Outline

- Dairy Compost/Manure Review
- Dryland, high-elevation dairy compost research methods, results, and preliminary summary
- Importance of understanding nutrient value of dairy compost or manure
Dairy Manure: An abundant resource in Idaho

3rd Dairy State in the Nation
Standing herd of 576,000 cows estimated in 2011
Idaho dairies produce an estimated 6.2 million tons of raw dairy manure each year

Compost & Manure Can:

✓ Provide soil nutrients
✓ Improve soil properties and overall soil quality/structure
✓ Improve water-holding capacity
✓ Increase soil organic matter (OM)

Increasing OM: Compost & Manure

✓ Manure/Compost provide food for soil microbes; healthy populations of soil microbes create a balanced soil system that cycles nutrients more efficiently.

Organic Matter

• Soil OM promotes a good cation exchange capacity (CEC).

• A good CEC enhances the soil holding capacity of macronutrients as well as other micronutrients through various soil chemistry complexes.

• OM is a reservoir of nutrients and acts as a slow-release fertilizer.
Dairy Compost

Finding the right formula

- Dependent on compost composition, soil nutrient availability, the crop grown, and local environmental conditions

mineralization rates

Dairy Compost: Mineralization

• Microbial conversion of organic nutrients into an inorganic form that plants can use.
Dairy Compost: Mineralization Rates

- Impacted by:
  - Microbes
  - Soil temperature
  - Soil moisture
  - Compost properties

University of Idaho
Dairy Compost Trials
Methods

Plot Locations:
Camas & Blaine (high-desert, organic systems)
Crops: alfalfa and malting barley

- 4-year trial, with 4 replicated plots
- Plot size = 50 x 350 ft
- Applying 0, 5, and 10 tons/acre every fall

Data Collecting:
- Soil Mineralization (N, P, K)
- Soil Residual Data (N, P, K)
Methods: Soil Data

- Buried bag technique
  - Pulled bag every 30 days during growing season
  - Analyzed for N, P, and K
- Residual soil data collected every fall (N, P, and K)
Results

Mineralization of N, P, K
Soil Residual of N, P, K
Economic Value
2010 Mineralization: Soil NO$_3$
2010 Mineralization: Soil P

Available Soil P (ppm)

Days of Field Incubation

P = 0.05
2010 Mineralization: Soil K

Available Soil K (ppm)

Days of Field Incubation

P = 0.05
2011 Mineralization: Soil P

Available Soil P (ppm)

Days of Field Incubation

P = 0.05
2011 Mineralization: Soil K

Available Soil K (ppm)

Days of Field Incubation

P = 0.05
2010 Residual Soil N

Soil Nitrate (ppm)

Compost Rate (tons/acre)

0  5  10

0  1  2  3  4  5  6  7  8  9  10

P = 0.05

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2010-11 Blaine Residual Soil P

Soil P (ppm)

Compost Rate (tons/acre)

Blue = 2010
Orange = 2011

$37 value over 0 T/A

$86 value over 0 T/A

P = 0.05
2010-11 Blaine Residual Soil K

Compost Rate (tons/acre)

Soil K (ppm)

Blue = 2010
Orange = 2011

$76 value over 0 T/A

$106 value over 0 T/A

P = 0.05
Preliminary Summary

- P mineralization with 5 and 10 T/A compost were double the control
- Use 10 T/A to increase K mineralization, and build soil residual K levels
- Use 5 T/A to increase P mineralization, and build soil residual P levels
- Economically effective to use dairy compost on dryland organic alfalfa/barley system
Value: Compost & Manure

- Slow release fertilizer
- Incorporating sustainable practices for soil health and nutrient holding capacity
- Better use of an abundant resource
- Economic value varies with nutrient content of compost or manure
<table>
<thead>
<tr>
<th>Nutrient Source</th>
<th>$</th>
<th>Management</th>
<th>N,P,K</th>
<th>Provide OM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic Fertilizer</td>
<td></td>
<td>Short-term</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>Dairy Compost</td>
<td></td>
<td>Long-term</td>
<td>Medium-High</td>
<td>Yes</td>
</tr>
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</table>
## Economic Benefit of Compost - Example

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Compost Nutrient lb/Ton</th>
<th>Fert. unit cost</th>
<th>Nutrient value/T of compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 P₂O₅</td>
<td>11</td>
<td>$0.82</td>
<td>$9.02</td>
</tr>
<tr>
<td>2009 K₂O</td>
<td>50</td>
<td>$0.69</td>
<td>$34.50</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td>$43.52</td>
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<tr>
<td>2010 P₂O₅</td>
<td>3</td>
<td>$0.82</td>
<td>$2.46</td>
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<tr>
<td>2010 K₂O</td>
<td>15</td>
<td>$0.69</td>
<td>$10.35</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td>$12.81</td>
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</tbody>
</table>
## Economic Benefit of Compost - Example

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Compost Nutrient lb/Ton</th>
<th>Fert. unit cost</th>
<th>Nutrient value/T of compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen - urea</td>
<td>14.5</td>
<td>$0.80</td>
<td>$11.60</td>
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<tr>
<td>$P_2O_5$</td>
<td>12.0</td>
<td>$0.82</td>
<td>$9.84</td>
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<tr>
<td>$K_2O$</td>
<td>26.0</td>
<td>$0.69</td>
<td>$17.94</td>
</tr>
<tr>
<td>Elemental S</td>
<td>3.0</td>
<td>$0.55</td>
<td>$1.65</td>
</tr>
<tr>
<td>1 ton Compost value</td>
<td></td>
<td></td>
<td>$41.03</td>
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</tbody>
</table>
### Economic Benefit of Compost - Example

<table>
<thead>
<tr>
<th>Compost Rate</th>
<th>Compost Cost &amp; Spreading</th>
<th>NPKS Value</th>
<th>Savings from Compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ton/acre</td>
<td>$25.00</td>
<td>$41.03</td>
<td>$16.03</td>
</tr>
<tr>
<td>5 ton/acre</td>
<td>$125.00</td>
<td>$205.15</td>
<td>$80.15</td>
</tr>
<tr>
<td>10 ton/acre</td>
<td>$250.00</td>
<td>$410.03</td>
<td>$160.30</td>
</tr>
</tbody>
</table>
Compost in field crops should be part of any long-term soil management plan.
QUESTIONS?

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Research Objectives

1. Increase knowledge on the use of dairy composted manure for organic and conventional systems in S. Idaho.

2. Evaluate macro-nutrient contribution from compost (N,P,K).
   a. Understand local mineralization rates
   b. Understand resulting residual soil nutrients
Research Objectives

3. Evaluate economic$ of this management practice

4. Help growers better match crop nutrient demand to compost nutrient release.

5. Evaluate changes in soil quality(OM).
Compost Supplemental Source of N

In **Organic** systems combine with:
- N fixing cover crops
- Organic fertilizers
- Manure

In **Conventional** systems combine with:
- Synthetic fertilizer
- Cover crops
- Manure
Variation Issues

• Powers et al. (1975) reported minimum and maximum values on a dry basis of animal