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MSU EXTENSION 2016 BEGINNING FARMER WEBINAR SERIES

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TWENTY THREE EVENING WEBINARS FOR PEOPLE WANTING TO 'GET STARTED' FARMING

February 8, 2016 7:00pm EST

Growing Raspberries in High Tunnels

Growing Raspberries in High Tunnels

Eric Hanson, Department of Horticulture, MSU

1. Raspberries – a review
2. What are high tunnels?

Break for questions

3. Why use them for raspberries?
4. How to do it.

Concluding questions

Raspberries

Red Raspberries
(*Rubus idaeus*)
‘Anne’ ‘Prelude’ ‘Heritage’

Black Raspberries
(*R. occidentalis*)
‘Jewel’ ‘Cumberland’

Purple Raspberries:
(*R. occidentalis* x *R. idaeus*)
‘Brandywine’ ‘Royalty’

Raspberry Fruiting Habits

Floricanes – 2nd year cane
(fruit in July)

Primocanes – 1st year canes
(fruit in fall)

Primocane fruiting varieties produce a crop in the fall. If canes are over-wintered, they produce a second (floricane) crop in July.

Double cropping primocane fruiting raspberries:

Canes die back during the winter to where they stopped fruiting in the fall. Lower floricane buds develop fruit in July, and new primocanes fruit in the fall.

Remnants of fall fruit

Basal floricane buds will develop fruit in July.

High tunnels are plastic covered hoop-houses that are generally:

-low cost (relatively)
-no foundation
-unheated

1. Stand-alone Tunnels

quonset- or gothic-shaped

2. Multi-bay or “three-season” high tunnels

Nor-Easter 30 x 96 ft structure

(Heidenreich et al. www.fruit.cornell.edu/berry.html)

Initial Investment:	
Package and other materials	$ 7,840
Poly	$ 150
Construction labor	$ 1,660
	$ 9,650

Annual costs:	
Tunnel depreciation (10 yr)	$ 970
Poly depreciation (3 yr)	$ 50
Interest on frame and poly @ 7%	$ 640
Monitoring and venting poly	$ 150
	$ 1,810

or **$0.63/ ft^2**

One-Acre Haygrove Tunnels

(Von Weihe et al., 2009)

Initial Investment:

Tunnel frames	$ 34,000
Poly	$ 8,000
Construction labor (200 hr @ $10/hr)	$ 2,000
	$ 44,000

Annual costs:

Tunnel depreciation (15 yr)	$ 2,300
Poly depreciation (3 yr)	$ 2,700
Interest on frame and poly @ 7%	$ 2,900
Install, vent, and remove poly	$ 1,200
	$ 9,100 or $0.21 / ft^2

Tunnels??
Which kind??

?

Small area – small investment

Greater season extension

Grow less hardy varieties(?)

Lower cost per ft^2

Management of soil salts

Greater risk of wind damage(?)

www.tunnelberries.org

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USDA
United States Department of Agriculture

Optimizing Protected Culture Environments for Berry Crops

Research and Extension Project

Providing growers with the knowledge needed to select tunnel structures and plastics that optimize productivity and pest management, while increasing profits and minimizing plastic waste generation.

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High Tunnels for Extended Growing Season

High Tunnels are temporary structures that provide some crop protection and environmental modification at a relatively low cost. Unlike greenhouses, high tunnels are ventilated by raising the sidewalls. Types of high tunnels include:

Hoophouse or Quonset style:

- Rounded roof profile
- Can collect snow so space arches close enough to bear the weight of snow.
- Sidewalls can be rounded or straight. Straight sidewalls provide space for taller crops.

Gothic style:

- Peaked roof, sheds snow more easily. Straight side walls.
- Higher profile for taller crops and more stable temperatures in warmer months
- Must have braces and purlins to withstand wind.

Multi-Bay High Tunnels:

/project-researchers.html

Site Considerations

North – South orientation for best light distribution

With slopes for water and air drainage

Position for wind protection

Provide drainage to remove water from the tunnel

Benefits of high tunnels

1. Season extension
   - supply reliable volumes when prices are strong
2. Improved production and quality
   - protect from the weather and optimize growing conditions
3. Suppress diseases and some insect pests

Drawbacks

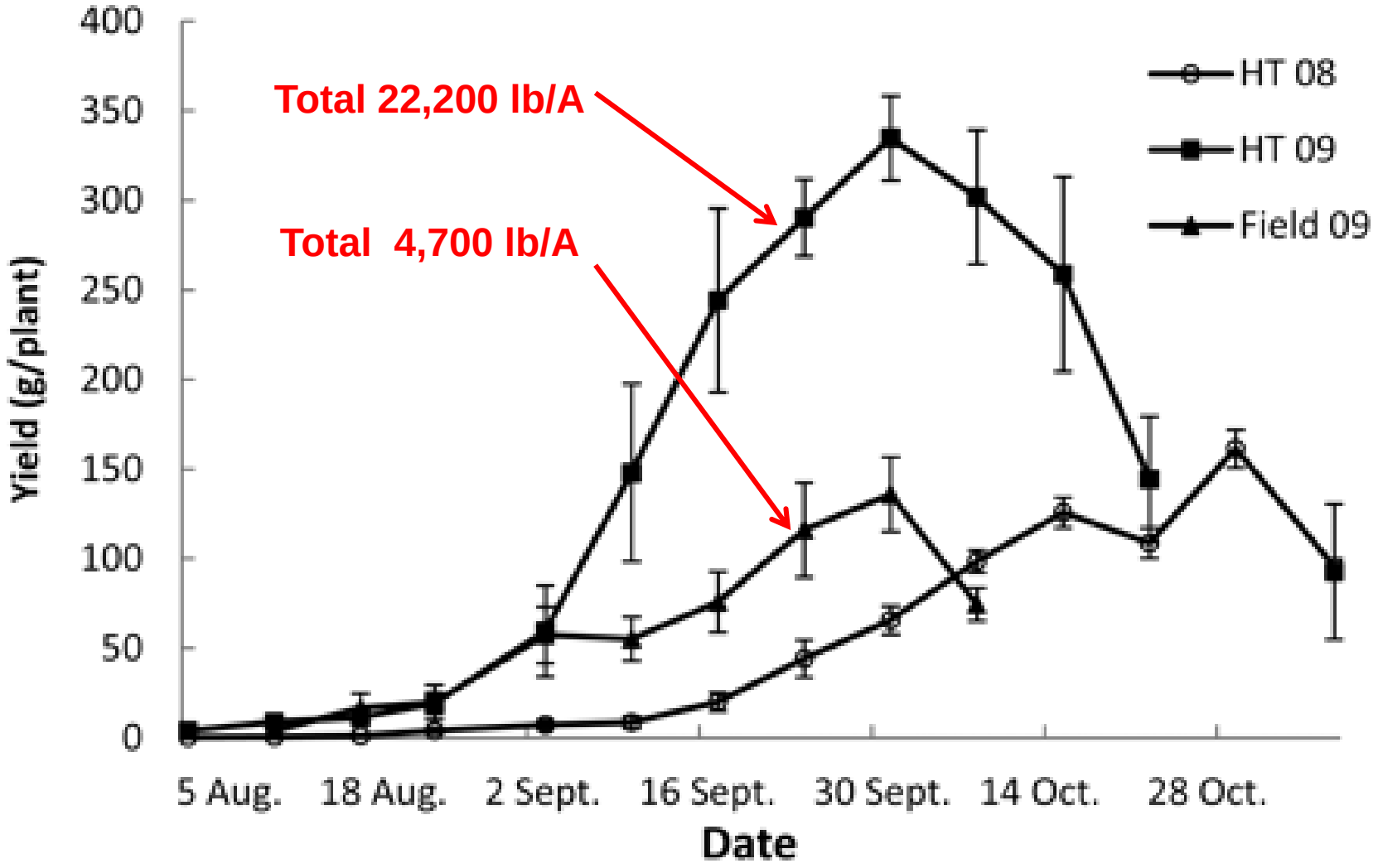
1. Cost
2. Management cost and learning curve
   - poly installation/removal, venting
3. Risk of damage from weather.

High tunnel raspberries and blackberries, PSU (K. Demchak)

Primocane-fruiting raspberries in stand-alone tunnels in MN:
-greater vigor, yield and berry size
-issues with temperature management, venting in summer and supplemental heat for late fall.

(Hoover and Poppe, University of MN)

Production of 5 primocane fruiting raspberry varieties in a stand-alone high tunnel (2008, 2009) and in the field (2009). Grand Rapids, MN (Zone 3b). From: Yao and Rosen, HortTechnology 21:429-434.



Raspberry trials at the Southwest Michigan Research and Extension Center, Benton Harbor, 2005-2009.

June 14, 2007

June 14, 2007

Tunnel Raspberries, SW Mich.

1. Harvest begins earlier and continues later.
2. Yields were twice field yields.
3. Berries 20-25% larger, much less rot.
4. Less anthracnose, leaf spot, Japanese beetle and leaf hoppers, but <u>more</u> spider mites in tunnels.

<u>Autumn Britten</u>

Tunnel Field

<u>Caroline</u>

Tunnel Field

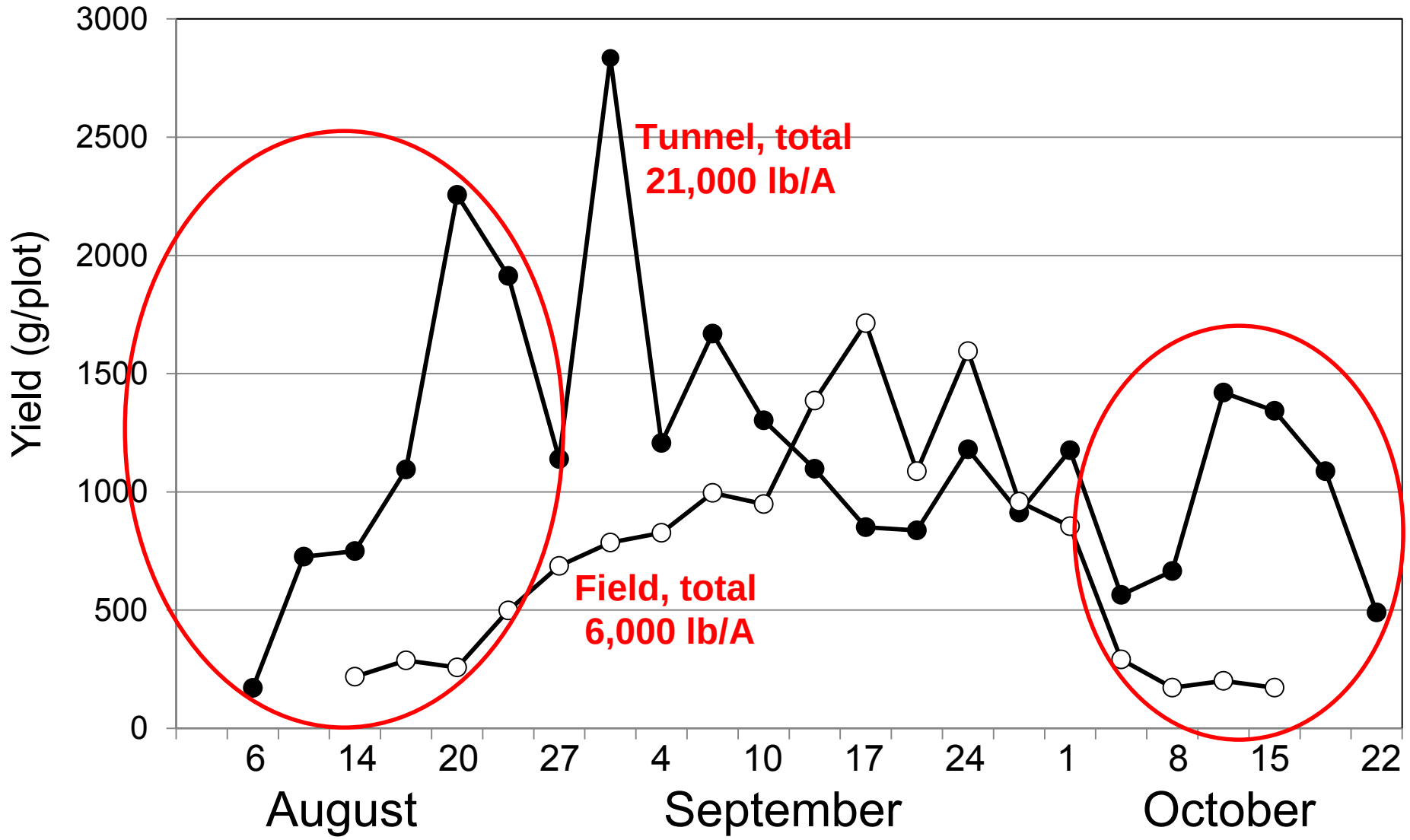
Yield (1,000 lb/acre) of primocane fruiting raspberries in a 3-season high tunnel and the open field, southwest MI.

	Tunnel			Field		
Variety	2005	2006	2007	2005	2006	2007
Autumn Britten	1	15	11	1	5	5
Caroline	3	21	25	1	8	11
Chinook	1	13	13	0	4	3
Heritage	2	16	22	1	4	11
AVERAGE	**2**	**14**	**14**	**1**	**4**	**7**

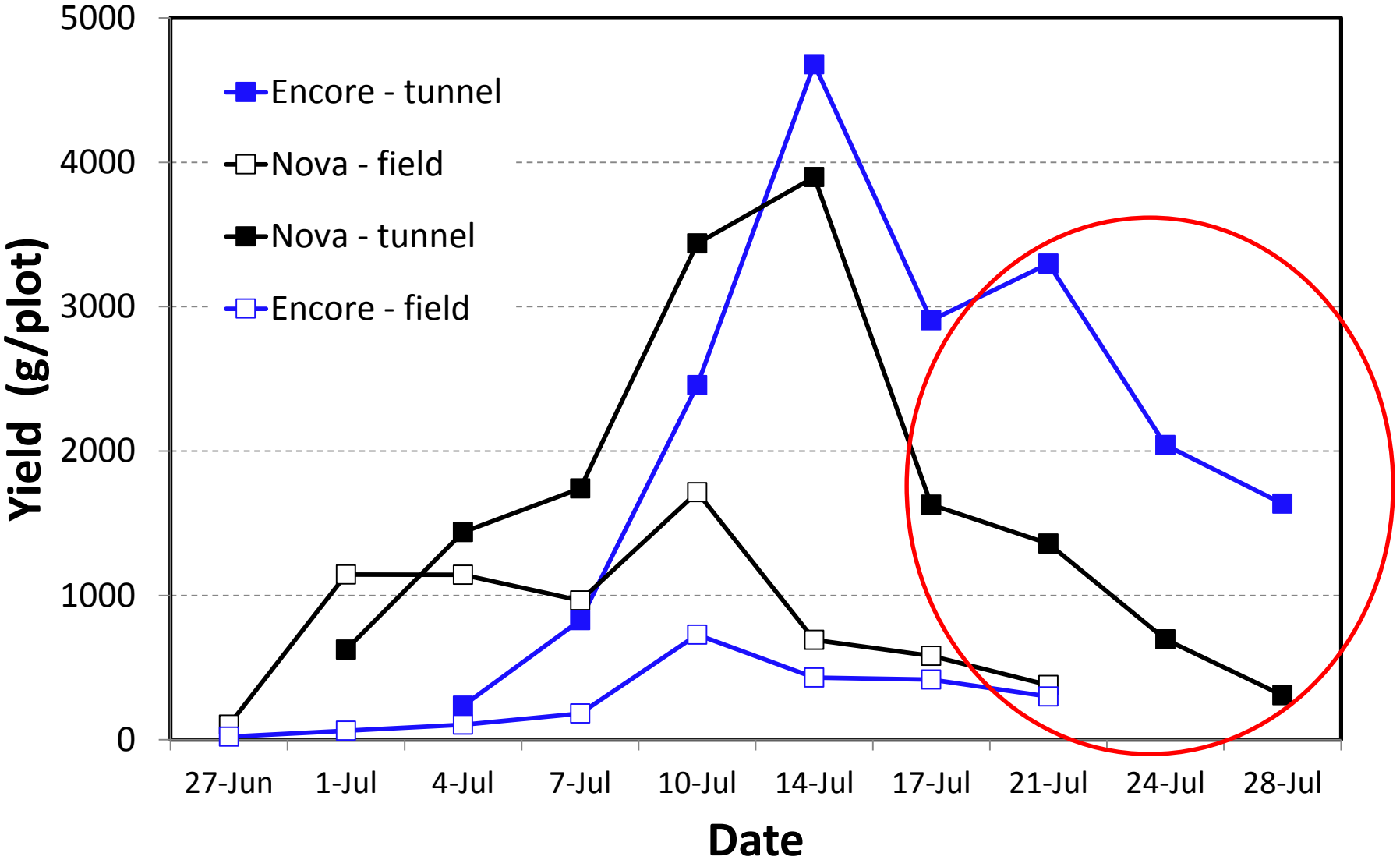
Yield (1000 lb/acre) of floricane fruiting raspberries in a 3-season tunnel and the open field, southwest MI.

	Tunnel			Field		
Variety	2006	2007	2008	2006	2007	2008
Canby	3	26	18	1	5	3
Encore	2	20	19	1	5	5
Heritage	1	5	8	0	3	3
Nova	4	26	18	3	13	9
AVERAGE	**3**	**19**	**16**	**1**	**6**	**5**

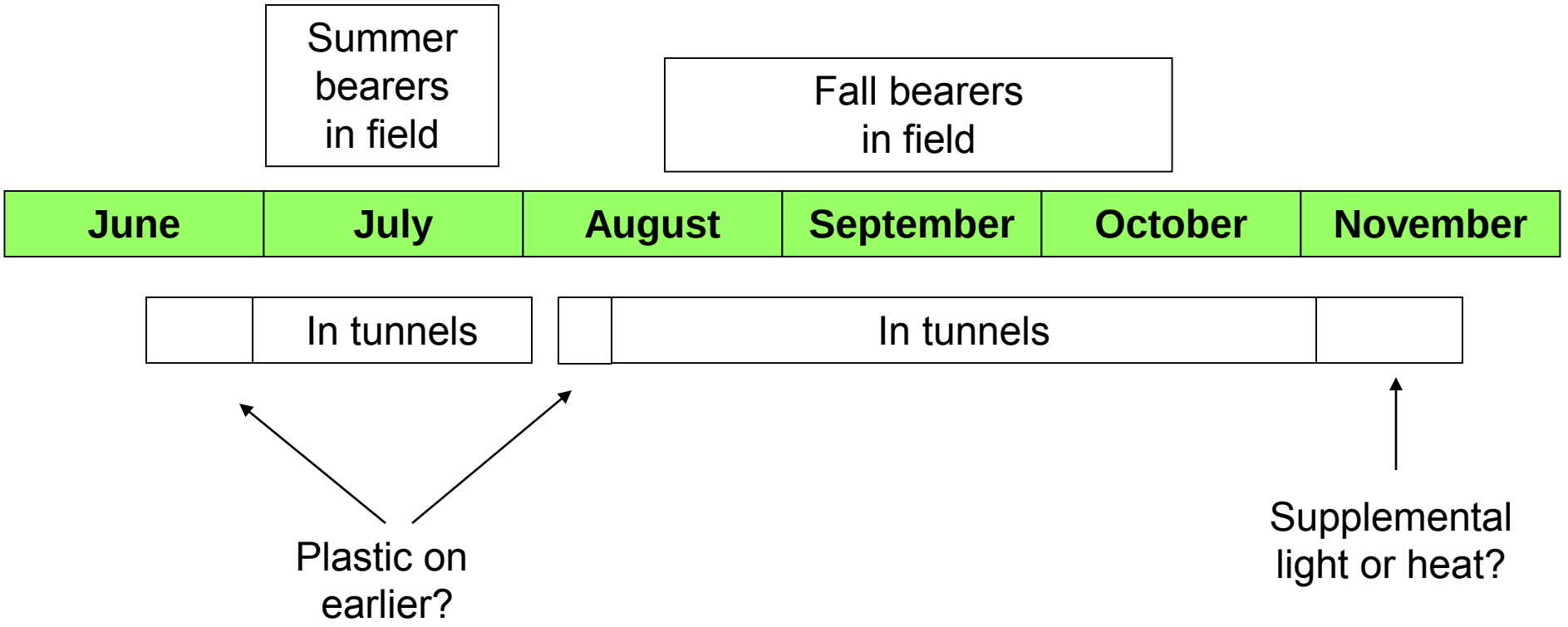
Yields of ‘Caroline’ primocane fruiting raspberries in tunnels and the field, Benton Harbor, MI, (Hardiness Zone 6b), 2007.



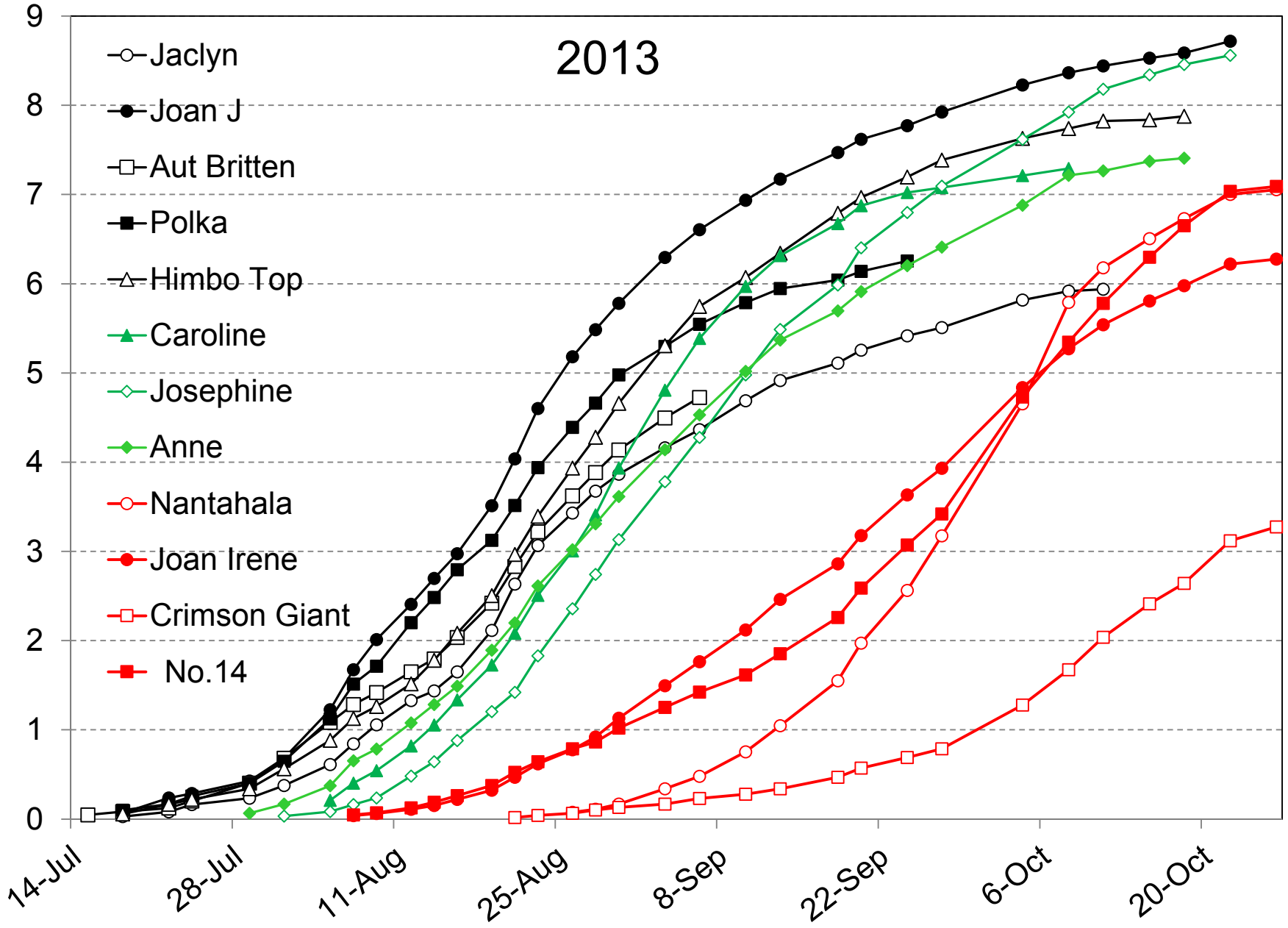
Summer Raspberry Yields, Benton Harbor MI, 2008



Raspberry Picking Seasons – SW Michigan



Cumulative yield (kg/plot) of potted raspberries in a high tunnel, Benton Harbor, MI

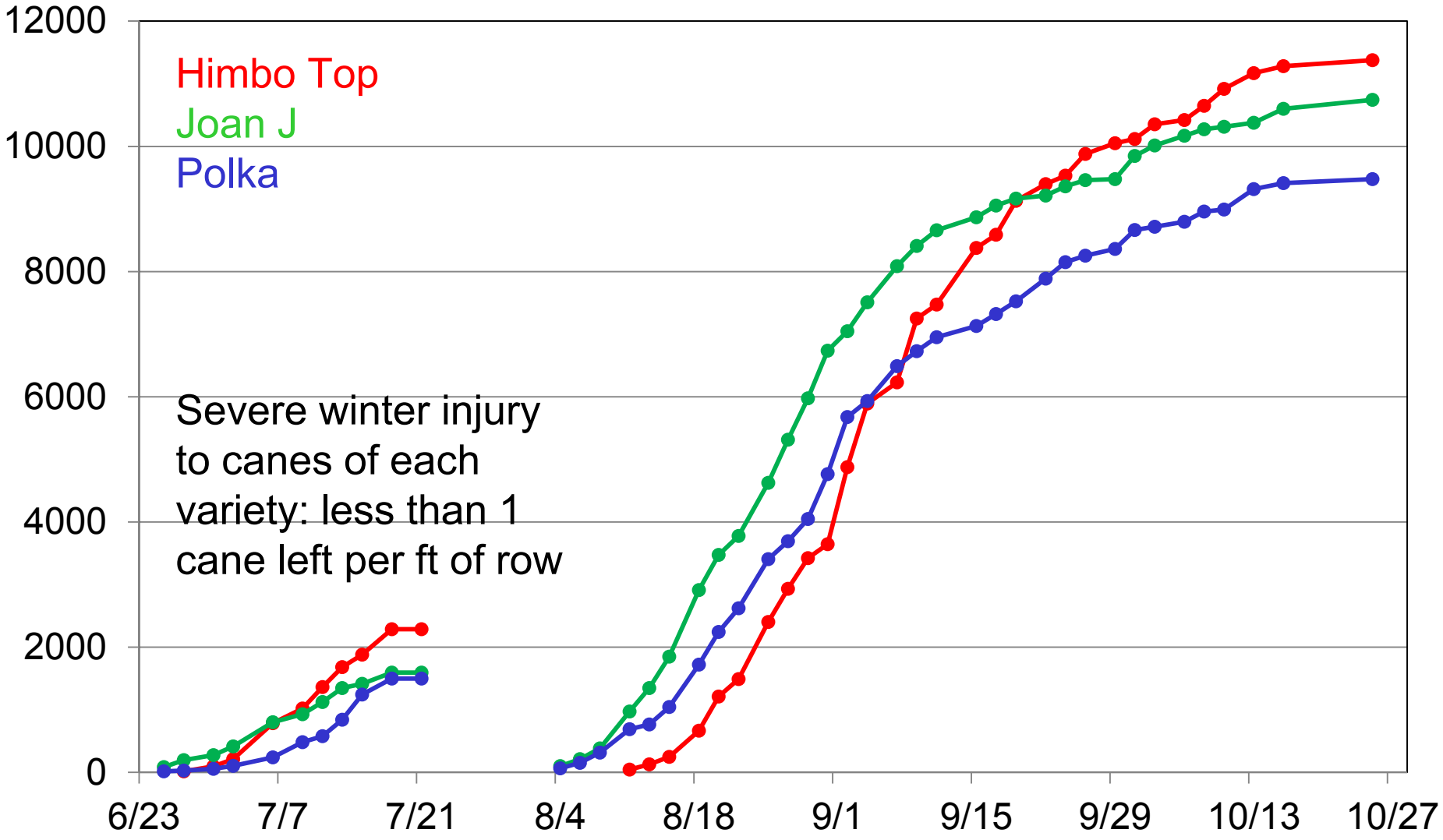


‘Heritage’ Double Cropping Study

NY, 2008 (M. Pritts, Cornell University)

	Cane management	Crop	Size (g/berry)	Yield (g/meter)	Marketable (%)
Field	Double-cropped	Summer	1.90	1,637	63.2
		Fall	2.26	4,761	66.8
		Total	**2.20**	**6,399**	**65.9**
	Single-cropped	**Fall**	**2.19**	**3,510**	**62.8**
Tunnel	Double-cropped	Summer	1.69	2,371	72.2
		Fall	2.16	5,685	83.5
		Total	**2.09**	**8,056**	**80.1**
	Single-cropped	**Fall**	**2.16**	**5,585**	**86.2**

Cumulative summer and fall yield (lb/acre) of three raspberry cultivars under high tunnels in East Lansing, MI, 2014.



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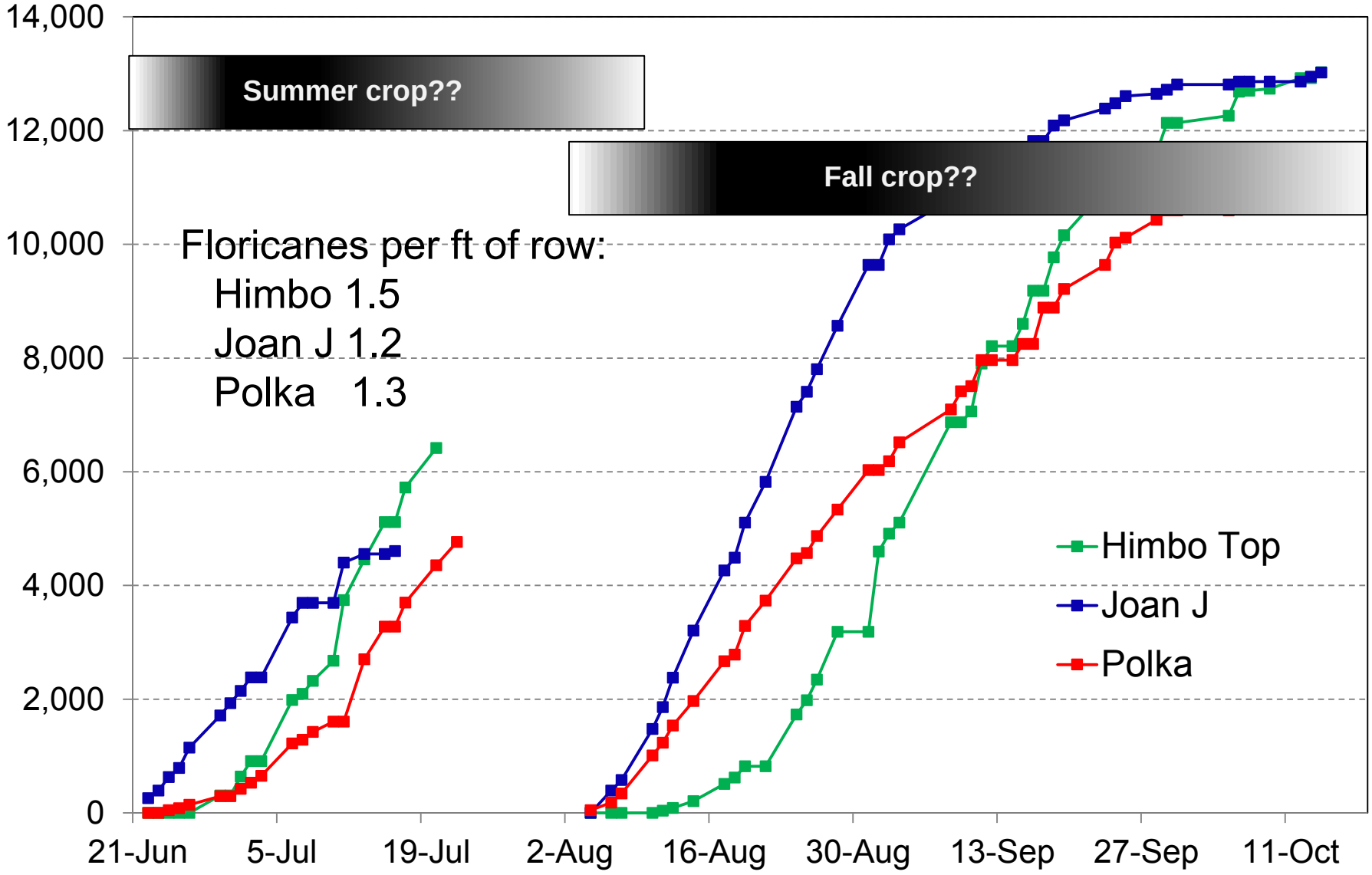


Questions or comments so far??

Choosing Varieties

Primocane fruiting:

- High quality and yield
- Season
- Double cropping?
- Market needs

Flouricane fruiting:

- Hardiness
- High quality and yield
- Season
- Market needs

Jaclyn Anne Caroline Joan J Himbo Top

Crimson Giant Josephine Polka Nantahala Joan Irene

Observations of raspberry varieties in Michigan are summarized in this publication, available on www.tunnelberries.org.

RASPBERRY VARIETY CHOICES FOR MICHIGAN

Eric Hanson, Department of Horticulture , Michigan State University and
Diane Brown-Rytlewski, Fruit Educator, Michigan State University Extension

Many raspberry varieties are available today. This fact sheet reviews the strengths and weaknesses of older varieties and provides descriptions and initial observations of some new varieties. Summer-fruiting (floricane-fruiting) and fall-bearing (primocane-fruiting) types are described separately.

SUMMER-FRUITING REDS

BOYNE Manitoba, Canada, 1960. (Chief X Indian Summer). This older red fruited variety has been used in colder areas due to its extreme hardiness. Berries are flavorful and ripen early, but tend to be dark, small, and soft, but flavorful. Freeze well. Plants have moderate vigor with thorny, upright canes, and some tolerance of Phytophthora root rot. Boyne is a good choice for home use or PYO in cold locations.

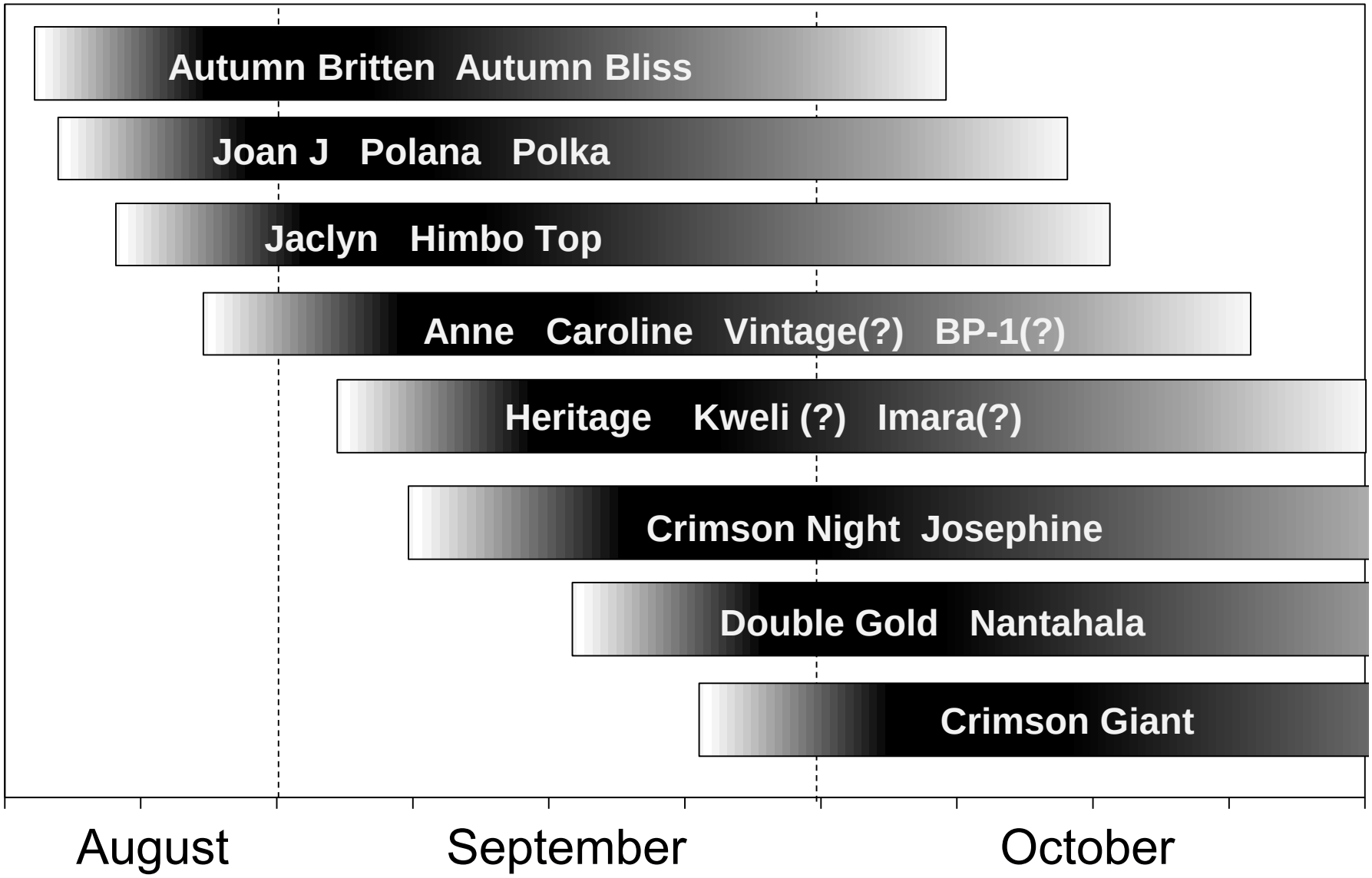
CANBY Oregon, 1953. (Viking X Lloyd George). This variety has been used for many years for fresh fruit in warmer Michigan locations. Berries ripen in the early midseason, with excellent flavor, a light red color, and moderate firmness. Plants have moderate vigor and resistance to aphids and some viruses. Canes are thornless, marginally hardy and susceptible to crown gall and *Anthracnose*.

ENCORE New York, 1998 (Canby X Cherokee). This season variety has become popular throughout Michigan and much of the Midwest because it is relatively hardy and produces large, firm fruit with very nice flavor. It is probably the best late season variety for commercial growing. Plants are vigorous and sucker freely. Encore produced numerous double berries grown as potted plants in high tunnels.

Fig. 1 Double berry on 'Encore' in high tunnel pot culture

HAIDA Vancouver, BC, 1973 (Malling Promise X Creston) is a late midseason variety that has been grown to some extend in the Midwest, although it is just marginally hardy for colder sites. Fruit are, medium to large with good firmness, and are suited for fresh and processed uses. Plants produce numerous spiny, upright canes and have resistance to raspberry aphid and spur blight.

General harvest times for primocane raspberries in high tunnels in southern Michigan. Relative harvest volumes increase with bar darkness. Varieties followed by (?) are only estimated.



Floricane-fruiting varieties (early to late)

Prelude: hardy, high yields, good flavor, medium firmness and size (some primocane fruit)

Nova: very hardy, high yields, medium flavor, medium to large, very firm (some primocane fruit)

Encore: hardy, very high yields, exc flavor, firm and large

Primocane fruiting varieties (early to late)

Polka: large bright red fruit, high yields,
but: attractive to leaf hoppers, Jap. beetles

Joan J: large, firm fruit with exc flavor, high yields
but: very dark color

Jaclyn: large, firm fruit with exc flavor,
but: modest yields, dark color, hard to pick

Himbo Top: large bright red fruit, high yields,
but: softer

Primocane-fruiters (cont.)

Caroline: medium-large, exc flavor, v high yields
but: softer

Anne: medium-large, exc unique flavor, high yields
but: slightly more gray mold

Josephine: very large, firm fruit with exc flavor,
but: dark color, later maturing

Nantahala: firm with exc flavor, high yields,
but: later maturing

Row spacing – not closer than 7 feet

Tunnels exclude rain so irrigation is essential
Trickle systems are best

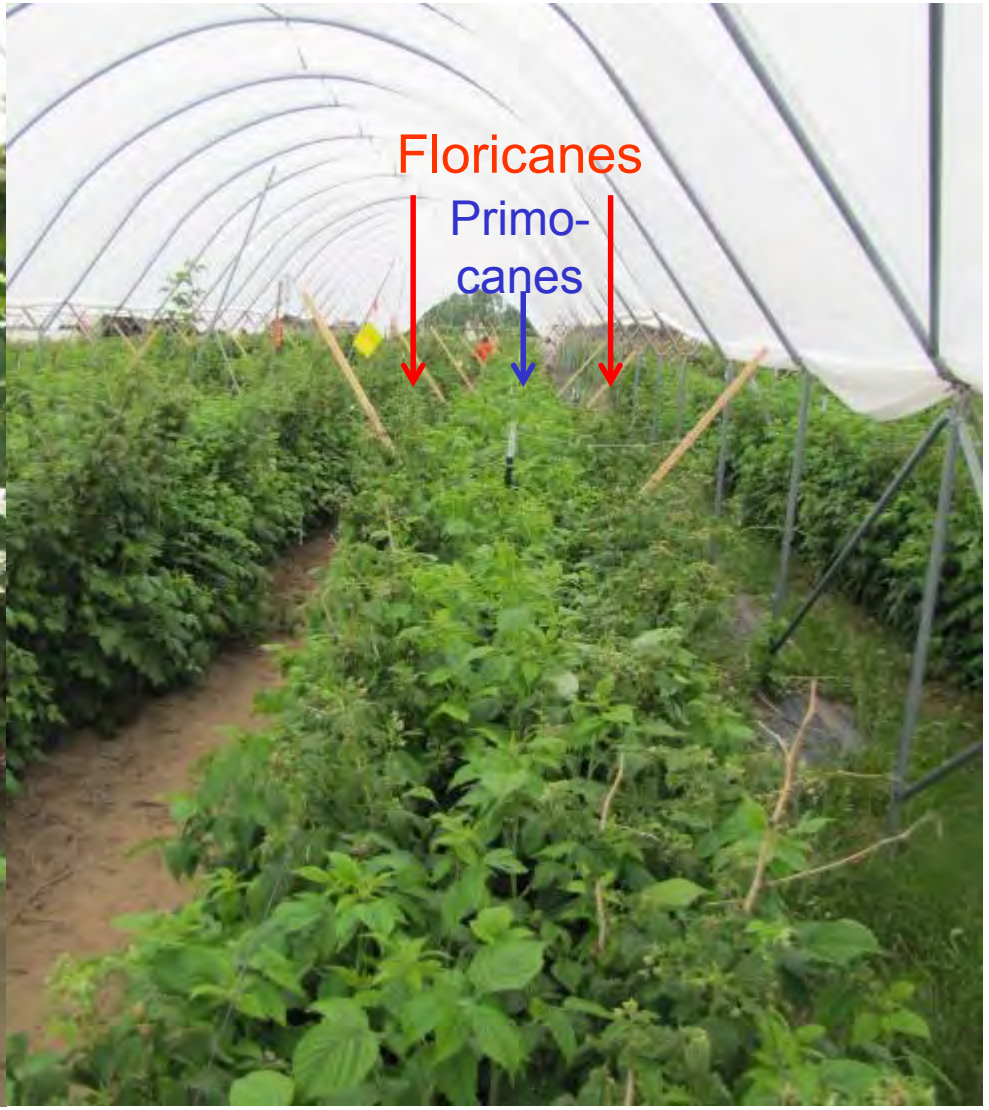
Trickle systems can also be used to fertigate plants

Weed Management

Between rows tilled twice per year.
Within rows hand weed twice per year or managed with herbicides

V-trellis to space and separate canes

Fence post/wood flashing, monofilament wire



Raspberries prefer mild temps (70s, low 80s).
Provide for ventilation

Venting –Tunnel temperatures compared to outside temperatures at 5 ft height

Fully vented

(August 7-31)

Daily min.	Daily max.
+ 0.4 F	+ 1.7 F

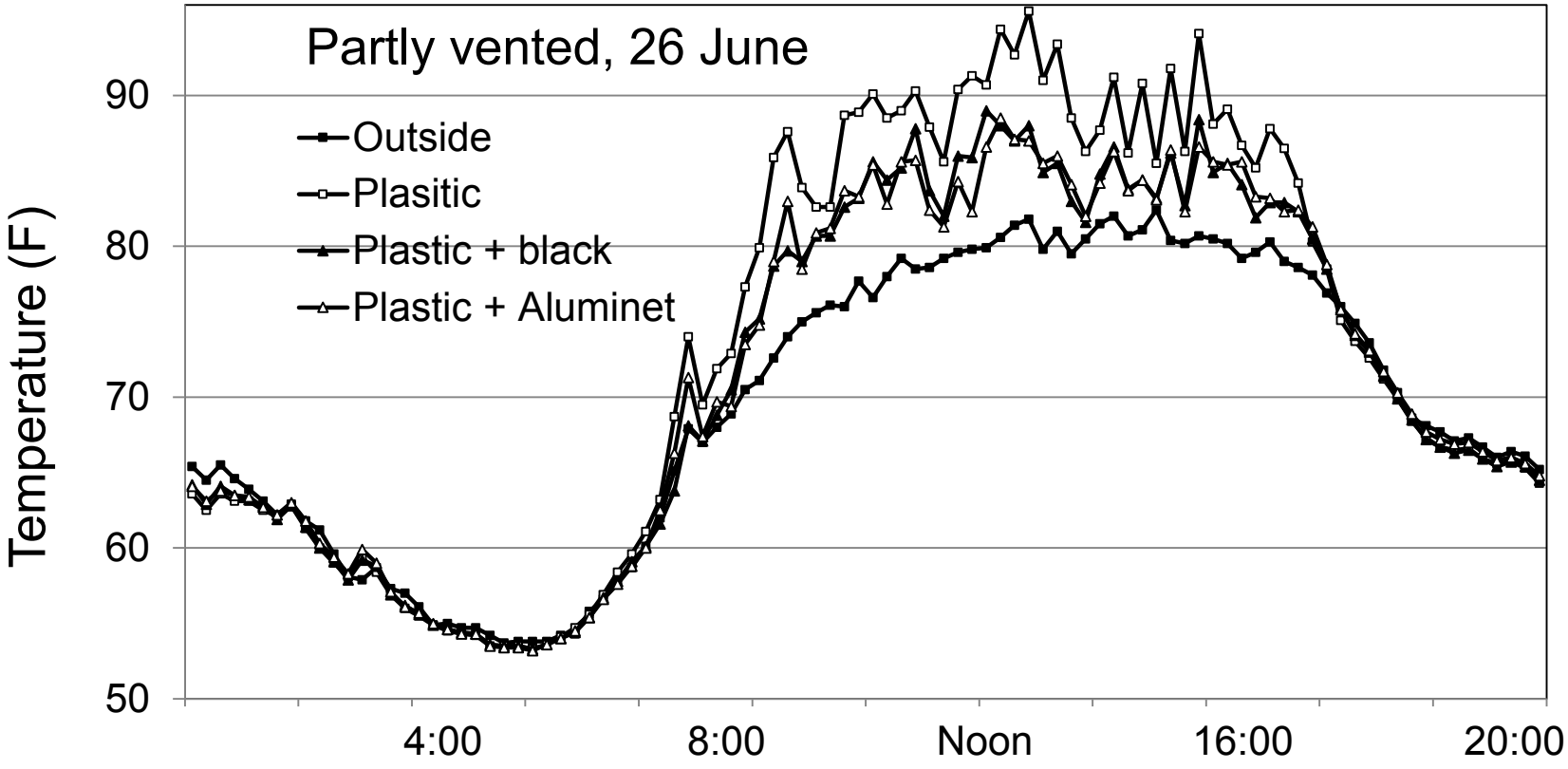
Closed except for ends

(Sep 8-19)

Daily min.	Daily max.
+ 0.4 F	+ 5.0 F

Black 30% shade

Aluminet 30%



Raspberries need bees for pollination

Honeybees do not like working under tunnels, but they will because they love raspberry flowers.

Honeybees and native bees may adequately pollinate small tunnels, but bumblebee hives are good insurance for larger tunnels.

Gray mold cause by the fungus *Botrytis cinerea* is a common pre- and post-harvest fruit rot.

Control is achieved with fungicides, timely harvest, and keeping plants dry with high tunnels.

Primary Pests – Michigan High Tunnels

Japanese beetle
Popillia japonica

Potato leafhopper
Empoasca fabae

Raspberry sawfly
Monophadnoides geniculatus

Raspberry cane borer
Oberea bimaculata

Two spotted spider mite
Tetranychus urticae

Spotted wing drosophila
Drosophila suzukii

Two spotted spider mites

(*Tetranychus urticae*)

Can be very severe in hot, dry conditions

Some pesticides (pyrethrum) increase populations

<u>Management</u>:

Vent to cool tunnels

Release predatory mites:

- *Phytoseiulus persimilis*
- *Amblyseius californicus*

Avoid pyrethrum sprays

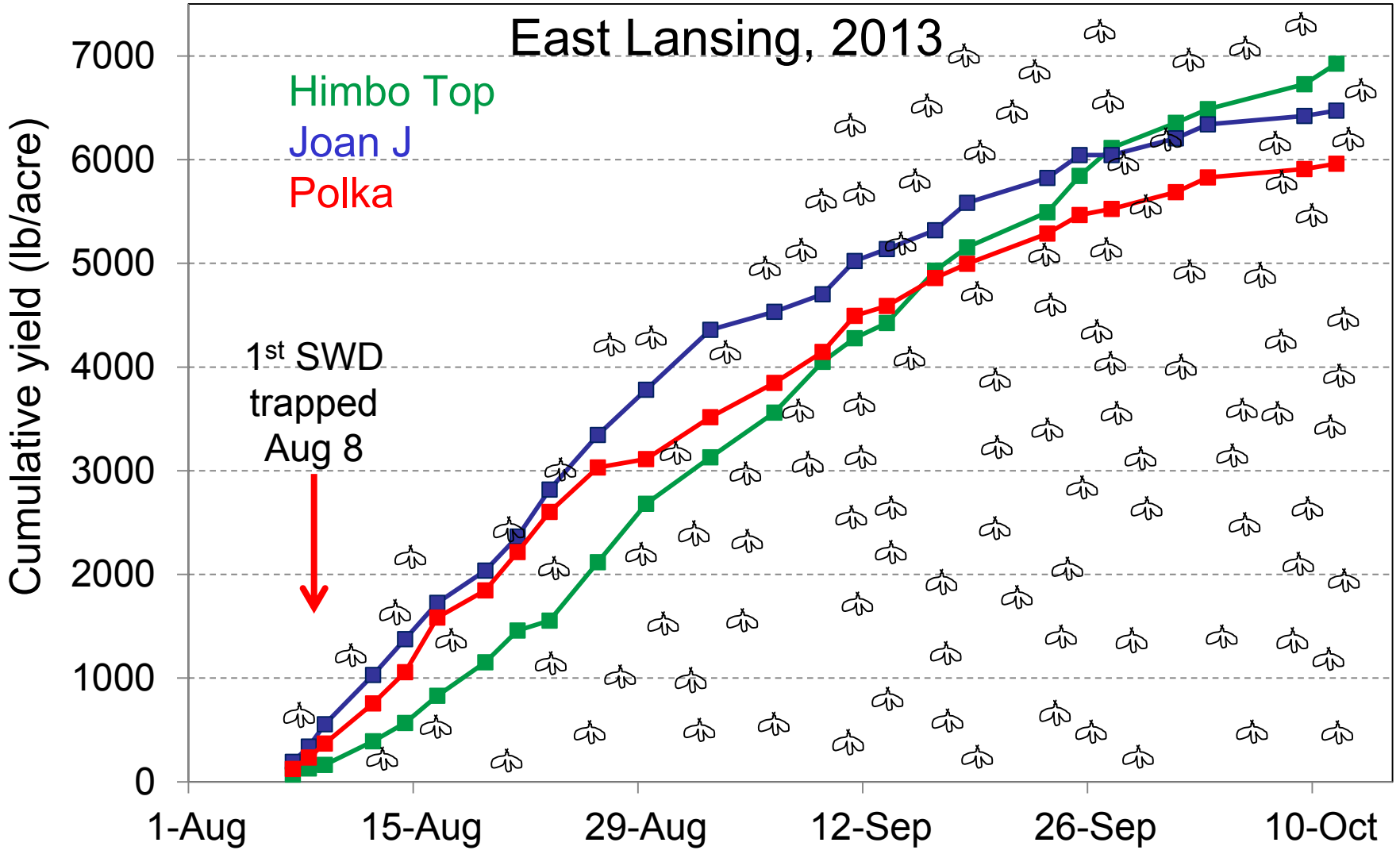
Spotted wing drosophila

New pest of raspberries and other fruits.
Flies lay eggs in ripening berries.
Larvae feed on and destroy berries.
Juice and stained caps indicate infestation.
Populations grow rapidly.

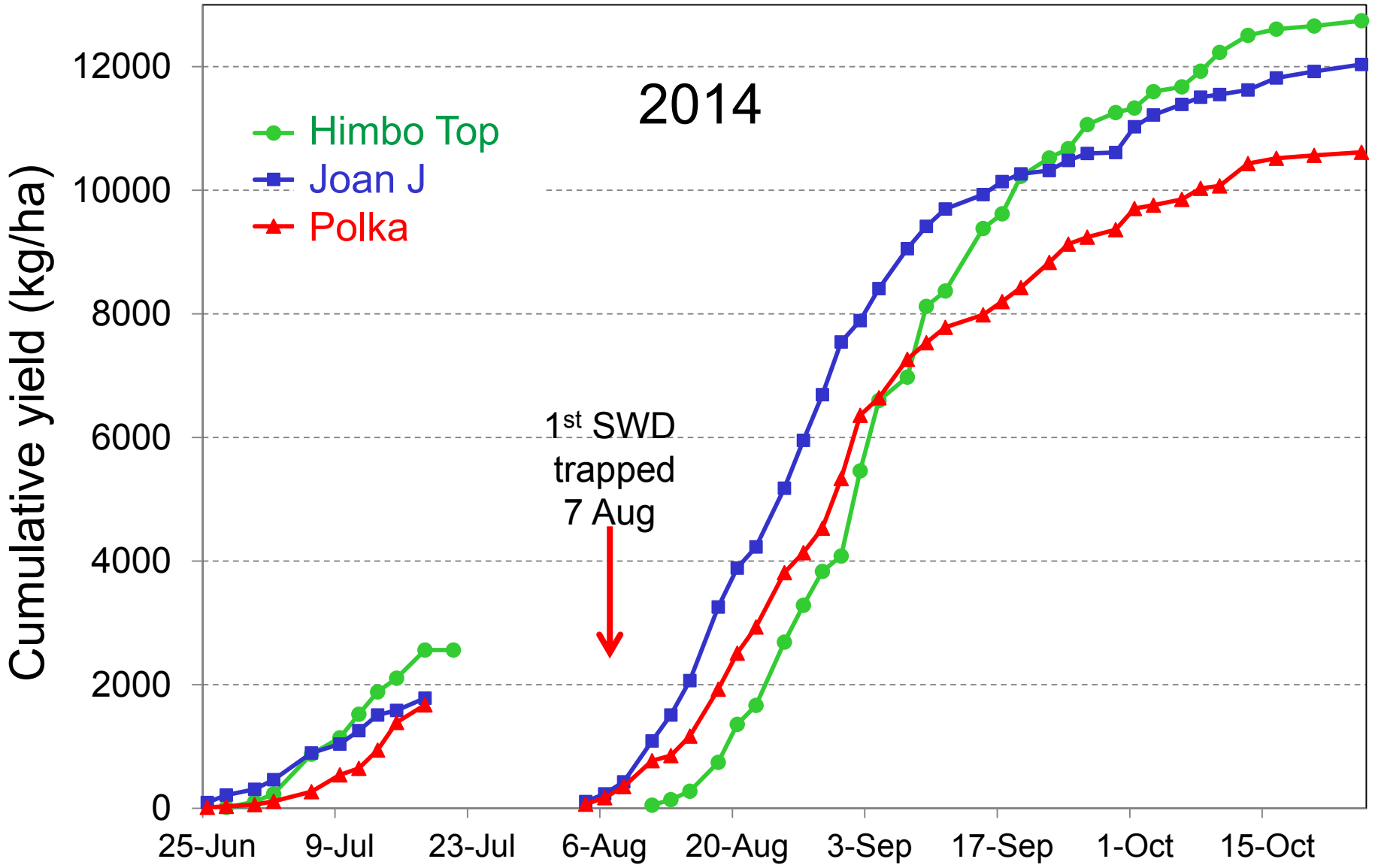
Management:

Thorough, frequent harvest.
Proper pruning/training
Timely pesticide use.

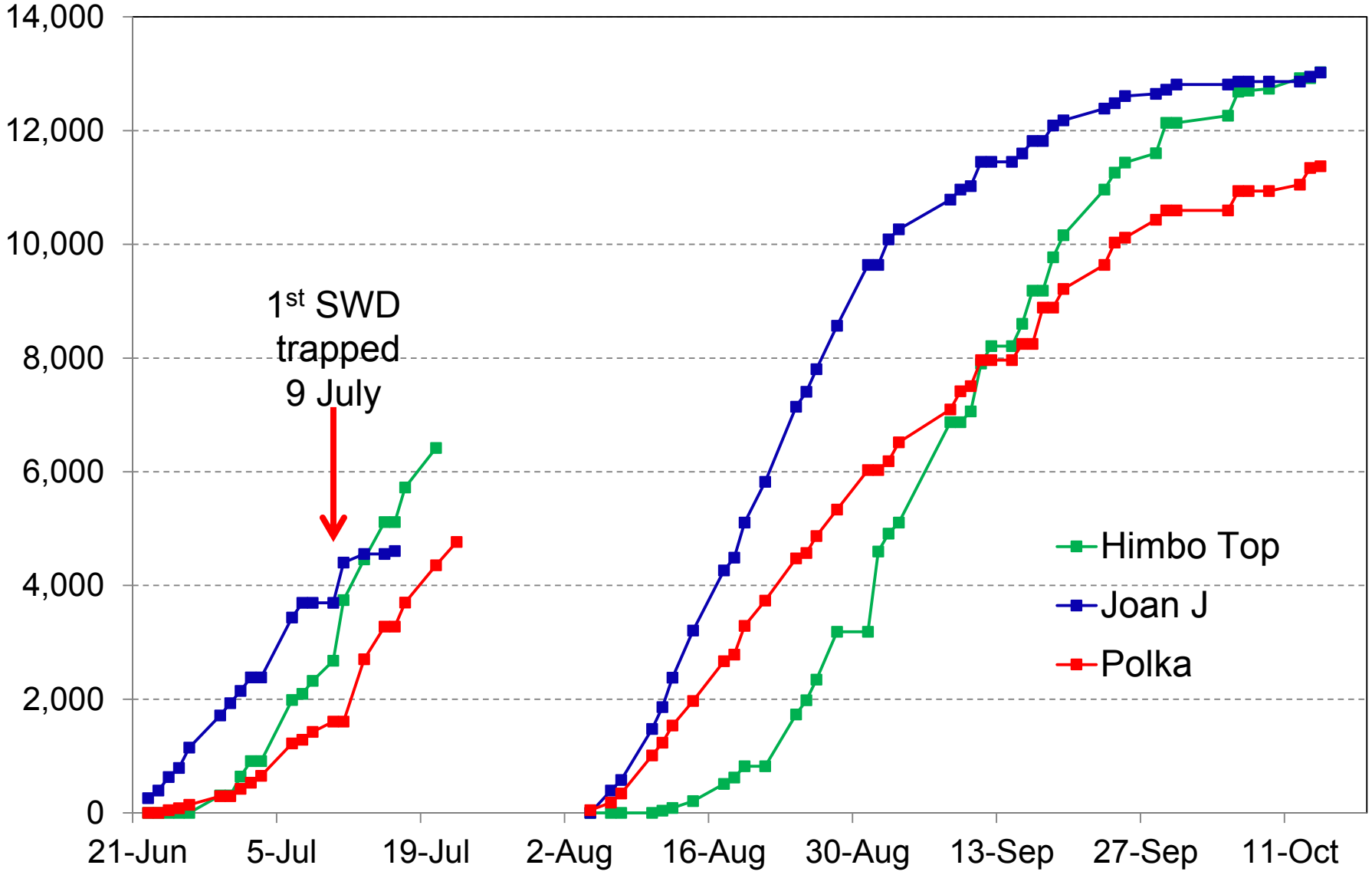
Spotted wing drosophila numbers escalate after summer crop is harvested



Primocane and floricane raspberry harvest times, E.L.



Cumulative summer and fall yield (lb/acre) of three raspberry cultivars under high tunnels in East Lansing, MI, 2015.



Physical exclusion of SWD

Rufus Isaacs and Heather Leach, Entomology, MSU

- Organic tunnel and two commercial tunnels
- Side walls and end doors
- ProtekNet netting (Dubois Agrinovation)

  1 mm x 0.6 mm mesh

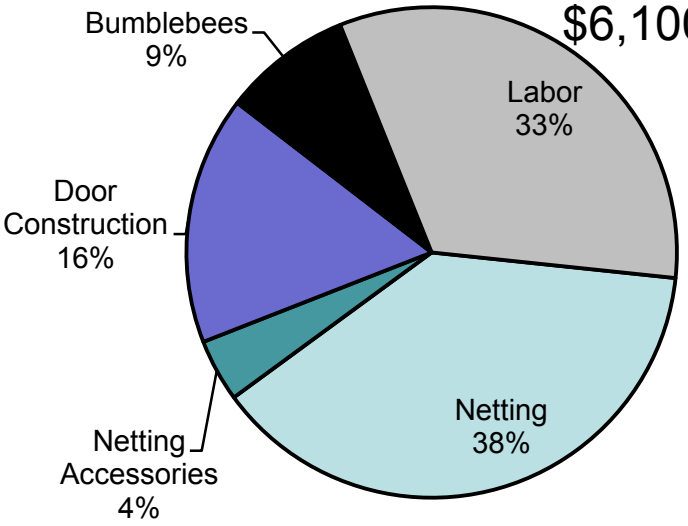
  90% light transmission, 80% porosity

Exclusion Netting for SWD Control

Heather Leach and Rufus Isaacs, Entomology, MSU

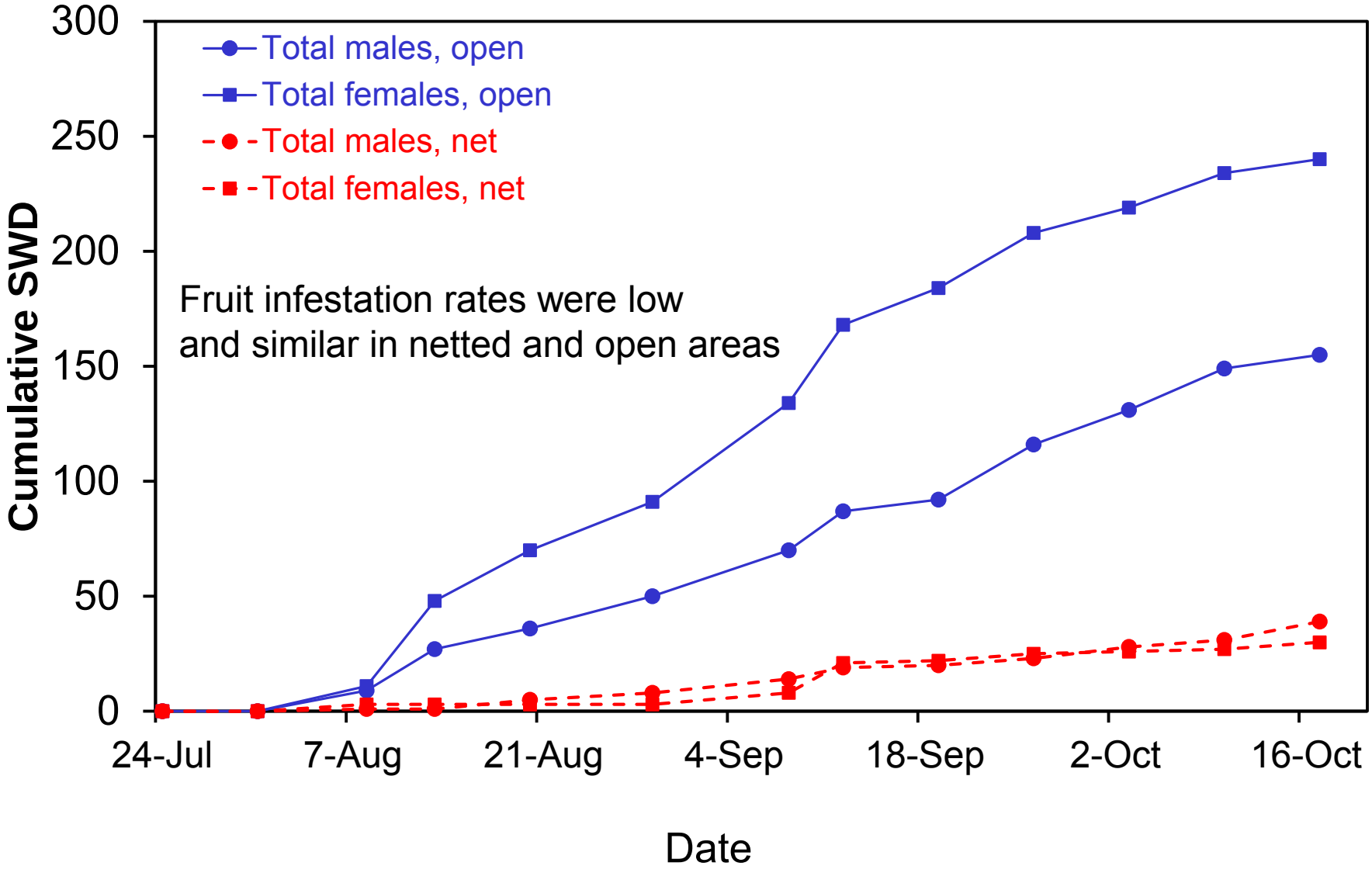
- Netting significantly delays and reduces SWD infestation
- Overall insect abundance decreased
- Netting may increase tunnel temperatures some
- No effect on fruit quality

Cost per acre: $6,100



Assumes 1 acre: 5 adjacent 400 x 25 ft tunnels
Door and side netting = Tek-Knit 80 gram (Berry Protection Solutions)

Cumulative captures of male and female *Drosophila suzukii* flies in open and netted areas of high tunnel raspberries, 2014.



Tunnels may facilitate organic production

1. Improved production and fruit quality
2. Suppressed fungal diseases (most)
3. Less weed competition??
4. Extend market season

Organic Raspberry Production in Three-Season High Tunnels

by Eric Hanson[1], Vicki Morrone[2], Rufus Isaacs[3], Michigan State University Extension
[1]MSU Department of Horticulture, [2]MSU Department of Community Sustainability, [3]MSU Department of Entomology

Extension Bulletin E3235

Can tunnel raspberries be profitable in Michigan? Yes, but……..

Competing with California or Mexican berries at wholesale prices would be challenging.

Growers can be profitable if they can gain price premiums for “locally produced” or “organically grown”, or by retail marketing.

Thank you!!
Any final questions?

Yield of potted raspberry varieties pruned to retain 2 floricanes or none. Grown under high tunnels, Benton Harbor MI, 2014.

		Yield (g/plant)		
Variety	**Floricanes**	**Summer**	**Fall**	**Total**
Josephine	yes	267	319	586
	no	0	798	798
Joan Irene	yes	438	545	983
	no	0	798	798
Crimson Giant	yes	387	311	698
	no	0	444	444