Northeast Cover Crop Efforts

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Dr. Steven Mirsky (Research Ecologist)

• USDA-ARS Beltsville Agricultural Research Center
  • Sustainable Ag. Systems Laboratory

• Education
  • Ph.D. – Agronomy
  • M.S. – Soil Science
  • BA – Agroecology
Research approach to quantifying the effects of cover crops on agro-ecosystem services

Cover crop effects on agro-ecosystem services
- N scavenging, availability, fixation, and use efficiency; weed control, water and soil quality, and GHG emissions

Cover crop management
- Planting and termination timing/methods, seeding rates, mixtures, integration with animal manure
  - Species specific responses to climate and edaphic properties

Cover crop germplasm assessment
- National legume cover crop breeding program

Develop cover crop-based no-till crop production systems
- Organic and conventional systems

Ecologically based weed management
- Multi-tactic approaches; weed-crop competition
Lower Chesapeake Bay – Long-term Agricultural Research (LCB-LTAR)
Cover Crop Systems Project (CCSP)

System Descriptions

<table>
<thead>
<tr>
<th>System (#)</th>
<th>Crop Designations</th>
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<tbody>
<tr>
<td>1</td>
<td>C - Corn</td>
</tr>
<tr>
<td></td>
<td>B - Full Season Soybeans</td>
</tr>
<tr>
<td></td>
<td>W - Wheat</td>
</tr>
<tr>
<td>2</td>
<td>r/lv - C - r</td>
</tr>
<tr>
<td></td>
<td>r - SB - w</td>
</tr>
<tr>
<td></td>
<td>W - r/lv</td>
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<td>3</td>
<td>C - r</td>
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<tr>
<td></td>
<td>r - SB - w</td>
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<tr>
<td></td>
<td>W - DB</td>
</tr>
<tr>
<td>4</td>
<td>g/l mix - C - r</td>
</tr>
<tr>
<td></td>
<td>r - SB - w</td>
</tr>
<tr>
<td></td>
<td>W - DB/ interseed g/l mix*</td>
</tr>
<tr>
<td>5</td>
<td>g/l mix - C - r</td>
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<tr>
<td></td>
<td>r - SB - w</td>
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<tr>
<td></td>
<td>W/ interseed g/l mix*</td>
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Legend:
- r/lv: rye and hairy vetch mix
- C: cereal rye
- SB: summer beans
- DB: double crop soybeans
- *: No sampling

Field operations are not affected
Lower Chesapeake Bay – Long-term Agricultural Research (LCB-LTAR)
Cover Crop Systems Project (CCSP)

**CORN PHASE**
- **vetch/cereal rye**
  - **Corn**
  - **Cereal Rye**
- **NPKS**
- **Herbicides**; continuous covers; experimental CC establishment methods

**SOYBEAN PHASE**
- **Soybean**
- **Wheat**
- **vetch/cereal rye**
- **NPKS**
- **Herbicides**; conventional standard; one CC

**WHEAT PHASE**
- **Wheat**
- **Dbl. Soybean**
- **vetch/cereal rye**
- **NPKS**
- **Herbicides**; conventional standard

**Legume/grass mix**
- **Corn**
- **Cereal Rye**
- **Soybean**
- **Wheat**
- **NPKS**
- **Herbicides**; experimental organic weed control methods

**ORG 1**
- Tillage; Organic Standard

**ORG 2**
- Reduced Tillage; experimental organic weed control methods

**NT 3**
- Herbicides; conventional standard; no CC’s

**NT 4**
- Herbicides; conventional standard; one CC

**NT 5**
- Herbicides; continuous covers; experimental CC establishment methods

**NT 6**
- Herbicides; continuous covers; experimental CC establishment methods

**Legend**
- **N** Nitrogen
- **P** Phosphorous
- **K** Potassium
- **S** Sulfur
- **M** Manure
- **Bl** Bale Straw
- **Ch** Chisel Plow
- **Ic** Interrow Cultivate
- **Mb** Moldboard Plow
- **Rc** Roller-crimper
- **Rh** Rotary Hoe
- **Sc** Stalk Chop
- **Sk** Sukup Interrow Cultivation
- **Til** Disk, Landsman, Cultipacker
- **Tt** Turbotill
- **H** Herbicide
Conservation Innovation Grant - Modeling

- Team members in PA, MD, NC, GA

- Short-term benefits of cover crops
  - Water infiltration, availability, use efficiency
  - Nitrogen availability and use efficiency

- Validate, calibrate, and improve process-based models for H$_2$O and N estimation

- Define mechanistic relationships governing surface and incorporated cover crop decay

- Decision support tools for farmers on water and adaptive N management
An IPM approach to addressing the multiple herbicide-resistant weed epidemic in three major U.S. field crop production regions

(USDA-ARS Area-wide funded project)

National effort examining multi-tactic weed mgmt.
- Emphasis on role of cover crops
Creating The Cover Crops That Organic Farmers Need: Delivering Regionally Adapted Varieties Across America
Priority Traits Ranked by Farmers

- Nitrogen fixation
- Winter hardiness
- Biomass production
- Early vigor
- Weed suppression
- Early maturity
- Disease resistance
- No hard seed

Figure by Sandra Wayman (504 respondents shown)
Overton, TX. Texas A&M AgriLife Research.
- Crimson clover breeder
- Breeding plots
- Recurrent selection of crimson clover
- Seed germplasm repository and seed increases

Ames, IA. Practical Farmers of Iowa
- Participatory germplasm screening
- On-farm selection

Madison, WI. USDA-ARS Dairy Forage Research Center
- Participatory germplasm screening
- Breeding plots
- Recurrent selection of hairy vetch

Ithaca, NY. Cornell University
- Participatory germplasm screening
- Mass selection of winter pea
- Bio. N fixation screening

Beltsville MD. Lead USDA-ARS Sustainable Ag Systems Lab.
- Participatory germplasm screening
- Recurrent selection of hairy vetch/crimson clover
- Mass selection of winter pea
- Bio. N fixation screening

Plant Materials Centers
- Big Flats NY
- Beltsville MD
- Elsberry MO
- Manhattan KS
- Bismarck ND
- Lockeford CA
- Corvallis OR
- Pullman WA
- Rose Lake MI

Legend
- Research station trials
- On-farm research
- Seed increase and breeding stock repository
- National Plant Materials Centers
- Industry collaborator/ Product distribution Ernst Conservation Seed

Raleigh NC. North Carolina State University
- Participatory germplasm screening
- Recurrent selection of hairy vetch/crimson clover
- Mass selection of winter pea
- On-station germplasm screening

Research station & on-farm selection
Northeast Cover Crops Council

- Project that ties Dr. Mirsky’s program together

- Funding sources: USDA-NIFA OREI breeding grant, USDA-NIFA Post Doctorate fellowship, NE-SARE PDP grant

- Team members to date: USDA ARS, NRCS, & PMC’s, universities, seed companies

- NRCS Soil Health Initiative

- Goal: support and encourage cover crop use in the Northeast
  - identify knowledge gaps
  - meta-analysis across region to fill gaps
  - provide precise info to farmers using process based models to create decision tools to predict cover crop growth and development
Northeast Cover Crops Council

- Goal: support and encourage cover crop use in the Northeast
  - encourage cross-collaboration and research
- provide resources to farmers
  - suite of cover crop decision tools
  - website
- SESYNC post-doc?
  - data synthesis, meta-analysis, and database management

• 1st meeting March 31 - April 1, 2016
Acknowledgements for NECCC

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• USDA-NIFA Fellowship proposal  # 2015-03658

• SARE project  # ENE16-144

• Our many collaborators!

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Questions?