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The

HOME FRUIT PLANTING

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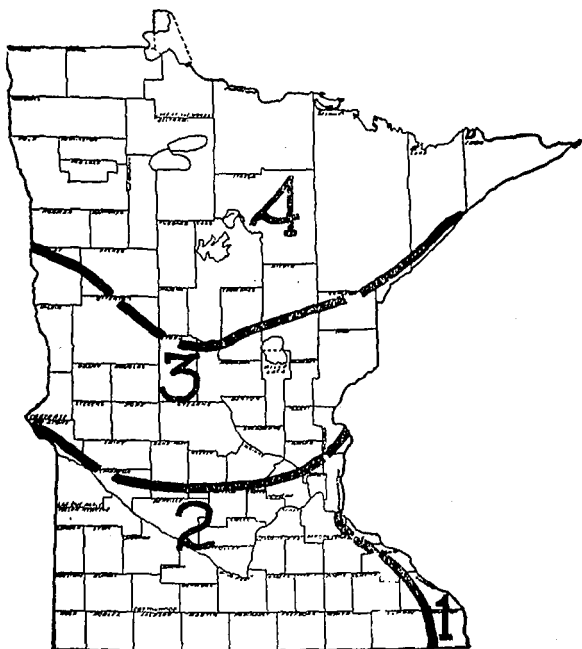


by

LEON G. SNYDER

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UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE



Minnesota Fruit Zones

Prepared by the Fruit List
Committee of the Minnesota
State Horticultural Society and
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The Home Fruit Planting

LEON C. SNYDER

Growing fruit in the garden and home orchard can become an interesting hobby as well as a profitable venture. By proper planning we can enjoy luscious vine- and tree-ripened fruits throughout the entire year. Strawberries, one of the first fruits to ripen, are soon followed by currants, raspberries, cherries, cherry plums, plums, pears, and apples.

Fruits, in addition to being good to eat, are good for us. They are classed among the protective foods around which our meals should be planned. In addition to furnishing bulk, they contain many body-building minerals and vitamins essential to health.

Success or failure in growing fruits will depend on four things: the selection of the planting site; the choice of varieties adapted to your locality; pest control; and cultural care. Since good fruit can be grown in every county in Minnesota, there is no reason why every farm family or city family with sufficient ground should not grow its own supply of fruits for fresh use as well as for freezing and canning. It is the purpose of this bulletin to present information on the cultural requirements of each of the commonly grown fruits.

Selecting the Site

Selecting the proper site for the 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 very important since protection against late spring frosts may mean the difference between a good crop and no crop. For small fruits and those tree fruits that require cultivation, such as plums and cherry plums, the site should be comparatively level. If on a slope, the rows should be planted on the contour to prevent erosion. For apples and pears, a north or east slope is best in southern Minnesota, while in the northern part of the state a south slope may aid in hardening the trees for winter and in

coloring the fruits. Grapes demand a south exposure to aid ripening fruit.

Nearness to the house should also be considered. Small fruits such as strawberries and raspberries may be planted at one end of the vegetable garden.

If a natural windbreak is not present, one should be provided on the north and west sides of the orchard. This can best be accomplished by locating the orchard site within the farm shelterbelt. It is also important to avoid planting fruit trees too close to windbreak trees because of root competition and shading. A safe distance is 50 feet from the inner row of shelterbelt trees to the fruit trees. Small fruits will need a windbreak to the south in those sections of the state subject to hot summer winds.

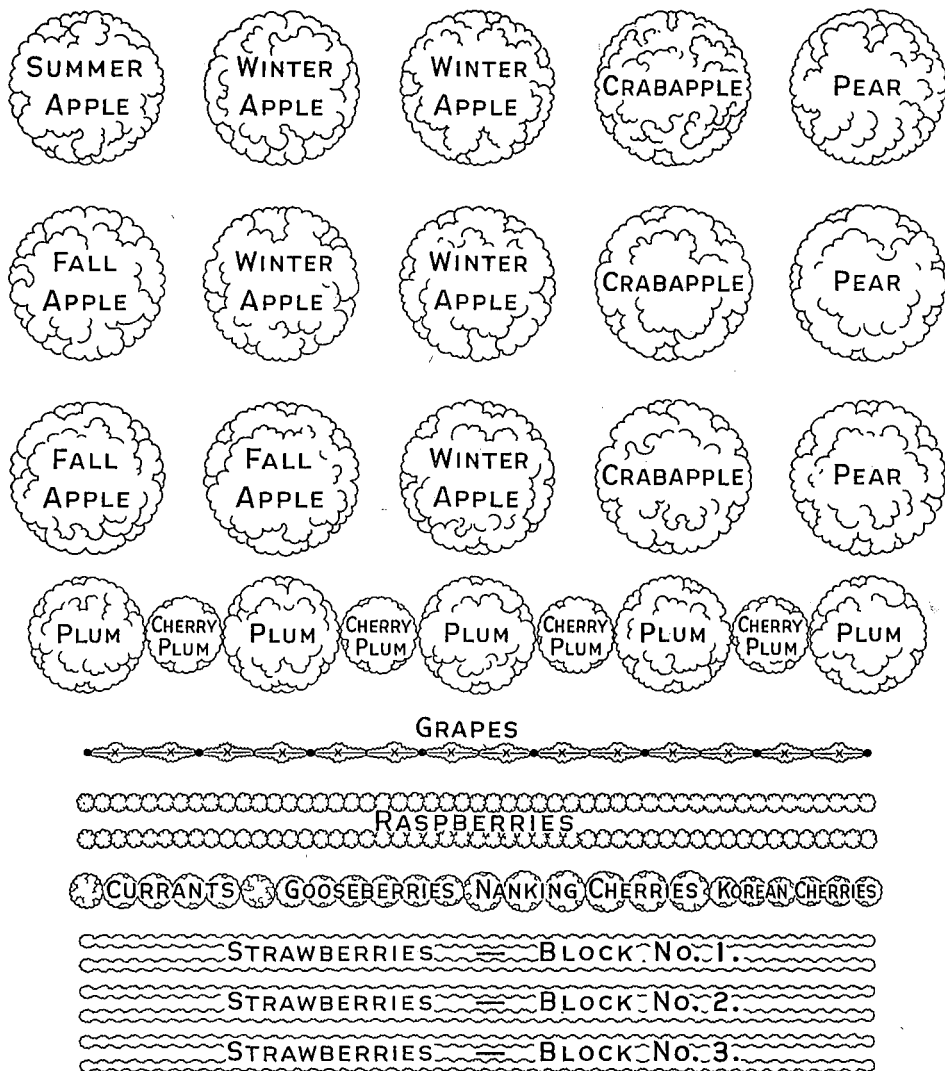


FIG. 1. Suggested home fruit planting for family of five

In northern Minnesota plant fewer winter apples and more summer and fall apples.

Provision should be made for rotating strawberry beds. Plant Block No. 1 the first year, Block No. 2 the second, and Block No. 3 the third. Abandon Block No. 1 after the second harvest (which will come in the third year) and prepare that ground for replanting in the fourth year. Block No. 2 will then be made ready for planting in the fifth year, etc.

The Planting Plan

Since the fruit planting represents a considerable expenditure in time and money, it should follow a carefully con-

sidered plan. Thought should be given to spacing, number of plants, selection of varieties, and arrangement.

With the aid of the accompanying charts on spacing, suggested varieties,

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	Plants needed for family of 5	Ripening period
Small fruits	feet	feet	years			
Currants	8	5	3	2-3 qts.	6	July
Gooseberries	8	5	3	2-3 qts.	6	July
Grapes	8	8	3	4-6 qts.	15	Sept.-Oct.
Raspberries	6-8	2½-4	1¼	1 qt.	50	July-Aug.
Strawberries	3-4	1½-2	¼-1¼	½ qt.	100	June-Oct.
Tree fruits						
Apples	30	30	6-10	5-10 bu.	8-10	Aug.-Oct.
Crabapples	30	30	6-10	5-10 bu.	3	Aug.-Oct.
Cherries (Korean)	8	4	2-3	1 qt.	6	August
Cherries (Nanking)	8	6	2-3	1 qt.	6	July
Cherry plums	15	15	3-4	1-2 bu.	5	Aug.-Sept.
Plums	20	20	5-6	1-2 bu.	5	Aug.-Sept.
Pears	30	30	6-10	1-2 bu.	3	Sept.-Oct.

Table 2. Suggested Varieties||

	For southern Minnesota (fruit zones 1 and 2)	For northern Minnesota (fruit zones 3 and 4)
APPLES—Summer	Mantet, Oriole	Erickson, Mantet,* Oriole
Fall	Beacon, Duchess, Lakeland, Minjon, Van Buren, Wealthy	Beacon,* Duchess,* Hibernial, Lakeland,* Minjon,* Van Buren*
Winter	Fireside, Haralson, Prairie Spy, Redwell, Victory	Fireside,* Haralson,* Redwell,* Victory*
CHERRIES (NANKING)	Drilea, Orient	Drilea,* Orient*
CHERRIES (SOUR)	Northstar	Northstar*
CERRY PLUMS	Compass,† Convoy,† Sapa, Sapalta	Compass,† Convoy,† Opata, Sapa,* Sapalta*
CRABAPPLES	Chestnut, Dolgo, Whitney	Chestnut, Dolgo, Red River, Whitney
CURRENTS ‡	Cascade, Red Lake	Cascade, Red Lake, Viking
GOOSEBERRIES ‡	Como, Pixwell	Como, Pixwell
GRAPES	Beta, Bluebell, Blue Jay,§ Moonbeam, Red Amber	Beta, Bluebell, Blue Jay,§ Minn. No. 78, Red Amber
PEARS	Bantam, Golden Spice, Mendel, Parker	Bantam, Golden Spice
PLUMS—Hybrid	Elliot, Ember, Redcoat, South Dakota,† Superior, Toka,† Underwood	LaCrescent, Redcoat, South Dakota,† Toka,† Underwood
European	Dietz, Mount Royal	
RASPBERRIES	Indian Summer, Latham, New- burgh, Sodus (purple)	Chief, Latham, Newburgh, Sodus (purple)*
STRAWBERRIES—		
June-bearing	Arrowhead, Dunlap, Premier	Arrowhead, Dunlap, Premier
Everbearing	Evermore, Gem, Red Rich, Wayzata, Superfection	Evermore, Gem, Red Rich, Wayzata, Superfection

* Should be planted in protected sites.

† Pollinizers.

‡ In white pine blister rust areas a permit must be obtained from the State Conservation Department before planting currants and gooseberries.

§ Imperfect flowers.

|| See Extension Bulletin 224, "Fruit Varieties for Minnesota," for complete list and descriptions. See also the inside front cover of this bulletin for a zone map.

and planting plan, you should be able to draw up a plan that will meet your own conditions and requirements. Remember that a small planting well cared for will give more fruit than a large, neglected planting that is not properly sprayed. Allow ample space for tree fruits to develop without crowding. This will result in low, bushy trees 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. Be certain to order only those varieties known to be adapted to your area. It is best to purchase plants from the closest reputable nurseryman. This will reduce shipping costs and insure getting the stock in the best possible condition. It is generally best to order from a northern nursery, rather than one too far south or east since Minnesota nurserymen are most apt to have adapted varieties grafted upon hardy rootstocks. This is important; a tree can be no hardier than its root system.

The size of the nursery stock is less important than the condition of the trees. The plants should be vigorous and healthy with well-developed root systems. In general a two- or three-year-old tree that is well branched will bear fruit a little earlier than a one-year-old whip. In northern and western Minnesota, where a low-headed, bush-type tree may be desired, a smaller tree that can be cut back severely when planted will give the best results.

Early spring is the best time to plant most fruits. Place your order early to be certain of getting the varieties desired. When the nursery stock arrives, it should be unwrapped and carefully examined. If the roots have dried, plunge them in water for several hours. Plant immediately, or, if the weather is such that planting cannot be done satisfactorily, heel the plants in on the north side of a building or other cool, shady spot. Nursery stock, carefully heeled in, can be held for a week or longer if necessary before planting. Be careful to keep the roots moist and covered at all times.

CULTURE OF TREE FRUITS

Apples and Pears

Planting. The soil for the apple and pear orchard should be thoroughly prepared the season before planting if the ground is sufficiently level to prevent erosion. On a steep slope, it will be best to start the trees in an established sod. In such case the ground in a three-foot circle where the tree is to be planted should be spaded and worked the previous fall.

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

place the topsoil in a separate pile from the subsoil. Prune any broken or long, straggly roots and place the tree in

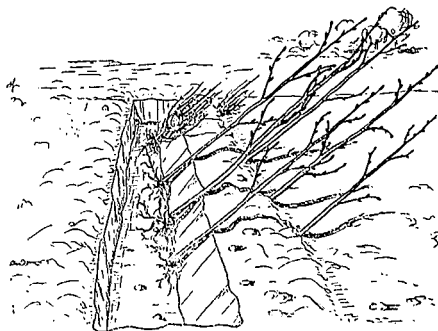


FIG. 2. Nursery stock should be heeled in if it cannot be planted immediately

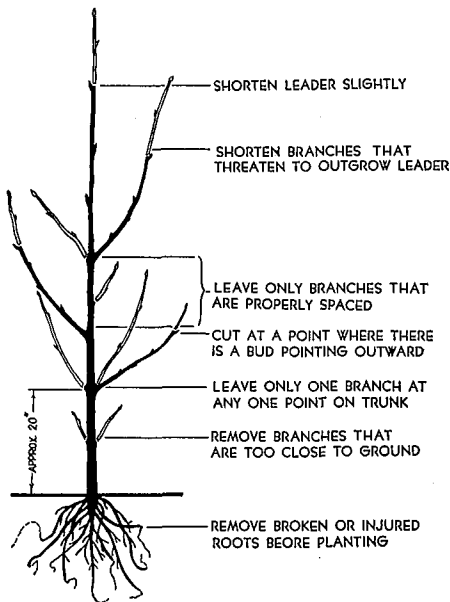


FIG. 3. Young fruit trees should be pruned when planted

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 two or three 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 3). These "scaffold" branches should be spaced at least six inches apart up and down the trunk.

In planting apples and pears be certain to allow ample room for the trees to develop without crowding. In southern Minnesota a minimum spacing of 30 feet is needed between the trees, while in northern Minnesota, where growth is slower, a minimum spacing of 25 feet might be sufficient. Close planting will result 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 four or five years. To use the ground to best advantage, garden crops may be grown between the trees during this period without injuring the trees. As the trees approach bearing age, it will generally be best to establish a grass sod. Bluegrass makes a good ground cover for the mature orchard. In drier parts of the state it may be advisable to continue cultivation even in the mature orchard if the new growth at the tips of the branches is less than six inches. On the other hand, in the moister sections it may be advisable to establish the sod earlier if the terminal growth is too rapid, since rapid, succulent growth is more subject to winter injury and fire blight.

On steep slopes, apples and pears can be successfully planted in sod if an area around the base of the tree is kept worked and fertilizers are added as needed.

The grass in the orchard should be mowed two or three times each season and the clippings allowed to remain on the ground. An additional mulch of straw or strawy-manure should be used under the trees. Start about a foot from the trunk and spread the mulch materials out to beyond the tips of the branches.

The mulch should be about six inches deep or deep enough to smother weeds. This mulch will need to be replenished each fall. If the grass is tall when cut, it can be raked up and used for mulching under the trees. This mulch will aid in moisture penetration and weed control and as it decomposes will add to the mineral content of the soil. Since the mulch may increase the fire hazard in dry periods, special care should be taken to prevent fires.

Commercial fertilizers should be used as needed. If the growth is satisfactory and the leaves appear vigorous and dark green, it will not be advantageous to use fertilizers. If, however, growth is

slow and the leaves small and light green, fertilizers will be beneficial.

A high-nitrogen fertilizer will generally prove best for most soils. Some successful orchardists use only ammonium sulfate or ammonium nitrate. Others feel that a complete fertilizer such as a 10-8-6 is better.

Some apply the fertilizer in a broad ring starting about two feet out from the trunk and extending out beyond the tips of the branches. Others use a fertilizer spreader and cover the ground uniformly between the trees. In the latter case, a heavy grass growth is encouraged over the entire area and sufficient mulching material can thus be grown in the orchard.

The rate of application will vary with the size of the trees and the method of application. Ammonium sulfate or ammonium nitrate should be applied at the rate of about one-half pound for each inch in diameter of the trunk. A young tree two or three years old would require about a half pound while a mature tree might take four to six pounds. If a complete fertilizer, such as 10-8-6 fertilizer, is used, the rate should be doubled. In case the entire area between the trees is fertilized, apply about 300 pounds of ammonium sulfate or ammonium nitrate per acre or about 600 pounds of the complete 10-8-6 fertilizer.

The best time to apply fertilizer is early in spring as growth is starting. Late applications may encourage late growth with resulting winter injury.

Preventing Winter Injury. Selecting hardy varieties of trees will reduce losses by winterkilling. If less hardy varieties, such as the Jonathan and Delicious, are grown in southeastern Minnesota they should be top-worked on a hardy tree such as Hibernial or Virginia crab. Proper cultural practices that will encourage vigorous growth early in the season and the use of fall cover crops to aid in ripening the wood in the fall will also reduce winterkilling.

Sunscauld is another type of injury which normally occurs in late winter on the southwest side of the main trunk and larger branches of small trees. The bark, being brown or gray in color, absorbs the sun's rays in midafternoon and often warms up to as high as 20°F. above the surrounding air temperature. If warm days are followed by cold nights, the activated bark tissues, having lost their resistance to cold, are killed. The bark then dries and splits and wood-rotting fungi enter. This may seriously weaken or even kill the tree.

To protect the tree from sunscauld it will be necessary to shade the southwest sides of the main trunk and larger branches. This can be done by tying narrow boards to the branches and main trunk or by wrapping the stem with strips of burlap or aluminum foil. Another method that seems to have merit is to hang evergreen branches on the southwest side of the main branches and trunk. Painting the trunk with

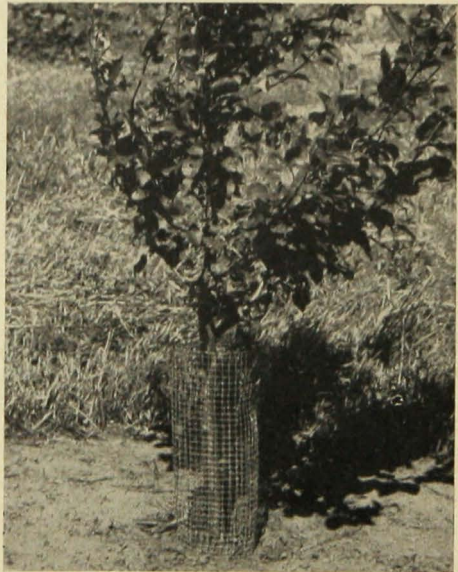


FIG. 4. Protect the fruit tree with a cylinder of hardware cloth to prevent rabbit and mouse injury

whitewash may lower the temperature by reflecting rather than absorbing the light and thus reduce sunscald.

Controlling Rabbits and Mice. Many young trees are lost each year because of girdling by rabbits and mice. The most practical means of protecting young trees from this damage is to enclose the base of the trunk with a cylinder of $\frac{1}{4}$ -inch mesh hardware cloth. This cylinder should be at least six or eight inches in diameter and extend from about an inch below the soil level to the first branch. Another method that is less permanent than using hardware cloth is to wrap the base of the trunk with heavy-weight aluminum foil locker paper. These safeguards should prove very successful in preventing mouse damage and in reducing rabbit damage. However, when the snow is deep, rabbits will eat the tips of the branches. Every means of reducing the rabbit population should be employed, including trapping and shooting where permitted. Leaving pruned branches lying on the ground will also reduce damage to the living trees since rabbits will chew the bark from these branches and leave the trees alone.

Many chemical sprays and paints have been recommended as rodent repellents. Among these, Castle Rock Rodent Repellent and Goodrite Z.I.P. have given the best results. Apply them in late fall.

Some orchardists have found that by putting cinders around the base of the trunk to a depth of about six inches they could greatly reduce losses due to mouse injury. Baiting the mice with poison grain is also effective in reducing the mouse population.

Livestock Injury. Too often we see the farm orchard being used as a pasture for farm livestock. There is no surer way of ruining the orchard. In addition to 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. The pruning which the young apple or pear tree receives is very important in shaping the tree and giving it a strong framework. The pruning at planting time consists simply of removing all side branches except those selected for the permanent framework of the tree, and heading back the selected branches. Some pruning will be needed the second and third springs to remove narrow crotches and to select additional scaffold branches. The ideal tree is one with 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 should be uniformly spaced around the trunk. If any of the side branches grow upward and over-



FIG. 5. In pruning young trees, leave strong, wide crotches such as No. 1 and eliminate narrow-angled crotches such as No. 2

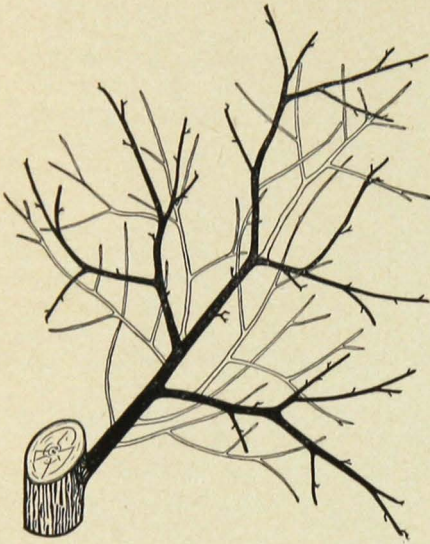


FIG. 6. In pruning a bearing fruit tree, remove branches too close to the trunk, weak shoots crowding bearing branches, and branches in crotches of other branches

take the leader, they should be headed back so that the tree will have only one leader.

All cuts should be made with a sharp knife or pruning shears and should be as close to the main stem as possible to insure rapid healing. 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 that pruning is a dwarfing process and that continued heavy pruning of a young tree will lengthen the time before the tree comes into bearing.

As the tree approaches maturity, a light pruning each year will prove beneficial. Remove any dead or diseased branches such as those showing fire blight cankers. Make the cuts as close to the main stem as possible and if the branch is large, first undercut to prevent tearing the bark when the branch falls. Large scars, two or more inches in diameter, should be painted with orange

shellac, grafting wax, or some special tree paint. Remove all water sprouts (fast-growing, upright branches) and branches that cross and rub. Small branches near the center of the tree that have ceased to grow more than a few inches in length each year should be removed since they produce only small, poorly colored fruits. Little pruning should be necessary in the top and sides of the tree. It is best to prune a little each year rather than to give the tree a severe pruning at infrequent intervals. Severe pruning upsets the balance of the tree and often results in the production of an abnormal number of water sprouts, which may increase the danger of fire blight.

The best time to prune your fruit tree is early in the spring before growth starts. Heavy pruning should be completed by mid-April. Water sprouts and weak branches can be removed during the summer months if time allows.

Thinning. Many varieties are said to be "alternate bearing." This means that they set a heavy crop one year and then lay off production the next. Since fruit bud formation depends on a reserve of food in the plant, thinning of the fruit will tend to encourage fruit bud formation in the "on" year and thus reduce

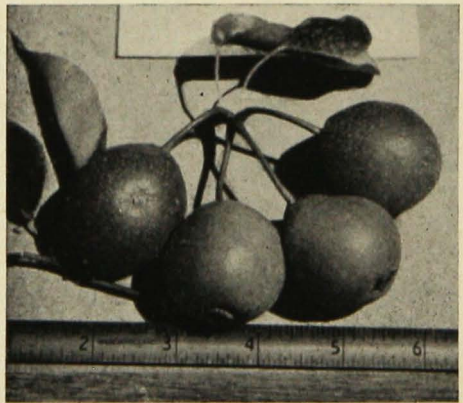


FIG. 7. The Bantam pear—a very hardy variety

this alternate-bearing tendency. Thinning will also result in larger and better-colored fruits. 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 five to eight 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, since the branches are more vigorous where they receive full sunlight. Thinning actually takes very little time and the improved yields and quality will more than repay the expense.

Harvesting and Storing. Apples and pears are very perishable and should be handled with extreme care. Summer apples may be harvested before they reach full maturity if they are to be used for pies and sauce. Generally these are picked as they are needed for use. Fall and winter apples and pears should be harvested when they reach the proper stage of maturity. This will be when they separate readily from the fruit spurs and before they drop. It may be advisable to pick over the tree several times to get all of the fruits at the right stage of maturity. Grasp the fruit and lift up to "unhinge" the fruit stem from the spur. Handle the fruits carefully to avoid bruising and stem punctures.

Store apples at a constant low temperature and in a room with a high moisture content to prevent shriveling. Storing the fruit in crocks or barrels will help to reduce shriveling. The best temperature for storage is between 35° and 40° F. At higher temperatures the fruits will keep—but for shorter periods of time.

Pears should be picked a little on the green side and allowed to ripen in a cool basement. Such pears will be juicier and have fewer gritty stone cells than tree-ripened fruits. Pears will not keep for long periods and should be eaten or canned when ready.

Insects and Diseases. Apples and pears suffer from about the same insect and disease pests. To grow clean fruit requires a careful program of sanitation and spraying. Since many of the insects and diseases overwinter on dead twigs and fallen leaves and fruits, a thorough fall cleanup will greatly reduce infection the next year. Follow the spray schedule given in Extension Pamphlet 184, *Fruit Spray Schedules*. The following are the important insects and diseases:

CODLING MOTH is the familiar apple worm which can be recognized by the brown excrement forced out of the tunnels. Affected fruits generally break down in storage and should be used at once. Picking and destroying wormy apples accompanied by a thorough spray program will control this pest.

APPLE MAGGOT, also known as the "railroad worm," is one of the most troublesome and destructive pests of apples. Injury is caused by the maggots which tunnel through the flesh and eventually destroy the fruit completely. In the early stages of injury it is necessary to cut the apple open to see the tunnels but in later stages the brown tunnels can be seen through the flesh. The insects continue their destruction of the fruits after the fruits have



FIG. 8. Apple maggot injury

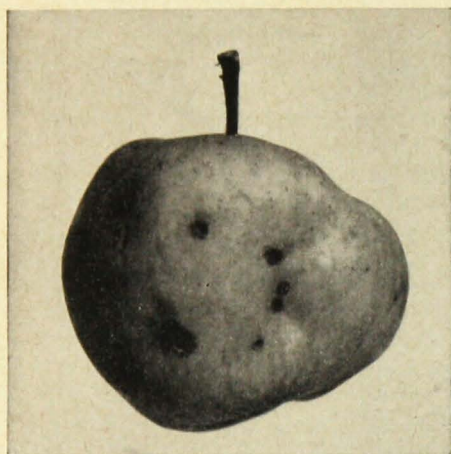


FIG. 9. Curculio on apple

been harvested and stored. What may have appeared to be a normal fruit when picked may break down completely in a few weeks. The maggot flies lay their eggs during late July so it is necessary to keep the fruits covered with a poison spray during the egg-laying period. Destruction of infected fruits is essential for good control. See Extension Pamphlet 184, *Fruit Spray Schedules*.

PLUM CURCULIO, which is described fully on page 14 in the section on stone fruits, causes considerable damage to apple fruits. However, there is also an apple curculio, a dark-brown snout beetle which feeds and lays its eggs on the young fruits. The resulting pits are shallow, funnel-shaped depressions quite unlike the damage caused by the plum curculio. Most of the infested fruits drop during June. The fallen apples should be destroyed.

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

growth so that affected branches usually die. Apply wettable DDT with first cover spray. A dormant lime-sulfur spray or a dormant D.N. (dinitro) oil spray are other controls recommended.

CANKER WORMS often work on unsprayed trees and skeletonize the leaves. They also feed on the blossoms and young fruits. Tent caterpillars and webworms cause similar injury during the summer months. The arsenical sprays and wettable DDT offer satisfactory controls.

APPLE SCAB is one of the most serious diseases of apples in Minnesota. Scab is caused by a fungus which produces dark-green, velvety spots on the leaves and fruits, usually seen first soon after the petals fall. At picking time such scabby apples will be deformed and cracked. This disease is most serious in a wet season. A thorough spray program is necessary for control.

FIRE BLIGHT is a bacterial disease that appears during the spring and early summer months. Affected flower clusters and blighted twigs turn black and the affected leaves remain attached to the twigs all summer. The bacteria overwinters in cankers which develop on infected branches. Since fire blight is most serious on vigorous, succulent growth, and is brought about by late fall growth and the use of high-nitrogen fertilizers, the control is aimed at adopting a cultural system that reduces fall growth. Sod culture reduces fire blight since the trees harden-off better for winter. Prune out all diseased branches and cankers and disinfect cut surfaces with orange shellac.

Stone Fruits

Of the stone fruits, only the plums, cherry plums, and certain of the bush cherries are adapted to Minnesota conditions. Peaches and apricots are sometimes tried, but attempts to grow them generally end in failure. The peach trees may survive for a few years but

their flower buds are generally killed since they can survive temperatures only as low as about -18° F. Apricots of Manchurian origin appear to be perfectly hardy but they bloom so early that late frosts often kill the blossoms or young fruits.

The plums are of three general groups: the so-called hybrid plums, selected wild plums, and the European-type plums. The hybrid plums are generally hardy, having been derived by crossing the native plums with high-quality, tender varieties. European plums belong to the species *Prunus domestica* and were formerly considered too tender for Minnesota winters. Recent tests have revealed that a few varieties such as the Mount Royal, Dietz, Russian Green Gage, and Krikon may be hardy in southern Minnesota and also in favored sites which are situated farther north.

The cherry plums owe their hardiness to the native sand cherry, which has been crossed with a number of plum varieties to produce the cherry plum group. For the most part these cherry plums develop into a large bush with fruits intermediate in size between the sand cherry and plum.

The bush cherries are of two types, the Nanking cherries and the Korean bush cherries. The Nanking cherry can be grown in the form of a very small tree or, more commonly, as a shrub about six to eight feet tall. The leaves are hairy and the fruits rather small but densely clustered along the stems. The fruits are good to eat fresh and for jelly. They also make good sauce and pies. The Korean cherry is a small bush about four feet tall. It produces large 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.

Most true sour cherries and sweet cherries are not hardy in Minnesota. Some new sour cherry selections from the Fruit Breeding Farm look promising

in southern Minnesota and may prove hardy farther north.

Planting and Soil Management. The method of planting the stone fruits is the same as described for apples and pears. The stone fruits should be planted in a block separate from the apples and pears and preferably on level ground, since they should be cultivated throughout their lives. The recommended spacing distance is 20 feet between plums, 15 feet between cherry plums, and 6 to 8 feet between bush cherries.

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 the stone fruits are placed next to the small fruits, they can be cultivated along with the raspberries and strawberries. If it is necessary to plant these fruits on a steep slope where cultivation would not be practical, the soil underneath the trees and out beyond the spread of the branches should be heavily mulched with straw, straw-manure, or marsh hay.

Fertilizers should be used as needed, following the same recommendations as described under apples.

Pruning. The plums are pruned in a manner similar to that recommended for apples and pears. Since the trees are smaller, the scaffold branches selected may be closer together. All narrow crotches should be eliminated, and all dead and diseased branches should be removed.

Cherry plums normally grow in the form of a large bush with numerous stems from the ground. The young stems that are two to four years old are most productive.

To keep a new supply of these young stems coming on, it will be necessary each spring to cut out the old stems that are no longer productive. These should be cut back as near to the ground as possible.

The bush cherries will need very little pruning except to cut out any dead or diseased wood. If the Nanking cherry is to be grown as a tree it will need to be trained for the first few years. If you desire a bush form, merely cut the tree back severely when it is planted.

Pollination. Stone fruit plantings require several varieties to insure cross-pollination since most of the hybrids are self-sterile. Since certain varieties are better pollinizers than others, these should be included in the planting. For the hybrid plums, the Kaga, Toka, Surprise, and South Dakota are recommended. For the cherry plums, plant the Compass or Nicollet. The European plums are self-fertile and do not require a pollinizer. For the Nanking and Korean cherries it is advisable to plant several selections to insure cross-pollination.

Winter Protection. The stone fruits are less subject to sunscald than apples and generally are not protected. To reduce winter damage, plant only varieties recommended for your area and 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 would have the desired effect of hardening the trees for winter and furnishing needed organic matter.

Mice and rabbits often cause heavy losses to the plum and cherry trees. Protect them in the same manner as described for apples.

Insects and Diseases. Stone fruits are affected by several very serious insect and disease troubles. The following are the most important:

PLUM CURCULIO is one of the snout beetles, averaging about one-fifth of an inch in length. The adult beetles feed on the expanding leaves and flowers but turn to the young fruits as soon as they form. Round feeding punctures on the newly formed fruits may be seen on plums soon after the shucks have been shed. Egg laying starts when the

fruits are about one-fourth inch in diameter and is largely completed by the time the fruits are one-half inch in diameter. Egg-laying injury can be distinguished from feeding injuries by the crescent-shaped cuts made by the females around the area where the eggs are laid. Affected fruits either drop prematurely or remain on the tree and become distorted and covered with scars. Although a thorough sanitation program will aid in the control of this insect, a complete spray program will be necessary to get clean fruit.

PLUM GOUGER is a smooth snout beetle slightly larger than the plum curculio. Eggs are laid in tiny punctures in the skin of young fruits, and when the grubs hatch they bore directly to the pit where development and pupation takes place. The adults upon emerging 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 which appear first as the fruit is beginning to ripen. Tree jarring every four or five days from full bloom until the plums are about one-fourth inch in diameter is the most successful means of control. Use a well-padded mallet early in the morning while it is still cool and before the beetles become active. Catch the beetles on a canvas or sheet and destroy. Chlordane applied with the petal spray may help.

LEAF SPOT diseases are quite common on stone fruits. These result in a spotting of the leaves and premature defoliation. Clean cultivation, by destroying some of the infected leaves and increasing the vigor of the trees, may reduce the severity of these diseases.

BROWN ROT is very common on cherries and plums, attacking the flowers, foliage, twigs, and leaves. The disease makes its appearance at blossoming time, and infected blossoms give the appearance of having been frosted. Warm, damp weather favors this phase of the disease, while dry weather checks

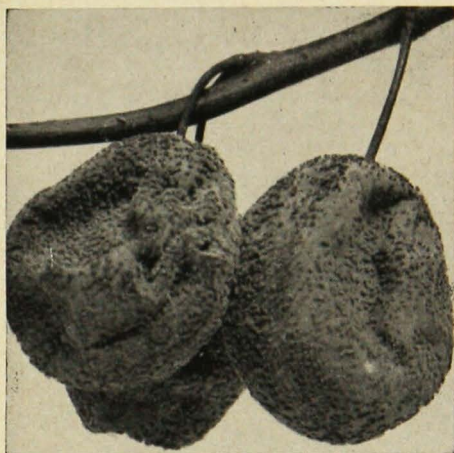


FIG. 10. Brown rot on plum

it. If weather favors the spread of the disease, blossom blight may be followed by a similar blighting of the 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 as they start to ripen and fruits affected by plum curculio or gouger are most apt to be infected. The disease may spread after the fruits are harvested and losses in transit and storage may be heavy.

Since the disease 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, the destruction of these mummies and removal of infected branches will aid in control of this disease.

CULTURE OF SMALL FRUITS

STRAWBERRIES

To grow really fine strawberries, one must pay very careful attention to every detail of their culture. Perhaps the most common mistake is the failure to space properly the runner plants that develop. As a result a strawberry "patch" develops with closely crowded plants that compete for moisture and minerals and produce small, misshapen berries.

Preparing the Soil. Strawberries can be grown on almost any soil type if it is properly prepared. A rich sandy loam is best, but even a clay or sandy soil will produce good strawberries if sufficient organic matter is worked into it before planting.

Although strawberries require an abundance of moisture at fruiting time, they should never be planted in poorly drained soil. If at all possible, the planting should be located where it can be

watered if a dry spell should come during the harvesting period.

The strawberry bed will generally be at one edge of the vegetable garden or may be planted between young fruit trees. The soil should be in a cultivated crop the year previous to planting to avoid a severe infestation of white grubs, since these insects lay their eggs in weedy or grassy places. This will also reduce the competition from weeds. A liberal application of perhaps 20 tons to the acre of well-rotted manure should be plowed or spaded under and the ground thoroughly worked before planting. On a small area this would be about a bushel for 50 square feet. This manure not only will improve the physical texture of the soil, but also will increase its water-holding capacity and improve its fertility.

Planting. Strawberries should be planted as early in the spring as the

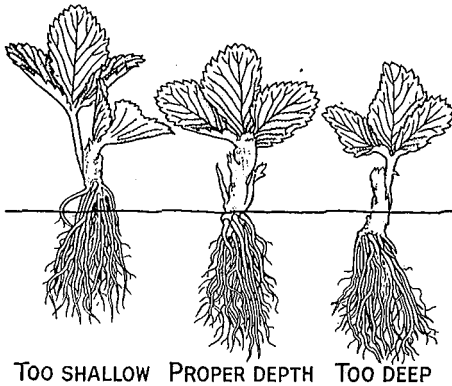


FIG. 11. Strawberries should be planted at the proper depth

ground can be worked. Obtain your plants from a local nursery if possible since plants that are shipped in from a long distance seldom arrive in the best condition for planting.

If you have a good variety and are merely enlarging your planting, it is entirely satisfactory to transplant healthy young strawberry plants from your old bed.

The proper spacing will depend on whether you plan to grow your plants under the hill or matted row system. Most of the June-bearing varieties are grown in the matted row, while ever-bearing varieties are often grown in hills with the runners removed as they form. The rows should be at least four feet apart to allow for horse cultivation. In the matted row, the plants should be set from 18 to 24 inches apart, while in the hill system they should be spaced from 12 to 15 inches apart. Often when the hill system is used, three rows are spaced about 12 inches apart with a picking aisle at least two feet wide between these multiple rows.

The depth at which the plants are set is very important. 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 of planting with the plants set at the proper depth. Keep the roots of the plants covered with a moist piece of burlap or other covering at all times, since they should never be allowed to dry out. If the roots are too long and straggly they may be trimmed with a sharp knife or pair of shears. The plants may also benefit from the removal of some of the outer leaves. Plant in the evening or on a cloudy day, if possible. If the ground is dry, scrape away the surface dry soil before making the opening with your spade. This will prevent dry, powdery dirt from falling in around the roots.

Summer Care. Strawberries should be kept cultivated clean during the first summer. A one-horse cultivator will be best for this purpose. Any weeds that come up in the row should be promptly pulled or hoed out or killed with 2,4-D. Strawberries are remarkably resistant to 2,4-D injury. Apply when the weeds are small. Do not use when the strawberries are in bloom or fruiting. 2,4-D does not kill the grasses.

Remove any flowers that form on newly transplanted June-bearing varieties as soon as they form. Allowing these flowers to develop the first year will result in very little edible fruit. If flowers are allowed to develop, the plant-forming capacity of the parent plant will be greatly decreased. Remove all flowers on everbearing strawberry plants up to July 1 the first year. The flowers that develop after that date will produce a fine fall crop.

If the strawberries are to be grown in the matted row, keep the rows about 18 inches wide. Within this 18-inch row space the runner plants as they form so that daughter plants are about eight inches apart. Remove late runners that form since they will produce few fruits

anyway and their presence will seriously reduce the crop the following spring by shading and moisture competition. Experiments have shown that where plants were spaced eight inches apart the yields are about four times as great as where they are allowed to grow four inches apart. Failure to thin out these surplus runner plants is one of the most important causes of small crops and of deformed berries.

If the plants are to be grown in the hill system, remove all runners as they form and keep the ground worked around the plants until the fall crop starts to ripen. At this time the ground should be mulched underneath and between the plants. In northern Minnesota, pine needles or shavings may be used for this summer mulch. In southern Minnesota, clean, chopped straw would be good. The purpose of this summer mulch is to keep the berries clean and conserve moisture. Plants at one end of the row should be allowed to develop runner plants to provide stock for starting a new patch the following spring.



FIG. 12. Winter mulch should be worked into the picking aisles

Winter Protection. The strawberry blossoms for the spring crop are formed in the fall of the year. Exposure of these buds to temperatures even as low as 20° F. will seriously reduce the yield of good-quality berries. For this reason it is desirable to mulch the plants before severe weather. Before applying the mulch, however, it is well to wait until after the plants have been subjected to a few good frosts to aid in hardening them off. The time to apply the mulch will vary with the season and the part of the state. Normally about the first of November will be right in the vicinity of the Twin Cities.

Use straw that is free from weed seed or marsh hay for mulching. This should be applied to a depth of two or three inches over the entire patch. If the patch is subject to blowing it may be necessary to hold the straw down with boards or branches.

The mulch should be left on as late in the spring as possible to hold back the bloom until after frost. Frequent checks will determine how late the mulch can safely be left on. If the leaves of the strawberry plants start to turn yellow, the mulch must be removed at once. In removing the mulch, lift the straw from over the rows and place in the picking aisles. Some of the finer materials in the mulch should be left in the row. The plants will push up through a light covering and the berries will be kept clean during the picking season. If a late spring frost threatens when the plants are in bloom, the mulch in the picking aisles can be used to cover the plants and thus protect them from frost.

Since the mulch covers the space between the rows, no cultivation is needed during the second season until after the harvest period. If weeds come up through the mulch, they should be pulled at once.

Harvesting the Berries. The fruits should be picked as soon as ripe to prevent soft and spoiled berries. In the

home garden, the fruits should be allowed to get an over-all red color, since the sugar content is higher on a garden-ripened fruit and the flavor is also better. It will be necessary to pick every other day during the peak of the season to get the maximum production. Pick the berries carefully and handle 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 canned, preserved, or frozen in a freezer-locker. Ripe strawberries may be held for several days in a good ice-box or refrigerator.

The fall crop of everbearing strawberries can be picked at less frequent intervals since the crop is lighter and the weather cooler. Even with these berries it will be advisable to pick twice a week if the crop warrants it.

Birds are often a nuisance during the ripening period since they also have a fondness for ripe berries. Locating the patch away from trees where the birds nest will reduce this trouble. Often it becomes necessary to cover the patch with coarse netting or chicken wire to keep the birds out.

Watering during Dry Periods. Strawberries demand a continuous moisture supply throughout their development. A dry period following planting will seriously reduce plant production and development, while a dry spell during the harvest period will greatly reduce the crop. If at all possible it will be desirable to locate the planting where it can be watered as needed.

Renovation. Some growers prefer to abandon the patch after harvesting the first crop; others like to carry it over for a second and even a third year. If it seems advisable to continue the patch for more than the first crop, it must be thoroughly renovated after the crop is harvested. Remove all of the coarse mulch material and mow the plants down to the ground with a scythe or

mower. Rake up all of the leaves and burn, since they may be infested with leaf spot and certain harmful insects. Next cultivate or plow between the rows, leaving a narrow band of plants about eight inches wide. Remove the old plants with a hoe, leaving only strong runner plants. A sidedressing of a complete fertilizer applied at the rate of one pound per 25 feet of row will generally prove beneficial.

If the weather is dry, a thorough watering at this time will speed new growth. Continue to cultivate throughout the remainder of the season and space the runner plants as recommended for the first season.

Duration of the Planting. Although a strawberry planting can be kept productive for several years by thoroughly renovating the patch each summer, this practice is not recommended. It will take less work and a better crop of berries will be produced if a new planting is made each spring and the old patch plowed under after its first crop.

This is equally true of everbearing varieties. The fall crop exhausts the plants so that they will produce only a light crop the following spring, and, although a fair crop might be expected the second fall, a better crop will be produced from a spring-planted patch.

Insects and Diseases. Most of the insect and disease troubles on strawberries can be reduced by following the cultural practices recommended in this bulletin. Sprays or dusts may be needed in severe cases.

STRAWBERRY LEAF DISEASES are common in Minnesota. There are at least three of these diseases, leaf spot, leaf scorch, and leaf blight. Leaf spot is distinguished by 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 a purple, ranging in

size from $\frac{1}{4}$ inch to over an inch in diameter. Leaf blight also affects the fruits, especially everbearing varieties. All three of these leaf diseases may appear on the same plant, thus making identification of the disease difficult.

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

WHITE GRUB is the most serious insect pest of the strawberry since it feeds on the roots of the plants. Do not plant strawberries on land that was in weeds or grass the previous year as the June beetle lays its eggs in such places. Also avoid planting strawberries near shade trees or thickets since the adult June beetles feed on tree leaves at night. Chlordane dust applied at the rate of 10 pounds per acre should help control grubs.

STRAWBERRY LEAF ROLLER MOTH lays its eggs on the underside of leaves. The young larvae feed on the leaves and then migrate to the upper surface and cause the leaves to fold over them. Dust with five per cent DDT as soon as the spring crop is picked, and repeat 10 days later.

STRAWBERRY WEEVIL is a small beetle that lays its eggs in the blossom cluster. After depositing the eggs the female girdles the stem, thus leaving the blossom cluster hanging on the ground. Since the adults overwinter in trash and weeds along the fence row, such places should be thoroughly cleaned. Establish new plantings at some distance from old plantings.

THE BRAMBLES

(Raspberries and Their Allies)

The brambles include a large group of such fine fruits as the red, purple, and black raspberries, blackberries, dewberries, boysenberries, and loganberries.

Many people attempt to grow raspberries, but only a very few do a really good job of it. In Minnesota only the red and purple raspberries are recommended.

Preparing the Soil. Raspberries should be grown on a well-drained soil that is high in organic matter. Almost any soil type will do, if planting can be watered during dry periods. If you must depend on natural rainfall, avoid using very light, sandy soils.

For best results plant on soil that has been cultivated the previous season. Apply about 20 tons of well-rotted manure per acre before plowing, and work the soil thoroughly just before planting. Since weeds, especially quack grass, are difficult to remove from the established planting, it is very important that the ground be clean.

Planting. Planting should be done 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 mosaic-free stock. Since mosaic (a virus disease) is the most serious disease of the raspberry, it is important that only healthy, disease-free plants be planted. The practice of obtaining plants from an old abandoned patch or from a neighbor is most costly. It takes just as much time and work to care for a planting infested with mosaic as one that is free from this disease. When the plants start to bear fruits the healthy patch will produce many times more fruit than the diseased patch.

Plant as soon as possible after the nursery stock arrives and never allow the roots to dry by exposure to the air. Compress the soil firmly about the roots after planting. Cut back the tops to within four to six inches of the ground. This will encourage the production of vigorous new shoots.

The correct spacing will depend on the system of training that is followed. If the plants are to be grown in hills, a six- by four-foot spacing will be about right. If the plants are to be

grown in a hedgerow, the plants may be set two and one-half feet apart in rows six feet apart.

Summer Care. Raspberries should have clean cultivation throughout the life of the planting. Failure to cultivate allows sprouts to come up all over the patch. This means competition for moisture, minerals, and sunlight, with the resulting small, inferior berries. Such a condition also favors insects and diseases. When the plants are grown in hedgerows, cultivation should limit the spread of the rows to about a foot in width. When the plants are grown in hills, cultivation should be in both directions, and the spread of the hills should be no more than 18 inches in diameter. The cultivation should be shallow to avoid injury to raspberry roots.

Cultivation should stop after the first of September since late cultivation may encourage late growth. In a wet fall, a planting of oats made just before the last cultivation will aid in hardening the plants and will enrich the soil when cultivated in the following spring.

Since the raspberry canes must be vigorous in order to produce large, high-quality berries, attention must be given to maintaining the soil fertility.

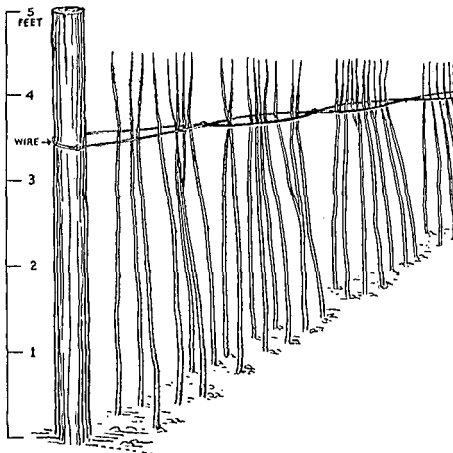


FIG. 13. Wire trellis-hedgerow system

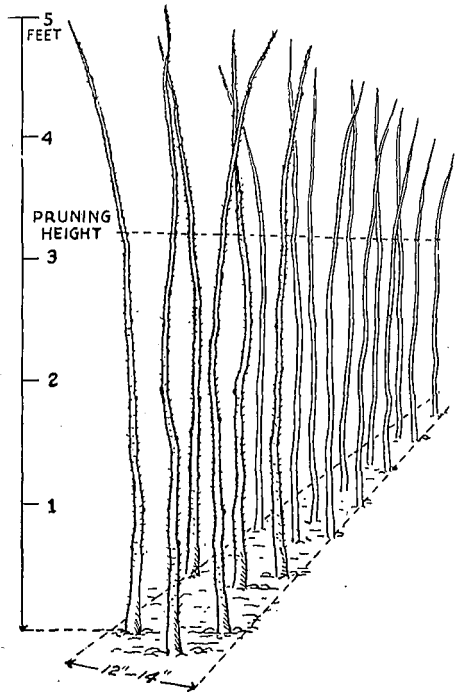


FIG. 14. Unsupported-hedgerow system

Well-rotted manure should be applied evenly between the rows, either late in the fall or early in the spring. If manure is not available, commercial fertilizer will do. A high-nitrogen fertilizer, such as a 10-8-6, should be used at the rate of about 10 pounds per 100 feet of row or 600 pounds to the acre. This fertilizer should be broadcast between the rows and worked in about May 1.

Pruning and Training. Raspberries must be properly pruned and trained if they are to produce the desired crop. Four systems of training are commonly followed in Minnesota. These are the wire trellis-hedgerow system, the unsupported-hedgerow system, the staked-hill system, and the teepee-hill system.

In the wire trellis system, posts are driven about a rod apart in the rows. Two wires are stretched on opposite sides of the posts at a height of about three and one-half feet from the ground.

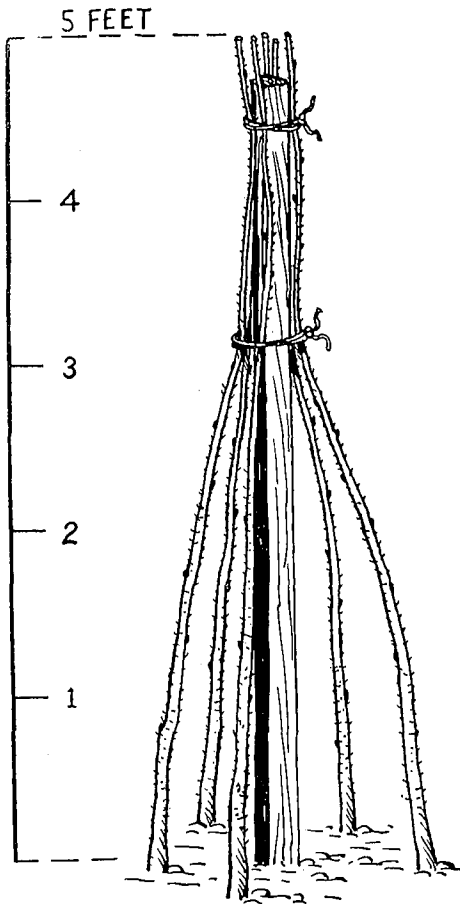


FIG. 15. Staked-hill system

The canes are placed between these wires and the wires tied at intervals to prevent their spread. The tips of the canes are then cut to a height of about four and one-half feet.

In the unsupported-hedgerow system it will be necessary to cut the canes back to about three feet. If this is not done, the fruiting canes will bend over and interfere with cultivation.

In the hill systems all of the old canes are cut off at the ground line as soon as they have finished producing fruit. The new canes are then thinned out, leaving eight to ten vigorous canes per hill. In the hedgerow systems, the old

canes are removed after fruiting and the new canes thinned out, leaving three to four vigorous canes per foot of row.

In the spring of the year, the canes are tied and cut back according to the training system adopted. In the staked-hill system the canes are tied securely to a stake driven into the center of the hill. Binder twine or strips of cloth may be used for tying. The tips of the cane are then cut back to about five feet.

In the teepee system the canes are tied together at a height of about three feet from the ground and a second tie made about six inches higher. These ties should be made tight so the canes are held firmly in place. Cut the tops back to about four feet from the ground.

Winter Protection. Raspberry plantings frequently suffer from winter in-

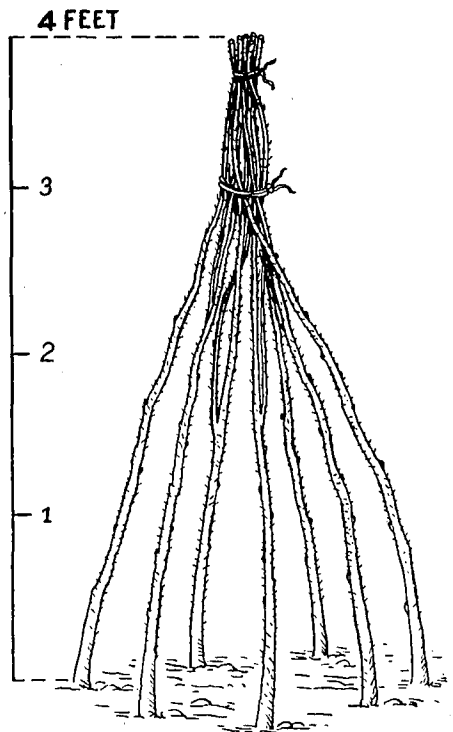


FIG. 16. Teepee-hill system



FIG. 17. Winter protection of raspberries is good insurance

jury. This loss seems to result from alternate warm and cold periods in late winter. A warm day in February or March causes the buds to swell and lose their cold resistance. When these warm days are followed by cold nights or prolonged cold spells, the buds are either killed or seriously weakened. This results in dead cane tips or new growth that is weak and unproductive. Such winter damage may seriously reduce the crop.

The only practical means of protecting the canes against this winter damage is to lay the canes down in the fall and cover them with earth. If the planting is located where snow covers the area all winter, the canes may be bent over and held in place with a wire loop resembling a croquet wicket. 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 the diseases are quite numerous and troublesome.

MOSAIC is by far the most serious disease of the raspberry. Since this is a "virus" disease that is within the plant, there is no cure except "roguing" and burning diseased plants. The disease results in reduced vigor of the plant and crumbly berries. The leaves are smaller than normal and crinkled, with a yellow and green mottling. Since it is very difficult to recognize this disease in its early stages, it is most important to start a new planting with disease-free plants purchased from a reliable nursery. A new planting should not be started near an old planting that is infected with mosaic. If it is necessary to locate the new planting near an old, diseased patch, remove the old plants and keep the ground cultivated clean to destroy any sprouts.

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

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

Start with disease-free plants and keep the planting thoroughly cultivated and weeded. This will result in good air circulation and make conditions less favorable for infection. If the disease becomes serious, it can be controlled by a thorough spray program.

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 extends completely around the stems at the point of the leaf attachment. The fruiting branches which develop from such areas are weakened and produce little fruit. Spur blight can generally be controlled by following cultural practices that provide good air circulation around the plants. If serious, it can be controlled by spraying.

RED SPIDER is really a tiny mite belonging to the spider group which sucks the juice from the underside of the leaves and does a great deal of damage. Affected leaves show rusty-brown blotches and fine, silken webs. In severe infestations it may be necessary to spray to obtain satisfactory control.

CANE BORERS of two types are known to infest raspberries. The adult of one type deposits its eggs near the tip of the cane, causing it to wilt. The other type attacks the base of the cane,

causing a swelling. The control is to remove and burn the affected canes as soon as noticed, making the cut well below the point of injury.

RASPBERRY SAWFLY often causes severe damage. The small, green, many-legged worms eat the soft leaf tissue, leaving only a skeleton of veins.

CURRENTS and GOOSEBERRIES

Currents and gooseberries are very hardy and easy to grow in all parts of Minnesota where their culture is allowed. In certain sections of the state 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.

Planting. Currents and gooseberries will grow on almost any soil type but do best on the heavier soils that are high in organic matter. Plant in the early spring in soil that has been thoroughly prepared. Space the plants about five feet apart in rows six to eight feet apart. Two-year-old nursery-grown plants are usually 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 and cut these 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 the roots. If well-rotted manure is available, apply about a bushel per plant in either late fall or early spring. Distribute uniformly over the soil near the plants and work in. If manure is not available, apply a cupful per plant of a complete 4-12-4 fertilizer in the spring.

Pruning. Pruning currents and gooseberries is very simple. After the fourth year remove all four-year-old stems, since three-year-old or younger stems produce more and better fruit. Removal of these old stems will stimulate vigorous young shoots at the base. If too

many young shoots develop, they should be thinned out. About 12 stems from the base is about right for a mature bush. Pruning should be done early in the spring before growth starts.

Insects and Diseases. There are comparatively few insects and diseases on currants and gooseberries and these can be readily controlled by clean cultivation, pruning, and, if necessary, spraying.

LEAF SPOT diseases are quite common. The spots are small and circular in outline, with gray centers. If these spots become numerous they result in premature defoliation of the bushes. Strict sanitation to destroy infected leaves will usually check this disease.

POWDERY MILDEW is one of the common mildews that cover the leaves with a white moldy growth and result in distortions of the leaves and stem tips. This disease can best be controlled by following the recommended spray schedule.

WHITE PINE BLISTER RUST shows up on currants and gooseberries as rust patches on the under surface of the leaves. The spots are covered with hairlike projections that hang down from the leaf. The Viking variety of red currant is quite resistant to this disease and should be grown in white pine areas of the state. Before planting currants or gooseberries in the blister rust control area, it is necessary to obtain a permit from the Department of Conservation, St. Paul. This is a control measure. The blister rust control area includes all of the counties in northeastern Minnesota where white pine grows.

CURRANT WORM is a typical green worm that feeds on the leaves, often stripping all of the leaves from the plant before the damage is noticed. It can be readily controlled by spraying with arsenate of lead or dusting with rotenone or 5 per cent DDT dust. Do not use arsenic or DDT when fruits are approaching maturity.

CURRANT APHID sucks the juice from the under surface of the leaves, causing reddish discoloration and crinkling. A dormant spray of lime-sulfur or an application of nicotine sulfate or rotenone when the leaves are a half to an inch long will control this insect.

GRAPES

By selecting a suitable site and planting only adapted varieties, grapes can be grown in most any part of the state for home use, but success is questionable if these precautions are not observed.

Selecting the Site. Since grapes require full sunlight and high temperatures to ripen their fruits, the exposure is most important. Select a site on a south slope or plant the grapes on the south side of an evergreen windbreak. In northern Minnesota grapes have been grown successfully on the south side of a garage or other farm building. The soil should preferably be a sandy loam with a high organic content.

Planting. Prepare the ground well before planting. Plant in the spring as early as possible, using vigorous two-year-old plants that have 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 eight by eight feet and run the rows across the slope.

Soil Management. Grapes require clean cultivation for best results. Keep weeds removed from the rows by hoeing. Do not cultivate after August 1 since late cultivation encourages late growth with consequent winterkilling. It may be desirable to plant a fall cover crop of oats at the last cultivation. This can be worked into the soil in the spring, thus improving the fertility.

Grapes usually respond favorably to fertilizer applications. Well-rotted manure, applied at the rate of a bushel per plant either late in the fall or early in the spring, will be best. Scatter be-



FIG. 18. Grapes should be trained on wires

tween the rows and cultivate in. If manure is not available apply a high nitrogen fertilizer, such as a 10-8-6, in a broad circle out about two feet from the stem. Use about one-half pound per plant and apply early in the spring.

Training Systems and Pruning. Grapes are usually trained to a wire trellis. Posts are driven at 16-foot intervals along the rows and two or three wires stretched about 18 inches to 24 inches apart.

Hardy grapes are normally trained with an upright stem and branches that go out in both directions along the wires. Since the grapes are produced on new wood each year, it is important to select vigorous young canes with well-developed buds to produce the crop. Each dormant bud should produce between one and three clusters of grapes. A mature grapevine should be pruned so it retains about 40 dormant buds. If a two-wire trellis is used, the four young branches that are selected for the framework should be cut back so

each bears about 10 buds. If three wires are used, cut back the selected branches to about seven buds. Any short branches near the main trunk should be cut back to one or two buds. These will develop strong shoots from which the framework branches can be selected the next year.

When tender grapes are grown, the training system must be such that the canes can be laid down and covered each fall. A strong cane should be selected and tied to the lower wire of the trellis. The branches that develop from this should be tied to the upper wires for support. In the fall these upright branches are cut back to one or two buds and the canes laid down and covered with soil. If it seems advisable to lengthen this cane, merely select a strong branch near the tip and cut it back to four or five buds, thus lengthening the cane by several feet. After several years this old cane may become overgrown and so covered with spurs that winter protection becomes difficult.

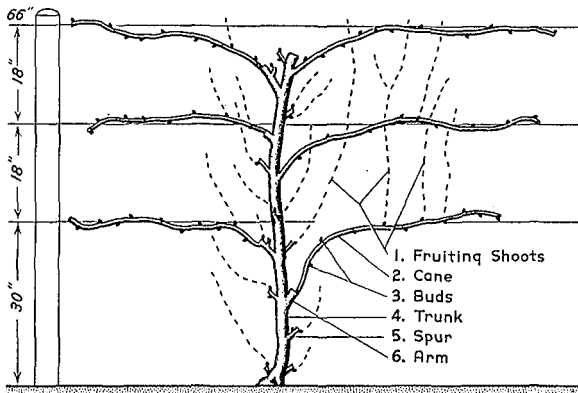


FIG. 19. Training system—
hardy grapevine

To replace the old cane, select a vigorous young branch from near the base of the stem. When it has reached a satisfactory size, cut off the old cane.

Grapes should be pruned during their dormant season. Tender grapes are pruned in the fall just before covering them for winter. Hardy varieties may be pruned in late winter. Avoid pruning late in the spring since grapevines bleed badly at this time.

Grapevines that have been neglected for a number of years will be difficult to prune to obtain 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 base of the plant it may be necessary to cut back the old canes to within three or four feet of the ground. This will force vigorous new growth from near the base that can be

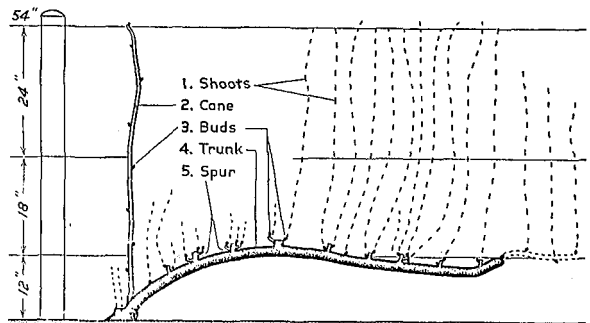
selected for the next year's crop. Such pruning will sacrifice one year's crop but will be worth while, since neglected vines produce little usable fruit.

Insects and Diseases. There are a few insect and disease pests that may become serious on grapes.

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 the 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.

FIG. 20. Training system—
tender grapevine



GRAPE BERRY MOTH lays its eggs on the fruits and the young worms burrow into the fruits. Clean cultivation will reduce the trouble from this insect.

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

BLUEBERRIES

There has been considerable interest in growing cultivated blueberries in recent years. With Minnesota's severe winters blueberry growing cannot be recommended unless you are willing to give the plants the necessary winter protection. Even our native blueberries often kill back to the snow line and the high-bush, hybrid blueberries are not as hardy as our native ones.

Blueberries must be grown on acid soil. If the soil is neutral or but slightly acid it will be necessary to prepare a special soil mixture of equal parts of acid peat and garden soil. Adding sulfur or aluminum sulfate will help maintain an acid soil. Have a soil test made before planting the blueberries. If the pH is above 5.50 it will be necessary to add more acid peat or aluminum sulfate.

Blueberries should never be cultivated, as their root systems are shal-

low. A mulch consisting of sawdust, shavings, oak leaves, or straw should be used to keep the weeds down. Where mulches are used it will be necessary to apply a high-nitrogen fertilizer, since the decomposing mulch materials remove nitrogen from the soil in their decomposition. Use about two ounces of a complete 10-8-6 fertilizer for each young plant. Increase this to about ½ pound per plant when the plants reach maturity.

Since blueberries grow best where the water table reaches to within 14 to 22 inches of the surface, it will be necessary to water during dry periods. If the water is hard, it will be advisable to use rain water since hard water will have a tendency to make the soil neutral in its reaction.

Locate the blueberry planting where snow will be apt to drift in and stay all winter. If this is not possible it will be necessary to enclose the plants in boxlike structures filled with leaves, straw, or other mulch materials.

WILD FRUITS

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

Fruit Sprays

Full information on home and commercial spraying may be found in Extension Pamphlet 184, *Fruit Spray Schedules*. This publication tells the what, how, and when of sprays used in combatting insects and diseases.

Your county agent

A familiar expression heard on Minnesota farms is "see your county agent." Every county in Minnesota has a county agricultural agent. Many counties also have home and 4-H Club agents. Where there are no home or 4-H agents, the county agents conduct their programs.

Actually the county agent is part of a four-way partnership between the United States Department of Agriculture, the University of Minnesota, the county government, and farm people.

It is the job of the county extension staff to bring to farmers and homemakers the latest information on farming and homemaking methods and to conduct 4-H Club work in the county.

Local committees, cooperating with the Director of the Minnesota Agricultural Extension Service, hire these agents and map out their programs.

Most county agents have their headquarters in the county courthouse. They are available to answer your questions and help solve your farming and home-making problems.

The bulletin is one of many published by the University of Minnesota Agricultural Extension Service as an additional service to bring up-to-date information to your attention. These Extension Service bulletins are distributed through your local county agent or through the Bulletin Room, University Farm, St. Paul, Minn.

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