

Strawberries for the Home Garden

Fact Sheet No. 7.000

Gardening Series | Fruits and Vegetables

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Revised by L. Langelo**

Strawberries require at least eight hours of full sun each day of the growing season to produce at their maximum capability. Because a strawberry planting will remain in the same location for multiple years, locate them in an area that does not interfere with the annual garden cultivation.

When strawberries are planted after sod, grubs, which have been feeding undetected on the sod roots, divert their attention to the strawberry roots. Because there are fewer strawberry roots, a sizable grub population may cause severe damage. After removing the sod, wait a year before planting strawberries because the grub population will decline.

The gardener generally has no choice as to soil type; however, a sandy loam soil with a southern exposure is ideal. Strawberries like a loose, moderately fertile soil. Before planting, work in 4 bushels of organic matter, 1 pound of nitrogen (N), 1 pound of phosphate (P_2O_5) and 1 pound of iron chelate per 1,000 square feet. In general, do not add more than 4 bushels of fresh manure or more than 8 bushels of decayed manure. If you add more than 4 bushels of raw organic matter such as straw and sawdust, also add 1/4 to 1/2 pound of nitrogen for each bushel in excess of four.

Varieties

Strawberry varieties are classified as June bearing, everbearing or day neutral. June-bearing varieties tend to produce the most flavorful, aromatic berries. However, if their

flowers are damaged by a late spring frost, they will produce a much reduced crop or no crop at all. In most areas of Colorado, June-bearing varieties actually ripen in July. Recommended June bearers (one crop) for this area are Guardian, Kent, Honeoye, Redchief, Delite, Jewel, Mesabi, A.C. Wendy, Cabot and Bloomiden.

Everbearing strawberries typically provide two main crops each year, with small amounts of fruit produced between the main crop in June and a lighter crop in late summer or early fall. For Colorado, everbearing strawberries are recommended for the home gardener because they tend to be very reliable producers. If a late spring frost kills the first flowers, you will still get a crop in late summer or fall. Some of the more common everbearing varieties are Ogallala, Fort Laramie and Ozark Beauty. Ogallala and Fort Laramie are recommended for Colorado because they are more hardy.

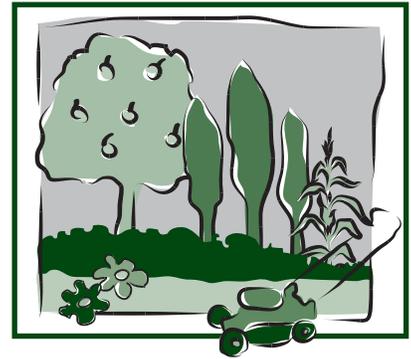
Day neutral varieties are similar to everbearers, but flower and fruit more consistently over the summer. Recommended day-neutral varieties include Tribute, Tristar and Fern.

Many gardeners plant everbearing, day-neutral and June-bearing types in order to extend harvest over the longest possible season.

Planting

There are two systems used for strawberry culture: the matted row, used with June-bearing strawberries, and the hill system, used with everbearing or day neutral varieties.

In the matted row system, space the plants 2 feet apart in rows 4 feet apart. These plants are allowed to produce runners to fill in the row. Leave a pathway 1 1/2 feet wide between rows. Remove or relocate runners that root in this pathway or within 5 inches of an established runner.



Quick Facts

- Strawberries are classified as June bearing, everbearing or day neutral.
- They should receive full sun at least eight hours every day.
- They adapt to nearly all areas of Colorado, even high elevations.
- Strawberry beds generally are kept for three years.
- Having two people plant means less stooping.
- Remove the first blossoms to produce a stronger plant that will bear more fruit.
- Strawberries are remarkably free from most insects and diseases in Colorado.
- Leave the caps on the plant if the berries will be eaten or preserved right away.
- Protect strawberries over the winter, generally with a straw mulch applied about December 1.

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With the hill system, space plants 1 foot apart in three rows that also are 1 foot apart, with 3 feet between each set of three rows. Remove all runners as they develop.

Select certified plants over non-certified ones. They have been certified to be free from insects and diseases. Unpack plants and plant right away or heel them in a trench as a temporary location until they can be set out in the garden.

Transplant in the late afternoon to reduce wilting due to heat stress. Discard plants with dark roots or unhealthy looking roots. Remove flower buds, runners and damaged leaves before planting. The usual planting method is to drive a spade into the soil, push the handle away to open up the soil, fan out the roots of the plant, and place the plant in the opening so that the soil level is even with the crown. While the plant is held with one hand, remove the spade with the other. Allow the soil to fill in the hole and tamp it down gently. It is important to water each plant immediately after planting. This practice will help avoid transplant shock and water can be used to settle the soil in around the roots without compacting the soil by pushing on it. Much stooping can be avoided if two people are involved in this operation. Watering each plant individually at planting, rather than sprinkling the plants when finished, will help to avoid forcing wilted leaves into the soil.

Cultivation

After planting, keep weeds down by hoeing. If the planting is large enough, consider an herbicide such as Dacthal. Apply this compound according to label instructions.

Remove the first blossoms that form on a new planting at least once on the hill system and twice on the matted row system. This diverts the resources of the plant into producing a strong plant and, in the case of the matted row system, more runners. Stronger plants bear more fruit than those allowed to fruit early. Later in the season, there will be some fruit to enjoy on the everbearers or day neutral varieties.

About July 1, fertilize the crop with 1 pound of nitrogen per 1,000 square feet. This may be obtained from 5 pounds of a 21-0-0 formulation. If the fertilizer is broadcast, drag the foliage with a sack to dislodge the fertilizer and then water. Repeat this process again in September.

Nitrogen applied before fruiting results in soft fruit and is not recommended.

Generally, keep a strawberry bed for three years. Remove it as soon as it ceases to bear in the fall, or leave it until spring. If the matted row system is used and the plants are still insect and disease free, plant a new bed in late August by carefully removing good, healthy, rooted runners and using them for planting the new bed. If the hill system is used where no runners are permitted, or if the plants are not healthy, order new plants in time for planting a bed in the spring, preferably in a different location.

Keep the soil damp until the first fall frost, then withhold water to help harden off the plants for winter. A final November watering helps prevent winter-kill from drying out the root system.

Insects and Disease

Strawberries are remarkably free from most insects and diseases in Colorado. Occasionally, an insect problem arises, such as crownborers, leafhoppers, aphids, earwigs, slugs or tarnished plant bugs. Malathion is a good standard home insecticide to control aphids, leafhoppers and quite a few other sucking and chewing insects. Use Sevin to control earwigs and beetles. Control crownborers with a soil-applied insecticide. Control slugs with commercially prepared baits available at most garden centers. Do not spray plants when in flower—pollinating insects may be harmed.

Disease problems occur less frequently than insect problems. Usually, the disease is controlled by removing the diseased plant or plant part. However, if it is widespread, other measures must be taken. In the case of systemic diseases, such as yellows (virus) or red stele (vascular), nothing can be done except to remove diseased plants. However, if a fungus develops on the foliage, spray the plants with a fungicide, such as Captan. Bacterial diseases on strawberries are not important in Colorado.

For more information, see fact sheet 2.931, [*Strawberry Diseases*](#).

Harvesting

Pick strawberries every other day during the peak of the season. It is poor practice to let fruit rot on the vine, so pick even the rotted fruit. If berries are eaten or

preserved immediately, harvest only red-ripe fruit and leave the caps on the plant. If the fruit will not be used for a few days, harvest the berries, caps and all, while still pink.

Mulching

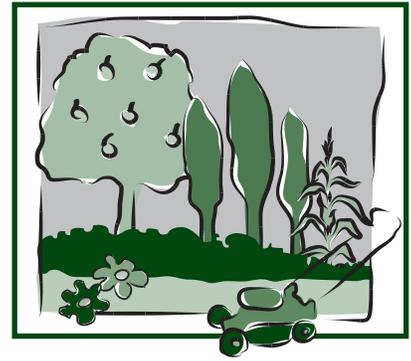
Protect strawberries over the winter, generally with a straw mulch applied about December 1. By then, cold weather has inhibited growth and the soil is cold. Distribute the mulch over the plants to a depth of 1 to 2 inches. Hold it in place with weighted boards or piles of soil. This mulch prevents the plant from losing moisture to drying winter winds. It also prevents root damage caused by alternate freezing and thawing of the ground.

Leave the mulch on as long as possible to restrain plant growth in the spring. Early spring growth produces early flowers subject to damage by adverse weather. Therefore, check the plants under the mulch in March for new growth. When growth begins, part the mulch to allow sunlight to reach the foliage. As the plants continue to grow, gradually remove the mulch, leaving as much as possible as a soil mulch to keep the fruit off the ground. Rake the mulch back over the plants to protect them in case of a late spring frost. Remove soon after the frost danger is over.

Strawberry Diseases

Fact Sheet No. 2.931

Gardening Series | Diseases



by C.E. Swift*

Many diseases attack strawberries. Disease-causing organisms may be on plants when they are purchased or in the soil where plants are set. Disease spores also may be carried into strawberry fields by wind, birds, insects, on a workers boots or shoes, and farm implements.

In most areas, losses may be reduced by:

- using proper cultural methods to include crop rotation,
- selecting varieties adapted for the area,
- selecting disease resistant varieties, and
- planting disease-free plants.

For more information on site selection, soil preparation, planting and cultural methods, see fact sheet 7.000, *Strawberries for the Home Garden*.

Prevent Stress

Strawberry plants are most susceptible to disease-causing organisms when stressed. Stress results from planting in clay or high salt soil, incorrect planting depth, too much or too little water, too much shade, winter drying and frost heaving.

Mulching may prevent winter damage and frost heaving. Mulch after the ground freezes (approximately December 1) to reduce excessive dehydration, soil temperature fluctuations, and winter damage and frost heaving. Frost heaving tears roots and severely damages the crown. Plants damaged but not killed by frost heaving are more susceptible to diseases the following growing season.

Red Stele Root Rot

Identification

Red stele, caused by *Phytophthora fragariae* var. *fragariae*, is a serious disease of strawberries in the United States. This fungal-like organism attacks plants during

late winter and spring. It is most destructive in heavy clay soils saturated with water.

Infected plants appear stunted and lose their shiny green luster. The plant's younger leaves often have a metallic, bluish-green cast. Older leaves turn prematurely yellow or red. Diseased plants wilt in dry weather and often die before the fruit starts to ripen.

Because pathogen spread is favored by water, red stele may be fairly well distributed throughout an entire strawberry patch during a cool, wet spring. Normally, however, this disease is prevalent only in the poorly drained areas of a field or patch. A well-prepared soil that drains quickly has less problems with the disease. Strawberries grown in raised beds typically have less problems with this disease as long as the soil is well-drained.

Red stele usually does not appear in a new planting until spring of the first bearing year. It is most evident from full bloom to harvest when plants are stressed due to fruit production. Some symptoms, however, may appear in late fall of the first growing season.

To identify the disease, examine the center of the root stele region. In a normal root, both the center (stele) and the part surrounding the stele are yellowish-white. In a plant infected with red stele disease, the stele is a distinctive rusty-red to dark brown. This discoloration may show only near the dead tip, or it may extend the length of the root. This condition is most evident in the spring before fruiting. Later in the season, this discoloration may be less evident as decaying roots are replaced by new roots.

Control

Planting resistant varieties (Table 1) is an effective means of control. Resistance to red stele disease is, however, a relative term. There are at least seven distinct biological races of the causal fungus and not all varieties of strawberries are resistant to all races. No chemical or cultural treatment ensures a normal crop in an infected planting.

Quick Facts

- Winter damage and poor cultural management predispose strawberry plants to diseases.
- Red stele, black root rot, powdery mildew, botrytis fruit rot, leaf spot, and leaf scorch are the most important strawberry diseases in Colorado.
- Strawberry plants are most susceptible to disease-causing organisms when subjected to stress.
- The best way to prevent strawberry diseases is to use disease-resistant, disease-free certified plants, proper soil preparation, a rotation period of three to five years when strawberry plants are not grown in the area, and proper irrigation.



Table 1. Red stele resistant cultivars.

June-bearing	
Allstar	Pathfinder
Darrow	Redchief
Delite	Sparkle
Earliglow	Stelemaster
Guardian	Sunrise
Joliette	Surecrop
Midway	
Day neutral	
Tribute	Tristar

Upon receiving plants, carefully look roots over to see if any have the rattail appearance that may indicate red stele. Cut open any suspicious roots to see if red stele symptoms are present. Do not plant infected stock.

Select a planting site that has good to excellent soil drainage, no history of red stele, and is located where water from nearby land will not drain through it. Avoid low, wet spots and heavy clay soils. Thoroughly clean soil and plant debris from cultivation equipment before use, especially if borrowing tools.

Soil fumigation is feasible on commercial plantings and may be helpful in situations where resistant varieties are not available or not adapted. Contact a commercial pesticide applicator if fumigation is necessary. In home gardens, chemical soil fumigation is not recommended due to the extreme toxicity of these products. For traditional and organic control options see Table 2.

Black Root Rot

Identification

This problem is caused by a complex of soil-inhabiting pathogens, nematodes, drought, winter injury, excessive application of fertilizer, and excessive soil moisture. Symptoms are most often noted in the spring. These include wilted plants, brown and/or distorted leaves, and black roots. Purple leaves with red petioles also have been associated with this problem.

When infected plants are dug up at the time of fruit-coloring, fine lateral roots will be missing or dead and irregular black patches may be visible on the fleshy white roots. On severely diseased plants these black patches grow together and no fleshy white roots will be visible. The interior (stele) of infected roots will be black.

Control

Proper soil preparation to improve organic matter content and drainage, combined with correct fertilization and watering practices, and steps to avoid soil compaction, are necessary to prevent black root rot. Make sure the strawberry bed is moist going into winter. To prevent frost heaving and root damage, mulch after the ground has frozen to a depth of several inches. Mulch applied during the summer helps prevent drought and excessive soil temperature, both associated with plant stress and black root rot.

Leaf Spot

Identification

Leaf spot is caused by the fungus *Mycosphaerella fragariae*. Also referred to as Ramularia leaf spot, "rust," bird's eye spot, "gray spotness," and white spot, this disease organism can be carried into the field on new plants, from nearby fields by birds or insects, by farm implements, or on hands and clothing of workers.

The fungus overwinters in purple spots on infected plants. These spots on the upper leaf surface produce spores, which start the disease cycle in the spring. Splashing rain helps scatter spores about the field. Damp, humid weather favors spore germination and the development of leaf spot disease.

Centers of spots initially are purple and later become tan or gray, then almost white. Older spots usually are white with a light purple border. Similar spots may appear on leaf stems, fruit stalks, runners and caps. Occasionally, dark spots surrounded by discolored areas about 1/4 inch in size appear on green fruit. This phase of the disease is called "black seed." The loss of foliage due to this pathogen can stunt the entire plant. Severely infected plants may die. Temperature affects symptom expression. Warm, humid weather results in spots being rusty brown without the reddish purple borders or light colored centers.

Control

Mowing the strawberry bed after the plants have finished fruiting will remove old infected leaves and reduce infectious material. Fertilizing after mowing helps stimulate growth making the plants healthier and less susceptible to many diseases.

The use of resistant varieties is the most practical and effective means to control leaf spot disease. Several strains of the fungus are known. Each affects varieties differently. Varieties that have demonstrated resistance are included in Table 3. Avoid overhead irrigation unless watering between 10 p.m. and 6 a.m. For control options see Table 2.

Fruit Rot and Blossom Blight

Identification

The most serious fruit rot and blossom blight found in Colorado is botrytis (gray mold), caused by the fungus *Botrytis cinerea*. Infection usually begins on berries touching the soil. However, infection may start in that part of a berry that touches another decayed berry or dead leaf. Gray mold often starts on blossoms and green fruit injured by frost. Sometimes the disease affects flower stalks enough to prevent the development of fruit.

Control

The proper spacing of plants and correct timing of fertilizer applications are the most important preventive measures. Disease is more severe when fertilizer is applied in the spring, when the matted row system is used (e.g. all daughter plants are allowed to take root), or when rows are kept narrow. These cultural practices result in dense, lush foliage that prevents rapid drying of fruit after rains or irrigating. Water on the foliage then results in suitable conditions for development of rot.

A clean straw mulch aids in producing cleaner berries and reduces fruit rot by keeping berries off the ground. Remove overripe or infected berries to help reduce this disease problem. See Table 2 for chemical controls.

Powdery Mildew

Identification

Powdery mildew, caused by the fungus *Sphaerotheca macularis* f.sp. *fragariae*, results in the rolling of infected leaves in late summer and fall, purplish or reddish blotches on leaves and sometimes a powdery growth. Pepper-like black specks appear on the underside of infected leaves in the fall. Infected flowers and fruit will be covered with a fine white fungal growth.

Control

Mowing as suggested above to remove infected tissue, applying protective systemic fungicides as soon as flowering begins, and planting resistant cultivars is recommended. Use resistant cultivars - see Table 3. Table 2 lists synthetic and organic pesticides for control of this disease.

Leaf Scorch

Identification

Symptoms caused by this fungus (*Diplocarpon earlianum*) include numerous, small, irregular shaped purple spots on leaves. The spots, unlike leaf spot (*M. fragariae*), are purple throughout (no light centers) and have no well-defined border. Blotches may grow together until the entire leaflet appears purplish or reddish brown.

Control

Watering at the wrong time of day results in tissue that is wet for too long a period and increases the likelihood of this and other disease problems becoming serious. This disease is more problematic when the leaf tissue is wet for 12 hours or longer. Other disease control strategies are similar to those given for leaf spot. Use resistant cultivars (see Table 3).

References

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Table 2. Organic and conventional pesticides for the control of strawberry diseases.¹

Disease	Fungicide	Application Rate and Instructions ²
Black root rot complex	Vapam, Telon C-17, Basimid G and Paladin	Must be applied pre-plant by a licensed commercial applicator. These are restricted use products.
Red Stele - <i>Phytophthora fragariae</i>	Aliette WDG (Aluminum tris)	Preplant dip – 2.5 lbs/100 gallons of water Foliar application – 2.5 to 5 lbs/acre. Begin application when plants start active growth. Make additional applications on a 30-60 day interval. PHI & REI = 12 hours.
Phytophthora, Fusarium, Verticillium and other Root Rot Diseases	Actinovate AG <i>Streptomyces lydicus</i>	Soil Drench – 3 – 12 oz. / acre Approved for organic production. PHI = 0 REI = 1 hour
Leaf Spot and fruit rot	Captan 50 WP	Follow label directions for application rate. Begin applications when growth starts in spring and before fruit starts to form. Repeat at 7-14 day intervals. PHI = up to day of harvest; REI = 24 hours.
Foliar diseases	Actinovate AG <i>Streptomyces lydicus</i>	Foliar Spray: Suppresses/controls many foliar diseases. 3 – 12 ounces per acre in 20 to 200 gallons water at 7 to 14 day interval. Organic production approved. PHI = 0; REI = 1 hour
Leaf spot	Copper compounds	Apply at prebloom and postharvest. Follow label directions.
Botrytis (Gray Mold)	Elevate 50WDG (Fenhexamid)	1.5 lbs/acre. Begin applications at early bloom period prior to disease establishment. No later than 10% bloom; Every 7 to 14 days. PHI = 0; REI = 12 hours.
Fruit rot, leaf scorch, leaf blight, powdery mildew	Topsin M 70WP (Thiophanate-methyl)	0.75 – 1 lb/acre. Begin applications at early bloom and repeat at 7 – 10 day intervals as needed. PHI = 1 day; REI = 12 hours.
Fruit rot and powdery mildew: also effective on Botrytis and many insects	JMS Stylet-oil	3 quarts/100 gallons of water. Spray weekly or once every two weeks depending on level of disease pressure. PHI = 0; REI = 4 hours. Organic Production Approved. PHI = 0; REI = 4 hours.
Powdery mildew and leaf spot	Nova 40W & Rally 40W (Myclobutanil)	2.5 – 5 oz/acre. Begin applications when disease first appears or when conditions favor disease. Repeat at 14 – 21 day intervals. PHI = 0; REI = 24 hours.
Botrytis Fruit Rot, and Powdery Mildew	Potassium bicarbonate - Sold under various brand names to include Kaligreen	2 ½ to 3 pounds per acre at first sign of disease. PHI = 1 day; REI = until product is dry.

¹Follow label directions and observe all restrictions and precautions on pesticide labels. Store all pesticides behind locked doors in original containers with labels intact. Use pesticides at correct dosage and intervals to avoid excessive residues and injury to the environment. Refer to [Fact Sheet 7.615](#) for mixing small quantities of pesticides.

²PHI = the minimum amount of time between the last fungicide application and fruit harvest
REI = restricted-entry interval. Do not enter or allow workers entry into treated areas during this period following fungicide application

Table 3. Strawberry cultivars and their susceptibility to diseases.

Cultivar	Leaf Spot	Leaf Scorch	Red Stele	Powdery Mildew
Allstar	T	T	R	T
Annapolis	VS	U	T - R	VS
Atlas	R	U	U	U
Blomidon	U	U	S	U
Cavendish	R	R	R	S to T
Earlignow	R	R	R	S to I
Guardian	S to I	R	R	S
Honeoye	S to T	T	S	I
Jewel	R	R	S	T
Kent	S	I	S	S
Lateglow	R	R	R	S
Lester	U	R	R	R
Midway	VS	S	R	T
Pathfinder	U	U	R	U
Raritan	S	S	S	S
Redchief	S	R	R	R
Sable	U	U	R	U
Scott	S to T	R	R	R
Sparkle	S	S	R	S
Stelemaster	U	U	R	VS
Surecrop	I to R	I	R	U
Tennessee Beauty	R	R to S	S	S
Tribute (day neutral)	T	T	R	R
Tristar	T	T	R	R

T = tolerant, R = resistant, I = intermediate, S = susceptible, VS = very susceptible, U = unknown

Other Diseases

Other diseases infrequently seen include *Verticillium*, *Armillaria* scorch, and tip burn.

If you are unsure of the problem, take diseased plants to your Colorado State University Extension county office for diagnosis and control recommendations. Dig up the complete plant so the roots can be examined along with the foliage, blossoms, and any fruit that is on the plant.

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. CSU Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

Raspberries for the Home Garden

Fact Sheet 7.001

Gardening Series | Fruits & Vegetables

By J. Reich, H. Hughes and J.E. Ells* (4/20)

Selected varieties of red and yellow raspberries (*Rubus idaeus*) may be successfully grown in Colorado. Native raspberries can grow to 10,000' elevation. Colorado's climate is not especially favorable for bramble fruit production, and only red and yellow raspberries are recommended for cultivation statewide. Several varieties of blackberries can be grown in the lower-elevation areas of the state. New hardy varieties of black raspberries including Niwot and Pequot can work in some areas of Colorado. Purple raspberries (see variety table), boysenberries, loganberries and dewberries require special winter protection and are not recommended for Colorado.

Types

There are two growth-types of raspberries: "summer-bearing" (floricane or "June bearing") and fall-bearing (Primocane or ever-bearing"). Summer-bearing varieties produce flowers and fruit once per season on second-year canes. This means that a given cane will grow vegetatively in its first year, followed by fruiting on that cane in its second year. Fall-

bearing raspberries flower and fruit along the upper portions of canes that are in their first year of growth. These canes may overwinter and produce a light summer crop on their lower portions, followed by a second crop on the tips of the current season's growth in the fall (up until freezing temperatures).

Varieties

Based on Colorado State University tests, with a few exceptions, fall-bearing types seem best adapted to the Front Range. Both fall-bearing and summer-bearing varieties do well on the Western Slope. Hardy varieties with mid-season production should be chosen for short-season, high elevation areas. Growing a variety of types may ensure a better crop. (See the variety chart for recommended varieties for Colorado).

Soil Preparation

Red raspberries grow in most garden soils if they have ample organic matter and adequate drainage. For summer-bearing raspberries in good garden soil, apply only a maintenance amount of fertilizer of a nitrogen fertilizer in



Quick Facts

- Of all bramble fruits, only red and yellow raspberries are recommended for general cultivation in Colorado. There are now a few hardy varieties of black raspberries.
- Blackberries are considered marginal, due to inadequate hardiness, but some varieties can be successful.
- Red raspberries grow well in most garden soils that are amply supplied with organic matter and adequately drained.
- Bramble plants are perennials, but their canes are either annual or biennial structures.
- Plant only true-to-name, disease-free stock from reputable sources.
- Twenty-five feet of row should produce 15 to 20 pounds of raspberries per year.

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Raspberry Variety Chart for Recommended Varieties for Colorado

Summer Bearing Red Raspberries (Floricanes) ²	Description
Boyne ¹	Fruits early; very hardy; short plants with good yield and flavor
Killarney	Fruits early- mid-season; hardy; productive, long canes need to be trellised. Good flavor.
Nova ¹	Fruits mid-season; has few thorns: good, slightly tart flavor
Canby	Fruits mid-season; has few thorns; ranks high in taste tests; does better in warm long-season areas of western Colorado.
Fall Bearing Red Raspberries (Primocane) ^{1,2}	
Jaclyn	Fruits early; often wins taste tests; lower yield
Polana	Fruits early; good flavor; short plants
Autumn Britten	Fruits early-mid season; produces fewer canes so plant more closely
Caroline	Fruits early- mid season; good yield; large firm fruit with tart but good flavor
Heritage	Old standard; often found growing in mountain towns; fruits mid-late season (can get a lower yield due to lateness of ripening); long-lived, shorter plants may not require support; good flavor.
Plainsman ³	Recommended for high elevations; shorter, upright canes; good flavor
Anne	Yellow fruit (mutation of red); mid- late season (ripens later than Heritage)
Fall Gold	Yellow fruit; very hardy plants; good flavor
Black Raspberries	
Niwot ⁵	Produces both primocane and floricanes crops; good yield- fruits earlier and longer than Jewel; vigorous plants require wider spacing and trellis; hardy to at least Zone 5
Pequot	Very hardy (Zone 3); early-mid season; fruits once per season; well-balanced flavor
Jewel	Standard very hardy purple variety; mid-season; produces only a primocane crop
Purple Raspberries ⁴	
Royalty	Hardy purple raspberry; fruits late-season; pick when red (firm and tart) or purple (softer and sweeter); large plants (space accordingly). Self-pollinating.
Blackberries	
Chester	Thornless; good yields of large tasty fruit; does well in warm, long-season areas of western Colorado.

¹ Recommended for the Front Range of Colorado.

² Recommended for Western Slope

³ Recommended for high-elevation, short-season areas.

⁴ Cross between red and black raspberries.

⁵ Bred along the Front Range of Colorado. Being tested in different areas of the state and country.

spring. Some areas in CO may require phosphate fertilizer. A soil test is recommended to determine what other nutrients are needed. Use cane growth to determine if there has been enough N applied. The space between the buds (internode) optimally is 4". Less you need N, greater the plant is too vigorous so reduce or skip adding nitrogen. Soils over 7 pH may be low in zinc, iron and manganese. In general, fall bearing raspberries require 1.5-2 times more nitrogen than summer bearing. The chart refers to good soil, new bed or untested refers to the amount of organic matter. Soils with higher organic matter 5%, need little to no fertilizer. Test every 3 years. An application of organic matter will help to conserve water and reduces N need.

Apply enough water to maintain a moderate moisture level in the root zone. During flowering and fruiting, more water is required. Withhold water after the first frost to help harden off the plants. A late November watering reduces winter drying.

Planting Raspberries

Red and yellow raspberries are commercially propagated by rooted suckers. These can easily be purchased from a variety of online and mail-order sources. They are typically sold

as "handles." A handle consists of a 12-18 inch section of a dormant cane with a large root mass attached. Soak bare-root plants in a bucket of water 1 hour to help them get prepared for planting. Plant them in the spring, 2 to 3 feet apart in rows 5 to 10 feet apart, depending on the varieties growth characteristics, how much pathway space you desire and the width of any cultivating equipment that may be used. After planting, cut the tops to within 4 to 6 inches of the ground.

After one or two years, suckers fill in the row to form a hedge of canes. During dormant-season pruning, thin the resulting collection of canes so that you leave five to six of the strongest canes per linear foot. The hedge-row should not be more than 2 feet wide at ground level. An application of organic mulch will conserve water and decrease weed competition.

Trellising

Trellising is advisable for all bramble crops in Colorado. Without some type of support, canes will flop and sprawl in such a way as to make weed control and harvesting much more difficult (and prickly). Stretch a wire on



Figure 1: Raspberry trellis with dormant canes secured to wires.

Nitrogen Fertilizer	% Organic Matter	At planting	Spring	June	August	Notes
Summer Bearing	Good OM	NA	.3 lb N or 1/3 cup/100 ft	1/3 cup/100 ft		Maintenance amount
Summer Bearing	New bed/untested	1/3 cup/100 ft	1/3 cup/100 ft	1/3 cup/100 ft		100 ft of hedgerow
Fall Bearing	Good OM		2/3 cup/100 ft	2/3 cup/100 ft	2/3 cup/100 ft	Maintenance amount
Fall Bearing	New bed/untested	2/3 cup/100 ft			1 lb N/1000 sf	

NOTE: Liquid measuring cups are very close in estimating the weight of dry granular fertilizers. 1 cup=8oz.
This recommendation bases on 21-0-0 fertilizer

either side of the hedge row, 3 feet above the ground depending on the variety and trellis structure. These wires confine the canes to the hedge row. To make them stand erect, you may have to tie the canes to the wire with soft twine. See Figure 1. For larger fruit size, tip canes at a convenient height. For larger yield, do not tip canes.

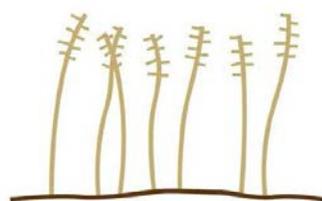
Pruning

For of summer- bearing varieties, remove the spent floricanes by cutting them off at the ground after they bear fruit. Dispose of these canes – they often harbor insects and disease. In the spring, remove the dead, weak and small canes. Remove winter- killed tips of the remaining canes. There are two methods to

prune fall-bearing varieties. The first, and easiest method is to mow or cut all the canes to ground level after the fall harvest and before spring growth. New canes will be produced in the spring. This eliminates the summer crop but also eliminates hardiness problems and cane borers and gives a larger harvest overall, unless an early frost occurs. The second is to remove the parts of the canes that fruited the previous year, which leaves the bottom portion of the cane to produce the following summer. New canes that grow from the crowns that spring will produce a fall crop at the tips. This method allows for two harvests, giving at least one harvest in short season areas. The disadvantage is that it will result in a reduced fall crop.

“Fall Bearing” Raspberries

Primocane Raspberries (set fruit on first-year canes)



Mid-Winter
(pre-pruning)



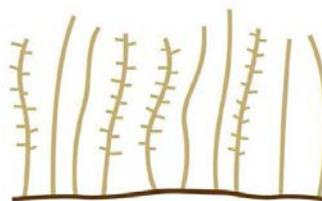
Late Winter
(after pruning)



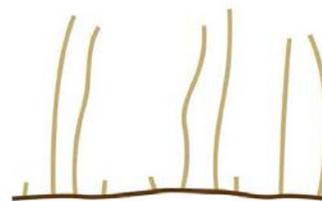
Spring

“Summer Bearing” Raspberries

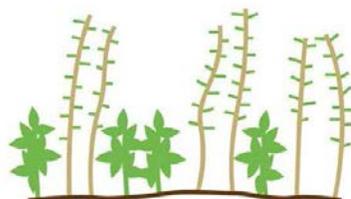
Florican Raspberry (set fruit on second-year canes)



Mid-Winter
(pre-pruning)



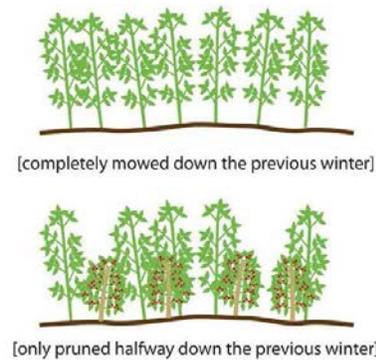
Late Winter
(after pruning)



Spring

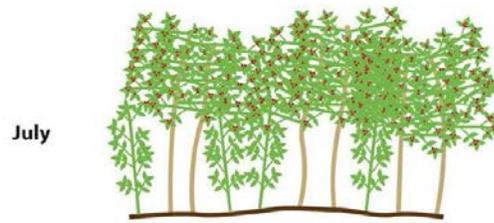
“Fall Bearing” Raspberries

Primocane Raspberries (set fruit on first-year canes)



“Summer Bearing” Raspberries

Florican Raspberries (set fruit on second-year canes)



Winter Protection

To obtain a crop of summer-bearing raspberries in many areas of Colorado, it will be necessary to protect the canes during the winter. This does not appear to be necessary for the varieties ‘Nova’ and ‘Boyne,’ as they appear to have adequate winter hardiness in all but the coldest locations. For all other summer-bearing varieties, follow these steps: After November 1, lay the canes down in one direction and hold them in place with a shovelful of soil on their tips or apply mulch. Plow or shovel a shallow furrow along each row and roll the soil over the canes. In early April, use a pitchfork to lift the canes out of the soil. Put the soil used to cover the canes back into the furrow.

The advantage of fall-bearing varieties is that winter covering is not needed -- the canes are mowed off after harvest. However, if a summer crop is desired from these canes, they must be protected as described for summer-bearing raspberries. In areas with a lack of snow cover, mulch can help prevent desiccation and insulate the plants.

Yield

By the third year, a 25-foot hedge row of red raspberries should yield 15 to 20 pounds of fruit per year under optimum conditions. After this, it is likely that productivity will decline gradually. After eight to 10 years, relocate the bed at least 50-75' away, where no brambles or solaneous plants have been in four years. Start with new certified disease free stock.

Disease and Insects

Raspberries can be affected by a wide range of diseases and insects, as are most cultivated plants. You can avoid most of these problems for several years by purchasing only quality, true-to-name, disease-free raspberry varieties. This typically means mail-ordering bare-root plants. These should be planted mid-April through early May.

It is not uncommon, during hot, dry weather, for raspberries along the Front Range to be infested with spider mites. The mites themselves are not always obvious, but their presence is indicated by tiny yellow spots on the leaves, which eventually turn bronze and/or brown. The most effective way to avoid mite

problems is to maintain healthy plants. This means applying a balanced fertilizer at least once a year, in May. Many plantings will benefit from additional fertilizer in June and July. In addition, make sure plants are adequately watered. Drought-stressed raspberry plants are a great place for spider mites to feed and breed. It is also important to prevent the planting from becoming too dense, as an overcrowded planting makes life easy for mites. This can be achieved most effectively by removing the thinnest, weakest canes, thereby allowing more light and air to reach the center of the planting. Regularly watering the foliage during hot weather will also help control mite populations.

Insecticides tend to be ineffective against mites, and their use often makes mite problems worse by killing a variety of beneficial, predatory arthropods. If a spray is desired, best results are often achieved with a “summer weight” (2%) application of horticultural oil.

Raspberry cane borers can be an important pest in Colorado. Symptoms of this pest include a sudden wilting and drooping of the tops of canes. The white larvae of the borer, if left uncontrolled, burrow downwards through the center of the cane and kill it.

Management in the garden is best achieved by removing the affected canes at the first sign of damage. Depending on location, mid-May through June is when these pests tend to do their damage. If caught early enough, while the larvae is still near the tip of the cane, the undamaged portion of the cane may be saved, allowing it to produce fruit.

[Spotted wing drosophila](#) is a newer insect coming to Colorado around 2013. It is different from other fruit flies in that its ovipositor is like a saw so it can penetrate good fruit and lay eggs. Refrigerate fresh picked berries, clean up dropped fruit and trap and monitor to control.

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CMG GardenNotes #233

Calculating Fertilizer Application Rates

Outline: Steps to calculating fertilizer application rate, page 1
 Fertilizer application rate table, page 3

Steps to Calculating Fertilizer Application Rate

Example is for a 40-foot by 100-foot lawn area, using a 20-10-0 fertilizer

1. Calculating size of area to be fertilized

$$\text{__ ft. long} \quad \times \quad \text{__ ft. wide} \quad = \quad \text{___ square feet}$$

Example:

$$\mathbf{40} \text{ feet} \quad \times \quad \mathbf{100} \text{ feet} \quad = \quad \mathbf{4000} \text{ square feet}$$

2. Calculating fertilizer application rate

$$\frac{\text{__ lb. nutrient per ___ sq. ft.}}{\text{__ \% nutrient in fertilizer}} \quad = \quad \text{__ pounds fertilizer / ___ sq. ft.}$$

Example:

$$\frac{\mathbf{1} \text{ lb. nutrient per } \mathbf{1000} \text{ sq. ft.}}{\mathbf{20\%} \text{ nutrient in fertilizer } \text{(.20)}} \quad = \quad \mathbf{5} \text{ pounds. fertilizer / } \mathbf{1000} \text{ sq. ft.}$$

3. Calculating pounds of fertilizer to apply

$$\begin{array}{r}
 \text{lawn or garden} \\
 \text{area}
 \end{array}
 \times
 \begin{array}{r}
 \text{application} \\
 \text{rate}
 \end{array}
 =
 \begin{array}{r}
 \text{pound of fertilizer} \\
 \text{per garden or lawn}
 \end{array}$$

$$\begin{array}{r}
 \text{___ sq. ft.} \\
 \text{-----} \\
 \text{garden or lawn}
 \end{array}
 \times
 \begin{array}{r}
 \text{___ pounds fertilizer} \\
 \text{-----} \\
 \text{___ sq. ft.}
 \end{array}
 =
 \begin{array}{r}
 \text{___ pounds fertilizer} \\
 \text{-----} \\
 \text{garden or lawn}
 \end{array}$$

Example:

$$\begin{array}{r}
 \text{4000 sq. ft.} \\
 \text{-----} \\
 \text{lawn}
 \end{array}
 \times
 \begin{array}{r}
 \text{5 pounds fertilizer} \\
 \text{-----} \\
 \text{1000 sq. ft.}
 \end{array}
 =
 \begin{array}{r}
 \text{20 pounds fertilizer} \\
 \text{-----} \\
 \text{lawn}
 \end{array}$$

Authors: David Whiting (CSU Extension, retired), Adrian Card (CSU Extension), and Carl Wilson (CSU Extension, retired)

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- o Colorado Master Gardener training is made possible, in part, by a grant from the *Colorado Garden Show, Inc.*
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Revised October 2014



Table 1. Fertilizer Application Rate Table

Because soil test recommendations for any given soil do not exactly match a fertilizer, select a fertilizer that gives comparative amounts of nitrogen, phosphorus and potassium as recommended by the soil test. In fertilizer application, it is most important to match the nitrogen requirement and compromise some for the phosphorus and potassium. The amount of fertilizer to apply that will give the recommended amount of nitrogen can be obtained from the following table:

Amount of Fertilizer to Apply Based on Actual Nitrogen Recommendations

Nitrogen Rate:		<u>0.1 pound nitrogen Per 100 square feet</u>	<u>0.2 pound nitrogen. per 100 square feet</u>	<u>1 pound nitrogen per 1,000 square feet</u>
<u>Fertilizer Grade</u>		pounds fertilizer to apply per 100 square feet	pounds fertilizer to apply per 100 square feet	pounds. fertilizer to apply per 1 000 square feet
45-0-0 (urea)		0.2	0.4	2.2
37-3-3		0.3	0.5	2.7
36-6-6		0.3	0.6	2.8
33-0-0		0.3	0.6	3.0
32-4-4	32-3-10	0.3	0.6	3.1
30-4-4	30-0-10	0.3	0.7	3.3
28-3-3	28-4-6	0.4	0.7	3.6
27-7-7	27-3-3	0.4	0.7	3.7
25-5-5	25-3-12	0.4	0.8	4.0
24-8-16	24-0-15	0.4	0.8	4.2
22-4-4	22-6-3	0.5	0.9	4.5
21-0-0	21-3-12	0.5	1.0	4.8
20-20-20	20-4-8	0.5	1.0	5.0
19-19-19	19-11-12	0.5	1.0	5.3
<u>18-6-12</u>	<u>18-3-6</u>	<u>0.6</u>	1.1	5.6
16-8-8	16-4-8	0.6	1.3	6.3
15-15-15	15-5-5	0.7	1.3	6.7
13-3-9	13-25-12	0.8	1.5	7.7
12-12-12	12-4-4	0.8	1.7	8.3
10-10-10	10-20-10	1.0	2.0	10.0
10-5-5	10-10-20	1.0	2.0	10.0
6-12-12	6-2-0	1.7	3.3	16.7
5-10-10	5-10-5	2.0	4.0	20.0

Example: If the N (nitrogen) recommendation is for 0.1 lb. N/100 sq. ft. and the fertilizer grade selected has a ratio of 18-6-12 (column 1), apply 0.6 lb. of this fertilizer per 100 sq. ft.

Note: 2 cups (1 pint) of dry fertilizer weighs about 1 pound.



Chokecherry in the Garden

Sky Wisner, Student, *Tiffany Maughan*, Research Associate,
and *Brent Black* Extension Fruit Specialist

Summary

Chokecherry (*Prunus virginiana*), also known as bitter-berry or wild cherry, is usually grown as a large shrub but can also be trained to be a small tree. It is native to North America and can be found growing wild in most counties of Utah. Fragrant cream-colored flowers bloom in the spring, and develop into small dark red to black fruit with relatively large pits. Chokecherries are not usually consumed raw; rather they are processed to make preserves, juices, wines, syrups, and jellies. Recently, chokecherry has gained popularity as a health food due to its high antioxidant levels. This tough plant can grow in most soil types and with minimal water. It is also very cold tolerant, making it an excellent choice for home fruit production in harsh climates.

Recommended Varieties

Although wild chokecherries are quite astringent, there are some cultivars that produce more palatable fruit and will do well in a home garden. ‘Boughen’s Chokeless’ (sometimes sold as ‘Boughen’s Sweet’) produces large, non-astringent fruit that have even been described as sweet. ‘Maskinonge’ is another non-astringent cultivar and produces high quality fruit. In addition, this bush does not heavily sucker. Both ‘Boughen’s Chokeless’ and ‘Maskinonge’ are typically grown as large shrubs and will grow to be about 6 to 8 feet wide and 8 to 12 feet tall. ‘Canada Red’ and ‘Shubert’ are widely popular purple-leaved ornamental cultivars, primarily grown as a small tree instead of a shrub. Both produce large black fruit.



How to Grow

Soil: Chokecherries occur naturally in a wide variety of soil types and pH levels. They grow well in soil ranging in pH from 5 to 8. This wide adaptability makes chokecherry an excellent choice for sites with poor soil where a fruit crop is still desired. However, well-drained soils with lots of organic matter, and sufficient irrigation water will help ensure larger, more abundant fruit.

Soil Preparation: Soil testing can help determine the appropriate amendments to add to the site before planting. Apply any deficient nutrients as indicated from soil tests, to the planting area and till into the soil.



Plants: Chokecherries are a woody, deciduous perennial. They grow in zones 2 to 10 and are found in all but 6 of the 50 states. They are grown either as a large erect shrub or a small tree. Size varies by cultivar, but most plants will not reach over 30 feet high and 10 to 20 feet wide when mature.

Chokecherry leaves are oval to somewhat oblong. They are glossy dark green on the top and lighter green on the bottom in early spring. Leaves of ‘Canada Red’ and ‘Schubert’ start out green in the spring and turn reddish purple as they mature. In general they do not have noteworthy fall color. The leaves have an alternate arrangement along slender reddish-brown stems and the stems have horizontal rows of raised air pores called lenticels. They have a deep rhizomatous root system that extends beyond the drip line of the tree. Due to this, chokecherry plants are prone to suckers, particularly if the roots are damaged. It is best to plant them in an area where suckering can be tolerated.

Depending on location, flowers open anytime from late April to July. The inflorescences are very fragrant and form in long, dense clusters or racemes of creamy-white flowers. These long clusters grow on the last year’s leafy twig growth and appear before the leaves are fully developed. Chokecherry fruits are drupes, having a fleshy outside with a stone center that contains the seed. It takes 10 weeks for fruit to fully mature, which depending on location and elevation, is usually from July to September. Most plants will not begin fruiting heavily until their 3rd or 4th year.

Planting and Spacing: Plant in the spring or fall to allow time for root establishment before summer

heat. Spacing will depend on cultivar, but as a general guideline, chokecherry plants should be spaced 5 to 8 feet apart. A gentle east or northeast slope helps reduce frost risk as slopes allow for cold air drainage. If planting multiple plants, run aisles north and south to help equalize light distribution and reduce wind. Before planting, prepare a hole twice the width and the same depth as the container or roughly the same depth and somewhat wider than the roots of the bare-root plant. Immediately after planting, water heavily to settle the soil around the roots and to remove air pockets. Applying mulch around the plant will help keep the soil moist between watering and keep weeds down.

Irrigation: During the first season, irrigate at an interval that will keep the soil moist, but not wet. Depending on rainfall and temperature, irrigate about two times per week to ensure establishment. For the next few years, maintain a bi-weekly watering program that will apply about 30 inches of water over the season. This can be reduced if there is significant rainfall accumulation. Although chokecherry plants are extremely drought tolerant, irrigation will improve yield and fruit quality. To keep the canopy dry and prevent disease occurrence, water at the base of the shrub. This may be accomplished with a drip system or deep watering with a hose.

Fertilization: Currently there are no specific recommendations of fertilizer application for chokecherry production. However, having the soil tested to determine current nutrient levels is helpful for making fertilization decisions. Applying a general, balanced fertilizer each spring (such as 4 ounces of 16-16-16 per plant) should meet most chokecherry nutrient needs. Adjustments in fertilizer application should be determined by plant growth, harvest and leaf color.

Pruning: Chokecherry can be trained as either a tree or a shrub. Regular pruning prevents chokecherry plants from becoming brushy and unproductive. Pruning should be carried out in late winter or early spring, prior to bud break. When training as a tree, the center of the plant should be thinned to keep it open for air circulation and light penetration, similar to other stone fruits such as peach or cherry. When trained as a shrub, renewal pruning, removing about one third of the old growth, will ensure adequate 1-year old wood for

continuous production. In either case, low spreading branches should also be removed. Plants should be maintained at about 6 to 10 feet in height to facilitate easy harvest. Since fruit forms on young wood, remove older, weaker wood annually.



'Canada Red' chokecherry, trained as a tree (left). Chokecherry trained as a shrub (right).

Problems

Pests and Diseases:

Pest /Disease	Identification	Control
Prairie Tent Caterpillar, Eastern Tent Caterpillar	Mass of webbing on branches. ½ inch light green caterpillars. Defoliation / deformation.	Destroy tents on cool days with larva inside. Foliar insecticides or BT application.
Aphids	Black or green soft bodied insects feeding on underside of leaf.	Insecticidal soap, horticultural oil, malathion.
Chokecherry Gall Midge	Bright orange larvae feed in infested fruit. Fruit will enlarge and seed aborts.	No registered insecticide for this pest. Remove and destroy damaged fruit in early summer.
Black Knot Fungus (<i>Dibotryon morbosum</i>)	Long, black swellings on tips of branches.	Prune out and burn infected branches. Fungicide.
Bacterial Spot (<i>Xanthomonas prunii</i>)	Leaves with red to purple spots that eventually become small holes. Fruit also develop brown spots.	Sanitation, avoid over-fertilizing with nitrogen.
Canker Fungus (<i>Valsa cincta</i>)	Sunken cankers on branches and trunk that lead to girdling.	Remove and burn infected branches. Fungicide, remove plant.

Toxicity: Wildlife also consume the fruit and help spread the seeds. However, the leaves, stems and pits of chokecherry are toxic. Poisoning generally occurs if an animal consumes over 0.25 percent of its bodyweight in less than an hour. Non-lethal

exposure usually results in a stomach ache. Wilted or stressed leaves are more dangerous due to higher cyanide levels. The fleshy part of the fruit is not toxic. Separate out the pits during processing to avoid contaminating the fruit flesh with the toxin.

Harvesting, Storage and Use

For best results, harvest chokecherries once fruit are fully ripe. Typically, this is when they have turned dark purple, black or dark red. Fruit can be dried, used in jams, jellies and syrups or to make wine.

Yield Potential

The chokecherry has a relatively long lifespan of 20 to 40 years. After a plant has established, some varieties can produce up to 30 to 40 pounds of fruit per plant per year.

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Serviceberry in the Garden

Kristan Crouch, Student, *Tiffany Maughan*, Research Associate, and *Brent Black*, Extension Fruit Specialist

Summary

Serviceberry (*Amelanchier* spp.), also known as juneberry, saskatoon or shadbush, is considered a large shrub that can be grown as a small tree. It is native to North America, and is adapted to many areas of Utah. White flowers appear in early spring, with yellow to red foliage in the fall. The fruit is a berry-like pome, and resemble small blueberries. When ripe, they are dark red, purple or almost black in color. They are primarily harvested for juice, jellies, jams and pies, but can also be eaten fresh. Serviceberries are cold hardy to zone 3, adapt to a range of soil types and may have desirable ornamental qualities.

Recommended Varieties

Amelanchier alnifolia var *pumila* is a naturally occurring dwarf variety that is native to the western United States. It will often stay quite small, only about 3 feet high and wide, and produces small round berries. There are several cultivars that have been selected for fruit production and will do well in the home garden (Table 1). Serviceberry availability at local nurseries can be limited, but many online companies carry serviceberry plants. Care should be taken to only order from reputable nursery companies. Another option is to propagate serviceberries on your own. One of the easiest and most effective methods of propagation is by digging up suckers from a healthy established plant and transplanting them to the desired location. This should be done in the spring before bud break, and



the shoots should be pruned back to about 2 inches. Serviceberries seeds will not grow true to parentage, and hardwood and softwood cuttings have only limited success.

How to Grow

Soil: Serviceberry is tolerant of a variety of soil types and pH levels, but prefers well-drained sandy loams and loams. However, it will also do well in silt loam as long as adequate drainage is provided. Clay soil can cause root rot problems, so till organic mulch into the soil before planting and consider

Table 1. Recommended serviceberry cultivars.		
Cultivar	Size at maturity	Comments
'Honeywood'	12' x 9'	Very productive, clusters of medium-large fruit. Minimal suckering. Ripens mid-season.
'Northline'	10' x 6'	Heavy producer, medium sized berries with excellent flavor and few seeds. Can produce many suckers. Ripens early to mid-season.
'Pembina'	12' x 8'	Productive with smaller, very flavorful fruit. Low sucker production but vigorous plant.
'Thiessen'	15' x 12'	.Very high yielding with large fruit. Ripens late-season.
'Regent'	6' x 6'	Smallest of the recommended varieties, little suckering. Small, mild-flavored fruit.
'Martin'	13' x 9'	High-yielding, large fruit. Ripens late-season.
'Parkhill'	12' x 8'	Well-suited for home growers or you-pick operations because the fruit ripen over a long period. Ripens mid-season. High-yielding

raised beds to avoid these issues. Sandy soils need to be properly irrigated to maintain moisture and nutrient uptake.

Soil Preparation: Soil testing can help determine the appropriate amendments to add to the site before planting. Apply any deficient nutrients, as indicated from testing results, to the planting area and till into the soil.

Plants: Serviceberry shrubs range in size from 6 feet tall and wide to 30 feet tall by 20 feet wide, depending on the cultivar. It is important to choose the appropriate cultivar to fit the planting site and the desired fruiting requirements. Serviceberry is self-fruitful and bloom typically occurs between early and late May, depending upon the location

and weather. Flowers will appear before or at the same time as leaves. Full sun is required for maximum harvest potential. Serviceberry plants are adaptable to partial shade, but will suffer from reduced yields.

Planting and Spacing: Planting in the spring or fall is ideal for serviceberry, as it allows root systems to establish before summer heat becomes an issue. For most online nursery companies, bare-root plants are more commonly available than containerized plants. Both will establish well, but bare-root plants will need more frequent irrigation for the first 2 weeks. Before planting, prepare a hole twice the width and the same depth as the container or roughly the same depth and somewhat wider than the roots of the bare-root plant. Immediately after planting, water heavily to settle the soil around the roots and to remove air pockets. Applying mulch around the plant will help keep the soil moist between watering and keep weeds down. Spacing should be based on the cultivar and should leave sufficient room between shrubs to allow sunlight to penetrate the canopies when full growth has been achieved.

Irrigation: During the first season, irrigate at an interval that will keep the soil moist, but not wet. Depending on rainfall and temperature, irrigate about two times per week. For the next few years, maintain a bi-weekly watering program that will apply about 30 inches of water over the season. This can be reduced if there is significant rainfall accumulation. Although established serviceberry plants can survive with little water, to achieve maximum yield and more desirable fruit, irrigation is needed. Additional irrigation may be necessary when hot, dry conditions are prevalent. It is best to water at the base of the shrub, in order to keep the canopy dry and reduce the chance of disease. This may be accomplished with a drip system or deep watering with a hose. It is also advisable to maintain a mulch bed around the base of the shrub instead of sod, as sod has very different watering requirements that conflict with that of serviceberry.

Fertilizer: Applying 4 ounces of an all-purpose fertilizer, such as 16-16-16, in the spring as the plant comes out of dormancy, should supply sufficient nutrients for the growing season and will maximize growth. If phosphorus and potassium are

shown to be readily available in a soil test, a nitrogen only fertilizer can be applied instead. Adjustments to a fertilizer program should be determined by plant growth, harvest yield and leaf color.

Pruning: Pruning is needed to maintain an open canopy, which allows for sufficient light penetration and air movement. The best time to prune is in the late winter or early spring, before new growth appears. Pruning also helps rejuvenate the shrub and promotes higher fruit yields. For the first 3 years, only prune out weak or damaged branches. After 3 years, when the plant is in production, pruning should become more vigorous to encourage new growth and to keep the plant size manageable. Flowers develop on stems that are 2 to 4 years old, and this should be kept in mind while pruning. Removing about one third of old growth from the shrub yearly will help maintain enough young fruiting wood for good fruit production. Similar to apple, serviceberry plants are prone to biennial bearing. This is when a large crop one year is followed by a very small crop load. If careful crop load management is practiced this effect can be minimized.

Problems

Pests and Diseases: Birds are probably the worst threat to serviceberry crops, as they seem to enjoy the fruit even more than we do. One of the most effective control options is to drape the branches with bird netting in order to protect ripening fruit. Aphids, spider mites and bark beetles can also be a problem. Dormant oil applied in the spring, just before bud break, can help control overwintering pests. Frequent scouting throughout the year should be done to monitor pest occurrence.

Entomosporium leaf and berry spot is one of the most common diseases of serviceberry plants. Symptoms include small, angular brown discolorations on the leaves, often with a yellow ring around the spot. Utah's low humidity helps keep disease occurrence low, but in rainy years or if over-watered, it can still be a problem. Keeping an open canopy through proper pruning, removing leaf litter in the fall and avoiding irrigation techniques that would wet the leaves will help control for *Entomosporium* leaf and berry spot. Infected fruit will have gray spots and will be disfigured. Prune

out diseased wood 12 inches below the infected section and sterilize the shears between each cut. Maintain an open canopy to aid in preventing disease occurrence. Saskatoon-Juniper rust can be another problem for serviceberry production. Yellow spots and swellings first develop on leaves and fruit, followed by characteristic yellow, spiky outgrowths from these locations. As the name implies, the life cycle of the rust includes stages on juniper plants. To avoid the disease, it is best to avoid planting serviceberry next to juniper plants. One chemical control option is a broad-spectrum fungicide (ex. Funginex 190 EC). Powdery mildew will also infect serviceberry shrubs. Look for a white dust on the leaves and stems. Early detection and pruning out of diseased shoots as well as planting resistant cultivars are the best control options.

USU Extension provides guidelines for home orchard pest management, as well as weekly fruit tree pest advisories that can be helpful in disease and pest identification and management and are available at your county agent's office or at <http://utahpests.usu.edu/ipm/htm/subscriptions>.

Weeds: Keeping weeds clear from around the serviceberry plant is important for achieving maximum yields. Applying a mulch around the base of the shrub can help keep weeds to a minimum. Another option is shallow cultivation to kill weeds, but care should be taken not to till deeper than a few inches in order to avoid damaging the serviceberry roots.

Harvesting, Storage and Use

The berry-like pomes usually ripen in late June through July. It is best to wait until two-thirds of the fruit is ripe before harvesting. Serviceberries continue to ripen after harvesting and should be refrigerated quickly to avoid spoilage. Early pickings that are somewhat less ripe are higher in acid and the more mature fruit have a higher sugar content. If using the fruit for jellies, jams and pie fillings, wait until fully ripe to ensure peak flavor and sweetness. However, the fruit is softer at this stage and can be damaged easily during harvest. It is best to pick by hand early in the morning, when the fruit is dry and cool. Remove damaged or diseased fruit and wash to clean. Fruit should be dry before refrigerating or freezing.

Productivity

Newly planted serviceberry shrubs will not produce heavily for the first 2 years. They will usually begin to bear fruit when 3 to 5 years old and reach full production at 8 years. Once established, some of the highest yielding cultivars will produce 10 pounds per plant. A well-maintained plant can produce fruit for 20 years.

Nutrition

Serviceberry fruit are high in fiber, iron, calcium, magnesium and manganese.

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GOLDEN CURRANT

Ribes aureum Pursh

Plant Symbol = RIAU

Contributed by: USDA NRCS National Plant Data Center & the Biota of North America Program



Botany Dept., NMNH, Smithsonian Institution
@ PLANTS

Alternate Names

Buffalo currant, fragrant golden currant, golden flowering currant, clove currant, spicebush

Uses

Wildlife: Fruits of *Ribes* species, including the golden currant, are a valuable food source for songbirds, chipmunks, ground squirrels, as well as numerous wildlife species and other animals.

Ethnobotanic: The sweet and flavorful fruits are full of seeds but are popular for making jam, jelly, pie, and even ice cream. Some western Indian tribes used currants (*Ribes* species) for making pemmican. The Kiowa Indians believed that snakes were afraid of the

currant bush and used it as a snakebite remedy. Other tribes have used the fruits to color clay pots.

Conservation: The fragrant (clove odor), golden-yellow flowers of spring, yellowish to red fall foliage, edible fruits, and wide ecological range make golden currant a valued ornamental shrub for a variety of natural landscapes. Golden currant is easily cultivated from seed or cuttings.

Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status, such as, state noxious status and wetland indicator values.

Description

General: Currant family (Grossulariaceae). A native shrub 1-3 m tall, spineless, with numerous, erect-arching branches forming an irregular crown up to 6 meters tall or more; bark gray to red-brown; rhizomatous. Leaves deciduous, light green and glossy, alternate or clustered, orbicular or cuneate-ovate with 3-5 rounded lobes, (0.6-)1-2.5(4.7) cm long and wide, cuneate to subcordate at base, glabrous or sometimes lightly hairy beneath. Flowers in short racemes of 5-10(-15), with the fragrance of cloves; long-tubed (from fused sepals) and trumpet-shaped, with 5 yellow sepal lobes spreading at the top, with 5, short, reddish petals inserted at the top of the tube. Fruit a berry 6-10 mm diameter, globose to ellipsoid, ripening from green to yellow to red and finally black to dark purple, with numerous seeds. The common name pertains to the conspicuous, golden flowers; "currant" is the general name for *Ribes* fruit.

Variation within the species: *Ribes odoratum*, often considered a distinct species, recognized by its considerably larger flowers, has been placed (replaced, as var. *villosum*) as the eastern segment of the broader species.

Var. *aureum* – (golden currant)

Var. *gracillimum* (Coville & Britt.) Jepson – (golden currant)

Var. *villosum* DC. – (fragrant golden currant, buffalo currant, clove currant)

synonym: *Ribes odoratum* H. Wendl.

Distribution: Var. *aureum* is widespread in the western US and southeastern Canada, with

populations in Ontario and perhaps Quebec, as far south in the US as trans-Pecos Texas. Var. *gracillimum* is endemic to California. Var. *villosum* in the central US, from western Texas to Montana and eastward to New York and Vermont; it is absent from the Atlantic seaboard. The species is naturalized in Europe from garden escapes. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Adaptation

Golden currant grows in grasslands, coniferous forests and woodlands, and riparian and mountain shrub communities. It occurs on floodplains, along streams, in ravines and washes, by springs, and on mountain slopes, at elevations of about 800–2600 meters. It is generally an early to mid-seral species in western coniferous forests. Var. *villosum* occurs on cliffs, rocky slopes, ravines, bluffs, open hillside, and thicket margins, often in sandy habitats. Golden currant is somewhat shade tolerant and may grow in open, scattered, and dense pine stands, but it is usually suppressed by a denser canopy.

Flowering (March–)April–June, just after appearance of the leaves; fruiting (May–)June–August.

Establishment

Plants of *Ribes* generally begin fruiting after 3 years. Seeds may remain viable in the soil and duff for many years. Germination is enhanced by scarification, but relatively good germination of golden currant seeds was obtained by stratification at -2.2–2.2 degrees C for 60 days without scarification.

Golden currant transplants well and forms suckers. Plants can also be grown from cuttings. It reproduces vegetatively by rhizomes, sprouting after cutting and fire.

Management

Golden currant can be used to re-vegetate roadsides and disturbed areas, such as mine spoils and rangeland. It is rated mostly good in initial establishment, growth rate, persistence, germination, seed production, ease of planting, and natural spread. It tolerates shearing and may be used on dry, exposed sites in a range of soil types, and it is a good soil stabilizer.

Golden currant is an alternate host for white pine blister rust (*Cronartium ribicola*); this and other species of *Ribes* have been targets of various eradication efforts where white pine is of commercial interest. Please check the PLANTS Profile for this plant for links to additional information.

Fire top-kills golden currant, but it can survive low- to moderate-severity fire by sprouting from rhizomes. Such fires also scarify soil-stored seed and enhance germination. Severe fire probably kills golden currant and may destroy soil-stored seeds.

Cultivars, Improved and Selected Materials (and area of origin)

These plant materials are readily available from commercial sources. One cultivar ('Crandall') has been referred to as "the North Country's answer to *Forsythia*." Other horticultural selections have been made for hardiness, flower color and density, and fruit taste and size.

Contact your local Natural Resources Conservation Service (formerly Soil Conservation Service) office for more information. Look in the phone book under "United States Government." The Natural Resources Conservation Service will be listed under the subheading "Department of Agriculture."

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For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site <<http://plants.usda.gov>> or the Plant Materials Program Web site <<http://Plant-Materials.nrcs.usda.gov>>

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Grape Trellising and Training Basics

Tiffany Maughan, Brent Black and Mike Pace

Grapes are a wonderful addition to the home garden. With proper care and pruning they are long-lived and productive plants. This fact sheet discusses basic pruning information and introduces two common training methods suitable for the Utah home garden. There are many different types of training systems used for grape production throughout the world. The best system for your grape vine depends on the cultivar grown, the climate, soil fertility, and personal preference. This fact sheet details two common systems, the 4-cane single-trunk Kniffin system (cane pruned) and bilateral high cordon (spur pruned). Both systems work well for Utah home growers. Other grape systems can be used successfully, but for simplicity only these two systems are discussed here.

Planning is one of the most important steps for successfully growing grapes. It can be tempting to simply buy a grape vine and plant it somewhere in the yard with visions of delicious grapes in your future. However, without attention to detail your grape vine may not be very fruitful or long lasting. First, familiarize yourself with what is needed for grape vine management as well as planting basics. The companion fact sheet [Grape Vine Management](#) is a helpful resource for understanding what is needed for success. Next, select the grape variety you would like to grow, paying attention to your climate as well as your desired use of the fruit. See the companion fact sheet [Grape Varieties for Utah](#) for a list of varieties that can be grown in Utah. Once you know what type of grape you will be planting and have selected a suitable place on your property, it is time to consider your trellising system and how you will train your grape vine.

Trellis Construction

For most training systems, grape vines must have support. This can be in the form of a trellis, arbor, or possibly a fence. However, it is important to consider the challenges of pruning when selecting the type of support to use. Chain-link or similar styled fence can present unnecessary challenges as the canes become intertwined in the fencing material making them particularly difficult to remove during pruning. There are many ways to trellis grapes. It is best to choose and construct your trellis before planting. Grape trellises are typically either single posts in a line connected by one to four lines of wire (Fig. 1) or posts with a cross bar at the top with two to four lines of wire running between the horizontal cross bars.

Trellis posts should be treated wood (metal posts will also work, but wire attachment is more difficult) and need to be long enough to be firmly anchored and still leave around 6 feet above the ground. Place inline posts about 20 to 25 feet apart. Use heavy galvanized wire (No. 9 or 10 gauge, high tensile) to support the weight of the vine. The number of wires you use will vary by the training system. Pound fencing staples into the windward side of the posts at the desired heights, leaving a space large enough to allow the wire to pass through. Thread the wire through the staples, making sure the wire can still move side to side. Using a turnbuckle or similar device to attach the wire to the post at one end can allow for adjusting the tension of the wire. See Fig. 1 for an example trellis system. Braces are used at the end of the trellis to provide support and anchorage. Note in this example that end braces are constructed by

placing the last two posts closer together with a cross bar between them and twisted wire running diagonally to reinforce the brace. If more than one row is desired, leave 10 to 12 feet between rows to facilitate harvest and maintenance. The distance between plants in a row depends on variety and trellising method, and can range from 6 to 12 feet.



Figure 1. A 2-wire vertical trellis suitable for the Kniffen training system, with wires (white arrows) at 36 and 60 inches above ground level. This view shows the end braces with cross bar and diagonal tensioned wire. A drip irrigation line is suspended approximately 1 foot above the ground.

Terminology

A basic understanding of grape vine structure and terminology is helpful for understanding pruning and training. The appropriately maintained grape vine consists of both permanent and seasonal wood. The *trunk*, also called the stem, is permanent wood. A *cordon* is semi-permanent wood that is trained horizontally along the trellis wire. Succulent new growth arising from a bud on older wood is called a *shoot*. After the shoot drops its leaves in the fall it is called a *cane*. A *spur* is a cane that has been pruned back to one to five buds. The top of the trunk where the vine transitions to cordon, spurs, or canes is called the *head*. On each shoot or cane there are *buds* that form at the base of each leaf that will produce the leaves, shoots, and flowers the following season.

Pruning

Fruiting shoots grow from 1-year old dormant buds. Pruning is done to replace the fruiting wood each year. Grape pruning requires removal of between 80

and 90% of the canes each year. A fully mature, healthy vine can support a total maximum of 40 shoots. Younger vines will need to have fewer shoots until they reach maturity. Limiting the number of shoots is important for good cluster size, root balance, and preparation for winter. Grape pruning is done in one of two ways depending on the variety and training system: cane pruning or spur pruning. In general, American type grapes and many hybrids should be cane pruned because their basal buds are typically only vegetative (leaves but no fruit). This means if you are spur pruning them you would be cutting off the buds that are most likely to produce fruit. European grapes can be cane or spur pruned. If you are not sure which pruning method would be better for your variety, it is best to use cane pruning. Each of the two methods are described below.

Cane Pruning Overview: In a cane pruned system, the trunk (permanent wood) is kept each year, along with fruiting canes originating from the trunk. After a cane produces fruit for 1 year, the majority of the cane is removed. A new fruiting cane and a renewal spur, both originating close to the trunk, are kept for regrowth of next year's fruiting cane. Cane pruning is a good option for cold climates. There are many different cane-pruned systems; the 4-cane single-trunk kniffin system described below is relatively simple and has been used successfully in Utah.

Spur Pruning Overview: In a spur pruned system, the permanent trunk and semi-permanent cordons are left from year to year. Along each cordon, multiple canes grow from spurs (two to three buds) spaced every 4 to 6 inches along the cordon. One common spur-pruned system, a bi-lateral high cordon, is detailed below.

Cane Pruning: 4-Cane Single-Trunk Kniffin

This system needs two strands of wire, one attached to the trellis posts at 36 to 40 inches above the ground and another at the top of the post (60 to 72 inches). By each newly planted vine, secure a garden stake or pole vertically to the bottom and top wire. See Fig. 4 for a visual illustration of this training method.

Trunk Establishment: In the weeks following planting, several new shoots will develop. Select the strongest shoot to keep (this will become the trunk)

and remove all other shoots so the vine directs all of its growth into the selected trunk. Loosely tie the selected shoot to a vertical stake that has been secured to the trellis wire. Once it grows a few inches past the lower trellis wire, pinch back the shoot tip to induce branching, leaving two buds above the wire. Several shoots near the top of the cane will develop. Select three shoots to keep and loosely secure the lower two horizontally to the wire, growing in opposite directions (see Fig. 4), with the third positioned vertically toward the second wire. This new growth will need to be secured to the horizontal wires every couple of weeks throughout the growing season. Remove all other shoots originating from the trunk as they appear. Timing of pinching back the vertical trunk at the second wire depends on when the branch reaches the top wire. If the vertical shoot reaches the top trellis wire late in the first growing season, wait to top the shoot until February or March in the dormant season. If the shoot does not grow to the top wire by the dormant season, continue training the cane to the top trellis wire in the second season. If any fruit clusters develop during the establishment year(s), remove them to allow the grape plant to develop a good root system.

Cane Establishment: Once the trunk is established and the four selected canes have been secured to the horizontal wires, the first dormant cane pruning should take place. Prune at the end of February or the beginning of March. On the bottom two canes, count out from the trunk to four or six buds and

prune off the remainder of the cane. On the top two canes, leave only three to five buds on each cane. During the following growing season, depending on the variety and vigor of the grape vine, flowers may develop. At this point, you can allow them to develop into fruit, but if more than one flower cluster forms per shoot, remove the bottom cluster before bloom. Do not do any summer pruning.

During the second dormant season during cane establishment, keep one shoot from the base of each cane as new fruiting wood and prune one shoot back to two to three buds for a renewal spur (Fig. 2). Renewal spurs will grow the canes for next year's production (Fig. 3). Tip each fruiting cane back to 10 or fewer buds, depending on the vigor of the plant. Canes differ in fruitfulness. When selecting which canes to keep, look for ones that are pencil width in diameter, grew in the light, and do not have abnormally long spaces between buds.

Fully Established: The renewal spurs left in the previous year will have grown canes from the two buds that were left. Choose the better of the two canes and prune it back to 10 buds to keep as next year's fruiting cane. Prune the other cane back to a two-bud renewal spur. Remove last year's fruiting cane. If the renewal spur did not produce a satisfactory replacement cane, one of the base shoots on last year's fruiting cane can be selected instead. Remember, a fully mature, healthy grape plant should be able to support a maximum total of 40 buds. A classic mistake of many homeowners is

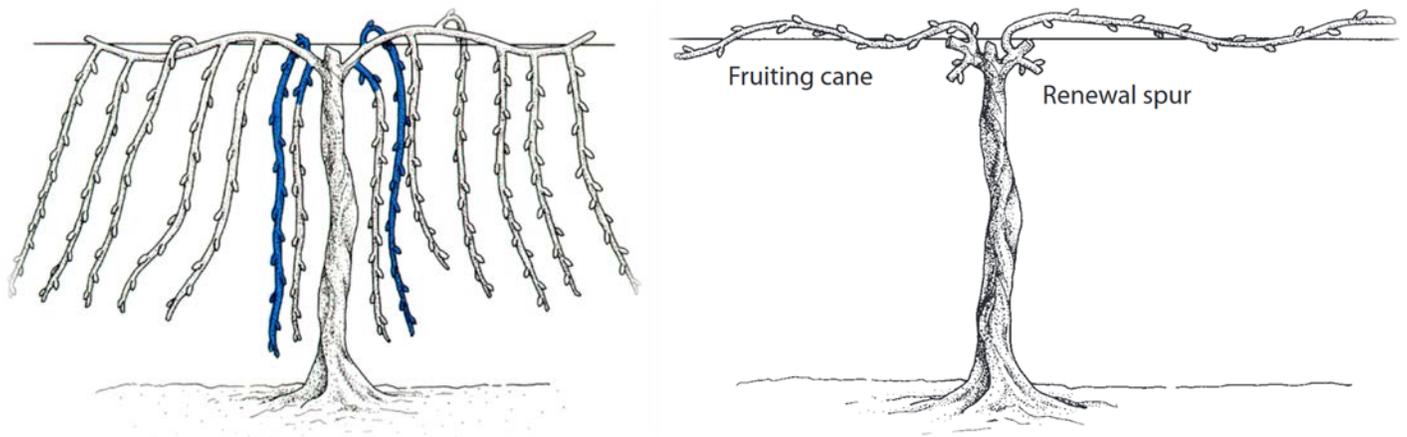


Figure 2. Image only shows one wire, the same pruning should be repeated for both wires in the 4-cane single trunk kniffin system. Before (left) and after (right) pruning during the second dormant season of cane establishment. Shading indicates wood that will be kept for the next season with the replacement cane attached to the wire for the following season. Images used with permission from Oregon State University Extension Service.

to leave more buds than this because removing so much wood each year is intimidating. Stick to the plan! Leaving more than 40 buds will limit the plant's ability to build up food reserves and increases the chance of winter injury. It also reduces the quality of the fruit produced.

Cold Climate Adaptation: In areas where spring frosts are common, during pruning growers can choose to leave two canes with one as an "insurance" cane until after spring frosts. In the event one of the canes that was selected is killed by frost and did not make it through the winter, they



Figure 3. Renewal spur with two buds next to fruiting cane. This orchard has a drip irrigation system also attached to the lower wire.

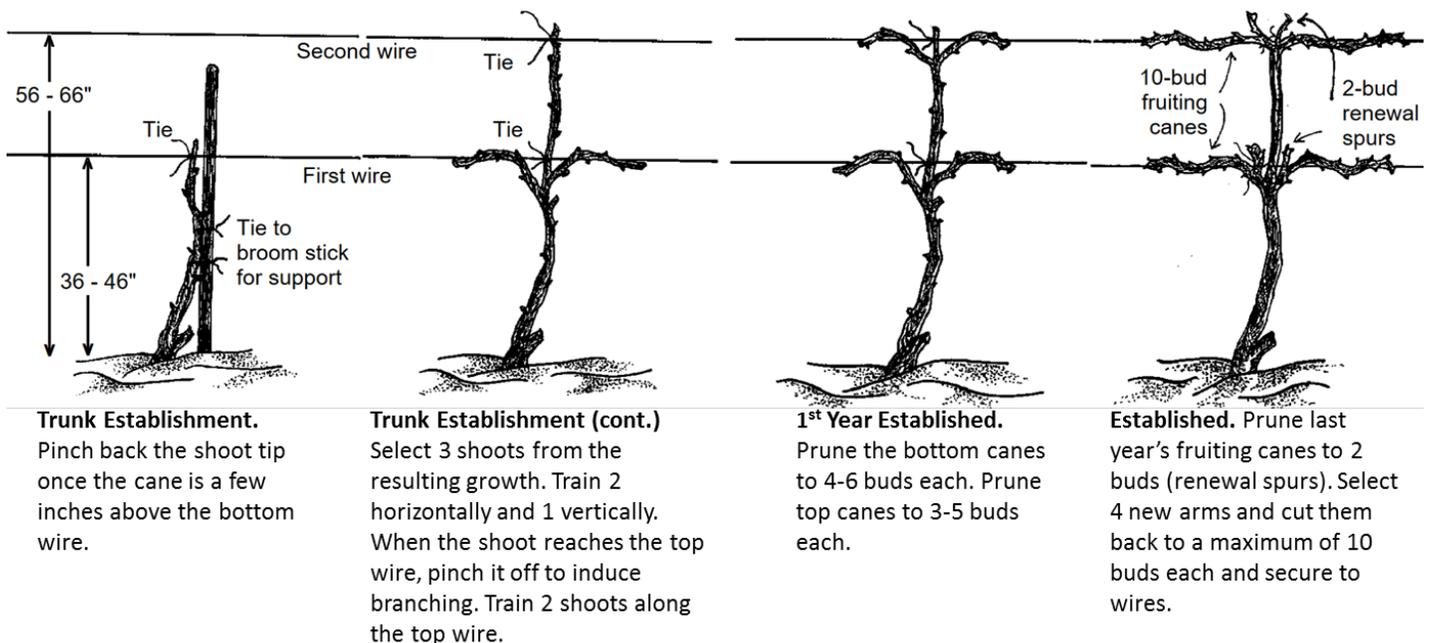


Figure 4. Grape trained to a 4-Cane Single-Trunk Kniffin system. Image used with permission from the University of Idaho, College of Agriculture.

can prune out the dead one and replace it with the insurance cane. It is important that after the danger of spring frosts have past, you go through and remove any extra insurance canes.

Spur Pruning: Bi-lateral High Cordon

This training system is well suited for varieties with a trailing or downward growth habit. The very similar bi-lateral *low* cordon system is better suited for varieties with an upright growth habit.

This system uses just one strand of wire at 5 to 6 feet to support the cordons, but may also use “catch” wires to hold the shoots. By each newly planted vine, secure a garden stake or pole vertically to the top wire to use as you train the vine to the wire. See Fig. 5 for a visual illustration of this training method.

Trunk/Cordon Establishment: Follow the same steps as outlined in the cane-pruning, trunk establishment section to establish a trunk that reaches the top wire. Depending on the vigor of the vine and site conditions, it may take more than one growing season to reach the wire. That is fine, simply continue training the vine to the top wire before beginning to establish the cordons. During the dormant season, top the newly grown trunk at the top wire. Remove any canes that may have grown on the trunk and make sure the trunk is securely tied to the stake. In the following growing season, begin establishing the cordons by selecting two shoots that grow near the wire and train them along the wire. Remove any fruit clusters that develop to encourage strong root and shoot development.

First Year Established: Prune back the two canes to 7 to 10 buds each, depending on vigor. Remove any canes that have grown lower on the trunk. During the following growing season, shoots will grow from the buds on the cordons that were trained along the trellis wire. Sometimes, more than one shoot will grow from each bud, with one that is stronger than the other. In the spring, when the longest cane is about 6 inches, remove the shorter canes. This can be done by grasping the extra shoot

at the base and carefully snapping it off. Do not allow more than one grape cluster to develop per shoot to prevent over-bearing on the young plant. Removing any extra clusters at bloom works well.

Second Year Established: Begin to establish fruiting spurs by selecting the strongest canes that are in a good position that have grown from the newly established cordon. For most varieties, leave a spur every 4 to 6 inches. Prune back the canes to spurs that have two or three buds. Leave no more than 40 buds per plant (in this case, 10 spurs on each of the two cordons with two buds per spur). At this point the vine should fill its allotted space.

Fully Established: When pruning during the dormant season, strive to maintain a balance between vegetative and reproductive growth. Prune the canes that grow from the spurs back to one to three buds. This section of cane left will become part of the spur and is the 2-year-old wood where the next year’s fruiting wood will grow from. Allow all fruit clusters to develop but continue to thin down to one shoot per node in the spring. Remove any suckers that develop on the trunk.

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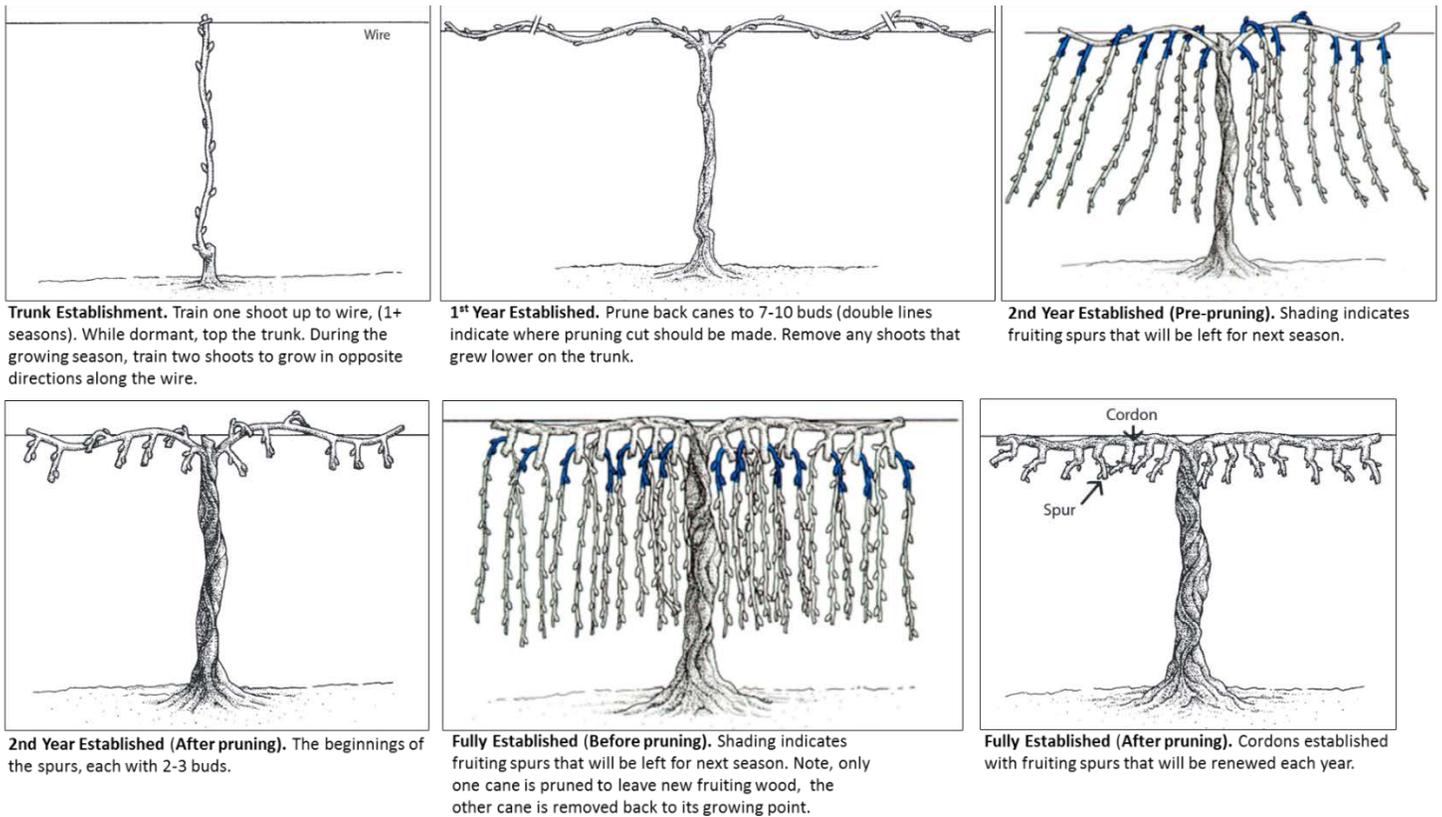


Figure 5. Grape trained to a bi-lateral cordon, spur pruned. Images used with permission from Oregon State University Extension Service.

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Grape Vine Management

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Introduction

Grapes are the most widely planted fruit crop in the world. They are used for wine, juice, raisins, table fruit, jam and jellies. With careful management, grape plants are long-lived, productive and an excellent addition to home gardens. This fact sheet introduces grape planting and management. The companion factsheets, [Grape Varieties for Utah](#), [Grape Training and Trellising Basics](#) and [Grape Irrigation](#) provide additional information.

Plants

Grapes are vining, woody, long-lived perennial plants. Grape vines are trained to have a permanent “trunk” that, depending on the training style and trellis system used, may also have permanent side branches known as arms or cordons that run along a trellis wire. New growth originates from compound buds and is the main form of vine growth. The new growth, known as the cane, is made up of tendrils for attachment, leaves, and fruit. Grape flowers form on the current year’s new growth (canes) and have non-showy light green/yellow flowers. In order to keep the plant productive, grape vines must be pruned heavily each year to remove excess canes, focus growth in the appropriate number of new canes, and to balance vegetative growth with fruit growth. Grapes are self-fruitful and pollinated by wind. In Utah, fruit harvest of the earliest varieties starts in late summer with later varieties extending the season until a killing frost occurs.

Variety selection is critical for success. There are four types of grapes (listed here from most to least cold tolerant): American, French/American hybrids, European, and Muscadine. Each type has many

different varieties to select from that are adapted for various uses, such as wine or table grapes. For more detailed information on variety selection, see [Grape Varieties for Utah](#). American types are best adapted to colder regions of the state. French/American hybrids and some European types are suitable for warmer areas of the state. Muscadines are typically not hardy enough and require a longer growing season than is available in Utah.

Site Selection

Deciding where to plant grapes in the home garden is an important first step. Most likely, no one spot will be perfect and some compromises will be necessary. Grapes need full sunlight to produce the highest yield possible. They are susceptible to late spring freeze damage and benefit from protective measures. If possible, choose a protected spot in the yard. Planting on a slope that allows for cold air drainage can help reduce the risk of freeze damage. Northeastern, and Eastern facing slopes are preferable as they stay cooler and delay spring bud break, which minimizes late spring freeze damage. They also do not get as hot in the summer. However, for many home growers, planting on a slope is not possible.

Planting grapes in a lawn should be avoided if possible. Turfgrass will compete with the grape vines for available water and nutrients, and lawn irrigation frequency is not typically appropriate for grapes. Additionally, grapes are very sensitive to selective herbicides used to control broadleaf weeds in lawns, and application near the vines should be avoided.

Soil

While grapes are forgiving of many soils, soil type strongly affects vine productivity and fruit quality. Productivity is increased on a sandy loam soil, and most limited in a heavy clay soil. If planting into clay soil, incorporate copious amounts of organic matter before planting. Raised beds can also improve drainage and aeration. Many Utah soils benefit from amendment.

Grape plants do best in soil with a pH between 6 and 7, but can still grow in Utah's more alkaline soils with appropriate fertilizer application. Grapes grown in soils with higher pH levels often struggle with iron chlorosis. Before planting grapes, it is a good idea to have your soil tested. Soil samples can be submitted to Utah State University Analytical Labs (USUAL). Visit the frequently asked questions section of their website <http://usual.usu.edu/> for detailed information on how to collect a soil sample and for pricing.

Site Preparation

Properly preparing the soil will help ensure success. Remove all weeds and other plants from the planting area to reduce competition for water and nutrients. Grapes are extremely sensitive to some of the herbicides used to control broadleaf weeds in the lawn such as 2,4-D. If hard to kill perennial weeds are in the area, application of some of the most effective herbicides after planting without damaging the grapevines will be much more difficult, if not impossible. Planting cover crops and incorporating green manure is a great option for both controlling weeds and improving soil health prior to planting grape vines. Incorporating organic matter, such as compost or weed-free manure the previous fall, will help to loosen heavy clay soils. If your soil test indicated low phosphorus, it is best to incorporate phosphorus fertilizer during site preparation since it is quite immobile in the soil and surface applications post-planting will not reach the roots quickly. Many composts are good sources of phosphorus.

Planting and Spacing

Rows should be 10 to 12 feet apart. The distance between plants in a row depends on variety and trellising method, and can range from 6 to 12 feet. See the companion fact sheet, Grape Training and Trellising Basics for different options. Photo 1 shows a commonly used trellis system. An area at

least 4 feet wide that is free of weeds and turf should be maintained around the base of each plant. Mulching around the new planting will help control weeds. Grapes can be planted in the spring or fall, but local nurseries and online sources will have a better selection of plants in the spring of the year. Do not allow young vines to dry out, particularly if planting bare-root stock. For best results, dig a hole twice as wide and as deep as the roots of the grape plant. If planting a bare-root plant, carefully spread the roots out in the hole and cover with soil to the previous soil line that should still be visible on the trunk. For container-grown plants, plant at the same depth as in the nursery pot. It is important to immediately water the plants in after planting to settle the soil around the roots of the plant and add more soil if needed, to bring it up to the correct soil level.



Photo 1. One-year-old grape planting trained to 2-wire Kniffen trellis system.

Irrigation

Grapes are somewhat drought tolerant once established. However, vines receiving full irrigation are typically more productive. In commercial wine grape production, it is common to drought stress the vines between fruit set and the onset of ripening. Although this stress reduces fruit size, it improves the quality of the fruit for wine making. However, improper timing or excessive drought stress can compromise the health of the plant, and is not recommended for a beginning hobbyist. Vines should be fully irrigated each year for best production and maximum fruit size. In most cases, applying 2 inches of water per week is sufficient. Irrigation frequency should be increased on sandy soils and decreased in heavy clay, and adjusted for

weather conditions. Reduce irrigation in the late summer and early fall to help the plant harden off for winter. Drip irrigation (Photo 2), or furrow irrigation should be used if possible. Using sprinklers to irrigate will wet the leaves and increase the risk of diseases. If late summer and fall precipitation is minimal and soils become dry, irrigate grapes just before the ground freezes to minimize winter injury from drying of the roots. See the companion fact sheet, “Grape Irrigation,” for an in-depth explanation of irrigation amount and timing.



Photo 2. Grape vine irrigated by drip irrigation system. The line is attached to the trellising wire.

Fertilization

Do not fertilize in the hole/furrow during planting, as doing so can cause injury to the roots. Fertilization is recommended starting in the second season to obtain the highest yield and fruit quality possible. A soil test is helpful in determining what nutrients need to be applied. Visually observing the vines will also help in determining what fertilizer applications may be needed. If the vines are stunted and have reduced canopy vigor they may be nitrogen deficient (Photo 3). This leads to a decrease in overall production. If nitrogen is over-abundant, however, excess vegetative growth will occur which can decrease fruit development and quality. Apply fertilizer, particularly nitrogen, in early spring before the buds start to swell and break dormancy. Application when the plant is actively growing will encourage the plant to grow excess vines with very little fruit. Apply in a 2-foot circle around the trunk of the plant. For established vines, a general recommendation is to apply 4.5 ounces (3/4 cup) of 21-0-0 fertilizer per year. If fertilizer is needed during years 2 and 3, only apply 2 ounces (6 tablespoons) of 34-0-0 per plant.



Photo 3. Left: Nitrogen deficiency in grape characterized by light yellowing of the entire leaf. Right: Top photo is grape vine with N deficiency, bottom photo has no N deficiency. Note the vigor in the top photo. Photos used with permission from Dr. Keven Ker, Brock University, Canada.

In Utah’s alkaline soils, grapes are prone to iron deficiency, especially in heavy clay soils or in plants that are being over-irrigated. This is recognized by leaves that have turned yellow but the veins remain green (Photo 4). If left untreated, the leaves may turn completely yellow and eventually brown along the edges. To combat iron deficiency, apply a spring application of iron chelate to the soil around the plant. Spraying a solution of iron chelate on the leaves can be a short-term remedy in severe situations. Excessive irrigation, particularly in the spring, increases the plants risk of iron deficiency. For more information reference [USU’s Iron Chlorosis in Berry Crops](#) fact sheet.



Photo 4. Iron deficiency in grape leaves with interveinal yellowing while veins remain green. Photo used with permission from Dr. Keven Ker, Brock University, Canada.

Training and Trellising

Proper training and trellising is critical for successful grape production. This can be done on a trellis, arbor, or possibly a fence. However, do not use a chain-link or similar style fence as the canes intertwined within the fence will be very difficult to remove during pruning. There are many ways to trellis grapes. Choose the type of trellis you plan to use before planting, as this will influence appropriate plant spacing. Trellis posts should be treated wood (metal poles can work as well but wire attachment is more difficult) and need to be long enough to be firmly anchored and still leave around 6 feet above the ground. The training and trellising grape fact sheet provides more detailed information.

Cluster Thinning

Do not over-crop the vines as this monopolizes nutrients needed for vine hardening and also results in small fruit size and poor fruit quality. Crop load is controlled through proper pruning and through post bloom cluster thinning. Thin fruit clusters just after bloom to limit the number of developing clusters to one or sometimes two clusters per cane. Cane numbers per vine are limited through pruning, which is discussed in the companion factsheet “Grape Training and Trellising Basics.”

Propagation

Grapevines are easily propagated from cuttings. Cuttings can be taken from 1-year-old dormant wood after all the leaves have fallen off and before bud swell in the spring. Choose a cane that is at least pencil sized or larger and cut it into sections with three to four buds each. It is important to keep track of which end of the plant is the bottom (closest to the trunk) and which is the top (closest to the tip). Cuttings can be rooted by burying the bottom two nodes in moist soilless media, loose sawdust or peat moss. Keep them in warm area and check to make sure the medium stays moist. Roots should form in about 1 month. Once a good root system has established, they can be planted into the garden. It is critical that plant material is healthy and disease-free. Unless you know that the source plant is free of any disease, including latent viruses, it is a good idea to purchase plants from a reputable nursery. Additionally, some of the recently released grape varieties are protected by patent law and cannot be propagated.

Problems

Winter Injury

The risk of winter injury to grape is high, particularly for European and French/American hybrid types. Even the hardiest American varieties may experience some winter die back in certain conditions. Canes need time to harden before cold temperatures. Only apply nitrogen fertilizers before fruit set and reduce irrigation frequency late in the growing season to minimize late-season vegetative growth and allow vines to go dormant. As discussed above, thin grape clusters as needed to maintain balance between nutrients used for fruit production and for vine hardening. One option for protecting cold sensitive vines from winter injury is to place straw bales around the trunk and base of the vines during the winter. This needs to be done prior to experiencing mid-winter cold temperatures but after a killing fall freeze. Another method used in cold climates is to train the vines low to the ground and then mulch the canes with sawdust or straw through the coldest part of the winter.

Weeds

Weeds compete with grapevines for nutrients and water. To obtain maximum production, weeds must be controlled. Eradicating hard to kill perennial weeds such as dandelions, crabgrass and field bindweed before planting will greatly reduce weed issues in the coming years. Grapes are very susceptible to systemic broadleaf herbicides used in lawns, such as 2,4-D and dicamba. Exposure to herbicides results in stunted cane growth, deformed leaves and non-uniform fruit development (Photo 5). 2,4-D damage may occur from spray applied



Photo 5. Herbicide damage on grape. Note the stunted, twisted growth of the leaves.

on your, or your neighbor's lawn if used at the wrong time of the year or from drift and volatilization at some distance. To minimize this risk, avoid using 2,4-D in areas surrounding the grape planting. Use extreme caution when using any systemic herbicides, including Roundup around grapes. Shield the trunk and lower leaves of the grapevine from any spray, and only apply when the wind is very calm, when the daytime high

temperatures will not exceed 85°F. For weed control surrounding the planting area, growing a cover crop in the alley way can outcompete weeds. It is important to read and follow the chemical label for mixing and application directions as the label is the law for using the chemical. Contact your local USU Extension office for more weed control advice.

Insect and Diseases

PEST/DISEASE	IDENTIFICATION	CONTROL
GRAPE LEAFHOPPER	The adult is narrow and is yellow with red and black markings. Adults lay eggs on grape leaves in the spring. Light yellow, wingless nymphs feed on the bottom of leaves.	Minimize weedy and grassy areas around the vines as they are alternative hosts.
GRAPE-LEAF SKELETONIZER	Black and yellow banded larva line up and feed side by side on the underside of the leaf. The larvae have long black spines that are poisonous. Adults are metallic bluish green moths that lay yellow eggs in clusters on the leaves.	Monitor closely for their presence. <i>Bacillus thuringiensis</i> (BT) and spinosad can be used for control.
EUROPEAN PAPER WASP	Yellow and black banded wasp with a long body and narrow waist. Feed on ripe fruit but are also a predator of caterpillars in the spring and early summer.	Treat nests with aerosol wasp sprays. Trap with fruit juice/yeast in a pop bottle.
SPIDER MITE	Very small arthropod that feeds on the underside of leaves. Like hot, dry, dusty conditions. Look for stippling (small spots on leaf) that may indicate their presence.	Natural predators are the best option for control. Encourage natural predators (lady beetles, predatory spider mites and others) by minimizing pesticide applications that would kill these desirable insects. If the infestation becomes severe, miticide application may be necessary.
POWDERY MILDEW	A fungus that causes white, powdery patches on the leaves. If young berries are infected they may harden or drop to the ground.	If you know powdery mildew will be a problem (high infection the previous year), apply systemic fungicides at bud break.

Harvest, Storage, and Use

Harvest timing is an important step in producing quality grapes. Grapes steadily increase in size as they ripen. If left on the vine too long, fruit will crack and mold. However, if harvested too early, overall yield is decreased and sugar accumulation and quality are decreased. Grapes will change color well before they are ready for harvest, so color

alone is not a reliable harvest indicator. As harvest time nears, monitor your grapes closely. For the home grower, taste is one of the easiest methods of knowing when to harvest. Wait until the berry is sweet and well sized. The fruit should still have some tartness (acid) in the flavor as well. Harvest grapes in a full cluster and use pruning shears to cut the cluster from the cane.

Grapes do not continue to ripen after they are picked, and quality begins to decline quickly after harvest. Expect to harvest around 8 to 12 pounds of grapes per vine. Yield varies by variety with some yielding up to 25 pounds. For wine and juice processing, have your equipment and ingredients prepared before harvest so you can begin processing as soon as possible. When processing grapes, it is critical to strictly adhere to food safety recommendations and tested recipes.



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