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Practices to Extend the Availability of Fresh Iowa-grown Raspberries and Blackberries

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Abstract
Raspberries and blackberries (brambles) are high-value fruit crops for commercial growers in Iowa. High tunnel production hastens the growing season, promoting greater yield and increased berry quality by protecting fruit from wind and rain. Similar to high tunnels, use of row covers has shown hastened production, but row covers are removed later in the year eliminating protection from weather. The primary goal of this project was to evaluate differences in total yield of primocane-fruiting brambles grown inside a high tunnel, under row covers, and with no cover. A secondary goal was to evaluate fresh and postharvest berry quality of primocane-fruiting brambles grown inside a tunnel structure, under row covers, and with no cover.

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Practices to Extend the Availability of Fresh Iowa-grown Raspberries and Blackberries

RFR-A9043

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Introduction

Raspberries and blackberries (brambles) are high-value fruit crops for commercial growers in Iowa. High tunnel production hastens the growing season, promoting greater yield and increased berry quality by protecting fruit from wind and rain. Similar to high tunnels, use of row covers has shown hastened production, but row covers are removed later in the year eliminating protection from weather. The primary goal of this project was to evaluate differences in total yield of primocane-fruiting brambles grown inside a high tunnel, under row covers, and with no cover. A secondary goal was to evaluate fresh and postharvest berry quality of primocane-fruiting brambles grown inside a tunnel structure, under row covers, and with no cover.

Materials and Methods

Experiment 1. In May 2009, plants of primocane-fruiting raspberry cultivars, Autumn Britten, Caroline, and Jaclyn and a primocane-fruiting blackberry from the University of Arkansas, APF-45, were planted in field plots and a high tunnel at the Horticulture Research Station, Ames, IA. However, the primocane-fruiting blackberry selection from the University of Arkansas, APF-45, was planted in 2008 in a high tunnel. Raspberry plants were spaced two ft within the row. Blackberries were spaced five ft within the row. Rows were spaced eight ft apart. Four replications of each cultivar were established for the three treatments—1) high tunnel, 2) field row cover, and 3) no field row cover production.

High tunnel. Bramble high tunnel plots were maintained in half of a 36 ft × 90 ft high tunnel set up in 2006 (Farmtek, Dyersville, IA).

Field plots (no high tunnel). Immediately after establishment in the field, row covers were placed over the four replicated plots of each cultivar for the treatment "row cover." Row covers were removed in early July, when the plants grew to the height of the row cover (approx. 18 in.).

Data variables collected included berry yield, number, and size by date during the growing season for the three treatments. Average berry size, firmness, and soluble solids at harvest from the three treatments determined berry quality of fresh fruit. Biomass weight was collected after harvest was complete, which included number of canes and total weight of canes.

Experiment 2. The post-harvest experiment was conducted with fruit from established plots of the primocane-fruiting raspberry Heritage grown in a mini tunnel and in field plot with no tunnel cover at the Horticulture Research Station, Ames, IA. Three random subsamples were collected from each treatment and stored in a refrigerator at 4°C for four days and seven days to evaluate post harvest berry quality. Average berry weight, water lost, diameter, firmness, and soluble solids measured postharvest berry quality.

Small tunnel structure. Bramble tunnel plots were maintained in half of a 16 ft × 48 ft high tunnel set up in 2008. Raspberry plants were pruned to the ground in the spring of 2009 and irrigated weekly.

Field plots (no high tunnel). Raspberry plants were pruned to the ground in the spring of 2009 and irrigated weekly. Plants were grown in field with no cover provided throughout the growing season.

Results and Discussion

Experiment 1. Harvesting of fruit from all treatments began in August and ended in the outside plots at frost (October 10). Fruit continued to be harvested in the high tunnel until the end of October, when mature fruit was less due to cloudy and cool weather. Total yield and plant biomass were higher among all cultivars when grown in a tunnel structure compared with field row cover and no cover treatments. There were little or no differences in berry quality of the three treatments. The cultivar Autumn Britten was the highest yielding primocane-fruiting raspberry cultivar. The cultivars Caroline and Jaclyn are both later-fruiting cultivars, which would result in less fruit harvested in the field before a killing frost. Average berry size was generally greater in the high tunnel. The cultivar Caroline produced the largest sized fruit (average berry weight and diameter). The primocane-fruiting blackberry selection APF-45 was planted in 2008, which resulted in greater number of canes and biomass weight. No fruit was produced on primocane-fruiting blackberries in the new field plots in 2009.

Experiment 2. For the cultivar Heritage, there were few differences in variables associated with the quality of bramble fruit grown in a tunnel structure compared with no cover field plots. Firmness of berries was greater in the no-cover plots after storage, which was a result of water loss. Firmness was similar among berries from the tunnel structure after storage. Berries from the tunnel structure would be more marketable after storage compared with berries grown with no cover.

These results also suggest that weather conditions may play a major role in production of raspberries when comparing fruit from covered plots with plots without a tunnel structure. Two weeks after berry quality measurements were completed with this project, central Iowa began to receive rainy, windy, and cool temperature conditions. Effects of these conditions were not measured, but marketability of fruit during these weather conditions was severely reduced. Fruits grown under the tunnel structure were large beautiful fruit. Fruit grown without a tunnel structure were smaller, misshapen, and not marketable. These results strongly suggest the need for tunnel structures to prolong berry quality and marketability into the fall.

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Table 1. Yield and berry quality comparison of fruit after treatments of high tunnel cover, field row cover, or no cover of four primocane-fruiting bramble cultivars.[z]

Cultivar	Treatment	Total yield (g)	Average berry weight (g)	Soluble solids concentrate (%)	Diameter (mm)	Firmness (Newtons)	Number of canes	Biomass weight (oz)
Autumn Britten	High tunnel	1004 a	2.7 bc	9.0 cb	18 cb	2.0 c	28 b	102 b
	Row Cover	452 bc	2.4 cd	9.1 cb	17 c	2.3 bc	12 cd	11 de
	No cover	226 cd	2.4 cd	8.8 cb	16 c	0.8 c	9 cd	4 e
Caroline	High tunnel	224 cd	3.4 b	9.3 b	20 b	1.0 c	44 a	71 c
	Row cover	52 d	2.5 cd	9.5 b	-	-	14 c	8 de
	No cover	29 d	1.8 d	8.2 c	-	-	9 cd	2 e
Jaclyn	High tunnel	173 cd	2.3 cd	9.4 b	17 c	1.0 c	11 cd	30 d
	Row cover	77 cd	2.1 cd	8.7 cb	16 c	0.9 c	6 d	3 e
	No cover	118 cd	1.9 d	9.5 b	17 c	3.8 b	8 cd	5 e
APF-45	High tunnel	789 ab	8.7 a	11.16 a	24 a	15.6 a	31 b	294 a
	Row cover	-	-	-	-	-	5 d	8 d
	No cover	-	-	-	-	-	5 d	10 e
LSD, P ≤ 0.05[y]		397	1.0	1.0	3	1.6	8	22

[z]Means are average four treatment replications.
[y]Least significant difference at P ≤ 0.05; NS = no statistical difference; means sharing the same letter are not statistically different from each other.

Table 2. Berry quality after post harvest treatments comparing Heritage primocane-fruiting raspberry fruit grown in a tunnel structure to no cover field grown fruit.[z]

Field treatment	Post harvest treatment	Average berry weight (g)	Soluble solids concentrate (%)	Diameter (mm)	Firmness (Newtons)	Water content (%)
Under tunnel structure	Fresh	2.5 a	9.3 a	16 ab	2.5 c	89.84 a
	4 days post harvest	2.1 abc	-	15 abc	2.6 c	41.60 b
	7 days post harvest	1.6 c	-	14 bc	2.9 bc	31.95 b
No cover	Fresh	2.4 ab	9.7 a	17 a	2.6 c	89.67 a
	4 days post harvest	1.7 bc	-	15 abc	3.8 ab	37.12 b
	7 days post harvest	1.7 bc	-	13 c	4.2 a	23.22 b
LSD, P ≤ 0.05[y]		0.7	1.7	2	2.1	24.78

[z]Means are average four treatment replications.
[y]Least significant difference at P ≤ 0.05; NS = no statistical difference; means sharing the same letter are not statistically different from each other.