

2008 SOUTHEAST REGIONAL BRAMBLE PRODUCTION GUIDE

Section Editors

Culture:

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Recommendations of specific bramble production practices and cultivars are based primarily on research and grower experiences in North Carolina, South Carolina, and Georgia. Because environmental conditions vary widely in the southern United States, growers in other states should be sure to obtain current information about bramble production practices and varieties from their state and county Cooperative Extension centers.

I. Introduction

The bramble (blackberry and raspberry) industry has recently undergone a significant change in the southern United States. The release of high quality and productive blackberry cultivars from the University of Arkansas breeding program, escalating fuel prices, and the high perishability of brambles has shifted production to the East Coast, where large markets exist for these crops. Since the late 1990s, the acreage devoted to brambles has increased throughout the southern U.S. in all grower categories:

- small-scale (less than 3-acre farms) for local and pick-your-own (PYO) sales;
- medium-scale (commercial local sales and PYO); and
- large-scale (farms of 10 to –30 or- more acres that produce fruits for wholesale marketing).

In addition, the release of raspberry cultivars from the University of Maryland and N.C. State University breeding programs have prompted growers to investigate the possibility of commercial raspberry production at high elevations throughout the region using both traditional and seasonal-extension techniques.

This guide was created to provide growers information on plant growth and basic production practices. Pest management for bramble growing in the southern U.S. is available in the *Southeast Regional Brambles Integrated Management Guide*: <http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2006/BrambleSprayGuide61506.pdf>.

Because this is an online guide, we plan to modify it regularly to provide the most up-to-date information for growers in the southern U.S.

Types of brambles

Both blackberries and raspberries are grouped by these plant characteristics:

1. growth habit,
2. fruiting habit (primocane or florican),
3. presence or absence of thorns (thorny or thornless), and
4. fruit color (raspberries only).

Growth habit. Bramble crops essentially display three growth habits: (1) erect, (2) semi-erect, or (3) trailing. Growth habit determines the type of trellis support the canes require. In some regions, erect types of both raspberries and blackberries do not require trellis support. In the southern U.S., however, blackberries and raspberries benefit from a trellis for commercial production.

Fruiting habit. Bramble crops produce fruit in either of two ways:

Floricanefruiting types produce fruit canes that are two years old. Fruit is produced on the lateral branches that emerge from *axillary buds* (the buds that occur at the leaf axil) on a second-year cane. After the floricanefruiting types have produced their crop, the canes die and must be removed to make room for new canes that arise from the root system.

Primocanefruiting types produce fruit at the *terminal portions* of the canes (the buds produced at the tips of stems) in the first year. This differs from floricanefruiting types, which do not produce until their second year. Primocanefruiting types can also produce fruit on canes in the second year. Although this fruit often ripens earlier than the traditional floricanefruiting crop, yields are low and primocane types are usually grown only for the primocane crop. Several raspberry primocanefruiting cultivars have excellent fruit quality and are recommended for planting in high elevation regions in the southern U.S. Primocanefruiting blackberries are available as well, but fruit quality on them is poor and yields are low. They are not recommended for the southern U.S. at this time.

Thorn habit. Thorny and thornless cultivars are available of both primocane- and floricanefruiting types of raspberries and blackberries. Most commercial blackberry growers plant thornless cultivars because they are easier to manage. At this writing in May 2008, most raspberry cultivars adapted to the southern U.S. have thorns, but the thorns are not as large as blackberry thorns.

Fruit color (raspberries only). Raspberries can produce red, yellow, purple, or black fruits. Red raspberries are by far the most common type and, in general, the most widely adapted for commercial production. Yellow and purple raspberries are not recommended for commercial production because available cultivars are highly perishable and do not produce high yields. Black raspberries do well in cooler parts of the region and may have niche markets. However, plantings of black raspberries are generally short-lived because current cultivars are susceptible to viruses.

II. Cultivars

Early-season blackberries and floricane-fruiting raspberries ripen shortly after strawberries, making them an ideal crop to extend the berry harvest season. The following recommendations are based on research trials and grower experience throughout the southern U.S. (Tables 1 and 2). Within the southern U.S., yields and adaptation will vary based on site. Season of harvest will vary by state as well: Early ripening cultivars will be harvested two to four weeks earlier in South Georgia than in North Carolina. Consult your local Cooperative Extension agent for local recommendations. More information on many of the blackberry cultivars listed below also can be found online: http://www.aragriculture.org/horticulture/fruits_nuts/Blackberries/default.htm.

No primary Web site for raspberry cultivar information exists, but additional information can be found at various sites using a search engine. In general, university sites provide the most reliable information.

Table 1. Recommended blackberry cultivars for North Carolina (N.C.), Georgia (Ga.), Tennessee (Tenn.), South Carolina (S.C.), Virginia (Va.), and Arkansas (Ark.)

Variety	Growth Habit	State						Thorns	Season	Comments
		N.C.	Ga.	Tenn.	S.C.	Va.	Ark.			
Arapaho	Erect	All	All	NR	All	All	All	No	Early	Lower yields; plant at higher density
Natchez	Erect	All	Trial	Trial	Trial	Trial	All	No	Early (slightly before or with Arapaho)	Large fruit; yields comparable to Ouachita; available in summer or fall 2008
Ouachita	Erect	All	All; Trial	All	All	All	All	No	Early to mid	Excellent flavor; high yields
Apache	Erect	All	NR	All	All	All	NR	No	Mid	White drupelets can be severe; local sales only
Kiowa	Erect	All	All; except high mountains	All	All	All	All	Yes	Mid	Low chilling; best for local sales and PYO
Navaho	Erect	All	All	All	All	All	All	No	Mid to late	Stores well; excellent flavor; average size
Hull	Semi-erect	All	All	All	?	All	?	No	Late	Good quality, but soft when ripe; local sales only
Chester	Semi-erect	All	All	?	?	All	?	No	Very late	Tart; average quality; very high yields
Triple Crown	Trailing	All	?	All	?	All	?	No	Very late	Sweet; good yields; local sales only

Notes:

All – The cultivar is recommended for all regions of the state.

NR – Not recommended

Trial – Not enough data; recommended for trial only

? – No information at this time

Table 2. Recommended raspberry cultivars for North Carolina (N.C.), Georgia (Ga.), Tennessee (Tenn.), South Carolina (S.C.), Virginia (Va.) and Arkansas (Ark.)

Cultivar	State: Region						Season	Comments
	N.C.	Ga.	Tenn.	S.C.	Va.	Ark.		
Floricane-fruiting cultivars								
Mandarin	Mountains and piedmont	Mountains and piedmont; Trial	All	?	Mountains and northern piedmont	?	Early summer, before blackberries	Availability may be very limited.
Dormanred	All	All	All	?	NR	?	Midsummer	Attractive fruit; but very low quality unless cooked
Reveille	Mountains	Mountains and piedmont; Trial	All	?	Mountains and northern piedmont	?	Early summer	Good quality but soft; local sales only
Primocane-fruiting cultivars								
Caroline	Mountains	Mountains and piedmont; Trial	All	?	Mountains and northern piedmont	?	Late Summer/fall	Medium berries; good quality; long season
Heritage	Mountains	Mountains and piedmont; Trial	All	?	Mountains and northern piedmont	?	Early fall	Small berries; late-season; average quality
Nantahala	Mountains	Mountains and piedmont; Trial	All	?	Trial	?	Late fall	Medium berries; very good quality, excellent flavor; few plants available in spring 2008

Notes:

NR – Not Recommended

Trial – Not enough data; recommended for trial only

? – No information at this time

III. Site Selection

General

Although blackberries and raspberries have similar soil requirements, they have very different climatic requirements. Determine if blackberries and raspberries are adapted to your area as well as what cultivars are best for your farm and marketing strategy.

Both blackberries and raspberries grow better in full sun and a well-drained soil. The most suitable soils are high in humic or organic matter (2 percent) and have a pH of 6.0 to 6.5. Sandy loam or loam soils are best. Blackberries and raspberries can be grown on sandy soils if a good irrigation system is used. In general, their root systems do not tolerate wet soils. Avoid clayey, poorly drained soils in locations with high water tables or in areas prone to flooding. Use of raised beds can, in part, compensate for a periodically wet site.

Avoid sites where strong hot summer winds or cold winter winds prevail. Hot summer winds can dry the fruit, causing sunscald, and increase the plants' water needs. In addition, fruit size and plant growth will be compromised. Cold winter winds can cause winter injury, which often results in cane breakage. Windbreaks can be used to reduce air movement if you suspect it may damage your crop. Keep in mind, however, that good air circulation minimizes disease problems.

New blackberry and raspberry plantings should be isolated as much as possible from wild raspberry and blackberry plants, which harbor diseases and insects that can devastate your crop. New plantings should be at least 100 to 200 yards from wild brambles. Additional site recommendations related to insects and diseases can be found in the *Southeast Regional Brambles Integrated Management Guide*:

<http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2007/BrambleSprayGuideNewTrialVersion112607.pdf>

Blackberry

Blackberries grow best in warm, temperate regions and are generally considered less hardy than raspberries. The plants flower from March in South Georgia to May in the mountains, and bloom over a long period. Because blackberries flower late, damage to flowers from spring frosts and freezes is seldom a problem in the piedmont and coastal plain. In the mountain areas where the winters are more severe, the use of hardy cultivars and planting of blackberries on hillsides above frost pockets will help to avoid damage to the canes from the cold. In general, blackberries are recommended for areas where winter temperatures stay above 10°F.

Raspberry

Raspberry plants perform best where the growing season is long and summer temperatures are mild. They also grow best where winters are uniformly cool and long enough to satisfy their chilling requirement. These conditions are not typical of most areas in the southern U.S. With careful selection of cultivars, however, coupled with good cultural practices, they can be grown successfully despite the odds. The best growing conditions in the southern U.S. exist in the high elevations of the Appalachian Mountains. The summer temperatures are not too hot, and the winter temperatures do not fluctuate as much as in the lower elevations.

IV. Site Preparation, Planting, and Establishment

Site Preparation

Thoroughly destroy perennial weeds and established sod before planting. Ideally this would occur one year before the bramble crop is to be established. Kill wild brambles with a chemical herbicide and remove the residue from the field. Several rototillings, diskings, or harrowings before planting are needed to destroy weeds and loosen the soil. Plow the land again to prepare for planting. Preplant land preparation should be completed in mid- to late February in the coastal plain and during March or in the preceding fall in the mountains.

If possible, avoid planting bramble fruits on a site previously planted to fruit crops, such as peaches, apples, grapes, raspberries or blackberries. The soil could harbor pathogens from previous plantings that cause *Phytophthora* root rot or crown gall infection.

Many blackberry varieties are susceptible to viruses, double blossom disease and orange rust, so cultivated plants should not be planted near wild blackberries. Do not plant raspberries immediately following potatoes, tomatoes, peppers, or eggplant because this increases the risk of infection with verticillium.

If possible, at least one year before planting brambles, grow a summer cover crop (such as sudangrass) or a winter cover crop of rye, oats, or wheat. A cover crop will suppress weeds and increase organic matter. Test soils for fertility and nematodes, and apply lime according to soil test recommendations.

Fumigation and the use of black plastic on raised beds will give newly set blackberry and raspberry plants an advantage by killing most weed seeds and soil pathogens. Fumigation is highly recommended if nematodes are present in the soil.

If possible, orient rows in a north-to-south direction to minimize sunscald on fruit on the south sides of the rows and maximize fruit quality on both sides of the rows.

Planting

Order plants a year before planting. Bare root dormant nursery stock or tissue culture plants are usually available from November to March. Be sure to get clean and healthy plants. New bare rootstock should be purchased from nurseries that have grown plants in a greenhouse or on fumigated land well isolated from other brambles. The plants should have been sprayed regularly for insect and disease control and inspected by state officials. Early spring planting of dormant stock is best. Plants set late in the spring may be adversely affected by drought or drying winds. In warmer areas, late fall planting is possible provided the soil is still warm and not excessively wet. Avoid planting on wet soil.

Bare root nursery stock. Plants should arrive just a day or two before planting. Do not keep plants in a cooler for an extended period of time or let the roots dry out. If the bare root plants are dry upon arrival, soak the roots in water for several hours before planting. If they will not be planted immediately, heel in the plants by digging a trench deep enough to contain the roots. Spread the plants along the trench, roots down, and cover the roots with moist soil. Be sure to keep the ground moist. Plants can be held in this manner until buds begin to swell (usually in a couple of weeks).

Always keep the bare roots covered and moist. Dig a hole large enough for the root system to spread in the hole. Cover the roots of bare-root plants with soil to a depth of 2 to 3 inches, and firm the soil around the roots.

Tissue-culture plug plants. Tissue-culture plants should be allowed to harden off in a protected and shaded location outdoors. When planting, take only the number of plants that can be transplanted in half a day to the field. Be sure they are watered well prior to planting. Tissue-culture plants should be set in holes so that the top of the root ball is even with the soil surface. Push a thin layer of soil around the top of the plug's root system.

When planting both bare root stock and tissue-culture plugs, give plants a thorough drenching with water, especially if the soil is dry and the weather is hot. After planting, cut off the stem of bare root plants at least 3 to 4 inches from the ground.

Viruses have been a major problem in Georgia blackberry production. These are transmitted by insects, nematodes, and propagation. In Georgia, tissue-culture plants that are screen-house grown or plants propagated the first year from tissue culture are recommended. Please note that a license from the University of Arkansas is required to propagate blackberry plants.

Establishment

Alleys. Alleys can be maintained with sods or with cultivation in areas where soil erosion and high temperatures do not occur. Sods from perennial grasses are preferable in most areas because they are not hosts for botrytis and verticillium. If sod is allowed to develop in between rows, it should be kept mowed. A 4-foot-wide weed-free strip must be kept in the plant row either by physical or chemical means to prevent weed competition with the bramble plant. Chemical weed control, used correctly, can be very effective. The choice of herbicide depends on soil type, weed species present, season of the year, herbicide application timing, and bearing status of the planting. The correct herbicide must be used at the proper time or serious injury to the bramble plants may result. (For detailed information on managing weeds and using herbicides, see the *Southeast Regional Brambles Integrated Management Guide*: <http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2007/BrambleSprayGuideNewTrialVersion112607.pdf>)

Spacing – Blackberry. Optimal spacing between plants and rows varies, depending on plant type, training method (trellis type), and size of farm equipment. Allow at least 10 to 12 feet between rows to facilitate tractor operations. Erect blackberries are spaced 2 to 4 feet in the row, and primocanes are allowed to fill in the spaces between plants. Both semi-erect and trailing types require 4 to 8 feet between plants to accommodate their very long canes. In South Georgia, many cultivars have fewer canes than farther north, and a spacing of 2 to 3 feet between plants is recommended. Generally, maximum row length should not exceed 600 feet. When planting before trellises are erected, align plants carefully in the rows to accommodate the trellises. To calculate how many plants you will need for each acre, refer to Table 3.

Spacing – Raspberry. Primocane-fruiting raspberries can be set at 2 feet apart in the row, while floricanes-fruiting types should be set at 3 to 4 feet apart within a row. The row-width range is from 8 to 15 feet, depending on equipment. However, rows should be spaced as closely as possible to ensure the highest possible yields per area. To calculate how many plants you will need per acre, refer to Table 3.

Table 3. Number of plants required per acre using different spacing within and between rows

Spacing within Row Feet	Spacing between Rows					
	8	10	12	13	14	15
2	2,722	2,178	1,815	1,675	1,556	1,425
3	1,815	1,452	1,210	1,117	1,037	968
4	1,360	1,090	907	838	778	726
5	1,090	870	726	670	662	581
6	907	726	605	558	519	484
8	680	544	453	419	389	363
10	544	435	362	335	311	290

V. Plant Growth

General

Understanding blackberry and raspberry plant growth is necessary for proper training and pruning of bramble plants. The crown of the blackberry and raspberry plant is perennial, and the stems (shoots) are biennial. Management of these two types of canes varies with plant type, pruning, and training-on the particular trellis system used.

Floricanes-fruiting blackberries and raspberries

Both floricanes-fruiting blackberries and raspberries have a similar plant growth cycle. In the first year, primocanes grow and often branch but remain vegetative. The second year, these same canes are called floricanes, and small branches grow from the buds, called laterals. Fruit is borne on the tips of these laterals. After the floricanes have produced a crop, they die. See the illustration at the link below to see the growth and development of floricanes-fruiting raspberries and blackberries:

<http://www.ncsu.edu/project/berries/teaching/teaching.html>

Primocane-fruiting raspberries and blackberries

Primocane varieties produce fruit on the tips of the first year's growth in the late summer and fall. Fruit production usually continues until a hard frost occurs. The canes are usually mowed to the ground in the winter. If allowed to grow a second year, the canes will fruit just below the tip. This production technique, however, is not recommended in the Deep South. Best results have occurred with only primocane production. Primocane-fruiting blackberries (such as Prime-Jan® and Prime-Jim®) have recently become available. However, their fruit quality is poor and yields are low in the southern U.S., so they are not recommended for commercial production at this time. Nurseries often refer to these types of raspberries and blackberries as "everbearing."

VI. Pruning and Training

General

All blackberries and raspberries must be pruned and trained. Floricane-fruiting brambles need pruning several times a year. Primocane-fruiting raspberries need to be pruned (mowed) only once a year during the winter.

Erect blackberries

In the first year, plants establish root systems and a moderate number of canes. Their growth habit in year one is very trailing, like a dewberry. Attach these flexible canes to the trellis by wrapping the canes loosely to the wire and then tying them to the wire. Growth of the primocanes in the second and subsequent years will be erect. To properly train erect types, allow the primocanes to develop in a row approximately 12 inches wide during the growing season. Most newly emerging primocanes will grow in the center of the row. While these primocanes are still flexible, encourage them to grow up in between the two sides of a T- or V-trellis by pushing them into the center of the row, before they reach the trellis's bottom wire. When the new shoots of erect blackberries reach 8 to 12 inches above the top wire, they should be tipped. This can be done with fingers while the canes are still succulent. Later on, use loppers or a mechanical hedger capable of making a clean sharp cut. Tipping or hedging can lead to cane blight disease, especially if the cuts are made just before a rain event. Apply a preventative fungicide to protect cuts from disease. Tipping or hedging stimulates the canes to branch. The tipped canes will grow stout and will be better able to support a heavy fruit crop the following year. In South Georgia, many thornless cultivars produce only one to three large primocanes each year. In this case, tip the canes during the summer when they attain a height of 2 to 3 feet to encourage branching.

After fruiting, remove dead floricanes and thin out weak primocanes, as time permits. In late winter, prune the laterals to 12 to 18 inches if needed. Where large-diameter pruning cuts are made, a stem disease has been severe in some years. A fungicide application after pruning is recommended. This will make harvesting more convenient and result in larger berries. At the same time, remove the remaining dead and weak wood. Leave only about six to eight healthy, vigorous evenly spaced canes spaced per linear yard (3 ft) of row. Erect blackberries must be trellised for additional support and for ease of harvest. Follow the trellising guidelines for trailing and semi-erect types using one of the trellises described below [\(VII. Trellis Systems\)](#).

Semi-erect and trailing blackberries

During the first growing season, semi-erect and trailing blackberry primocanes should be tied to a trellis to allow weed control under the vines. After the first season, all types of blackberries must be trained on trellises to assure clean, disease-free fruit and easy picking.

The second season, before buds swell, bring floricanes up to the trellis wires and tie them individually with soft string or plastic tape from a hand-held device designed for tying brambles and grapes (such as a Max Tapener). The lateral branches are pruned to 10 to 12 inches in length at the same time. If 3 feet or more of growth was produced the first year, cropping can occur in year two. If only a small amount of growth was made the first year, cut the canes back to within several inches of the ground. This helps the plants become better established by preventing a severe stress on their productivity from fruiting, and favors the development of sturdier, more fruitful shoots in the subsequent year. In the succeeding years, new shoot growth is more vigorous.

Primocanes of trailing and semi-erect blackberries are extremely vigorous and need to be managed throughout the summer. Tie primocanes loosely together as they develop, and train them up through the plant to the top wire. Once they have reached the top wire, divide and tie them to the wire. This method is well suited for semi-erect and less vigorous trailing cultivars. Place plants close together and place canes uniformly over the trellis to maximize light exposure and yield. This system requires more labor and is therefore more costly than weaving.

Floricanes-fruiting raspberries

The biennial system is the most common training and pruning system in the eastern United States for summer fruiting raspberries. In this system, primocanes are allowed to grow throughout the season. In most cases, floricanes that produced fruit are removed immediately after fruiting, to increase air movement and decrease disease pressure in the canopy. However, recent research suggests that these canes may serve as a source of stored carbohydrates for cold protection in the winter. In the mountain regions, growers may want to consider pruning out floricanes after the coldest part of the winter is over. In early spring, remaining canes should be topped to a convenient picking height (usually 3 to 4 feet). If canes are too dense, fruit size is reduced. If canes are thinned too much, total yield will suffer. In early spring, weaker canes should be removed and the remainder thinned to 3 to 4 canes per square foot. Leave only the most vigorous canes, those having good height, large diameter, numerous nodes in the fruiting zone, and no obvious signs of disease or insect damage or winter injury.

Primocane-fruiting raspberries

During the late winter or early spring, remove all canes at the base before growth begins in spring. Fruit will be produced on primocanes in the fall of the year. In lower elevations, to produce a late-season crop, cut the canes to the ground in the early spring before growth begins. Then prune the canes to near ground level a second time when they are approximately 1 foot tall. This will help delay harvest until late summer after the heat of the summer has passed.

VII. Trellis Systems

Growers use many trellis support systems to support bramble canes. Your trellising goal is to minimize labor and maximize yield. Each trellis type has its advantages and disadvantages, and most can be modified to suit your needs. Evaluate each trellis system to determine what type best suits your needs.

I-trellis

A single post can be used and the canes can simply be gathered and tied to the post at approximately 4 feet (Figure 1).

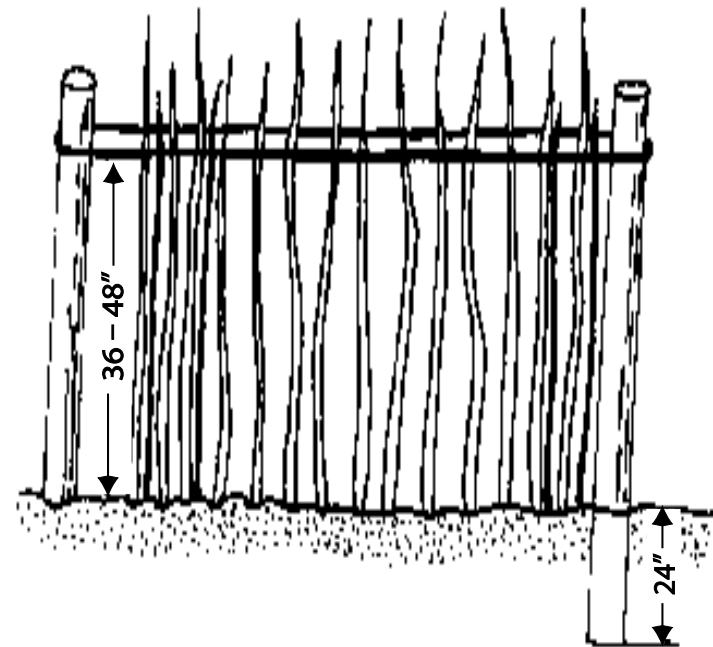
Advantages

- Easy to build and maintain.
- Economical.

Disadvantages

- Lower yield.
- Crowded canopy, which will increase disease pressure and make harvest more difficult.

Figure 1. I-Trellis (Hedgerow). 6- to 8-foot metal fence posts, cedar posts, or pressure-treated posts (4 to 6 inches in diameter) are spaced about 20 feet apart. Posts are buried 24 inches in the ground. (From Roper, T.R., D.L. Mahr and S.N. Jeffers. *Growing Raspberries in Wisconsin*. University of Wisconsin, Publication A1610)



V-trellis (with metal T-posts)

The most common type of bramble trellis is the V-trellis (Figures 2a and b).

Advantages

- This trellis allows greater light penetration into the canopy and as a result, higher yields than a single post.
- Air circulation is greater, so disease pressure is decreased.
- If fence posts are used, horizontal wires can be moved up or down to accommodate a cultivar's vigor.

Disadvantages

- Higher cost than a simple I-trellis.

Figure 2. V-trellis for blackberry or raspberry support. Typical V-trellis design with steel posts set 20 to 30 degrees from vertical.

Figure 2a.

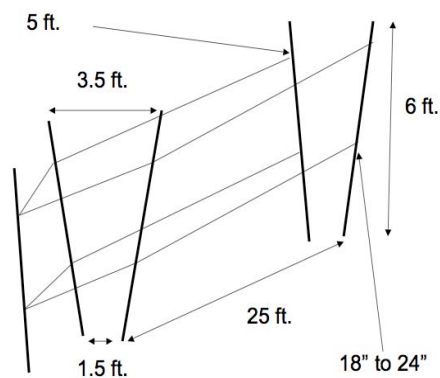


Figure 2b.



V-trellis (with rebar)

Growers in South Georgia use this system (Figures 3a and b).

Advantages

- Posts can be reused and therefore are economical.
- Easy cane removal after harvest.

Disadvantages

- Cannot be higher than 4 feet, so some potential yield is forfeited.
- May not be able to support heavy crop load.
- May not hold up in ice storms.

Figure 3. Rebar V-trellis. Growers in Georgia have devised this system for their blackberries. The main post is made of $\frac{1}{2}$ -inch rebar, while the crossarms are $\frac{3}{8}$ -inch rebar.

Figure 3a.

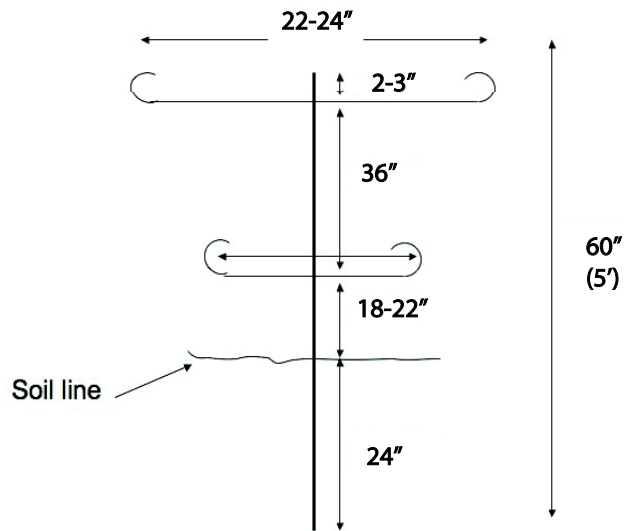


Figure 3b.



V-trellis (with wood)

This trellis has a similar structure as the previous system, but is made of wood (Figures 4a and b).

Advantages

- Opens up canopy for higher yields and improved air circulation.
- Can retrofit from an I-trellis without having to install new posts.

Disadvantages

- Wire height cannot be adjusted once cross arms are installed.

Figure 4. Wood V-trellis. This trellis functions similarly to the rebar V-trellis. 8-foot posts made from pressure-treated lumber or cedar are set 2 feet in the ground. Crossarms are pressure treated 2-inch by 4-inch lumber. Posts are set 20 to 30 feet apart in the row.

Figure 4a.

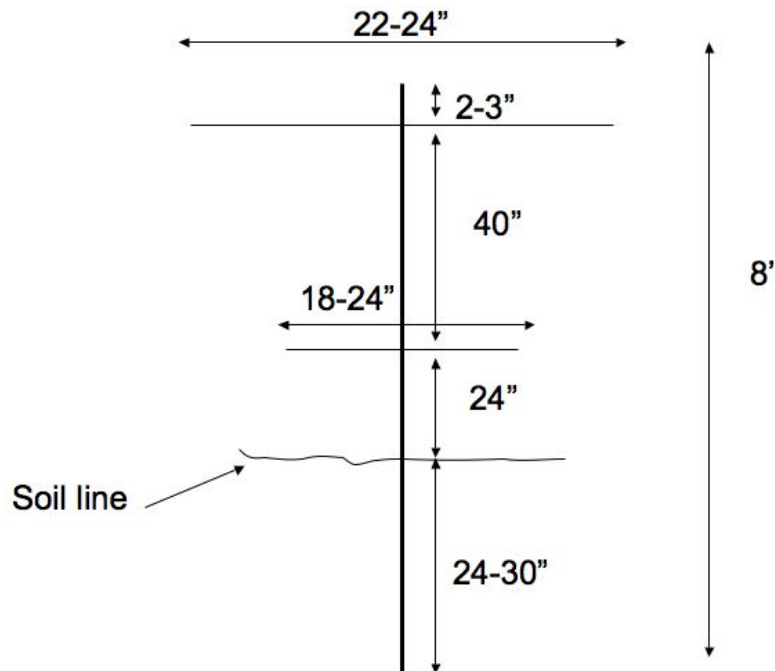


Figure 4b.



Stiles shift trellis

This trellis (Figures 5a and b) was designed by researchers at Virginia Tech (<http://scholar.lib.vt.edu/mirrors/vaes/vaes99-1.pdf>).

Advantages

- Easier harvest, all fruit is on one side of the canopy.
- Less sunscald.

Disadvantages

- Expensive.
- Harder to learn how to train and prune.

Figure 5. Shift trellis (images courtesy of Virginia Technical University, <http://scholar.lib.vt.edu/mirrors/vaes/vaes99-1.pdf>). The shift is a pivoting trellis, which means it moves in an arc from one side of the row to the other. At bloom, the canopy is positioned parallel to the ground to concentrate flower development on the upper part of the canopy. As the fruit begins to mature, the arm is moved to 120 degrees from the horizontal prebloom position and slanted westward.

Figure 5a.

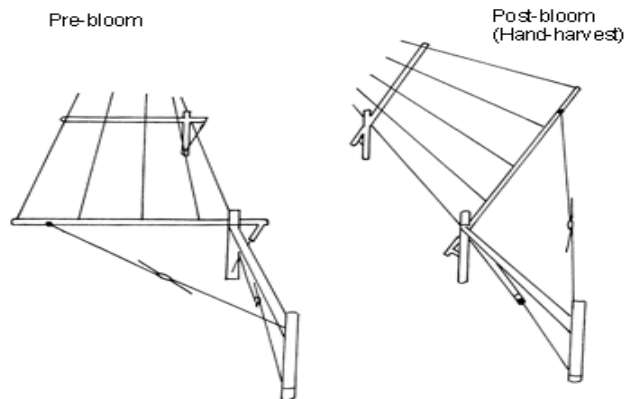


Figure 5b.



VIII. Water Management

General

Irrigation is recommended for bramble production. Water is the most critical factor for optimal fruit growth and primocane development. A shortage of water during primocane development will limit fruit size and also the number and diameter of primocanes. This limitation will negatively impact both the current season's and the following year's crops.

Nearly all of the moisture used by blackberries and raspberries comes from the top 6 inches of the soil, which is the primary rooting zone. If moisture is applied by overhead irrigation, blackberry and raspberry plants generally need at least 1 inch of water during each 7-day interval of the growing season. Higher amounts are required with sandy soils and in South Georgia.

Trickle irrigation

The amount of water can be reduced if trickle or similar irrigation systems are used because only the soil around the plant is wet. The trickle irrigation method will reduce fruit rots by avoiding the need to wet the foliage and fruit during application of water. It is important for the water to be clean and the system to be maintained properly so that the trickle system does not become clogged. Both well water and surface water from ponds or streams must be tested for chemical and biological impurities and must receive recommended treatment and filtration for optimal function of a drip irrigation system. Contact your local Extension office for more information on how to collect a sample and where to take it for an evaluation.

Mulching

Mulches can be used to conserve moisture. Large volumes of material and many hours of labor are required, and some mulch must be replaced each year. Mulches also may introduce weed seeds, encourage rodent infestation and crown gall, and be a fire hazard. However, weed-free mulches of small-grain straw or other suitable materials conserve moisture, minimize erosion, aid in weed control, and add organic matter to the soil. Do not use hay, because it may contain the chemical picloram (Grazon). Mulches should be given serious consideration if blackberries are to be grown on lighter soils with low organic matter. Black plastic is a good mulch in locations where orange velvet algae is a serious problem. Black plastic mulch has been observed to reduce algae problems by reducing soil splashing and providing a drier microclimate around the base of the bush. For more information on orange velvet algae (orange felt) see: <http://www.smallfruits.org/Bramble/pestinformation/OrangeFelt.pdf>.

IX. Integrated Pest Management

See the Southeast Regional Brambles Integrated Management Guide:

<http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2007/BrambleSprayGuideNewTrialVersion112607.pdf>

X. Fertility Management

General

Blackberries and raspberries can be grown on a variety of soil types. Regardless of the soil type, however, organic matter additions, pH adjustments, and incorporation of phosphorus (P) and potassium (K) should be completed before planting to optimize productivity. Take a soil test three to six months prior to planting to ensure that the right soil amendments are added at the most efficient rates.

Blackberry

Nitrogen (N) recommendations are usually based on the age of the planting, soil type, vigor desired, foliar analysis, and history of N application in the planting. The higher levels of N noted in the recommendations for N application are for sandy soil.

- During the first year, fertilize 30 to 60 days after planting. Usually rates of 25 to 50 lb/acre of actual N are recommended for the first year. Apply every four to six weeks during the growing season.
- In the second year, 35 to 65 lb/acre actual N is recommended.
- For the third and subsequent years, 60 to 80 lb/acre actual N is usually recommended.

Nitrogen should be applied in split applications. Apply the first portion at bud break and the remainder just after harvest. Typically about $\frac{2}{3}$ is applied in the spring and $\frac{1}{3}$ after harvest.

The incorporation of P and K should be based on soil test recommendations. Calcium (Ca) and magnesium (Mg) are occasionally added to blackberry plantings. Ca is usually applied in the form of lime, and Mg via dolomitic lime if lime is needed or by adding

magnesium sulfate (Epsom salts). The remaining minor elements are rarely a problem. A soil test to determine levels of soil P, K, and pH should be completed every other year. Foliar sampling should be conducted every year following harvest for accurate nutrient management, especially N.

If using a drip system, the nutrients can be added via the drip system. Portion out the fertilizer at the recommended rates weekly or as needed.

Raspberry

Fertilizer applications should be made according to soil test recommendations. Apply 500 to 800 pounds of 10-10-10 fertilizer per acre in split applications on established plantings.

- During the first year, fertilize 30 to 60 days after planting.
- Apply 50 to 80 lb/acre of actual N. Lower amounts (50 to 60 lb/acre) are recommended for the first and second years. Full amounts (70 to 80 lb/acre) are recommended for the third year and subsequent years.

Apply half the fertilizer in March and the remainder in May. Fertilizer can be spread uniformly across the row, or side-dress with half on each side of the row in a 3-foot-wide band. If applying a liquid fertilizer, add the recommended rates weekly or as needed.

Leaf analysis

A leaf analysis provides an accurate measure of nutrients needs present in the plant because actual nutrient levels in the plant are determined. Take leaf samples shortly after harvest of randomly selected young primocane leaves. Leaves should be washed in distilled water and sent to a lab for analysis. Adjust fertilizer for the following year based on test results.

XI. Fruit Development

General

Nearly all bramble cultivars are self-fruitful, and therefore self-pollination or pollination by the same cultivar will result in fruit development. Commercial growers should consider placing one or two hives of honeybees per acre grouped into units of five or ten hives per location.

The time from flowering to fruit harvest can vary significantly for both blackberries and raspberries. Growers should keep records of peak bloom and harvest each year to help them manage harvest (see Table 4, an example for blackberries).

Blackberry

As the fruit ripens, it grows in size and weight. Color changes from green to red to black. Blackberries take 35 to 45 days to mature once they are pollinated.

Flavor and sugars also increase as the fruit grows, and the fruit will soften and loosen from the receptacle when ripe. About 85 percent of the fruit size is gained in the last days of maturation. Development at this time depends on adequate supplies of carbohydrates and water; any limitation will adversely affect fruit size.

Raspberry

The fruit of the raspberry also grows in size and weight. Raspberry fruit changes from green to light red to red. The time for raspberries to mature is approximately 30 days after they are pollinated. When a raspberry fruit is ripe, it easily separates from the plant, leaving the torus or core attached to the plant.

**Table 4. Days from flowering to fruit development of erect thornless blackberries in Clarksville, Ark.
(Source: J.R. Clark, personal communication)**

	Arapaho	Ouachita	Apache	Navaho
50% Bloom	May 4	May 7	May 5	May 7
Peak Fruiting	June 11	June 19	June 30	July 1
Number of Days	38	42	56	55

XII. Harvesting and Postharvest Management

General

The primary objective of postharvest handling of blackberries and raspberries is to maintain fruit quality. Follow these general guidelines for harvesting blackberries and raspberries:

- Pick in the morning while the temperature is still cool and the berries are firm.
- Pick and handle the fruit carefully to avoid crushing or bruising.
- Place harvested fruit directly into the picking container.
- Have a separate container for culled fruit. If they are culled for cosmetic reasons, they could be frozen or used in processing.
- Gently place the berries no more than two to three berries deep in berry baskets or picking containers to avoid further bruising during storage. For this reason, ½-pint containers are recommended.
- Cool the fruit as soon as possible after harvest. Coolers should be set at 33 to 35°F with 90 to 95 percent relative humidity.
- Approximately six to eight trained pickers are usually recommended per acre. Fruit should be picked directly into the final containers, and be moved into cold storage as soon as possible.
- A variety of picking containers are available from your local distributor. Each one has its advantages and disadvantages. Decide what type of basket suits your individual needs:
- Pulp baskets are inexpensive, have ventilation holes for cooling, and can absorb water from fruit harvested wet. However, they absorb juice on the bottom, which may be undesirable.
- Polystyrene baskets are lighter, absorb less water, and can be printed with a label.
- Commercial growers most commonly use clamshells. Clamshells are sturdy, plastic, vented boxes with hinged lids that allow boxes to be stacked without crushing the fruit. An absorbent pad is placed in the bottom of each clamshell to absorb excess juice and moisture from the fruit.

Blackberry

Harvest blackberries at least twice a week. For pick-your-own and local sales, it is better to pick when the color has a dull appearance to maximize flavor. At this stage the berries will have higher sugars but reduced shelf life and are best suited for local markets. For shipping, blackberries have acceptable flavor and store longer if they are picked when they are shiny black.

Postharvest handling of blackberries is critical when selling fruit to retail or wholesale markets. Fruit reddening is a manifestation that can occur in stored blackberries. It is characterized by one or several bright red drupelets that detract from the attractiveness of the berries. Although the exact cause is not certain, possible causes include cultivar, early harvest date, temperatures above 77° F during picking, immature fruit, chemical composition, and condensation on the fruit.

Raspberry

Harvest raspberries daily. Harvest at the pink or light-red stage for fresh market or at full redness for immediate sale at pick-your-own operations. Raspberry fruit are very soft and even more perishable than blackberries, but the strategies listed above can extend shelf life.

XII. Handling To Avoid Contaminants

Recent outbreaks of food-borne illnesses have increased public awareness of food contamination. Although these outbreaks have been linked to other products, take steps to avoid contamination of your crop. The financial loss of your produce to contamination could be significant.

Numerous steps can be implemented at the farm to minimize contamination of fresh produce heading to the market:

- Avoid using manure as a fertilizer close to harvest.
- Use drip or overhead irrigation from a well only if the well casing is maintained and livestock are excluded from the pump area.
- Exclude animal grazing and minimize wild animal traffic in planting.
- Clean and sanitize storage facilities with 10 percent bleach solution.
- Provide restroom facilities for laborers and customers.
- Supply soap and water for handwashing and enforce its use.
- Encourage customers to wash hands before picking blackberries.
- Do not pack and avoid handling decayed fruit.
- Cool fruit quickly to minimize growth of pathogens.
- Store fruit at 33 to 35°F to maintain product quality and minimize pathogen growth.

XIII. Use of Dormex®

If properly used, Dormex® (50 percent hydrogen cyanamide) can stimulate more rapid and uniform bud break of cultivars with higher chilling requirements such as Apache and Navaho in South Georgia. For more information on how to apply this product, see the bramble integrated management guide:

<http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2007/BrambleSprayGuideNewTrialVersion112607.pdf>

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Acknowledgement

Portions of this publication were taken directly from these publications:

Growing Blackberries in North Carolina (AG-401) and *Growing Raspberries in North Carolina* (AG-569), North Carolina Cooperative Extension Service, N.C. State University.

Commercial Bramble Culture (Bulletin 964), University of Georgia Agricultural Experiment Station.



Published by
North Carolina Cooperative Extension



NC STATE UNIVERSITY

AG-697-W

05/2008

E08-50292

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