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Growing Raspberries and Blackberries

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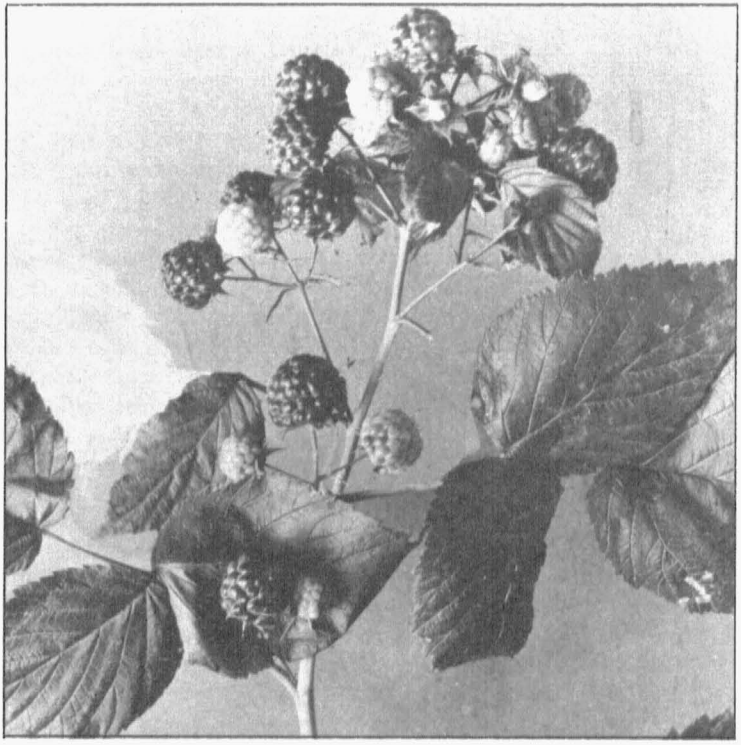


COLUMBIA, MISSOURI

Growing Raspberries and Blackberries

H. G. SWARTWOUT AND W. R. MARTIN, JR.

The brambles offer a number of advantages to any one interested in the growing of fruits. They mature their crops at a time of the year when there is very little fresh fruit on the market coming in after the strawberry season is over and before most of the local tree fruits begin to ripen. Not much capital is required to go into the business—there being no more than a small investment in a sprayer, cultivating tools and a packing shed or shelter. In many cases equipment already on hand will suffice at least in the beginning. The plants come into bearing early—if gotten off to a good start a fair crop will be produced the year after the plants are set—thus giving quick cash returns. New plants for extending the planting can be easily propagated from one's own patch and shifts to new and better varieties or adjustments in locations can be made within a comparatively short time and without much expense. It must be kept in mind, however, that care will need to be taken in the selection of a place to grow them, that they are not without their troubles from diseases and insects although these are not unsurmountable, that the crops are affected by droughts especially near and during the ripening period, that the fruit must be picked regularly and frequently and disposed of quickly and that from time to time red raspberry canes will be winter killed.

Adaptation and Demand

The blackberry is one of the most widely adapted and dependably productive of the various fruits that may be grown in Missouri. There has been no general effort, however, to develop a market demand for blackberries. In fact, the inferior quality of the fruit generally available has had more or less of a depressing effect on sales. Blackberries are sour unless well ripened and are of poor flavor and of unattractive appearance unless well grown and correctly handled. By placing a more palatable and attractive product on the market an increased consumption of blackberries could no doubt be brought about. This means growing them within easy reach of the markets preferably for daily deliveries early in the morning while the fruit is still fresh, bright and in possession of its full and natural flavor. The abundance of wild berries in some sections has had a tendency to hold down the cultivation of blackberries but there are large areas in which there is little or no wild fruit available. Moreover, much of the fruit gathered from wild

plants is soft, over-ripe and otherwise unfit for general market purposes. It soon spoils and is definitely local in utilization. Even in sections where wild fruit is available there is usually some demand for a market quality product.

There is a generally good demand for raspberries and with a suitable site, proper choice of varieties and correct cultural care good yields can be obtained. Although rather exacting in their requirements there are several regions in Missouri where soils are generally favorable for their development and there are scattered sites suitable for local market production in practically every part of the state. With the introduction in comparatively recent years of better varieties the possibilities for the successful growing of raspberries has been increased.

Dewberries and others of the trailing type of blackberry, such as the Boysenberry, in contrast to raspberries, are better suited to the more southern part of the state. There is every indication that the Boysenberry will do well under the climatic conditions of southeast Missouri and with the demand good for a high dessert quality of fruit of this type there are possibilities in local market culture in this section. However, when ripe enough to have good quality the berries are soft and must be disposed of quickly and with little handling. It can be grown in a limited way in extreme southwest Missouri but in view of tests and observations to date it is of very doubtful value even for home production in other parts of the state.

With the importance of getting the fruit to the consumer as soon as possible after picking and the fact that there is little distribution to outlying markets, raspberries and blackberries can well be grown as local market crops near more of the smaller consuming centers where such fruits may be largely unavailable. They can be grown as an enterprise in themselves where the volume of sales will justify or in connection with a diversified farming or fruit growing program. They are well suited for planting in conjunction with local market vegetable growing enterprises and may be grown as intercrops in young apple orchards.

Considerations in Making Market Plantings

Before making a planting of brambles, information should be obtained as to the kinds for which there is a market demand or for which there may be a decided preference in the region in which the fruit is to be sold. While there is usually an outlet for all kinds certain ones can more often be disposed of to better advantage and in larger quantities than others. In some localities red raspberries are more in demand than black raspberries, in other places the demand for blackcaps is the greater. The purple raspberries are not widely known but by those who have tried them they are considered the best of the raspberries for jam making and similar culinary uses, besides being of good quality as a fresh dessert fruit.

Where they are not known they have sometimes been discriminated against. In some instances they have commanded a premium on the market. The demand for blackberries is variable. In many cases it is dependent upon the quality of the product offered for sale.

For local market and roadside sales it is usually advisable to include in the planting all three kinds of raspberries along with blackberries, with varieties to extend the season from early to late where suitable varieties are available. Unless it is known that large quantities of fruit can be sold at a reasonable profit, that the grower is experienced in the culture of brambles and that conditions are favorable for their development, it is advisable to start with a small planting to be enlarged as returns and market demands justify.

It is not always profitable to grow those brambles for which there is the greatest demand or for which there is a premium in price because of very low yields or uncertainty of crops. The Boysenberry except in southeastern and perhaps extreme southwestern Missouri, and the high quality but winter tender varieties of red raspberries are cases in point. While it is advisable to beware of markets well supplied with raspberries and blackberries the production of a high quality product carefully handled and offered in attractive packages will often return a profit on a market for which there is plenty of fruit but of an inferior quality. These various factors of market supplies, demands, and prices along with the suitability of available sites should be carefully weighed before making a planting or enlarging a planting already made.

The location of a bramble planting should be such as to permit quick disposal of the fruit without long or rough hauling. Look for the best available site in a locality.

Selecting a Site for Brambles

The site for a blackberry or raspberry planting should be carefully selected from the standpoint of air and water drainage, exposure and soil. Consideration should be given to the best available place on the farm. This is particularly true of raspberries and unless at least a reasonably favorable piece of ground is available it would be advisable to seek elsewhere for a good site or forego planting them altogether.

Topography and Exposure.—Land high enough and without timber obstruction so that air can drain to lower levels is desirable in choosing a site for brambles. Diseases such as anthracnose also are worse in low enclosed areas where air movement is restricted and humidity is high. These conditions apply more to raspberries than to the upright blackberries. Flat upland areas in Missouri are commonly underlaid with a water impervious, claypan layer near the surface and become water soaked during rainy periods and excessively dry during summer droughts, conditions under which raspberries soon perish and which are highly unsatisfactory for blackberries.

High or exposed positions which are wind swept are undesirable. The drying effect of winter winds increases winter injury to canes while summer winds lead to greater loss of water by the plants and break out the new shoots of black and purple raspberries. Land near the foot of a hill often provides a good site for brambles. Such an area is somewhat sheltered from strong winds, if it has an outlet to lower levels it will have suitable air drainage, and the soil is more fertile and moist than at higher elevations. A north slope, where available, is generally to be preferred. The humus content of the soil is more easily maintained and it is cooler and more moist than southern exposures, conditions conducive to larger berries and higher yields. The fruit, however, is a few days later in maturing than on a southerly slope.

Soils.—Good water-holding capacity of the soil is important. Shortage of water just before and during the ripening period reduces the size of the berries even causing them to "dry up" to such an extent as to make them worthless. On the other hand there must be good underdrainage. Proper underdrainage is dependent upon a subsoil open enough for the "free" water to drain away. To determine the character of the subsoil a liberal scattering of borings should be made or holes dug over prospective sites. Subsoils of a brown or reddish color are more open and drain better than those of a yellow or gray color. Gravelly and sandy soils do not have sufficient water holding capacity while heavy clays do not absorb water readily and much of the moisture they contain is not available to the plants. Silt loam underlaid with a slightly heavier subsoil for water retention are in general best although any of the range from sandy loam to clay loam is satisfactory if other conditions are suitable.

Soils of at least moderate fertility and well supplied with humus are desirable. High fertility, however, is less important than good texture. Fertility can be increased, if necessary, by applying fertilizers, and humus added by turning under green manure crops or other organic matter. Blackberries are less exacting in their requirements than the raspberries but for commercial production should be grown under at least reasonably favorable conditions. Deep soils which will permit the roots to invade the soil to a depth of several feet provides a greater area from which to obtain moisture and nutrients. The roots of brambles cannot penetrate heavy claypan layers to any great extent.

Isolation from Diseases.—As a precaution against diseases brambles should not be set on land that has been occupied by them in recent years. Raspberries in particular should not immediately follow tree fruits or grapes since these plants are quite commonly affected with crown gall to which raspberries are highly susceptible. Blackberries are subject to crown gall but are not often seriously

damaged. Land which has been in ordinary field crops for several years is likely to be relatively free of crown gall organisms.

Propagating the Brambles

The methods of propagating the brambles are relatively simple, the production of good plants, depending largely upon disease conditions and upon the soil. Plants that show any evidence of such troubles as crown gall, the virus diseases of raspberries, and orange rust of blackberries should not be used as propagating stock. Young plantings set with strong plants and making a vigorous growth are a safer source of planting stock than weak plants and old patches.

A loose sandy or silt loam will give better crowns and a heavier root system than soils which are tight.

Black and Purple Raspberries.—The black and common varieties of purple raspberries naturally propagate themselves by means of plants produced at the tips of the canes. The best plants are obtained, however, by placing the tips into the soil and firming it about them. The canes are ready for "tipping in" when the ends become somewhat swollen and assume a "snaky" bending with the leaves small and wrinkled. This condition usually develops in late August or early September but sometimes does not occur until later. Brushing about by wind or lying on hot ground may so damage the tips that new plants will not develop. This condition has been rather common in Missouri with some of the purple varieties. In other instances a profuse growth of short laterals is produced each of which may root but the plants are weak and undesirable. The kind of plants wanted to start a new planting are well developed plants produced singly or no more than two or three at the ends of large sized vigorous canes.

One method of "tipping in" is to lift out a shovelful of soil, place the tip in the hole which is 2 or 3 inches deep, replace the soil, and firm it to prevent drying and to keep the tips from being pulled out by wind. Pushing a spade or trowel into the soil in such a way that the tips can be inserted vertically or nearly so is better than horizontal layering. More rapid layering can be accomplished by plowing out a furrow, pulling the tips into place and covering by any convenient manner. The plants are left undisturbed over winter to be lifted in the spring as they are needed.

Blackberries.—The best blackberry plants for transplanting are produced from root cuttings. These are made from roots about ½ inch in diameter, cut into 3 to 4 inch lengths. They may be made during the winter and buried in a well drained soil out-of-doors or stored in a moist material in a cool place; or, the roots dug and the cuttings made in the spring as they are to be planted. The cuttings are dropped horizontally, 3 or 4 inches apart, in trenches about 3 inches deep and soil firmly packed over them. After one season's growth they are ready to dig and set in the field.

Suckers which grew the year before along the sides of the main part of a blackberry row may be dug in the spring and used in starting a new planting. They are removed with a 4 or 5 inch section of the parent root attached to the bottom of the cane.

Red Raspberries.—The propagation of the red raspberry is by means of suckers growing from underground stems. The canes along the sides of fruiting rows may be dug and used in setting a new patch or the young suckers just as they appear above ground carefully lifted just as they are needed and set in their new location without delay.

Trailing Blackberries.—Most of the dewberries and the Boysenberry propagate readily by means of tip layerage as employed for black and purple raspberries.

Varieties

Two or more varieties ripening at different times are desirable especially for local and roadside marketing where suitably adapted varieties are available. It should be borne in mind, however, that in this section of the country the hazards of production are greater with the later maturing kinds. None of the everbearing varieties are worth growing in Missouri.

A number of new varieties have been introduced in comparatively recent years some of which have proved their worth; some others are promising but information on them is limited. Extensive planting of varieties that have not been tested in this section is inadvisable. A variety that may be vigorous and productive in some other part of the country may be ill adapted here. Growers should be critical of glowing descriptions especially of new varieties.

Red Raspberries.—Most varieties of red raspberries are quite subject to winter injury and to the ill effects of summer heat and droughts in Missouri. For this reason caution should be observed in planting extensively any but thoroughly tested varieties.

Latham: The most generally planted and has been the most dependable red raspberry in Missouri.

Chief: Fruit earlier but smaller and of higher quality than Latham. Less productive than Latham but is in general the best early variety of red raspberry at present.

Black Raspberries.—

Bristol: Very large firm berries of excellent quality, ripening a few days before Cumberland. One of the most vigorous and productive of all the blackcaps tried. Recommended for a considerable part of any planting.

Cumberland: Has been the standard commercial variety for this section because of good production but in recent trials both Bristol and Dundee have been bearing heavier crops. Midseason.

Dundee: Midseason. Not as vigorous but as productive as Bristol in limited trials. Promising for local markets.

Logan: Large firm fruit of good quality ripening ahead of Cumberland. Of sufficient promise to include as an early variety.

Purple Raspberries.—These are hybrids between black and red varieties and are more vigorous in growth and more productive than either parent. They are not widely known but are worthy of more attention. The fruit is of a purplish tinge and somewhat more tart than red raspberries in which group they would be considered from the standpoint of sales. They are excellent for canning, for making jams, and for use in ice cream. The season of ripening is later and longer than blackcaps.

Sodus: Fruit very large, firm and of good quality. With Potomac the best of the purple raspberries for Missouri at the present time. A little later than Latham.

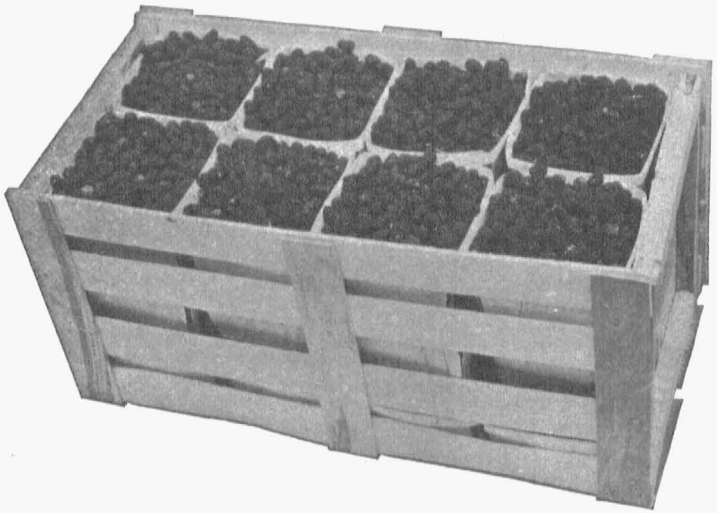
Potomac: A little smaller but firmer berry than Sodus and the plants are considered more disease resistant.

Blackberries.—There are two groups, the early and the late maturing. Early Harvest represents the former while other varieties belong to the latter group. By planting Early Harvest, Alfred, Eldorado and Brainerd where the latter can be grown a picking season of about 6 weeks can be had.

Eldorado: Midseason. Pure stock practically immune to orange rust. The most extensively planted variety.

Alfred: A little earlier than Eldorado. Orange rust has shown up in several plantings. Has been subject to a late leaf spot. A promising new variety.

Early Harvest: An early blackberry but small in size and of only fair quality. Highly productive outyielding all other varieties in



A 24-quart crate of Early Harvest blackberries. Blackberries are often packed in quart boxes but pint containers are usually preferred for raspberries, dewberries, and Boysenberries.

a ratio of 2 to 1 in Missouri. Very susceptible to orange rust usually being only a matter of time until plantings become seriously affected. Of value for its extra earliness and very high yields.

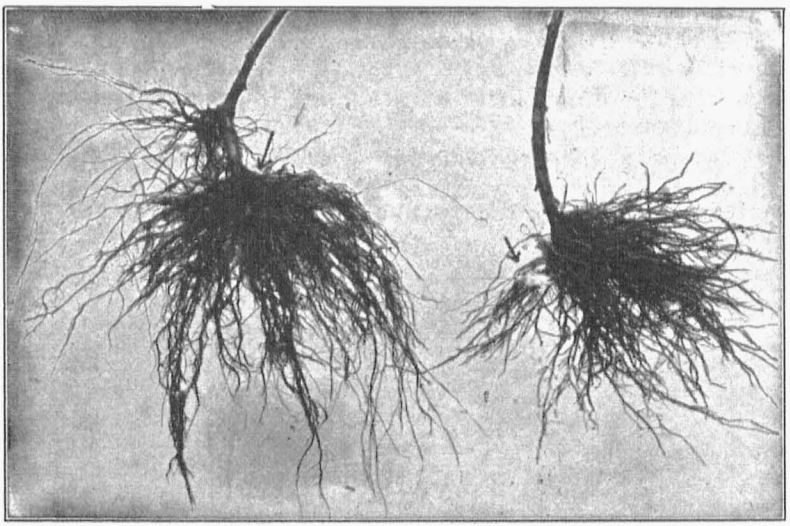
Brainerd: A promising new variety for south Missouri. Very vigorous and because of sprawling habit should probably have a support. Very productive, late. Berries of only medium size of fair quality when well ripened. Good for culinary uses.

Boysenberry: A variety for extreme southern Missouri. Fruit very large, dark red, almost black, soft, excellent quality. Very vigorous growth, prostrate and should be fruited on a trellis. Not highly productive here. Very susceptible to anthracnose and cane borer. When grown outside of southeast Missouri it should have winter protection in the form of straw or soil.

Lucretia: If a dewberry is to be grown Lucretia is recommended.

Planting Stock

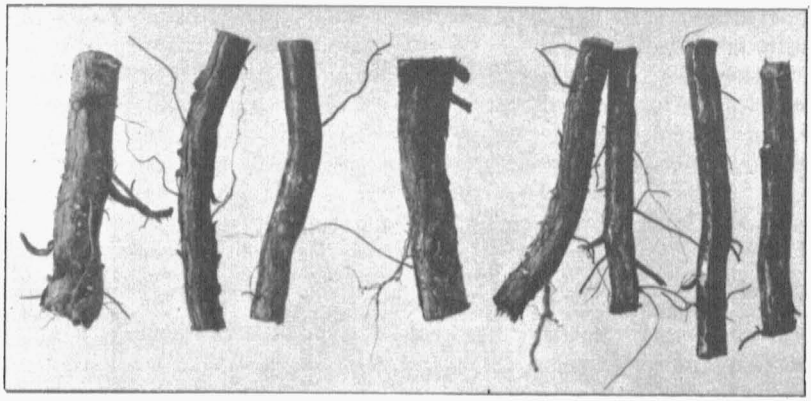
Planting stock may be purchased or produced at home. In any case only vigorous healthy plants should be used in establishing a new plantation.



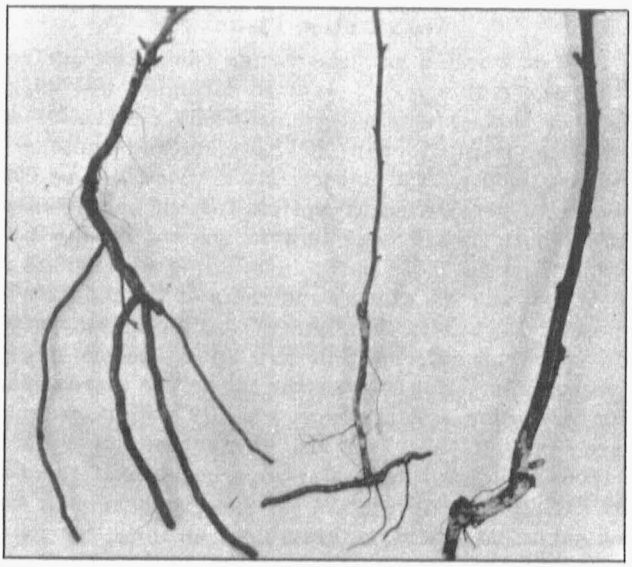
Tip plants of black raspberry showing young shoots arising from the crowns of the new plants. The plants should be set before these shoots become any longer.

All the brambles are sensitive to drying of the roots and prompt care of the plants upon arrival is necessary to prevent injury from drying out and heating. If for any reason the plants cannot be set within a day or two after they are received the packages should be opened, the plants spread one layer deep in trenches and covered with loose moist soil worked well in among the roots and firmed

about them. If there is any sign of the plants being dry they will be benefited by soaking the roots in water for 4 or 5 hours before healing the plants in a trench. It is important with brambles that there be as little delay as possible between the time of digging and setting.



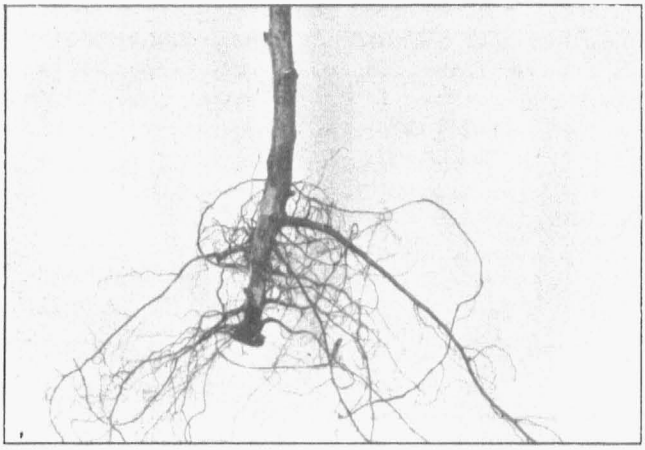
Blackberry root cuttings. Roots ¼-½ inch in diameter are cut into 3 or 4 inch lengths.



Left, a root-cutting blackberry plant with well developed root system. Such a plant will become established and make a good growth the year it is set. It is the type of plant recommended for starting a new planting. Center, a sucker plant dug with a section of the parent root. Right, a pulled sucker plant a very poor type.

Root cutting plants of blackberries have better developed root system than sucker plants and for this reason can be depended

upon to develop a good row sooner. Tip plants of black and purple raspberries and of trailing blackberries are better than transplants. Red raspberries are sold as 1 year sucker plants. The first grade is nearly always the best buy.



A red raspberry sucker plant.

The Planting Plan

On level land or where a mulch covering the entire surface is to be maintained the plants may be set in straight rows at regular uniform distances but on sloping ground where cultivation is to be practiced it is advisable to run the rows on the contour. Even on gently sloping land with a uniform grade there will be continual sheet erosion with perhaps imperceptible loss of soil from year to year but in a short time a considerable amount of the best soil, that on which effort has been spent in building up organic matter, will have been lost and the crowns and roots of the plants will have become exposed. Decline in the vigor of the plants may at first be hardly noticeable but deterioration will soon become more rapid and more pronounced. The steeper the grade the more severe will be the form of erosion and the more rapidly will it occur. With soils that are none too "deep" the loss of much of the surface layer may make them unfit for future plantings because of the nearness to the surface of a poor tight subsoil. Humus is considered essential in the practical management of bramble plantings, for its effects in relation to soil nutrients, texture of the soil, moisture holding capacity, and water absorption. Moisture is another highly important factor in bramble production. Contour planting prevents the washing away of the humus bearing soil and increases water intake which may prove especially valuable in the summer when much of the water from heavy rains might otherwise be lost in runoff.

With the land worked down to a fairly even grade by filling in depressions, contours are established, and the rows laid off to conform with the contour lines, with some slight but practical modifications, such as elimination of wavy lines to make even sweeping curves and some shifting of the spacing between rows to better fit in point rows. Pronounced depressions should not be planted but sodded down to serve as spillways, to catch any soil that may flow down the middles, and to avoid too irregular rows. If they are very large a hay crop may be taken from them, if they are narrow cultivating tools can be dragged across to the middles to the other side. They also may serve as turnways and convenient alleyways in picking and spraying.

The plants should be set at the general ground level and not on ridges. With cultivation soil will be worked gradually from the middles to the plant rows forming essentially a small terrace at each row. A fair ridge will be developed the first year and will be complete the second year.

Another system of merit in contour planting is to alternate contour bands wide enough for several rows of brambles with grass bands. Hay may be harvested from these contoured grass strips. Later they may be planted to brambles with the bramble strips seeded to hay crops thus forming an alternating rotation system.

On steep land contour planting with cultivation is open to question at least unless done in connection with some mulching. Complete mulching is probably the best treatment for such situations.

Contours cannot be established without a "level" instrument. Any attempt to do otherwise is pure guess work, and the county agent should be consulted about laying out contours.

In plantings of any appreciable size cross alleyways, greater spacing between certain rows or both are important from the standpoint of convenience in spraying, of getting packages into the field, of removing picked fruit and where mulching is done for hauling it in to convenient distributing points.

Preparation of the Soil

Growing some intensively cultivated or hoed crop on the land a year or two before the time of planting will do much to eradicate weeds and improves the tilth of the soil where sods are turned under. Unless the soil is well supplied with humus some green manure crop, preferably a legume, which has been well fertilized and cared for to promote a heavy growth should be turned under the year before the planting is to be done; or, 10 to 20 tons per acre of stable or barnyard manure may be applied and plowed under in the fall or early spring either as a supplementary treatment or in the place of a green crop. Plowing should be deep and in most cases is best done in the fall. Before planting, disk and harrow the soil until it is well pulverized and firmly packed.

Planting Distances

The spacing of plants is determined largely by the system of culture and the vigor of growth of the variety. The closer the planting the higher the yield up to the point where the plants seriously compete with one another. Adequate moisture is most likely to be the limiting factor. Sufficient space must be allowed for picking, the use of tillage tools, and where spraying is to be done the handling of equipment.

Black and purple raspberries are usually set in rows 7 or 8 feet apart. A good distance between plants in the rows is 3 to 3½ feet for blackcaps and 3½ to 4 feet for the purple varieties.

A suitable planting distance for red raspberries is 3 to 4 feet in the row with 7 to 8 feet between the rows. Blackberries are usually set about 3 feet apart in rows 8 feet apart.

Such vigorously growing trailing blackberries as the Boysenberry may be set 6 to 8 feet apart with about the same distance between the rows. Six feet is perhaps far enough between plants except for very fertile soils. The common varieties of dewberry when grown in rows are usually set about 3 feet apart.

Red raspberries and dewberries when grown in the hill system are set and maintained at a distance of 5 x 5 or 6 x 6 feet.

Planting

Time of Planting.—The best time to set tip plants of black and purple raspberries is early in the spring while the plants are still dormant or nearly so, the first part of April or even earlier in the southern parts of the state. After the plants have started to grow the new shoots are likely to be damaged in handling and planting, or the plants may not become well established before the advent of hot dry weather. If set in the fall the plants are subject to winter injury.

Red raspberries and blackberries may be set either in the fall or spring but in general spring planting is preferred. Fall set plants need to be protected during the winter by plowing soil to them from each side of the row or by mulching.

Setting the Plants.—Drying of the plants between the time of digging and planting, or after setting from failure to properly firm the soil about the roots is a common cause of the failure of plants to grow.

Drying during planting can be held to a minimum by carrying the plants to the field in wet burlap or a tub of water and by setting the plants as they are dropped. If the day is warm and sunny, protection against the drying effects of sun and wind can be afforded by dipping the roots in a puddle of clay and water.

Setting is usually done in holes opened with a spade or in trenches made by plowing out a furrow. Whatever method is used the important points in setting operation are to avoid bunching or crowd-

ing of the roots, to firmly pack moist well pulverized soil about the roots and crowns and not to get the growing points too deep or too shallow. The best way to get a well set plant is to do the preliminary work with the hands. The remainder of the soil can then be shoveled in and firmed about the plants with the feet. Care must be taken not to pack the soil too tightly if it is a little wet.

With the black and purple raspberries and the trailing blackberries the crowns are covered to a depth of 2 to 2½ inches unless the soil is quite sandy when deeper planting is advisable. Ordinarily red raspberry and blackberry plants are set 3 inches or if the soil is sandy 4 inches below the surface of the ground. Blackberries may be set a little deeper than red raspberries. If plants are set too deeply the new shoots may not be able to push their way to the surface of the ground, if set too shallow they are subject to drying out, to droughts, to injury from winter heaving, and the new shoots are more likely to be broken down or blown out by winds.

The "handle" or short section of old cane left on tip plants when digging and which is for convenience in handling should be cut off close to the ground as it may constitute a source of anthracnose infection. Stakes may be set at intervals to serve as row markers in the early cultivations. If by necessity planting is delayed until new growth is well started there may be some advantage in not removing the handles but any flower clusters that develop should be removed.

Large canes of vigorous red raspberry and blackberry plants are shortened to 15 to 18 inches, small canes are cut to a shorter length. Too heavy cutting back of the canes weakens the plants.

Cultivation

Cultivation should begin early and be as frequent and as thorough as is necessary to keep down weeds and the soil loose enough to absorb water from rains. Cultivation should be shallow. Deep working of the soil damages the roots and causes excessive suckering of blackberries and red raspberries. Cultivation during the picking season is not advisable unless the soil is becoming hard packed from tramping by the pickers. Working loose dry soil is both unnecessary and stirs up a dust that makes the berries dirty. Cultivation should cease in August in time to plant a cover crop or allow the natural wild grasses to grow to harden the canes and promote greater winter hardiness by drying out the soil.

Mulching

Mulching is an excellent method of handling plantings of raspberries and blackberries, the chief problem where the patch is very large being the cost and availability of mulching material. Mulches should be applied deep enough, 3 or 4 inches after settling, to keep down all but the larger weeds and must be maintained by additions

from time to time as the under part decays. There are further advantages to mulches which outweigh their value in controlling weeds, weed control being mostly a matter of convenience. They keep the surface soil cooler in hot weather, the soil beneath becomes loose and open, absorbing heavy and frequent rains better than bare soil and the moisture from light showers is held instead of being largely evaporated into the air, as is the case with uncovered soils. Mulching is not advisable on soils that do not have good underdrainage because of water logging with excessive rains. Furthermore, it must be kept in mind that mulches are a fire hazard.

Grain straw, spoiled hay, sweet clover, strawy manure, and other similar coarse material may be used. The value of mulching is well exemplified by the development of wild blackberries at the fringes of woodlands under a natural covering of leaves. If sufficient material is available the entire surface of the ground may be covered but in market plantings applications are most commonly made only in the plant rows, the middles being cultivated in the ordinary manner. A chemical nitrogenous fertilizer such as sulfate of ammonia at the rate of about 200 lbs. per acre will need to be applied immediately before or soon after the mulch is applied to replace the nitrogen temporarily tied up by the mulching material.

Fertilizing the Brambles

There are other conditions than the lack of plant nutrients in the soil that affect the growth and yield of brambles and before any fertilizer is used it should first be determined whether poor growth may not be due to a lack of humus in the soil, shortage of moisture, poor drainage, disease, or incorrect cultural care. Fertilizers will not compensate for the lack of favorable conditions in these respects.

Good production in brambles is dependent upon a vigorous cane growth. While excessively heavy vegetative development may in some cases be undesirable the greatest difficulty under ordinary conditions of field culture is in getting enough growth. With black and purple raspberries it is almost impossible to over stimulate the plants. With blackberries and red raspberries cane growth beyond a moderately vigorous condition has not in all cases been accompanied by a corresponding increase in yield.

A liberal supply of humus in the soil is important in any soil management program with brambles. Organic matter as it decays furnishes nitrogen and brings about other conditions favorable for plant development and cannot from a practical standpoint be substituted for with commercial fertilizers. It may be supplemented by the addition of a nitrogen fertilizer such as sulfate of ammonia or nitrate of soda where conditions would seem to warrant its use. The former might be used at the rate of 150 to 200 lbs. per acre and the latter at 200 to 250 lbs. per acre. The greatest returns for the amount of fertilizer used are received where it is applied to plants

growing under favorable conditions and making a moderate growth rather than very vigorous or weak growth. With proper preparation of the soil there should be nō need for fertilizers the first year or two after the plants are set if no mulch is applied. In bearing fields broadcast the fertilizer in the middles between the rows shortly after growth begins. Heavy applications of a nitrogen fertilizer may cause the production of soft berries.

There has been little or no response in Missouri from superphosphate applied for its direct effect on raspberries and blackberries. Value from superphosphate and to a large extent from commercial nitrogen fertilizers is probably best obtained through the stimulation of green manure crops to be turned under before the planting is made and through their use on cover crops, after the planting is established. For this purpose 300 lbs. of superphosphate and 100 to 150 lbs. of a nitrogen fertilizer for non-legumes are suggested. Potassium fertilizers are rarely needed.

Stable or barnyard manure, 10 or 15 tons per acre up to 20 tons on poorer soils, is an excellent material furnishing nitrogen and helping to maintain the humus content of the soil. Apply it during the winter or early in the spring before growth begins. Hen manure, furnishing largely nitrogen, may be used up to 2 or 3 tons per acre.

Cover Crops

The growing of cover crops between the rows in late summer is valuable in helping to maintain humus in the soil and if a legume is used for supplying nitrogen, in checking erosion on sloping land not otherwise protected against washing, and in hardening the canes for the winter by competing with the brambles for moisture and nutrients. Most cover crops are sown in August or early September after moisture conditions become favorable for their growth. Seeding is sometimes done in July but with dry weather there may be a poor stand or with an early heavy growth the withdrawal of water may be so great as to prove harmful to the brambles. For the development of the cover crop about 300 lbs. of superphosphate or a fertilizer high in phosphorus is usually advisable and if needed for vigorous growth this may be supplemented by about 100 lbs. of nitrogen fertilizer such as nitrate of soda or sulfate of ammonia but no more should be used than will be utilized by the cover crops. Too much nitrogen in a wet fall may delay the maturing of the canes.

Winter killing crops such as oats, millet, and soybeans are generally more manageable than an overwintering crop. Oats at the rate of 3 bushel per acre with liberal fertilization has proved to be one of the best of several cover crops tried over a period of years in the Station's experimental fields. Soybeans which should be seeded soon after the berries are harvested are valuable for their ability to add nitrogen to the soil. The rate of seeding cover crops should be liberal in order to secure a dense growth of vegetation.

Pruning and Training

Habit of Growth.—Pruning and training practices are based upon the growth habits of the brambles. Those brambles grown in this section of the country have perennial roots with biennial tops, that is, the roots live for many years while the tops live only two years or more correctly a part of two years. Each spring new shoots arise from buds at the bases of the older stems (in the case of upright blackberries and red raspberries shoots grow also from roots or underground stems). These shoots reach full size the first growing season. The next spring the buds grow out into comparatively short leafy shoots terminated by a flower or cluster of flowers. After the fruit is matured the canes die. New shoots produced that year from below ground produce the crop the following year.

Black and purple raspberries and the trailing blackberries such as the dewberries, Boysenberry and Youngberry grow in clumps making it a comparatively easy matter to keep them confined to the plants originally set. Red raspberries and the upright blackberries send up sucker shoots at random from the original plants and unless means are taken to curb them they will continue to extend out to form thickets. Unless the plants are kept confined to rather limited areas the value of the plantings is greatly reduced. In wide rows most of the canes do not receive enough light and there is too much competition for moisture and nutrients for good development. While it is quite within the realm of possibility to so handle thickets as to get good results it is not feasible to give the plants the care they should have. Picking is difficult and many berries will be overlooked until overripe.

Time of Dormant Pruning.—The winter or dormant pruning of brambles should be delayed until late winter or early spring before growth begins. There is then less risk of drying out and dying back from the cut ends; also such injury as the canes may be subject to will already have occurred and such damaged wood can be removed.

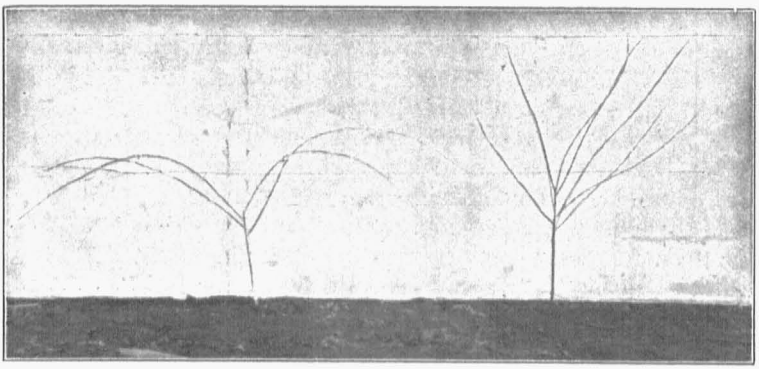
Black Raspberries

Young Plantings.—With the shock of transplanting the plants may not make enough growth to require any pruning the first summer after the plants are set.

If the plants make a vigorous early start, 2 or 3 inches of the tips of the new shoots should be broken out when they have reached a height of about 18 inches. This treatment is called "topping." It strengthens the main stem and induces the growth of laterals near the top. Unless the shoots reach 18 inches by midsummer no topping should be done.

The following spring before growth starts any small weak canes are removed and the laterals of the stronger ones shortened to 4 or 6 inches. If no summer topping was done the stronger canes

are headed back to within about 2 feet of the ground or enough to prevent them bending or breaking to the ground with their load of fruit.

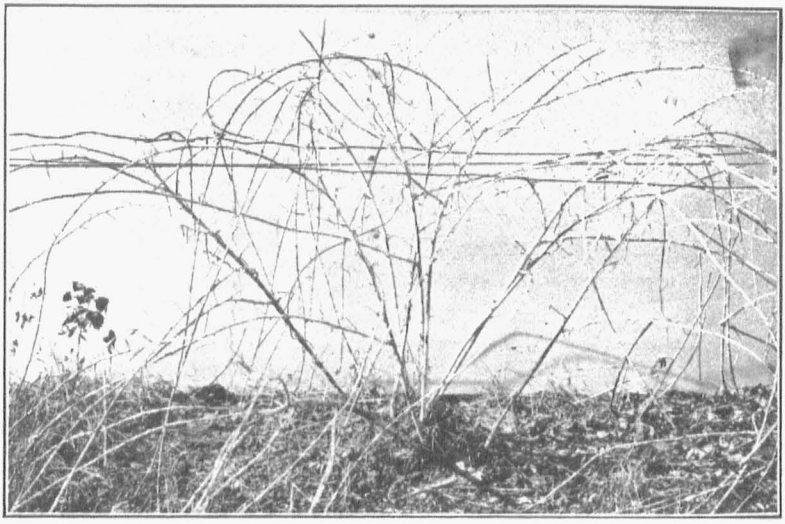


Left, a black raspberry cane showing the laterals produced by breaking out 2 or 3 inches of the tip of the new shoot when 18-20 inches high. Right, an Early Harvest blackberry cane carrying several well developed laterals induced by pinching out the tip of the new shoots when about 24 inches in height.

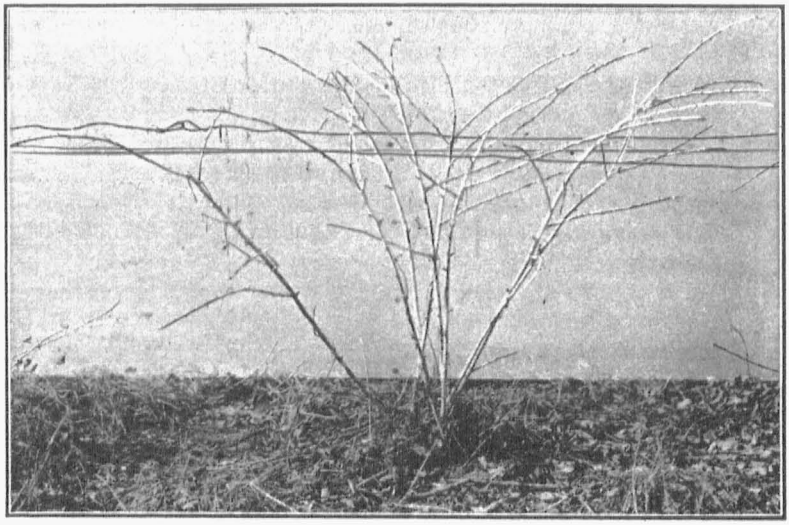
Pruning Mature Plants.—In May and June as the new shoots reach a height of 18 to 20 inches the top several inches are broken out. This stops terminal growth, induces a thickening and strengthening of the stem and the production of laterals within a foot of the top. Sometimes the topping is delayed until most of the shoots have reached or passed the 18 inch level when they can all be topped at one time to the same height or possibly a little higher for the older and taller ones. This has the advantage of avoiding confusion of new shoots with vigorous laterals from previous pinchings. It seems better, however, to make 2 or 3 trips over the patch when most of the shoots are reaching 18 inches in order to top them at about the proper time. When shoots are allowed to grow a foot or more too high and are cut back severely the laterals are slower in starting and weaker. In topping, 2 or 3 inches of the tip should be taken out. This favors wide-angled strongly anchored laterals which is not always the case when just the tip end is pinched out. Low topping tends to develop canes strong enough to stand up under a load of fruit without the use of any kind of mechanical support.

In late winter before growth begins all small and badly damaged canes and laterals should be removed and the remaining laterals shortened to 8 to 12 inches depending on the number of laterals per cane and the size of the canes. There should be no thinning out of the larger healthy canes as their removal unnecessarily reduces the yield.

Heavy cutting back of the laterals reduces the number of berries per cane but in the case of black raspberries increases the size of



A black raspberry plant before pruning.



The same plant after pruning. The laterals have been thinned and shortened.

the individual fruits compensating in large part for the reduction in number. As between short laterals and those of moderate length the quality of fruit is improved and there are fewer berries to pick with little or no reduction in total yield. The prevailing practice is to leave the laterals too long.

After the fruit has been harvested the old canes may be removed. In general it seems a better practice to cut them out as soon as possible after the fruiting season is over although they are sometimes left until the time of the late winter dormant pruning of the new canes. The chief advantage in leaving them seems to be to support the new growth and this is sometimes an important consideration.

Purple Raspberries

The purple raspberries have the same general habit of growth as the blackcaps and are pruned in the same general way. Being more vigorous, the shoots are headed some 6 inches higher and the laterals left several inches longer than the blacks. Twelve to 15 inches is long enough to leave the laterals and a little shorter seems to give the largest berries.

Red Raspberries

Red raspberries are most commonly trained in Missouri to a hedge row in which suckers are allowed to grow at random between and to either side of the original plants. This hedge row should be kept narrowed to not exceed 18 inches, 12 to 15 inches is better.

As the shoots should not be topped and heavy heading back of canes is undesirable, they sometimes become too tall and slender to carry a load of fruit without bending to the ground or breaking in which case some kind of support should be provided. A simple type consists of a line of posts in the middle of the hedge row with a wire on each side. Short cross arms may or may not be nailed to the posts but cross wires are necessary at intervals between the posts to keep the two wires from spreading too far apart.

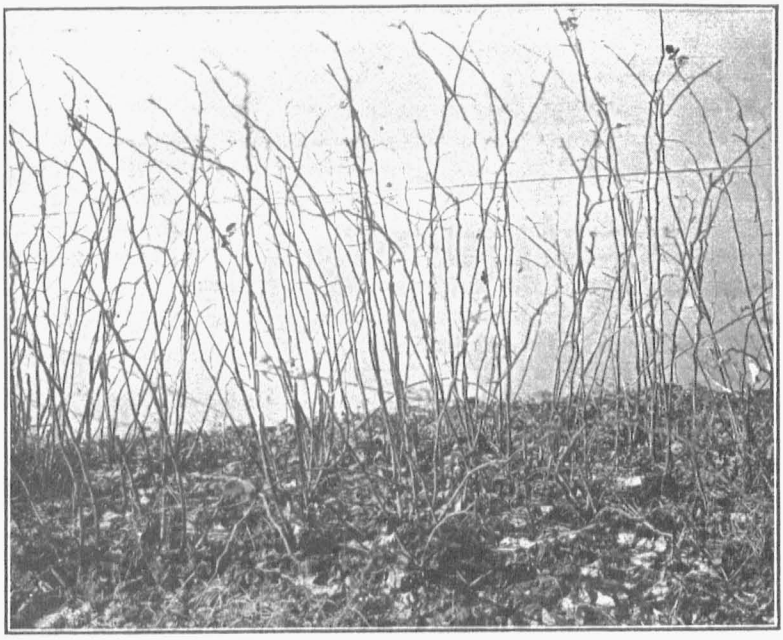
In some sections the hill system is employed. The plants are set 5 x 5 feet or 6 x 6 feet with cultivation in both directions. Stakes about 5 feet high to which the shoots are rather closely tied are used as supports. Another method is to encircle each hill of canes one or more times with a soft twine in such a way that the clump becomes self-supporting.

While the hill system has some advantages the yield is usually less than from well managed hedge rows.

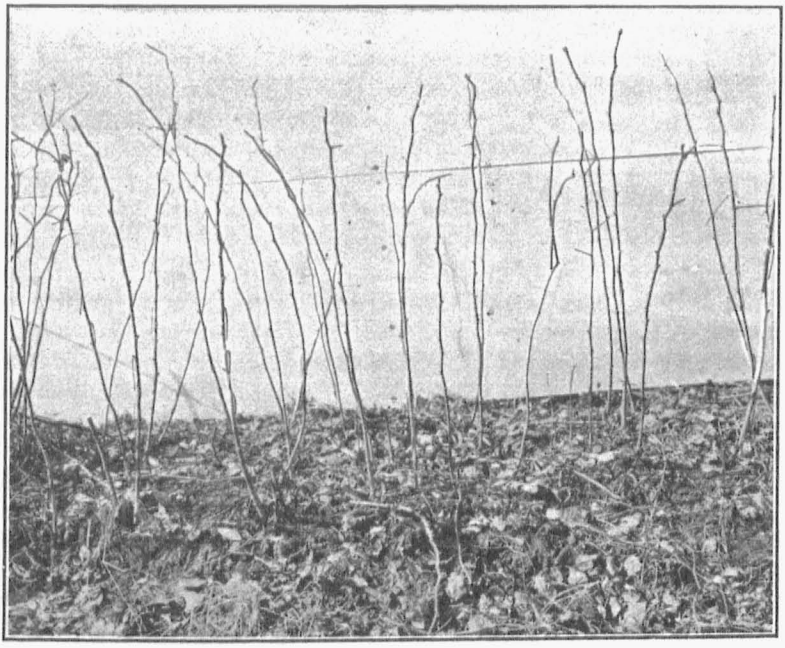
Topping of the shoots is not practiced with red raspberries. Laterals tend to be weak or make a straggly growth that is difficult to manage, it induces extra suckers usually underdeveloped, and the wood is more subject to winter killing.

Dormant pruning should be delayed until late winter or very early spring, but it should be done before growth begins. The previous year's fruiting wood is removed if it has not already been taken out. Weak and damaged canes are removed. Thinning out strong canes is a questionable practice. In the hill system 3 to 8 canes are left depending upon the age and vigor of the plants.

Unless the tips of the canes have died back during the winter very little heading back should be done, just enough to remove the



Section of a red raspberry row before pruning.

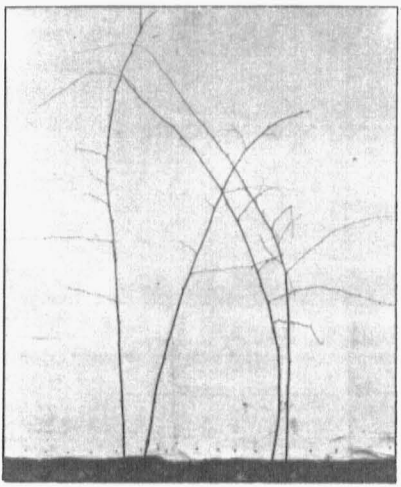


Same red raspberry row after pruning. The weak canes have been removed and the remaining ones shortened enough to remove winter injured wood.

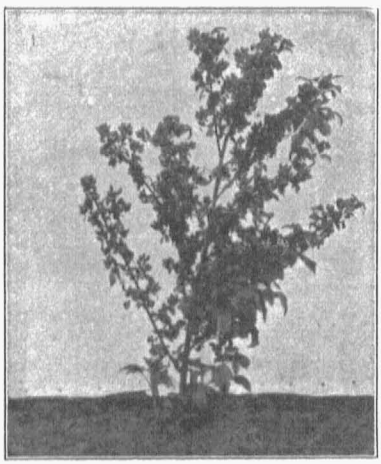
small weak portion at the end or to make the canes a little more manageable. If very tall, a support may be required to hold them up. Heavy cutting reduces the number of berries without a compensating increase in size.

Erect Blackberries

The erect growing blackberries are trained to the hedgerow system in which the canes are allowed to fill a strip up to 2 feet in width and the shoots topped to induce low branching and to strengthen the canes so that they will stand without a supporting trellis. Other systems are sometimes used but this method seems well suited to Missouri conditions.

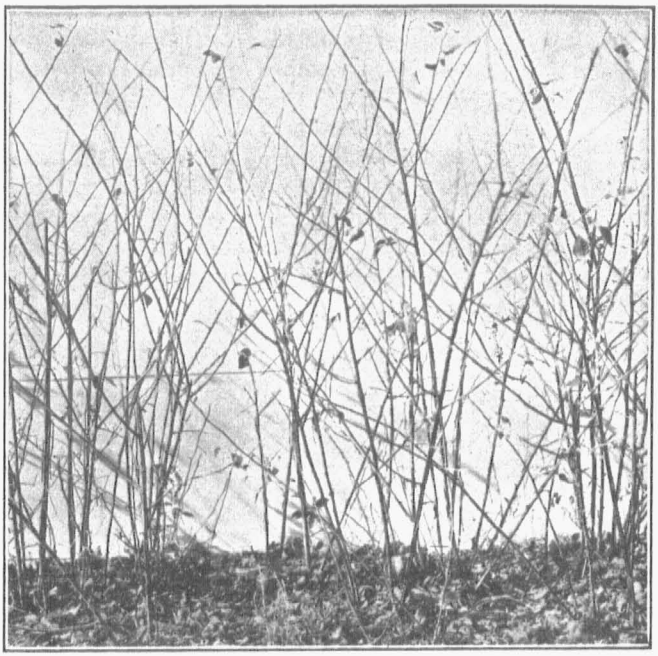


Type of blackberry canes produced when no "topping" is done. The canes are tall with poorly developed laterals.

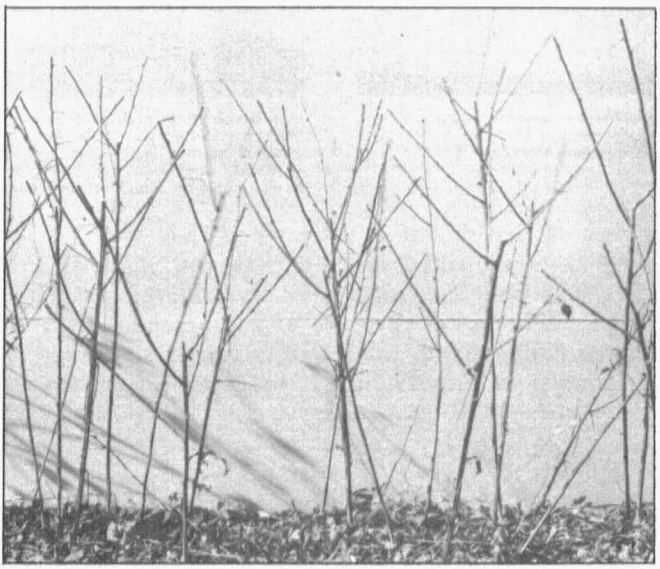


A blackberry cane which was topped at the proper height. Note the short stocky growth of the cane with well distributed laterals, enabling the cane to carry a heavy crop of fruit without a support.

The topping of the shoots is done when they reach a height of 24 to 30 inches—the height varying with the vigor of growth of the variety. The bearing canes may be removed as soon as the fruit has been harvested as they are of no particular value. Before growth starts in the spring, weak and damaged canes are removed, the others thinned to 8 to 10 inches apart on the average and the laterals shortened. With Early Harvest which carries fruit buds close together and close down to the main stem the branches should be cut back to 8 to 10 inches. A length of 12 to 18 inches is satisfactory for most of the commonly grown late maturing varieties. With a heavy stand of canes and long laterals unless there is an abundance of water the berries may be small and "seedy." Under drought conditions much of the fruit may never mature. On soils that are not very fertile or moist the thinning out of the canes to a somewhat greater distance is advisable.



Section of a blackberry row before the dormant pruning.



Same blackberry canes after pruning. The weak canes and laterals have been removed and the remaining vigorous laterals shortened.

Trailing Blackberries

The new shoots of the dewberry, Boysenberry, Youngberry, and other trailing blackberries are allowed to grow on the ground and remain there over winter. They are kept pulled in to the row by the cultivator which is run in the same direction at each cultivation to avoid breaking the shoots or producing a tangle. Various kinds of supports are used to hold the canes off the ground while fruiting. A common and satisfactory type is a vertical two wire trellis similar to that used for grapes, with the lower wire 2 feet from the ground and the upper one 3 feet for dewberries and 4 to 4½ feet for the Boysen-, Young-, and other long caned varieties. In the spring before growth begins the weak canes are removed and the strong ones are lifted and tied to the wires. A method that has been satisfactory with the Boysen variety is to thin the canes to 4 to 6, more may be left if the plants are unusually vigorous, cut them back to a length of about 8 feet, spread fanwise, loop over the top wire and tie to the lower one. Other methods of distribution that will admit light may be used but long free ends of canes should be avoided.

Picking

Care in picking and handling is of utmost importance. The berries are soft and easily bruised or crushed and fruit in this condition is unattractive in appearance and will soon spoil.

Raspberries are ready to pick for the market as soon as they will separate readily from the receptacle or "core." By this time they will have acquired good color and are still fairly firm. If picked too early the berries are lacking in flavor and some varieties crumble badly in pulling them loose. For home use for dessert purposes they should be left until fully ripe.

Blackberries should not be picked until they have softened slightly and will separate easily from the cluster. As blackberries color before they are ripe there is a tendency to pick them too soon. Such berries are sour and are objected to by consumers.

To pick the fruit use the thumb and two fingers and hold only a few berries in the hand at a time. Raspberries are pulled straight off the stem while blackberries are given a slight side pull. The berries should be placed not dropped into the containers in which they are to be marketed. The fruit is too soft to permit sorting or transferring from one container to another.

A common method of picking in this section is to use carriers holding 4 or 6 boxes, the carrier resting on the ground near the picker or supported on short legs. In some cases the box is held in one hand and the picking done with the other hand. In some sections carriers are built to hold one or two boxes, these carriers being strapped to the waist of the picker. Do not pick into buckets from while the fruit will have to be transferred. Keep the berries in the shade as much as possible. Exposure to the sun overheats and damages the berries.

Blackberries when exposed to the sun for very long turn a reddish color and develop a bitter taste.

At the beginning and near the end of the picking season gathering the berries every third day will be often enough but at the height of the season they should be picked every other day and if the weather is warm and the berries are ripening rapidly, going over the patch every day may be worthwhile. More uniform fruit is secured and with clean picking there will be few overripe berries with which to contend. A few soft or defective berries may spoil the market value of an entire box. If for any reason picking is delayed and overripe fruit accumulates it may be advisable to have pickers carry two boxes with them separating the overripe from the firm fruit as it is gathered.

The best time for picking is in the morning as soon as the dew is off. At this time the berries are cool and "fresh" and the pickers work better than in the heat of the day.

Packing

Berries for the market are packed in pint or quart boxes. The American style box is a substantial attractive container which is popular in this section.

Red raspberries, dewberries, and Boysenberries are usually packed in pint boxes. While there is some demand for these fruits in quart boxes they carry better in the smaller containers and consumers generally prefer to buy in the smaller units. A shallow style of box is sometimes used. The boxes are most commonly packed in 24-pint and 24-quart crates although other size crates may be used. The boxes should be well filled at the corners and the fruit mounded a little above the tops of the boxes to allow for the settling which almost invariably will come with handling. Slack packages do not sell well.

Packing Shelter.—Some kind of shelter or shed near the berry field is almost necessary to serve as a central point to which the fruit can be brought for protection against sun and rain and for inspection and packing into crates. Such a structure can be a simple and temporary one, with only a protecting roof or more elaborate with storage place for packages and pacing material.

Yields

Yields vary widely with the variety, the soil, weather conditions, cultural care, and the extent to which the plants are affected with diseases. The estimates given here are for reasonably favorable conditions and considering a full stand of plants.

Black raspberries may be expected to yield 1200 to 1800 quarts per acre.

Purple raspberries in the few places where they have been grown have given somewhat higher yields.

Red raspberries in crop years will produce 1000 to 2000 quarts per acre. The average over a period of years will be less, the amount depending on the frequency with which the canes are winter injured.

With the late maturing varieties of blackberries a yield of 1800 to 2000 quarts per acre is usually expected with favorable weather conditions. Dry weather, however, often materially reduces the crop. In the Station's trial fields Early Harvest has far outyielded other varieties of blackberries. Over the state as a whole blackberries yield better than raspberries.

Duration of Plantings

Much can be done to postpone the time of decline in production of bramble plantings by preventing the loss of soil by erosion, by maintaining a liberal supply of humus in the soil, and by strict attention to sanitation and spraying for the control of the more serious diseases and insects. Excessively heavy bearing, hot dry weather and probably others are also factors in the failure of established plantings. As soon as a planting starts to fail a new one should be started to take its place. The duration of a planting of raspberries in Missouri usually will range from 4 or 5 years to 8 or 10 years and blackberries 12 to 15 years or even longer.

More Common Insects and Diseases and Their Control

Rose Scale.—The presence of rose scale is indicated by small white flecks along the more basal portions of the canes. Sometimes the entire lower parts of the canes are encrusted with the whitish scale coverings of the insects.

Control.—Rose scale is easily controlled by spraying with liquid lime sulfur, 1 gallon to 8 gallons of water, or commercial oil sprays used according to the directions of the manufacturer. Rarely, however, do the insects cause enough damage to justify spraying, but burning infested canes as they are removed in dormant pruning is advisable. This is usually sufficient to hold the insect in check.

Red-Necked Cane Borer.—This is the insect that causes the swellings an inch or two in length on bramble canes, especially along the more basal portions. One or several swellings at intervals may be found. The insects either kill the canes above the swellings or weaken them and render them practically worthless for fruit production.

It is usually serious only on such trailing blackberries as the Youngberry and Boysenberry.

Control.—All canes showing swellings should be cut out and burned by mid-April. With the more susceptible Boysen and Young varieties special attention should be given to the elimination and destruction of all infested canes not only of these varieties but of any nearby brambles. Any wild plants in the vicinity should be destroyed. When most of the canes are affected it is advisable to

forego a crop, remove all the wood during the winter, thoroughly clean up the area and start over with the new crop of shoots.

Red Spiders.—Red spiders along with several other species of mites occasionally damage the foliage and young growing tips of brambles. Whether or not they develop to serious proportions depends very largely upon weather conditions. Rainy weather is unfavorable to them and it is only with long dry spells that they are likely to become abundant enough to cause any appreciable damage. The very small inconspicuous mites infest mostly the under sides of the leaves and their presence is often not suspected until the foliage begins to show a faded dull appearance. By this time they have become so numerous and have been feeding for so long that considerable damage will already have been done. On the upper sides of the leaves where the mites are feeding light colored pin-point speckles appear in patches and along the larger veins. With heavy infestations the leaves may brown at the edges and drop. When the mites are numerous there is usually some webbing about the young tips of the shoots.

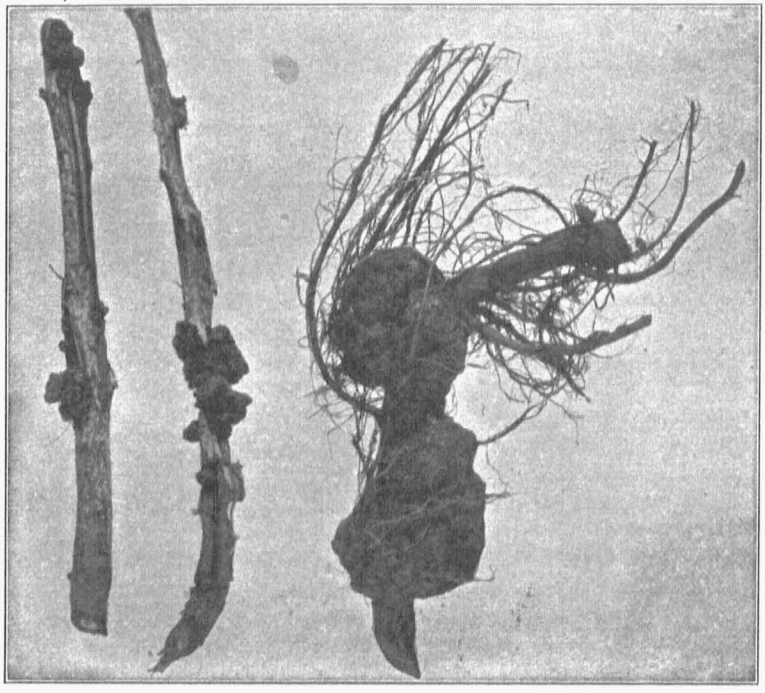
Control.—Spraying the plants with a summer grade oil emulsion diluted at the rate of 4 quarts to 100 gallons of water has given the best results. Apply a spray as soon as it is evident that the mites are building up rapidly in numbers. Another application may need to be made a few weeks later. Special attention should be given to thoroughly cover the under sides of the leaves and the tips of shoots. Do not spray for red spiders as a regular practice, only when the presence of mites makes it necessary.

Crown Gall.—Crown gall is a common and serious disease of red and black raspberries. Purple raspberries are a little less severely affected. Blackberries and dewberries are subject to attack but seldom show any ill effects. Galls or wart-like swellings may appear on the roots, at the crowns, or along the canes. The general effect on raspberries is a weakening of the plants.

Control.—Sanitation is the only practical means of control. Purchase plants from reliable nurseries or take them from fields that are apparently free of the disease. Unfortunately, infected plants do not always show galls so that complete elimination of the disease by grading is not possible. In setting plants it is advisable to examine each one and discard all that show any galls.

Orange Rust.—Orange rust is primarily a disease of blackberries. The disease is readily recognized by the yellowish to orange-red colored spots or areas which appear in the spring on the under sides of the leaves of affected plants. The presence of the disease can be recognized also by the small weak shoots growing in clusters from affected roots and crowns. The leaves of such shoots are somewhat dwarfed and of a wrinkled greenish yellow color but they are not to be confused with the curling of leaves by aphis which is sometimes quite pronounced.

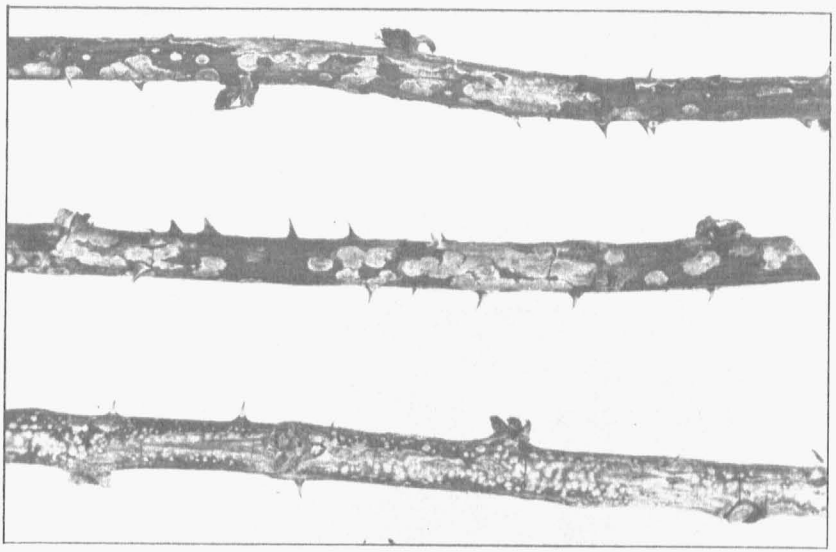
Control.—The orange rust fungus once it becomes established in a plant remains permanently. To prevent the spread of the disease, affected plants with their entire root system should be dug out and burned before the orange colored spores begin to scatter. If there are only a few plants and the work is thorough the disease can often be eradicated by this means. After the disease becomes general over a plantation about the only thing to do is to plow it out and plant the land to other crops. The disease is widely distributed among wild blackberry plants which should be eradicated from the immediate vicinity of cultivated plantings.



Crown gall on roots and canes of the black raspberry.

Anthracnose.—All the brambles are subject to anthracnose and any or all of the above-ground parts of the plants may be attacked. The severity of the disease varies with the different kinds of brambles. The black raspberries and trailing blackberries such as dewberry, Boysenberry, and Youngberry are especially susceptible to injury, so much so that thorough control of anthracnose is practically a necessity for their successful production. Purple and red varieties of raspberries are more resistant to the disease than blacks but spraying for protection against anthracnose is advisable

especially in the case of the purples. The Latham red is quite commonly affected although not always severely. The upright blackberries are the most resistant, such losses as occur, being due mostly to diseased fruit stems rather than cane infections so common and destructive on black and purple varieties of raspberries.



Anthracnose spots on black raspberry canes.

On the young shoots which are to become the canes that will produce the next year's crop the disease first appears as small purplish spots. These may enlarge up to ⅛ inch or more in diameter, remaining more or less circular in outline, or becoming somewhat elongated or elliptical in the long direction of the stem. They are edged with slightly raised reddish-purple borders. Later the centers of the spots turn grayish in color, become sunken and often crack lengthwise of the stem. When the spots are numerous the margins may soon join to form rather large rough-surfaced diseased areas. Under such severe conditions the shoots may be killed. More often the canes are weakened making them more subject to winter injury, or the movement of water through the canes is so interrupted that with dry weather the following spring the berries dry up before they mature. Shoot or cane infections are the cause of most of the injury to black and purple raspberries.

Spots similar to those produced on canes may be produced on the stems which grow out from the canes in the spring and bear the fruit. If spots are abundant on these stems the berries will not mature properly. Such fruit stem infections are the cause of most of the losses with blackberries and red raspberries. The serious-

ness of fruit stem infections on red raspberries seems to depend largely upon the development of the "gray bark" stage of anthracnose on the canes the year before. Such affected canes after they turn brown in the fall show light gray spots or areas especially on the sunny side. The gray bark stage of anthracnose is common only on red raspberries. It probably does little damage in itself but with rains in the spring the disease is scattered to all new growing parts of the plants. Cane and fruit stem infections are both important with dewberries and Boysenberries.

On the leaves the disease develops as small angular spots with purplish borders, the spots resembling those of Septoria Leaf Spot another disease which usually is more abundant on the foliage of brambles than is anthracnose. Damage due to leaf spots either those caused by anthracnose or by other diseases is rarely of any consequence.

When the fruit is diseased the entire berry or such parts as are infected may remain small and dry or they may develop without much flavor and turn a dull dark brown color.

Control.—The "handles" or sections of old stem on tip plants of black and purple raspberries and training blackberries should be removed at planting time to avoid any risk of the spread of the disease from these to the new shoots. The removal of the fruiting canes as soon as the berries are harvested may aid some in the control of anthracnose but is not adequate in itself. Spraying is the most satisfactory method of controlling anthracnose. A spray applied just as the buds are opening in the spring is most effective. Unless this spray is made, control is not likely to be satisfactory. With black and purple raspberries and the trailing brambles another spray is advisable when weather conditions do not make it unsafe. For instructions on spraying consult Control Measures in General.

Control Measures in General

Sanitation.—The application of sanitary measures is the most practical way of controlling most of the diseases and insects of brambles and in many cases is the only means. Eradicate all wild plants and stray bushes in the vicinity of cultivated patches and destroy heavily diseased plantings before establishing new ones nearby. All prunings should be removed from the field and destroyed. By such treatment most of the less common troubles can be kept from developing to serious proportions. A careful check of the patch should be kept for such serious troubles as crown gall and virus diseases of raspberries and orange rust of blackberries. At their first appearance in the field affected plants should be removed in their entirety including all the roots and burned. Once such diseases as these have made much headway there is little that can be done to check them and new plantings should be started. In the case of crown gall no new plants should be set where diseased

ones have been removed. It is important that orange rust affected plants be destroyed before the membranes on the under sides of the leaves break and the orange colored spores scatter to other plants. The virus diseases are not so readily detected by the inexperienced observer but any plants showing abnormal conditions rather generally over the whole plant should be regarded with suspicion and the plants removed and destroyed.

Spraying.—The spraying of dewberries, Boysenberries, and raspberries, red, black, and purple for the control of anthracnose should be a regular practice. The disease may not be present to a serious extent every year and in all patches but it is widely distributed and is a frequent cause of heavy losses.

Delayed Dormant Spray.—Use liquid lime sulfur 1 gal. to 8 gal. of water or about 11 gallons with enough water to make 100 gallons of diluted spray. Apply as the buds swell in the spring but not later than when green tips appear. This is the most important spray for the control of anthracnose. It is also effective against rose scale and probably helps in controlling red spiders. This one spray is usually adequate for the control of anthracnose on red raspberries.

Second Spray.—Apply when the new shoots from below ground are 6-8 inches high using liquid lime sulfur 1 quart to 10 gals. of water or 2½ gals. to make 100 gals. of spray. Break the spray into a fine mist and drift it into the bushes rather than driving it in with force in order to lessen the risk of spray injury; also, avoid spraying on a hot day. This spray is aimed at anthracnose but is helpful in holding down red spiders.

Applications of lime sulfur later in the season than this usually do more damage than they do good.