Thornless Blackberry Cultivars Grown with a Rotatable Cross-Arm Trellis System

RFR-A1648

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Introduction

Blackberries (*Rubus* L.) are a potential berry crop to diversify Iowa's agricultural enterprises if plant injury caused by low temperatures is avoided. Winter temperatures below -13°F damage current commercial blackberry cultivars. Systems that improve winter survival of less-winter hardy, thornless blackberries have been used in other locations of eastern United States. The systems include using a rotating-arm trellis to lay blackberry canes near the soil surface to overwinter them under a row cover for protection. The rotatable arm trellis growing system also enhances management practices, such as pruning and training, harvesting, pest management, and proper air and sunlight penetration in the blackberry canopy during the growing season.

A rotatable cross-arm trellis system includes using row covers, which are placed over blackberry canes rotated to near the soil surface in the fall months, typically in late November to early December and before temperatures reach below +10°F.

The objective of this research was to determine if thornless blackberry cultivars could produce acceptable yields with a rotatable cross-arm blackberry trellis in Iowa.

Materials and Methods

Two thornless blackberry cultivars, Chester Thornless and Triple Crown, were established in 2011 at the Armstrong Memorial Research and Demonstration Farm, Lewis, Iowa, and the Horticulture Research Station, Ames, Iowa. The plants were set 5 ft apart within the rows in landscape fabric, with 12 ft between the rows center-to-center. Four replications were included. Trickle irrigation was used under the landscape fabric. Weeding was done as needed. Weeds or common bluegrass between rows were mowed. Pests were managed according to the recommended practices.

A Rotating Cross-Arm™ Trellis System (Trellis Growing Systems, Fort Wayne, IN) was established in the blackberry plots in 2012. In 2012–2015, floating row covers were placed over the floricanes, which were rotated to the lowest trellis position and nearest to the soil surface, in late November to mid-December. Five-ounce, floating row covers (DeWitt Co.) were used from 2012–2014 and Agribon® Ag-70 floating row covers were used in 2014 through spring 2016. In April, row covers were removed, but the trellis remained in the "down" position, and an application of liquid-lime sulfur was applied to the dormant canes for anthracnose control. In June after bloom, the trellis cross-arms and floricanes were raised to the upright position for ease of harvest.

Yield was determined by weighing all fruit harvested on each harvest date and calculating a total for the entire season for

each replication. Average berry weights were obtained by weighing 10 random berries for each replication and on each harvest date.

Results and Discussion

Armstrong. Acceptable yields of blackberry fruit were obtained in research plots at the Armstrong Memorial Research and Demonstration Farm, Lewis, in 2013 (Table 1), but not in 2014 or 2015, due to floricane death. Blackberry plants did not die in 2014–2015, only the floricanes died back. New plant growth occurred from the plants' crowns in 2014–2015. Average berry weight in 2013 was highest with Triple Crown (Table 1). Week 4 (Aug 18–24) had the largest yield of both cultivars (Table 6, Figure 1).

In 2016, plant growth data were evaluated based on cultivar and location (Lewis and Ames) for main and interaction effects (Table 2). In Lewis, floricanes overwintered with little damage in the 2015–2016 winter season with 91.9 percent of all canes alive (Table 3). Over both locations, the percent of the trellis filled with canes was higher with Triple Crown compared with Chester Thornless (Table 4), and indicated more plant shoot growth in the previous growing season. Acceptable yields were expected in Lewis in 2016 due to the percentage of live canes, but fruit yield data were not determined. Over a four-year period with growing seasons in 2013–2016, commercial yields or commercial potential yields were obtained in two of the years (2013 and 2016).

Horticulture Research Station. Blackberry yields did not occur at the Horticulture Research Station during 2013–2015, due to floricane death. In 2016, 62.4 percent of all canes were alive (Table 3), which was less than the Lewis site. Although yield occurred in 2016, plants had low yields per plot, with Triple Crown berries weighing more than Chester Thornless (Table 5).

Overall summary. Of the two locations, the Lewis site showed the most potential for commercial yield of thornless blackberry cultivars in two years when using row covers and the Rotating Cross-Arm™ Trellis System. Sufficient and commercially viable yields of the thornless blackberry cultivars tested were not obtained in Ames in the four-year period. Further research should investigate different weights of floating row covers for optimal protection and their dates of application and removal to adapt the rotatable cross-arm trellis system to the different climate conditions in the State of Iowa. Use of the rotatable cross-arm trellis may produce sufficient yields when used in high tunnels, because blackberries have overwintered in high tunnels in Iowa.

Acknowledgements

We thank Trellis Growing Systems (trellisgrowingsystems.com) for providing the Rotating Cross-Arm™ Trellis System and DeWitt floating row covers for each research location.

Table 1. Total yield and average berry weight of two thornless blackberry cultivars grown at Iowa State University, Armstrong Memorial Research and Demonstration Farm, Lewis, 2013.[z]

Cultivar	Berry weight (g/berry)	Yield (kg/plot)[y]
Triple Crown	7.69 a[x]	27.4 a
Chester Thornless	4.67 b	22.0 a

[z]Harvest dates were July 31–August 28, 2013.
[y]Plot size included a trellis panel with 3 plants, spaced 5 ft apart, or 15 ft of row.
[x]Means with the same letters within a column are not different at P < 0.05 using Tukey's adjustment for multiple comparisons.

Table 2. P-values of main and interaction effects of thornless blackberry cultivars, Chester Thornless and Triple Crown, grown at two Iowa State University locations, Armstrong Memorial Research and Demonstration Farm, Lewis, and Horticulture Research Station, Ames, 2016.

	Canes alive (%)	Trellis filled (%)	Average berry weight	Total yield
Cultivar	0.1714	0.0101	0.04	0.4014
Location	0.0008	0.1011	-	-
Cultivar*Location	0.7733	0.5993	-	-

Table 3. Percentage of thornless blackberry canes alive at two Iowa State University locations, Armstrong Memorial Research and Demonstration Farm, Lewis, and Horticulture Research Station, Ames, May, 2016.

Location	Canes alive[z] (%)
Armstrong	91.9 a[y]
Ames	62.4 b

[z]Percentage data were not transformed for analysis because the variances did not differ according to Bartlett's Test for Homogeneity.
[y]Means with the same letters within a column are not different at P < 0.05 using Tukey's adjustment for multiple comparisons.

Table 4. Percentage of the trellis filled by canes of Chester Thornless and Triple Crown blackberry cultivars grown at two Iowa State University locations, Armstrong Memorial Research and Demonstration Farm, Lewis, and Horticulture Research Station, Ames, May, 2016.

Cultivar	Trellis filled[z] (%)
Triple Crown	74.4 a[y]
Chester Thornless	55.6 b

[z]Percentage data were not transformed for analysis because the variances did not differ according to Bartlett's Test for Homogeneity.
[y]Means with the same letters within a column are not different at P < 0.05 using Tukey's adjustment for multiple comparisons.

Table 5. Average berry weight and total yield of Chester Thornless and Triple Crown blackberry cultivars grown at one location, Iowa State University, Horticulture Research Station, Ames, 2016.[z]

Cultivar	Berry weight (g/berry)	Yield (g/plot)[y]
Triple Crown	6.23 a[x]	445.0 a
Chester Thornless	4.93 b	624.6 a

[z]Harvest dates were July 19–August 16, 2016.
[y]Plot size included a trellis panel with 3 plants, spaced 5 ft apart, or 15 ft of row.
[x]Means with the same letters within a column are not different at P < 0.05 using Tukey's adjustment for multiple comparisons.

Table 6. Number of harvests in each week period of two thornless blackberry cultivars grown in replicated plots at the Armstrong Memorial Research and Demonstration Farm, Lewis, IA, 2013.

		Number of harvests[z]	
Week	**Dates of harvest**	**Triple Crown**	**Chester Thornless**
1	July 28–August 3	2	2
2	August 4–August 10	3	3
3	August 11–August 17	3	3
4	August 18–August 24	4	4
5	August 25–August 31	1	2

[z]Means of four replications.

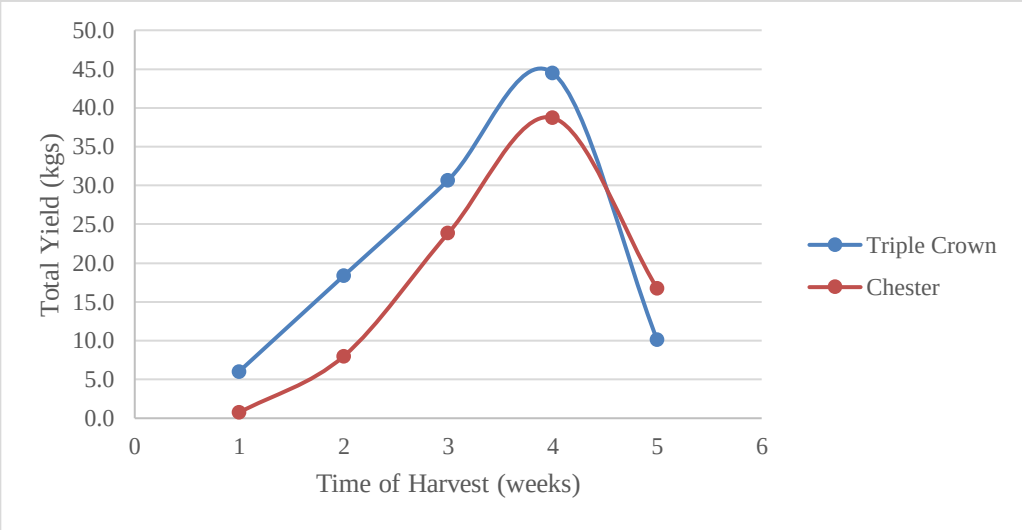

Figure 1. Total weekly yield (kg/plot) of Chester Thornless and Triple Crown thornless blackberries grown at the Armstrong Memorial Research and Demonstration Farm, Lewis, IA. Plot length was 15 ft of row. Weeks included harvest dates of the following time periods: Week 1 = July 28–Aug 3; Week 2 = Aug 4–Aug 10; Week 3 = Aug 11–Aug 17; Week 4 = Aug 18–Aug 24; Week 5 = Aug 25–Aug 31, 2013.

Figure 2. Photographs of rotating cross-arm trellis systems used in thornless blackberry research plots at the Armstrong Memorial Research and Demonstration Farm, Lewis, IA, 2013 (Photograph credits: B. Havlovic).