How is Spotted Wing Drosophila Changing the Way We Grow Berries?

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Photo: New York Times
Which US city consumes the most raspberries per household?
Minneapolis / St. Paul
Which state produces the most berries?
Why aren’t we growing more berries?
First of all...We can grow more berries!

But...

1. More challenging than berry production in California or Pacific Northwest
2. Temperate climate means more disease, winter injury, insect pressure – and our climate is getting wetter!
3. Spotted wing drosophila
Fruit preferences

- Raspberries
- Blueberries
- Tart cherries
- Honeyberries
- Strawberries
- Grapes
- Cherry tomatoes
- Currants
- Kiwiberries
- Stone fruits
Timing of infestation over the season

Weekly trap counts: fruitedge.umn.edu/swdtrap
Timing of infestation over the season

Also depends on crop ripeness

- **Example 1:** In 2018, tart cherries ripened before SWD showed up. Ripened later in 2019, once SWD was at peak populations.

- **Example 2:** SWD is at peak in July, but grapes aren’t ripe yet. Don’t spray for SWD until fruit is ripening.
How has SWD impacted berry production in the Midwest?
### Raspberry management prior to 2012

<table>
<thead>
<tr>
<th>Minnesota</th>
<th>2007 Acreage (# acres)</th>
<th>2008-2009 Yield (lbs/acre)</th>
<th>Production (lbs)</th>
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<tr>
<td>Baseline production</td>
<td>296</td>
<td>4,708</td>
<td>1,393,568</td>
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<td>Certified organic, red, open field</td>
<td>5</td>
<td>1,307</td>
<td>6,535</td>
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<tr>
<td>Non-organic</td>
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<tr>
<td>- red, open field</td>
<td>254</td>
<td>4,708</td>
<td>1,195,832</td>
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<td>- black, open field</td>
<td>13</td>
<td>2,000</td>
<td>26,000</td>
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<td>- red, high tunnel</td>
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<tr>
<td>Adjusted production</td>
<td>296</td>
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<td>1,762,439</td>
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</table>

Source: GigiDigiacomo, UMN Dept. of Applied Economics
2017 MN raspberry grower survey: Impact of SWD on production

- Median yield loss of 20% from MN farms
- 79% of raspberry growers experienced some level of SWD infestation in 2017.
- 74% of MN growers are actively managing to control SWD
- Cost to MN raspberry industry: $2.2 million annually

Organically managed farms: 47% of survey participants

DiGiacomo et al., 2019
Let’s consider another factor

Hydrologists picked Oct. 1 as the cutoff date for measuring a ‘water year’
- Measure total local precipitation from Oct 1 - Sept 30
- Can track MN water years back to 1871, 148 years total!

When was the rainiest water year on record in MN?
              2019
Top 10 Wettest Water Years in MN- NWS

<table>
<thead>
<tr>
<th>Rank</th>
<th>Season</th>
<th>Total Precipitation</th>
<th>Missing Count</th>
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<tr>
<td>1</td>
<td>2018-2019</td>
<td>41.39</td>
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<tr>
<td>2</td>
<td>2015-2016</td>
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<td>4</td>
<td>1982-1983</td>
<td>40.99</td>
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<td>5</td>
<td>1891-1892</td>
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<td>6</td>
<td>1880-1881</td>
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<td>1964-1965</td>
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<td>10</td>
<td>1983-1984</td>
<td>37.99</td>
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148 total years
3 of the top 10 (30%) within 20 years
6 of the top 10 (60%) within 40 years
90% of MN eclipsed 30” rainfall in 2019

100% of WI

21 separate weather stations in MN broke their precipitation records in 2019

20 of those (95%) were previously set within 40 years

IT WAS WET
Why am I bothering to bring rain into this talk?

The climate isn’t just changing, it has *changed*

There are immediate ecological consequences of our changed climate

Greater disease pressure

More rain + SWD prefers humidity + sprays less effective in rainy conditions = SWD is *more dangerous* in our changed climate

We need to consider the future AND the present
Raspberry management after 2012 (intro. of SWD)

- SWD commonplace in MN – *expect it & adapt to it*
- Some MN raspberry growers getting out of raspberries rather than adapting
- More frequent insecticide applications (OMRI approved & conventional)
- SWD contributing to fruit diseases
- Increased focus on daily harvest, sanitation, refrigeration
- Massive research effort (on-farm and lab) into how to manage SWD organically
Multi-faceted, ecological approach to managing SWD

Takes into account:
• Environmental stewardship
• Economic feasibility
• Effectiveness of the strategy
Why we can’t “spray” this problem away

Very few effective organic insecticide options:

- Entrust, Pyganic (OMRI)
- SWD can develop resistance to these products!
- Essential oils like Ecotrol may be effective, need controlled field testing
- Expensive, frequent applications
- Difficult to harvest when spraying frequently
Like many invasive species, long term sustainable control of SWD is hard.

But it is also possible, if we are open to new approaches.
Ongoing Organic Research

- UMN: Rogers, Hutchison labs
- Cornell, Michigan State, WSU, OSU, others
- Quebec berry growers &
- TunnelBerries project
Management “Tool Box” for SWD

- Sanitation & daily harvest
- Heavier pruning
- Immediate refrigeration
- Using infested berries for processing
- Push-pull?
- Cultivar selection?
- Minimize habitat
- Organic insecticides
- Exclusion netting
Cultural Management Tools

Meant to decrease presence of SWD by making it hard to survive. Not meant as a stand-alone approach to control.

- Sanitation
- Heavier pruning
- Daily harvest
- Minimize habitat
  - Increased airflow
  - Landscape fabric or bare ground
“Sanitation” to reduce SWD population

**Essential sanitation practices:**
- Increase harvest frequency (pick every 1-2 days)
- Remove dropped or over-ripe fruit
- SWD can survive composting

**Fermentation + burial**
- Containment vessel (allow for gas exchange) for 1 week
- Bury fermented fruit 4” deep

**Solarization**
- Clear plastic bag or covering, minimum of 100ºF
- Several hours to 1 week

Source: Matthew Gullickson, UMN Horticulture
Heavier pruning - blueberry

- Potential for earlier harvest
  - "Phenology Management"
- Larger berries
- More air flow (SWD are poor fliers)
- Better spray penetration
- Un-pruned plants may provide more habitat for SWD
SWD presence & severity for common blueberry cultivars and raspberry types. Presence & severity determined from 3 years of trapping data taken from sites throughout MN.

<table>
<thead>
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<th>Blueberries</th>
<th>JAN</th>
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<th>MAY</th>
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**Background colors:**  
- **Green** = No pressure  
- **Yellow** = Light pressure  
- **Orange** = Moderate pressure  
- **Red** = Heavy pressure

Long bar = Possible harvest season  
Short bar = Average harvest season

Source: Andy Petran, UMN Horticulture
Jersey’ Blueberries, Northfield, MN, 2016 & 2017

• Light = 25% less than grower standard
• Heavy = 25% more than grower standard
• Measured yield, berry temp & SWD fruit infestation

Source: Andy Petran, UMN Horticulture
Heavier pruning - raspberry

**Summer-bearing raspberries:**
- Canes should be pruned to no less than 6 inches apart

**Fall-bearing raspberries:**
- Mow all canes down every year during dormancy

**All types:** Thin out suckers, keep canes within row widths
Heavier pruning – tart cherry

- Michigan organic tart cherry study (no spray)
- Prune out 6-10 larger limbs from each tree every winter
- 10 limbs removed: 80% fewer SWD in berries

Source: Nikki Rothwell, Michigan State University
Daily Harvest

Raspberries harvested every 1-2 days have lower infestation than every 3 days

Source: Matthew Gullickson, UMN Horticulture
Daily Harvest

Source: Matthew Gullickson, UMN Horticulture
SWD larvae
Habitat Minimization

- Landscape fabric
- Consistent mowing
- Bare ground (high tunnels)
- Sweep/leaf blow fallen fruit
Habitat Minimization - Mowing

- Keep grass very short in the field/orchard

Credit: Matthew Gulickson, UMN Horticulture

Jeffe and Geudot, 2019, Photo credit: University of Minnesota Extension
Organic Insecticides

- Entrust
- Spinosad
- Essential oils: Ecotrol. In testing w/ mixed results from farmers
- Many organic growers still spray, while doing all of the tactics discussed before

Can we grow berries without spraying for SWD?
Exclusion netting – the future of berry production?
Exclusion netting for SWD

Is this the future of berry production in the era of SWD?

• Quebec, Europe, CA & Pacific NW
• Midwest & eastern US farms late adopters of this technology
• Much research still being done to refine technique & economics

It’s not just about SWD

• Excludes all potential pests
  • Need to consider pollinators
• Protected culture increases yield, berry size, berry quality, and marketability
Multiple benefits of growing berries in high tunnels
High tunnel raspberries

In adjacent open field:
Blueberries also happier under exclusion net structures
The netting

- 80g netting
- NOT 60 or 70g
- Can last over 10 years, but can acquire bird or hail damage
- Berry Protection Solutions, (NY, Dale Ila Riggs)
- DuBois Agrinovation (Quebec)
- Ag Resources (Detroit Lakes, MN)
Exclusion net setup varies from farm to farm

- General principles stay the same
- Farmers typically figure out design based on their farm’s needs
Andy’s Farm, 2020

• One acre of Day-neutral strawberries
• Young, beginning farmer
• Leasing land
• Any infrastructure needs to be:
  Removable (non-permanent)
  Inexpensive
• ¼ acre under net in 2019
  - ½ acre in 2020
My Support Structure, 2020

- PVC support poles with endcaps
  - 30’ pole spacing
  - 10’ poles placed 3’ into ground
- Poly wire forms a grid on top
  - EZ-WIRE polyamide wire, cheaper than metal cable
  - Wire locked in place with “Gripple” wire tensioners
Recommend Steel Perimeter Poles

- NEED anchors if using PVC perimeter poles
- 2 anchors on corner poles

Anchors keep PVC from “falling” inward under the weight of the net

1. Put in PVC
2. Put on endcaps
3. Wire up EZ-WIRE grid
4. Put on net
5. Secure perimeter poles to anchors
2 days without proper anchoring

3 months with proper anchoring

Multiple windstorms with 40mph gusts
2019 Performance

• Netting worked very well for Day-neutral strawberry production
  - No tarnished plant bug
  - Very little SWD (no vestibule)

• Will be doubling netting area in 2020, will work to 100% under net
Next Steps for Improving Management of SWD

Research Priorities:

- On-farm research needed – farmers interested in trialing, demonstrating exclusion net
- “Push-pull” – essential oils, herbs
  - Ecotrol
  - Some farms good success, others less, need more data
- New products from PNW to trial in Midwest
- Fans in high tunnels
- *Trichopria drosophilae* wasp
Questions and Comments?

We want to hear from you!

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