Performance of Organic Farming Systems and Implications on Climate Change

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http://www.extension.org/organic_production

Presenter: Erin Silva, University of Wisconsin

Performance of Organic Farming Systems and Implications on Climate Change

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Wisconsin’s organics tops the national ranks

• #1 for total organic livestock
• #1 for field crop acreage
• #1 for total organic milk cows (22% of USA total)
• #2 in organic milk sales (64% of organic sales)
• #2 in organic farms (n=1159 farms)
• #10 in vegetables

• Organic dairy and livestock farms drive market for organic feed

Source: UW-Madison CIAS/DATCP 2012 status report

WICST was born in 1989

➢ Two locations:
  • Arlington (well drained silt loam soils)
  • Lakeland (more-poorly drained silt loam soils)

➢ Over 20 years of data summarized:
  • from 1992 to 2012
  • Trends emerging
    • Economics
    • Soil carbon
    • Yield trends
    • Weed seed
Cash-grain systems

Continuous corn  Strip-till corn-soybean  Organic grain

Dairy (forage-based) systems

Conventional Alfalfa  Organic forage  Managed grazing

Effect of weed pressure on corn yield

<table>
<thead>
<tr>
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<th>Wet Springs (May + June &gt;10&quot; rain)</th>
<th>Normal Springs</th>
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<td>ARS</td>
<td>LAC</td>
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<tr>
<td>Conventional (min-till corn-soybean)</td>
<td>160</td>
<td>137</td>
</tr>
<tr>
<td>Organic (3-yr grain)</td>
<td>115</td>
<td>103</td>
</tr>
<tr>
<td>Org:conv</td>
<td>72%</td>
<td>76%</td>
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Effect of weed pressure on soybean yields

<table>
<thead>
<tr>
<th>Wet Springs (May + June &gt; 10&quot; rain)</th>
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<tr>
<td>ARS LAC</td>
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<tr>
<td>Conventional (min-till corn-soybean)</td>
<td>48 57 57 53</td>
</tr>
<tr>
<td>Organic (3-yr grain)</td>
<td>38 44 54 49</td>
</tr>
<tr>
<td>Org:conv</td>
<td>79% 76% 95% 92%</td>
</tr>
</tbody>
</table>

30' rotary hoe or tine weeder can do ~ 30 acres/hr

Corn yields in extreme weather yrs

- cont. corn
- strip-till corn-sb
- conv. dairy
- organic grain
- organic dairy

2008 (flood) 2012 (drought)
Rodale

• Corn in the legume-based (left) and conventional (right) plots six weeks after planting during the 1995 drought. The conventional corn is showing signs of water stress.

Rodale - Organic corn yields were 31% higher than conventional in years of drought.

Conventional vs. Organic Corn Yield Trends
Conventional vs. Organic Corn Yield Trends

Yield, bu/a vs. Cycle

- Conventional Corn
- Organic Corn - in 3-yr forage system

Conventional vs. Organic Soybeans

Yield, bu/a vs. Cycle

- Organic
- Conventional

Conventional vs. Organic Alfalfa

Yield, t dm/a vs. Cycle

- Organic
- Conventional
Base Gross Margins (GM)

- GM = Crop revenue – variable costs
- Grain priced at harvest; hay priced in winter
- Gov’t payments included
- Feed-grade organic premiums included
- Systems scaled up to farm size
  - 1200 acres for conventional grain farms
  - 600 acres for organic grain farm
  - 150 acres of conventional and organic forage farms

Historic GM of grain systems

Historic GM of forage systems
Corn and soybean feed-price trends (at harvest)

Fertilizer cost in corn phase at ARL ($/acre)

Corn seeding cost at ARL ($/acre)
RUSLE2 Soil loss estimates (18-yr avg, ARL)

N₂O emissions/unit of N harvested-ARL

C and N changes in other Long-Term Studies
- LTAR (Iowa) - Total nitrogen increased by 33 percent in the organic plots
  - higher concentrations of carbon, potassium, phosphorous, magnesium and calcium
  - results suggest that organic farming can foster greater efficiency in nutrient use and higher potential for sequestering carbon
• Rodale FST - in both organic and conventional systems, the highest overall GHG emissions were caused by soil processes fueled by nitrogen fertilizer, compost, and crop residues.

• Organic system uses 45% less energy – mainly from not allowing conventional fertilizers.

• Demand for non-renewable energy resources of the farming systems in the DOC experiment (1985–1998) per hectare and year (columns) and per kg dry matter (DM, line) (Nemecek et al., 2011).
Conclusions

• Yields: Org:Conv >90% when weeds controlled
• Organic yields better than continuous GM corn in extreme weather years
• Organic yields similar to rotated GM corn in extreme weather years
• Yield trends
  – Corn increased at 2.5 bu/a/yr (same for organic and conventional)
  – Soybeans had slight gain at 0.2 bu/a/yr (same for organic and conventional)
  – Alfalfa—no real trend yet

Conclusion (cont’d)

• Profitability: organic > conventional
  – Gross margin higher in last 5 yrs. vs. previous 5 yr
  – Large part of the profitability is coming from strong and steady premiums (in this study feed premiums)
  – Inputs (seed, fuel, and nutrients) are driving up expenses, often near to the cost of conventional inputs
• Ecosystem Services
  – All systems losing carbon other than pasture
  – Expand rotation with alfalfa can reduce soil loss
  – GHG lower under rotations but not necessary due to organic management
Find the slides and recording of this presentation at http://www.extension.org/pages/67347

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Additional organic farming questions? Ask them at https://ask.extension.org/groups/1668

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