

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE COLLEGE OF AGRICULTURE
AND APPLIED SCIENCE
MANHATTAN, KANSAS

DEPARTMENT OF HORTICULTURE



RASPBERRIES RIPENED ON THE PLANTS ARE DELICIOUS

GROWING BUSH FRUITS IN KANSAS¹

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Bush fruits as discussed in this circular include raspberries, blackberries, dewberries, gooseberries, and currants. These fruits occupy a unique position in the pomological field. They do not have the universal appeal that strawberries do, because

1. Contribution No. 212, Department of Horticulture.

they are a little slower coming into bearing, occupy more space, and are not so well established on the market. They are not so slow coming into bearing as tree fruits and are not so long lived; hence the bush fruits fit into an important place of their own between strawberries and tree fruits. For convenience the fruits will be discussed under two divisions: (1) Brambles, and (2) Gooseberries and Currants. Raspberries, blackberries, and dewberries will be included under brambles.

BRAMBLES

The full possibilities of bramble production either commercially or at home have not been generally recognized in Kansas. Poor quality of many of the berries on the market has prejudiced housewives against brambles as a dessert fruit. Locally grown berries of choice varieties properly ripened on the plants are a luscious and healthful fruit. They have a delicate flavor and are palatable and nourishing. There are numerous ways in which the fruit can be prepared and served.

Bramble culture, although somewhat specialized, has several advantages over tree-fruit production. A bramble plantation is easily established, the expense is not unreasonably high, it comes into bearing in two years, the fruit matures early in the season, injury by spring frost is rare, and excessive amount of care is not required. Should the plantation become unprofitable for some reason, brambles are easily plowed under in preparing the site for other crops.

In spite of these and other advantages, the production of brambles has decreased in the last 30 years. This is primarily due to the drought years, the difficulties of controlling pests, the lack of profitable varieties, marketing difficulties, and the poor care given to many bramble plantations.

Table 1. Bramble acreages and production in Kansas.²

	Acreage		Production (24-pt. crates)	
	1915	1945	1915	1945
Raspberries	1,611	515	43,615	6,356
Blackberries	1,988	468	55,719	5,700
Totals	3,599	983	99,334	12,056

2. From biennial reports of the Kansas State Horticultural Society. Bramble acreage has decreased about 75 percent in the last 30 years.

With the introduction of more profitable varieties and the development of methods of pest control, it would seem that an expansion of bramble planting would be desirable, especially in the eastern and southern sections of the state, if growers will adopt modern cultural practices and marketing methods. A bramble plantation should produce eight to ten profitable crops if properly handled.

Selecting a Site for Brambles

Since bramble fruits deteriorate rather quickly after picking, their place is in a home garden or in a commercial patch near a local market. In selecting a site for a commercial planting one should consider only the best site, but for home planting some of the desirable features may be sacrificed in favor of a site close to the home.

Northeast slopes are desirable for bramble sites in Kansas. Plants on such exposures are less injured by hot summer winds, are less likely to be damaged by late spring frosts be-

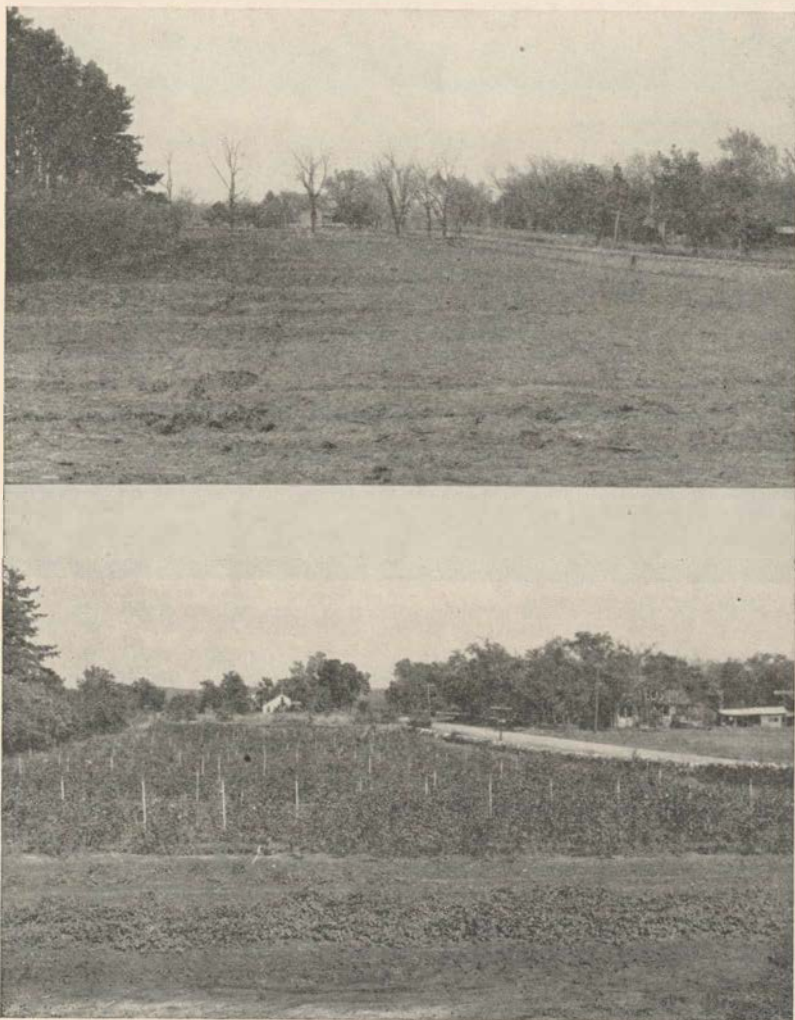


Fig. 1. A promising site before and after planting to bush fruits.

cause of delayed spring growth, and the soil retains moisture better than on south slopes.

Good water and air drainage are important in selecting a site. Both surface and underground water drainage are necessary. Surface drainage is obtained by choosing a gently sloping site. Such a slope will also aid in draining the air, provided the colder, heavier air can escape from the lower part of the plantation.

A plantation in an air pocket is more subject to frosts, and also more likely to become diseased due to higher relative moisture in the air as the temperature of the air decreases.



Fig. 2. Cumberland black raspberries on a well-selected site.

Bramble roots are easily damaged by water-logged soil, so the subsoil should permit excess water to percolate into the lower strata. Brambles require a liberal and constant supply of moisture, but are very sensitive to "wet.feet."

The best soil for brambles is one that is fertile, well drained, of good tilth, and retentive of moisture. A medium sandy loam with an abundance of organic matter meets these requirements. A heavy soil is exacting in cultivation requirements and under Kansas conditions bakes hard and absorbs water too slowly. Too light a soil will be easily worked, but does not retain moisture. Although brambles are not very deep rooted, the soil should be several feet deep to provide water-storage space. The fertility of the soil is more easily built up before planting than after the plants are growing. Brambles do best on soil that is rich in humus or decayed organic matter.

Windbreaks on the south and west sides of a bramble plantation are an asset. One or two rows of evergreens, such as the western yellow pine, Austrian pine or Scotch pine, and arborvitae, or, among deciduous trees, hackberry, elm, Russian olive, or ash makes a good windbreak. The trees should not be planted too close to the brambles, as the windbreak would rob the brambles of water and plant food. Twenty-five to thirty feet is close enough.

Isolation of healthy brambles from disease sources is important. Avoid old bramble sites, especially those in which crown gall or orange rust was prevalent. Anthracnose can be carried to healthy plants from diseased patches. All old, neglected bramble plants either cultivated or wild within two or three hundred feet of the proposed new site should be destroyed.

Brambles may be used as intercrops in a young orchard to advantage provided there is enough moisture for both. When so used, brambles should be planted only in every other space between rows so as to allow the sprayer to pass in the alternate spaces. Three rows, eight feet apart, can be planted between rows of apple trees set 40 feet apart. Brambles may be set between trees in rows. This decreases the acreage of cane fruits, but when so placed they do not interfere with orchard operations so much. Care must be exercised not to keep the intercrop in the orchard too long and thus damage the main crop. The number of years will be determined by the distance between tree rows and the vigor of the trees. As a rule, the brambles should be out by the time the trees come into bearing.

Varieties

BLACK RASPBERRIES

Black raspberries, or "black caps," are the most widely adapted of the brambles and the most likely to succeed in Kansas. The following are some of the varieties that can be grown.

Black Pearl. Berries round, large and firm; season early and short; hardy; quality fair to good.

Cumberland. Berries large, conical, attractive, medium in size; midseason; hardy; quality good; canes tend to break off at the crown; most important commercial variety in Kansas.

Kansas. Berries large, firm; season early; quality fair; more tender to cold than Black Pearl.

Plum Farmer. Berries very large, firm; season early and short; hardy; fair quality.

New Varieties. Bristol, Logan, Morrison, and Quillen show promise.

PURPLE CANE RASPBERRIES

Purple cane or hybrid raspberries are not so hardy as black raspberries, but if protected during the winter may be grown

in Kansas on carefully selected sites in eastern and southeastern sections.

Columbian. Berries round, large, dark, somewhat soft; quality good.

Cardinal. Originated with A. H. Griesa, Lawrence, Kan., 1888. Large; rather soft; hardy; productive.

Sodus. Firm, large berries; drought resistant; resistant to mosaic; vigorous; productive.

Potomac. New variety introduced by the United States Department of Agriculture; productive; disease resistant; mid-season; somewhat acid; large.

RED RASPBERRIES

Red raspberries are frequently damaged in winter by the dry, cold weather and in the summer by the hot winds. They are recommended only in the eastern part of the state on special sites where they can be protected during the winter.

Chief. Berries medium size, firm; early; quality good.

Latham. Berries large, firm, attractive; midseason; quality good.

New Varieties. Flaming Giant, Newburg, Sunrise, and Taylor show promise.

BLACKBERRIES

Next to black raspberries, blackberries are the best adapted brambles for Kansas conditions. There is local demand for more blackberries than are now being produced in the state.

Eldorado. Leading variety in Kansas. Berries are large, firm, attractive; plants are hardy and productive; quality, fair to good.

Kittatinny. Erect grower; hardy; fair quality.

Snyder. Berries large; midseason; fair quality. More susceptible to drought than Eldorado.

Early Harvest. Erect growth; very early; fruit small, susceptible to orange rust.

Alfred. New variety; erect grower; berries large, firm; partially self-sterile. (Fig. 6.)

DEWBERRIES

Dewberries are not recommended except for southeastern Kansas. They are tender to cold and are frequently damaged by hot summer winds. Among varieties that are grown are Lucretia, Young, and Boysen. Due to their trailing habit of growth, they are more difficult to manage than blackberries. Where grown on a suitable site and protected during the winter, they produce very large, attractive fruit.

TRAILING RASPBERRIES

Several strains of trailing raspberries have been tested at the station horticultural farm. The plants are vigorous growers, and the trailing canes root readily at the tips. Fruits are attractive, dark red to orange red, very glassy and tart. (Fig. 3, right.) Trailing raspberries will require cultural treatments like those suggested for dewberries. (Fig. 3, left.) This fruit is not recommended for general planting until further studies have been made and new varieties developed.

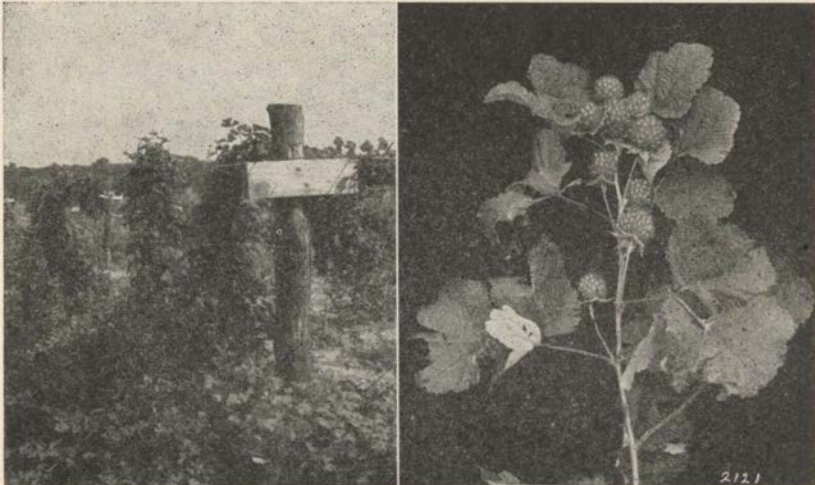


Fig. 3. Trailing raspberries. Left—Plants on a trellis; Right—A cluster of fruits.

Establishing a Bramble Plantation

Thorough preparation of the soil is an important step in successfully establishing a bramble plantation. It is easier to eradicate all noxious weeds before the bramble plants are set. The preparation of the soil should begin at least a year before planting. Soil humus should be built up by adding barnyard manure at the rate of 8 or 10 tons per acre or by plowing under a green manure crop such as vetch. It is well to plow the soil in the fall and work it early in the spring to make it smooth and ready for early planting. If plowing is not done in the fall, it should be done sufficiently early in the spring to allow the soil to settle before planting.

Early spring planting is desirable under most conditions in Kansas. Planting must be done before any spring growth takes place; the new shoots are easily injured, and may be infected with anthracnose from parent plants before transplanting.

Distance between plants and between rows will depend upon varieties, system of culture, and on area available. For the hedgerow system the plants are set about three feet apart in the rows, and rows seven to nine feet apart. For the hill system five by five or six by six feet is satisfactory. The number of plants needed per acre can be calculated by multiplying the distances between plants in feet and dividing the product into 43,560, the number of square feet in an acre. Planting 3 by 8 feet requires 1,815 plants. It is well to buy a few extra plants for good selection.



Fig. 4. Black raspberries the first summer after planting on a gently sloping site.

Plants may be obtained from a reliable nursery or from a clean, well-established plantation. One should be careful to get disease-free plants. The propagation of brambles is simple, hence the plants are cheap. Unless the grower is familiar with the common pests, it does not pay to get plants from an old planting. The black raspberries and dewberries propagate by tip layers. In the late summer the canes elongate rapidly, making a "snaky" or "rat-tail" growth. If these tips are covered with two or three inches of soil they will take root readily. The tips may be inserted into a hole in the soil about three inches deep, made by a stick or chisel. The soil should be firmed down about the tips to keep them from blowing out. If a large number of plants is desirable, the growing canes are pinched back early in the summer. This produces many laterals, and each lateral will produce a new plant. The rooted tips are dug the following spring. The parent cane is cut at a height of about six inches to serve as a "handle" in planting.

Red- and purple-cane raspberries and blackberries are propagated by transplanting the suckers or shoots that grow up from the underground stems. These plants usually come



Fig. 5. Tip layering of black raspberries. (1) Cane just starting to elongate. (2) Cane showing "snaking" or "rat-tailing." (3) Tip ready to be covered. (4) Rooted tip. (5) Rooted tip showing new plant starting at A. (6) Rooted tip showing new plant B. (7) New plant handle shown at C.

up in large numbers between rows or among plants in the row. They can be transplanted during the summer, if taken with some soil, or the following spring.

Blackberries can be propagated also by root cuttings. Good root cuttings are about three to four inches long and about one-fourth to three-eighths inch thick. These should be stratified in moist sand over winter and planted horizontally in furrows about three inches deep.

Setting the plants in straight rows makes future handling easier. Rows may be laid out on the contour, but are difficult to trellis. North-south rows suffer less from the south winds in summer. Holes should be dug large enough to hold the roots without crowding, or the plant may be placed into furrows eight or ten inches deep. The soil must be packed firmly about the roots to prevent drying out. A depression is left around each plant to be leveled off by cultivation as the plants grow.



Fig. 6. Cluster of Alfred blackberry showing poor pollination; only a few drupelets developed.

Self-sterile or partially self-sterile varieties of brambles are found occasionally, especially among dewberries and blackberries. (Fig. 6.) Such varieties should be planted in small blocks near other varieties for cross pollination.

Prune back the plants immediately after planting. Black raspberry and dewberry "handles" should be cut off at the surface of the soil to remove any wood that might be diseased. Sucker plants are left six or eight inches high. The prunings should be removed from the field and burned as a sanitary measure.

Cultivation should start soon after planting and continue until fall in order to keep weeds down and thus conserve all the moisture for the brambles. Roots of brambles grow near the surface, so the cultivation must be shallow to prevent injury to the root systems.

Cultural Practices

SYSTEMS OF TRAINING

Black- and purple-cane raspberries are usually limited to the original crowns in the rows. A light trellis is desirable to prevent the breaking of the young canes at the crown. The trellis may consist of a post for each plant and a piece of twine attached to the post and tied around the plant, or a two-wire support with a wire on either side of the plants. The height of the wires above the ground depends upon the vigor of the plants but is usually 18 to 24 inches.



Fig. 7. An inexpensive black raspberry trellis.

Red raspberries and blackberries are usually grown in a hedge row 12 to 18 inches wide. Blackberries, if "summer topped," will need no support. Red raspberries will require support. A trellis consisting of two wires, one above the other, to which the canes are tied is satisfactory, or the wires may be placed one on each side of the row about 24 to 30 inches above ground.

Dewberries are usually kept in the original crowns but may be grown in the hedgerow system. If in hills, they must be trellised. A trellis consisting of two wires arranged one on each side of the row on cross arms about 30 inches above the ground is satisfactory. The bearing canes are brought up between the wires after dormant pruning, laid on cross wires, and tied in place. The current season's canes are allowed to lie on the ground until the dormant pruning.

PRUNING

Bramble canes grow up one year, produce the crop the following year, and then die. Fruit is produced on shoots that grow from lateral buds on the one-year-old canes. (Fig. 8.) With this in mind, a discussion on pruning can be divided into three headings: summer topping, removal of fruiting canes, and dormant pruning.



Fig. 8. Fruiting habits of brambles. Left: Cumberland black raspberry. Right: Eldorado blackberry.

Summer topping or pinching out is practiced with black and purple raspberries and with blackberries. When the growing canes have reached a height of 18 to 24 inches, the grow-

ing tips are pinched back an inch or two. This stops terminal growth and forces the laterals to develop and assume a low, stocky appearance less subject to wind damage and better able to carry a load of fruit. It is necessary to go over the plantation several times to pinch the tips of the shoots as they reach the desired height. Since blackberries are normally stronger and more vigorous, they can be allowed to reach a height of 24 to 30 inches before pinching back. Red raspberries are not "summer topped" because they are slow to produce lateral branches and often fail to set fruit buds on the late growth.

After-harvest pruning is practiced with all brambles. The old canes which produced a crop are of no further value to the plantation and should be removed and burned. They crowd the new growing shoots and are a source of diseases and insects. If the canes are removed while still green, they can be cut off more easily than after they become hard and dry. (Fig. 9.)

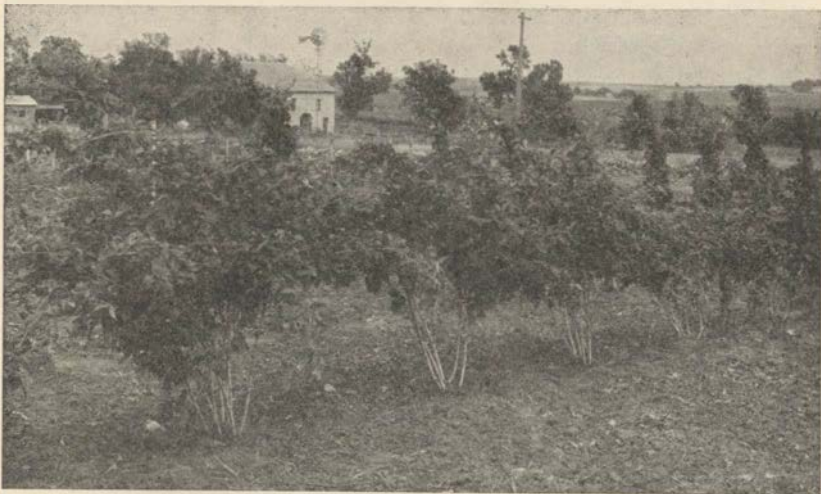


Fig. 9. Black raspberries pruned after harvest.

Dormant pruning is done in late winter when danger of severe freezing is past. By this time the amount of winter damage may be determined and the dead canes removed. If pruning is done too early there might be subsequent killing of fruiting wood and the crop thus be reduced. Dormant pruning, however, should be completed before growth starts in the spring.

The pruning of black- and purple-cane raspberries and of blackberries consists of heading back the laterals that grew the previous season. On vigorous black raspberries the laterals are cut to 8 to 12 inches in length and on purple-cane rasp-

berries and blackberries to 10 to 14 inches. All weak canes are cut off at the base, and canes that tend to lie on the ground are also cut off. Four to six branched canes per plant are sufficient to produce a good crop. (Fig. 10.)

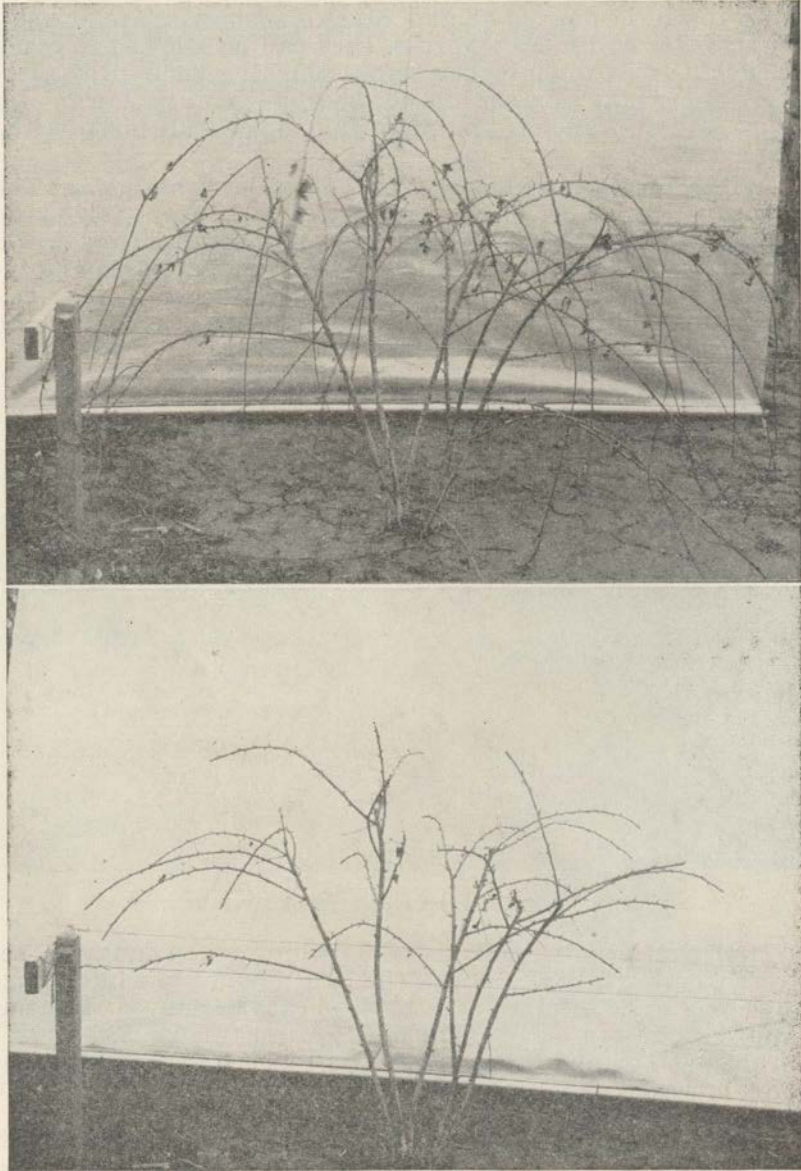


Fig. 10. A Black Pearl raspberry plant. Top: before pruning. Bottom: after pruning.

The pruning of red raspberries consists of cutting out thin canes and heading the strong ones back to four or five feet. If they are grown in the hill system, four to six canes are left to the hill. In a hedge row the canes are left six to eight inches apart.

Dewberries may require special methods of pruning, depending upon the type of trellis used. The weak canes are cut off at the base. Other canes are thinned out to six or eight per plant and these are headed back to six or eight feet and tied to the wires. If posts are used, more canes may be left per plant and all tied to the post and headed back to five or six feet.

Due to the difficulty of removing old fruiting wood after harvest without damaging the young canes, some growers cut off both the old and the new wood at the after-harvest pruning time. Such severe pruning may so delay the young canes that they will not have time enough to develop fruit buds before winter. This practice might be satisfactory in the southern part of the state if there is enough moisture for vigorous cane growth.

Pruning tools of three types are used in pruning brambles; the small hand shears, or "snips," long-handled loppers, and a pruning hook. The hand shears are used in heading the laterals and the loppers and hook in removing canes and old fruiting wood. (Fig. 11.)

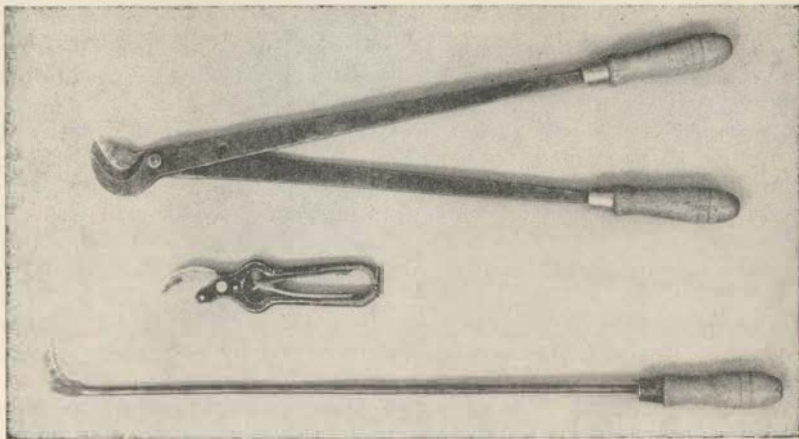


Fig. 11. Desirable types of pruning tools.

CULTIVATION

Frequent shallow cultivation during the spring and summer is desirable. Some hand work is always necessary to destroy weeds in the rows and to loosen soil missed by the tillage tools. A narrow disc and a "five-tooth" cultivator are good tools to use in a bramble plantation. Care should be exercised

to keep the ground level. There is often a tendency to work the soil towards the plants, making ridges where the rows are and low places between rows. Slight ridging is not objectionable if the rows are on the contour.

FERTILIZERS

The importance of organic content of the soil for brambles cannot be overemphasized. It has a marked influence on the water-holding capacity of the soil, the texture, physical condition of the soil, and the nitrogen content. In Kansas, moisture is more often the limiting factor than soil nutrients. As was mentioned under "selecting a site," the soil should have an abundance of organic matter when the brambles are planted. To keep up the supply, it is necessary to apply barnyard manure at the rate of 8 to 10 tons per acre each season and incorporate it into the soil. If barnyard manure is not available, a green crop of vetch, soybeans, or cowpeas can be plowed under. The cover crops are seeded in late summer and plowed under early in the spring. To supplement the cover crops, nitrogen-carrying commercial fertilizer, such as sulphate of ammonia or nitrate of soda, at the rate of 100 to 200 pounds per acre can be added. This should be applied early in the spring so as to be available when growth starts.

Phosphorus and occasionally potassium are beneficial on some soils, especially in southeastern Kansas. An application of 175 to 200 pounds per acre of fertilizers containing these materials is usually sufficient.

A **straw mulch** may be applied to small plantations if proper precautions are taken to avoid rodent damage and fire. Straw is difficult to get for a large planting and may be too expensive. If straw mulch is used, the layer should be deep enough to prevent weed growth. The straw will furnish organic matter, but it will be necessary to add a nitrogenous fertilizer. Straw is used occasionally as a winter protection on red raspberries or dewberries and then left under the plants in the spring. Each winter enough additional straw is added to maintain an efficient mulch.

Irrigation of brambles will increase yields almost every season. These fruits are easily damaged by droughts; a few timely applications of water may save the crop, and under extreme conditions may save the plants. During the ripening of the fruit and after harvest when the new shoots are growing and setting fruit buds for next year's crop are critical periods in bramble plantations. The supply of water at these times greatly influences the amount and quality of fruit produced. Furrow irrigation is most satisfactory on gently sloping land. Overhead irrigation is good but rather expensive. Surface irrigation with the "porous hose" is becoming popular.

Winter protection is necessary with some kinds and va-

rieties of brambles. Red- and purple-cane raspberries are most frequently injured, and dewberries such as Young and Boysen are also killed back badly every winter. In Kansas the winters are usually dry, and often the day and night fluctuation in temperature is wide. Such variations in temperature dry the small fruit plants and weaken them so much that they either die or do very poorly the following spring. Also the freezing and thawing of the soil may heave the plants partly out of the ground.

The winter protection, therefore, should aim to do three things: (1) Reduce the freezing and thawing of the soil, (2) reduce the freezing and thawing of the canes, (3) reduce the desiccation or drying out of canes.

Bramble varieties that need protection are covered with straw or with soil. (Figs. 12 and 13.) In covering brambles, two men usually work together. One workman bends the



Fig. 12. Straw used to protect red raspberries and dewberries.

plants and holds them down until the other covers them with soil. (Fig. 13.) Some growers pin the plants down with crotched sticks. This helps hold the plants even in wet weather when they might work out through the wet soil. The canes must be bent carefully to avoid breakage. Some growers use a plow to finish covering the plants by plowing on each side of the row, throwing the soil over the plants.

If straw is used to cover brambles it should be free of grain, as the grain will grow and become a weed. Since straw is light, it is necessary to pin the canes down before covering

with straw. About three or four inches of soil are sufficient to protect brambles, and from 8 to 12 inches of straw are usually applied.



Fig. 13. Demonstrating the proper method of covering Latham red raspberry canes with soil for winter protection.

The soil or straw must be removed from brambles before any growth takes place. The new shoots on the canes of brambles are very tender and will be damaged if uncovered after growth starts.

The method of removal of mulches varies. The straw is usually removed with a fork and most of it is left between rows. A small amount of the straw may be left among the plants to help hold moisture. The straw between rows will help at harvesting time by allowing pickers to walk on the straw after rains.

The removal of soil is more difficult and requires greater care to avoid bruising and breaking canes. One way to remove the soil is to use a shovel for the soil to within an inch or so of the canes. Then a strong fork is used, pushing the tines through the soil beneath the canes and slowly lifting up and shaking the plants. The soil will drop down among the canes and through the fork, permitting the plants to be straightened out. When the plants are again erect, the excess soil can be raked away from the base of the plants. The plants are now ready for their late winter pruning. All bruised or broken canes are cut out. All weak or crooked canes are also removed.

Bramble Pests

INSECTS AND MITES

The **tree cricket** occasionally causes damage to bramble canes. The injury is done by the females laying eggs into the canes. The eggs are laid in rows in characteristic slits. The canes often split down along the line of eggs.

When such canes are found during the dormant pruning they should be pruned out and burned.

The **red-necked cane borer** also attacks the canes. Young larvae of this insect bore into canes and cause gall-like swellings about two inches long. These swellings cause the canes



Fig. 14. Raspberry canes showing swelling due to red-necked cane borer

to split. Since the larvae overwinter in the galls, they can be killed by burning infested canes at pruning time. (Fig. 14.)

Red spiders cause bramble leaves to turn a whitish color and drop early in the season. The injury usually starts on leaves at the base of the plant and continues upward. Red spiders are more destructive during dry periods than during rainy seasons. A thorough spraying with a good grade of summer oil emulsion will control the pest. The oil is used at the rate of one-half to three-fourths of one percent; that is, two to three pints to 50 gallons of water. (Fig. 15.)

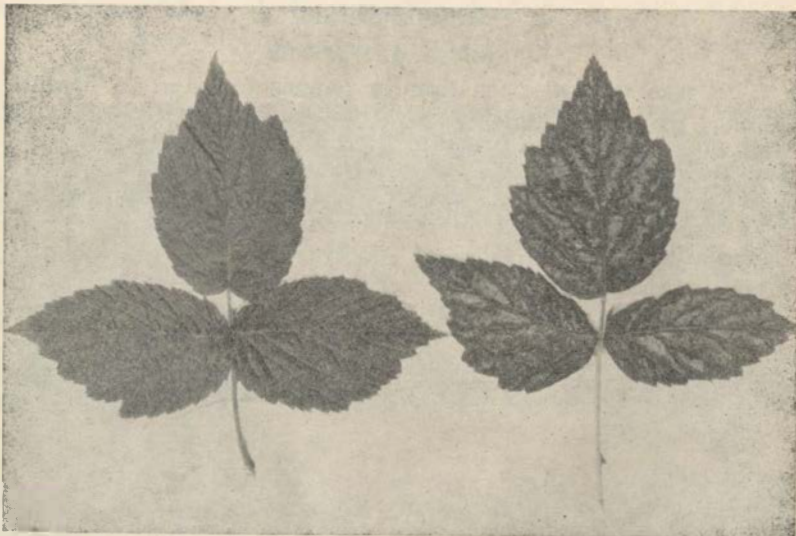


Fig. 15. The black raspberry leaves on the left are healthy; those on the right have been damaged by red spider.

The rose scale occasionally becomes abundant enough to encrust the lower portions of bramble canes. It gives the canes a white, scurfy appearance. It is called rose scale because it also infests roses. If the recommended liquid lime-sulfur applications are made for anthracnose, this insect will be controlled. (Fig. 16.)



Fig. 16. A raspberry cane infested with rose scale.

DISEASES

Anthracnose is one of the most destructive diseases of brambles. It attacks the stems, leaves, and fruit and often destroys the entire crop. On the young current year's shoots it first appears as small, sunken circular spots. Later these spots enlarge and become gray in color, surrounded by a reddish-purple margin. If heavily infected, the canes appear rough and warty and the cankers may partially or entirely girdle the canes. On the leaves the disease causes tiny spots

of light-gray color surrounded by the characteristic purple margin. Later the center of the spot dries and drops out, leaving a "shot hole" appearance. Diseased fruit dries without developing much size and often takes on a rusty brown color. (Fig. 17.)

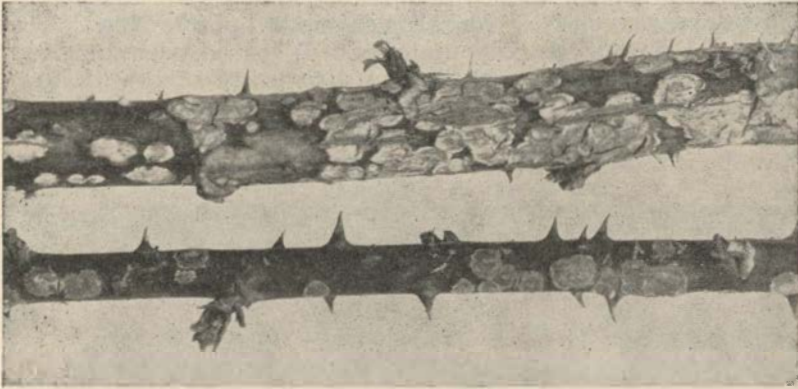


Fig. 17. Raspberry canes infected with anthracnose.

Control consists of sanitation, pruning, and spraying. All old bramble plants, either tame or wild, near the plantation must be destroyed. Weeds should be hoed out and berry plants kept open so as to keep the humidity low among the plants. All badly infected canes must be pruned out and burned. The old canes should be carefully removed after harvest so as not to bruise the young shoots.

Spraying should begin in the late winter or early spring before growth starts, using 1 gallon of liquid lime-sulfur to 10 gallons of water. A second application is made when the young shoots are about 6 to 10 inches high, using liquid lime-sulfur 1 to 35. If the disease is very bad, an after-harvest application of Bordeaux mixture 3-4-50 plus one-half pound of a casein spreader or a pint of summer oil may be applied.

● **Orange rust** is another disease which affects blackberries, dewberries, and black- and purple-cane raspberries. It is very serious because it infects the entire plant, including the crown and roots, so the entire plant must be removed and destroyed to stop the disease. Infected shoots grow rather spindly; leaves are narrow and grow upright and stiff. Later the orange-colored, blisterlike pustules appear on the undersides of the leaves. When dry the spores fall out and the entire plant has an orange, rusty appearance. The disease is spread by the spores or from roots of infected plants to the roots of healthy plants underground. Great care should be exercised in establishing a plantation to avoid setting infected plants. All old bramble patches and wild plants near the plantation

must be destroyed. Infected plants must be dug out, roots and all, and burned.

Crown gall is a bacterial disease causing warty, gall-like swellings at the base of the canes or on the crown and roots. (Fig. 18.) Such swellings may also occur some distance above the ground on the canes. The disease weakens the plants and decreases yields. Planting diseased plants should be avoided when starting a plantation. Diseased plants should be dug out and destroyed to stop the spread of the disease. Several years must intervene between plantings on infected soils, as the organism which causes crown gall may live in the soil two or three years.

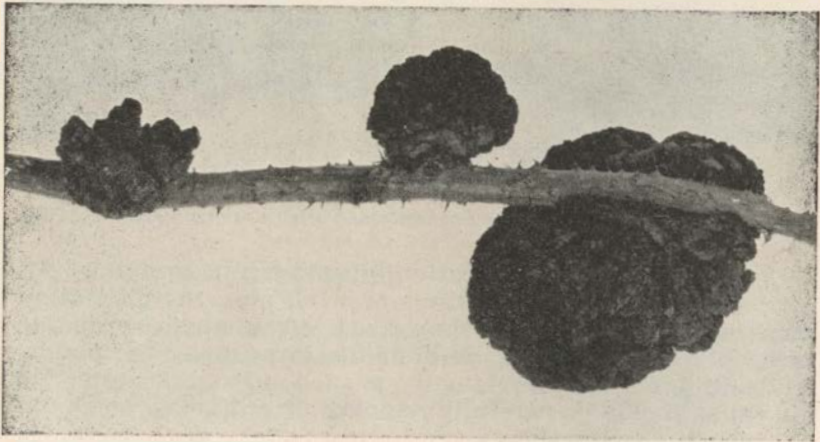


Fig. 18. Raspberry cane infected with crown gall.

Other diseases that sometimes damage brambles are mildew, leafspot, and virus diseases such as mosaic and leaf curl. It requires constant inspection to keep a bramble plantation free of diseases.

COMBINED SPRAY SCHEDULE

The spray season starts during the dormant season. Perhaps the best time for the dormant spray is in late winter or early spring after the plants have been pruned and before the buds start swelling. The material applied at this time is liquid lime-sulfur at the rate of 1 gallon to 8 or 10 gallons of water. This material is intended for anthracnose, but may help in the control of red spider. The fungicide apparently "burns out" the disease cankers on the overwintering canes and prevents their further activity on the canes. It thus lessens the spread of the disease to the new canes when they start to grow. Recent work indicates that this is the most effective spray against anthracnose.

This application must be thoroughly done or some cankers will be missed and serve as sources of infection for the new shoots. The canes should be sprayed from both sides, taking special care to cover the basal portions and the crowns thoroughly. Using pressure up to 250 or 300 pounds will help break up the spray and drive it in among the canes.

The second application is made when the young canes are about six inches high. This spray will protect the new canes against infection by anthracnose and mildew and will control red spider, aphids, and any leaf-eating insects. The spray mixture consists of liquid lime-sulfur $1\frac{1}{2}$ gallons, lead arsenate $1\frac{1}{2}$ pounds, and lime $1\frac{1}{2}$ pounds in 50 gallons of water. Raspberry shoots and young leaves are rather tender to lime-sulfur, so the spray should be allowed to drift in among the young canes rather than be blown forcibly against the new growth.

The last application is made after harvest. This consists of Bordeaux mixture with 3 pounds of copper sulphate, 4 pounds of hydrated lime, 1 quart of summer oil, and $1\frac{1}{2}$ pounds of lead arsenate to 50 gallons of water. This spray will control late anthracnose, cover the wounds caused by the removal of old fruiting canes, and also destroy any leaf-eating insects like sawfly larvae. If aphids are present the addition of a half pint of nicotine sulphate will control these insects.

Harvesting Brambles

Each picker should be provided with a carrier that will hold 8 to 12 cups. (Fig. 19.) In addition, a picking carrier that holds two one-quart cups made so it can be suspended from the waist is convenient. The large carrier can be left in the shade while picking into the smaller one. A supply of crates and cups should be obtained as soon as a fairly reliable estimate of the crop can be made. Since berries must be kept out of the sun as much as possible after they are picked, a packing shed is valuable in a commercial plantation. A simple shelter of rough boards in which crates and berry boxes can be stored and the packing done is worth what it costs. (Fig. 20.) It should be conveniently located.

Picking must be done at least two or three times a week, depending on the market, the variety, and weather conditions. Six to eight pickers per acre are necessary during the peak of the harvest. The pickers should be trained to pick the berries with the thumb and two fingers, not to hold too many berries in the hand and to place the berries carefully into the cups. Grading is usually done by the pickers to avoid excessive handling of the fruit. Since berries deteriorate rapidly after picking, they must be kept out of the sun and placed in cold storage without delay if they are not marketed. Berries mould quickly if packed while wet.

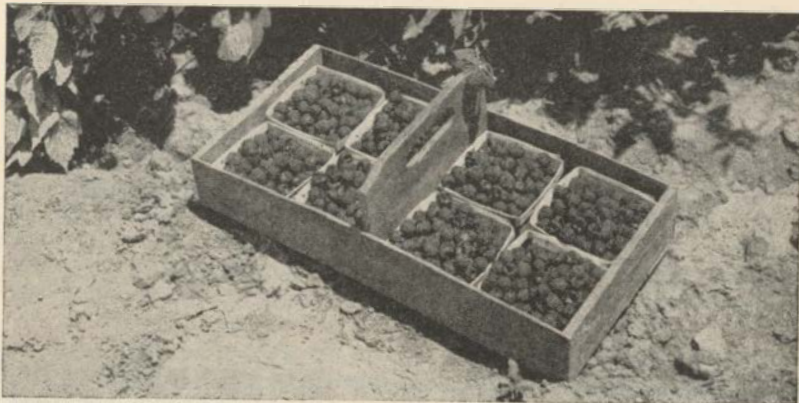


Fig. 19. A convenient berry box carrier.



Fig. 20. A packing shed like this adjacent to the berry field is convenient.

Raspberries are ready to pick when they separate readily from the receptacle. Blackberries and dewberries color before they are fully ripe; so for best flavor, pick the blackberries and dewberries when they separate easily from the plant and have developed a high sugar content.

Red raspberries and dewberries are usually packed in pint cups into 24-pint crates. (Fig. 21.) Blackberries, and black- and purple-cane raspberries are often packed in quart cups into 24-quart crates. The market demand usually determines the size of containers to use. Whatever the size, the box should be well filled with berries in first-class condition. A

few bad berries detract from the appearance of the whole box and lower the price. New, clean boxes and crates must be used if the grower wants to meet competition on the general market.



Fig. 21. Crates of Cumberland black raspberries properly sorted and crated for market.

Marketing problems are practically solved if good berries are grown and carefully picked and packed. Growers must guard against a glut in the market. Excessive offerings following unusual weather conditions or a double holiday often break a good market. Growers with small acreages may find it to their advantage to market cooperatively with other growers. This will enable them to put their fruit on more distant markets.

A favorably located roadside market is a good outlet for berries. Choice kinds and varieties of high quality, attractively packed and reasonably priced, will soon build up a good trade.

Gooseberries and Currants

Gooseberries and currants are native to the northern half of the United States, where the climate is cool and moist. Kansas is at the southern edge of this region, and hence these fruits do not succeed very well except on carefully selected sites and under special cultural practices. Gooseberries and currants are hardy and withstand the low winter temperatures, but are sensitive to summer heat and drought.

SELECTING A SITE FOR GOOSEBERRIES AND CURRANTS

A north or northeast slope should be selected for gooseberries and currants in order to protect the plants from the direct sun as much as possible. A sloping site also provides water and air drainage, reducing late spring frost hazard and danger of mildew. If only a few plants for home use are to be grown,



Fig. 22. A snow fence on the south side of gooseberry bushes will protect them from hot south winds. The unprotected portion of the row in the foreground has been replanted twice.

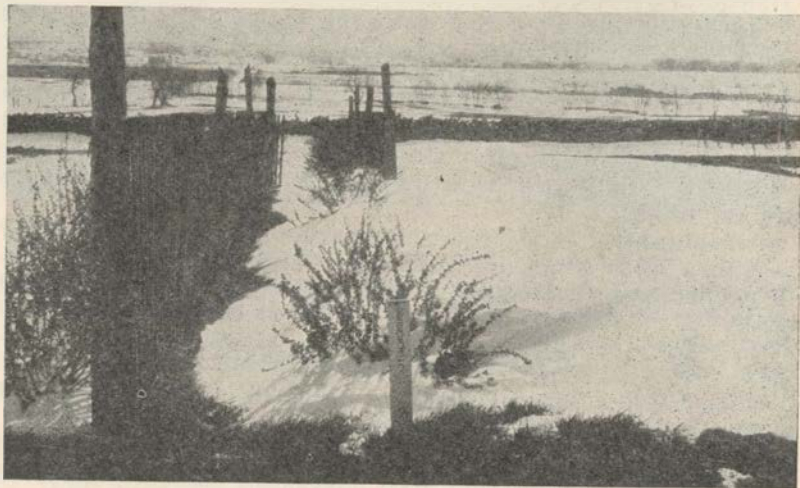


Fig. 23. Snow caught by a windbreak on the north will supply considerable moisture for the following season.

they can be planted on the north side of a building or a snow picket fence (Figs. 22 and 23) or in some other partly shaded or sheltered place. Low frost pockets must be avoided, as these fruits blossom early in the spring and are likely to be injured by late spring frosts.

Heavier types of soils such as clay loams are more desirable for gooseberries and currants than are light sandy soils. Heavier soils retain moisture better and remain cooler. The soil should be well drained and fertile.

PLANTING GOOSEBERRIES AND CURRANTS

Planting is generally done in early spring before growth starts. Plants are set deep enough that the lower branches are below the level of the soil in order to develop the bush form. All broken roots should be cut off and the top reduced to three or four branches, each six to eight inches long. Always pack the soil firmly about the roots.

Distance between plants will depend upon the system of culture and upon varieties. The usual distance between plants is four to six feet and six to eight feet between rows. A one-horse cultivator can be used if the rows are six feet apart. Small varieties, if cultivated by hand, can be planted four feet by four feet.

Cultivation should start soon after planting and be repeated often enough to keep the weeds down. Both gooseberries and currants are shallow rooted, so cultivation must be shallow to avoid damage to the roots.

A mulch of straw or other vegetable material is beneficial in conserving moisture, in keeping the soil cool, and in preventing weed growth. If mulch is used, care must be taken to prevent rodent damage. The mulch should be moved away from the immediate base of the bushes in the fall and some bait, such as poisoned grain, placed around each plant.

PRUNING GOOSEBERRIES AND CURRANTS

Tools used in pruning brambles are satisfactory for pruning gooseberries and currants. (Fig. 11.)

Pruning is a sort of renewal process in which the oldest wood is removed or headed back each year. Gooseberries and currants bear fruit on one-year-old wood and on spurs on older wood. In general, pruning consists of removing branches three years old or older close to the crown and removal of some of the young branches if they become too numerous. Branches which tend to droop to the ground are removed for better air circulation and for keeping the berries off the ground. (Fig. 24.) Pruning is usually done in late winter or early spring before growth takes place.

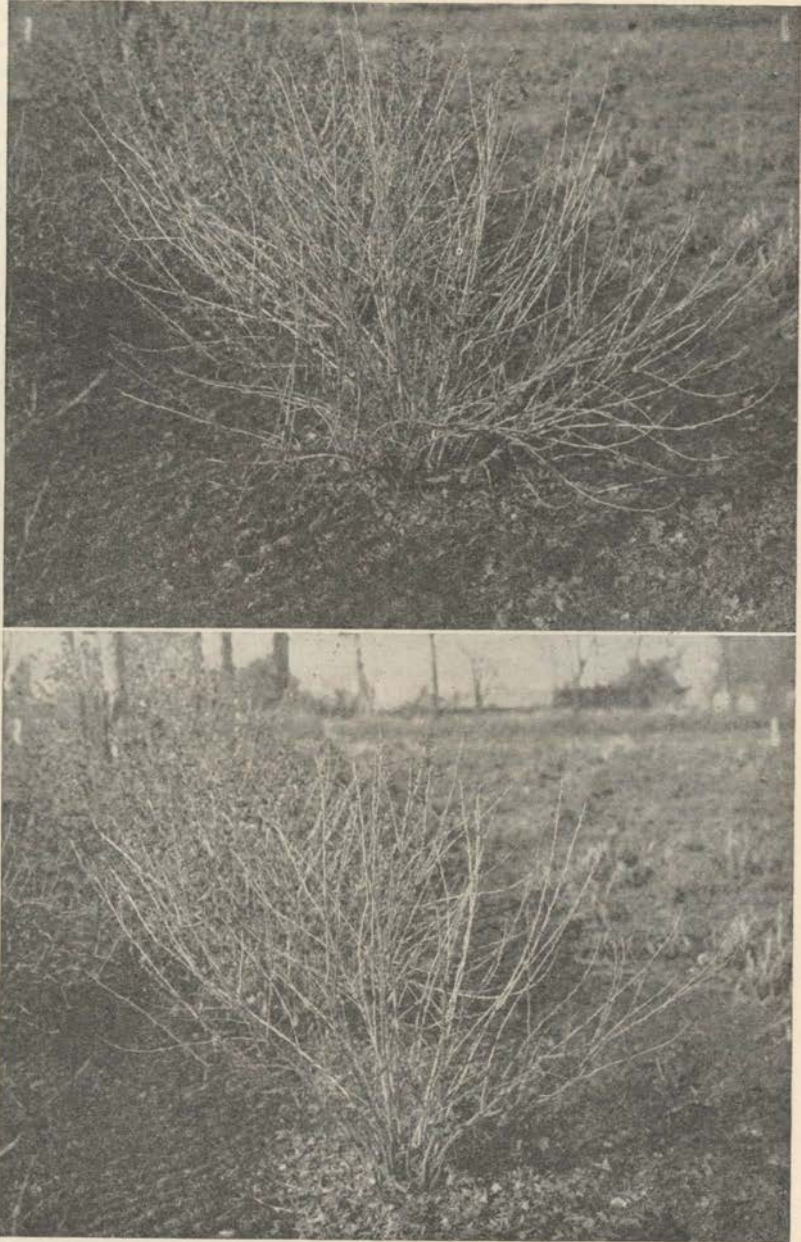


Fig. 24. A gooseberry bush before and after being properly pruned.

SPRAYING GOOSEBERRIES AND CURRANTS

The principal pests affecting gooseberries and currants are the currant worms, aphids, red spiders, mildew, and leaf spots. Three sprays are usually sufficient for currants and gooseberries. The first application, consisting of liquid lime-sulfur $1\frac{1}{2}$ gallons or dry lime-sulfur 4 pounds and lead arsenate $1\frac{1}{2}$ pounds to 50 gallons of water, is made as soon as the first foliage is fully unfolded. A second spray is applied just before blossoming, using the same mixture. The third application is made after harvest, using Bordeaux mixture 3-6-50 and lead arsenate $1\frac{1}{2}$ pounds. If aphids are present at any time, nicotine sulphate 1 to 800 is applied. Red spiders are controlled by spraying with one of the commercial summer oils according to the manufacturer's directions or by dusting with sulfur.

VARIETIES OF GOOSEBERRIES AND CURRANTS

The American varieties of gooseberries are usually better adapted to Kansas conditions than the European varieties. The varieties most commonly grown are Downing, Houghton, Glendale, and Pearl. The North Dakota Agricultural Experiment Station recently introduced three varieties, Pixwell, Perry, and Abundance, which seem worthy of trial in Kansas.

Currant varieties most commonly grown are Cherry, Fay, Perfection, Red Cross, and Wilder.

Recent work indicates that some of the native currants may be desirable. The Crandall and Golden Prolific are among these varieties. The native currants stand hot, dry weather exceedingly well.

HARVESTING THE CROP

Gooseberries are usually picked before they are fully ripe. They develop a better flavor and require less sugar if left on the bushes until they start turning red. The berries are often stripped by hand, using leather gloves, for local market or for immediate use. Leaves can later be removed by fanning. Choice gooseberries should be picked with special care to avoid injury to the fruit. Large-fruited fancy varieties are picked over twice. Gooseberries have been known to yield from 100 to 300 bushels per acre.

Currants which are to be used for jelly should be picked before fully ripe. Fruit for jams, stewing, or for spicing should be ripened on the bushes. Currants are picked by the stems to avoid bruising.

Quart baskets are suitable for gooseberries and currants as picking containers and also for marketing. A carrier like the one illustrated in Figure 19 can be used in picking these fruits.

THE WHITE PINE BLISTER RUST

Currants and gooseberries are considered the chief agencies in the spread of the white pine blister rust. These fruit plants are alternate hosts for this destructive white-pine disease. For this reason a rather strict quarantine law has been imposed on gooseberries and currants in many states where white pines are grown.

Since gooseberries and currants are outlawed in many states and limited in production in others due to the white-pine blister-rust problem, it would seem that the production of these fruits could profitably be increased in Kansas where very few white pines are found.

Home Preservation of Bush Fruits

It is not within the scope of this circular to discuss fully the preservation of bush fruits. There are many ways of canning and preserving these fruits for future use. Since the preservation of fruit by freezing is new, a short discussion of this method is included.

There are four generally recommended methods of packing bush fruit for freezing:

1. Packing whole without sweetening. The berries are sorted, washed, and put into containers without any further treatment.

2. Packed whole with sugar. This method is especially desirable if the fruits are to be used in cooking. The fruit is sorted, washed, and packed with sugar, using one part of sugar to three or four parts of berries. The berries and sugar are allowed to stand for some time to dissolve the sugar before freezing.

3. Packed whole with syrup. The fruit is sorted, washed, and packed into containers, and covered with a 50-percent syrup. The syrup will dilute the flavor somewhat, but it preserves the shape of the berries and desirably penetrates the fruit during storage.

4. Sliced or crushed and packed with sugar. This method is recommended for deformed berries, for berries that lack uniformity in size, and for berries to be used later as crushed fruit for ice cream or other uses. The berries are either sliced, chopped, or crushed and mixed with sugar, using three or four parts of berries to one part of sugar.

CONTAINERS

A wide range of containers for frozen berries is available on the market. Any of several brands of paraffin-coated paper-board cartons is satisfactory. Cellophane bags are cheap and if properly sealed and protected by paperboard boxes are satisfactory. Wide-mouthed fruit jars are expensive, but they can be used repeatedly. (Fig. 25.)

Fruits for freezing should be well ripened on the plants, but not too soft, and placed into the freezer locker soon after picking.

In general, frozen fruits are used in the same way as are fresh fruits. They retain much of the fresh flavor and the vitamins found in fresh fruit. Freezing is a quick way to preserve bush fruits.

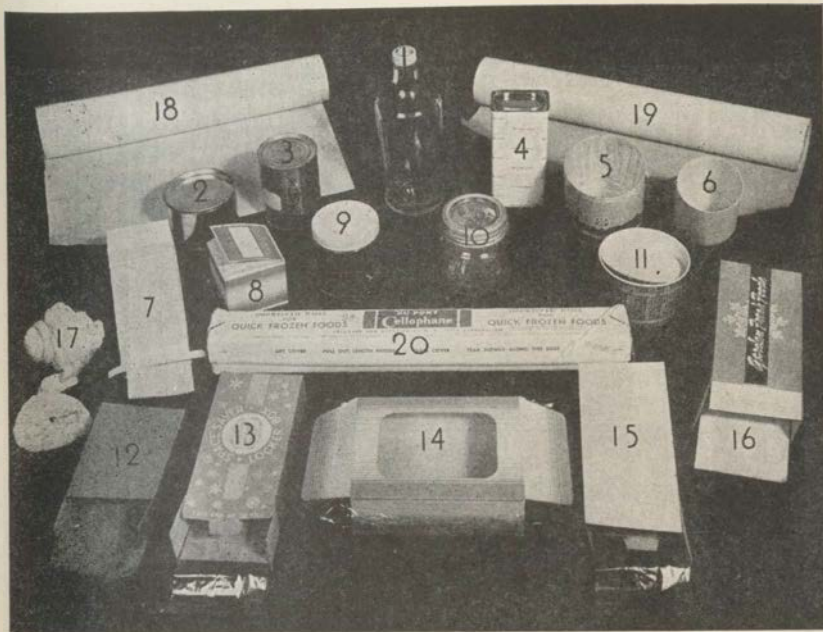


Fig. 25. Types of containers for storing food in frozen food cabinets and materials used in wrapping meats. (1) Bottle for fruit and vegetable juices (wider at top than bottom) (2) Lacquered tin can with slip-in cover made by American Can Company. (3) Tin can hermetically sealed on small home sealer. (4) Paper carton with metal top (opening too small). (5) Paper carton with pleated cellophane liner made by Sealright Company. (6) Paraffined carton made by Sealright Company. (7) Locker-Pak parchment cover with waxed inner liner made by B. C. Betner Company. (8) Dacca Pack, cubical waxed carton made by Container Corporation of America. (9) (10) Wide-mouthed fruit jars. (11) Lily-Tulip cup with disc lid. (12) Lindley carton with cellophane bag as liner. (13) Southerland carton. (14) Cellophane-covered carton made by Menasha Products Company. (15) Cellophane-lined carton. (16) Carton with waxed paper bag. (17) Stockinette used in wrapping meats, birds, etc. (18) Paper-cellophane combination wrapping material. (19) Locker paper for wrapping meats. (20) Cellophane for wrapping foods for the cabinet.