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Organic Culture of Bramble Fruits

Horticulture Production Guide

Abstract: This publication focuses on organic practices for blackberry and raspberry production. Included are discussions of site selection and preparation; fertility; weed, disease, and insect management; greenhouse production of raspberries; and economics and marketing. Electronic and printed resources are provided.

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Introduction

This publication addresses the nuances involved in the production and marketing of organic bramble fruit. As such, it does not deal with many of the basics of bramble culture, like varietal selection, pruning, and irrigation, which are largely the same under both organic and conventional management. For basic information on brambles, please contact your local Cooperative Extension. If you have not already done so, we encourage you to read ATTRA's *Overview of Organic Fruit Production*; it provides valuable introductory information on organic fruit culture. ATTRA's *Overview of Organic Crop Production* is also suggested.

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NCAT

Organic growers use cultural practices, natural fertilizers, and biological controls rather than synthetic fertilizers and pesticides. When done well, organic farming is more friendly to the environment and is believed to produce healthier food. Experience has shown that bramble fruits are relatively easy to produce using organic methods.

However, while anyone can choose to *grow* organically, federal regulations now control the *labeling and marketing* of ***all*** organic products. If you have a commercial farm and plan to represent your produce as organic, you will need to be certified. To learn about organic certification and the steps involved, read ATTRA's *Organic Farm Certification and The National Organic Program*.

Cultural Considerations

The Basics of Bramble Production

The classification *bramble fruits* applies to a large number of plant species within the genus *Rubus*. The most commonly known bramble fruits are blackberries and raspberries, but other types—such as dewberries, tayberries, boysenberries, and loganberries—are also popular. Many of the bramble types and varieties are thorned, though some are not. Plant breeders have worked especially hard in recent years to develop thornless varieties. Growth habit also varies among bramble fruits. Some have prostrate growth and require trellising for commercial production; others grow fully upright and don't need trellising.

Untangling Brambles

Red raspberries can be either of two types. *Summer-bearing* red raspberries have the typical biennial life cycle of a bramble: they bear their fruit from late June to August of their second year, and the canes die after fruiting. *Primocane-bearing* types such as Heritage are the exception to this life cycle: they bear fruit during the first year. Also called "everbearing" raspberries, they will fruit again in the spring, on the buds below those that fruited the previous fall. Because both of these red raspberries produce new canes (suckers) primarily from the root system, they are usually grown in a hedgerow. They are the most winter-hardy of the raspberries.

Black raspberries initiate new canes from the crown of the plant rather than from root suckers. Because of this, they are grown in a "hill" system: each plant is grown independently, with pruning and maintenance done on a per-plant basis. They require summer tipping, unlike red raspberries, because individual canes will grow to unmanageable lengths. Black raspberries bear their fruit in late June through July, and are the most winter-tender of the raspberries.

Purple and yellow raspberries are also available but are not widely grown, though they can be a very high-value specialty crop. Purple varieties include Success, Brandywine, and Royalty. Yellow varieties include Fall Gold, Kiwi Gold, and Goldie.

Eastern blackberries can be thorny and erect, or thornless and trailing. Breeders have recently been able to produce thornless and erect cultivars. Thornless types are much more cold sensitive (to 0°F). Cultivars with a trailing growth habit require trellising. Thorny types often have excellent fruit quality but the thorns make harvest difficult. Generally, thorny types of blackberries will tolerate temperatures to about -5°F. They do not require trellising.

Tayberries were bred by crossing a blackberry with a raspberry. The flavor of the fruit reflects this parentage, and many people feel that a ripe tayberry is the most flavorful bramble of all. Unfortunately, tayberries are very soft when fully ripe, so they don't lend themselves to commercial production. Although they are quite thorny, they grow in a manner similar to trailing blackberries and require similar planting, training, and pruning techniques.

Other brambles, most of which are either hybrids among *Rubus* species or specific cultivars of blackberry, such as Loganberry, Boysenberry, Marionberry, and Ollalaberry, are grown extensively in the Pacific Northwest of the United States. They have excellent fruit quality, but are not well adapted to environmental conditions in the Northeast and should not be grown there. Their most limiting characteristic is their cold-tenderness.

Source: Small-Scale Fruit Production: A Comprehensive Guide (Penn State Cooperative Extension Publication), available online at <http://ssfruit.cas.psu.edu/chapter7/chapter7a.htm>.

Typically, bramble canes are vegetative during their first year of growth, and in this stage they are called *primocanes*. They are called *floricanes* the following season, during which they bear fruit. New primocanes emerge while the older floricanes fruit, so mature plants have both active primocanes and floricanes in evidence each season. Several raspberry cultivars are primocane-fruiting. These varieties produce a late summer or fall crop on the upper portions of the primocane stem in the first year. The next year, the same cane—now a floricane—produces a second crop lower on the stem.

Because growth and fruiting habits vary among bramble species, so do production practices. It is important that the grower seek out the cultural guidelines for the specific berry being grown.

Most bramble plantings are established either from root cuttings or plants. Spacing within rows at planting depends largely on the species. Eventually, most bramble fruits are managed as continuous hedgerows rather than as individual plants. The row spacing for commercial hedgerow plantings is typically 12 feet to accommodate tractor operations, allow for air movement, and optimize sunlight penetration (1).

Brambles, especially blackberries, are fairly drought-tolerant and are sometimes grown without supplemental irrigation. Most commercial plantings, however, are irrigated to assure quantity and quality of production. Because bramble fruit is highly perishable, marketing strategies must be developed well in advance. Many growers rely on direct marketing—particularly U-pick, roadside stands, and farmers' markets—to sell their crop.

Site Selection and Preparation

A planting site higher than the surrounding area provides air circulation and water drainage, reducing disease and insect problems. Sites with adequate air circulation also reduce the possibility of winter injury and late spring frosts. However, where strong prevailing winds occur, open sites (such as the crests of hills) may expose plants to desiccation and excessive wind stress—major causes of winter kill in brambles.

Brambles are adapted to a wide range of soils but do best when planted on well-drained, deep, fertile soil that is high in humus and free of hardpan. A pH of 6.0 to 6.5 is preferred. Compared to raspberries, blackberries are more tolerant of heavy soils and the soil-borne diseases often associated with heavy soils. Adding organic matter and planting in raised beds can be of help in avoiding these problems.

Sites previously established in fruit crops (e.g., peaches, apples, grapes, brambles, etc.) are poor choices because of potential problems with crown gall infection. Likewise, land recently planted to solanaceous crops (e.g., tomatoes, potatoes, peppers, eggplant, tobacco) presents increased risks of verticillium wilt. Nearby thickets of wild brambles should also be removed, if possible, to reduce sources of insect pests and diseases. Experts advise a minimum of 300 to 400 feet of separation from wild hosts or other commercial plantings (2).

Perennial weeds, especially aggressive grasses such as bermuda, should be controlled in advance of planting, or an alternative site should be chosen. This is extremely important in organic and reduced-herbicide plantings, as perennial weeds are especially difficult to manage with non-chemical methods.

Species and Cultivar Selection

It is advantageous to organic and low-input growers to select well-adapted species and varieties, especially those genetically resistant to common diseases. By so doing, growers find they have more time and resources to spend on other critical areas, such as weed control. Cultivar information is readily available from state or county Cooperative Extension services and from local nurseries. When purchasing, it is also important to buy from reputable suppliers to ensure virus-free and nematode-free planting stock.

With one exception, there are few restrictions on proximity when planting different varieties and species of brambles on the same farm (assuming all are locally adapted). Black and purple raspberries are much more susceptible to damage from mosaic and leaf curl viruses than are red and yellow cultivars. Since these diseases are vectored by aphids, black and purple varieties should be separated as much as possible, and located upwind, from red and yellow raspberries (3).

Alleyway Management

Brambles can be managed either under clean cultivation or with sodded alleyways. In some instances, the alleyways between new plantings are clean-cultivated, with a permanent cover crop planted at a later date. Brambles have extensive root systems, and as plantings mature, deep tillage between berry rows must be avoided to prevent root damage, unwanted suckering, and increased susceptibility to crown gall through plant wounds. According to Kansas recommendations (4), cultivation should not exceed 4 inches in depth; Georgia (5) advises cultivating no deeper than 1½ inches.

Where clean cultivation is used, the establishment of annual winter cover crops in alleyways is encouraged to reduce erosion, build soil organic matter, and act as a catch crop for nutrients. Establishment of a good cover crop in late summer or early fall also precludes the need for fall cultivation, which stimulates excessive late-season cane growth—tissue that is especially vulnerable to winter kill (4). A cereal crop such as rye (*Secale cereale)* is normally recommended for use as a winter cover crop, though annual ryegrass *(Lolium multiflorum* Lamark) is also suggested. The practice of simply allowing weeds to grow as a cover crop is discouraged, as many may go to seed and increase problems in the future.

Permanent sodded alleyways offer the greatest protection against soil erosion and the loss of nutrients through leaching, while also suppressing weeds. Conventional recommendations for sodded alleyways advise the maintenance of a four-foot-wide vegetation-free strip in the plant row, to reduce the competitive effects of the cover crop on the berries (2).

The selection of plant species for use in sodded alleyways is also important. Non-aggressive sod-forming grasses like bluegrass, fescue, and perennial ryegrass (*Lolium perenne* L.) are often recommended (7), as these are only moderately competitive with brambles. Aggressive species like bermuda are definitely discouraged.

The use of non-aggressive legumes as winter cover crops or as a companion to grasses in sodded alleyways offers the advantage of providing a significant amount of the annual nitrogen needs through biological fixation. The downside of legumes is the buildup of stinkbug and tarnished plant bug populations. In Oklahoma, at the Kerr Center for Sustainable Agriculture, a blend of subterranean, Dutch white, and ladino clovers was successfully used in alleyways in a blackberry planting (8). Frequent mowings appeared to reduce the threat from stinkbugs and plant bugs and prevented weed seed development. No evidence of winter damage from excessive soil nitrogen was observed.

In a Canadian study, raspberries were grown with white clover and perennial ryegrass covers. The white clover cover resulted in higher berry yields, improved vegetative growth, and better nitrogen nutrition than the perennial ryegrass. When compared to clean cultivation, yields with the white clover cover crop were comparable (9).

In all cases, sodded alleyways do compete with the bramble crop for nutrients and moisture. Their benefits, however, usually outweigh the negatives; growers can compensate by applying supplemental irrigation and additional nitrogen fertilizer if needed.

For additional details on cover crops, please request ATTRA's *Overview of Cover Crops and Green Manures*.

Pruning & Trellising

The appropriate means of pruning, training, and trellising a bramble crop is largely dictated by the species and varieties grown. Good information on specific procedures is provided in conventional literature available from Cooperative Extension. A few details, however, are of special note to organic and low-input producers.

Destruction of spent floricanes is important for disease and insect pest control. Removing and burning these floricanes is commonly recommended, though shredding and soil incorporation are sometimes practiced. While trellising is necessary on most trailing brambles, it is also an option for most raspberries and a number of other bramble species.

While somewhat expensive, trellising increases air movement in the plant canopy—reducing the need for sprays to manage plant diseases. Trellising also enhances the effectiveness of pesticides, by allowing better spray penetration (11). And because trellising allows easier access to fruit, cleaner picking is possible, resulting in fewer overripe berries—lessening the attraction to picnic, sap, June, and Japanese beetles (12).

Air movement and sunlight penetration can also be enhanced by using alternate row production in regions with suitable growing seasons. In this approach, every other row is mowed during dormancy, resulting in a much more open field during the early part of the season. Aggressive regrowth in the primocane rows is exceptionally competitive with weeds, and yields in floricane rows are heavy. Reduced pruning cost is an additional benefit (13, 14).

Weed Management

Aspects of weed management already discussed include suppression via cover crops and the importance of pre-plant weed control. Refer to ATTRA's *Overview of Organic Fruit Production* for details on pre-plant weed control strategies. Subsequent weed control in established bramble plantings through cultivation, hoeing, or hand-weeding is very difficult. The use of traditional grape hoes or more modern versions such as Weed Badger™ and Green Hoe™ cultivators has been suggested. Descriptions and contacts for these implements are provided in ATTRA's *Overview of Organic Fruit Production*. Whatever the technology employed, all mechanical weeding must be shallow to avoid root damage.

Weeder geese can eliminate most of the grass and many of the tender broadleaf weeds from a planting. Since geese will also eat the ripe fruit and perhaps even some of the newly emerging primocanes, their use should be timed appropriately. Obviously, stocking rates will be much lower and management will be easier on clean-cultivated plantings.

Investigators at the Kerr Center for Sustainable Agriculture have used weeder geese for effective weed control in blueberries with sodded middles. The center's strategy entails the use of movable electric fencing and intensive grazing (8). Call ATTRA for additional information on weeding with geese.

Mulching

Research over the years has demonstrated definite advantages to mulching in raspberries (15, 16) and thornless blackberries (17). Mulching conserves moisture, moderates temperature fluctuations, decreases weed pressure, and enhances yield. Results of research at the Missouri Fruit Experiment Station, however, show that while mulching with organic materials can be helpful in controlling some weeds, it is not sufficient for total weed control by itself. In fact, excessively deep in-row mulching can interfere with primocane emergence. It may also harbor damaging rodents.

Mulching can also aggravate phytophthora root rot problems on susceptible red raspberry cultivars grown on heavy (clayey), irrigated soils. In such a situation, New York researchers recommend straw mulch during the establishment year only (18).

Geotextile mulches, such as woven plastic and weed barrier fabrics, are gaining favor as long-term weed control solutions, and appear suitable for use in bramble plantings. The fabric must be slit properly to minimize suppression of emerging primocanes. Plantings have been made using the fabric solely as an in-row cover, and also as a seamless mulch sheet, extending row to row across the middles. Though the initial cost is high, it may prove reasonable when amortized over the expected lifetime of 10 to 12

years. Available fabric mulches include Sunbelt™ by DeWitt Co. (19) and Lumite by Shaw Fabrics. Additionally, county or state Extension Services can provide information on fabric mulches, and, in some cases, might supply these products themselves.

ESTIMATES OF NITROGEN REQUIREMENTS FOR BRAMBLE CROPS

Bramble Type	Growth Stage	Pounds per Acre of Nitrogen*
Upright blackberries Summer-bearing purple and black raspberries	Establishment Year Maintenance	25 to 30 50 to 60
Trailing blackberries Summer-bearing red raspberries	Establishment Year Maintenance	30 to 35 65 to 75
Primocane fruiting raspberries (no summer)	Establishment Year Maintenance	30 to 40 95 to 115

* Reduce rates by 10 to 24% for dryland production

Fertility Management

Sustainable fertility management in brambles begins well in advance of planting, with soil testing and site preparation. Refer to ATTRA's *Overview of Organic Fruit Production* for general information on pre-plant soil preparation for fruit crops, plus additional information on fertilization. Some specific aspects of site preparation for bramble crops should be noted:

- Brambles tolerate a fairly wide pH range from 4.5 to 7.5. However, the optimum pH range is 6.0 to 6.5. Lime or other suitable amendments should be applied in the year prior to establishment to bring the soil into his pH range.

- Avoid excessive applications of phosphate. High levels of soil phosphorus have been associated with zinc deficiency in brambles. Growers planning to use poultry litter prior to establishment or as a maintenance fertilizer should take special note, since poultry wastes are especially high in phosphates.

- Brambles are also sensitive to chlorine salts, and natural sources of potassium chloride should not be used either pre-plant or as a maintenance fertilizer.

Even when cover crops and mulches are used, annual applications of supplementary fertilizer—especially nitrogen—are needed in most bramble plantings to sustain good yields. Organic growers primarily use manures, composts, animal by-products, and vegetable or seed meals to make up the difference. Estimates of total nitrogen fertilizer requirements are provided below. During the establishment year, application should be delayed until the canes have emerged, especially if salt-based materials or manures are applied, since young brambles are easily salt-damaged. Maintenance rates shown can be applied as a single spring application (pre-bloom), or split to apply one-half immediately after harvest.

Additional guidelines for supplemental fertilization include:

- Be certain to credit the nitrogen contribution from cover crops and reduce supplementary fertilizer rates accordingly. ATTRA's *Overview of Cover Crops and Green Manures* provides information useful in making this estimation.
- It is a good rule of thumb to assume that only 50% of the nitrogen in most manure or compost will be available during the year of application. (The availability of nitrogen in fresh poultry manure may be closer to 90% in the first year.) However, the remaining nitrogen will become available in subsequent

years and should be credited accordingly.

•Be especially cautious to avoid nitrogen burn and nutrient imbalances when using manure. The fertilizer value of manure is highly variable and usually unbalanced with respect to nitrogen, phosphorus, and potassium (N-P-K). Considering these properties, specific application rates are impossible to recommend. Typically, farmers apply manures at roughly 1-4 tons per acre, depending on the fertility of the soil. Poultry manures, which are usually higher in nitrogen, are applied at 1-2 tons per acre.

•The timing of manure applications is very important. Manure cannot be applied to the plants within 120 days of harvest under conditions where the fruit is either in contact with the soil or can be splashed with soil from rainfall or irrigation. Manure cannot be applied within 90 days of harvest where the fruit is elevated or otherwise shielded from soil contact.

•If manure is fully and properly composted, it can safely be applied at higher rates and at any time during the season. For further details on manure and composting requirements, see ATTRA's *Manures for Organic Crop Production*.

•When using organic fertilizers—especially unprocessed manures—growers find that any material not finely textured is difficult to spread within an established bramble hedge-row. Large clumps of organic matter can also impede primocane emergence. Coarse-textured compost or manure is more easily applied if sieved or simply broken up with spading forks or shovels. The ATTRA publication *Manures for Organic Crop Production* provides useful information on manure-spreader calibration.

•In contrast to animal manures, cottonseed meal (N-P-K approximately equal to 7-2-2) is more predictable as to nutrient content, and its texture makes it easy to apply to brambles. Though more expensive than cottonseed meal, blood meal (N-P-K approximately equal to 12-1.3-0.7) is widely available, easily applied, and more rapidly available to plants. To apply roughly 60 lbs of actual nitrogen per acre, one would need to apply almost 860 lbs of cottonseed meal or 500 lbs of blood meal per acre. This is equivalent to about 2 1/3 lbs of cottonseed or 1 1/3 lbs of blood meal per 10 feet of row (assuming 12-foot row spacing).

•All solid organic fertilizers should be applied in the mid- to late winter to allow adequate decomposition time before the spring growth spurt. Also, if applied too late, solid organic fertilizers may still be releasing nutrients to plants late in the season, which can result in cold damage to tender late growth.

•Magnesium and boron deficiencies sometimes occur in brambles, though these are less likely under a sound organic fertilization scheme. Magnesium deficiencies can occur under conditions where excessively high potassium levels are accompanied by low calcium. Dolomitic limestone, sul-po-mag, and epsom salts are suitable for correcting soil deficiencies. Boron deficiencies are most likely in high pH soils, particularly in the Northwest. Small amounts of Solubor™ or borax are commonly used as amendments (20, 21).

•Biannual soil and/or plant-tissue testing is advisable to identify nutrient imbalances and adjust fertilization accordingly. Testing services are usually available through county and state Cooperative Extension.

For an overview of soil fertility in organic farming systems, see ATTRA's *Sustainable Soil Management*. For further information on alternative fertilizer materials, see ATTRA's *Alternative Soil Amendments*.

Greenhouse Raspberry Production

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(Reprinted with the author's permission)

Raspberries are uniquely suited for winter greenhouse production in the U.S. Unlike strawberries, no significant domestic sources of winter raspberries exist. The vast majority of winter raspberries are flown in from the Southern Hemisphere. Quality is generally poor because raspberries have an extremely short postharvest life, and bruise easily during shipping. As a result, consumers are willing to pay between $3.00 and $6.00 per half-pint for fresh fruit, and restaurant chefs seem willing to pay even more.

Compared to field production, greenhouse produced berries are larger, firmer and much less prone to fruit rot. Only 6% of our greenhouse berries were crumbly or otherwise unmarketable, whereas the percentage of field-grown berries that are unmarketable is usually much higher. Fruit tends to be slightly less sweet and more acid in the greenhouse, but well within the limits of acceptability. Only Royalty purple raspberry and Heritage red raspberry ("summer crop") did not produce fruit of acceptable flavor.

Procedure

Although we have not optimized the system, these procedures work reasonably well. Summer-bearing (floricane-fruiting) tissue-cultured raspberry plugs are planted into 1 gallon pots filled with equal parts sand:peat:perlite:vermiculite in May, allowed to grow outdoors on a gravel bed with irrigation until late December, then brought into the greenhouse. While outdoors, plants are fertilized weekly with a complete soluble fertilizer solution containing 100 ppm N, and pest outbreaks are managed using conventional practices. Once in the greenhouse, canes are trellised and plants watered with a 100 ppm N fertilizer solution. Temperatures are maintained at 65F during the day, and 50F at night - ideal for raspberries but too cold for most other plants. Supplemental light can accelerate development by 2 to 3 weeks and increase yield by 20 –30%.

Six weeks after moving plants into a lighted greenhouse, they flower. Bumblebees are used to pollinate the flowers, and fruiting can begin as early as mid-February, about 10 weeks after moving plants indoors.

Once flowering begins, the nutrient solution is reduced to 50 ppm nitrogen. With one-year-old plants, we use double rows (with row centers 5 ft. apart) and a pot-to-pot spacing so that approx. 26 plants are contained in each 3 m length of row. Each plant produces about two half-pints (350g) of fruit. New primocanes are removed when they reach a height of 18 inches. (Removing all primocanes as they emerge is detrimental to the carbohydrate status of the plants.) Those that are 18 inches tall near the end of harvest are retained for fruiting the following year.

After the first harvest is over in April, we transplant into 7 gallon pots and place plants outside for the second growing season. We return plants to the greenhouse in mid-December after the chilling requirement has been fulfilled. Rapidly satisfying the chilling requirement is one advantage that northern growers have over more southern producers. Outdoors in full sun, plants are watered regularly and fertilized once a week with a soluble balanced fertilizer (100 ppm N). Canes are held upright with trellises as they grow. In the second production cycle, we space plants 22 in. apart in single rows, with 5.5 ft. between rows, and trellis canes upright to a single wire.

Pests and Diseases

We regularly released *Phytoseiulus persimilis* for twospotted spider mites (there are no pesticides labeled for use on raspberries in greenhouses). Household fans are used to circulate air down the rows to reduce pockets of high humidity (ideal is 65–75%) and the subsequent risk of fungal infection.

Economics

At our orchard store, we sold raspberries for $3.00 per half-pint without consumer resistance. We have calculated that net profits of $2,500–$5,000 per 1,000 sq. ft. are reasonable. Raspberries are well-suited to greenhouse production, and the economics appear to be favorable.

For more information on greenhouse raspberry production, visit the Web site: <http://www.hort.cornell.edu/department/faculty/pritts/Greenhouse/Frontpage.htm>.

Diseases

The foundations of organic disease control are sanitation (removal and destruction of infected plant parts); keeping the plants in good vigor through weed control, good fertility, and moisture management (mulching and irrigation); and using resistant varieties. For descriptions and diagnoses of plant diseases, refer to Cooperative Extension publications or contact an Extension specialist. Also see Chapter 7: Small-Scale Fruit Production—A Comprehensive Guide (Penn State Cooperative Extension Publication), available online at <http://ssfruit.cas.psu.edu/chapter7/chapter7a.htm>.

Phytophthora Root Rot

Phytophthora root rot is not known to be a problem on blackberries and causes minimal problems in black and purple raspberries (22, 23). It can, however, be a problem in some soils on susceptible varieties of red raspberries. A listing of known resistant and highly susceptible varieties, compiled from several sources (22, 23, 24, 25, 26, 28), is provided below.

Soils naturally suppressive of phytophthora fungi contain large amounts of organic matter, plentiful calcium, and nitrogen in the ammonium form (decaying organic matter will produce ammonium nitrogen) (27). Planting on raised beds is also helpful.

Cornell researchers found that amending the soil with gypsum (calcium sulfate) reduced the incidence of phytophthora in red raspberries. Other amendments tested—including compost, lime, sulfur, and potassium—were either ineffective or inferior to gypsum against phytophthora (28).

As mentioned earlier, mulching susceptible red raspberry cultivars can foster phytophthora problems. This appears to be common only in irrigated plantings on heavy soils. If all factors are present—susceptible cultivars, heavy soil, irrigation—research indicates that mulch is advantageous during the establishment year, but may favor phytophthora thereafter (14).

PHYTOPHTHORA RESISTANCE OF RASPBERRY VARIETIES

Phytophthora-Resistant Varieties		Phytophthora-Susceptible Varieties	
Boyne	Latham	Canby	Munger
Bristol	Lauren	Chilcotin	Reveille
Cherokee	Meeker	Comox	Ruby
Chilliwack	Newburgh	Cumberland	Skeena
Dundee	Nordic	Festival	Taylor
Fall Red	Pathfinder	Heritage	Titan
Killarney	Sumner	Hilton	Willamette
Jewel	Sunrise		

Verticillium Wilt

Verticillium wilt is caused by the fungus *Verticillium albo-atrum*. To avoid soil-borne verticillium wilt problems, an often-repeated recommendation is that growers should wait at least three to four years before planting in a field where potatoes, tomatoes, peppers, eggplant, or tobacco have been grown; however, research has shown *Verticillium* species to be capable of surviving in the soil for more than 14 years in the absence of a host (29).

Also, common weeds such as black nightshade, redroot pigweed, lambsquarter, and horsenettle support verticillium (30). Soil solarization can greatly reduce the verticillium inoculum (refer to ATTRA's *Overview of Organic Fruit Production* for more information on soil solarization).

Among red raspberries, which tend to be more tolerant, Cuthbert and Syracuse have shown to be resistant under field conditions (10). Among blackberries, Himalaya and Evergreen are verticillium-resistant (30).

Crown Gall

Crown gall is caused by the bacterium *Agrobacterium radiobacter* var. tumefaciens, which usually enters through wounds in the roots or crowns of raspberry and blackberry plants. The disease is best controlled by planting healthy stock on a "clean" site. On a planting site where crown gall has been known to occur, a waiting period of three to five years is advised before replanting. As an alternative, a biological treatment (dip) with a non-pathogenic strain of a closely related bacterium (*A. radiobacter* var. radiobacter strain K84) can protect the planting stock from infection by the virulent *A. radiobacter* var. tumefaciens (31). Two commercial formulations of this treatment are available (32, 33).

Gray Mold

The only serious disease of bramble fruit is gray mold, caused by the fungus *Botrytis cinerea*. Gray mold can be devastating if rainy weather coincides with harvest when fruits are at their ripest and most susceptible. Raspberries are more susceptible than blackberries. No organically acceptable fungicides are available for controlling this disease, but there are biological controls proven effective against gray mold (34). Unfortunately, none of these biological controls are as yet EPA-registered for use on aboveground plant parts.

The incidence of gray mold can be reduced through advanced planning in site selection—choosing a location with good soil and air drainage, and orienting crop rows with prevailing breezes. Subsequent cultural management to improve sunlight entry and air movement (e.g., trellising, alternate row production, removal of spent floricanes, thinning, weed control, and cover crop mowing, etc.) and maintaining a tight picking schedule to reduce the presence of overripe fruit also contribute greatly to suppressing gray mold.

Leaf Spot

Another fungal problem in humid climates is leaf spot (causal organism: *Sphaerulina rubi*). Most blackberries are resistant, but raspberries—especially those growing in the southern extremes of their adapted region—can be hard hit. Practicing good sanitation, especially the removal and destruction of old floricanes, and managing to increase air movement and sunlight penetration work to suppress leaf spot. Overwintering inoculum can also be reduced with a single delayed-dormant spray of lime sulfur (35).

There is some genetic resistance to leaf spot among raspberry varieties. Heritage, Southland, Fall Gold, and MN 659 appear especially resistant, and black raspberry varieties demonstrate moderate resistance. Red raspberry varieties Sentry, Taylor, Skeena, Killarney, and Canby appear most susceptible (36).

Orange Rust

Orange rust affects blackberries and black raspberries. The organism *Gymnoconia peckianus*, which causes rust-colored lesions on leaves, will commonly infect the whole plant, stunting some plants seriously. Control measures largely focus on the planting of clean stock and diligent scouting to rogue out infected crop and wild plants, roots and all. Practices to improve air circulation are also advised (37).

Among blackberry cultivars, Eldorado, Raven, Snyder, and Ebony King appear resistant.

Among thornless blackberry varieties, Hull, Chester, and Arapaho appear resistant.

Anthracnose

Anthracnose (causal organism: *Elsinoe veneta*) can be a serious disease on blackberries and black raspberries. It is less of a threat to purple and red raspberries, and most of the thornless blackberry varieties exhibit resistance. Again, sanitation procedures and practices to improve air circulation play major roles in disease suppression. Anthracnose can also be controlled organically with a single delayed-dormant spray of liquid lime-sulfur (7). Under severe conditions, additional later sprays using bordeaux, burgundy mix, or a fixed copper may help.

Spur Blight

Spur blight (causal organism: *Didymella applanata*) is a fungal disease of red raspberries and sometimes of purple raspberries that can reduce the yields and life of a planting. Control procedures are essentially the same as those for anthracnose. The cultivars Amity, Festival, Haida, and Prestige all show some resistance (38).

Viruses

There are several bramble viruses of economic importance. Again, planting clean stock and rogueing out and destroying infected plants are important practices in limiting virus spread. Raspberries can be particularly hard hit in areas where aphid vectors of viruses are present. Breeding for resistance to aphid vectors has proved highly effective in restricting virus infection in plantings (39, 40).

Insects

Aphids

Besides vectoring viruses, aphids can be troublesome on brambles when feeding is so intense that leaves become curled and distorted. High aphid populations are often an indication of excessive nitrogen fertilization—a more frequent problem where soluble nitrate fertilizer is used.

Organic growers usually find that, if they don't spray, naturally occurring enemies of the aphids will eventually exert control. However, organic growers may also use insecticides such as soap sprays, rotenone, and pyrethrum for control.

Borers

Other major insect pests of brambles include the borers: the raspberry crown borer, the raspberry cane borer, and the red-necked cane borer. Despite the names of these pests, all three attack blackberries as well as raspberries. Control of all three is best achieved organically by rogueing out and destroying infested plants.

Beetles

Japanese and June beetles can be major pests of bramble fruit if their adult emergence coincides with the ripening. Since ripe berries are picked every day or every other day, there are few pesticides (organic or otherwise) that are both effective against these beetles and usable up to the day of harvest. Some botanicals—such as rotenone—can legally be used even the day of harvest according to current label restrictions; however, none have proved adequate for June and Japanese beetle control.

Consequently, organic growers have to resort to other methods to control these pests. Hand picking, trapping, exclusion with row covers, and reducing the immatures (grubs) in the soil with tillage, milky spore disease, and/or beneficial nematodes have all been attempted by growers with varying degrees of success. Targeting the grubs requires advance planning—the beneficial nematodes and milky spore disease are

not effective against adult beetles. Grubs can be especially plentiful in undisturbed pasture or turf soils. Tillage and soil treatment with beneficial nematodes or milky spore disease are helpful in destroying pupae or grubs, but since the adults can fly in from relatively distant sites, it is often impractical to till or treat enough ground adjacent to the bramble planting to effectively suppress a local population.

Attempts have been made to exploit a behavioral phenomenon of these pests for control. Apparently the beetles are initially attracted by the odors of ripening fruit and fruit yeasts. After the first beetles find the food source, they emit an aggregation pheromone which functions as a scent beacon for other beetles. Commercial traps that use these pheromones for trapping the beetles are available through mail-order garden supply companies, but growers and researchers alike caution that they can end up attracting more beetles to the planting than the traps can handle, making the problem even worse. However, understanding this behavioral phenomenon reinforces the importance of hand picking or otherwise dealing with those first few beetles.

Arkansas researchers report that buckets of water and rotting fruit attract June beetles (41). The water can be laced with a pesticide or the beetles scooped off and otherwise killed. In any case, these researchers caution that the buckets must be emptied of beetles regularly because the pests soon accumulate to the extent that the last-arriving beetles may be unable to reach the water and thus easily crawl out. The fruit brew may also need to be changed if it appears to have lost its yeast-like smell or is no longer attracting the beetles. In all instances where beetle traps are employed, current wisdom advises placing them away from the field to avoid the possibility of drawing the pests to the crop.

Surround™ WPis a kaolin-clay-based insect repellent effective against both June and Japanese beetles. It is considered "organic" by the Organic Materials Review Institute, and is registered on brambles. However, the clay is nearly impossible to wash off from between the drupelets (the individual seed-bearing structures that together make up the "berry," which, botanically, is more correctly called a "drupe"). As a result the Surround label cautions that Surround should only be applied to berries intended for processing (42).

Refugia

While cover crops may provide shelter to several bramble pests, cover crops and adjacent vegetation also harbor beneficial insects that pollinate the crop and help to suppress pest insect and mite populations. When crops and field borders are managed with beneficials in mind they are often referred to as refugia, and represent a new approach to pest management based on planned biodiversity. To learn more about refugia, please request the ATTRA publication *Farmscaping to Enhance Biological Control*.

Economics and Marketing

Overview of Bramble Economics

In the U.S., large-scale commercial bramble production is located almost exclusively in states along the Pacific Coast. The remaining bramble fruit production is scattered in small plantings throughout the United States. Most of the commercial crop is processed, with only a small amount making its way to the fresh market. In general, fresh bramble fruit doesn't ship well and thus is generally most appropriate for local markets. Still, it can bring high prices.

"Demand and prices for blackberries and raspberries are rising..."

More than 95 percent of the bramble fruit grown in Washington and Oregon is sold for processing. California brambles are grown mainly for the fresh market, since shippers use the fresh-market infrastructure developed for strawberries to handle and sell raspberries. Statistics are not available for other states, but in California the fresh market, especially direct-to-consumer sales, reportedly accounts for most sales (43).

Demand for both fresh and processed bramble fruit is increasing. Recent reports indicate that prices and sales are rising. Raspberries are the most important commercial bramble fruit, and the black and red types the most popular. Purple and yellow raspberries are less widely grown than the others, but demand is still strong (44). Blackberry acreage and yield are also increasing as that crop becomes more popular.

Bramble fruits can be a good crop to add to the production mix for the small-scale and/or part-time farmer. Once established, raspberry plantings, for example, should produce for at least six years, and some produce for more than 20 years (45). Bramble fruits, which ripen shortly after strawberries or later in August or September, can extend the small producer's harvest season. However, since bramble fruits have special production requirements and a very short shelf life and marketing season, growing them is not appropriate for everyone.

The high cost of machinery, irrigation, quality plants, and labor requirements often discourages growers from getting into the bramble market. Economically, raspberries or blackberries are considered to be a medium- to high-risk crop because of a high initial investment, returns delayed for two or more years, biological factors including the climate, and high fixed costs (44).

Establishment costs can range from $3,000 to $4,500 per acre. Plantations should consist of at least 3 acres to provide enough fruit for sale. Most growers report needing at least five to ten good pickers per acre to keep up with the ripening fruit. Growers who plan to harvest their crop with mechanical harvesters generally need at least 10 acres in production to justify renting a machine (46).

In budgetary information developed by Kansas State University in 1993, the total variable and fixed costs for an acre of red raspberries were $2,222 in the establishment year and $1,720 in each of the three subsequent years. (Note that these figures do not include costs associated with irrigation, land payments, interest, or returns to management.) Based on these costs, it was estimated that, at an average yield of 1 ton per acre and a market price of $1.25 per lb, the grower would remain in a negative cash position for at least three years, since no crop is produced in the establishment year (1).

However, market prices will vary by region, affecting economic returns. For example, while the Kansas study above was based on a market price of $1.25, a survey conducted by Ohio Sate University in 2001 showed average black raspberry prices in Ohio to be $2.37 per lb in pick-your-own markets, $3.33 per pint in on-farm markets, and $3.79 per pint in farmers' markets (6).

Organic production is typically more costly than conventional production.

For more information on marketing and economics, see Ohio State University Extension Service's publication "Brambles—Production Management and Marketing" online at <http://ohioline.osu.edu/b782/index.html>.

While the bulk of brambles are grown conventionally, there is some commercial organic production. Organic production is typically more costly than conventional production. Among the factors that often increase per-unit production costs in organic systems are the added labor and machinery costs associated with weed control, the loss of benefits associated with scale (organic operations are typically smaller), and reduced yields due to pest pressure.

However, small-acreage organic raspberry fields, carefully hand-harvested every day over a 4-week period, can be lucrative. Expected yields in 1997 for mechanically harvested organic raspberries (in the Pacific Northwest) were between 3 and 4 tons an acre, with hand-harvested berries yielding 4 to 5 tons per acre. Prices have been high, with premiums of up to 35 cents a pound over conventional. However, increased acreage in both the U.S. and overseas is expected to continue to drive down prices by increasing supply (47).

Marketing

Can you make money growing raspberries? To help decide, first consider where to market the berries. Options include wholesalers, cooperatives, local retailers, roadside stands, pick-your-own, farmers' markets, and processing firms. Many small, independent fruit producers find it increasingly difficult to market their ber-

ries. Eighty percent of all fresh fruits and vegetables sold at the retail level are presently handled by chain stores in the United States. High labor costs and lack of a wholesale market at a fair return has made direct marketing much more attractive to small growers. The cost / price squeeze is particularly dramatic in the case of brambles. Direct marketing provides a means of increasing the grower's net return.

Before you plant organic fields, make your marketing arrangements. Since costs are high, it is crucial to locate markets that will pay the premium prices required to turn a profit. For help with understanding, researching, and locating organic markets, see ATTRA's *Organic Marketing Resources*.

A study from Ohio (44) examined the profitability of three different bramble fruit markets: pick-your-own (PYO), hand-harvested for either on- or off-farm sales, and mechanically harvested for either immediate processing or individually quick frozen (IQF) storage.

PYO marketing is highly attractive as a low-investment alternative. However, researchers found that these operations were required to sell at relatively low prices, PYO being less popular today than it used to be. Also, marketing options for PYO can be limited for operations located far from population centers. Inclement weather can have a particularly depressing effect on this marketing strategy, too. Hand-harvested berries can be sold directly to consumers or to retail. Hand-harvesting requires the management of additional seasonal workers. The researchers found that growers need to charge at least $1.00 more per pound for hand-harvested berries than PYO-harvested berries to turn a profit.

Machine-harvested berries are generally taken to a processor for freezing or juicing. Low yields and few hours of machine use per year increase the cost of machine-harvested berries. Mechanical harvest requires a business that can handle large volumes of berries in one day. Processed berry prices tend to change more rapidly than fresh berry prices. The researchers found that when growers with small farms are capable of producing an average of 3,200 pounds or more per acre, they are able to compete with larger farms in marketing machine-harvested berries. However, it may be difficult to locate processors outside the Pacific Northwest.

Marketing Health through Bramble Fruits

The demand for nutritionally enhanced foods continues to grow. Beyond their vitamin and mineral content, bramble fruits are now known to contain important phytochemicals (naturally occuring compounds). The term *nutraceutical* refers to a phytochemical substance that may be considered food (or part of a food) and that provides medical or health benefits, including prevention and treatment of disease. Nutraceuticals represent one of the most important food-industry trends for marketing to an increasingly knowledgeable and health-conscious consumer. Information on nutraceutical properties of bramble fruits can be found at <http://www.ag.ohio-state.edu/~sfgnet/ellagic.html>.

Value Adding

Since bramble fruits are so perishable and easily damaged, the farmer may have a lot of damaged berries unsuitable for the fresh market on his or her hands. While it is not recommended to rely exclusively on culls for value-added products, culls can make up a large part of fruit ingredients in products such as fruit leathers and jams and jellies.

For more information on adding value, request the ATTRA publications *Adding Value to Farm Products: An Overview* and *Keys to Success in Value-Added Agriculture*.

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Further Resources

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Compendium of Raspberry and Blackberry Diseases and Insects
Ellis, M.A., et al. (ed.). 1991. The American Phytopathological Society, St. Paul, MN. 122 p.
Available for $49 + shipping from:

APS PRESS Customer Service
3340 Pilot Knob Road
Saint Paul, MN 55121-2097
Toll-free ordering: 800-328-7560
http://store.yahoo.com/shopapspress/41213.html

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http://www.fruitgrowersnews.com/
Subscription cost is $11.00 per year or $28 for 3 years. Some articles available online.

Electronic Resources:

Ohio State University Extension Web site
http://ohioline.osu.edu/lines/fruit.html#FRU.6

University of California Fruit & Nut Research and Information Center
http://fruitsandnuts.ucdavis.edu/rasp.html

Small fruit production information index. North Carolina State University
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http://www.smallfruits.org/

Berry Growers' Associations

Minnesota Fruit & Vegetable Growers Assn.
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New York State Berry Growers Association
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http://www.hort.cornell.edu/grower/nybga/

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http://www.oregon-berries.com/

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Fax: 360-354-0948
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http://www.red-raspberry.org/

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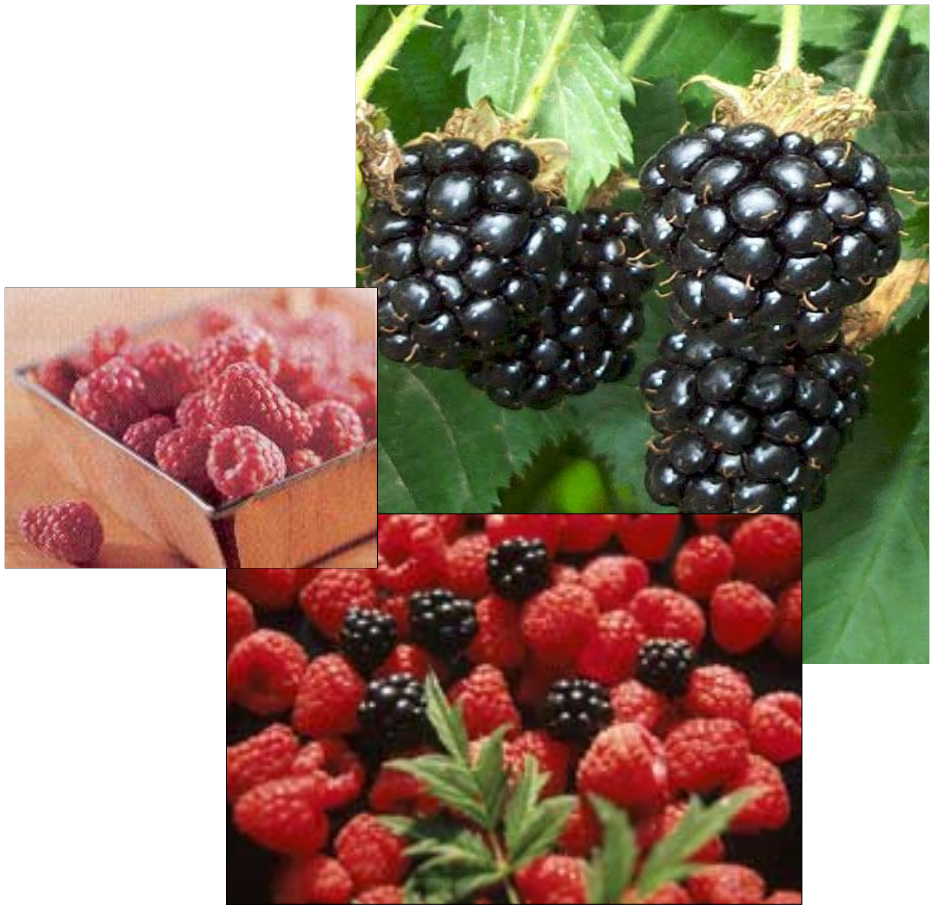

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