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JANUARY 2015
SDSU DEPARTMENT OF PLANT SCIENCE

Growing Raspberries in South Dakota

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Raspberries can be eaten fresh; incorporated into breakfast cereals, yogurts or salads; baked in muffins or pies; preserved for jelly, jam or syrup; or used in numerous other ways. They are a good source of vitamin C and contain high levels of fiber. They also contain high levels of phytochemicals, such as ellagic acid, gallic acid and rutin, which are nutrients that are believed to reduce the risk of diseases such as cancer.

All raspberries belong to the genus *Rubus* and are brambles (thorny plants of the genus *Rubus*). Raspberries have a perennial crown and root system, but the canes (the aboveground stems) are biennials, meaning they live for only two growing seasons.

During the first season, the new canes, called *primocanes*, are produced from the roots and crown of the plant. New primocanes are produced each year from each plant, so fruit production continues year after year. After primocanes overwinter, they are called *floricanes*.

Raspberry Types

Raspberries are classified by whether they fruit in the summer or in the fall. Summer-fruiting types produce leaves and set the buds on the primocanes the first season and then produce fruit mid-summer the following year on the floricanes. The floricane then dies. Plantings typically produce a small crop in their second season and a full crop after that.

The flowering buds of fall-fruiting raspberries (also called *primocane-fruiting* type) will set fruit towards the tops of the primocanes in the late summer/early fall. If the canes are left to overwinter, they will produce a smaller second crop on the lower portion of their floricanes the next July. Although two crops can be obtained (fall and then summer) from this type, using only a fall harvest cropping system is recommended. Growing only for the fall harvest reduces the disease and cold hardiness problems and can extend the life of the planting. Plantings of either fall or summer fruiting raspberries will typically remain productive for 15-20 years.

Red raspberries and yellow- or amber-colored raspberries (*Rubus idaeus*) initiate shoot buds from the roots at random locations. Yellow-fruited raspberries are simply color variants of the red and are grown the same as red-fruiting types. Although red raspberries include both primocane and floricane types, the available yellow raspberries are all primocane-fruiting types. The yellow cultivars are more prone to fruit discoloration due to disease or mechanical damage.

Black raspberries (*R. occidentalis*) are summer fruiting and have the same cane growth cycle as red raspberries; however, new primocanes in black raspberries are initiated only from crown buds at the cane base. Purple raspberries are a hybrid between the red and black species and are summer fruiting. Most black raspberry varieties do not survive South Dakota winters well as they are damaged by temperatures below -15°F. Black raspberry cultivars tend to be

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susceptible to anthracnose, have smaller berries and lower yields, and are pruned differently than red types. Purple raspberries are intermediate between the black and red in hardiness (damaged by temperatures below -20°F) and in other characteristics, and may be grown in the mid- to southern areas of the state. Purple raspberries ripen a little later than reds and blacks, and their fruit is generally better for preservation than for fresh use.

Planting

Plant bareroot stock in the spring when soil temperatures reach 45°F in a location that receives full sun and has good drainage. Raspberries should be planted in early spring once temperatures stay above 20°F. If tissue-cultured plants are used, wait until the chance of spring frosts has passed. Plant at a depth that will place the top of the root ball ¾ inch under the soil. Pay close attention to watering tissue cultured plants, as their root systems are very small.

Be sure to plant into a weed free strip that is 3 to 4 ft. wide. There are few herbicides labeled for use in raspberry plantings, so perennial weeds need to be controlled a year in advance of planting. In heavy soils, plant into a raised bed (6" to 10" high). Raspberries may be grown in rows or in hills. Plant red and yellow raspberries 2 to 3 ft. apart and allow them to develop a solid row 1 to 1½ ft. wide. Spacing between rows should be adjusted to accommodate cultivation equipment, but are generally 8 ft. apart in commercial plantings.

A raspberry "hill" refers to a cluster of canes, not a mound of soil. Black and some purple raspberries are more easily maintained in separate hills because they produce canes from crown buds, rather than suckering like red and yellow raspberries. Space plants 4 to 6 ft. apart in a hill system and confine them to 2-ft. diameter hills. Some purple cultivars sucker more readily and may more easily be maintained in a hedge row.

Trim the canes back to a height of 6" and set red raspberries into a shallow hole so the highest root is 1-2" below ground. Spread the roots laterally, then fill with soil, and water so the soil settles. Place dormant black and purple transplants so that the tips of the crown are about 2½" below the soil surface. Tamp soil carefully to avoid damaging buds. Water after planting to sufficiently settle soil around the new roots.

Always plant quality disease-free and winter-hardy cultivars. Avoid planting in areas where strawberries, potatoes, tomatoes, sunflowers, or alfalfa were grown in the past 4-5 years, as these crops and raspberries are susceptible to *Verticillium* wilt, a soil-borne disease. Although good air circulation is suggested to reduce disease problems, excessive wind can cause cane injury or decrease fruit set, so moderate wind protection is recommended.

Watering

Good drainage is critical for brambles; they are prone to root rots and should not be planted on poorly drained soils. Use trickle irrigation or hand watering at the base of the plant to reduce foliar and fruit disease potential. Raspberries need 1½ to 2" of water a week throughout the growing season. Avoid excessive irrigation as it may result in soft fruit and increased vulnerability to disease. Decrease watering in late summer and early fall to help the plants harden off in order to lessen potential winter damage. After raspberries are dormant in fall, irrigate once more before winter.

Soil and Nutrient Conditions

Have a soil test done the fall prior to planting and amend to adjust the soil pH, phosphorus, potassium and organic matter, if necessary. Raspberries can tolerate a wide range of soil pH, from 5.8 to 7.5. Soil organic matter of 3% to 4% is best for raspberries. Incorporate phosphorus into the soil if soil test indicates phosphorus is below 25 ppm and incorporate potassium if soil test indicates it is below 100 ppm. Do not apply commercial fertilizers at the time of planting, as new raspberry roots are very sensitive to fertilizer salts.

When new canes emerge in new plantings (a few weeks after planting), apply 2 to 3 tbsp. lawn fertilizer (33-0-0 or similar strength) around each plant, several inches away from the base of the plants. If using fertilizer sold for lawns, be sure it does not contain herbicide! If the soil pH is higher than 7.2, use ammonium sulfate (21-0-0-24S) instead, at a rate of ¼ cup per plant. For larger plantings, use 1 to 1.5 lbs. of 33-0-0, or 1.5 to 3 lbs. ammonium sulfate, per

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100 ft. row. Use lower rates for heavier and/or high organic matter soils. If you tilled in a cover crop or high-carbon material such as straw shortly before planting, you may need to apply extra nitrogen initially to feed the microbes that will be breaking down that organic matter.

Once the planting is established, fertilize twice a year. The first application should be before new growth begins, while the timing of the second application depends on whether the plants are summer-bearing or fall-bearing. For the first application, use a 10-10-10 product at ¼ c. per plant (= 3 to 4 lb. per 100 ft. row); or if soil tests showed adequate phosphorous and potassium levels, use a product higher in nitrogen (such as 33-0-0), at a rate of 2 to 3 tbsp. per plant (up to 2 lb./100 ft. of row). On soils with pH higher than 7.2, use, use ammonium sulfate instead, at a rate of 2 tbsp. per plant (1.5 lb. per 100 ft. of row).

Established summer-bearing plants should receive their second fertilizer application 3 to 4 weeks after bud break, at the rates listed above for the first application. For established fall-fruiting raspberries, delay the second application until early August (during bloom), at the higher ranges of the rates listed above. Do not apply fertilizer after mid-August, as the canes may not harden off sufficiently for winter. Decrease fertilizer amounts during hot dry years, or if your plants grow vigorously with dark green leaves but produce few fruit.

A yearly application of 3.5 cubic ft. of well-composted manure per 100 sq. ft. of row may be used instead of the applications above. Be sure to avoid manures that contain weed seeds! Do not use fresh manure, as it can harbor pathogens that cause food-borne illnesses.

Weeding & Mulching

Perennial weeds such as grass and thistle are extremely difficult to control in established raspberry plantings, therefore bed preparation should begin the year before planting to eliminate these weed problems. A combination of cultivation, cover crops, and/or herbicide will help control annual and perennial weeds. Check labels carefully, as some herbicides persist and can be harmful to new raspberry plants.

After planting, raspberries may be mulched. Mulch is very beneficial as it retains moisture during establishment, reduces soil heaving in the winter, and increases the organic matter of the soil over time. Apply a 1-3" layer of mulch, such as chopped leaves, dried lawn clippings (herbicide-free only), straw, wood chips or shavings, or shredded paper, on the soil surface around the canes. If wood chips or shavings are used for mulch, add ¼ to ½ c. of 33-0-0 fertilizer to avoid nitrogen depletion, as the wood is broken down over time in the soil.

As the raspberries become established, be sure to cultivate a strip at the row edge to prevent weed competition. Avoid cultivating deeper than 2" to 3" to avoid damage to the roots.

Pruning

Training and pruning of the red, purple and black raspberry is slightly different, since they have different growth habits.

Summer-fruiting red raspberries

- Dormant pruning in early spring (March-Early April)
  - Remove old floricanes that fruited previous year (if they were not removed after the leaves of the fruiting canes died in the late summer). If there are disease problems, take care to remove floricanes in the summer as soon as they have finished fruiting.
  - Thin the 1-year old canes by removing all but 6 to 8 of the most vigorous canes (biggest,

Figure 1 & 2. Summer-fruiting raspberries after dormant-season pruning. Summer-fruiting raspberry canes should be thinned to 6 to 8 canes per foot of row. Photos by Anne Fennell, SDSU

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healthiest) per linear foot of row or hill. (Fig. 1)
- Remove tips killed by winter injury as well as spindly growth at the ends of the canes. Spindly growth generally does not produce high quality fruit, and makes management more difficult. Do not remove more than ¼ of the total height (unless it is winter damaged) as yield will be significantly reduced.

- If the planting does not have a support trellis, cut the canes back to about 4 to 5 ft.
- As primocanes emerge throughout the summer, remove any new canes from the edges of the rows, to maintain row width.

Summer tipping of the primocanes for height control is not recommended since this slows cane development and may cause buds that are developing for next year's crop to break and grow.

Red and Yellow Fall/primocane-fruiting raspberries

A fall and a summer crop can be obtained from primocane-fruiting types but it is generally easier to use a fall harvest only cropping system:

- After plants become dormant, mow or cut all the canes 1" to 2" above the ground. (Fig 2)
- To avoid the spread of disease, remove cut canes from planting, unless canes are cut and shredded using a rotary mower.

New canes will emerge in the spring and bear a crop in the late summer/early fall of the same growing season.

- Maintain plant rows at 18" wide with 6 to 9 ft. between the rows.
- Do not prune or tip primocanes. Flowering begins at the tip in primocane-fruiting raspberries. Tipping the primocanes will delay flowering and reduce yield in this type of raspberry.

Purple and black raspberries

- Remove 3" to 4" off the tips of the primocanes when they reach a height of 28-30" to promote production of lateral branches which bear the fruit on these types of raspberries. Do this multiple times over the summer.
- After harvest, remove spent floricanes to prevent disease spread to new canes.

Figure 3. Purple raspberries before and after dormant pruning.

- When dormant, remove the weak and damaged primocanes, keeping 5 to 9 canes per plant that have a ½" or greater diameter.
- Head back the lateral branches on the canes. For purple raspberries the side branches are cut back to form sturdy branches 12-18" long. See Fig. 3.

Trellising

Trellising is recommended for raspberries to prevent wind injury. Trellising improves yield and light penetration, and makes picking easier. The primocane/fall fruiting types fruit at the cane tops, and the heavy fruit load causes the cane to droop toward the ground. Purple raspberries do not require trellising.

The simplest trellis system uses posts with attached single or double wires or twine. Posts should be placed about every 10 to 12 ft. A simple T-trellis system can also be used (Fig. 4). Consider a temporary support or

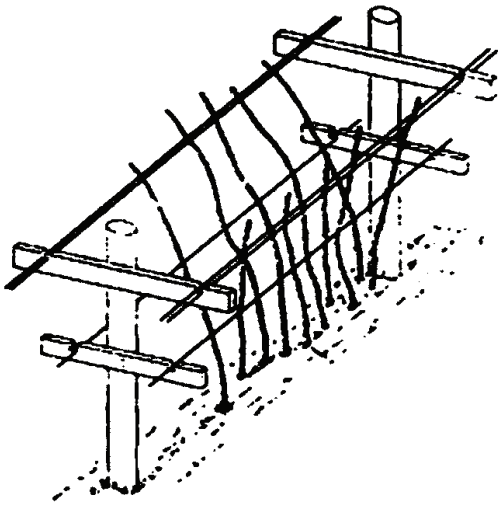

Figure 4. An example of a support system for raspberries.

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trellising system for fall-bearing so it can be removed to make dormant pruning easier.

Diseases

Good cultural practices will usually reduce insect and disease problems. Removal and disposal of infested canes is sufficient control in most instances, especially if plants are not watered with overhead sprinklers. Some common raspberry diseases include the soil-borne pathogens phytophthora and verticillium wilt; stem-infecting anthracnose and fruit-infecting gray mold. By planting certified disease-free plants in well-drained soil, destroying wild or abandoned brambles near the garden, and removing weak and diseased plants in established plantings, you can reduce the spread of disease. After harvest, remove and destroy canes that have fruited and died, and remove weak primocanes. This will help improve air circulation through proper thinning and pruning.

Insects

Some common raspberry pests include: aphids, raspberry cane borer, spider mites, sap beetles (picnic beetles), and tarnished plant bug. Two newer pests include the Asian Lady Beetle, and the Spotted-wing Drosophila (fruit fly).

Aphids will generally feed on the tips of tender young canes or on the underside of leaves. In the home garden, numbers can be reduced by hosing them off with a strong stream of water, or applying insecticidal soap (be sure to spray thoroughly, including the undersides of leaves).

Raspberry cane borers puncture the stem tips of the canes in order to lay eggs. This causes cane tips to wilt. Once hatched, grubs bore down the cane and eventually kill it. To control, prune 5" to 6" below the wilted tips and then destroy the prunings. Red-necked cane borers typically appear in the early summer. Cut out and destroy dormant canes in the fall that have abnormal swelling, which may indicate the presence of borer larvae.

Spider mites will feed on the underside of leaves, typically during a hot, dry season. Mites are more likely to attack water-stressed plants, so maintain adequate moisture. A miticide can be used during the growing season, while a dormant spray can be used once the leaves fall or before the canes break bud in the spring. Use pesticides strictly in accordance with the label requirements. Raspberries have a very short time from flowering to fruit ripening (~21 days) and it is critical to avoid chemical applications near harvest.

Sap, or picnic beetles, small black beetles with yellow or orange markings, are currently the more frequent cause of insect damage on raspberries. They are attracted to all types of overripe fruit and quickly become a nuisance when ripe fruit is left in the planting. Frequent picking will help reduce the amount of overripe fruit and decrease the planting's attractiveness to the beetles.

Tarnished plant bugs feed on developing berries, and can deform them. Maintaining weed control can reduce the overwintering adult populations.

Asian Lady Beetle can become a pest in fall/primocane fruiting raspberries near soybean fields, as they look for alternative food sources once the soybean fields dry out. They also seek hibernation spots as night temperatures drop in the fall. The beetle causes damage by feeding on fruit and by releasing an alkaloid on the berry that alters berry flavor.

The Spotted Wing Drosophila (SWD) is an invasive new pest that has potential to greatly damage fall-bearing raspberries in South Dakota. They resemble common fruit flies, so contact SDSU Extension for positive identification and pesticide recommendations. The male flies can be identified by the spots on the ends of their wings (Fig. 5). The adult SWD lives for about two weeks, and a female can lay more than 300 eggs over those two weeks. Infested fruit do not show obvious symptoms for a few days, but then begin to break down. Researchers are working to develop better understanding of this pest and possible control methods. To reduce damage in your plantings, take the following steps:

1. Remove culled fruit from plantings and destroy by burning or burying the fruit at least two feet deep; crushing the fruit is NOT effective to control SWD emergence. Remove any fruit that has fallen to the ground.

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Figure 5. Spotted Wing Drosophila male

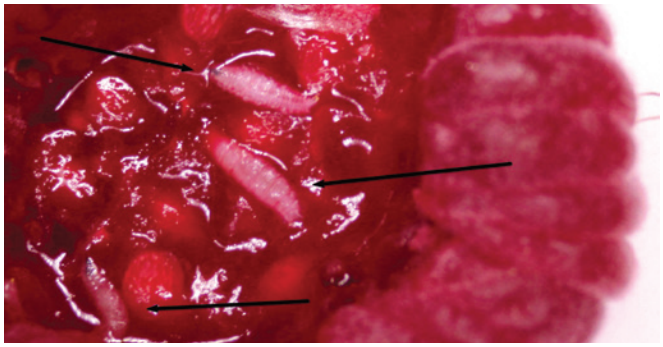

Figure 6. Spotted Wing Drosophila larva in raspberry.

2. Cool berries immediately after harvest to stop the development of any eggs in the fruit.

3. For small plantings, consider the use of insect exclusion netting (1/32 inch (1 mm) mesh, but keep in mind that bees are needed for pollination. This type of netting can be purchased through insect supply companies.

4. If you have obtained **positive** identification of the SWD and decide to use insecticides, apply just before the fruit starts to ripen, and frequently throughout the fruiting period. The SWD are attracted to the color and odor of ripening fruit. Always follow the label; and watch for required pre-harvest intervals. The types of insecticide should be alternated to avoid development of resistance, and don't spray when bees are actively working the plants.

Harvest & Storage

Harvest raspberries when they have well-developed color, and can be easily removed from the receptacle. Fruit should be harvested every 2 to 4 days. Once the planting is mature (three years old), expect per plant yields of about 6 to 9 lbs. for summer-fruiting red raspberries, 3 to 4 lbs. for fall-fruiting raspberries and 3 lbs. for purple raspberries.

Raspberries should be cooled immediately after picking. Fruit should be stored in shallow containers, as berries are fragile and multiple layers of berries will smash the bottom layers. Fruit storage temperatures should be maintained between 32°F and 36°F with 90% to 95% humidity. Fruit may be frozen immediately for maximum quality. Do not wash fruit before storage; wash immediately before use. Red and purple raspberries that have been immediately cooled may be refrigerated for as long as 7 days while yellow raspberries will only store for 3 days. To reduce condensation that can contribute to molding, fruit should be cooled before covering.

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Publication: 06-2000-2015