

GROWING BLACKBERRIES

IN NORTH CAROLINA



North Carolina Cooperative Extension Service

North Carolina State University

Growing Blackberries in North Carolina

Introduction

The blackberry has a long and interesting history in North Carolina. According to the *Manual of Vascular Flora of the Carolinas*, 11 species of blackberries are either native to North Carolina or were introduced very early to the state. Native Americans ate wild blackberries for thousands of years, and the early European settlers ate blackberries fresh, dried, and as preserves. Today these wild blackberries, and what some people locally refer to as dewberries (trailing blackberries), are still enjoyed.

Beginning in the early 1930s, breeding programs were initiated by the United States Department of Agriculture (USDA), and a number of state experiment stations began developing cultivated blackberry varieties (cultivars). The commercial blackberry industry in the United States today is based on improved cultivars developed by these breeding programs. North Carolina had a dewberry shipping industry from the 1930s through the 1950s. Recently the industry has been restricted to pick-your-own farms, which grow erect and semi-erect blackberries. Although there continues to be a market for pick-your-own fruit, ready-picked fruit is increasingly popular at farm stands and in retail markets. No longer considered just a local commodity, blackberries have joined the ranks of specialty crops. A great potential exists for blackberries to become a common seasonal item in retail markets throughout the country.

In the past several years, breeding programs throughout the United States have released new cultivars. Many are adapted to the diverse range of climates of North Carolina, including the mountains, piedmont, and coastal plain. However, climatic adaptation is not the primary limiting factor for successful blackberry production. A disease called double blossom or rosette (witches' broom), caused by the fungus *Cercospora rubi* (Wint.), is currently the most significant production challenge. Some cultivars have tolerance but not total resistance to the disease, so aggressive cultural practices are needed. Local infestation of the fungal pathogen may preclude production in some areas. This disease is quite variable from region to region in the United States; cultivars like Navaho generally have few problems in North Carolina, but are quite susceptible to it in the deep South, such as in Mississippi.

This publication is a guide for individuals interested in growing blackberries commercially. However, many of the cultural practices described can be adapted for use by homeowners. Homeowners may also want to experiment with a wider range of varieties than recommended in this publication.

Marketing and size of operation

Marketing

Early fruiting blackberry cultivars generally ripen shortly after strawberries and, therefore, can easily extend a small fruit harvest season. Although some growers shy away from brambles because of their high labor demands, a properly managed and marketed crop can be profitable. The success of any bramble operation requires that the grower produce high quality fruit. The quality of the product is very important when growing blackberries. Blackberries are extremely perishable and must reach their market quickly before they spoil. Identification of readily available markets and selling the fruit at a profit are key components for success. Blackberries can be sold via pick-your-own operations, roadside sales, restaurants, and retail and wholesale markets. Some varieties can be shipped across the United States and internationally. In all cases, fruit should be of uniform quality and sold in attractive containers. If fruit on the farm is sold, the farm stand and fields should be neat and organized. Additional value-added products, such as jams, jellies, juices, syrups, vinaigrettes, and cobblers or prepared cobbler fillings, can increase profits.

Size of operation

Once you have identified potential markets and thoroughly investigated the economics of blackberry production, you must also determine the size of your operation. Size of operation depends on the following factors:

- 1) Market potential;
- 2) Availability of suitable land;
- 3) Availability of skilled or trainable labor;
- 4) Cash available for initial investment in plants, supplies, and equipment; and
- 5) Ability to manage input of resources, marketing of products, and problems as they arise.

A successful operation requires the proper balance of the above factors to minimize risk and maximize profits.

Blackberry types and cultivar recommendations

Types

Blackberries can be classified into three types based on their growth habit (Figure 1):

- 1) Erect, which produce self-supporting canes;
- 2) Semi-erect, where canes are partially erect but require a trellis for support; and
- 3) Trailing, where canes are not erect and require a trellis for support.

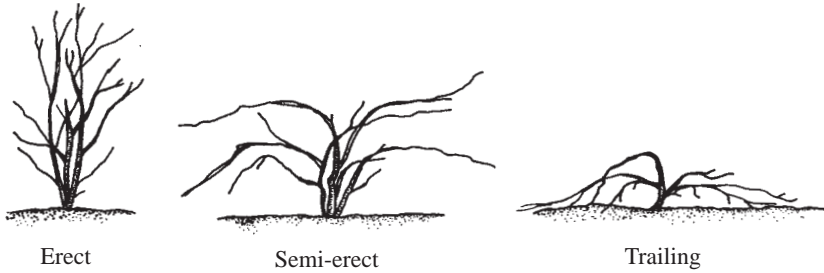


Figure 1

Each type of blackberry has thorny and thornless cultivars. Trailing and semi-erect types have few root buds and usually produce primocanes from crown buds. Erect blackberries have many vegetative buds on the roots and readily produce primocanes from both roots and crowns.

Cultivar recommendations

The following recommendations are based on research trials and grower experience in North Carolina. A brief description of each cultivar is included below. Most of the cultivars are from the University of Arkansas breeding program. These cultivars, named in honor of Native American tribes, do well in North Carolina. However, there are numerous other cultivars from other sources that are worthy of trial in your area. For more information please see references listed at the end of this publication or contact your local Extension agent. Yields will vary greatly depending on region, blackberry type, cultivar, and cultural care. Cultivars followed by a “?” have undergone limited testing, but are worthy of trial. An electronic listing of nurseries selling blackberries can be found at <http://www.ces.ncsu.edu/depts/hort/hil/>.

Mountains

Arapaho, Chester, Cherokee, Cheyenne, Kiowa?, Navaho, Shawnee, and Triple Crown?

Piedmont

Arapaho, Cheyenne, Choctaw, Kiowa?, Navaho, Shawnee, and Triple Crown?

Coastal plain

Arapaho, Chester, Cheyenne, Choctaw, Hull, Kiowa?, Lochness, Navaho, Shawnee, and Triple Crown?

Arapaho. Released by the University of Arkansas in 1993. Very erect, thornless, and suckers freely. Ripens 2 weeks earlier than Navaho, but has a short picking period. Fruit: good quality, medium size, short, conic, glossy black, firm, stores and ships better than most other blackberries; modest seed size. Up to this time has been resistant to double blossom in North Carolina, and orange rust has also seldom been observed.

Cherokee. Released by the University of Arkansas in 1974. One of the first releases from the Arkansas breeding program. Plants are vigorous, erect, and thorny. Produces large firm fruit, with very good flavor and stable fruit pigments (frozen fruit does not turn pinkish on thawing). Primarily used by homeowners in North Carolina. Resistant to orange rust but susceptible to double blossom.

Chester Thornless. Released by USDA and Southern Illinois University in 1985. Large, firm fruit ripens late season. Semi-erect, requires trellis. Highly productive. Good for processing. Appears resistant to double blossom. Orange rust has seldom been a problem in North Carolina.

Cheyenne. Released by the University of Arkansas in 1977. Large firm fruit, maintains size throughout the season. Good for processing. Vigorous, erect, moderately thorny. Resistant to orange rust but susceptible to double blossom.

Choctaw. Released by the University of Arkansas in 1989. Early ripening. High yields when not hurt by freeze damage to blossoms in the spring. Medium size with mild flavor. Smaller seeds than most cultivars. Plant are vigorous, erect, and very thorny. Resistant to orange rust but susceptible to double blossom.

Hull. Released by USDA and Illinois Agricultural Experiment Station in 1981. Thornless, semi-erect, requires trellis. Large, oblong fruit. Highly productive, ripens late but a little before Chester. Good for processing. Appears to be resistant to double blossom. Orange rust has seldom been a problem in North Carolina.

Kiowa. Released by the University of Arkansas in 1996. Erect, very thorny, and vigorous. Very large fruit and long ripening season. Performs well in areas where Shawnee grows well. Also good for home gardeners. Resistant to orange rust but susceptible to double blossom.

Navaho. Released by the University of Arkansas in 1988. Erect, thornless. Medium size berries of good quality; moderate to high productivity. Stores well, suitable for air transport. Susceptible to orange rust. Has not had a problem with double blossom in North Carolina up to this time.

Shawnee. Released by the University of Arkansas in 1985. Large fruit, maintains size throughout season, medium firmness. Very productive, hardy plants. Fruit good for pick-your-own and local sales; does not store well. Very susceptible to double blossom. Resistant to orange rust.

Triple Crown. Released by the in USDA 1996. Very large firm glossy black fruit with excellent flavor when fully ripe. Late ripening, and fruit can sunburn when exposed. Relatively high yield, vigorous crowns, thornless, and fruit is well distributed on canes. More upright than Hull but requires trellising to support the vigorous laterals. One plant was observed with double blossom at Reidsville in 1998, but this may be an isolated case. Double blossom has not been observed on the new variety to date in North Carolina.

Site considerations

Blackberries grow best in warmer, temperate regions and are generally considered less hardy than raspberries. The plants flower relatively late, from May onward, 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 regions. In the mountain areas where the winters are more severe, the use of hardy cultivars and planting of blackberries on hillsides will help to avoid damage to the canes from the cold. However, do not plant on south slopes. Southern slopes warm first in the spring, causing buds to open earlier and making cultivars susceptible to damage from frost.

Avoid sites where strong hot or cold winds are prevalent. Hot summer winds can dry the fruit, causing sunscald, and increase the plants' water demand. 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. However, keep in mind that good air circulation should be maintained in the field, because adequate ventilation minimizes disease problems.

Blackberries prefer full sun and a well-drained soil. The most suitable soils are high in humic or organic matter (2 to 4 percent) having a pH of 6.0 to 6.5. Sandy loam or loam soils are best. Blackberries can be grown on sandy soils, using soil amendments to increase and maintain organic matter. In general, their root systems do not tolerate wet soils. Avoid heavy, 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.

Land preparation, planting, and establishment

At least one year before planting, a summer cover crop like sudangrass or a winter cover crop of rye, oats, or wheat should be planted. A cover crop will suppress weeds and increase organic matter. Soils should be tested and lime applied according to soil test recommendations.

Perennial weeds and established sod should be thoroughly destroyed before planting. Blackberries should not be planted immediately following potatoes, tomatoes, peppers, or eggplant, since this increases the risk of infection with verticillium wilt. A site previously planted to fruit crops like peaches, apples, grapes, raspberries or blackberries should also be avoided because of possible *Phytophthora* root rot or crown gall infection. Most blackberries are susceptible to double blossom, so they should not be planted near wild blackberries. (A minimum of 1,000 feet will restrict disease infection.) Wild blackberries should be killed with a chemical herbicide and then removed from the field.

Several rototillings, diskings, or harrowings before planting are needed to destroy weeds and loosen the soil. The land should be plowed again to prepare for planting. Preplant land preparation should be done in mid- to late February in the coastal plain and during March in the mountains. Fumigation is recommended if nematodes are present in the soil. Fumigation in the absence of nematodes will give newly set blackberry plants an advantage by killing most weed seeds and soil pathogens. 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 production on both sides of the rows. Bare root dormant nursery plants are usually available from November to March. Be sure to get clean and healthy plants. New stock should be purchased from nurseries that have grown plants 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. In warmer areas, late fall planting is possible provided the soil is still warm and not excessively wet. If the soil is wet, delay planting. Plants set late in the spring may be adversely affected by drought or drying winds.

It is important that roots not be allowed to dry out. If the 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 a couple of weeks). When planting, take only the number of plants that can be transplanted in half a day to the field. Always keep the roots covered and moist.

Dig a hole large enough for the root system to spread in the hole. Cover the roots with soil to a depth of 2 to 3 inches, and firm the soil around the roots. Plants should be given a thorough drenching with water, especially if the soil is dry and the weather is hot. After planting, cut off the stem at least 3 to 4 inches from the ground. This will force new growth from the crown or root buds.

Optimal spacing between plants and rows varies, depending on plant type, training method, 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. Table 1 (page 9) lists number of plants required for various plant and row spacings.

Some nurseries sell erect blackberry root pieces as planting stock. These are usually cheaper to buy, but you will need more root pieces to fill in an acre. Root cuttings should be placed 2 to 3 feet apart in a row. Roots should be 6 to 8 inches long and have a diameter slightly larger than a pencil. Generally, maximum row length should not exceed 300 feet. When planting before trellises are erected, align plants carefully in the rows to accommodate the trellises.

Preplant weed control is important and should begin before blackberries are planted. Elimination of perennial weeds before planting is much easier than after the blackberry plants are established. Plant cover crops, and use cultivation and herbicides to reduce weeds. Weeds can also be minimized by planting into established sod strips sprayed with herbicides.

Weed control following planting should be implemented immediately. Blackberries may be shallowly cultivated during the first growing season, but care must be taken to prevent breaking the tender, newly emerging primocanes. Herbicides are available, which, when properly used, can be effective in weed control.

Blackberry plantings can be clean cultivated between the rows by shallow tilling or disking. As the planting ages, blackberry roots will invade the area between the rows, and cultivating too deeply will injure roots and induce unwanted suckering between the rows. Cultivation is a very effective method of weed control in plantings that are maintained in hills. In the spring, throw the soil toward the rows to smother small weeds. During the summer, pull the soil back into the row middles. Cultivate often enough and to a modest depth to effectively control weeds until harvest begins. Cultivate again once or twice after harvest to control weeds. Herbicides can be used in the rows to control weeds.

If aisles are not clean cultivated, plant sod between rows in the fall before planting or in the spring after planting. Sod from perennial grasses are preferable because they are not hosts for botrytis and verticillium. If sod is allowed to develop in between rows, it should be mowed several times during the growing season. Alternatively, where appropriate, a fall cover crop of rye can be planted for disking in the spring. If sod is used in the middles, a 4-foot-wide weed-free grass strip must be kept in the plant row either by physical or chemical means to prevent weed competition with the blackberry 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 or nonbearing status of the planting. The correct herbicide must be used at the proper time or serious injury to the blackberry plants may result. Read and follow the labels carefully. For more detailed information consult the current *North Carolina Agricultural Chemicals Manual* for the latest recommendations.

Pruning and training

Growth habit

Understanding blackberry growth habit is necessary for proper training and pruning of the plant. The crown of the blackberry is perennial, and the stems (shoots) are biennial. Trailing and semi-erect types of blackberries produce new shoots called primocanes from the buds formed on the crown. Erect types form shoots from crown buds and from buds formed on the roots. Primocanes grow one season and produce laterals. The second year, these same canes are called floricanes and small branches grow from the buds, on the laterals. Fruit is borne on the tips of these small branches. After the floricanes have produced a crop, they die.

Erect blackberries

Don't be alarmed if during the first growing season you notice that many of the canes of the erect types will have a trailing habit. Growth of the canes in the second and subsequent years will be erect.

Proper training of erect types entails allowing primocanes to develop in a row approximately 12 inches wide during the growing season. In the second season when the new shoots of erect blackberries reach a height of 30 to 36 inches, cut off the tips. This can be done with loppers or a mechanical hedger capable of making a clean sharp cut (Figure 2). This hedging stimulates the canes to branch. The tipped canes will grow stout and will be better able to



Figure 2

support a heavy fruit crop the following year. If time and labor permit, thin new shoots at the same time to reduce crowding in the row, thus allowing laterals more room to grow. After fruiting, remove dead floricanes and thin out weak primocanes, as time permits.

In late winter prune the laterals to 12 to 14 inches. 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 healthy, vigorous canes spaced per linear foot of row.

Erect blackberries can be trellised for additional support and for ease of harvest. Follow guidelines described for trailing and semi-erect types using a standard trellis.

Semi-erect and trailing blackberries

During the first growing season, semi-erect and trailing blackberry primocanes do not need to be trained to a trellis. However, after the first season, semi-erect thornless blackberries and trailing blackberries must be trained on trellises to assure clean, disease-free fruit and ease of picking. The second season, before bud 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. The lateral branches are pruned to 10 to 12 inches at the same time.

Often, only a small crop is available for harvest the year after planting. For this reason, some growers cut back to within several inches of the ground canes that would have otherwise fruited. This helps the plants become better established by preventing a severe drain on their productivity from fruiting, and favors the development of sturdier, more fruitful shoots in the subsequent year.

In the second and succeeding years, new shoot growth is more vigorous. These shoots should be tied to the trellis as soon as they have reached a height of 4 to 6 feet. Fan the canes out from the ground and tie them where they cross each wire. Avoid tying canes in bundles.

In summer, as soon as the last berries have been picked, cut out all the old canes. Do not remove new canes that have come up since spring, except to thin to four to eight shoots per crown. The best shoots should be selected so that wires are well covered with evenly spaced shoots. Broken shoots or those too short or too weak for training should be removed.

Ordinarily, no further summer pruning is performed on semi-erect thornless blackberry varieties. However, research indicates potential benefits from periodic summer topping to encourage more lateral branching and the development of shorter, more compact plants. Plants

should be set closer than 6 feet in the row if this management plan is adopted.

Trellis support/Training system

Many trellis support systems are used by growers to support the canes. Some aim to minimize labor and maximize yield. A single post can be used and the canes can simply be gathered and tied to the post at approximately 5 feet. However, most cultivars will have higher yields when trellised, especially semi-erect and trailing types. All types of blackberries can be supported by a trellis. Several systems are illustrated and briefly described here (see references for more specific details). 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.

Standard two-wire trellis

This is the most common type of trellis used for trailing and semi-erect blackberries. It is simple to build. Two wires (gauge size 9 or 11) are stretched between line posts set 20-24 feet apart in the row. String one wire 3 feet from the ground and the other about 5 feet from the ground. Staple wires loosely to posts to allow for contraction in cold weather. Trellises of this height require sturdy end posts, 8 feet in length, well braced, and anchored. Line posts should be about 8 feet long and 3 inches in diameter. Sink trellis posts into the ground at least 2 1/2 feet (Figure 3)

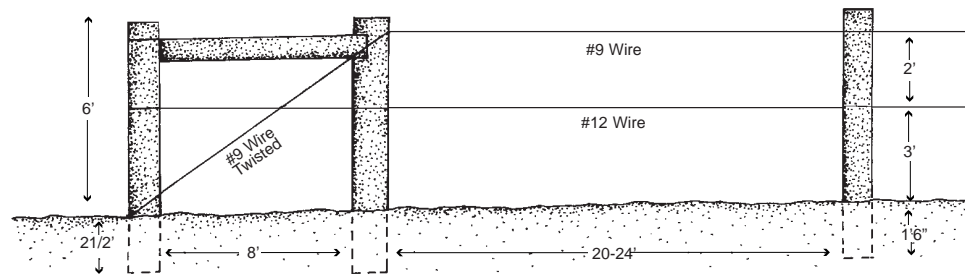


Figure 3

Managing primocanes on a two-wire trellis

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.

Floricanes woven to a two-wire trellis (Figure 4)

Bring the longest cane over the top wire and under the bottom wire in a spiral. Place remaining canes parallel to this first cane until all the canes have been trained. After all canes have been tied, cut the ends so canes from adjacent plants do not overlap.

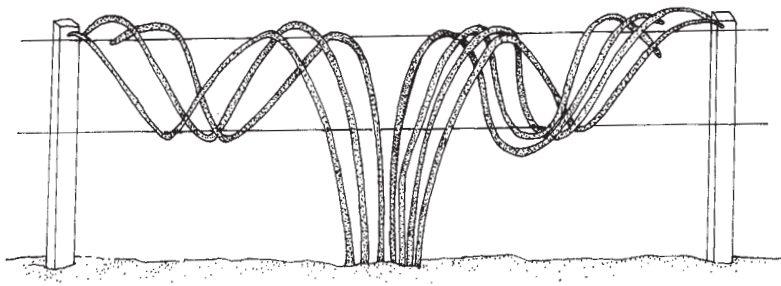


Figure 4

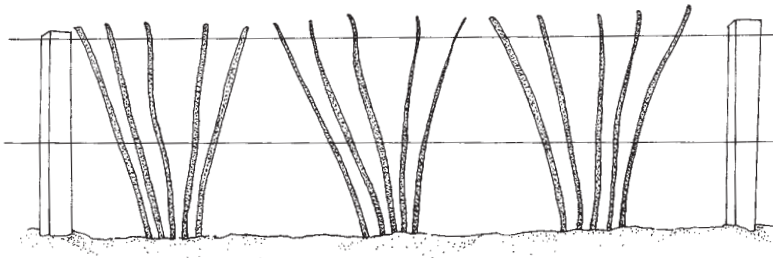


Figure 5

Floricanes trained in fan shape to a two-wire trellis (Figure 5)

This system is well suited for semi-erect and less vigorous trailing cultivars. Plants should be placed close together and canes placed uniformly over the trellis to maximize light exposure and yield. This system requires more labor and is therefore more costly than weaving.

Supported hedgerow

This system is often used for erect cultivars. Canes are confined within and supported by two horizontal wires (Figure 6). Primocanes can be allowed to grow up in between floricanes that were previously trained to both wires. An alternate method involves training the primocanes on one side and floricanes on the other. Thus only half of the row (one side) would be fruiting in any one year. This latter system is more labor intensive, but facilitates picking by allowing more room for the fruiting canes.

Shift trellis—hand harvest

The shift trellis was designed to increase productivity by concentrating all fruit on one side of the canopy, thereby minimizing berry loss to sunscald and improving fruit quality (Stiles 1995, 1999). Management of insects and diseases is easier also due to the concentration of fruit in one area of the canopy, making pesticide application much more effective. The shift is like a hinged trellis, which allows the trellis to move 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 7).

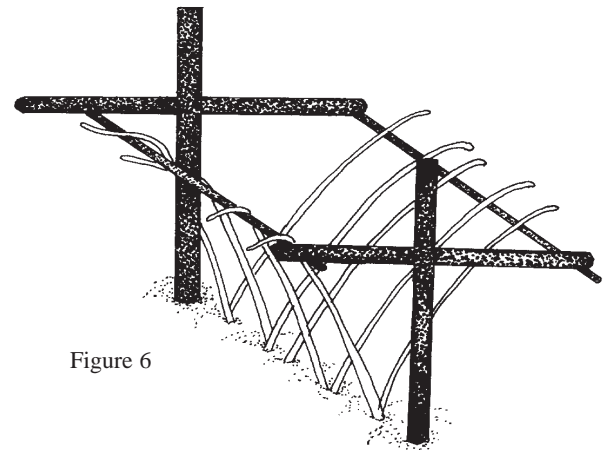


Figure 6

Rotatable cross arm trellis—machine harvest

A training system to mechanically harvest semi-erect blackberries has been recently developed by the USDA (Takeda and Peterson 1999). This system was developed in conjunction with a bramble harvester capable of moving over the trellis and detaching the fruit with minimal damage to the fruit (Figures 8 and 9). In the fall and early spring, the longer cross arm is positioned over the short arm (about 22.5 degrees above horizontal) to encourage flowers to develop on the upper part of the canopy. In the late spring, the long cross arm is swung back to the other side for harvest. This cane training trellis system positions fruit below the canes for easy removal by the harvester. Fruit harvested from this system is suitable for fresh market sales. Economic studies conducted by the USDA indicate that this system appears to be profitable.

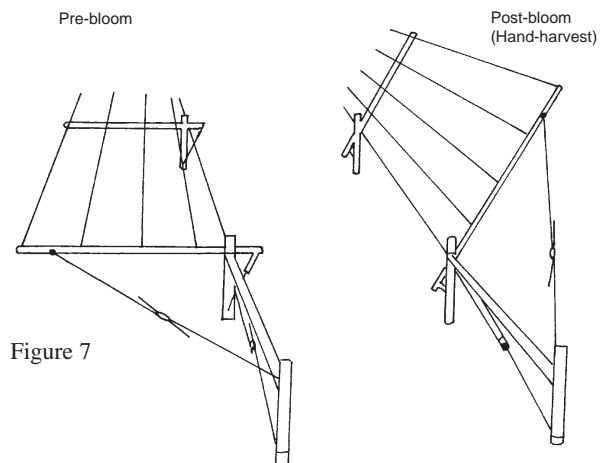


Figure 7

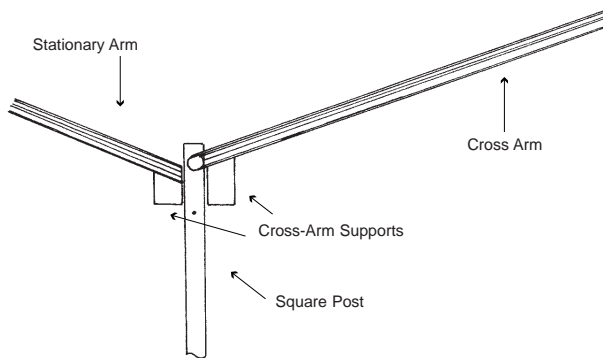


Figure 8

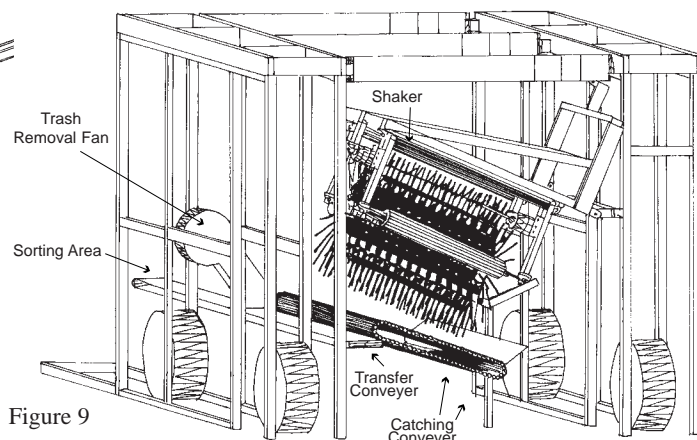


Figure 9

Water management

Lack of water before or during harvest can seriously reduce productivity. Water is the most critical factor for optimal fruit growth and primocane development. A shortage of water at this time 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 comes from the top 6 inches of the soil, which is the primary rooting zone.

Blackberry plants generally need at least 1 inch of water during each 7- to 10-day interval of the growing season. The amount of water can be reduced, if trickle or similar irrigation systems are used, since only the soil around the plant is wet. The lower-volume trickle method is especially well suited to semi-erect thornless blackberries where new growth is confined to the immediate area of the original crown of the plant. In addition, 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 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 the system.

Mulches can be used to conserve moisture. Large volumes of material and 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 straw or other suitable materials conserve moisture, minimize erosion, aid in weed control, and add organic matter to the soil. They should be given serious consideration if blackberries are to be grown on lighter, low organic matter soils without supplemental irrigation.

Insects and diseases

Many insects and diseases can damage blackberries.

Damage can be kept to minimum if the following general rules are followed:

- 1) Remove all wild blackberry plants near the area;
- 2) Select high quality planting stock from a reputable nursery;
- 3) Destroy plants in which disease appears, and prune out insect-infested canes and burn them; and
- 4) Remove floricanes from the field soon after they have fruited.

Contact your local Cooperative Extension agent for diagnosis of specific pest problems. In addition, many publications are available that can help you in the identification of your pest problems. A partial list can be found at the end of this publication.

Fertility management

Blackberries are adapted to many soil types; however, organic matter additions, pH adjustments, and incorporation of phosphorus (P) and potassium (K) should be done before planting to optimize productivity. A soil test taken three to six months prior to planting is recommended. 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. 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. In the second year, 35 to 65 lb/acre actual N are recommended. The higher levels of N are for sandy soils. For the third and subsequent years, 60 to 80 lb/acre N are usually recommended. Nitrogen can be applied in split or single applications. If using a split application, apply the first portion at bud break and the remainder just after harvest. Ammonium nitrate is the most common form of N used on blackberries.

The incorporation of P and K should be based on soil test recommendations. See Table 2 (page 9) for general P and K preplant recommendations.

Calcium (Ca) and magnesium (Mg) are occasionally added to blackberry plantings. Calcium 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. Monitoring levels of soil P, K, and pH should be done every other year. Foliar sampling should be conducted every year following harvest for accurate nutrient management, especially nitrogen.

Fruit development

Nearly all blackberry cultivars are self-fruitful, and therefore self-pollination or pollination by the same cultivar will result in fruit development. Honeybees usually transfer pollen from one flower to another. Bees are strongly attracted to bramble blossoms by the copious amounts of nectar. However, wild bees are not a reliable source of pollination, especially during bad weather. Commercial growers should consider placing one or two hives per acre grouped into units of five or ten per location.

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 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 the size of fruit.

Harvesting and postharvest management

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, Cheyenne, Choctaw, Kiowa, and Shawnee have acceptable flavor and store longer if they are picked when they are shiny black. Navaho and Arapaho are firm enough to be picked dull black for both local markets and shipping. Estimated shelf life for some cultivars is listed in Table 3 (page 9). Some general guidelines for harvesting blackberries are:

- 1) Pick in the morning while the temperature is still cool and the berries are firm;
- 2) Pick and handle the fruit carefully to avoid crushing or bruising;
- 3) Most cultivars should be picked when fully ripened or dull black for local markets and when shiny black for shipping;

- 4) Gently place the berries no more than 2 inches deep in berry baskets or picking containers to avoid further bruising; and
- 5) Cool the fruit as soon as possible after harvest.

Postharvest handling of blackberries is a critical component when selling fruit to retail or wholesale markets. Proper packing, storage, and shipping facilities will help to deliver a high quality product with maximum shelf life. Fruit reddening is a manifestation that can occur in stored blackberries. It is characterized by one or several bright red drupelets and will 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.

Handling to avoid contaminants

Recent outbreaks of foodborne illnesses have increased public awareness of food contamination. Although these outbreaks have been linked to imported products, take steps to avoid contamination of your crop. The financial loss of your produce to contamination could be great. Numerous steps can be implemented at the farm to minimize contamination of fresh produce heading to the market.

- 1) Avoid using manure as a fertilizer.
- 2) Use drip or overhead irrigation from a well only if the well casing is maintained and livestock are excluded from the pump area.
- 3) Exclude animal grazing and minimize wild animal traffic in planting.
- 4) Clean and sanitize storage facilities with 10 percent bleach solution.
- 5) Provide rest room facilities for laborers and customers.
- 6) Supply soap and water for hand washing and enforce its use.
- 7) Encourage customers to wash hands before picking blackberries.
- 8) Do not pack and avoid handling decayed fruit.
- 9) Cool fruit quickly to minimize growth of pathogens.
- 10) Store fruit at 32°F (0° C) to maintain product quality and minimize pathogen growth.

Nutritional composition

Blackberries are nutritious. One serving of blackberries (one cup or 140 gm) provides 50 percent of the vitamin C, 10 percent of the folate, and 22 percent of the fiber required daily. Blackberries are also a good source of potassium, calcium, and iron. In addition, the compound ellagic acid, identified as an anticarcinogen, is found in blackberries.

Table 1. Estimated number of plants or root pieces per acre required using different spacing systems.

Spacing within row	Spacing between rows		
	Feet	8	10
2	2,722	2,178	1,815
3	1,815	1,452	1,210
4	1,360	1,090	907
5	1,090	870	726
6	907	726	605
8	680	544	453
10	544	435	362

Table 2. Soil P and K preplant amendments.

P level	Action	Form
<50 lb/acre	Add 60-80 lb/acre P ₂ O ₅	Triple superphosphate
>50 lb/acre	None	
K level	Action	Form
<150 lb/acre	Add 60 lb/acre K ₂ O	Potassium sulfate
250-300 lb/acre	Add 30 lb/acre K ₂ O	Potassium sulfate

Table 3. Shelf life of some cultivars.

	Temp. (C)	Shelf life (days)	Temp. (C)	Shelf life (days)
Choctaw	2	3-5	5	1-2
Shawnee	2	3-5	5	1-2
Kiowa	2	3-5	5	1-2
Arapaho	2	7-10	5	3-5
Navaho	2	10-14	5	3-5

References

1. *Raspberries for the home garden*. North Carolina Cooperative Extension Service. Horticulture Information Leaflet 8204.
2. *Bramble production guide*. Northeastern Regional Agricultural Engineering Service. 152 Riley Robb Hall, Cooperative Extension, Ithaca, NY 14853. Phone: (607) 255-5701.
3. *A small scale alternative agriculture: Brambles*. USDA. Office for small-scale agriculture. Ag Box 2244, Washington, D.C. 20250-2244. Phone: (202) 410-1805. Fax: (202) 401-1804.
4. *Bramble production*. The management and marketing of raspberries and blackberries. 1994. P.C. Crandall. Food Products Press, New York.
5. *Shift-trellises for better management of brambles (Rubus cvs.)*. 1995 H.D. Stiles Virginia Agricultural Experiment Station. Bulletin 95-2. Blacksburg, VA, 24061-0402: Virginia Agricultural Experimental Station, Virginia Tech, 46 pp.
6. *Growing raspberries in North Carolina*. North Carolina Cooperative Extension Service. AG-569.
7. Takeda, F., and D.L. Peterson. 1999. Considerations for machine-harvesting eastern thornless blackberries for fresh market: Trellis designs, cane training system, and mechanical harvester development. *HortTechnology* 9(1): 16-22.
8. Radford, A.E., H.A. Ahles, and C.R. Bell. 1968. *Manual of Vascular Flora of the Carolinas*. The University of North Carolina Press, Chapel Hill.
9. Compendium of raspberry and blackberry diseases and insects. 1991. M.A. Ellis, R.H. Converse, R.N. Williams, and B. Williamson (eds.) American Phytopathological Society. St. Paul, MN.
10. Limited Arm-Rotation Shift-Trellis (LARS) and Primocane Management Apparatus (PMA) for Raspberries and Blackberries (Rubus cvs. or crops). Center, Department of Horticulture, Virginia Tech, Blackstone, VA 2384-0448. VAES Bulletin 99-1. <http://www.vaes.vt.edu/research/publications/vaes99-1.pdf>

Acknowledgements

Sincere thanks go to Penny Perkins-Veazie for postharvest recommendations.

Prepared by Gina Fernandez and James R. Ballington, Extension Horticulture Specialist and Professor of Horticulture

This bulletin is a substantial revision of *Blackberry Production in North Carolina*
by E. Barclay Poling, Extension Horticulture Specialist.

2,000 copies of this public document were printed at a cost of \$00, or \$.00 per copy.



College of Agriculture & Life Sciences • NC State University
School of Agriculture • NC A&T State University

Published by
North Carolina Cooperative Extension Service

Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Employment and program opportunities are offered to all people regardless of race, color, national origin, sex, age, or disability. North Carolina State University, North Carolina A&T State University, US Department of Agriculture, and local governments cooperating.
