Mesotunnels: Exploring a new approach for organic cucurbits

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Organic cucurbit production is challenging.
• *Serratia marcescens* causes CYVD

• *Erwinia tracheiphila* causes bacterial wilt
• Squash bugs spread CYVD.

• Cucumber beetles spread bacterial wilt.
CYVD Disease Cycle

Overwintering adults

Feeding on cucurbit

New generation acquire CYVD

CYVD Transmission

Squash bugs reproduce

Symptoms
Bacterial Wilt Disease Cycle

Overwintering adults

Acquire bacteria

Beetles reproduce

Transmission

Cucurbit seedlings

Symptoms

Bacterial Wilt Disease Cycle
Barriers exclude insects and some diseases.
What are mesotunnels?

Low tunnel

Mesotunnel
## Comparing tunnel types

<table>
<thead>
<tr>
<th>Low tunnels</th>
<th>Mesotunnels</th>
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</thead>
<tbody>
<tr>
<td>Spunbond polypropylene</td>
<td>Nylon mesh netting</td>
</tr>
<tr>
<td>Wire hoops</td>
<td>Steel conduit hoops</td>
</tr>
<tr>
<td>18” tall</td>
<td>42” tall</td>
</tr>
<tr>
<td>Can overheat plants</td>
<td>Won’t overheat plants</td>
</tr>
<tr>
<td><strong>Removed at bloom</strong></td>
<td><strong>Can remain all season</strong></td>
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</table>
Setting up mesotunnels
Setting up mesotunnels
Setting up mesotunnels
What about pollination and weed control?
2020 field trials in 3 states
* 2 crops: Muskmelon and acorn squash
* 2 trials: Pollination and weed control
Pollination treatments

Full-season mesotunnels (bees added)
On-off-on
Open ends

Landscape fabric between rows.
Marketable yield

Full-season*
On-off-on -
Open ends

Full-season -
On-off-on*
Open ends
Weed management trials

• Teff @ 4 lb/A
• Teff @ 8 lb/A
• Landscape fabric
• Bare ground
Marketable yield

Teff @ 4 lb/A
Teff @ 8 lb/A
Landscape fabric *
Bare ground

Teff @ 4 lb/A
Teff @ 8 lb/A
Landscape fabric *
Bare ground -
University of Kentucky

• Pollination
• Weed control
• Foliar disease control
Kentucky pollination trials
MARKETABLE YIELD

Acorn squash

120-ft-long plots

• Full-season
• On-off-on
• Open-ends *
• On-off

Muskmelon

30-ft-long plots

Full-season *
On-off-on
Open-ends *
On-off
Kentucky weed control trial
(Acorn squash, on-off-on)

• Buckwheat (90 lb/A)
• Teff (12 lb/A)
• Teff (24 lb/A)
• Teff (36 lb/A)

• Yield: No differences
• Weed control: Best with buckwheat and 2 higher teff rates
Kentucky foliar disease trial
(Acorn squash, on-off-on)

- Mesotunnels with fungicide sprays *
- Mesotunnels without fungicide sprays *
- No mesotunnels; fungicide sprays
- No mesotunnels or fungicide sprays
Cornell University (NY) trial

- Acorn squash with full-season mesotunnels
- Acorn squash without mesotunnels
- Muskmelon with full-season mesotunnels
- Muskmelon without mesotunnels

- **Acorn squash**: Less PM/DM & CYVD with mesotunnels, but more aphids
- **Muskmelon**: 3x more marketable fruit with mesotunnels and much less bacterial wilt, but more PM and DM
Take-homes from 2020 field trials

• Yield impact from mesotunnels differed by crop and state.
• Teff suppressed weeds but sometimes yield, too.
• 2021: Mow teff when covers are off.
• Microclimate inside mesotunnels may impact disease risk.
Biological control of diseases: another organic option?
Our targets: Bacterial wilt and CYVD
CYVD pathogenicity test
Screening for bacterial wilt Biocontrol agents

In vivo assays: co-inoculation

*Erwinia tracheiphila* (SCR3)

*Burkholderia pyrocinia* (62E8, FP62 and 55B1)
*Pseudomonas putida* (KT2440 and KT2442)
*Pseudomonas fluorescens* (Pf55), *Paraburkholderia phytofirmans* (PSJN-1), *Enterobacter cloacae* (JL1157)

Among others.
Screening phages* for bacterial wilt biocontrol

From Dr. Fu’s stock

From cucumber beetles

* Phages are viruses of bacteria
Summary

• We’re figuring out how to do pollination and weed control in mesotunnels.
• When and where are mesotunnels profitable?
  • Economic analysis is underway.
• Biological disease control could partner with mesotunnels.
• Check out our website: The Current Cucurbit –
  • www.cucurbit.plantpath.edu

• Two more years of trials to go – follow us on Twitter!
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