

Commercial Production Guide

Blackberry & Raspberry

► Many variables go into successful production of blackberries and raspberries—from choosing the right site, variety, and planting stock to knowing how to care for and harvest this delicate fruit. Learn the key concepts to growing a healthy crop.

Blackberries and raspberries are members of the family Rosaceae and genus *Rubus*. They are known as brambles or caneberries, common terms for a diverse group of berries that includes blackberries, raspberries, dewberries, and their hybrids.

The flowers of blackberries and raspberries are composed of several ovaries. Once fertilized, each ovary gives rise to a drupelet. Together these drupelets form the aggregate blackberry or raspberry fruit. Blackberry flowers produce nectar and pollen that attract bees, which serve as pollinators. Honey derived from blackberry flowers is reported to be light in color with good flavor.

The crown and root systems of brambles are perennial (live for many years), while canes (stems) are biennial (live for 2 years). In spring, new canes emerge from buds on crowns or roots. During their first year these canes are called primocanes (first-year canes) and usually do not produce flowers and fruit. In the second year, following a dormant period, the canes flower and fruit and are called floricanes.

Primocanes grow rapidly in length following emergence and usually produce compound leaves. In contrast, floricanes do not increase in length but produce short, lateral branches with a few leaves and a terminal inflorescence (flower cluster).

Distinguishing Characteristics

Raspberries can be red, black, purple, or yellow. Some blackberries and red and yellow raspberries are considered everbearing because they produce fruit in



the fall on primocanes and in the summer on floricanes. Blackberries can be either thorny or thornless. You can distinguish between raspberry and blackberry fruit at picking: with blackberries, the white receptacle (core) comes off with the fruit; with raspberries it remains attached to the stem.

Most raspberry cultivars are poorly adapted to the South because they lack heat and drought tolerance. Blackberries, on the other hand, can withstand extreme heat and summer drought and are very well suited to the Alabama climate. Caneberry adaptation from best to worst for southern climates is blackberries, black raspberries, purple raspberries, and red raspberries. Raspberry acreage in the South is limited to high, cool elevations or sites that are partially shaded from intense afternoon radiation.

Blackberries are the most common bramble in the southeastern United States and are adapted to a wide range of environments. Based on their growth habit, blackberries may be categorized into three types: erect and semi-erect; western-trailing evergreen blackberry and boysenberry; and southern-trailing blackberry or dewberry. Of these, the erect and semi-erect types are extensively cultivated, and the dewberry is cultivated on a limited scale. The western-trailing types are not well adapted to the South, primarily because of their susceptibility to diseases.

Blackberry cultivars range from completely self-fruitful (individual plants do not require pollination from other blackberry plants) to completely self-unfruitful (individual plants require pollination from other plants). Most commercially available blackberry varieties are self-fruitful and do not require a pollinizer.

Although wild blackberries are often harvested in Alabama, they have several limitations, including comparatively small berries, lack of uniformity, low yield, and late maturation.

Site Selection

Selection of a suitable planting site is the first step toward success in growing brambles. In addition to economic considerations, such as proximity to markets, availability of labor, and accessibility, several topographical and biological factors also require consideration. The two most important factors to consider in choosing a planting site for brambles are air drainage and water drainage.

Brambles, like most fruit crops, are subject to damage from spring frosts at bloom time. Planting on sloping sites or elevated level areas allows cold air to drain away from the blackberries on frosty nights. Low-lying sites or areas surrounded by trees that impede air drainage should be avoided.

Brambles are damaged when water stands around their roots at any time of the year. Plantings on poorly drained soil are unproductive and short lived. Poorly drained soil also encourages development of diseases such as *Phytophthora* root rot. An elevated site that provides air drainage usually has good water drainage as well.

Before planting, consider the cropping history of the site and the nature of nearby crops. Do not plant blackberries immediately following crops from the solanaceous family, such as potato, tomato, pepper, or eggplant; this increases the risk of infection with *Verticillium* wilt. Also avoid any site previously planted

with fruit crops having a history of crown gall. When possible, separate new blackberry plantings from other cultivated or wild brambles by at least 350 feet to restrict disease infection.

Blackberries do best in full sunlight, so avoid sites near trees. Trees not only shade the planting but compete for soil moisture, impede air drainage, and provide shelter for predatory birds during fruit ripening. In large, open, windy areas, however, windbreaks may be essential to prevent cane breakage.

While the direction of the site slope is not a critical factor in selection, it can affect the time of bloom and fruit maturation. In most areas, blackberries on a southern slope bloom and fruit slightly earlier than those planted on a northern slope.

Blackberries grow and produce satisfactorily on a wide range of soil types, from sandy to heavy clay loams, provided that the drainage is good. Availability of water for irrigation near the planting is an important consideration.

Good soil characteristics for blackberry production are deep, sandy loams that are moderately fertile, high in organic matter, easily worked, and retentive of moisture but well drained. If the subsoil has a hardpan or the water table is high, the root system will be restricted, and the plants will suffer during periods of drought. Blackberries are tolerant of a wide range of soil pH but grow best in pH of 6.0 to 6.5.

Land Preparation

Select the site and prepare for planting a year in advance if possible. This allows time for proper soil preparation, elimination of perennial weeds, fertility adjustments, elimination of some soil insect problems, and installation of an irrigation system.

Eliminate highly competitive perennial grasses, such as bermudagrass, prior to planting blackberries. Use either repeated tillage under dry conditions or a combination of tillage and herbicide treatment when ample moisture has induced succulent weed growth. The most effective time to kill perennial weeds with a systemic herbicide, such as glyphosate, is in the fall several weeks before a killing frost.

It is advisable to grow a cover crop on the site the year prior to planting. This helps to eradicate/reduce weed pressure and improve soil tilth. Planting directly after turning under sod increases the risk of damage from white grubs and other soil insects.

If the soil is low in organic matter, add materials such as pine bark in the fall prior to spring planting. Lime may be incorporated at this time if needed.

Prepare the site for planting as early in the spring as possible. Deeply plow, disk, and harrow the soil until well pulverized. If a hardpan exists, subsoiling is recommended. Phosphorus and potassium fertilizers may be incorporated into the soil during land preparation. Nitrogen can be added immediately before or after planting to minimize nitrogen loss. Base the amount of fertilizer used on soil test recommendations.

Variety Selection

Most blackberry cultivars (varieties) are climatically adapted throughout Alabama. Many new thornless blackberry varieties are available from breeding programs and are increasingly appearing in the retail market. Primocane-fruiting blackberries hold promise for the potential to produce more than one crop per year—the normal summer crop (the floricane crop) and a later crop on the current season primocanes.

New varieties have been observed to flower and fruit until frost, depending on late summer and fall temperatures, plant health, and location they are grown. In more northern climates, they have the potential to provide a crop even if floricanes are damaged by winter cold since the primocanes grow and fruit in the same season.

The major limitation to blackberry production in the Southeast is the fungal disease that causes double blossom/rosette. The newly developed thornless University of Arkansas varieties show resistance to this disease. In addition, the Arkansas varieties are upright in growth habit and are crown-forming. They do not require the trellising system used for trailing and semi-erect varieties. A trellis system should be considered, however, for ease of picking and keeping the canes from touching the ground.

Proper cultivar selection is essential if successful commercial production is to be achieved. The most successful operations use erect blackberry varieties that produce good-quality fruit that ripen over an extended period. Yield potential, susceptibility to diseases, ripening

season, ease of harvest, cultural practices required, marketing strategies, and postharvest shelf life should all be considered in the selection process. Many possible choices are available.



Floricane-Fruiting Thornless Varieties

- **'Apache'**
Release: 1998
Plant type: thornless, erect
Chill requirement: approximately 800 chill hours
Fruit size: 7-to-10-gram berry, one of the largest among thornless varieties
Flavor/sweetness: average 10 percent soluble solids
Maturity date: ripens in late June in Arkansas
Disease resistance: double blossom/rosette disease
Comments: 'Apache' is known to have issues with white drupelet disorder and is not widely planted anymore. Fruit storage and handling potential is reported to be good.
- **'Arapaho'**
Release: 1993
Plant type: thornless, erect
Chilling requirement: 450 chill hours
Fruit size: 5 grams on average
Flavor/sweetness: 9.6 percent average soluble solids; berry flavor rated good
Maturity date: early June
Disease resistance: double blossom/rosette and orange rust
Comments: 'Arapaho' plant growth is moderately vigorous. Fruit storage and handling potential are good.

- **'Chester'**
Release: 1985
Plant type: thornless, semi-erect
Chilling requirement: 800 chill hours
Fruit size: 5 grams on average
Flavor/sweetness: excellent flavor when picked fully ripe; berries considered fully ripe when dull black color rather than shiny black; flavor regarded as mild
Maturity date: late June
Disease resistance: cane blight, crown gall
Comments: Postharvest handling is excellent. Plants require trellis support. 'Chester' is resistant to drought and frost.

- **'Natchez'**
Release: 2007
Plant type: thornless, semi-erect
Chilling requirement: 400 chill hours
Fruit size: 10 grams, very large
Flavor/sweetness: flavor rated as good; 9.5 percent soluble solids
Maturity date: early June
Comments: Fruit storage and handling potential is very good and is comparable to other Arkansas thornless varieties.

- **'Navaho'**
Release: 1989
Plant type: thornless, erect
Chilling requirement: 850 chill hours
Fruit size: 5 grams on average
Flavor/sweetness: flavor rated as excellent; 11.4 percent soluble solids
Maturity date: late season
Disease resistance: anthracnose (mod.), rosette/double blossom
Comments: Harvest period extends for 5 to 6 weeks and fruits later in the season. Fruit is very firm, and the storage and handling potential is exceptional. 'Navaho' is susceptible to orange rust.

- **'Ouachita'**
Release: 2003
Plant type: thornless, erect
Chilling requirement: 400 to 500 chill hours
Fruit size: 5.5 grams
Flavor/sweetness: exceptional flavor and sweetness with soluble solids of 10 percent
Maturity date: mid-to-late June
Disease resistance: double blossom/rosette disease
Comments: It is expected to do well where 'Apache', 'Arapaho', and 'Navaho' have performed well. Desirable characteristics include consistent high yields, large fruit size, and good postharvest keeping quality.

- **'Osage'**
Release: 2012
Plant type: thornless, erect
Chilling requirement: 400 to 500 chill hours
Fruit size: 4.4 to 5.5 grams
Flavor/sweetness: flavor consistently good with soluble solids of 11.2 percent
Maturity date: mid-early season
Disease resistance: orange rust and double blossom/rosette; limited fruit anthracnose observed
Comments: Berries have excellent storage potential for the shipping market. Fruit size is smaller than 'Ouachita'.

- **'Sweetie Pie'**
Release: 2016
Plant type: thornless, semi-erect
Chilling requirement: 400 chill hours
Fruit size: 5 grams
Flavor/sweetness: excellent flavor with soluble solids of 11 percent
Maturity date: mid-to-late season
Disease resistance: double blossom/rosette disease
Comments: The variety is suitable for home gardens, local markets, and you-pick operations. 'Sweetie Pie' is well adapted and productive in the Gulf Coast region. This variety is susceptible to orange rust.

- *'Triple Crown'*
Release: 1996
Plant type: thornless, semi-erect
Chilling requirement: 800-plus chill hours
Fruit size: medium to large, 6 to 8 grams
Flavor/sweetness: good flavor
Maturity date: late, July 10
Disease resistance: none found
Comments: Yield is high. Berries are considered the best among USDA thornless varieties. 'Triple Crown' is a good fit for local markets due to postharvest fruit quality.

New Floricane-Fruiting Thornless Blackberry Varieties

- *'Caddo'*
Release: 2019
Plant type: thornless, erect
Chilling requirement: 800 chill hours
Fruit size: 8 to 9 grams
Flavor/sweetness: great aromatics; sugars 10 percent or higher
Maturity date: between 'Natchez' and 'Osage'
Disease resistance: leaf rust, orange rust, anthracnose, and rosette/double blossom
Comments: 'Caddo' produces large, elongated berries all season and has comparable yield and postharvest qualities to 'Osage' and 'Ouachita'. Bushes are healthy.
- *'Ponca'*
Release: 2019
Plant type: thornless, erect
Chilling requirement: none listed
Fruit size: 7 grams
Flavor/sweetness: consistently sweet with soluble solids of 10 to 13 percent; subacid flavor with tremendous aromatic profile
Maturity date: early season
Disease resistance: anthracnose and orange rust not observed; little leaf and cane rust documented
Comments: Major attributes are exceptional flavor and shortened internodes.

Floricane-Fruiting Thorny Blackberry Varieties

- *'Kiowa'*
Release: 1996
Plant type: thorny, erect
Chilling requirement: 200 to 300 chill hours
Fruit size: large, 9 to 14 grams
Flavor/sweetness: average flavor with 10 percent soluble solids
Comments: Usually has a long ripening period. Berries are not suitable for shipping.

Primocane-Fruiting Blackberry Varieties

- *'Prime-Ark 45' Primocane*
Plant type: thorny, erect
Fruit size: medium-large; primocane fruits averaged 4 to 5 grams in Arkansas, 7 grams in Oregon, and 9 grams in California; floricane fruits larger at 6 grams in Arkansas
Flavor/sweetness: soluble solids 10 to 11 percent in floricane fruit and 12 percent in primocane fruit
Maturity date: floricane first harvest early June; primocane first harvest early August in Arkansas
Disease resistance: no orange rust observed and only slight anthracnose observed; no information available on resistance to double blossom/rosette
Comments: 'Prime-Ark 45' is primarily intended to provide a high-quality berry with excellent postharvest handling to allow production of berries for local and shipping markets in late summer to fall fruiting seasons in areas where it is adapted. Summer temperatures above 85 degrees Fahrenheit can reduce fruit set and quality on primocanes.
- *'Prime-Ark 45 Traveler'*
Plant type: thornless, erect
Fruit size: semi-elongated berries weighing 7 to 8 grams
Flavor/sweetness: very good flavor with soluble solids of 9 to 11 percent
Maturity date: floricane first harvest early June; primocane harvest late July/early August in Arkansas
Comments: 'Prime-Ark 45 Traveler' maintained firmness compared to other varieties both prior to and after cold storage.

- *'Prime-Ark Freedom'*

Plant type: thornless, erect

Chilling requirement: Exceedingly early bloom dates could indicate lower chilling requirements, but this has not been confirmed due to the evaluation site in Arkansas being a high-chill location.

Fruit size: floricane fruits 9 grams (average) in Arkansas and slightly less for primocane fruits

Flavor/sweetness: good flavor and average soluble solids of 10.4 percent

Maturity date: floricane first harvest early, up to 9 to 11 days earlier than early ripening 'Natchez' and 16 to 18 days before 'Ouachita'; primocane first ripe fruit date difficult to determine, but observations indicate first ripe fruit mid-to-late July on tipped primocanes

Disease resistance: no orange rust observed; slight anthracnose observed; no information available on resistance to double blossom/rosette

Comments: 'Prime-Ark Freedom' is the world's first primocane-fruiting and thornless commercial blackberry introduction. It is intended for local markets or home gardens due to low storage potential. This variety is not recommended for shipping. Plant growth in Arkansas is not excessive.

Other Primocane-Fruiting Blackberries

- *'Stark Black Jim'*

Release: 2017

Plant type: thornless, erect

Chilling requirement: none listed

Fruit size: large berry with small seeds

Flavor/sweetness: excellent flavor with soluble solids of 11 to 12 percent

Maturity date: August (primocane fruit), July (floricane fruit)

Disease resistance: none listed

Comments: 'Stark Black Jim' is not recommended for commercial production; is suitable for home gardens and local markets.

- *'Baby Cakes'*

Release: 2016

Plant type: thornless, ornamental, compact

Chilling requirement: none listed

Fruit size: large

Flavor/sweetness: sweet

Maturity date: early July

Disease resistance: none listed

Comments: The reduced plant size makes it suitable for potted deck blackberry cultivation/edible decoration.

Red Raspberries

Red raspberries are not well adapted to Alabama climate conditions. They may perform best in partial shade or afternoon shade. Keep soil around plants heavily mulched and plants well-watered during summer.

- *'Southland'*

Release: 1968 (North Carolina)

Plant type: erect

Fruit size: medium

Flavor/sweetness: mild flavor, slightly acidic with good dessert quality

Maturity date: Spring crop ripens early; fall crop begins to ripen early August and continues until frost

Disease resistance: leaf spot, mildew, and anthracnose

Comments: 'Southland' was developed in cooperation with the USDA. It is adapted to the fluctuating winter temperatures of the upper South. Berries are bright red and cone shaped. Overmature berries tend to crumble.

- *'Heritage'*

Release: 1969

Plant type: erect

Fruit size: medium

Maturity date: outstanding for its heavy fall crop; spring crop moderate

Comments: 'Heritage' is the predominant everbearing red raspberry in the central and eastern United States. Berries are firm, of excellent quality, and attractive. The plants are vigorous, producing many upright, sturdy canes that hold up their fruit well.

- *'Dorman Red'*

Release: 1972

Plant type: trailing

Fruit size: medium

Flavor/sweetness: Poor flavor

Comments: This plant has trailing canes and requires an appropriate trellis. It is the most heat tolerant of all red raspberry varieties.

- *'Nantahala'*

Release: 2008 (North Carolina)

Plant type: erect

Fruit size: large

Maturity date: August in southwestern North Carolina and September in northwestern North Carolina

Disease resistance: leaf rust and leaf spot in North Carolina trials under minimal spray program

Comments: 'Nantahala' is a primocane-fruiting and

late-season variety. The canes develop prickles at the base of the plant. Fruit is larger than 'Heritage' but has a smaller number of drupelets.

Purple Raspberries

Purple raspberries are the result of crosses between red and black raspberries. The fruit resembles the red parent more than the black. The flavor is not distinctly like either parent but is particularly good. This fruit is not as popular as the red or black, probably because it is less well known.

- **'Brandywine'**
Fruit: large, good quality, vigorous
Flavor/sweetness: tart; makes excellent jam and jelly
Comments: This variety is promising and worthy of trial. 'Brandywine' is propagated by tip layering. Trellising is recommended.
- **'Royalty'**
Release: 1993 from New York Agricultural Experiment Station
Plant type: suckers like the red raspberry and has relatively stout canes
Fruit: large
Flavor/sweetness: sweeter than 'Brandywine' and makes excellent jam and jelly
Maturity date: late in season
Disease resistance: multiple insect resistance and immunity to the raspberry aphid, which carries mosaic virus
Comments: It is recommended for trial.

Black Raspberries

There are few commercial black raspberry plantings in the Deep South because of low yields and poor environmental adaptation.

- **'Bristol'**
Release: 1934 New York Experiment Station
Fruit: medium to large, well-formed, glossy, very attractive, excellent quality
Flavor/sweetness: very flavorful
Maturity date: early season
- **'Jewel'**
Release: 1973 (New York)
Fruit size: larger than 'Bristol'
Disease resistance: more disease resistance than other black raspberry varieties
Comments: 'Bristol' is one of its parents.

- **'Logan'**
Fruit: large and attractive
Maturity date: ripens early
- **'Allen'**
Release: 1957 (New York)
Plant type: productive and vigorous
Fruit: large and attractive
Comments: Harvest is fairly concentrated.
- **'Black Hawk'**
Release: 1955 (Iowa)
Plant type: very hardy
Fruit: large and cold firm
Maturity date: ripens very late
- **'Haut'**
Release: 1989 (University of Maryland)
Fruit size: moderate
Flavor/sweetness: very sweet
Maturity date: ripens early and over a longer period than other black raspberry varieties

Obtaining Planting Stock

Variety Selection

Following site selection, the most important decisions for a grower are plant variety and planting stock source. Poor variety selection is irreversible and cannot be corrected without starting over. There are many varieties of blackberries and raspberries from which to choose, but only a few are well adapted to any specific region.

Sources of Planting Stock

After determining the varieties to be planted, a grower must locate a source of planting material. This is a critical decision since many serious production problems are directly associated with the planting material used.

It is essential in bramble production to start with certified, virus-tested, disease-free planting stock. The length of life of the planting and the annual productivity are directly related to the health of the plants. A reputable nursery source must be used.

Many nurseries offer plants bearing state certification. This certificate indicates that plants have been grown from special healthy stock under regulated conditions designed to eliminate disease and insect pests as much as possible. Make every effort to obtain planting stock developed under such a program. Do not use plants

from an old planting unless they are carefully inspected by a person knowledgeable about bramble disease and insect pests.

Propagation

Nursery stock is available as transplants, suckers, tips, root cuttings, or tissue-cultured plants. Transplants are larger and more vigorous than suckers. Nurseries develop transplants by replanting suckers (red raspberries) or tips (black raspberries and blackberries) and allowing them to grow another year.

In home garden settings, a number of these propagation methods can be used depending on the growth habit of the plant. For example, erect blackberry plants are propagated more successfully through root cuttings and root mass digging. Semi-erect blackberry plants respond better to tip layering or rooting of dormant hardwood cuttings. Before propagating, check the patent status of the variety. A license is required to propagate patented plants.



Dormant suckers are the traditional blackberry or red raspberry transplant. Black raspberries rarely produce suckers. Purple raspberry suckers are sometimes used but, like black raspberries, are mostly propagated by rooting primocane tips (tip layering in late summer and fall).

To be good-quality transplants, red raspberry suckers must retain a portion of the parent-plant root; they may have an inverted T or L shape. Transplants with relatively large root systems are acceptable, but those with few or no roots and no part of the parent root are less likely to survive. Succulent red raspberry suckers (primocanes) may be transplanted in early spring when suckers are 5 to 8 inches tall; however, care must be taken to provide adequate moisture and weed control.

Black and purple raspberries and some blackberry varieties are propagated by tip layering. This is usually done in late August by burying the tips of the current season's cane 2 to 4 inches in the soil. The buried tips develop roots and form new plants before dormancy the same year. Cut them from the original plant before digging. About 6 inches of old cane (called the handle) is left attached to the rooted tip. Plants are shipped with these handles attached.

Root cuttings can be used to produce either red raspberry and some blackberry variety transplants or to directly establish plantations for fruit production. Choose roots of variable lengths and 1/16 to 3/16 inch in diameter. Plant at about a 3-inch soil depth with approximately 2 ounces of roots per hill or per 3 feet of hedgerow.

Tissue culturing is the most common means of propagation and is well suited for commercial fruit production. The method allows for a large number of plants to be produced at one time.

Tissue culturing involves removal of the growing tips from virus-free plants under sterile conditions. Growing tips are placed on a nutrient medium, which causes cells to multiply until a separate plant (plantlet) is produced. The plantlet is placed in sterile soil and allowed to grow until it is ready for planting.

When derived from virus-free parent plants and rooted in sterile potting media, this kind of transplant should be free of most serious diseases, insects, and nematodes. Transplants derived from tissue culture usually cost more than suckers, but the investment in disease-free plants is worthwhile. In vitro tip-cultured (aka tissue-cultured) red, purple, and black raspberry plants are available from certain nurseries.

Caring for Planting Stock

Planting should be done when planting stock is dormant. Early spring is generally the most desirable time. It is often necessary to store planting stock received from a nursery until weather and other factors are conducive to planting. Plants and root cuttings can be held successfully in storage at 34 to 36 degrees Fahrenheit for several months if drying is prevented.

When plants or root cuttings arrive, open the package and check the condition of the planting stock. If they are dry, moisten them. Unless planting is to be done within a few days, heel-in the plants in a trench deep enough to cover the roots or wrap them in plastic and place them in a refrigerator. Whichever method is used to store plants, precautions must be taken to prevent drying.

Spacing Suggestions

Four factors determine spacing in a bramble planting: the size of the farm equipment; the training system desired; the growth habits of the variety; and the cost of transplants. The size of the farm equipment will determine the row width. The training system, the growth habits, and the investment desired will determine the distance between plants in the row (table 1).

Two types of training systems are used: the hedgerow and linear systems. All systems can be used with red and yellow raspberries and blackberries. Black and purple raspberries are usually trained to the linear system.

Hedgerow is the most popular training system for red raspberries. Set the plants at about 2½ to 3 feet apart in the row and 6 to 12 feet between rows. Sucker plants from underground stems will form a solid and continuous row in 1 or 2 years.

Linear systems differ from hedgerows in planting. Fruiting canes come from the crown of the original plant. For red raspberries, set plants at the same distance as in the hedgerow system.

Planting

Plant blackberries in late winter or spring. Fall planting is possible, but in areas of freezing winter temperatures, fall-set plants need to be mulched to prevent heaving

(especially with bare roots). While early spring planting is desirable, do not set plants until the soil is dry enough to work. Prepare the planting row with the same care used for planting vegetables; this includes making a raised bed/row and installing drip irrigation.

Place blackberries in rows spaced 10 to 12 feet apart. The distance between plants in the row depends on the type of blackberry being grown, the training system to be used, and the equipment used between the rows.

Plants of erect, thorny varieties generally are set 3 to 4 feet apart in the row and allowed to fill in for establishment of a solid hedgerow. If root cuttings are used for planting, they often are set 2 feet apart for more rapid row establishment. Most trailing and semi-erect varieties, both thorny and thornless, are set 6 to 8 feet apart in the row, depending on the vigor of the variety, and trained to a hill system of culture.

Under certain conditions, the direction to run the plant row deserves consideration. Where slopes are involved, cross-slope planting is better for irrigation and erosion control. In areas of occasional strong winds, it is best to orient rows in the direction of strong winds; a crosswind can result in considerable breakage of primocanes. In areas of high temperatures during harvest, the fruit on the west side of north-south rows may sunburn. Blackberries planted on a south-facing slope tend to ripen slightly earlier.

Table 1. Suggested Plant Spacing at Establishment

Type of Bramble	Spacing in Rows (ft)	Spacing Between Rows (ft) ^a	Plants per Acre	Management Systems
Thorned blackberry (erect) root pieces	2	10–12	2,187–1,815	Hedgerow ^b
Thorned blackberry (erect) rooted plants	3	10–12	1,452–1,210	Hedgerow
Thorned blackberry (trailing)	6–10	10–12	435–362	High trellis
Thornless blackberry (erect) rooted plants	3	10–12	1,452–1,210	Hedgerow
Thorned blackberry (semi-erect)	6–8	10–12	726–453	High trellis ^c
Red, yellow raspberry	2	10	2,178	Low trellis ^d
Black raspberry	2.5	10	1,452	Low trellis
Purple raspberry	3	12	1,210	High trellis

^aCommercial plantings require 12-foot row spacings.

^bPlanting system where blackberry plants are spaced 2.5 to 3 feet apart in a row

^cTrellis system with top wire that is 5 feet or higher

^dTrellis system with top wire set at 3 feet or higher

During the planting operation, it is very important to prevent the plants or root cuttings from drying. Prior to planting, contain plants in wet burlap bags in shade and set as soon as dropped for planting. Plant roots and root cuttings can be protected from drying during planting by coating with a layer of mud.

Other important points in planting are to set at the proper depth, allow proper space for spreading the roots laterally, and firm the soil well. In many cases, irrigation will need to be applied soon after setting to ensure proper soil moisture for root survival and development.

Planting may be done in a furrow or in individual holes. Set plants at about the same depth as they grew in the nursery. Cover root cuttings 4 to 5 inches deep on sandy soils and 2 to 3 inches deep on heavier soil types. Planting on raised beds with drip irrigation improves drainage issues.

Weed Control

The first consideration following planting is to control weeds effectively. Blackberries may be shallowly cultivated during the first growing season, but care must be taken to prevent breaking the tender, newly emerging primocanes. Herbicides for weed control are available and can be effective when properly used.

Sod is usually established between rows, and rows are kept clean of any weeds. If sod is allowed to develop between rows, it should be mowed several times during the growing season. If sod is not maintained in row middles, the area must be kept free of weeds by physical or chemical means. Herbicides can be used to manage weeds during site preparation as well as after planting.

Fertilization During the First Year

The types and amounts of nutrient elements to apply to a bramble at planting are determined by soil analysis. This ensures application of only those elements that are needed.

Along with nutrient analysis, the soil test indicates if lime is required to adjust soil pH. The chemical reaction involved in pH adjustment typically requires several months. Conduct soil tests well in advance of the scheduled planting date to allow the pH-adjusting chemical reaction to take place. If soil pH is too low or too high, some nutrients become unavailable to the plants or are supplied at levels that are toxic to the plant.

Follow instructions provided in the soil test on how much of each nutrient to apply. Broadcast the soil nutrients and incorporate 4 to 8 inches into the soil.

Any fertilizer needs for the initial growing season should be identified by soil tests and corrected during preplant land preparation. If plants fail to initiate vigorous growth, however, additional nutrients can be applied in the spring. Avoid application of nitrogen fertilizer later than July since this may result in subsequent winter injury. A typical first-year fertilization should be about 200 pounds per acre of a 10-10-10 fertilizer 1 month after planting.

Foliar nutrient testing assesses the nutrient content of the plant. Nutrient content can be compared to previously established nutrient sufficiency ranges for particular crops. Testing of primocanes to assess foliar nutrient content is done to determine if fertility practices are adequate or if they should be amended the following year. Foliar nutrient testing also allows for late-season amendment if results indicate a deficiency. Testing to assess the current season's needs can be done at any time during the season when nitrogen or a micronutrient is suspected to be deficient.

Sample floricanes-fruiting varieties in the Southeast after harvest. Conduct foliar sampling of primocane-fruiting varieties beginning with bloom to the green fruit stage. Select leaves free of blemish or disease for testing. Choose the most recently mature leaves approximately 12 inches from the tip of the cane. Collect 50 leaves from blocks that are no more than 5 acres and from no more than 50 primocanes. Place individual samples in brown paper lunch bags and ship them to a lab.

Interpreting Results

Sufficiency ranges for each nutrient have been developed for blackberry and other crops from previously conducted research that relates foliar nutrient status to optimal yields. These ranges are specific to the stage of plant development and time of year. Compare the results from your primocane foliar sample of a particular nutrient to the sufficiency range of that nutrient. If a nutrient is deficient and a deficiency is observed in the plant, adjustments to the fertility program may be made for the following year.

Training and Pruning Blackberries Without A Trellis

Erect Hedgerow System Types

Training. Varieties of erect blackberries are self-supporting and can be grown without a trellis system. Some type of support, however, will minimize cane breakage from wind, cultivation, and picking operations.

With hedgerow systems, the suckers or primocanes will fill in the entire row space. Keep the base of the row to a width of about 1½ feet by removing suckers that arise beyond this limit. The best plant density for the hedgerow system is four to six vigorous canes per lineal foot of row.

Pruning. Both summer and winter pruning are practiced with erect blackberries. During the summer, primocanes are topped by cutting or pinching out the shoot tip when they reach 3 to 4 feet (figure 1a). This removes apical dominance and allows lateral branches, which produce fruiting wood, to develop (figure 1b). It also prevents long, arching cane growth, which is more likely to result in cane breakage.

Cane breakage can be minimized by installing a trellis to hold the canes in an upright position. Since primocanes emerge at various times, summer topping must be done several times during the growing season. Unwanted suckers also must be removed during the summer.

Blackberry canes are biennial; therefore, floricanes die soon after fruiting. Dead canes can be removed at any time from the end of harvest to the next spring. Since old, dead canes may serve as a reservoir of disease and insects pests, early removal and burning is desirable.

Double blossom rosette can be a problem with some blackberry varieties. Some growers minimize this problem by removing all the primocanes until the floricanes finish blooming. This disrupts the disease cycle by preventing fungal spores from spreading to developing primocanes.

During the dormant season, pruning consists of shortening laterals, removing weak and insect-and disease-infested canes, and thinning canes in areas missed during the preceding summer. Maximum productivity and largest fruit size is realized when lateral branches are pruned to lengths of 12 to 18 inches.

Training and Pruning Blackberry Plants Using a Trellis System

Trailing and Semi-erect Types

Training and pruning. Trailing and semi-erect varieties must be trained to some type of support system. It is common, however, to also see erect varieties growing on a trellis system. The support may be simply a strong post or stake, 4 to 5 feet tall, to which the canes are tied, or one of several variations of a wire trellis system.

Greater yield and ease of harvest generally is obtained from training to a wire trellis. The most common trellis is

a two-wire vertical system consisting of wire stretched between posts set 15 to 20 feet apart in the row. One wire is attached 3½ feet above the ground and the other 6 feet (figure 2) above the ground.

Three-wire trellis systems may have the first wire 2 feet from the ground, the second wire 3½ feet from the ground, and the third at 5 feet. Canes are tied to these wires, running in both directions from the plant.

With trailing varieties, six to eight primocanes are evenly spaced in upright positions on the trellis and topped just above the top wire and tied to the trellis. After topping, lateral shoots begin to grow. The lateral shoots can be tied to the trellis if space allows, or they can be pruned back during the winter to 12 to 18 inches. Heavy, unsupported branches are easily broken by the wind.

Upright varieties are sometimes planted at closer spacing. Because of their upright growth habit, it is not practical to have six to eight shoots evenly spaced on the trellis as with the trailing varieties; therefore, at least two primocanes are used to fill the trellis. These primocanes can be topped above the wire and tied to the trellis. After topping, the lateral shoots begin to grow.

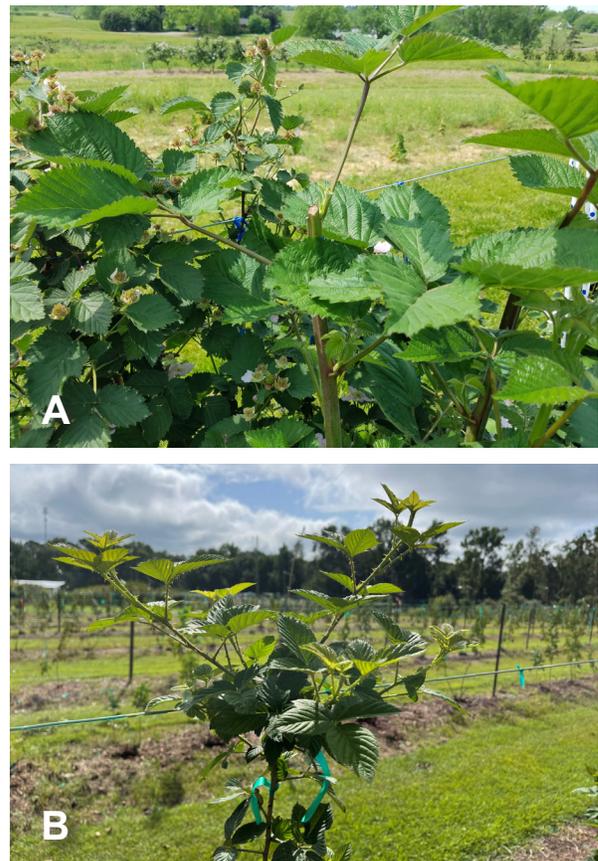


Figure 1. A. Primocanes are summer topped at a height of 3 to 4 feet. This operation is performed over several weeks because these first-year canes reach the proper height for topping at different times. B. Primocane several weeks after summer topping, showing the growth of lateral shoots from leaf axils.

Like the trailing system, the lateral shoots can be tied to the trellis if space allows, or they can be pruned back during the winter to 12 to 18 inches.

Some growers use a double-T trellis or V-shaped trellis for blackberries with an upright growth habit. This type of trellis system uses wires on each side of the plant and holds the plant in an upright position without tying every upright cane. The plants are checked periodically during the growing season to make sure the upright shoots are positioned inside the wires. The plant is topped just above the top wire, or wherever branching is desired, to encourage lateral growth. Cutting the lateral shoots back to 12 to 18 inches during the winter is recommended with this trellis system as well. Additionally, tying a few canes together may help during heavy winds.

Following harvest, old floricanes must be cut off at ground level, removed, and burned as soon as possible. Waiting to perform this process encourages disease.

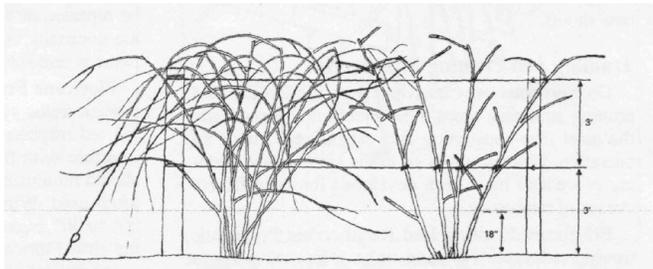


Figure 2. Vertical two wire trellis for semi-erect thornless blackberry culture. Left, plant before pruning, right, same plant after pruning.

Plants may produce more growth than needed to fill the trellis. In this case, some shoots need to be removed. A blackberry plant producing more canes than are needed can decrease yield. A thick row with many shoots decreases air circulation, decreases fungicide spray coverage, and encourages diseases.

Training and Pruning Raspberries

Growers must use care when choosing training and pruning strategies since these practices are generally the most time-consuming and expensive parts of an operation. Different types of trellis systems and pruning procedures have been developed for different classes of raspberries.

Primocane-Fruiting Red Raspberries

Primocane-fruiting red raspberries tend to have top-heavy canes that require support for efficient harvest and movement in the planting. The trellis system used is usually temporary since trellis removal is necessary for mowing during the dormant season if only the fall crop is desired. Steel or wooden posts may be placed in the row at 25-to-30-foot intervals. Some growers attach a 3-foot crossarm at 4 feet (forming a T-trellis), while other growers do not use a crossarm.

Twine is run down both sides of the row and attached to either the post or the crossarm at 4 feet of height at blossom time. This procedure may have to be repeated at 5 feet of height at harvest if the canes are unusually vigorous or the crop load is heavy. The twine is removed following harvest.

Floricanes-Fruiting Red Raspberries

Several permanent trellis systems can be used for floricanes-fruiting red raspberries. Since the developing primocanes interfere with the fruiting floricanes, trellis systems should minimize the interference.

A V-shaped trellis is often used. Wires are strung along posts placed at 20-to-30-degree angles along the outer margins of the planting row. Floricanes are tied to the wires, and primocanes are allowed to grow into the middle. Another trellis system used is a permanent T-trellis similar to the temporary T-trellis described previously.

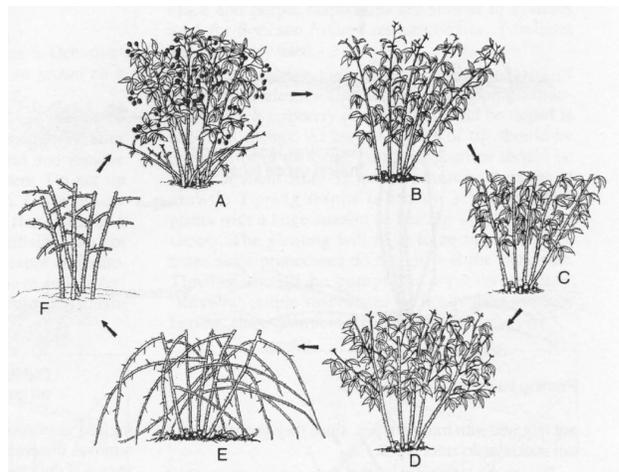


Figure 3. Blackberry and black raspberry development and pruning cycle: A. Summer fruiting of floricanes and growth of primocanes. B. Primocanes prior to summer topping after fruited floricanes have been removed. C. Primocanes after topping. D. Lateral branching of primocanes in response to topping. E. Dormant canes prior to winter pruning. F. Laterals pruned back during dormant season (copyright Prentice-Hall, 1990. Used by permission)

Floricanefruiting red raspberries occasionally are grown on a single-wire trellis. Pruning during the growing season is limited to removal of the floricanes immediately after fruiting. Cut these canes at ground level, remove them from the planting, and destroy them.

Do not tip primocanes during the growing season. Dormant-season pruning consists of topping the floricanes at a height convenient for picking and trellising. Do not remove more than 25 percent of the canes, or reductions in yield will occur. Remove any winter-killed wood. Thin out canes to three or four per square foot, selecting the most vigorous and healthy. Maintain row width at 18 inches.

Growers of floricanefruiting red raspberries in other regions of the United States are investigating annual mowing to reduce pruning costs. Each year a portion of the planting is mowed to the ground in early spring, similar to primocane-bearing red raspberries. Mowing has the advantage of reducing hand pruning and cane thinning. Disadvantages include reduced berry size, reduced fruit quality, and reduced yield for a given area of land (the mowed portion does not bear fruit).

Black and Purple Raspberries

Trellis systems for black and purple raspberries are similar to systems used for floricanefruiting red raspberries, with T-trellises commonly used. Pruning during the growing season consists of removing floricanes after harvest and tipping primocanes. Tip black raspberry primocanes at about 28 inches, removing at least 4 inches of tip from the cane. Tip purple raspberries at about 30 to 32 inches, removing 4 inches of growth.

Tipping results in stocky, self-supporting plants with a large amount of bearing wood on lateral shoots. The planting will have to be tipped several times since primocanes do not grow at the same rate. Tipping should be completed by harvest time. 'Royalty' purple raspberries do not require summer tipping since growth is much like a red raspberry.

Remove floricanes immediately after harvest by cutting them close to the ground. Dormant-season pruning consists of removing all but five to eight strong canes per crown. Remove any winter-damaged wood. Head back laterals to eight to ten buds (8 to 10 inches).

Fertilizing Established Plantings

A good nutrient program is necessary for healthy, sustained growth and fruit production. In the absence of soil or foliar tests, plant growth is a good indication of nutrient requirements. The nutrient most likely needed will be nitrogen. Blackberries utilize nitrogen in producing vegetative growth, which is directly related to future productivity. In most areas nitrogen needs to be applied annually.

Make the initial fertilizer application during land preparation prior to planting. This application should be sufficient for the first growing season. In the second and following seasons, a general application recommendation is 60 to 80 pounds per acre of actual nitrogen. Broadcast into the row area in early spring before growth begins. If rows are mulched, increase the amount of nitrogen by 50 to 100 percent for the first 3 years. If plants show excessive growth, reduce the amount of nitrogen applied accordingly.

Composted animal manures are very good sources of nitrogen and add organic matter to the soil. A general application rate for manure is 6 to 8 tons per acre of cow or horse manure and 2 to 3 tons per acre of poultry manure. Manure should be applied during late fall or winter when plants are dormant. Unless composted, animal manure may be a source of weed seeds.

If blackberry middles are clean cultivated, a winter cover crop is recommended. Cover crops planted in late summer between blackberry rows will block erosion, help harden blackberry canes for winter competition for moisture and nutrients, and provide valuable organic matter to soil when turned under in the spring. In addition, legume crops are available that add nitrogen to the soil. Some good cover crops for blackberries are cowpeas, oats, and rye. Care must be taken with aggressive crops such as vetch to prevent the seeds from getting into the blackberry row.

Irrigation

Although blackberry species survive extended periods of drought in their native habitats, a shortage of soil moisture can seriously reduce yields and fruit size of cultivated plantings. Lack of sufficient moisture in the spring affects fruit development. Insufficient moisture at any time of the growing season may have a detrimental effect on the subsequent year's crop. Irrigation may be especially important to the survival and growth of first-year plantings. Later yields are dependent on rapid establishment of well-filled hedgerows.

Blackberries in general require about 1 inch of water per week during the growing season. More may be required during fruit development in the spring and during hot, windy weather. When this amount is not supplied by rainfall, supplemental irrigation should be used. Any method of distributing irrigation water to the plants is satisfactory. Many growers use sprinkler irrigation, and trickle irrigation systems have become popular in blackberry culture.

Under hot, dry conditions, operate drip irrigation systems for at least 8 to 10 hours each week. More frequent, even daily, irrigation may be beneficial on very sandy sites and in mature plantings.

Adjust irrigation amounts and frequency throughout the growing season to correspond to evaporation rates. Based on averages for evaporation rates across the South, plants use 0.7 inch of water per week in May and September, 1.4 inch per week in June and August, and 2 inches per week in July. Soil moisture reserves must be regularly replenished by rainfall or irrigation; otherwise, plants become stressed and suffer losses in growth and production.

Pest Control

Many of the pest problems of blackberries can be prevented by starting with clean planting stock and subsequent application of good sanitary measures. By eradicating all wild bramble plants in the area and isolating new plantings from old ones, many diseases and insect problems can be prevented. Plants showing symptoms of virus, crown gall, and orange rust should be pulled from the field and burned. Timely removal and burning of dead floricanes after harvest and removal and burning of winter pruning will reduce populations of destructive pests.

The most common diseases and insect pests of blackberry are listed in table 2. Many pests are occasionally damaging to blackberries, but only a few are so consistently destructive that a regular control program is warranted.

Insects and Diseases

There are many insect and disease pests of brambles. As a rule, insects and mites do not present a major problem but may be serious in isolated situations. Diseases, however, seriously limit the productivity of brambles each year. Refer to the *Southeast Regional Caneberry Integrated Management Guide* on the

Southern Region Small Fruit Consortium website for insect, disease, and weed control recommendations. The major pests are listed in table 2. Following are the three most serious diseases:

Double Blossom Rosette

Double blossom rosette is a fungus disease of many varieties of erect and trailing blackberries, particularly in the humid southern United States. Rosette occurs on red and black raspberry but is seldom serious. Most recommended blackberry varieties are resistant to this disease.

Rosette-infected blossoms do not form berries. Noninfected parts of the same cane may produce poor-quality fruit. This disease seriously reduces fruit quality and yield.

Orange Rust

Orange rust is the most important of several rust diseases that attack brambles. All varieties of black and purple raspberries, erect blackberries, and most varieties of trailing blackberries are very susceptible. Red raspberries are not susceptible.

Unlike most fungi that infect brambles, orange rust develops in a systemic, perennial fashion. It grows throughout the roots, crown, and shoots of infected plants and is perennial inside the belowground parts.

Once plants are infected with orange rust, they are infected for life. Orange rust is debilitating but does not normally kill the plant. Infected plants are usually stunted and weakened and produce little or no fruit.

Orange rust–infected plants can be easily identified shortly after new growth appears in the early spring. Newly formed shoots are weak and spindly. New leaves on infected plants are stunted or misshapen and pale green to yellowish. The weak, unthrifty appearance of infested plants is important to remember when you consider control.

Within a few weeks of leafing out, the lower surface of infected leaves is covered with blister-like pustules. These waxy lesions soon take on the powdery, bright-orange rust appearance that gives the disease its name. These rusted leaves wither and drop in late spring or early summer.

Later in the season, the tips of young, infected canes appear to outgrow the fungus. At this point, infected

Table 2. Major Insect and Disease Pests of Brambles

Major Bramble Insects	Major Bramble Diseases
Strawberry weevil	Double blossom rosette
Spider mite	Orange rust
Japanese beetle	Anthracnose
Blackberry psyllid	Septoria leaf spot
Tarnished plant bug	Crown gall
Rednecked cane borer	Botrytis fruit rot (gray mold)
Tree cricket	Cane blight
Thrip	Powdery mildew
Aphid	Phytophthora root rot
Sap beetle	
Stink bug	
Spotted wing drosophila	

plants may appear normal, but they are systemically infected. In the years that follow they will be bushy and spindly and will not bear fruit.

In mid-spring, bright-orange spores from the pustules of infected leaves are spread by the wind to healthy susceptible leaves. These spores germinate in the presence of water. They may penetrate the leaf directly or enter through a stomate.

Always start a planting with disease-free, rust-free nursery stock from a reputable nursery. Never make root cuttings from a planting where orange rust has been a problem. Before setting out new plants, remove and destroy all nearby wild brambles that can serve as a reservoir for the rust fungus.

Careful and timely removal of infected plants from the planting is probably the most important control method currently available for orange rust. Inspect plantings in early spring just after the plants leaf out; orange rust-infected plants are easily identified at this time. Dig them up (roots and all) and burn them. Rogue out and destroy plants with rust symptoms before the orange spores are produced. Once spores are produced they cause new infections that may not show up until the following spring.

There are no fungicides recommended for controlling orange rust. Strict sanitation and taking care to plant disease-free plants are the only control.

Anthracnose

Anthracnose, sometimes called dieback, is a common foliage and cane disease of brambles. The disease is first noticeable in the spring as small, purplish spots on new shoots and as purple-bordered spots on leaves. As spots on canes enlarge, they become oval and gradually turn gray.

Badly infected canes dry out and crack, and the cane tips die back. Leaf spots become white with age, and affected tissue frequently drops out, leaving a shot-hole effect. The causal fungus also attacks fruit, resulting in small, dry, scabby berries. One of the most serious problems associated with anthracnose is the decline and death of fruiting canes just ahead of and during early harvest.

Anthracnose control on susceptible varieties is accomplished by a combination of cultural practices and chemical control. Before planting, destroy any wild brambles in the immediate area. In humid areas where anthracnose is likely to cause greatest damage, use tolerant or resistant varieties. Plant at sites having good air movement, and space plants wide enough apart to permit good air circulation. For established plants, remove and burn all badly infested canes soon after harvest. Keep weed and grass growth in the row at a minimum to maintain good air circulation around plants.

Chemical control of anthracnose on susceptible varieties involves three to four fungicide spray applications beginning in early spring when leaf buds have swelled or are just beginning to open. Timing of the first application is very important in preventing later buildup of causal fungus. Make sure all plant parts are covered thoroughly with spray material.

Harvesting and Marketing

Blackberries are a very perishable fruit and must be harvested, packed, stored, and marketed with utmost care if they are to remain in good condition. The best index of maturity is the ease of separation of the fruit from the pedicel. Fruit color is a poor indicator since most blackberries color before they are fully ripe. Most pickers tend to harvest fruit that is still underripe and sour. For optimal ripeness, pick blackberries when they are a dull, black color as opposed to shiny black.

Blackberries ripen from May in the Southeast to July in the Pacific Northwest. The fruiting period of individual varieties ranges from 4 to 7 weeks at a given location. Pick fruit as frequently as every second or third day.

Berries left on the plants until overripe become soft and moldy and may fall to the ground. Spotted wing drosophila (SWD) adults feed on ripe or overripe berries. Frequent harvests are recommended to prevent damage caused by SWD. The best time of day to pick is in the cool of morning, but berries should never be picked when wet with dew or rain, since wet berries mold very quickly. Pick berries by gently lifting with thumb and fingers. Hold only a few berries in your hand at one time. Gently place harvested berries in the container in which they are to be marketed; transferring from container to container results in unnecessary bruising.

Always protect harvested fruit from the sun; exposure for even a short time results in the fruit turning red and the flavor becoming bitter. Removing field heat by rapid cooling greatly extends the shelf life of the fruit. In older varieties, fully ripe blackberries of all types are extremely perishable and should be used within a day of harvest. Less mature fruit may be stored for a few days if fruit is promptly cooled and handled carefully during harvest and transport.

Newly ripe blackberries may be held for 2 to 3 days at a temperature of 31 to 32 degrees Fahrenheit and relative humidity of 90 to 95 percent. After this period, fruit gradually loses black pigment and takes on a less attractive reddish tone. Many newer varieties have a longer shelf life. Use shallow picking containers to prevent mashed berries. It is important to minimize handling. It is generally best to pick directly into 12-pint

flats or gallon containers that are market-ready. Ideally, the picking container should be strapped to the waist or hung around the neck of the picker to free both hands and eliminate time wasted in handling the container.

The pick-your-own concept of direct marketing has greatly stimulated interest in blackberry culture in many areas. Where adequate population density exists, this is an ideal method of marketing blackberries. Growers should establish a marketing outlet prior to planting blackberries.

A partial crop of fruit may be expected the second summer after planting blackberries. By the third harvest season, full production is reached. An effectively managed blackberry planting should yield 6,000 to 8,000 pounds per acre, and even higher yields are possible. Since the crowns and roots of blackberries are perennial, a well-cared-for planting should remain productive for many years.

Budget Information

A customizable budget is available at Enterprise Budgets for Horticulture Crops on the Alabama Extension website at www.aces.edu. The budget provides growers with an idea of the cost and potential return of commercially produced blackberries on a per-acre basis. The spreadsheet is interactive and has columns to input costs specific to your farm. The budget is revised annually or biannually to provide the most up-to-date costs. Find the budget at <https://www.aces.edu/blog/topics/farm-management/enterprise-budgets-for-horticulture-crops/>.



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