Assessing Benefits of Winter Crops

Winter Crops for Bioenergy Workshop

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Presentation for Penn State Bioenergy Short Course Series 2011
Dan Dostie, State Resource Conservationist, USDA NRCS, Harrisburg, PA
Objectives

- Review the Benefits of Winter Crops
- Present Tools to Assess Benefits Provided
- Discuss NRCS Programs Promoting Bioenergy
Current NRCS Practice Standard Definitions

- **Cover Crop (340)**
  Crops including grasses, legumes and forbs for *seasonal* cover and other conservation purposes and not harvested for seed or forage
  (Applies on all lands requiring vegetative cover for natural resource protection and or improvement)

- **Forage and Biomass Planting (512)**
  Establishing adapted and/or compatible species, varieties, or cultivars of herbaceous species suitable for pasture, hay, or biomass production
  (Applies to all lands suitable to the establishment of *annual*, biennial or perennial species for *forage or biomass production* )
Benefits of Winter Crops

- Add biodiversity to existing crop rotation yielding a variety of environmental benefits
- Add new source of income from biomass harvest
- Contribute to producing a national renewable energy supply

"The greatest service which can be rendered any country is to add a useful plant to its agriculture."

Thomas Jefferson Quote in reference to his service to his country
Environmental Benefits of Winter Crops

- Improve the Health of the Soil
  - Sustain Crop Productivity
  - Provide Clean Water
  - Support Fish and Wildlife Communities
  - Mitigate Climate Change
Soil Biology and the Landscape

- Plant root hair
- Bacterial colonies
- Mycorrhizal hyphae
- Actinomycete hyphae and spores
- Decomposing plant cells
- Nematode
- Clay-organic matter complex
- Flagellate
- Fungal hyphae and spores
- Amoeba
- Ciliate
Tools to Assess Benefits of Winter Crops

- PA Soil Health Assessment Worksheet
- NRCS Soil Loss Equation (RUSLE2)
- On Farm Landscape Energy Audits

NRCS delivers Conservation Technology in Partnership with leading University and Research Centers
## PA Soil Health Assessment Worksheet

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Excellent Soil Health</th>
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<tbody>
<tr>
<td>Soil Structure</td>
<td>Stable, strong soil aggregates; good weight-bearing ability by soil super structure; excellent tilth; low potential for compaction, crusting and/or puddling</td>
</tr>
<tr>
<td>Surface Cover</td>
<td>Soil surface cover year-round with growing crop, crop residue and/or cover crop; 50-100% soil cover</td>
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<tr>
<td>Water Infiltration and Drainage</td>
<td>Soil drains well after rain; brief or no ponding visible; surface pores; low runoff</td>
</tr>
<tr>
<td>Organic Matter</td>
<td>Organic matter content stable at or increasing toward high levels for given soil type; active carbon sequestration practices</td>
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<tr>
<td>pH</td>
<td>Soil pH within the optimum range for grown plants</td>
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<tr>
<td>Fertility</td>
<td>Sufficient levels of all essential plant nutrients; proper nutrient balance ratios</td>
</tr>
<tr>
<td>Soil Movement</td>
<td>No visual evidence of soil movement; surface runoff generally clear</td>
</tr>
<tr>
<td>Soil Biodiversity</td>
<td>Numerous signs of earthworms including night crawlers; active strong bio-diverse soil life community present</td>
</tr>
<tr>
<td>Plant Growth</td>
<td>Healthy uniform growth; consistently high yields; robust root system; plants resist stress</td>
</tr>
</tbody>
</table>
Example of Bulk Density indicator of Soil Health

Soil Densities

- Mixed
- Austrian Winter Peas
- Diakon Radish

Soil bulk density (gr/cm^3)
NRCS Soil Loss Equation (RUSLE2)

- Centre County Example with Winter Canola
- Lancaster County Example with Winter Barley
- Other tools embedded in RUSLE2
Centre County

- All crops no-till
- All crop residues returned to field
- 200 ft, 15% slope
- Hagerstown soil (5)
- Yields
  - Corn grain – 150 bu
  - Corn silage – 23 T
  - Wheat – 80 bu
  - Winter canola – 60 bu
Lancaster County

NRCS RUSLE2 Estimated erosion

- All crops no-till
- 200 ft, 15% slope
- Hagerstown soil
- Yields
  - Corn grain – 150 bu
  - Soybean - 60
  - Barley – 110 bu
  - Rye cover 2.5 T
Other Tools in RUSLE2 . . .

- Fuel Savings Estimator
- Soil Condition Index (trend of OM)
- Soil Tillage Intensity Rating (STIR)
- Lots of other On Line Tools too!
On Farm Landscape Energy Audits

- Documents current energy usage, over the past annual cycle, and provides cost-effective recommendations for energy conservation.

- Includes energy used in the cultivation, protection, and harvesting of agricultural crops.
NRCS Programs Promoting Bioenergy

- New Policy Energy as a Concern
- Technology being developed
Energy as a Resource Concern

- New Policy as of October 2010

- It is NRCS Policy to provide assistance to support the national goal of reducing reliance on fossil fuels through energy conservation and replacement of fossil fuel-based energy with renewable energy sources including biomass feedstock production that is environmentally and economically sustainable.
Energy as a Resource Concern

The scope of NRCS technical assistance to address energy related resource concerns includes:

(1) Reducing *on-farm energy* derived from fossil fuels and energy efficiency.

(2) Assistance to produce renewable energy *feedstocks* in a sustainable manner.

(3) Assistance to produce energy from renewable resources to support the application of a conservation practice.
Conservation Technology being developed

- 7 existing practice standards (512)

- 32 practices having energy added as a purpose
  - To be reviewed on Federal Register
  - Cover Crops (340)
  - Residue Management (NT, MT, RT, Ssnl)
  - Renewable Energy Production (641) NEW!
USDA Financial Assistance 2012

- Biomass Crop Assistance Program (FSA)
- Rural Energy for America Program (RD)
- Conservation Loans (FSA)
- Conservation Reserve Program (FSA)

- NRCS may provide Technical Assistance
NRCS Financial Assistance 2012

- **Environmental Quality Incentives Program**
  - On Farm Landscape Energy Audits
  - Conservation Practices to consider
    - Forage and Biomass Planting (512)
    - Cover Crops (340)
    - Residue Management (NT 329, MT 345)
    - Crop Rotation (328)
NRCS Financial Assistance 2012

• Payment Cost Categories
  • Typical Statewide Average Scenarios
  • Materials, Equipment/Installation, Labor, Mobilization, Operation & Maintenance, Acquisition of Technical Knowledge, Forgone Income, Risk, Administration Costs

• NOT all eligible costs!!!!
Current Cover Crop Scenarios

- Rye, Wheat, Barley, Buckwheat
- Typical Scenario for average 30 acre unit
- Conventional Seeding $25/ac
- No Till or Aerial $35/ac
- Organic Scenarios $38/48ac
Current Forage & Biomass Planting Scenarios

- Typical Scenario for average 8 acre unit
- Non Native Seeding $220/ac
  - Orchard, ryegrass, clover
- Native Seeding $260/ac
  - Switchgrass Mix
- Organic Scenarios $240/$300/ac
Current Crop Rotation Scenarios

- **Typical Scenario for average 30 acre unit**
- **General Change $9/ac**
  - Adding legumes, etc
- **Increasing Residue $21/ac**
  - Minimum 30% residue
  - Positive Soil Condition Index so need to increase OM, improve field operations, & reduce erosion.
- **Vegetables $45/ac**
- **Organic Scenarios $25/ac/$58**
Current Residue Management Scenarios

- **No Till** $22/ac
  - Planting Corn or Drilling Small Grains
  - Typical scenario for average 130 acre unit

- **Organic No Till** $36/ac
  - Includes No Till seeding of rye/vetch cover crop
  - Use of Roller Crimper to terminate cover crop
  - Typical scenario for average 25 acre unit
NRCS Financial Assistance 2012

- Chesapeake Bay Watershed Initiative?
- Federal Budget Impacts?

Questions?