthy of trial. But always mulch them, at least for the winter. When spacing trees, take into account the size of tree which may be expected from the rootstock involved. In general, follow the same cultural practices as described for standard apples and pears.

Stone Fruits

Several types of stone fruits are adapted to Minnesota conditions—plums, cherry plums, bush cherries, sour cherries, and certain hybrid apricots. Although peaches have frequently fruited, they have not proved hardy; the trees are often killed either to the ground line or entirely.

Apricots which have resulted from crosses with the hardy Manchurian apricot appear hardy and fruit quite regularly. Two varieties, Moongold and Sungold, recently named by the

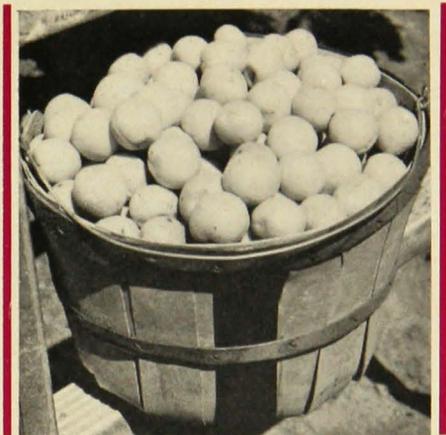


Figure 9. Moongold apricot should be planted along with Sungold for cross pollination in order to obtain good fruit set.

University of Minnesota, are recommended. The apricot and also some plums and cherries bloom so early that late spring frosts are a hazard.

The plums are of three general groups: the so-called hybrid plums, selected wild plums, and European-type plums. The hybrid plums are generally hardy, having been derived by crossing native plums with high quality tender varieties.

European plums, of the species *Prunus domestica*, were formerly considered too tender for Minnesota winters. Recent tests revealed that a few varieties such as the Mount Royal, Stanley, and Dietz, may be hardy in southern Minnesota and also in favored sites farther north.

Cherry plums owe their hardiness to the native sand cherry which was crossed with several plum varieties to produce the cherry plum group. Generally, these cherry plums develop into large bushes with fruits intermediate in size between the sand cherry and plum.

The bush cherries are of two types: Nanking cherries and Korean bush

cherries. The Nanking cherry can be grown in the form of a very small tree or, more commonly, as a shrub about 6 to 8 feet tall. Leaves are hairy and fruits rather small but densely clustered along stems. The fruits are good to eat fresh or as jelly. They also make good sauce and pies.

The Korean cherry is a bush 4 to 6 feet tall. It produces larger fruits which resemble sour cherries and can be used for cherry pies and sauce. It is fairly hardy and can be grown in most parts of the state.

Two varieties of pie cherries—North Star and Meteor—from the University Fruit Breeding Farm are hardy in southern Minnesota. They have also been satisfactory in favored areas in central and more northerly sections. These two varieties produce fruits of good sour cherry size and quality. They produce attractive small trees and deserve extensive use.

Sweet cherries are not hardy in Minnesota.

PLANTING AND SOIL MANAGEMENT. The method of planting stone fruits is the same as described for apples and pears. Plant stone fruits in a block separate from apples and pears, preferably on nearly level ground, because you should keep them under cultivation.

Stone fruits grown in sod are more subject to leaf diseases and early defoliation than those grown under clean cultivation. For this reason cultivation is generally practiced in the plum and cherry orchard. If you place stone fruits next to the small fruits, they can be cultivated along with raspberries and strawberries.

If it is necessary to plant stone fruits on a steep slope where cultivation is not practical, heavily mulch the soil underneath the spread of the branches with straw, strawy manure,

or marsh hay. Sod may cover the remaining space. Use fertilizers as needed, following the same recommendations as for apples.

PRUNING. Prune plums in a manner similar to that recommended for apples and pears. Since the trees are smaller, the scaffold branches selected may be closer together. Eliminate all narrow crotches and remove all dead and diseased branches.

Cherry plums normally grow in the form of a large bush with numerous stems from the ground. The young stems that are 2 to 4 years old are most productive. To have a new supply of these young stems each spring, you must cut out the old unproductive stems. Cut these back as near to the ground as possible.

Bush cherries need pruning to cut out any dead, old, or diseased wood. If the Nanking cherry is to be grown as a tree, you must train it for the first few years. If you desire a bush form, merely cut the tree back severely when you plant it.

POLLINATION. Stone fruit plantings require several varieties to insure cross-pollination since most hybrids are self-sterile. Certain varieties are better pollinizers than others, so include these in the planting. For the hybrid plums, Toka and South Dakota are recommended. For the cherry plums, plant Compass. The European plums are self-fertile and do not require a pollinizer.

For Nanking and Korean cherries, plant several selections to insure cross-pollination. North Star and Meteor cherries are self-fertile. Moongold and Sungold apricots are self-sterile and should be planted as a pair.

PREVENTING WINTER INJURY. The stone fruits are less subject to

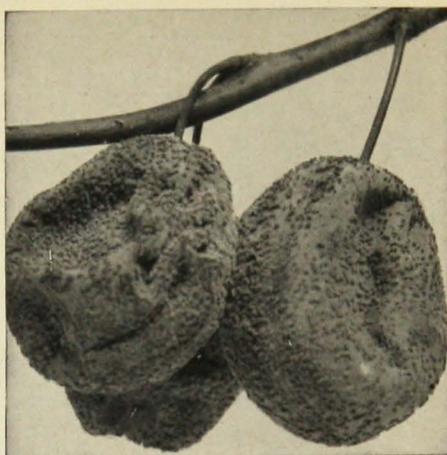


Figure 10. Brown rot on plums.

sunscauld than are apples and generally are not protected. To reduce winter damage, plant only varieties recommended for your area. Also, adopt cultural practices that harden the trees off in the fall. In some soils and in a wet fall, a cover crop of oats planted early in September has the desired effect of hardening the trees for winter and furnishing needed organic matter.

MICE AND RABBITS. These pests often cause heavy losses to plum and cherry trees. Protect them in the same manner as described for apples.

INSECTS AND DISEASES. Stone fruits are affected by several serious insect and disease troubles. The following are the most important:

Plum curculio (see description on page 13).

Plum gouger is a smooth snout beetle, slightly larger than the plum curculio. Eggs are laid in tiny punctures in the skin of young fruit. When the grubs hatch they bore directly to the pit where development and pupation take place.

The adults cause the principal damage when they bore their way to the outside. Their exit is marked by round holes, about one-eighth inch in diameter; these first appear when the fruit ripens. Dieldrin applied at petal-fall controls this pest.

Leaf spot diseases are quite common on stone fruits. These result in a spotting of leaves and premature defoliation. Cultivation, by burying some of the infected leaves and increasing the vigor of the trees, may reduce the severity of these diseases.

Brown rot is common on cherries, plums, and apricots. It attacks flowers, foliage, twigs, and leaves. The disease may become evident at blossoming time; infected blossoms give the appearance of having been frosted. Warm damp weather favors this phase of the disease; dry weather checks it. If weather favors spread of the disease, blossom blight may be followed by a similar blighting of

twigs and leaves—resembling fire blight on apples and pears.

This disease is best known on the fruits. A brown spot forms where the organism enters the fruit. These spots enlarge until the whole fruit is discolored. Such fruits are soft and watery and later become covered with brown tufts of fungus growth.

Fruits are most susceptible when they start to ripen. Fruits affected by plum curculio or gouger are most apt to be infected. The disease may spread after the fruits are harvested. Losses in transit and storage may be heavy.

The disease organism overwinters on mummies (diseased fruits which dry and either fall to the ground or cling to the tree) and in cankers formed on diseased twigs and branches, so destruction of these mummies and removal of infected branches help control this disease. A regular spray program with a fungicide such as captan is usually effective. Refer to Extension Pamphlet 184, *Home Fruit Spray Guide*.

Culture Of Small Fruits

Strawberries

To grow really fine strawberries, you must carefully attend to every detail of their culture. Perhaps the most common mistake is failure to properly space the runner plants that develop during the growing season. As a result a strawberry "patch" develops with closely crowded plants; these compete for moisture and minerals and produce small misshapen berries.

PREPARING THE SOIL. You can grow strawberries on almost any soil

type if you properly prepare it. A rich sandy loam is best, but even a clay or sandy soil produces good strawberries if sufficient organic matter is worked into it before planting.

Although strawberries require an abundance of moisture at fruiting time, never plant them in poorly drained soil. If at all possible, locate the planting where it can be watered any time moisture is deficient.

The strawberry bed is generally at one edge of the vegetable garden or may be planted between young fruit

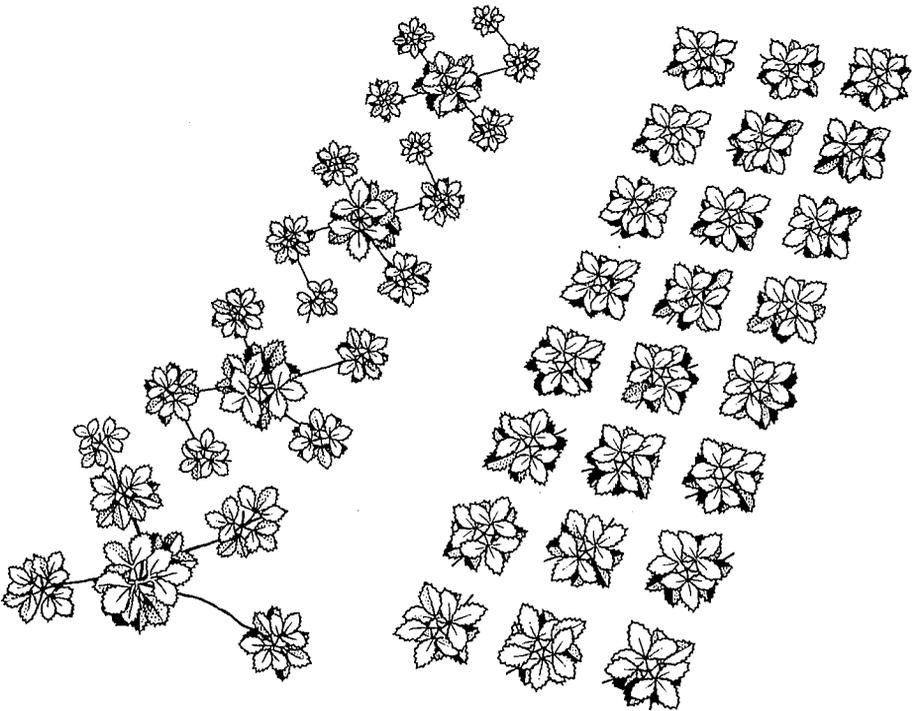


Figure 11. Left: Matted row system is recommended for June-bearing strawberry varieties. Right: Triple-row hill system is recommended for everbearing varieties.

trees. It is always advisable to plant strawberries in soil which was maintained under clean cultivation for at least one summer previous to planting time. This procedure avoids severe infestations of white grubs and also reduces the common and serious problem of controlling perennial weeds.

Plow or spade under a liberal application of well rotted manure, about 80 tons to the acre, and work the ground thoroughly before planting. On a small area this would be about 4 bushels of manure for 50 square feet. This manure not only improves the physical texture of the soil, but also increases its water-holding capacity and improves fertility.

PLANTING. Plant strawberries early in the spring, as soon as the soil is dry enough to cultivate effectively. Obtain plants from a local nursery if possible; plants that are shipped in from a long distance seldom arrive in the best condition for planting.

Plants of most of the important strawberry varieties, certified as being substantially free of virus diseases, are now available. All reliable nurseries sell such plants or plants grown from such stocks if these lines are at all available in the trade.

Virus diseases can be an important factor in rendering strawberry plants unthrifty and unproductive. So it is always advisable to obtain plants that are certified free or essentially free of virus diseases. However, young vigorous plants taken from a planting that appears strong and healthy are usually satisfactory. This is particularly true of certain varieties like Robinson and Dunlap which appear to tolerate virus diseases with little harmful effect.

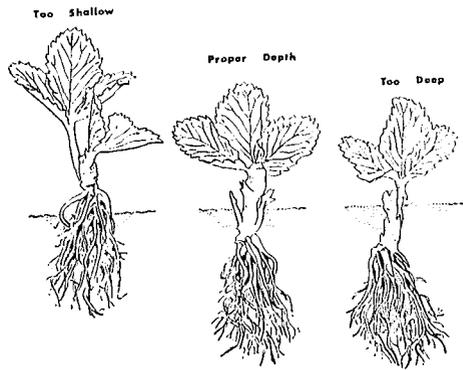


Figure 12. It is important to plant strawberries at the proper depth.

The proper spacing depends on whether you grow your plants under the hill or matted row system. Most June-bearing varieties are grown in the matted row, while everbearing varieties are often grown in hills with the runners removed as they form. The rows should be at least 4 feet apart to allow for cultivation.

In the matted row, set the plants from 18 to 24 inches apart. In the hill system, space them from 12 to 15 inches apart. When the hill system is used, two or three rows are often spaced about 12 inches apart with a picking aisle at least 2 feet wide between these multiple rows.

Before planting, keep roots covered with moist burlap or another covering at all times—never allow them to dry out. If the roots are too long and straggly, you may trim them with a sharp knife or shears. The plants may also benefit from the removal of some outer leaves.

Be careful when deciding on the depth to set the plants. If set too deep the crown rots or fails to send out runner plants. If planted too shallow the exposed crown dries out. Always plant so the exposed crown is just level with the soil line.

Open a slit in the ground with a spade and spread the roots out in this opening. Remove the spade and compress the soil firmly about the roots. A little practice will enable you to do a good job with the plants set at the proper depth.

If possible, plant in the evening or on a cloudy day. If the soil is dry, scrape away the surface layer before making the opening. This procedure prevents dry powdery soil from falling in around the roots.

SUMMER CARE. Keep strawberries cultivated during the first summer and free from weeds at all times. Promptly pull or hoe out any weeds that come up in the row or kill them with 2,4-D if they are broadleaved weeds; 2,4-D does not kill the grasses. Strawberries are remarkably resistant to 2,4-D injury. Apply it when the weeds are small; do not use it when strawberries are making runners, in bloom, or fruiting.

Remove any flowers that form on newly planted June-bearing strawberry plants during the 1st year. Allowing these flowers to develop results in few edible fruits. If fruits develop, the growth and runner production of the plant are reduced greatly.

Remove all flowers on everbearing strawberry plants up to July 1 of the 1st year. Flowers that develop after that date produce a fine fall crop.

If you grow strawberries using the matted row system, keep rows about 18 inches wide. Within this 18-inch row, space runner plants as they form so that daughter plants are about 8 inches apart. Remove late runners that form—they produce few fruits anyway and their presence seriously reduces the crop the following spring because of crowding.

Experiments showed that where plants are spaced 8 inches apart,

yields are about four times as great as where they are 4 inches apart. Failure to thin out runner plants is a common cause of small crops and deformed berries.

If plants are to be grown in the hill system, remove all runners as they form. Keep the soil worked around the plants until the fall crop starts to ripen. At this time mulch the soil underneath and between plants in order to keep berries clean and to conserve moisture. Pine needles, shavings, wood chips, or chopped straw are good materials to use for this summer mulch. You might allow plants to develop runner plants at one end of the row; these will provide stock for a new planting the following spring.

WINTER PROTECTION. Strawberry blossom buds for the spring crop are formed in the fall of the year. Exposure of these buds to temperatures as low as 20° F. seriously reduces the yield of good quality berries. For this reason mulch the plants before severe winter weather. But don't apply the mulch until the plants are subjected to a few good frosts—these help to harden them off. The time to apply the mulch varies with the season and the part of the state. Normally, early November is right in the Twin Cities area.

For mulching, use straw or marsh hay that is free from weed seed. Apply this to a 2- or 3-inch depth over the entire planting. If the area is not protected from wind, you might have to place boards or branches on the mulch to hold it down.

Leave the mulch on as late in the spring as possible to hold back bloom until after frost. Check frequently—if leaves of plants start to turn yellow, remove the mulch at once.

When removing the mulch, lift the straw from over the rows and place it

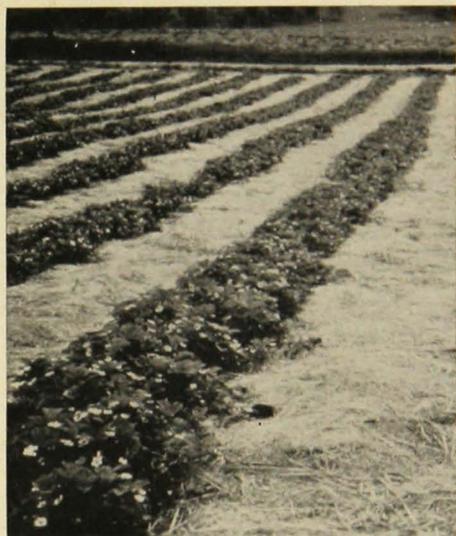


Figure 13. Work the winter mulch into the picking aisles.

in the picking aisles. Leave some of the finer mulch materials in the row. The plants then push up through a light covering and the berries are kept clean during the picking season. If a late spring frost threatens when the plants are in bloom, you can use the mulch in the picking aisles to cover the plants.

Since the mulch covers the space between the rows, no cultivation is needed during the second season until after harvest. If weeds come up through the mulch, pull them at once.

HARVESTING. To prevent soft and spoiled berries, pick them as soon as they are ripe. In the home garden, allow the berries to become an overall red color; the sugar content is higher and the flavor is better on a garden-ripened fruit. You must pick every other day during the peak of the season for maximum production.

Pick the berries carefully and handle them with care to prevent bruising. Always pick all of the ripe berries

since they will not keep until the next time. Fresh strawberries should be eaten as soon after picking as possible and the surplus preserved by canning and freezing. Ripe strawberries may be held for several days in a good refrigerator.

You may pick the fall crop of ever-bearing strawberries less frequently because the crop is lighter and the weather usually cooler. Nevertheless, it is advisable to pick twice a week if the crop warrants it.

Birds often damage many berries during the ripening period. Locating the patch away from trees where birds nest reduces this trouble. You may have to cover the rows with coarse netting or chicken wire to keep birds out.

WATERING. Strawberries demand a continuous moisture supply throughout their development. A dry period following planting seriously reduces plant production and development; a dry spell during harvest greatly reduces the crop. If at all possible, locate the planting where it can be watered as needed.

RENOVATING. Some growers prefer to abandon the patch after harvesting the first crop; others like to carry it over for a 2nd and even a 3rd year. If it seems advisable to continue the patch for more than the first crop, thoroughly renovate it after harvest.

Remove the coarse mulch material and cultivate or plow between the rows, leaving a narrow band of plants about 8 inches wide. Remove the old plants with a hoe, leaving only strong young plants. A sidedressing of a complete fertilizer applied at the rate of 1 pound for 25 feet of row generally proves beneficial.

If the weather is dry, a thorough watering at this time speeds new

growth. Continue to cultivate throughout the season; space runner plants as recommended for the first season.

You can keep the June-bearing strawberry planting productive for several years by thoroughly renovating the patch each summer. But a better crop of berries is produced if a new planting is made each spring and the old patch plowed under after its first crop.

This may also be true of everbearing varieties, but some everbearers are rather slow to become established; in such cases, the best crop may result in the 2nd year. Some growers now plant everbearing strawberries at around the end of August with good success. In this way, plants are larger by the time the first fall crop ripens and a heavier crop can be expected. Unless irrigation water is available at planting time and during the latter part of the growing season don't attempt fall planting.

INSECTS AND DISEASES. You can reduce most insect and disease troubles in strawberries by following the cultural practices recommended in this bulletin. Sprays or dusts are helpful in most cases. A thorough spray of a fungicide such as captan combined with DDT and Kelthane usually controls insects and diseases. See Plant Pathology Fact Sheet 2, *Disease Control for Strawberries*.

Strawberry leaf diseases are common in Minnesota. There are at least three of these diseases: leaf spot, leaf scorch, and leaf blight. You can distinguish leaf spot by the definite spots that are first purplish in color. As the spots become older, the centers turn a tan to whitish color with purplish borders.

Leaf scorch produces smaller, dark-purplish spots that lack white centers.

Leaf blight produces large red to brown spots bordered by purple; the spots range from one-fourth to over 1 inch in diameter. Leaf blight also affects the fruit, especially everbearing varieties. All three of these leaf diseases may appear on the same plant or leaf, thus making identification of the disease rather difficult.

Sanitation and good culture combined with captan sprays are recommended. Start new plantings each year with healthy plants. If old plantings are left, renovate them thoroughly after harvest. Destroy old leaves and straw by burning.

Botrytis fruit rot may cause heavy losses to ripening and harvested fruit. The fungicide, captan, effectively controls this disease. Apply the first spray before plants flower. Applications may be repeated at weekly intervals until a few days before harvest.

White grub (the larva of the June beetle), if present, is a serious insect pest on strawberries since it feeds on roots of plants. Do not plant strawberries on land that was in weeds or grass the previous year—the June beetle lays its eggs in such places. Also avoid planting strawberries near shade trees or thickets because the adult June beetles feed on tree leaves at night. Chlordane or dieldrin applied to the soil before planting should control the grubs. See Entomology Fact Sheet 22, *Controlling White Grubs in Lawns*.

Spider mites and cyclamen mites may also become serious pests. Cyclamen mites are particularly prevalent on everbearing varieties but may also be serious on June-bearers. These tiny mites feed on the young developing leaves and flowerbuds in the crown of the plant, causing stunting and dis-

tortion. As a result, fruits are generally small and poorly formed.

You can control both spider mites and cyclamen mites by spraying thoroughly with Kelthane during the pre-bloom period. For cyclamen mite control, you must apply the spray forcefully into the crowns of the plants.

Other frequently troublesome insects are:

The strawberry weevil which girdles stems of flowerbuds and clusters.

The tarnished plant bug which causes many berries to be small and much of the distortion—known as “nubbins”—in fruits.

The strawberry sawfly which feeds on leaves.

You can effectively control these three insects by spraying or dusting with DDT or methoxychlor. A thorough prebloom application greatly reduces damage from these insects.

For further details on insect and disease control see Extension Pamphlet 184, *Home Fruit Spray Guide*.

Raspberries

Raspberries—red, purple, and black—belong to a large group of fine fruits known as the brambles. Other fruits of this group are blackberries, dewberries, boysenberries, and loganberries but only the raspberries are recommended for Minnesota conditions. Many persons attempt to grow raspberries and other fruits of this group but few do a good job of it. In Minnesota, red raspberries are by far the most popular and successful of the brambles.

PLANTING. Grow raspberries on a well drained soil that is high in organic matter. Almost any soil type will do if the planting can be watered

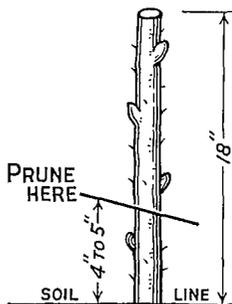


Figure 14. Prune off all but a few inches of the raspberry cane at planting time.

during dry periods. Avoid light, sandy soils unless irrigation is available.

For best results, plant on soil that was cultivated the previous season. Apply about 80 tons of well rotted manure per acre before plowing; work the soil thoroughly just before planting. Since weeds, especially quackgrass, are difficult to remove from the established planting, the area should be free from perennial weeds.

Plant in the early spring as soon as the soil can be properly worked. Purchase certified plants from a reliable nursery to be certain of obtaining high quality stock. Since virus diseases are serious in the raspberry, use only healthy, disease-free plants.

The practice of obtaining plants from an old abandoned patch or from a neighbor is very costly. It takes just as much time and work to care for an infected planting as one that is free from disease.

Plant as soon as possible after the nursery stock arrives. And *never* allow the roots to dry by exposure to the air. Pack the soil firmly about the roots after planting. Cut back the tops to within 4 inches of the ground; this encourages the production of vigorous new canes.

The correct spacing depends on the system of training that you follow. If the plants are to be grown in hills, a 6- by 4-foot spacing is about right. If the plants are to be grown in a

hedgerow, you may set the plants $2\frac{1}{2}$ feet apart in rows that are 6 to 9 feet apart.

SUMMER CARE. Raspberries should have clean cultivation throughout the life of the planting. Failure to cultivate allows canes to develop all over the patch. This results in competition for moisture, minerals, and sunlight—the result is small inferior berries. Such a condition also favors insects and diseases.

If you grow plants in hedgerows, the cultivation should limit the spread of the rows to about a foot in width. When you grow plants in hills, cultivation should be in both directions. The spread of the hills should be no more than 18 inches at ground level. Keep the cultivation shallow to avoid injury to raspberry roots.

Stop cultivation after August because late cultivation may encourage late growth. In a wet fall, a planting of oats made just before the last cultivation aids in hardening plants before winter sets in.

Since raspberry canes must be vigorous in order to produce large high

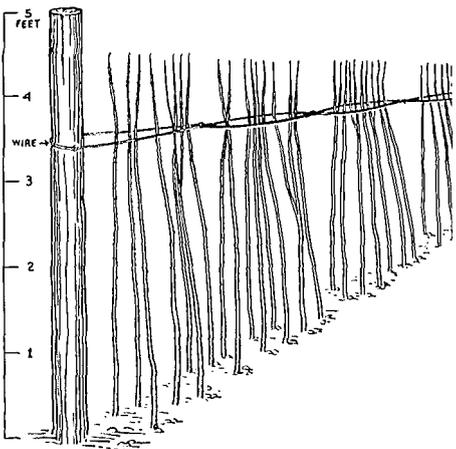


Figure 15. Wire trellis hedgerow system.

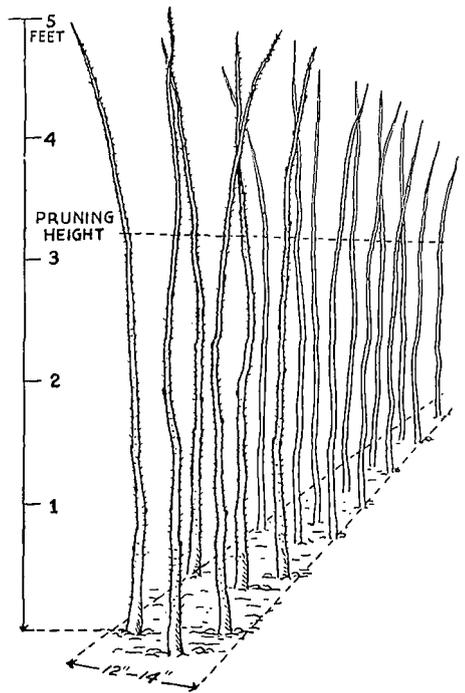


Figure 16. Unsupported-hedgerow system.

quality berries, you must try to maintain soil fertility. Apply well rotted manure evenly between rows, either late in the fall or early in the spring. If manure is not available, you may broadcast a commercial fertilizer between the rows and work it in about May 1. Use a complete fertilizer high in nitrogen at the rate of about 10 pounds per 100 feet of row or 600 pounds to the acre.

PRUNING AND TRAINING. Raspberries must be properly pruned and trained if they are to produce the desired crop. The four systems of training commonly followed in Minnesota with red or purple raspberries are:

- **Wire trellis-hedgerow system.** Set posts about a rod apart in the rows. Stretch two wires on opposite sides of

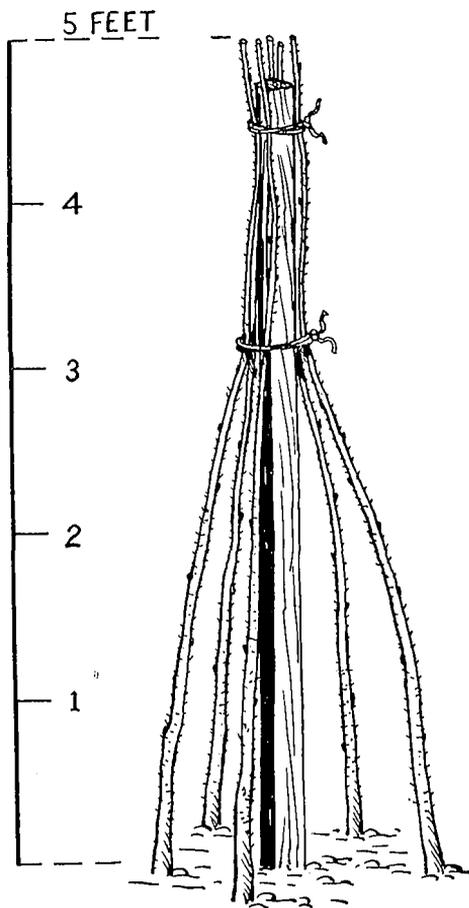


Figure 17. Staked-hill system.

the posts at a height of about $3\frac{1}{2}$ feet from the ground. Place the canes between these and tie the wires at intervals to prevent their spread. Then cut the tips of the canes to a height of about $4\frac{1}{2}$ feet. Leave 3 to 4 vigorous canes per foot of row.

• **Unsupported-hedgerow system.** Cut canes back to about 3 feet so the fruiting canes will not bend over and interfere with cultivation. Remove the old canes after fruiting and thin out the new canes. Space canes as for the trellis hedgerow.

• **Staked-hill and teepee-hill systems.** Cut out all old canes at the ground line as soon as they finish producing fruit. Then thin out the new canes leaving 5 to 8 vigorous canes per hill.

In the spring of the year, tie and cut back the canes according to the training system adopted. For the staked-hill system, tie the canes securely to a stake driven into the center of the hill. You may use binder twine or strips of cloth for tying. Then cut back the tips of the canes to about 5 feet.

For the teepee-hill system, tie the canes together at a height of about 3 feet from the ground; make a second tie about 6 inches higher. Make these ties tight so canes are held firmly in place. Cut the tops back to about 4 feet from the ground.

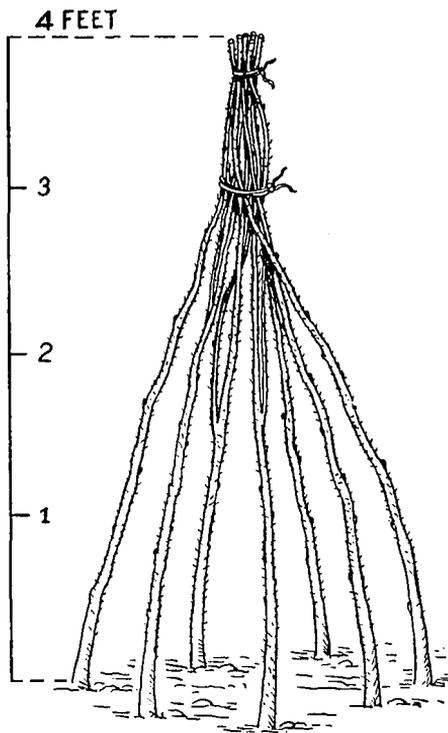


Figure 18. Teepee-hill system.

The nonsupported hill system, a fifth system, is most commonly followed with black raspberries. In the fall or early spring, cut off old canes which have fruited at ground level. When new canes which emerge in early summer are 20 to 30 inches high, top them back to 18 to 24 inches. The development of strong lateral branches near the top of the cane is thereby induced. The following spring cut back these laterals to within about 8 inches of the main cane; they then produce fruiting branches.

As with red raspberries, remember that the crop is produced on canes which developed the previous summer. Once a cane has fruited it is no longer of any value to the plant. So prune it out to permit better development of new canes.

Autumn fruiting (or everbearing) raspberries do not conform entirely to this pattern. The fall crop of this type raspberry is produced on canes which developed during the same season. Canes that fruit in the fall produce another crop the following spring. If you only desire the fall crop, you may improve it by cutting canes to the ground early in the spring in order to encourage strong growth in new canes. Vigorous healthy plants can produce heavy crops at both times.

WINTER PROTECTION. Raspberry plantings frequently suffer from winter injury. This loss seems to result from alternate warm and cold periods in late winter. Warm days in February or March cause buds to swell and lose their cold resistance. When these warm days are followed by cold nights or prolonged cold spells, buds are either killed or seriously weakened. The result is either dead cane tips or new growth that is weak and unproductive.

If winter conditions are extremely dry and without appreciable snow cover, much injury also may result from cane drying. Such winter damage may seriously reduce the crop.

The only practical means of protecting canes from winter damage is to bend the canes down in the fall and cover them with soil. If the planting is located where snow covers the area all winter, you may bend the canes over and hold them in place with a wire loop resembling a croquet wicket. Or, place a few shovelful of soil on cane tips. Do this in late October or early November before the ground freezes. In the spring uncover the canes and tie them to their supports.

INSECTS AND DISEASES. Insect pests on raspberries are few in number but diseases are quite numerous and troublesome. See Extension Pamphlet 184, *Home Fruit Spray Guide*, and Plant Pathology Fact Sheet 8, *Raspberry Diseases*.

Mosaic is the most serious disease of the raspberry. Since this virus disease is within the plant, there is no cure. Remove or "rogue" and burn the diseased plants. The disease results in reduced plant vigor and crumbly berries. The leaves are smaller than normal and crinkled, with a yellow and green mottling.

It is difficult to recognize this disease in its early stages, so start a new planting with disease-free plants purchased from a reliable nursery. If possible, don't start a new planting near an old planting that is infected with mosaic. But if you must, remove the old plants and keep the ground cultivated to destroy any sprouts that emerge from the old crowns or the roots.

Black raspberries are particularly susceptible to mosaic so plant them away from red raspberries if possible.

Crown gall is a bacterial disease that produces swellings on the roots or crowns at or near the soil line. These swellings reduce plant vigor and cut down yields. Avoid trouble by planting only disease-free stock.

Anthracnose is a fungus disease that produces lesions on young canes, leaves, and fruiting stems. By harvest-time the disease may have spread to the leaves. The spots appear as small purplish raised areas that enlarge and become sunken and grayish in the center. This disease increases the loss due to winter injury and reduces the size and quality of berries.

Start with disease-free plants and keep the planting thoroughly thinned out and weeded. This procedure results in good air circulation and makes conditions less favorable for infection. If the disease becomes serious, you can control it with a thorough spray program. Black raspberries are likely to be more seriously affected by this disease than red and purple raspberries.

Spur blight is less common than anthracnose and probably does less damage. The disease shows first on the young canes where a purplish-brown discoloration may extend completely or partially around the stems at the point of leaf attachment. The fruiting branches developed from such areas are weak and produce little fruit.

Generally, you can control spur blight by following cultural practices that provide good air circulation around plants. If serious, spur blight can be controlled by spraying.

Spider mites suck the juice from the underside of leaves and do great dam-

age. Affected leaves show rusty-brown blotches and fine silken webs. In severe infestations a thorough spray application of an effective miticide such as Kelthane is recommended.

Cane borers of two types infest raspberries. The adult of one type deposits its eggs near the cane tip, causing it to wilt. The other type attacks the base of the cane, causing a swelling. For control, remove and burn affected canes as soon as you notice them; make the cut well below the point of injury.

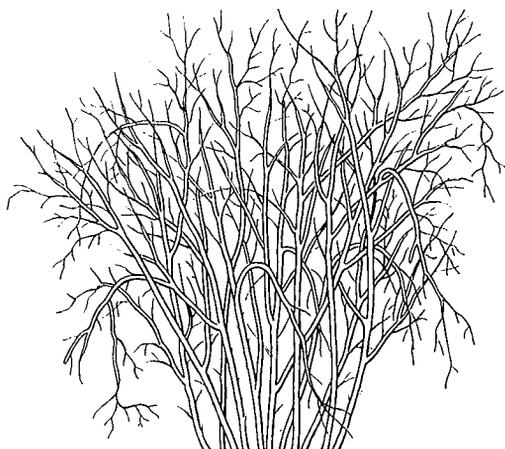
Raspberry sawfly often causes severe damage. This small, green, many-legged worm eats the soft leaf tissue, leaving only a skeleton of veins. DDT or methoxychlor applied after leafing-out but before blossoming is effective.

Currants and Gooseberries

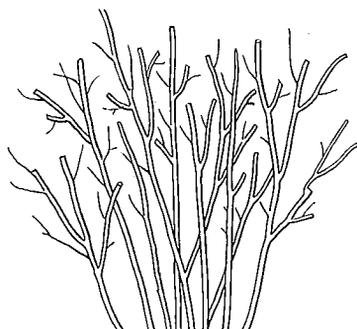
Currants and gooseberries are hardy and easy to grow in all parts of Minnesota. But in all northeastern counties, where white pine is an important timber tree, a permit is required to grow these fruits because they are alternate hosts to white pine blister rust. Permits are available from the Forest Pest Control Office, Centennial Building, St. Paul, Minnesota 55101.

PLANTING. Currants and gooseberries grow on almost any soil type but do best on heavier soils that are high in organic matter. Plant in the early spring in soil that has been thoroughly prepared. Space the plants about 5 feet apart in rows 6 to 8 feet apart. Usually, 2-year-old nursery-grown plants are used.

Set the plants about an inch deeper than they were in the nursery and firm the soil around the roots. Remove all but four or five canes; cut these



Bush before pruning



Bush after pruning

Figure 19. The "before" and "after" of pruning currants and gooseberries.

back to about one-third of their original length.

SUMMER CARE. Keep the ground thoroughly cultivated throughout the life of the planting. Avoid deep cultivation that might injure roots. If well rotted manure is available, apply about 1 bushel per plant in either late fall or early spring. Distribute the manure uniformly over the soil near the plants and work it in. If manure is not available, apply a cupful per plant of a complete 10-10-10 fertilizer in the spring.

PRUNING. Pruning currants and gooseberries is not difficult. After the 4th year, remove all 4-year-old stems; 3-year-old or younger stems produce better fruit. Removal of these old stems stimulates vigorous young shoots at the base. If too many young shoots develop, thin them out. About 12 stems from the base is about right for a mature bush. Prune early in the spring before growth starts.

INSECTS AND DISEASES. Comparatively few insects and diseases

affect currants and gooseberries; these can be readily controlled by clean cultivation, pruning, and, if necessary, spraying. See Extension Pamphlet 184, *Home Fruit Spray Guide*.

Leaf spot diseases are quite common. The spots are small and circular in outline with gray centers. If these spots become numerous, the result is premature defoliation of bushes. Strict sanitation to destroy infected leaves usually checks this disease.

Powdery mildew is common and covers the leaves with a white moldy growth that results in distortions of leaves and stem tips. You can best control this disease by following the recommended spray schedule.

White pine blister rust shows up on currants and gooseberries as rust patches on the undersurface of leaves. Spots are covered with hairlike projections that hang down. The Viking variety of red currant is quite resistant to this disease and should be grown in white pine areas.

Before planting currants or gooseberries in the blister rust control area, obtain your permit. This is a control measure.

Currant worm feeds on the leaves, and often strips all of the leaves from the plant before the damage is noticed. You can control it by spraying with arsenate of lead, DDT, or methoxychlor or dusting with rotenone or 5-percent DDT dust. Do not use arsenic or DDT after fruits begin to form.

Currant aphid sucks juice from the undersurface of leaves, causing reddish discoloration and crinkling. An application of malathion, when the leaves are one-half inch long, controls this insect.

Grapes

Grapes can be grown in almost any part of the state for home use. But success depends on the selection of

a suitable site and planting of adapted varieties.

SELECTING THE SITE. Since grapes require full sunlight and high temperatures to ripen, the exposure is important. Select a site on a southern slope or plant the grapes on the south side of a windbreak. In northern Minnesota, grapes have been grown successfully on the south side of a building. The soil should preferably be a sandy loam with a high humus content.

PLANTING. Prepare the soil thoroughly before planting. Plant in the spring as early as possible, using vigorous 2-year-old plants with well developed root systems. Set the plant a little deeper than it was in the nursery and firm the soil around the roots. Space the plants about 8 x 8 feet and run rows across the slope.

SOIL MANAGEMENT. Grapes require clean cultivation for best results.



Figure 20. Grapes should be trained on wires (see arrow).

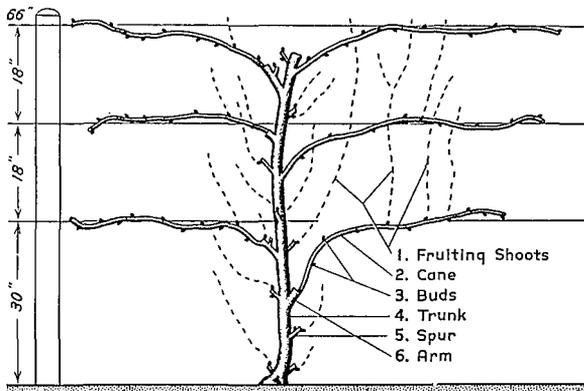


Figure 21. Training system for hardy grapevine.

Keep weeds removed from the rows by hoeing. Do not cultivate after August 1 since late cultivation encourages late growth with consequent winterkilling. You may want to plant a fall cover crop of oats in early August. This can be worked into the soil in the spring, thus adding organic matter.

Grapes usually respond favorably to fertilizer applications. Well-rotted manure, applied at the rate of 1 bushel per plant either late in the fall or early in the spring, is best. Scatter this between the rows and cultivate. If manure is not available, apply a high nitrogen complete fertilizer in a broad circle out about 2 feet from the stem. Use about one-half pound per plant; apply early in the spring.

TRAINING SYSTEMS AND PRUNING. Grapes are usually trained to a wire trellis. Drive posts at 16-foot intervals along the rows. Then stretch two or three wires about 18 to 24 inches apart along the posts.

Hardy grapes are normally trained with an upright stem and branches that go out in both directions along the wires. Since grapes are produced on 1-year-old wood, select vigorous young canes with well developed buds to produce the crop. Each dor-

mant bud should produce between one and three clusters of grapes. Prune a mature grapevine so it retains about 40 dormant buds.

If you use a two-wire trellis, cut back the four young branches that you select for the framework so that each bears about 10 buds. If you use three wires, cut back the selected branches to about seven buds. Cut back any short branches near the main trunk to one or two buds. These develop strong shoots from which the fruiting canes can be selected the next year.

When you grow tender grapes, the training system must allow the canes to be laid down and covered each fall. Select and tie a strong cane to the lower wire of the trellis. Later, tie the branches that develop from this to the upper wires for support. In the fall, cut back these upright branches to two or three buds. Lay the canes down and cover them with soil.

If it seems advisable to lengthen the central cane, merely select a strong branch near the tip and cut it back to four or five buds. After several years this old cane may become overgrown and so covered with spurs that winter protection becomes difficult. To replace the old trunk, select a vig-

orous young cane from near the stem base. When it has reached a satisfactory size, cut off the old trunk.

Prune grapes during their dormant season: tender grapes in the fall just before covering them for winter, hardy varieties in late winter. Profuse bleeding may follow spring pruning but this has not been found to be particularly harmful.

Grapevines that have been neglected for a number of years are difficult to prune to the desired form. Cut back severely, leaving only four or six fruiting canes, depending on the number of wires. If there are no fruiting canes near the plant base, you may have to cut back the old canes to within 3 to 4 feet of the ground. This forces vigorous new growth from near the base that can be selected for the next year's crop. Such pruning sacrifices 1 year's crop but is worthwhile—neglected vines produce few usable fruits.

INSECTS AND DISEASES. A few insect and disease pests may become serious on grapes. See Extension Pamphlet 184, *Home Fruit Spray Guide*.

Black rot is a fungus disease that affects both leaves and fruits. Dark-brown spots appear on the leaves and leaf stalks. The affected fruits turn from green to red or brownish-black

and shrivel. These mummied fruits may drop off or remain attached to the clusters.

Downy mildew appears as yellowish-green spots on the upper side of leaves. A downy growth appears on the under side of these spots. The berries, if infected, turn brown, shrivel, and drop off. Follow the recommended spray program.

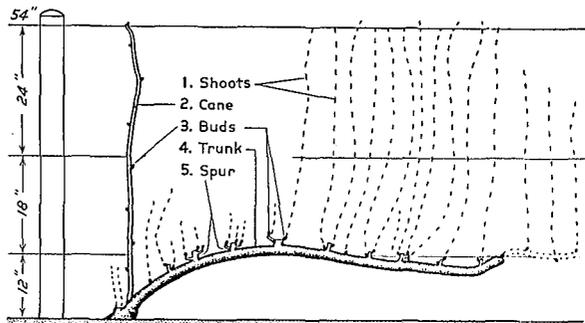
Leafhoppers may become quite numerous and do considerable damage to grapes. The hoppers are small, about one-eighth inch long, and winged. They fly about in swarms like gnats. By sucking the juice from leaves, they cause them first to appear whitish, then brown and dry. Injury to leaves reduces the size and quality of fruits. DDT or methoxychlor gives effective control.

Grapes are extremely sensitive to 2,4-D so take great care if this herbicide is used anywhere in the area. The use of relatively nonvolatile forms of 2,4-D, such as amine or sodium salt forms, is advisable.

Blueberries

In recent years, interest in growing cultivated blueberries has increased considerably. With Minnesota's severe winters blueberry growing cannot be

Figure 22. Training system for tender grapevine.



recommended unless you are willing to give plants the necessary winter protection. Even our native blueberries often kill back to the snow line.

Blueberries must be grown on acid soil. If the soil is neutral or but slightly acid, you must prepare a special soil mixture of equal parts of acid peat and garden soil. Adding sulfur or aluminum sulfate helps maintain an acid soil. Have a soil test made before planting blueberries. If the pH is above 5.5, add more acid peat or aluminum sulfate.

Never cultivate blueberries because their root systems are shallow. Use a mulch consisting of sawdust, shavings, oak leaves, or straw to keep weeds down. A sawdust mulch 6 to 8 inches deep has helped blueberries at the Fruit Breeding Farm, Excelsior. Such a mulch seems to provide satisfactory growing conditions even in soils at pH levels above 5.5.

If you use a mulch, also apply a high nitrogen fertilizer; the decomposing mulch materials remove nitrogen from the soil in their decomposition. Use about 2 ounces of a high nitrogen complete fertilizer for each young plant. Increase this to about one-half pound per plant when plants reach maturity.

Do not use fertilizers containing nitrate nitrogen, such as ammonium nitrate, since they may harm the

plants. Ammonium sulphate has been used with great success along with sawdust mulches at the Fruit Breeding Farm.

Because blueberries grow best where the water table is 14 to 22 inches from the surface, they will need irrigation during dry periods. If the water is hard, use rain water; hard water makes the soil more alkaline in its reaction.

Locate the blueberry planting where snow is apt to drift in and stay all winter. If this is not possible, you may have to enclose the plants in box-like structures filled with leaves, straw, or other mulch materials.

Several standard high-bush blueberry varieties have performed well at Excelsior. Rancocas, Earliblue, and Blueray were among the best.

Wild Fruits

Minnesota has many wild fruits other than blueberries, strawberries, and raspberries including: the high-bush cranberry, serviceberry, elderberry, and chokecherry. These fruits might well be planted in the wind-break. In addition to adding beauty and giving wind protection, they furnish good fruit for jelly and preserves. Wild fruits attract birds and help keep them out of strawberries and raspberries.

Fruit Sprays

You may find full information on home and commercial spraying in Extension Pamphlet 184, *Home Fruit Spray Guide*, and Special Report 6, *Commercial Fruit Pest Control Guide*. To obtain single copies of up to 10 different publications, write: Bulletin Room, Institute of Agriculture, University of Minnesota, St. Paul, Minnesota 55101.