Sweet Cherries: High Tunnels Change Just About Everything

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MSU High Tunnel Cherry Project

Tree Goals:
- Fill orchard space and begin fruiting rapidly
- Manage and harvest trees mostly from the ground

Fruiting Goals:
- Premium quality - size, sugar, appearance
- Reduced cracking, fruit rots, bird damage

Research Sites:
- SWMREC (Benton Harbor): Four 24 ft x 200 ft tunnels
- CHES (Clarksville): Three 28 ft x 159 ft tunnels
- Adjacent comparative plots without tunnels

Cherry Tunnel Climatic Monitoring

Two stations: permanent and mobile

- air temperature
- relative humidity
- wind speed and gust
- leaf wetness
- solar radiation
- soil temperature

SWMREC Varieties & Tree Development

Red: Skeena/Gi5, NY 119/Gi5, Glacier/Gi6

Blush: Rainier/Gi5, Early Robin/Gi12

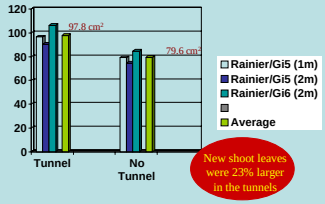
Guards/Pollinizers: Benton (sf), BlackGold (sf), BlushingGold, Cristalina, Lapins (sf), Regina, Sandra Rose (sf), Summit, Tieton, Ulster;

20 advanced selections from Cornell & WSU, plus the sweet/tarts Danube and Jubileum

Table 1. 2006 sweet cherry lateral shoot formation, with and without high tunnel production systems, SWMREC (est. 2005)

Variety	n=	Tunnel 2006 Lateral Shoots (#)	No Tunnel 2006 Lateral Shoots (#)
Early Robin / Gi12	36	26.8	22.6
Rainier / Gi5	36	23.7	22.0
Skeena / Gi5	36	24.1	29.6
Average		24.9	24.7
NY 119 / Gi5	21	18.5	19.7
Glacier / Gi6	10	12.3	9.0
Ave w/NY 119 & Glacier		21.1	20.6

Fig. 1. 2006 sweet cherry shoot leaf size, with and without high tunnel production systems, at MSU-CHES



Tunnel Production of Sweet Cherries Can Affect Tree Growth and Leaf Area; Fruit Set, Yield, and Quality; and Incidence of Fruit Cracking, Insect Pests, and Diseases

High tunnel production systems resulted in larger leaves, smaller diameter trunks, and variety-specific effects on lateral shoot formation (Table 1 and Fig. 1). Fruit set at CHES was excellent in 2006; high tunnels reduced fruit set and yield (Table 2), presumably due to reduced honeybee activity. However, average fruit size and market size distributions (Table 3) were outstanding, achieving levels not only uncommon for the Great Lakes but on par with sweet cherry production anywhere in the world. Crop values per acre appear to justify the higher establishment costs for tunnel production systems.

Thus far, high tunnels have provided noticeable reductions of:

- spring frost damage during bloom (2006)
- rain-induced fruit cracking and postharvest diseases (2005)
- red blush development on 'Rainier' (2005-06; not a good effect!)

Moreover, additional advantages have been observed with respect to integrated pest management issues (e.g., Fig. 2) and reduced pesticide inputs, as high tunnel production also reduced:

- cherry leaf spot damage and defoliation (2006)
- Japanese beetle damage and defoliation (2006)
- bacterial canker (2006; preliminary data)
- bird damage to fruit and deer damage to trees

There have been noticeable, though not yet economically important, increases of:

- powdery mildew (2005), aphids & spider mites (2006)

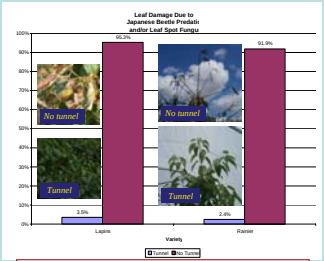


Fig. 2. Sweet cherry new shoot leaf damage due to Japanese beetle and cherry leaf spot, recorded 9 Aug 2006 at MSU-CHES

In 2006, no pesticides were used in the CHES tunnels; there was little to no apparent movement of plum curculio or cherry fruit fly into the tunnels from surrounding infested plots, which were sprayed conventionally.

In 2006, brown rot infections were significant in both the tunnel and no-tunnel plots. Although levels were similar at harvest, it appeared to develop earlier under the tunnels, probably due to higher humidity and temperatures.

Much research remains regarding high tunnel production of sweet cherries - climatic (especially temperature, humidity, and light) analyses; optimization of yields, fruit quality traits, and high density tree architectures; whether IPM strategies can approach organic certification, etc. However, the dramatic results of these preliminary studies have revealed a significant set of potential advantages under Great Lakes growing conditions for growers wishing to target dwarf cherry production for high value premium fresh markets.

Financial, in-kind, and/or technical support from Project GREEEN, Haygrove Inc., International Fruit Tree Association, Summit Sales, Gisela Inc., Michigan Agricultural Experiment Station, SWMREC, and CHES is gratefully acknowledged.

CHES Varieties and Cropping

Red: Lapins/Gi5 and Gi6, Sweetheart/Gi5

Blush: Rainier/Gi5 and Gi6

Planted in 2000, tunnels erected in 2005

Table 2. 2006 'Rainier' sweet cherry yield and fruit size, with and without high tunnel production systems, CHES (est. 2000)

	'Rainier'/Gisela 5 Covered (tunnel)	'Rainier'/Gisela 5 Open (no tunnel)	'Rainier'/Gisela_6 Covered (tunnel)	'Rainier'/Gisela_6 Open (no tunnel)
Tree Yield				
(kg/tree)	13.7	25.1	10.0	21.8
(lb/tree)	30.1	55.2	22.0	48.0
[1]*Orchard Yield*				
(mt/ha)	12.2	22.4	8.9	19.4
(ton/acre)	5.4	9.9	4.0	8.6
Fruit Weight				
100 fruit mean (g)	12.5	8.3	12.5	9.3

[1]Tree density is 890 trees/ha (360 trees/acre)

Table 3. 2006 'Rainier' sweet cherry fruit size distribution and crop value with and without high tunnel production systems, CHES (est. 2000)

	'Rainier'/Gisela 5 Tunnel	'Rainier'/Gisela 5 No Tunnel	'Rainier'/Gisela_6 Tunnel	'Rainier'/Gisela_6 No Tunnel
Fruit Size Distribution (%)				
9-Row & larger	73	3	81	9
9.5 to 10-Row	24	39	17	62
10.5 to 11-Row	3	38	2	25
11.5-Row & smaller	1	20	0	4
[2]*Gross Crop Value ($)*				
($/acre)	24,500	24,750	18,650	27,250
[3]*Net Crop Value (Gross value – Harvest cost)*				
($/acre)	19,100	14,850	14,650	18,650

[2]Crop values based on: Export/specialty premium (9-row & larger) $2.50/lb, Domestic premium (9.5 to 10-Row) $1.75/lb, Domestic value (10.5 to 11-Row) $1.00/lb, Processing (11.5-Row & smaller) $0.50/lb

[3]Labor cost to hand-pick based on $0.50/lb

2007 Pollination Options to Improve Fruit Set

- Honeybee hives placed in the tunnel
- A bumblebee hive placed in each (?) tunnel
- Hornfaced bee straws placed in each tunnel