

Primocane-fruited Raspberry Production

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Abstract. Primocane-fruited raspberries (*Rubus idaeus* L.) have the capacity to fruit in the fall and again the next summer. Because of their low chilling requirement, this type is used to produce a double crop in warmer regions of the world. However, many growers prune canes to the ground after the fall crop, sacrificing the summer crop for a single, large fall crop. This practice is less labor-intensive than the selective cane removal required for double-cropping and crop quality is often higher. Primocane-fruited raspberries also are easily manipulated to extend the season. Early- and late-fruited cultivars, cultural manipulations, rowcovers, high tunnels, and greenhouses are all used commercially to extend the season of primocane raspberries year-round. This is beneficial for consumers because high-quality fruit is now available for a much longer period than was possible in the past.

Primocane-fruited raspberries (*Rubus idaeus* L.) produce new canes (primocanes) from buds on the roots or from basal buds on older canes or the crown. Flowers are initiated on these primocanes regardless of day-length and when field-grown can produce fruit within one growing season, usually in late summer or fall (Keep, 1961). Flowering and fruiting occurs on the distal buds of the primocane with proximal buds remaining dormant until the following spring, providing the potential for two crops per year. More traditional floricanes-fruited raspberries initiate flowers in axillary buds on primocanes under short days and cooler temperatures of fall, but a chilling period is required before these buds will grow. Consequently, axillary buds on floricanes flower and fruit in early summer of the second year. If given enough time, many raspberry genotypes will eventually initiate flowers on primocanes that have not been exposed to short days or cool temperatures, but these are not generally called primocane-fruited types because fruiting does not happen within a typical growing season (Jennings, 1988).

When fruited both in summer and fall, crop quality can be reduced relative to a fall-only crop (Pritts, 1989). Although double-fruited is practiced in California, Chile, and some other warm regions where chilling hours are limited (Daubeney et al., 1992), many primocane types are fruited for the fall crop only. Because of their adaptability and ease of manipulation, growers have been able to achieve season extension even when fruiting for a single crop. These techniques, coupled with earlier and later fruiting cultivars with good fruit characteristics, are having a dramatic impact on the raspberry market. Fresh raspberries are now available every month of the year from U.S. sources (USDA, Agricultural Marketing Service) with much of the fresh market supplied by primocane-fruited cultivars.

ADVANTAGES OF PRIMOCANE-FRUITING CULTIVARS

Primocane-fruited raspberries have many advantages over traditional summer-fruited, floricanes raspberries. Most notably, they provide an opportunity to extend the season from late summer into fall. Whereas the summer raspberry harvest lasts ≈ 6 weeks, fall fruiting can add an additional 6 weeks or longer to the season. Their short chilling requirement allows them to be grown in warmer regions where floricanes-fruited types fail to thrive.

Unlike floricanes-fruited types that require selective cane removal, an entire field of primocane-fruited types can be mowed to the ground in late fall or early spring each year. This decreases pruning costs significantly if the grower is willing to sacrifice the summer crop. Because primocanes only fruit at the distal end of canes rather than along the entire cane, elaborate trellises that separate primocanes from floricanes and enhance light penetration into the lower canopy serve little purpose. Annual removal of all canes after fall fruiting also helps break insect and pathogen life cycles, assisting with pest management. Winter injury to canes is not a concern if they will be removed or destroyed anyway. Because of these advantages, primocane-fruited raspberries were rapidly and widely planted around the world after the introduction of 'Lloyd George' and then 'Heritage' in 1969 (Ourecky, 1969).

IMPACT OF PRIMOCANE-FRUITING CULTIVARS

'Heritage' was the first primocane-fruited raspberry that produced a commercially acceptable crop early enough to be harvested in most growing regions (Daubeney et al., 1992). Although worldwide data on primocane-fruited cultivars are not available, 29% of the hectareage of eastern North American growers surveyed in 1987 was 'Heritage' or another primocane-fruited type (Swartz et al., 1992). Nonnecke and Luby (1992) reported that primocane production was 40% of the hectareage in the midwestern United States, representing a significant increase over the previous 10 years. In Chile, 80% of the hectareage is 'Heritage' (Hennicke,

2003). California hectareage, which is comprised mostly of primocane-fruited types, increased from 650 in 1992 to 1700 in 2005 (USDA National Agricultural Statistics Service), representing approximately half of U.S. production.

Over the last 25 years, many cultivars of primocane-fruited raspberries have been released (Finn and Knight, 2002). Some newer cultivars have large, flavorful fruit, earlier or later cropping, and exhibit a range of fruit colors. Certain new proprietary cultivars perform extremely well in specific locations. However, no single cultivar has replaced 'Heritage' as the industry standard for broad adaptability and consistent yield. The main challenge of growing 'Heritage', at least in colder climates, is that much of the fall crop is lost to frost before all of the fruit ripens (Goulart and Demchak, 1999; Pritts et al., 1992).

TECHNIQUES TO EXTEND THE SEASON

One approach to accelerating growth, flowering, and fruiting to permit a greater harvest before fall frost is to use rowcovers to warm the soil and plants in spring. Pritts et al. (1992) demonstrated that covering a field of primocane-fruited raspberries with rowcover before cane emergence, and then removing it when the canes are ≈ 0.5 m tall, will allow fruit to ripen as much as 2 weeks earlier than uncovered plants. Primocane-fruited raspberries also can be grown in a high tunnel to accelerate flowering and fruiting (Demchak et al., 2003). High tunnels are now widely used in California to protect raspberries from weather vagaries and provide some season extension for both the spring and fall crops.

Another approach is to protect plants from frost while they are fruiting to extend the season later in fall (Oliviera et al., 1996; Pitsioudis et al., 2001). For example, a typical unprotected crop of 'Heritage' raspberries may be harvested for 5 weeks in the northeast until the first hard frost, but if grown under a tunnel that is covered with plastic in late summer, it may be harvested for 10 weeks or longer (Pritts, 2006).

The peak crop of 'Heritage' may be intentionally delayed to shift production until

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later. Methods that will delay harvest include heavy winter mulching after canes have been removed, mowing newly emerging primocanes in early spring, and tipping primocanes before flowering (Pritts, 2006). The appropriate time for these treatments to be beneficial depends on the climate at each location (Oliviera et al., 1996, 1998). Certain of these treatments can have a negative impact on fruiting because either the treatment decreases cane length and yield potential or it delays ripening beyond a time when fruit development can be supported by mild temperatures. Applying delaying treatments to plants in a high tunnel can be an effective strategy to extend the season in colder climates.

Primocane-fruited types can be grown in pots in a greenhouse. Growers can hold potted plants in a cooler and introduce them to a greenhouse environment a few months before fruit is to be harvested. This approach allows a grower to target just about any marketing window, particularly when coupled with tipping and pruning to manipulate the time of flowering. For example, removing the expended portion of a primocane can promote budbreak further down the cane if environmental conditions are favorable (Dale et al., 2005) leading to repeat-fruited on a single cane. In addition, some primocane-fruited cultivars will continuously produce flowers and new primocanes in a greenhouse environment, allowing a grower to harvest over a long period of time from the same plants (Dale et al., 2001, 2005).

These techniques, coupled with earlier and later primocane-fruited cultivars with good fruit characteristics, should continue to have a dramatic impact on the wholesale raspberry market while increasing the length of time that berries are available from local growers.

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