Advances in Small Farm Production

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K-STATE
Research and Extension
• Food Safety Plans
• Tiered regulation
What do we do when the system fails?
- Re-design it
- Add, replace, or remove a cog
- Add a whole series of cogs
Integrated Pest Management

OMRI-approved Fung. & Pest.

Biological control
Sanitation
Cultural control
Environmental control
Genetic resistance
Crop Selection
Growing system
Site Selection
Knowledge/Experience
High Tunnel Production

• NRCS EQUIP Program
• Role of Season Extension
• Role of Environmental Protection
200’ x 96’ Multi-Bay Haygrove Tunnel
Three-season | Luminance plastic
Why High Tunnels?

- All shapes and sizes
  - Three or four seasons
- Climate Control
  - Season Extension
  - Use of low tunnels, etc.
  - Protection
- Reduced Foliar Disease
- Access to new market windows
- Production stability

Photo courtesy: S. O’Connell (NCSU)
Incredible growth of warm and cool season crops
Why High Tunnels?

Environmental Protection

- Early/late frosts
- WIND
- Thermal Stress
- Storms
- Heat ??
Working / Harvesting Conditions
Protection from Heat

High Tunnels = Early Planting Date

• Fruit set before heat
• Plant is established
  – Root system
  – Foliage – fruit shading
• Planting Preference
  – Scheduling
  – Varieties
  – Transplant quality
Protection from Heat

High Tunnels *can* be cooler than the field

- Ventilation
- Plastic type
  - UV/IR blocking
- Shade cloth
  - 30% is recommended
  - Timing
  - Structural ??
Overall objective: to determine the effect of variety and evaporative cooling on postharvest quality, decay, and shelf life of day-neutral strawberries grown in a high tunnel.
Early Tomato Production
Tomato Grafting

- First reports of vegetable grafting occurred in Asia in the 1920’s.
  - Fusarium wilt of melon

- Popularized in Japan and Korea
  - Tunnel and Greenhouse production
Tube Grafting

- Grafting for the US
  - High tunnels
  - Disease Management
- Technique and Econ

(Rivard and Louws, 2011)
Propagation Costs

(Rivard et al., 2010)
Grafted Tomato Propagation

- **Goal:** To optimize grafted tomato propagation systems that can be utilized by small-acreage growers with limited propagation capacity.

- Investigation of **healing chamber environment**
- Working with **leaf removal** as a way to reduce water stress in the scion
  - Follow-up studies of mature plants (field and GH)
- Determine ways to reduce **adventitious roots** from the scion post-grafting
  - Environment, leaf removal, hormone interactions
Coordinated Rootstock Trials

- **Goal:** To identify vigorous tomato rootstocks which increase productivity with little to no disease pressure, particularly in high tunnel systems.
  - Complementary to disease management work
- Mostly hybrid scion (BHN 589)
- Rootstocks:
  - Maxifort
  - Multifort
  - Arnold
  - DRO 131
  - Colosus
  - Trooper Lite
  - Estamino
  - Emperador
  - RST-04-106
  - RT 1028
  - (Have shown to significantly increase yield in high tunnels)
Annual Strawberry Production

- Fall planting
- Winter row covers
- Spring harvest
- Summer cover crop
- Plastic removal
- Clean-up
Planting date is very IMPORTANT
NRCS Conservation Innovation Grant Program

- Rivard, C.L., M. Kennelly, J. Griffin, R. Janke, D. Presley, P. Tomlinson, R. Wynia (NRCS), M. Bates (MU)

- Demonstrate no-till systems
  - Pumpkin, sweet corn, snap bean
  - Equipment (planter) experience

- 4 replicated trials at KSU/NRCS locations

- 16 demonstration trials at commercial farms (2014-15)
Characteristics of Crops that Do Well in No-Till

- **Competitive** crops do best
  - Canopy development
  - Water and nutrients
- **Planting date**
  - Late (summer crops)
- **Crops that do well under mulch**
- **Transplants**
- **Crops that require intensive weed management**
Grow Your Own Mulch

• Cover crop residues serve as mulch
  – Weed management
  – Soil moisture
  – Crop health and quality

• Reduced soil temperatures
  – Fall crops
Challenges exist in No-Till Systems

- Soil temperature
- Nutrient Management
- Managing cover crops
- Disease and pest pressure
- Production logistics

Southern Blight on Tomato
<table>
<thead>
<tr>
<th></th>
<th>Biomass (lbs/acre)</th>
<th>C:N</th>
<th>Available N (lbs/acre)</th>
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<tbody>
<tr>
<td><strong>Rye</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Tunnel</td>
<td>3749.4</td>
<td>9.8</td>
<td>83.2</td>
</tr>
<tr>
<td>Field</td>
<td>721.8</td>
<td>8.5</td>
<td>54.2</td>
</tr>
<tr>
<td><strong>Vetch</strong></td>
<td></td>
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Fertilizing with Cover Crops

Nitrogen Recovery / Deposition

- **NO₃ Recovery**
- **Legume cover crops**
- **Calculated lbs/A N**
  - **Legumes**
    - 3.5-4% (young tissue)
    - 3-3.5% (flowering)
  - **Grasses**
    - 2-3% (young tissue)
    - 1.5-2.5% (flowering)

\[
\text{Lbs biomass} \times \text{Estimated } \% \text{ N} \times 0.50 \text{ Availability} = \text{Total Nitrogen}
\]
Beneficial habitat planted around the tunnel
Ecological function

- Cover crops
- Compost

Single tactic control of a single problem/issue in a monocultured crop

Systems Approach

Farming system

Biodiversity

Ecological function
Systems Approach

- Disease suppression
- Plant growth promotion
- Good yields

Ecological function

- Cover crops
- Compost
- Certified plants
- Crop rotation
- Nutrient mgmt

Farming system

- Biologica
s- Knowledge of pathogens
- Soil community (bias)

Biodiversity
Multiple crops over time and space to foster high biodiversity, multi-pest suppression, and vigorous plant health.
QUESTIONS ??