

# Raspberries: A New Greenhouse Crop

*All photos courtesy of Jeff W. Werner.*

**Raspberries fetch high prices, and they don't survive long-distance transport as well as other fruits. Local marketing of greenhouse-grown raspberries could be just the lucrative, off-season niche you've been searching for.**

By Meriam Karlsson  
and Jeffrey Werner

**R**aspberries have an exceptionally short shelf life, are easily damaged when handled and do not transport well. Because of their perishable nature, the opportunities to market high-quality, fresh raspberries produced under favorable field conditions in distant locations are limited. In an effort to extend local availability and the season for fresh raspberries, greenhouse production should be considered. The targeted local market is for high-value, top-quality, off-season, fresh raspberries, since greenhouse production is expected to be more expensive than conventional field systems.

#### **THE RASPBERRY PLANT**

The raspberry production cycle differs from most commonly grown greenhouse crops. Raspberries used in commercial production are perennial plants with fruit developing on the canes in a two-year cropping sequence. The first-year growth is referred to as primocanes, which are called floricanes in the second year. Based on the fruiting characteristics, there are two main types of raspberries. The summer, or floricanes-bearing, type produces flowers and berries on the floricanes following natural cooling during the winter. The fall, or primocane-bearing, type produces a limited number of flowers and

berries on the upper portion of the primocanes at the end of the growing season. During the second year, fall-bearing types continue to flower similar to summer-bearing types following colder temperatures.

The primocane-bearing variety 'Tulameen' responds favorably to a greenhouse environment in respect to yield, berry size and flavor. Other varieties, such as 'Chilliwack', 'Canby', 'Encore' and 'Malahat', may also perform well depending on the crop cycle, local growing conditions and desired scheduling. We chose to grow Tulameen because of positive reports and recommendations for greenhouse production.

Raspberry canes of Tulameen are also readily available for purchase from commercial propagators and nurseries.

### RASPBERRY PRODUCTION

Various techniques and schedules may be implemented to produce raspberries in a greenhouse environment for marketing at different times of the year. Bare-root, multi-cane plants can be potted into 3-gallon containers in May and allowed to grow outdoors during the summer. The tall-growing raspberry canes in containers easily get top-heavy. To improve pot and plant stability, sand mixed with a peat-lite medium (Premier Pro-Mix

BX, Premier Brands Inc., Red Hill, Pa.) was initially used as the potting mix. The sand was later omitted since no advantage could be distinguished for adding sand to the growing medium.

The plants can be left outside in the fall if local conditions allow for natural cooling, or placed in a cooler at approximately 40° F. Prior to cooling, plants are pruned, leaving 3-4 of the most vigorous primocanes. Numerous, high-quality raspberries are more efficiently produced on a few strong and well-supported canes than on many weaker ones. Pruning also facilitates handling and improves disease and pest control. Low light continuously or for a few hours each day is beneficial, and maintaining even soil moisture is essential during artificial cooling. Under natural conditions, the chilling requirement is met by mid-December, and the plants are brought into a greenhouse at 55-65° F. Flowering is expected to initiate after 6-8 weeks and fruiting after 10-12 weeks. The first ripe raspberries in this production system may be picked in early March, and harvest is expected to continue for up to 60 days.

For plants placed in a cooler, pots may be taken out in sequential intervals to have continuous flowering and fruit production over a longer time period. In our studies, five weeks at 40° F was sufficient to fulfill the cooling requirement. As a guideline, we recommend cooling Tulameen for at least six weeks or approximately 1,000 hours to ensure proper exposure to low temperatures. On the other hand, raspberry canes left in a cooler for up to six months grew and developed without any reduction in flowering or berry production. Holding canes at the low temperature for greenhouse forcing provides opportunities to schedule fresh raspberry production for various marketing opportunities.

Although raspberries do not require high light levels, supplemental lighting during the winter to at least 750 foot-candles will improve the growth, flowering and, subsequently, the yield in Northern areas. Extending the daylength to 16 hours is beneficial both in respect to a photoperiodic long-day effect and ability to provide adequate daily total amounts of light. At low light levels, the rate of plant and crop development is expected to be slower.

Spacing and arrangements of the pots in the greenhouse depend on management techniques, logistics and the size of the plants. Initially, plants may be kept pot to pot in single or double rows. Spacing with 20-



*Raspberry canes in production in a polyethylene-covered greenhouse.*



22 inches between larger plants allows for adequate development and handling. The rows may be 3-5 1/2 feet apart. Trellising the rows to keep canes upright while fruit develops facilitates management of the plants, pest control and harvest. A fertilizer regime with a water-soluble fertilizer high in potassium (Hydrosol 5-11-26) and a general-purpose fertilizer (Peter's 15-16-17) at alternate irrigations worked well in our studies.

### **POLLINATION**

To set fruit, raspberry flowers need to be pollinated. Bumblebees are now commonly used for crops in greenhouse production systems that require pollination. Bumblebees are easier to manage and remain more active in cloudy weather and lower temperatures than honeybees. Equally or more efficient pollination has been reported with bumblebees compared to honeybees in greenhouses and plastic tunnels. Bumblebee hives are commercially available year-round, and one colony is expected to provide efficient pollination for 6-8 weeks. On a limited or experimental scale, successful pollination can also be accomplished by hand using an artist's brush during periods of slow bumblebee activity.

### **LONG-CANE PLANTS**

Another option for greenhouse raspberry production is long- or single-

cane plants. Bare-root long canes (3-4 feet) shipped during late fall or early spring from the Pacific Northwest already have the required cooling and can immediately be planted and forced into flower and berry production or alternatively kept in a cooler for later forcing. The long canes were planted in 3-gallon pots and evaluated for productivity and yield using similar management and production techniques as described for the multi-cane plants. Several single-cane plants in a larger container is another production strategy that may be evaluated. ♦



*Size comparison of raspberries. Tulameen is a good variety for extended production with flowers at different stages.*

## crop cultivation

At the completion of berry production, each floricanes was pruned to the soil level and removed. The newly developing primocanes were cut back, leaving approximately four feet of growth immediately prior to returning the plants to a

cooler. The pruning practice appears to stimulate bud formation on the primocanes. Removing the top portion of the primocanes also facilitates plant management, pest control, handling and the transfer of plants to and from the cooler. Care

to avoid damaging the developing buds while moving plants is critical. Yield increased for the single-cane plants during the second production cycle compared to the initial crop. Following the second crop cycle, the single-cane plants were

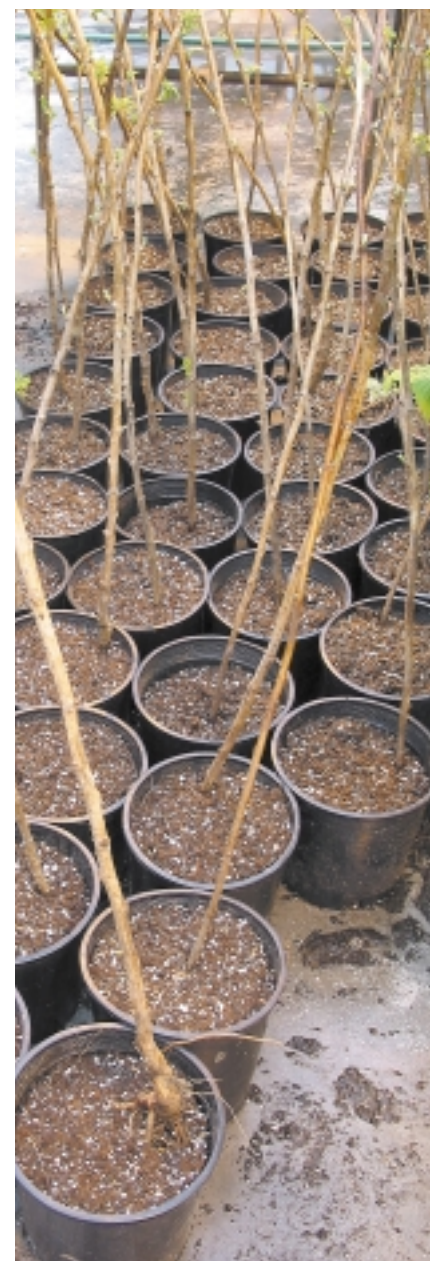
discarded. Under our conditions, it was deemed more efficient and economical to bring in new long-cane plants than to maintain the old canes for a third cropping cycle.

### YIELD

Fresh raspberries are sold in units of half-pints (180 grams). Retail prices between \$3 and \$6 for a half-pint are common. Up to 12 half-pints of high-quality berries have been harvested from individual, greenhouse-grown, multi-cane plants. Most berries are between three and six grams in size with some berries as large as eight grams.

### POTENTIAL PEST PROBLEMS

The main pest problem both with multi-cane and long-cane raspberries is infestations of two-spotted spider mites (*Tetranychus*



*Spring planting of floricanes from previous summer field production.*




*Tulameen berries are known for their size, color and productivity.*

*urticae*). Relative humidity is naturally low during Northern winter conditions, providing an ideal environment for spider mites. Control measures, including beneficials (*Phytoseiulus persimilis*), safer soap and sanitation, are used repeatedly to control and manage outbreaks. Good relative humidity also helps keep spider mites in check. Although infestations can be sustained to manageable levels through continuous monitoring and integration of pest control procedures, spider mite attacks are likely to be a continuous challenge and an obstacle in greenhouse raspberry production. Thrips and aphids are other potential pest problems. Although observed on plants in our trials, neither thrip nor aphid infestations have been severe. Biological control measures are available such as *Amblyseius cucumeris* for thrips and lacewing larvae for aphid control.

## CONCLUSIONS

Under Northern conditions, we recommend using single or long canes rather than multi-cane plants. The long-cane raspberry plants are easier to handle and maintain in a greenhouse production system, and a larger number of plants can be productively grown in an available designated area. In addition, the long canes are easier to ship than multi-cane plants and may be planted immediately or stored in a cooler for later forcing.

The raspberries produced in our study were of exceptional quality, size, color and flavor. Raspberries shipped from more Southern locations cannot compete with the superior quality of locally grown,

fresh greenhouse raspberries. Raspberries offer a high-value greenhouse crop alternative that may be worth considering for local marketing to consumers willing to pay a premium price for high-quality, fresh raspberries. 

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