



Growing Blackberries & Raspberries in Kentucky

R.T. Jones and J.G. Strang

Demand for raspberries and blackberries (commonly called brambles) often exceeds supply in many parts of Kentucky, thus providing the opportunity to grow brambles for local markets and “pick-your-own” operations as well as for home use. Unfortunately, the general shortage of hand picking labor frequently limits commercial production of blackberries and raspberries in Kentucky. Bramble fruits do not store or ship well, which limits the market area but increases the demand for local, high-quality fruit.

Brambles grow and yield well in most parts of Kentucky and begin to bear the second season after they are planted. They have biennial canes and perennial roots. The roots and crowns live for a number of years and each spring produce a new crop of canes (primocanes) while the fruit is maturing on the canes (flora-canes) that grew the season before. These fruit-bearing canes die naturally after the summer harvest. With favorable growing conditions and proper care, a raspberry planting may produce for eight to 12 years. Plantings made on poor sites and receiving poor care may last only three to five years. Blackberry plants usually live longer than raspberries because they are better adapted to Kentucky’s climate.

Site Selection and Preparation

Deep, fertile soil that is well drained, high in humus, and free from hard pans is best for brambles. However, almost any well-drained soil can be modified to grow brambles. The plants will not tolerate free-standing water in the winter. It may be possible to tile some poorly drained sites to make them acceptable for brambles. If the site has a plow pan, subsoiling is beneficial and should be done during August or September of the year before you plant when the soil is dry. Planting all brambles on raised beds may help reduce root rot and prolong the life of the planting. Trickle irrigation and mulching will help ensure good plant growth and high yield.

When possible, plant brambles on a northern slope or where there is afternoon shade. Such soils are cooler and hold moisture better. Mulching or irrigating will

accomplish the same goal. **Irrigation is necessary for commercial production.** Sites with adequate air drainage reduce the possibility of winter injury and damage from late spring frosts. Avoid extremely windy sites for raspberries because canes are susceptible to wind whipping and breakage.

Select the site a year before planting. Blackberries and raspberries should not follow potatoes, tomatoes, peppers, eggplants, tobacco, strawberries, or other bramble crops for three to four years. These crops can build up the *Verticillium* wilt fungus inoculum level in the soil. Plant infection by *Verticillium* causes loss of vigor and, eventually, plant death. It is best to grow a green manure crop the year preceding the bramble crop to increase organic matter. A cultivated non-host crop such as wheat or corn will reduce white grub and weed problems, particularly if the field has been in sod. Do not use a persistent herbicide such as atrazine that could damage your brambles.

Take a soil sample to your county Extension office for testing. Apply the recommended soil nutrients or soil amendments and plow these under. Manure (8 to 10 tons per acre) or a green manure crop can be incorporated at the same time. Before planting, either in the fall or early spring, plow the area to a depth of 6 to 9 inches. The soil should be thoroughly pulverized (disked) just before planting, and the plants or root cuttings planted as early as possible in the spring, typically in March. On sites subject to erosion, plow a 4- to 6-foot wide area for each row on the contour to prepare a planting bed. Establishing sod strips will help control erosion.

Cultivars

Remember to purchase certified, virus-free stock when possible.

Black Raspberries

Because of low yields and poor environmental adaptation and bird problems, there are few commercial black raspberry plantings in Kentucky.

Allen fruit are large and attractive, and the plants are productive and vigorous. Harvest is fairly concentrated with this cultivar.

Black Hawk is a very hardy cultivar from Iowa. Fruit are large and firm and ripen very late.

Bristol has been one of the heaviest producers at research sites in both Lexington and Princeton, Kentucky. Fruit are medium to large, well formed, glossy, and very attractive; they are very flavorful, and their quality is excellent. Bristol ripens early in the season.

Haut was released from the University of Maryland. It ripens early and over a longer period than other black raspberry cultivars. Berries are moderate in size and very sweet. Recommended for production.

Jewel has Bristol as one of its parents. Its fruit size is larger than Bristol's, and it has more disease resistance than other black raspberry cultivars. Plants are vigorous and very winter-hardy. It is considered better than Bristol and is recommended for commercial production.

Logan ripens early and has performed well in Kentucky. The berries are large and attractive, and the plants yield well.

June-Bearing Red Raspberries

Canby produces early, large, flavorful fruit. Some reports indicate that plants may be a little cold tender. Plants are nearly thornless and are resistant to mosaic virus. Recommended for home and commercial plantings.

Citadel, of Maryland origin, is a late mid-season cultivar. Fruit are very large, firm, and dark red. While it may be difficult to pick, it is vigorous and resistant to leaf spot diseases.

Latham is an older cultivar and has been the most important one in Kentucky for many years. It yields well and is fairly winter-hardy. The fruit is roundish, medium in size, firm but somewhat noncohesive, and light red. Plants are susceptible to mosaic virus.

Liberty, a release from Iowa, has performed exceptionally well in western Kentucky. Recommended for commercial production.

Reveille, also of Maryland origin, is a large-fruited early-season cultivar with excellent color and quality. Plants are very winter-hardy and tolerate fluctuating spring temperatures. It is too soft for commercial use, but its size and earliness make it excellent for home use or pick-your-own and roadside sales.

Titan, a 1985 release from Cornell University, has very large, bright red fruit that ripen early in the season and are harvested over a long period. Fruit have a mild, pleasant flavor with excellent quality. The plants sucker sparsely, and a T-type trellis is recommended because of the berries' weight. This cultivar is very susceptible to phytophthora

root rot and consequently does not survive well on heavier soils. Growing Titan on a 9-inch high-raised bed with trickle irrigation reduces this disease problem. Recommended for trial.

Everbearing Red Raspberries (often called "Fall Bearing")

For all practical purposes, these are restricted to red raspberries. The plants bear a fall crop on the tips of the new canes that develop the first year. Ripe berries usually appear by late August and continue until frost. The spring crop is then borne just a bit farther down on these same canes the following year. After the spring (or summer) crop is harvested, these bearing canes die naturally while a new set of canes develops. With Kentucky's long frost-free fall, commercial production of everbearing raspberries can be profitable.

Autumn Bliss was introduced in 1966 by the East Malling Research Station, East Malling, England. Fruit are large, medium to dark red, oval-conic, with an excellent mild flavor. Fruit ripen earlier than Heritage. This cultivar has performed very well in cultivar trials in Kentucky.

Heritage, of New York origin, is the predominant everbearing red raspberry in the central and eastern United States. It is outstanding for its heavy fall crop, which starts in mid-August and extends to the first hard frost. Berries are medium-sized, firm, of excellent quality, and attractive. The spring crop is only moderate. The plants are vigorous, producing many upright, sturdy canes that hold up their fruit well. This variety has done well in Kentucky. Some growers are managing it for the fall crop alone, as mentioned elsewhere in this publication.

Redwing is a cultivar of Minnesota origin and ripens 10 to 15 days ahead of Heritage. Fruit have good flavor and adequate firmness for shipping and shatter less than Heritage. The plants have superior heat tolerance and have been reported to do well in southern areas. This variety has performed well in some areas of the state and poorly in others. Recommended for plantings.

Caroline is a new fall-bearing red raspberry that produces large, sweet, firm fruit. The plant is very vigorous and may require a trellis. Reported to have a resistance to root rots.

Ruby (Watson), a 1989 release from New York, is a cross between Heritage and Titan. The bright red fruit are the largest of the everbearing raspberries, typically 50 percent larger than Heritage. Berries are dry and do not bleed with handling, making them excellent for shipping. Yields and flavor are similar to Heritage. Plants are vigorous but are not as erect as Heritage and thus need to be trellised. Because Ruby is susceptible to phytophthora root rot, Botrytis fruit

rot, and crown gall, it should not be grown where crown gall has been a problem or on heavier, wet soils prone to phytophthora root rot. This cultivar has received limited testing in Kentucky and has performed well.

Yellow Raspberries

Yellow raspberries are not planted commercially in Kentucky. Cultural requirements are the same as for red raspberries.

Anne is the largest, best-tasting yellow everbearing raspberry. It ripens at the same time as Heritage or Kiwigold. Excellent size, appearance, and sweet flavor. May be mowed for fall production.

Kiwigold is an everbearing raspberry with good-sized yellow fruit. Ripens in same time slot as Heritage. Fruit will develop a reddish blush. Nice taste.

Purple Raspberries

Purple raspberries are the result of crosses between red and black raspberries. The fruit resemble the red parent more than the black. The flavor is not distinctly like either parent but is very good; however, this fruit is not as popular as the red or black, probably because it is less well known. Several varieties to consider:

Brandywine is a vigorous, large-fruited raspberry. Berries are tart and of good quality and make excellent jams and jellies. Brandywine is propagated by tip layering; trellising is recommended. There are some indications that in Kentucky Brandywine may not be quite as hardy as other purple cultivars.

Royalty, from the New York Agricultural Experiment Station, is similar to Brandywine in that it is vigorous and has very large fruit that ripen late in the season. The fruit are sweeter than those of Brandywine and also make excellent jams and jellies. Royalty has multiple insect resistance and immunity to the raspberry aphid, which carries mosaic virus. It suckers like the red raspberry and has relatively stout canes. It is recommended.

Blackberries

There are three types of blackberries: semi-erect, semi-trailing, and trailing. The trailing type, also called dewberries, and the semi-trailing type must be supported on trellises. The semi-erect type usually does not need trellising. In general, most trailing types, such as boysenberry, loganberry, and youngberry, are not winter-hardy in Kentucky and are not recommended for this area unless the grower is willing to go to considerable trouble and expense to protect them.

The semi-trailing thornless blackberries have larger fruit with larger seeds, and the plants are much more vigorous and productive than the semi-erect (thorny and thornless)

types. The semi-trailing thornless blackberries bloom later than semi-erect blackberries. Semi-trailing blackberry fruit is tarter. As the berries ripen, they turn from red to shiny jet black, then to a dull black, and they are easily detached from the plant. At this point, they can be eaten out of hand. All blackberries are excellent for baking and making jellies; generally, however, semi-erect blackberry fruit are sweeter, and the recommended cultivars are much hardier than those of the semi-trailing, thornless types.

One of the chief limiting factors to growing blackberries in Kentucky in recent years has been a disease called “sterility.” The plants bloom and grow vigorously but produce only “nubbins,” or malformed fruit. Certain varieties or strains of blackberries seem to be less susceptible to this disorder than others, and every effort should be made to secure good virus-free plants. Any plant showing this disorder should be destroyed immediately, roots and all.

Semi-Erect Blackberries

Apache produces larger fruit and higher yields than any previously released erect thornless blackberry. Ripens earlier than Navaho. Canes more erect than other thornless varieties. Recommended for Kentucky.

Cherokee, from the University of Arkansas, fruits in mid-season and is vigorous, semi-erect, thorny, and very productive. The fruit are large, firm, of good quality, and adapted to mechanical harvesting. Cherokee has out-yielded the other Arkansas releases in eastern Kentucky and is the hardiest of the Arkansas releases.

Cheyenne, from the University of Arkansas, has large, very firm fruit adapted to hand and mechanical harvest. The fruit ripen between Cherokee and Comanche, and the seeds are smaller than those of Comanche. This thorny variety looks very promising, particularly in western Kentucky and warmer portions of the state.

Choctaw, a release from Arkansas, is a very early ripening thorny cultivar. The fruit are large, have very small seeds, and have excellent quality. Recommended for Kentucky.

Comanche, from the University of Arkansas, is early, vigorous, semi-erect, and very productive. It has very large, firm fruit that are excellent for processing or fresh market. This thorny variety has not done as well as Cherokee and Cheyenne in some Kentucky plantings.

Darrow, a thorny New York release, is now considered the standard for eastern blackberries. The plants are very winter-hardy and are vigorous and productive. The fruit ripen mid-season and mature over a long period. Berries are medium-sized, firm, and of good quality. Darrow has produced well throughout Kentucky; however, it has frequently been found to have sterility.

In Kentucky, the Arkansas releases have consistently outyielded and shown more vigor than the Darrow variety. Orange rust does not seem to be a problem on the Arkansas selections, but they are very susceptible to double blossom and virus problems, and they do not like heavy soils.

Navaho, an Arkansas release, was the first semi-erect thornless blackberry to be released. Fruit are medium in size, sweet, and mature with semi-trailing blackberries. Navaho is rated as having the best flavor of all the blackberry cultivars. When cooked or canned, the berries retain their dark black or purple color, while other semi-erect berries turn a dark red. After harvest, berries have an excellent shelf life. Navaho is not a heavy producer but produces over a very long period. It is reported to be hardy to -11°F. However, it appears to harden off later and begins growth earlier in the spring, making it more prone to injury from early-fall and late-spring freezes. Plants do not send up as many suckers as thorny blackberries and are slow to fill in the row. Not recommended for home plantings and commercial trial due to orange rust.

Shawnee, from the University of Arkansas, is noted for its consistent high fruit yields as well as its very large fruit size. Fruit ripen later and over a longer period than do other thorny cultivars. Fruit are firmer than those of Cherokee and Comanche, and size is maintained throughout the season. Seed size is slightly larger than that of Cherokee and Cheyenne. Winterhardiness is less than Cherokee. There is one report of a combination of winter injury and cane blight on a very vigorous planting in Kentucky when the temperature did not get below 7°F. Shawnee is recommended for production in the warmer parts of Kentucky.

Thornless Semi-Trailing Blackberries

All of these cultivars require a trellis for optimum production:

Black Satin, a mid-season cultivar, is significantly harder than Smoothstem and Thornfree, but winter injury is a problem in severe winters. Black Satin is recommended for the warmer sections of the state. In general, Black Satin is not successful in sections of the state as cold as Louisville.

Chester ripens later than other cultivars. It also has resistance to cane blight caused by *Botryosphaeria dothidea*. Berries have good flavor, although they are tarter than Hull. They are firm like those of Hull and do not lose color, soften, or leak juice on hot sunny days. Chester is recommended for commercial planting.

Dirksen is an early-blooming and early-ripening thornless that is harder than Black Satin. Dirksen has less vigor than Black Satin and shows a decline in yield as the planting ages. In the warmer parts of the state, Dirksen is recommended as a companion plant with Black Satin. In colder

parts of the state, Dirksen has much less winter injury than Black Satin.

Hull has more winterhardiness than Black Satin. It blooms later than Dirksen and ripens between Dirksen and Black Satin. Fruit quality is superior to other semi-trailing thornless cultivars. The berries are sweeter, the color is better, and they are firmer and consequently less likely to leak juice than previously released cultivars. Both berry size and yield are similar to those of Black Satin. Hull is recommended for Kentucky planting.

Triple Crown is a thornless, semi-erect blackberry with large, sweet, aromatic fruit. Ripens from about July 5 to August 5. Ripens about one week later than Hull. Requires a trellis for support.

Raspberry-Blackberry Crosses

A tayberry is a cross between a red raspberry and a blackberry. Fruit are very large, and the plant is trailing and very thorny. This cultivar is not cold hardy enough to consistently produce fruit in Kentucky.

Propagation

Propagating brambles is relatively easy; however, because of virus complexes in brambles, most growers prefer to establish plantings from certified, virus-free nursery stock.

Black and purple raspberries, the semi-erect thornless blackberries, and dewberries are propagated by tip layering and meristem cuttings. In August or early September, the tips of the new shoots should be bent to the ground and covered with soil. Roots will form during the fall, and in the spring the new plants may be cut from the parent for setting. The plants will be stronger if the young plant is left attached to the mother plant over winter.

Red and yellow raspberries, Royalty purple raspberry, and the semi-erect thorny blackberries are propagated from the sucker shoots that arise from the roots of the old plants. Be sure to leave a piece of the parent root attached to each plant. Transplant only the most vigorous and healthy suckers. Under favorable conditions, it is possible to transplant young raspberry suckers in the spring when they are 5 to 6 inches high. Semi-erect thorny blackberries and the Apache blackberry are also propagated from root cuttings.

Almost all brambles can be propagated by soft wood primocane cuttings placed under intermittent mist.

Planting

Although brambles may be set in late fall, it is better to plant them in early spring before growth starts. Early spring (March and early April) plantings tend to yield more fruit the first cropping year (13 to 15 months after planting) than do later plantings. Do not let plants or root cuttings dry out before, during, or after the planting process. Raspberry

and thornless blackberry plants should be planted 1 inch deeper than they were in the nursery. If the plants are from tip layers, cut off the old cane or “handle” before planting to avoid infecting the new shoots with any diseases that could possibly be on the old cane.

Pencil-sized root cuttings of semi-erect blackberries are generally planted directly into the field. Studies have shown that yields are similar whether the planting is started with small plants or root cuttings. Cuttings (about 4 inches long and ¼ to ⅜ inches thick) are dropped flat into a freshly opened furrow and covered with about 3 inches of soil. It may take one to two months for shoots to reach the soil surface when root cuttings are used. Table 1 gives planting information for raspberries and blackberries.

Pollination

All raspberry and blackberry cultivars grown in Kentucky are self-fertile. The central portion of each blackberry or raspberry flower contains a large number of pistils (female part) surrounded by many stamens (male part). In the pollination process, pollen is transferred from the stamens to the pistils. Every pistil has the potential to produce a seed and a drupelet. Each fruit is made up of a number of drupelets.

Brambles are pollinated primarily by honeybees. Two hives of bees are recommended per acre to ensure adequate pollination. Avoid insecticide applications during the bloom period. If insecticides need to be applied during bloom, use labeled pesticides with low bee toxicity and apply when bees are not visiting the flowers—usually late in the afternoon or at night.

Fertilization

Nitrogen should be the only element needed for the first three years if soil test recommendations were followed before planting. During the first season, band 50 pounds of actual nitrogen per acre 6 inches from the plants 60 days after planting. In subsequent years, band 50 to 150 pounds of actual nitrogen per acre in February or early March. This

is equal to 150 to 450 pounds of ammonium nitrate per acre or 3 to 10 pounds of ammonium nitrate per 100 feet of row.

To determine how much nitrogen to use, examine the foliage color and the plant vigor. Use the low rate of nitrogen on fertile soils where the plants are vigorous and the foliage is dark green. Use the higher rate on poorer soils or where canes are spindly and short and the foliage is light green to yellowish. Never place fertilizer in the furrow next to the roots. Fall cover crops may need an additional 15 to 25 pounds of nitrogen if they are growing poorly. Apply fall nitrogen after the bramble plants are dormant. After three years of growth, test the soil and add phosphorus and potassium if needed.

Soil Management

Control weeds by cultivating between rows and/or using a herbicide the first season, or by using plastic or organic mulch. Sow a cover crop such as rye between rows in the fall, but avoid sowing seeds in the row. Disk the cover crop into the soil in the spring and cultivate the remainder of the season. When using disks for cultivation, set the blades just to scrape the surface, not to cut deeply, to prevent damage to the shallow root system. Some growers establish sod strips after the first season and practice weed control in the row with herbicides or mulches, or a combination of the two. Fescue is the preferred species for sod strips.

If you decide to use a mulch, a heavy covering of 6 to 8 inches of straw, straw manure, grass clippings, sawdust, or other organic matter is very beneficial to brambles, especially raspberries. University of Kentucky researchers report that red raspberry yield doubled with mulching. In addition to increased yield, the red raspberries were larger and better developed. On raspberries, initial mulching is most effective in the fall of the second year or the spring of the third year. Studies on thornless blackberries indicate that a straw mulch will give higher yields than a wood chip mulch.

Table 1. Recommended plant spacing, plants per acre, and management systems for raspberries and blackberries.

Bramble Type	Distance in Rows (ft.)	Distance between Rows (ft.)	Plants/Acre	Management System
Red and yellow raspberry	2	8-12 ¹	2,722-1,815	Hedgerow—no trellis or low trellis
Black raspberry	3	8- 10 ²	1,815-1,452	No trellis or low trellis
Purple raspberry	3½	10-12	1,244-1,037	Low trellis
Semi-erect thorny blackberry	2	10-12 ³	2,178-1,815	No trellis
Semi-erect thornless blackberry	3	10-12	1,452-1,210	No trellis or low trellis
Semi-trailing thornless blackberry	8	12-13	453-418	High trellis

¹ Use the wider between-row spacing for fertile soils and/or large equipment. Adjust the row width to give ample room for the implements to be used in cultivation and harvesting. Closer between-row spacings are possible for backyard use. When using the hill system, red raspberries are usually set 5 or 6 feet apart.
² Black and purple raspberries can also be set in 6-ft by 6-ft hills.
³ Growers with commercial experience consider a 12-ft row the minimum for semi-trailing blackberries.

An organic mulch conserves moisture, reduces weed pressure, improves soil tilth, keeps the berries clean, and maintains the soil temperature at a more uniform level during the summer. The mulching materials are renewed each year, usually following harvest. Mulching, however, has several drawbacks, including the large volume of organic material needed, the increased labor requirements for application, and increased rodent damage.

Chemical Weed Control

Herbicides are recommended for controlling weeds in brambles. The proper use of the right herbicide efficiently controls weeds but does not disturb root growth, as may cultivation. Herbicides also help reduce tip layering in the brambles where this is a problem. Cooperative Extension publication ID-94, *Kentucky Commercial Small Fruit and Grape Spray Guide*, contains the latest blackberry and raspberry weed control recommendations.

Irrigation

Brambles require an average of 1 inch of water per week during the growing season. Most years have dry periods when irrigation is very beneficial. Supplemental water is frequently needed at or near harvest when lack of moisture can seriously reduce fruit size. Also, irrigation is beneficial during plant establishment. Watering whenever moisture stress is likely, particularly after harvest, will result in larger, healthier canes and larger crops of fruit. Brambles respond very well to trickle irrigation.

Pruning and Training

Black and Purple Raspberries

These raspberries give best results when trained to the hill system. They are easily maintained in this way because they do not spread beyond their original location, unless tip layering is allowed. Most can be grown without a trellis, but for vigorous plantings, a trellis may be preferred. For support, tie the canes to a stake in each hill, or use a horizontal two-wire trellis made on posts that stand about 2½ feet above the ground. Cut 2x4s in 2-foot lengths and fasten them as cross arms to the posts. Run wire down each side of the row and fasten it to the ends of each cross arm and place the canes and fruiting shoots between the two wires (Figure 1). Some growers have been very successful in growing these raspberries without supports by summer tipping the canes at a 2-foot height.

Early each summer, when the new shoots are about 2½ feet tall, cut off 2 to 3 inches of the growing tip (Figure 2). This makes the canes stocky and causes side branches to grow, thus greatly increasing the bearing surface of the plants. (The one exception to this is the Royalty purple raspberry. Recent New York data indicate that there is no

advantage to summer pinching this cultivar.) More severe tipping produces weak laterals. Vigorous plantings may need to be tipped three to four times because of the variation in cane height. The following spring, prune the side branches to about 10 or 12 inches. Plant vigor and soil fertility determine how many canes should be left. Ordinarily, you should leave from four to six canes per hill (Figure 1). In general, pruning decreases the number of berries and increases their individual size. A common mistake in pruning black raspberries is leaving the side branches too long. This results in too many fruit buds and poor berry development (Figure 1).

Blackberries

Semi-erect blackberries (thorny and thornless) should be pruned in a similar manner to black and purple raspberries. Growth the first season tends to be more trailing than erect. During the first dormant-season pruning, cut all shoots where they begin to arch downward (Figure 3). This keeps the first season's fruit off the ground and eliminates some of the crop, which helps to produce vigorous canes for the next year's crop.

Blackberries are more vigorous than raspberries, so they may be summer topped or pinched higher (about 36 to 42 inches). Vigorous semi-erect blackberries may be summer pinched or topped a second or even a third time when

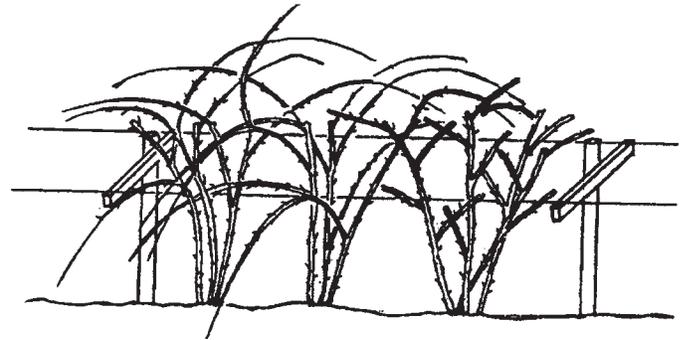


Figure 1. Horizontal 2-wire trellis for black and purple raspberries. Left: plants before pruning. Right: after pruning.

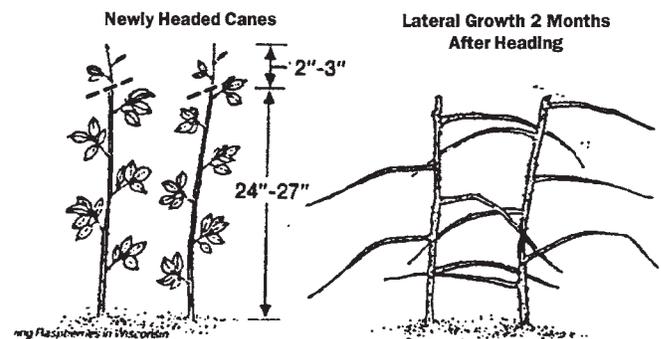


Figure 2. Summer tipping or pinching of black and purple raspberries.

growth reaches a height of 1 foot above the previous topping height. During the second and subsequent dormant prunings, remove spindly canes. Don't let the row width at ground level get wider than 12 inches. This will give a row width of 36 inches at the tops of the plants; rows wider than 36 inches are difficult to harvest. Remove one-third to one-half of the total number of canes arising from each hill on semi-erect thornless cultivars. Leave at least four to six large-diameter canes per hill. Laterals may be cut 12 to 16 inches long during the dormant season. Leave six canes per foot of row for thorny types. Extremely vigorous semi-erect blackberries sometimes require a trellis similar to the temporary trellis described for everbearing red raspberries. Sucker plants, particularly those in the row middles, should be pulled out during the summer.

Semi-trailing thornless blackberries should be trained on a trellis that is constructed either before planting or during the first growing season. The end posts should have 6 to 6½ feet above ground and be well braced with a minimum diameter of 6 to 8 inches. Place line posts 25 to 30 feet apart in the row. These should be at least 4 inches in diameter and should extend 6 feet above the ground.

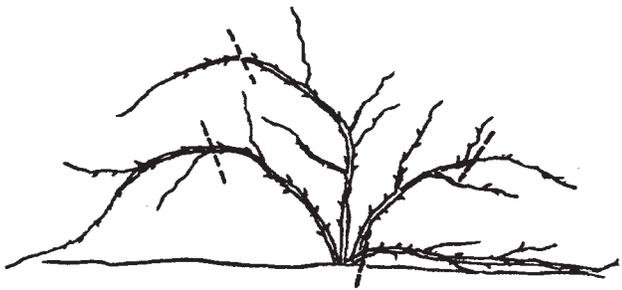


Figure 3. Dormant pruning cuts to be made on semi-erect blackberries after the first season's growth.

Stretch two loosely stapled (10-gauge) wires at heights of 3 feet and 6 feet above the ground and securely fasten these to the end posts. Make provisions to enable retightening the wires each spring at one of the end posts (Figure 4).

Following planting, completely remove the above-ground portion of last year's cane so that new shoots will not be infected with anthracnose if there are cankers on the old cane. Train the new shoots up a stake or onto the trellis to prevent tip rooting. Thornless blackberries have a trailing growth habit the first season and send up more erect shoots the second season. Do not summer prune during the first growing season.

The second growing season in the spring before buds begin to swell, remove all but two or three of the most vigorous canes. Tie these shoots to the trellis in a fan pattern. Remove dead laterals and those that are less than ¼-inch in diameter. After the buds have swollen and produced ½ to 1 inch of new growth, strip the new growth from the lower portion of each cane that is within 18 inches of the ground. This eliminates the production of berries that lie on the ground and are unmarketable.

After fruiting, it helps to remove the canes that have fruited to make way for the new shoots. If canes are extremely vigorous, they may be tipped 1 foot above the top wire to promote the development of laterals. Avoid summer tipping before, during, or just following a rain or irrigation to reduce the danger of cane blight. Keep new shoots tied up to prevent tip rooting.

Early the third and subsequent growing seasons in the spring, reduce the cane number by one-third to one-fourth. Leave the thickest, most vigorous canes and remove spindly ones (Figure 4). Next, shorten the lateral shoots to about 18 inches in length. If the laterals are vigorous and originate below the bottom wire, they may be left long and tied to

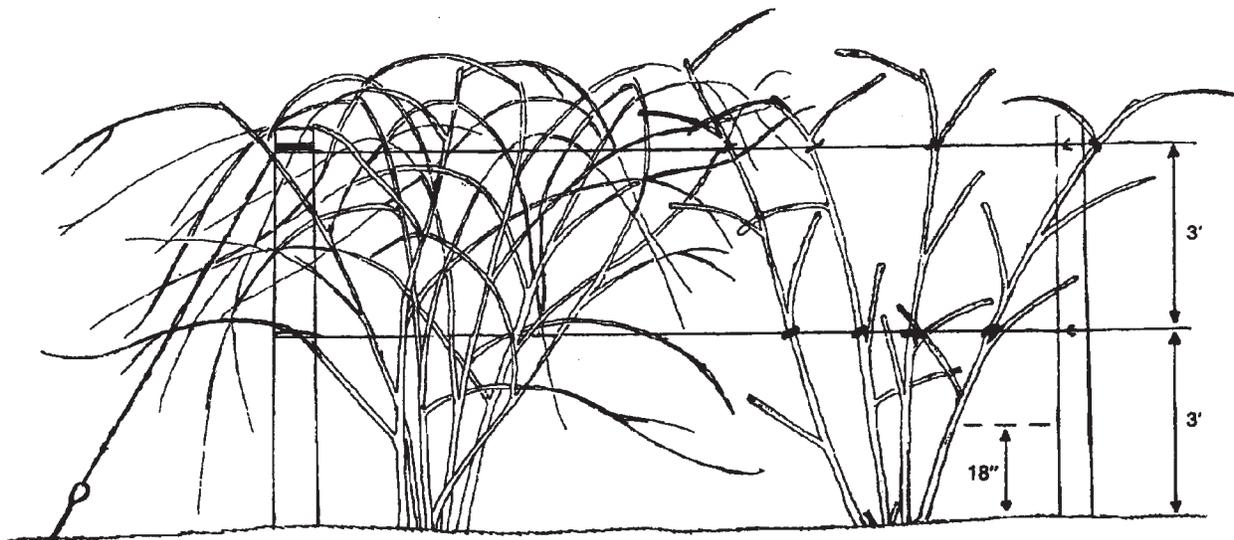


Figure 4. Vertical, 2-wire trellis for semi-trailing thornless blackberry culture. Left: Plant before pruning. Right: Same plant after pruning.

the upper trellis wires. Tie the canes in a fan pattern to both the lower and upper trellis wires. Shoots of adjacent plants can overlap a foot or two.

Again when the buds have made ½ to 1 inch of new growth, strip the growth from the canes within 18 inches of the ground. Remove canes after fruiting and tip new canes as described for the second growing season.

Excessive cane growth will result following a winter when the canes are killed to the ground and the crop is lost. The spring following the excessive growth, pruning should be heavier than normal because the plants will tend to overproduce. If thornless blackberries are not pruned sufficiently, they will overproduce, send up few canes for the next year's crop, and be more subject to winter injury.

Red Raspberries

The tips of June-bearing and everbearing red raspberry canes are not summer pinched like black and purple raspberries. Red raspberries do not tend to form side branches and thus do not respond well to this practice. In addition, pinching causes more suckers. The most common method of training red raspberries is the hedgerow system.

For **June-bearing red raspberries**, during the dormant pruning, narrow the row to 18 to 24 inches in width and thin the canes until those left for fruiting average about 15 canes for each 4 feet of row (Figure 5). Space canes so that they are well distributed over the row width, 4 to 6 inches apart. Leave only the large diameter vigorous canes, and prune them back to a height of 5 feet. If more than the top one-fourth of the cane is removed, yields will be reduced. After fruiting, prune out the old canes that have fruited.

Prune **everbearing red raspberries** a little differently. To produce a fall crop only, cut off all canes, using a rotary mower set 2 or 3 inches high, in late winter or very early spring. This eliminates the spring crop and produces an extra thick stand of new canes that will bear a heavy fall crop on the upper portions of the canes. This also eliminates all hand pruning, prevents winter injury, and reduces disease problems.

Vigorous everbearing red raspberries grown for the fall crop alone may require a temporary trellis several weeks before harvest (Figure 6). Drive 3 ½- to 4-foot-long tomato-type stakes at 25-foot intervals down the center of the row. Run bailer twine down each side of the row and loop it around each stake at about a 3-foot height. Then tie the two strands of bailer twine together at intervals between the stakes to hold up the plants. This trellis is easily removed for spring mowing.

If you want a spring or summer harvest, plant a June-bearing cultivar or leave a portion of the everbearers for spring production. In the latter case, during the dormant pruning, narrow the row to 18 to 24 inches wide and thin

the canes to 15 vigorous canes for each 4 feet of row, as with the June-bearers. Next cut off the top portions of the canes that fruited the previous fall. The spring crop will originate from the lower portions of these canes. Following the spring crop, remove the canes that have fruited.

Cane Removal

Since the fruiting canes of raspberries and blackberries normally die after the summer harvest, it is best to remove and burn them as soon as harvest is over. This is important because if the old canes are not removed, they will often spread diseases to the young canes. Even bits of old canes left on the ground may become the source of a cane-blight infection. If anthracnose was not controlled earlier, remove severely infected new canes when removing the old ones.

Winter Injury

Early in the spring, it is fairly difficult to determine whether blackberries have been winter injured. Winter injury of semi-trailing thornless blackberries usually occurs in mid-winter when the temperature drops below -5°F. Canes that have been injured have a dry pith, not a moist green pith. Sometimes at higher temperatures (15° to -5°F), only the terminal portion is killed. If semi-trailing and semi-erect thornless blackberries are only partially winter injured, they will leaf out and grow in the spring. Often a cane blight disease infects portions of the injured canes, bleaching and killing these sections. As the weather warms up and the leaves require more water, portions of the canes above the bleached areas will wilt, collapse, and die on hot days. This often occurs around the time of flowering and fruit set.

A temperature of -17°F is usually considered to be the point where fully hardened semi-erect blackberries are killed. However, warm temperatures in late winter will deharden the canes, and death can occur at higher temperatures, especially with a rapid freezing rate. The upper portions or the entire cane of a winter injured thorny blackberry will fail to leaf out in the spring.

Harvesting

Berry quality depends on following recommended production and harvesting practices.

When picked for sale and shipment, berries should be only firm ripe and not soft ripe. The soft, fully ripe berries (for home use) are sweeter but will not ship well and will usually decay before they can be marketed.

Ripe berries should be picked regularly at least twice a week and possibly every other day under hot, rainy conditions. It is best to pick in the morning after the dew has dried off the fruit to reduce fruit decay. Pick berries carefully, place in the marketing container, and do not drop



Figure 5. Left: June-bearing red raspberry plants before thinning and pruning. Right: after thinning and pruning.

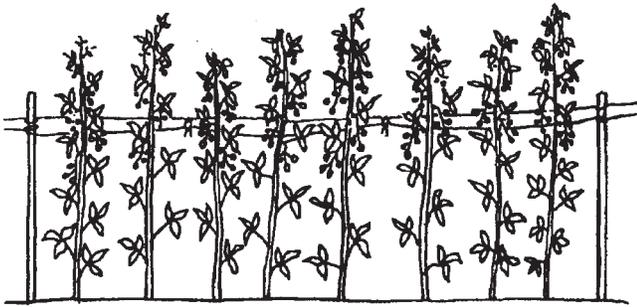


Figure 6. Temporary trellis for everbearing red raspberries that are grown for only the fall crop. Note the use of tomato stakes at 25-ft. intervals and bailer twine to support the plants.

them. As soon as it is filled, the container should be put in the shade and kept cool. It is best to rapidly cool berries to 40°F within a half hour of harvest. Berries that are not cooled are more susceptible to fruit rots. Raspberries and blackberries may be stored for a few days at temperatures between 32° and 40°F under a high relative humidity if berries are promptly cooled at harvest. Pint or quart berry boxes are used in marketing, and some of these are packed in 16-quart or pint crates or in newer flat cardboard trays. For home use and pick-your-own, various types of shallow containers can be used.

For hand picking, six to 10 pickers are needed per acre and often more at the height of the season. It generally takes the following number of customers for pick-your-own operations to harvest an acre of berries: red raspberries, 300; black raspberries, 180; semi-erect blackberries, 300; and thornless semi-trailing blackberries, 450.

Large, over-the-row, mechanical harvesters are now available for large volume harvesting for processing. However, these are expensive, and large acreages are needed to justify the cost.

Yields

Yields are quite variable and depend on such things as location, variety, cultural care, and cooperation from the weather. Expected yields for good plantings are shown in Table 2.

Table 2. Blackberry and raspberry expected yields for good mature plantings.

	Pounds*	Volume
Red raspberry	1,680-2,240	2,400-3,200 pt
Black raspberry	1,700	1,214 qt
Purple raspberry	2,400	1,714 qt
Semi-erect thorny blackberry	7,500	5,357 qt
Semi-erect thornless blackberry	6,000	4,286 qt
Semi-trailing thornless blackberry	9,000	6,429 qt

* A quart of blackberries or raspberries generally weighs about 1.4 lb.

Marketing

Many methods of berry marketing are practiced, including shipping to large central markets, delivery to local stores, roadside market sales, and pick-your-own sales. Many fine personal sale programs have been and can be developed as profitable berry outlets.

Berries are excellent for immediate home use as fresh, frozen, or canned fruit or as preserves. Demand has also been reported for home and commercial wine production (especially blackberries) and for commercial preserving outlets.

“Pick-Your-Own” Operations

Because of the high labor needs at harvest and the scarcity and expense of harvest labor, the pick-your-own program is ideal for blackberries and raspberries. This program is working well in some parts of Kentucky and elsewhere. Pick-your-own relieves the grower of the problem of getting harvest labor and also of handling, shipping, selling and, possibly, storing the berries. It provides the consumer with high-quality berries possessing an added storage life and some “back to the farm” recreation. The overall trend for pick-your-own is stable to slightly declining because of the increasing number of two-income families.

Diseases

Anthracnose

This disease is especially troublesome on black raspberries and purple raspberries, and it is also serious on some blackberry varieties. It causes oval or circular grayish white scabby spots on the canes and sometimes on the leaves. It often girdles the canes before the crop matures, causing the berries to dry up. It is especially important, therefore, to plant only stock that is free from this disease. Before taking new plants to the field for setting, cut off the stubs of the old canes attached to the young plants below where the ground level will be and burn them. This keeps them from infecting the new shoots with anthracnose and cane blight. Apply a delayed dormant spray when the leaves are showing green, or when they are about 1/8-inch long. Red raspberries are less likely to be seriously damaged by anthracnose than black and purple varieties, but sprays should be applied if there has been much anthracnose on the plants.

Cane Blight and Spur Blight

These diseases may cause extensive damage to raspberry canes. Remove and burn blighted canes, all old canes, and cane parts immediately after harvest, and any plants already made unproductive by these diseases. After the disease has become established on a plant, there is no means of control; however, fungicides applied for anthracnose control will protect plants from cane blight and spur blight.

Another cane blight has been observed in Kentucky and surrounding states on thornless blackberries, primarily on second-year fruiting canes. It is usually found following particularly cold winters where there is winter injury on canes. Cane blight forms a bleached area on the cane, and the portion of the cane above the canker either dies or is extremely weak and does not produce a crop (Figure 7). A number of pathogenic fungi have been found in the cankers. Management of this problem involves using a liquid lime sulfur spray in early spring, reducing plant stress through weed control, pruning out diseased canes, and timely irrigation.



Figure 7. Cane blight on thornless blackberries.

Septoria Leaf Spot of Blackberry/Raspberry Leaf Spot

Small, brown to tan spots may develop on leaves infected with either leaf spot disease. Serious defoliation may result during wet weather, but in most seasons, the disease is not that severe. Sprays applied for anthracnose control will also control leaf spot. The purple raspberry cultivar Royalty appears to be very susceptible to the raspberry leaf spot fungus.

Crown Gall

This disease causes galls to form on the roots and lower parts of the canes of both raspberries and blackberries. It is more common on red raspberries but also injures black and purple varieties. Cut out and burn infected plants found in the patch. At planting time, discard and burn any plants with obvious swellings on the roots.

If you are planting into an area that is known to be infested with crown gall, you might want to treat your plants with Galltrol or Norbac 84 at planting. These are preparations of *Agrobacterium radiobacter* strain 84, which is antagonistic to crown gall bacteria. Treat the plant by dipping the roots into a solution of Galltrol or Norbac 84 before planting. These bacteria colonize the root system of treated plants and prevent roots from becoming infected with crown gall. This treatment is fairly expensive and is recommended only on problem sites.

Orange Rust

In Kentucky, orange rust is severe on some wild and cultivated thorny blackberries. It is known to infect black and purple raspberries and thornless blackberries to some extent but does not attack red raspberries. In spring, the leaves on infected plants turn yellowish and are narrow and twisted. The lower sides of the leaves are soon covered with bright, orange-yellow pustules full of spores, which upon

scattering, spread the disease. Infected canes are spindly and clustered, never develop normally, and do not bear fruit. The disease spreads throughout infected plants, and any new canes will be infected. For control, dig out (roots and all) and burn any infected plants. Also, remove any wild blackberries or black raspberries from the vicinity of cultivated plantings.

Note: A type of late yellow rust is known on some blackberries and occasionally on red raspberries. It appears late in the season, producing yellow powdery spores on the lower leaf surfaces. It does little damage and should not to be confused with orange rust.

Phytophthora Root and Crown Rot

Raspberries planted in poorly drained locations are subject to root rot problems. Lower stems may become girdled by the fungal infections, and plants collapse and die. Avoid using sites that remain wet following rain. Root and crown rot can be largely avoided by planting the bramble crops on 10-inch-high raised beds or ridges. Spring and fall applications of recommended root and crown rot fungicides may also help. See ID-94, *Kentucky Commercial Small Fruit and Grape Spray Guide*.

Fruit Rots

Gray mold fruit rot is caused by *Botrytis cinerea* and is the most common fruit rot of raspberries and blackberries in the field. This disease can be a problem during wet harvest seasons. Fungicide sprays during fruit ripening and harvest help control this disease. Rhizopus and Mucor fungi can also cause fruit rot.

Double Blossom or Rosette

Double blossom or rosette is a fungus disease that may chronically infect blackberry plants in the southeastern United States. It causes flower buds to enlarge and produce coarse reddish flowers with twisted petals that make the flowers appear double. These flowers do not produce fruit. Infected plants also develop abnormal broomlike growths of leafy shoots. To control the disease, cut all canes close to the ground after harvest and remove them. Recommended fungicides applied before and after harvest may also help. Many thornless blackberries appear to have more resistance to this disease than do the thorny blackberries.

Sterility

Sterility is a symptom possibly caused by a virus disease that occurs in all blackberry-growing areas of the United States. Affected blackberries or black raspberries usually grow more vigorously than healthy blackberries and bloom heavily, but they either fail to set fruit or produce only small, misshapen berries.

For control, remove and burn plants that fail to set fruit, and dig up roots to prevent new shoots from appearing. Avoid replanting in the spot for several years afterward. Plant only state-certified plants that were propagated from fruitful stock from reputable nurseries. This problem can destroy a plantation, so don't take any chances.

Care must be taken to ensure that the symptoms of sterility are not confused with cultural problems. If a bramble planting blooms and sets fruit well one season and then the entire planting has a poor fruit crop the following season, suspect disease or insect injury to the berry cluster stems or poor pollination. Ordinarily, sterility will show up in a few plants and spread gradually through the patch over a period of years. However, there have been some cases where nurseries have unknowingly propagated plants from infected plants. In these cases, the new plantings will be uniformly infected throughout, and there will probably be little if any normal fruit the first fruiting year.

Virus Diseases

Red raspberries are not seriously injured by the various mosaics, but black raspberries are. Make new raspberry plantings from plants known to be free of mosaic or similar virus diseases. If mosaic or other virus diseases are found in a planting, dig out the plants and burn them. Mosaic can be recognized by its mottling of the leaves. Other virus diseases may cause dwarfing, leaf curl, or die-back. (See the above section on "Sterility.") Remove sterile plants, using the precautions recommended for removal of mosaic plants.

Insects and Mites

Mites

Light-colored, speckled, and slightly curled foliage on brambles, especially in dry seasons, is often caused by very small yellowish or reddish mites called "red spiders" or "red mites."

Red-Necked Cane Borer

The larva of this small red-and-black beetle is long and flat-headed. It bores within raspberry and thornless blackberry canes and causes swellings from 1 to 3 inches long. Infested canes die or are severely weakened and can be recognized by swellings near the ground. The best control is to cut out and burn all affected canes during the dormant pruning, as the adults emerge in May and June. Since this insect also breeds in blackberries and dewberries, destroying nearby wild brambles will aid in its control. Adults can be killed, just before blooming or immediately after harvest, by spraying. Pesticide applications are most effective just before bloom or immediately after harvest.

Raspberry Cane Borer

Numerous freshly wilted tips on young raspberry shoots are a sign of cane borers. The adult, a yellow and black long-horn beetle, kills the cane tips by making two rows of punctures along each shoot about ½ inch apart and laying a single egg in the shoot between the two girdles. Removing freshly wilted tips below the lower girdle gets rid of the eggs before the borers hatch and thus saves many canes. The borer hatching from each egg burrows downward in the cane and remains there for two seasons before it changes to an adult. Because of the borer's long life cycle, removing weakened canes and all old canes after fruiting is a good control method.

Strawberry Weevil (Clipper)

This small snout beetle passes the winter as an adult and lays its eggs in the unopened fruit buds of the strawberry as well as the cultivated and wild blackberry. It then crawls down and stings or girdles the stem ¼ inch or so below the bud. Each bud that is attacked wilts and does not develop. Very heavy attacks can reduce the fruit crop. The weevil is easy to see and is another good reason to closely inspect the developing crop. Early season, pre-bloom pesticide applications will usually control the problem.

Aphids

Brambles are very sensitive to injury by aphids. Aphids are soft-bodied insects that feed on the undersides of leaves and cause both crinkling and downward cupping of the leaves. Natural predators and weather conditions usually control this pest. However, if infestation occurs on 10 percent or more of the shoots, institute control measures.

White Grubs and Cutworms

White grubs are the larvae of the May or June beetle and may cause injury by feeding on the roots if large numbers are present. Cutworms may cause injury to emerging shoots in new plantings. Both insects are more apt to be present where brambles follow an established sod.

Japanese Beetles

These metallic-colored beetles feed on the leaves and fruit of brambles and are a problem in central and eastern Kentucky. For more information on Japanese beetles and their control, consult Cooperative Extension publication ENT-5, *The Japanese Beetle*.

Sap Beetles and Picnic Beetles

Sap beetles and picnic beetles are small, flat, brown or black oval beetles with orange markings that are attracted to the overripe fruit of blackberries and raspberries. Try to keep overripe and crushed fruit out of the patch to avoid attracting these beetles.

For more information on pest control, see your county Extension agent for ID-94, *Kentucky Commercial Small Fruit and Grape Spray Guide* or ID-21, *Disease and Insect Control for Home Grown Fruit in Kentucky*.