Method for Producing Long-cane Blackberry Plants

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ADDITIONAL INDEX WORDS. *Rubus*, propagation, tip layering, primocane, lateral cane, trellis, cane training, rooting, flowering

SUMMARY. The objective of this study was to evaluate primocane cane training and propagation techniques for the production of long-cane blackberry (*Rubus* spp.) plants. Seventeen to 29 6-ft-long canes were produced from each semierect 'Triple Crown' and trailing 'Siskiyou' blackberry plant grown on the rotating cross-arm (RCA) trellis and cane training system. By early August, the lateral canes had grown beyond the top wire ≈6 ft above the ground and continued growing downward to the ground. The tips of the lateral canes reached the soil level from mid-August to mid-September at which time they were placed in 1/2-gal pots containing peat-based media. In early Oct. 2009, the tip-rooted lateral canes were cut from the stock plant at the uppermost trellis wire. Among the long-cane plants produced in 2009, 76% of buds in 'Siskiyou' broke, but less than 30% of buds in 'Triple Crown' broke in a heated greenhouse. Flowering occurred in 15% of the shoots that developed on rooted 'Siskiyou' long canes, but the shoots on the long-cane plants of 'Triple Crown' were morphologically vegetative and flowering did not occur. In 2010–11, the long-cane plants were detached from the stock plants in December, January, and March. The numbers of nodes with a flowering shoot improved to 41% and 16% and the number of flowers per shoot increased to two and five flowers on long-cane plants of 'Siskiyou' and 'Triple Crown' blackberry, respectively.

A variety of techniques and vegetative materials are used to asexually propagate blackberry. Blackberry plants can be easily reproduced from root suckers, crown division, root cuttings, tip layering, soft stem cuttings, and tissue culture (TC). Layering is a rooting method by which adventitious roots are stimulated on the primocane while it is still attached to the stock plant (Hartmann et al., 2010). Before the introduction of TC propagation, tip layering was a common nursery practice for propagating blackberry cultivars that did not sucker freely (Crandall, 1995). However, this technique required a sizeable planting for the layering bed, a lengthy production period, and good control of weeds and other soil pests. Also, few tip-rooted transplants could be produced from each plant (Caldwell, 1984). Primocane cuttings taken in the summer root readily but require considerably more care for successful plant production (Broome and Zimmerman, 1978). The plants propagated by the above-mentioned methods usually produce their first commercial crop in the second or third growing season in the field (Crandall, 1995).

Out-of-season blackberry production plants are typically established in protected environments such as in a greenhouse or under high tunnel. With the high investment for protected cultivation systems, yield in the first year of production is desirable to obtain a quick return on the investment. In southern Europe, raspberry growers use bare-root, long-cane plants harvested in late fall from fields in Scotland, having 20 to 40 axillary buds with differentiated floral bud. Once established in polyethylene tunnels in winter, these long-cane plants produce fruit within 6 months after planting (Brennan et al., 1999). For long-cane blackberry culture in Portugal, each year growers buy TC transplants that have grown in the nursery for 8 to 9 months to develop one upright cane (P. Oliviera, personal communication). Long-cane blackberry plants propagated by the tip-layering method are less expensive and more practical to manage than long-cane blackberry plants from TC transplants or root cuttings (Pitsioudis et al., 2009), but outputs of long-cane blackberry plants in Europe using available nursery techniques for long-cane production have been low (P. Oliviera, personal communication).

The RCA trellis system (Fig. 1A) expands the canopy surface area and spatially separates the floricanes and primocanes into two canopies (Takeda and Peterson, 1999). It has improved harvest efficiency because the fruit are positioned on one side of the trellis. In the latest RCA trellis design, the primocanes are bent at a height of ≈18–22 inches to force them to grow horizontally and when the primocane terminals reach the adjacent plant they are tipped (Takeda and Phillips, 2011). The reason for bending the primocanes so low to the ground is to promote the development of lateral canes arising from the leaf axils along the horizontal portion of the primocane. Bending the primocanes to force their growth in horizontal orientation at or near the base of the rotatable cross-arm also allows for easy rotation of the cross-arm which can

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Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711
0.3048	ft	m	3.2808
3.7854	gal	L	0.2642
2.54	inch(es)	cm	0.3937
33.9057	oz/yard²	g·m⁻²	0.0295
0.4732	pt	L	2.1134
(°F – 32) ÷ 1.8	°F	°C	(1.8 × °C) + 32

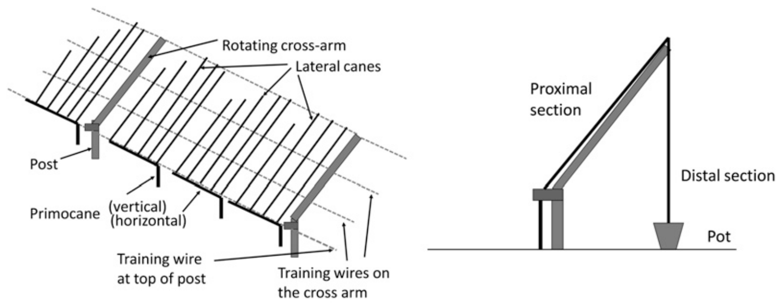

Fig. 1. Schematic drawings of producing long-cane blackberry plants on the rotating cross-arm (RCA) trellis system (not to scale). (A) An overview of the architecture of blackberry plants trained to the RCA trellis and the main components of the RCA trellis. Primocanes are bent and tied to the training wire near the top of the trellis post to force primocanes to grow horizontally along the wire. The lateral canes that emerge from the horizontal section of the primocane are trained to grow upward at ≈70° above the horizontal set by the cross-arm and trellis wires (dashed lines). When the cane grows beyond the top wire on the cross-arm, it continues to grow downward. (B) A side view of a blackberry plant trained to the RCA trellis. The cane tip is inserted in the pot when the cane reaches the ground. In late fall, the distal section can be separated from the proximal section (stock plant) by cutting the cane near the top wire on the cross-arm.

be performed without causing extensive cane breakage when the RCA trellis and cane training system is used as part of winter protection (Takeda et al., 2008; Takeda and Phillips, 2011). Previously, Takeda et al. (2003a) reported that on 'Chester Thornless' blackberry plants, in which the primocanes were bent at a height of 40 inches to facilitate the over-the-row mechanical harvester, the first three primocanes produced more than 23 lateral canes that were >40 inches in length; however, primocanes that emerged later in the summer were less vigorous and produced fewer lateral canes (Takeda et al., 2003b). The lateral canes produced on early emerging primocanes of mature plants of 'Triple Crown' blackberry were larger and longer than canes produced on 1-year-old micropropagated 'Triple Crown' plants (F. Takeda, personal observation). Also, the TC transplants tended to produce short upright primocanes and several lateral shoots close to the ground in the first year (Takeda et al., 2005).

The objective of this study was to use the RCA trellis and cane training system as described previously (Takeda and Peterson, 1999; Takeda et al., 2003a, 2008) as a means to produce many long lateral canes rooted at their tips (e.g., tip layering) for production of long-cane plants of trailing 'Siskiyou' and semierect 'Triple Crown' blackberry.

Materials and methods

The stock plants used in the study were nursery-matured trailing 'Siskiyou' (Finn et al., 1999) and semierect 'Triple Crown' (Galletta et al., 1998) transplants established in 2001 on raised beds covered with black landscape fabric (Takeda et al., 2008). 'Triple Crown' and 'Siskiyou' blackberry plants were established in a replicated block at the Appalachian Fruit Research Station, Kearneysville, WV (lat. 39.5°N, long. 77.9°W, elevation 590 ft). Rows were spaced 11 ft apart and were oriented in the north-south direction with 5-ft spacing between plants. Plot maintenance and pest control followed the established bramble production guidelines for the region (Brittingham-Brant et al., 2006). Plants were irrigated with drip tape (UniRam; Netafim, Tel Aviv, Israel) until early September to supplement rainfall. A modified RCA trellis was installed in 2001. The description of the RCA trellis and the sequence of primocane training and positioning of the cross-arms are reported elsewhere (Takeda et al., 2003a, 2008). During May and June 2009, three primocanes for each plant were bent and tied to the training wire 18 inches above the ground when they were ≈24 inches tall (Fig. 1A). Primocanes were tipped when they reached the adjacent plant. Later emerging primocanes were removed before they were 18 inches tall. Lateral canes that emerged from axillary buds on the tied canes were restricted to the angle created by the wires on the main, rotatable arm and a movable short arm (Takeda et al., 2008). At weekly intervals, the lateral canes were tied to one of the four wires on the cross-arms, which were angled at ≈70° (Fig. 1A).

In 2009, lateral canes of 'Siskiyou' blackberry that had extended to near soil level on 13 Aug. were buried in 1/2-gal pots (Figs. 1B and 2) filled with moist peat-based media (Sunshine Mix #4; Sun Gro Horticulture, Bellevue, WA). Lateral canes of 'Triple Crown' blackberry that had extended to near soil level were inserted on 28 Aug. and 8 Sept. in 1/2-gal pots filled with the same peat-based media. The pots were irrigated with a dripper twice weekly (1 pt per application) through drip tape (T-Tape; John Deere Water Technologies, San Marcos, CA) until late September. On 7 Oct., the distal 6-ft sections of lateral canes with their tips in the pots were detached from the stock plant and transplanted into 2-gal pots and held in an unheated greenhouse for 1 month. In November, the potted long-cane plants were moved into a cold room (43 ± 2 °F). One-half of each cultivar was held for 29 d and the other half for 41 d. After cold storage, the plants were transferred to modified, walk-in growth chambers (72 ± 8 °F) (Environmental Growth Chambers, Chagrin Falls, OH) maintained in a heated greenhouse. The ceiling and walls consisted of clear, biwall polycarbonate sheets. After 2, 4, and 6 weeks in the growth chamber, budbreak among axillary buds on long-cane plants were recorded. Thereafter at weekly intervals, bloom dates were recorded.

For the 2010–11 study, the 4.0-inch distal ends of the lateral canes were cut off when the tips reached the ground and the ends of cut lateral canes were inserted into 1/2-gal pots filled with peat-based media (Sunshine Mix #4). Tip layering of lateral canes of 'Siskiyou' and 'Triple Crown' blackberry in 2010 occurred from 19 Aug. to 9 Sept. A total of 106 and 144 lateral canes of 'Siskiyou' and 'Triple Crown' blackberry plants were tip layered, respectively. Water was

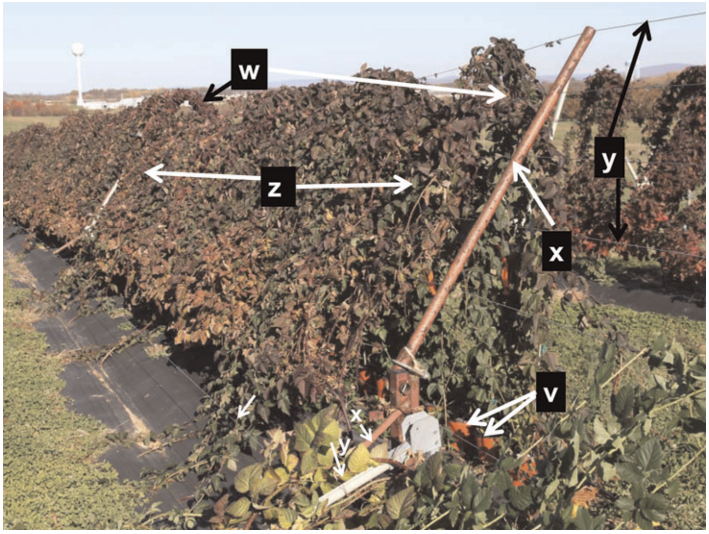

Fig. 2. A row of 'Siskiyou' blackberry plants trained to the rotating cross-arm trellis system for producing long-cane blackberry plants. Note that the lateral canes (z) have been trained to grow upward at the angle set by the wires (y) and the cross-arm (x). Many lateral canes have grown beyond the top wire and are now growing downward (w). Pots (v) have been positioned to tip layer the lateral canes.

applied to each pot twice each week (1 pt per application) through drip tape (T-Tape) until mid-November. Tip-rooted lateral canes were detached from the stock plants in Dec. 2010, Jan. 2011, and Mar. 2011. The long-cane plants detached from the stock plants in December were moved into an unheated greenhouse for ≈1 month. The remaining lateral canes with their tips rooted in pots were winterized to protect the roots and canes from freezing temperatures. Top soil was mounded around and over the pots containing the tips of 'Triple Crown' lateral canes. The potted ends of the lateral canes of 'Siskiyou' blackberry were swung over the top wire of the trellis and lowered into a trench dug on the side of the row and the trench was back filled with top soil. The cross-arms were then rotated as described previously (Takeda et al., 2008) to orient the lateral canes trained to the long, rotating arm from nearly vertical to horizontal. The horizontally oriented lateral canes were then covered with 48-inch-wide plastic sheeting (Covalence Plastics, Minneapolis, MN) and then the entire plant canopy was covered with a 1.5-oz/yard^2 floating rowcover (Atmore Industries, Atmore, AL) with the edges secured to the ground. On 20 Jan. and 3 Mar., the winter protection covers were lifted, the pots were dug out, and the distal half of the lateral canes was detached from the stock plant. The detached, long-cane plants were moved into a heated greenhouse (65 ± 10 °F) for growth measurements.

Each node of the long-cane plants was checked weekly for leaf emergence (budbreak) and for bloom of the primary flower bud. After bloom, flowers on each shoots were counted. The raw budbreak percentage data were transformed using the arcsine–square root transformation before statistical analysis and subjected to an analysis of variance using PROC MIXED of SAS (version 9.1.3; SAS Institute, Cary, NC). This approach allowed modeling of the repeated measures aspects of the study. In 2009–10, 'Siskiyou' lateral canes tip layered on 13 Aug., 'Triple Crown' lateral canes tip layered on 28 Aug. and 8 Sept. were the three main plots and the two cold storage durations were the subplots. For the 2010–11 study, cultivar was the main plot and the detachment date of lateral canes from the stock plant was the subplot. In both years, each long-cane plant was used as a replicate. When differences were detected at $P \leq 0.05$, means were separated by the least significant difference technique.

Results and discussion

In both 'Triple Crown' and 'Siskiyou plants, the first primocane tall enough to be tied to the training wire on the RCA trellis produced most growth and more lateral canes (data not presented). Similar growth responses were reported for 'Chester Thornless' blackberry trained to the RCA trellis (Takeda et al., 2003b). Bending the primocanes to force their growth in the horizontal direction negates the apical control by the shoot tip over the axillary buds at more proximal nodes. The significant increase in lateral cane numbers by this cane manipulation has been observed in other erect and semierect blackberry cultivars (Takeda et al., 2003a).

In 2009, as many as 75% and 94% of 'Siskiyou' and 'Triple Crown' lateral canes, respectively, trained to the long cross-arms of the RCA trellis grew beyond the top wire and reached the ground (Fig. 2; Table 1). In 2010, tertiary lateral canes that emerged from some nodes on the lateral canes that had been trained on the trellis were also retained; therefore, the number of canes that grew down to the ground was 20.4 and 29.0 canes per 'Siskiyou' and 'Triple Crown' stock plant, respectively. In both years, much of the tips of 'Siskiyou' and 'Triple Crown' lateral canes reached the ground from mid-August to early September (Fig. 2). Based on the number of lateral canes that developed on bent primocanes that grew at least 12 ft and stock plant density used in this study, it could be extrapolated that as many as 16,157 and 22,968 long-cane plants could be generated per acre of stock plants. It is likely that in a commercial nursery for producing long-cane plants, the rows could be set at ≈8 ft, potentially resulting in a 37% increase of long-cane plants.

Once the long-cane plants were moved from the cold room to a warm environment, bud growth commenced quickly (Table 2). The layering date (28 Aug. or 8 Sept.) and duration of cold storage (29 or 41 d) had no effect on budbreak (data not presented). The axillary buds on the long-cane plants of 'Siskiyou' broke within 1 week in the growth chamber. In contrast, 1 to 2 weeks in the warm environment were needed for the axillary buds on the long-cane plants of 'Triple Crown' blackberry to break. Although not statistically different, plants that were stored for 6 weeks at 43 °F needed 1 week for budbreak, whereas plants that were stored for 4 weeks took ≈2 weeks to break bud. After 3 weeks,

Table 1. Production of lateral canes (no./plant) and canes longer than 12 ft (3.66 m) in 'Siskiyou' and 'Triple Crown' blackberry trained on the rotating cross-arm (RCA) trellis system for production of long-cane plants in 2009 and 2010. Once three primocanes were trained, all canes that emerged subsequently were suckered before they grew 18 inches (45.7 cm) tall.

	Yr			
	2009		2010	
	Lateral canes	Lateral canes >12 ft	Lateral canes	Lateral canes >12 ft
Cultivar	[mean ± SD (no./plant)][z]		[mean ± SD (no./plant)][z]	
Siskiyou	20 ± 3.6	15 ± 3.5	19.6 ± 1.9	20.4 ± 3.7
Triple Crown	17 ± 2.0	16 ± 3.4	23.6 ± 2.6	29.0 ± 3.4

[z]Mean and SD based on five randomly selected stock plants.

Table 2. Effects of cultivar, time of layering, and time in cold storage on percent budbreak and number of flowering shoots on long-cane plants of 'Siskiyou' and 'Triple Crown' blackberry tip layered in Aug. and Sept. 2009. Rooted long canes were detached from the stock plants in early Oct. 2009. The detached plants were moved into an unheated greenhouse for 1 mo. after which they were held in a cold room at 45 °F (7.2 °C) for either 29 or 41 d and then grown in a heated greenhouse for growth measurements at 2, 4, and 6 weeks.

	Budbreak (%)			Flowering
Treatment	At 2 wk	At 4 wk	At 6 wk	shoots (%)
'Siskiyou'	69 a[z]	76 a	76 a	15 a
'Triple Crown'	16 b	24 b	30 b	0 b
Significance[y]				
Cultivar	***	***	***	***
Layering date	NS	NS	NS	NS
Days in cold storage	NS	NS	NS	NS
Cultivar × layering date × cold storage	NS	NS	NS	NS

[z]Mean separation on arcsin–square root transformed data. Means within a column followed by different letters are statistically different using least significant difference at $P = 0.05$.
[y]NS, ***Nonsignificant or significant at $P = 0.05$ or 0.001, respectively.

shoots had emerged from 76% of axillary buds on 'Siskiyou' blackberry, but less than 30% of buds had broken in long-cane plants of 'Triple Crown' blackberry. In both cultivars, budbreak percentage did not increase after 4 weeks. Of the shoots that emerged in long-cane plants of 'Siskiyou', 15% of shoots ended with differentiation of flowers, but none of the shoots on 'Triple Crown' blackberry plants produced flowers.

Shoots emerged from over 90% of buds on the long-cane plants of 'Siskiyou' and 75% of buds on long-cane plants of 'Triple Crown' in 2010 (Fig. 3A; Table 3). About 41% and 16% of the shoots that emerged on the 'Siskiyou' and 'Triple Crown' long-cane plants ended in an inflorescence. However, on some long-cane plants nearly all the shoots ended in an inflorescence (data not presented) and as many as five to eight flowers were on an inflorescence (Fig. 3B and C). These findings suggest that the timing of detaching rooted long-cane plants from the stock plant and the environment in which the long-cane plants are held before transporting them to a heated environment can affect the reproductive potential of long-cane plants. In the 2010–11 study, significant main- and subplot effects and a significant interaction were detected between genotype and detachment time for percent of buds that broke, but not for percent of nodes with flowering shoots or number of flowers per inflorescence. Reproductive development was optimal when the canes were detached from the stock plants in December. When the canes were detached from the stock plant in early October as in 2009, little or no reproductive development occurred among the long-cane plants that were grown in a heated greenhouse.

Delaying the detachment to January or March reduced the percentage of buds that developed a shoot and the percentage of nodes in which the shoot ended in an inflorescence (Table 3). The exposure of rooted tips to temperatures below 32 °F may have affected reproductive development. The roots of tip-layered 'Siskiyou' lateral canes that were covered with a floating rowcover during winter remained at or above 30 °F from December to March (data not presented). However, 'Triple Crown' plants were not covered during winter. Subsequently, the temperatures in the pots containing the rooted section of 'Triple Crown' lateral canes plants dropped on 5 d to 25 to 28 °F each time for ≈2 h (data not presented). Frequent cycles of freezing and thawing and exposure of young roots to ≈25 °F can lead to tissue damage (Fitter and Hay, 1987). Such exposure of roots that developed late in the growing season to freezing temperatures may have impaired subsequent growth and development of axillary buds and contributed to fewer shoots ending in an inflorescence (Table 3).

Long-cane plants can be produced in an area with a temperate climate and with access to cold rooms for chilling potted plants before shipment. For fruit production, the chilled long-cane plants can be transported to a warmer area, such as southern Florida where the accumulation of chilling hours (temperatures below 44.6 °F) is less than 100 h (G. Krewer, personal communication) and not adequate for growing floricane-fruiting blackberry in an outdoor perennial cropping system (Warmund and Krumme, 2005). Long-cane plants are also suitable for producing fruit in winter and spring in a protected environment such as a greenhouse or indoor living space. In warm conditions, potted long-cane plant can break buds within 2 weeks (Table 2) and bloom ≈25 d after budbreak (Black et al., 2008). Fruit can mature in ≈42 d after bloom (Takeda, 1987). Fruit produced in the springtime in the United States is considered out-of-season and can command a higher price.

In the southeastern United States, blackberry plants may become severely infected with one or more viruses within 3 years after field establishment

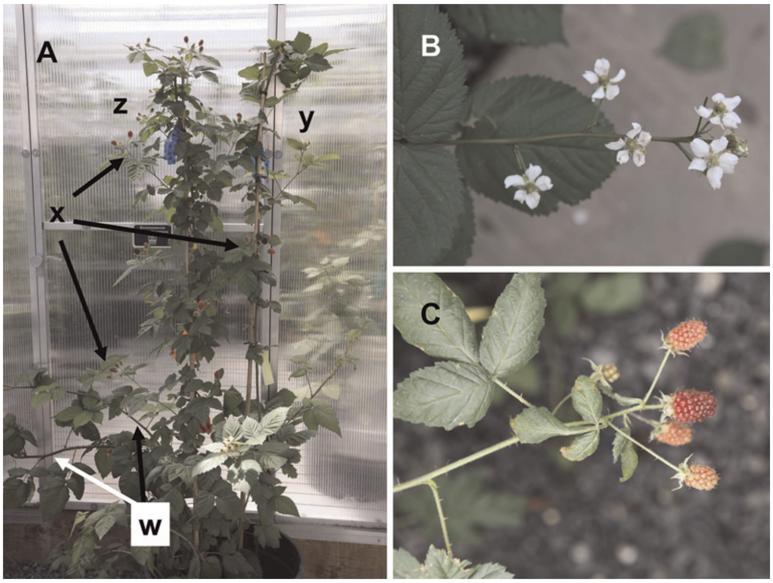

Fig. 3. (A) Long-cane plants of 'Siskiyou' (z) and 'Triple Crown' (y) blackberry after 10 weeks in a heated greenhouse. The long-cane plants were tied to a bamboo stake to maintain them upright. Note that the fruiting shoots (x) have emerged from the axillary buds along the entire length of the rooted long-cane plants. Some fruit on the 'Siskiyou' long-cane plant is ready for harvest. 'Triple Crown' long-cane plant has just begun to bloom. Primocanes (w) have emerged from the plant crown and are growing vigorously. (B) A close-up of a flowering shoot of 'Triple Crown' blackberry at bloom. Leaves subtending flowers were removed. (C) A fruiting shoot of 'Siskiyou' blackberry with five maturing fruit.

Table 3. Effect of cultivar and detachment date on budbreak, nodes with flowering shoot, and number of flowers per flowering shoot in long-cane plants of 'Siskiyou' and 'Triple Crown' blackberry produced in 2010. The tips of hanging lateral canes were layered in 1/2-gal (1.9 L) pots from 19 Aug. to 8–9 Sept. Rooted lateral canes were detached from the stock plants in Dec. 2010, Jan. 2011, and Mar. 2011 and moved to a heated greenhouse maintained at 66 ± 8 °F (18.9 ± 4.4 °C) for growth measurements. The data were collected for each node between Mar. and June 2011.

	Nodes with		
Treatment	Budbreak (%)	Flowering shoot (%)	Flowers (no./shoot)
Cultivar			
Siskiyou	92 a[z]	41 a	2.1 b
Triple Crown	75 b	16 b	5.3 a
Detachment mo.			
December	92 a	39 a	3.8 a
January	80 b	23 b	3.6 a
March	79 b	23 b	3.8 a
Significance[y]			
Cultivar	***	***	***
Detachment mo.	***	***	NS
Cultivar × Detachment mo.	**	NS	NS

[z]Mean separation on arcsin–square root transformed data. Means within a column followed by different letters for rooted canes 'Siskiyou' and 'Triple Crown' blackberry plants detached from stock plants on three different mo. are statistically different using least significant difference at $P = 0.05$.
[y]NS, *, **, ***Nonsignificant or significant at $P = 0.05$, 0.01, or 0.001, respectively.

and productivity can decline significantly (R. Martin, personal communication). Therefore, a process that produces fruit during the establishment year could be a tremendous benefit to growers in that region. The blackberry plants produced by the method described can produce fruit as soon as in 3 or 4 months rather than 1 year or more after transplanting. Also, they are suitable for high density production system in a greenhouse (Fig. 3A) using soil-less production techniques.

In this study, only the distal half of the lateral canes was used to produce long-cane plants from each stock plant (Fig. 1B). However, if a nursery for long-cane plants is established in an area with milder fall to winter conditions, production of additional 25 to 30 long-cane plants per stock plants is a possibility. After the rooted distal 6-ft-long cane section is detached from the stock plant, the cross-arms can be rotated to bring down the 5-ft-long proximal section of the lateral canes to ground level and the ends stuck in pots to induce rooting at the tip (F. Takeda, personal observations). Using the sequence described for training primocanes and lateral canes on the RCA trellis and tip layering the distal and proximal sections of the lateral cane sequentially, ≈50,000 long-cane plants per acre could be produced. In Portugal, production of two 5-ft-long cane plants per 3.1 ft row length of TC blackberry transplants set at 1 ft apart in 6-ft-wide row middle is considered satisfactory (P. Oliviera, personal communication). This method equates to ≈4400 long-cane plants per acre whereas the propagation system described in this article can potentially generate 10 times more long-cane plants than by the technique used in Portugal.

The results of our study also suggest that the timing of detaching tip-rooted lateral canes from the stock plants affect the productivity of long-cane plants. When the tip-rooted lateral canes were detached from the stock plant in October, little or no fruit production occurred (Table 2). Percent budbreak, numbers of flowering shoots, and flowers per shoot were increased when cane detachment was delayed to December or until flower buds have presumably begun to differentiate in the axillary buds. Takeda et al. (2002) reported that in buds of 'Boysen' and 'Cherokee' blackberry growing in Oregon transition to reproductive development occurred as early as November. Subsequent development of floral primordia (e.g., sepals, petals, stamens, and pistils) occurred through winter, but in 'Chester Thornless' blackberry the buds remained undifferentiated until spring. The phenology of flower bud differentiation varies among blackberry cultivars and is influenced by prevailing winter temperatures. Since periods of low temperature (<36 °F) can arrest development in blackberry (Takeda and Wisniewski, 1989; Takeda et al., 2002) and soil temperatures below 25 °F injure roots (Fitter and Hay, 1987), areas with less severe winter conditions could be more favorable for the production of long-cane plants.

The new method for propagating long-cane blackberry plants is highly efficient. Long-cane blackberry plants can be manipulated to stimulate early flowering or possibly cold stored for a period to delay harvest until late summer or fall. These production features should be useful to both nurserymen and fruit growers. Additional research is needed to improve the percentage of nodes that break bud and the percentage of lateral shoots with flower buds in 'Triple Crown' blackberry. Further evaluation of the cultural system described in this study for producing blackberry long-cane plants is suggested for other blackberry cultivars in an area with much milder winter conditions than at the present location which is in U.S. Department of Agriculture Plant Hardiness Zone 6b.

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