



Growing Brambles in High Tunnels: Prepare for Something Different

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Laura McDermott Cornell University Cooperative Extension ENYCHP Small Fruit Specialist

Cornell Cooperative Extension Eastern NY Commercial Horticulture Program

What we'll cover:

- Why consider High Tunnels?
 Structures
 Cultivars
- Production Guidelines what's different?





For perspective:

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Why Consider High Tunnels?

Advantages

- Extend the season
- Increase overall plant health
- Improve yield
- Improve fruit quality
- Reduce pesticides
- Increase harvest flexibility
- Adapt to a changing climate!!!!

Disadvantages

- More management required
 - Exceptional growth!
- Increased mite pressure
- Different disease problems
 - Powdery Mildew
- Increase in heat related issues
 - Sunburn
 - Double fruit



Observed Trends in 1-day Very Heavy Precipitation (1958 to 2012)

The Northeast has had the greatest increase in heavy precipitation in the United States. Observed Change in Very Heavy Precipitation







The period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall, has increased in each U.S. region during 1991-2012 relative to 1901-1960. NOAA/NCDC / CICS-NC.



Plastic Types and Manufacturers

The table below is not intended to be an exhaustive list, but rather a listing of plastics available to growers in the northeastern U.S. along with some sources to aid growers in locating plastics that they may wish to try. No endorsement of these plastics is intended, and the omission of any tunnel covering simply means that we may not be aware of its availability. Distributors and manufacturers of any high tunnel coverings not listed are encouraged to contact us to be added to our listing.

Click on each plastic type for more information:



Our goal is to produce local berries over a longer season to make them more attractive to buyers and local consumers using the fertile soils and abundant water in the Northeast and Midwest, and where land is less expensive so crop rotation can substitute for fumigation. This approach requires fewer inputs than producing and marketing fruit from specific regions on the west coast. Tunnels also offer a mechanism to buffer the increasing fluctuations in rainfall and temperature experienced by growers over the last 20 years as the climate changes.

High Tunnel Structures

- Single Bay
 - easier to manage for season extension
 - BUT small tunnels leave little room for error
 - May help with overwintering
- Cost for 30 x 100 = ~\$10-20,000
- Flexible for other crops





Rain shelters



Cultivars



Floricane Variety Performance

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Variety	Yield (t/ha) 2010-12	No. 150g Units/ha 2010-12	Mean Wt. (g) 2010-12	Max/Min (g) 2010-12	
Canby	7.6 10.4 3.8	50,700 69,400 25,300	2.9 2.5 2.0	3.8/2.3 2.9/1.5 2.9/1.2	
Encore	8.4 10.4 5.5	56,000 69,400 36,700	3.7 3.3 2.7	4.8/2.7 5.3/1.7 3.6/2.0	
K81-6	8.7 13.0 4.1	58,000 86,700 27,300	4.1 4.0 2.6	5.5/2.7 5.8/2.1 4.0/1.7	
Killarney	9.9 9.6 5.9	66,000 64,000 39,400	2.6 2.6 2.0	3.4/1.9 4.1/1.8 2.6/1.2	
Moutere	10.2 10.1 5.6	68,000 67,400 37,400	2.9 2.8 2.2	5.1/1.9 4.2/1.9 3.5/1.6	
Prelude	7.6 6.5 8.6	50,700 43,400 57,400	2.4 1.9 2.0	3.1/1.9 2.5/1.6 2.6/1.3	~
Titan	6.8 7.9 1.7	45,400 52,700 11,300	3.9 3.4 2.2	4.9/3.1 5.7/1.4 3.6/1.4	Co Co Co

Dr. Weber,

Prelude

- Mid-late June
- Good flavor
- Firm, round
- Double cropping potential
 - Primocane fruit is larger
- Vigorous
- PRR resistant
- Cornell variety



Encore

- Large firm fruit
- Good flavor
- Late July into August
- Susceptible to PRR
- Cold damage from fluctuating temperatures
- Aphid resistant
- Cornell variety





K81-6

- Late season
- Very large, moderately firm fruit
- Good eating quality
- Good cold hardiness
- Susceptible to raspberry fireblight
- Nova Scotia variety



Primocane Variety Performance

Variety	Yield	No. 150g	Mean Wt.	Max/Min
	(t/ha)	Units/ha	(g)	(g)
	2009-11	2009-11	2009-11	2009-11
Autumn Britten	7.6	50,800	3.1	3.8/2.3
	7.2	48,300	3.0	3.9/2.0
	5.8	38,900	3.0	3.6/2.2
Caroline	11.6	77,600	2.5	3.4/1.7
	12.3	82,000	2.6	3.8/1.7
	8.9	59,830	2.5	3.5/1.8
Himbo Top	9.8	65,366	3.0	4.5/2.1
	10.7	71,302	3.0	3.9/2.2
	9.4	63,032	2.8	3.4/2.3
Jaclyn	11.7	77,839	3.1	3.9/2.3
	4.8	32,149	2.9	3.8/2.4
	6.0	40,287	2.9	3.3/2.6
Joan J	14.9	99,400	2.9	5.0/1.9
	15.6	104,300	3.1	4.0/2.2
	12.5	83,800	2.7	3.7/2.0
Polka	11.6	77,600	2.6	3.4/1.9
	9.4	63,000	3.0	4.0/2.2
	8.1	54,500	3.0	3.4/2.2
Heritage	8.4	56,200	2.1	3.0/1.6
	10.8	72,200	1.8	2.8/1.0
	8.6	57,700	2.3	2.8/1.2

Raspberry Harvest Timing

<u>Variety</u>	June	July	August	September	October	November
Prelude	X-			X		
Killarney)	х				
Canby		·x				
Moutere		X				
Encore		x				
Titan		x	-			
K81-6		X				
Autumn Britten			X-			
Polka			x			
Joan J			>	<		
Jaclyn)	(
Himbo Top			;	x		
Caroline				·X	-	
Heritage				X		

Raspberry Harvest Timing



Autumn Britten

- Early season fall
- Large fruit
- Medium red
 - Darkens with storage
- Firm with good flavor
- Very good fruit quality
 - Relatively low yield
- Sparse cane producer
 - Plant at higher density
- UK variety



Polka

- Vigorous upright canes
- Very high flavor
- Bright red fruit
 - Darkens after harvest
- Potato leaf hopper stunting can be a problem
 Polish variety



Himbo Top

- Bright red fruit
- Good productivity
- Can be soft w/ high temperatures
 - Large cavity
- Long, weepy fruiting laterals
 - Requires extra trellising
 - Tying may be necessary
- Long production season
 - Possible double crop
- Swiss variety



Joan J

- Very productive
- Very firm
 - Pasty or jammy
- Dark red fruit
- Large conic shape
- Thornless
- Often too short for double crop
- UK variety



Heritage

- Very good fruit quality
- Small/medium size
- Good flavor
 - Freezes well
- Fall bearing standard
- Very upright canes
- Cornell variety



Crimson Giant

- Very large conic fruit
- Very late season
 - Continues 30 d after Heritage
- Good color and flavor
- 9/17/11 1st harvest-11/7/11 final harvest
 - Mean 3.8 g
- Cornell variety





Crimson Night

- Mid to late primocane fruit
- Dark red conic fruit
- Very sweet distinctive flavor
- Makes dark red jam
- Excellent frozen quality
- Cornell variety



- Peach colored conic fruit
 - Freezes pink
- Fairly soft
 - Local sales
- Outstanding flavor
- Very tall, upright plants
 - Suitable for double cropping
- Cornell variety

Courtesy Dr. Courtney Weber, Cornell

Double Gold



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Crimson Treasure

- Large, firm, bright red, conic fruit
 - 3 to 6 g
- Good flavor and shelf life
- High yield
 - 13-15 t/ha
- Long harvest period
- Upright, self supporting canes
 - Relatively short
- Cornell variety



Additional Variety Evaluations

Primocane

- Anne (weepy, soft)
- Rosanne (powdery mildew)
- BP-1 (dark)
- Niwot (black PF) (double fruit, powdery mildew)
- Josephine (crumbly, dark)
- Nantahala (powdery mildew)

Floricane

- Nova (small)
- Lewis (PRR/cold damage)
- Squamish (PRR)
- Tulamagic (dark, poor form)
- Latham (small, soft)
- Tulameen (cold damage, PRR)
- Royalty (purple) (dull, soft)
- Octavia (poor flavor & quality)
- Cowichan (PRR)

Soil compaction and soil biological activity in tunnels



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Soil moisture and Soil pH

- Soil moisture in the open field is variable across the season.
- Soil moisture in tunnels can be more tightly regulated so risk of root disease should be low, unless the site is predisposed to accumulating water from runoff. Site selection and design are critical for reducing this risk.
- Soil pH can decrease over time as cations are leached out of the soil through rainfall and irrigation. This is particularly true on lighter soils. Supplemental lime eventually may be required.
- Within high tunnels, soil pH can increase over time as cations accumulate in the root zone and are not leached by rainfall. This is particularly true if hard water is used for irrigation. Organic matter additions also can raise pH inside tunnels.



Pest Problems

- Far fewer weeds
- Mites and potato leafhopper
- Little fruit rot, but some foliar disease
- Existing soil Borne disease like Verticillium – but much less Phytophthora!



Fertility

- Test and amend soil prior to planting
- Foliar testing annually
 - Timing critical when leaf expansion has ceased but before plants senesce
- Soil testing every 2-3 years or in problem areas

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Сгор	Age of planting	Amount <i>/timings</i> (actual N)	N source	Comments			
Raspberries (summer-bearing)							
	0	25-35 lb/A, 4 weeks after planting	calcium nitrate	Avoid touching plants with fertilizers after planting.			
	1	35-55 lb/A, in May or split between May and June	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.			
	2+	40-80 lb/A, in May or split between May and June	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.			
Raspberries (fall-bearing)							
	0	25 lb/A, 4 weeks after planting	calcium nitrate	Avoid touching plants with fertilizers after planting.			
	1	50-80 lb/A, split between May and June	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.			
	2+	70-100 lb/A, split between May and June	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used. Adjust with leaf analysis.			

From Cornell Pest Management Guidelines for Berry Crops







C. Weber C. Weber

- Insects
 - Mites
 - Potato Leaf Hopper
 - Spotted Wing Drosophila









Potato Leafhopper Adult

Foliar Symptoms of PLH

- Economic threshold/monitoring

 no explicit thresholds
 monitor frequently
- Damage
 - distorted leaves, yellowing, stunted growth

POTATO LEAFHOPPER



Potato leafhopper northern migration in spring (from Elson Shields, Cornell)



Pest Management

• Insects

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• Spotted Wing Drosophila







Exclusion Netting



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Air Assist Sprayers Backpack Manufacturers include:

- Cifferelli
- Solo
- Stihl

Boom sprayer Manufacturers include:

- Airtec
- CIMA
- Hardi

Single Sided Manufacturers include:

Bdi Machinery Sales





Pruning Objectives

- Increase productivity
- Improve fruit quality
- Reduce impact from pests
- Increase planting longevity
- Improve harvest labor efficiency





Floricane Removal and Cane Thinning

- Reduce insect & disease pressure
- Increase light, air & spray penetration throughout the canopy
- When removed immediately after harvest:
 - summer nutrients goes to next years cane
 - Forces farmer to pay attention to plants
 - Remove infested or infected plants, otherwise shred and incorporate into planting.

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Cross Arm Trellis (blackberries)

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<u>https://www.tunnelberries.org/</u> <u>https://blogs.cornell.edu/berries/</u> <u>https://climatechange.cornell.edu/</u>

QUESTIONS?

