BE LOYAL TO THE SOIL

SOIL HEALTH PRESENTATION WITH A SPRINKLING OF ECONOMICS
FOR TODAY

• What is soil health?
• How do we test the health of our soil?
• What practices improve our soil health?
• Is there an economic benefit with improved soil health?
DIG A LITTLE- LEARN A LOT

What Is Healthy Soil

- Nutrient Rich
- Mix of 50% solids, 25% air and 25% water
- Has a soil texture consisting of a mixture of 30-40% sand, 30-40% silt, and 8-28% clay (called loam)
- PH level between 6.3 to 6.8
- Free of excess salts
- Teaming with beneficial soil microbes

- https://www.youtube.com/watch?v=2JZJB4zM3Y4
• **Soil health** can be defined as “the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans.”

• **To put it simply, it is how well the soil does what it is supposed to do.** For a soil to be healthy, all the processes—physical, chemical, and biological—are working as they should. A healthy soil has good soil structure, high infiltration rates, and high water-holding capacity. It resists erosion, cycles nutrients, and supports healthy plants and animals. Most people know a healthy soil when they see it—by its color, its structure, and even its smell.
OVERVIEW OF SCIENCE OF HEALTHY SOILS

https://www.youtube.com/watch?v=wD7cX-2yvas  6 min
HEALTHY SOIL

HEALTHY PRACTICES

• NO-TILL
• COVER CROPS
• NUTRIENT MANAGEMENT
• INTEGRATED PEST MANAGEMENT
• CROP DIVERSITY

HEALTHY IMPACTS

• RESPIRATION
• BULK DENSITY
• INCREASE SOIL ORGANIC MATTER
• INCREASE C:N
• SOIL ORGANISMS
• INFILTRATION-CONSERVE WATER
• AROMA
• LESS FUEL, LABOR & COMMERCIAL FERTILIZER
• LESS EROSION
WHAT NEEDS CONSIDERED TO IMPROVE SOIL HEALTH?

- Soil structure
- Soil organic matter
- Microorganisms
- Bulk density/compaction
- Infiltration
- Water holding capacity
- Soil temperature
- Reduce erosion
SOIL HEALTH TESTS

Soil Quality Test Kit Guide

- Bulk Density
- Respiration
- Infiltration
- Stability
- Earthworm
- Slake
What are Mycorrhizal Fungi?

- NATURALLY OCCURING Beneficial Fungi
- Form SYMBIOTIC relationships with plants
- Attach to roots and become EXTENSIONS of the root system

- They dramatically EXPAND ACCESS to moisture & nutrients from the soil
- In return, the host plant feeds the fungi with sugars and organic substances
SOLVITA TEST
Respiration

SOLVITA BASAL RESPIRATION – using a bulb planter helps to take a sample

Solvita CO2-Burst Method Soil Test
SOIL HEALTH ASSESSMENT

SOLVITA TEST OF 6—ORGANIC N 245#

SOLVITA TEST OF 3.5—ORGANIC N 59#
A one inch layer of water is added to a six inch diameter ring to measure infiltration rate.

Table 1. Steady infiltration rates for general soil texture groups in very deeply wetted soil. (Hillel, D. 1982. Introduction to soil physics. Academic Press, San Diego, CA)

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Steady Infiltration Rate (in/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sands</td>
<td>&gt; 0.8</td>
</tr>
<tr>
<td>Loams</td>
<td>0.2 - 0.4</td>
</tr>
<tr>
<td>Clays</td>
<td>0.04 - 0.2</td>
</tr>
</tbody>
</table>
Did You Know?

Soil stability serves as a qualitative indicator of soil biological activity, energy flow, and nutrient cycling. Binding of soil particles must constantly be renewed by biological processes.

https://www.youtube.com/watch?v=9_ItEhCrLoQ  1 min
**BULK DENSITY**

Measures compaction level of soil

Table 1.—General relationship of soil bulk density to root growth based on soil texture

<table>
<thead>
<tr>
<th>Soil texture</th>
<th>Ideal bulk density for plant growth (grams/cm³)</th>
<th>Bulk density that affects root growth (grams/cm³)</th>
<th>Bulk density that restricts root growth (grams/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand, loamy sand</td>
<td>&lt;1.60</td>
<td>1.69</td>
<td>&gt;1.80</td>
</tr>
<tr>
<td>Sandy loam, loam</td>
<td>&lt;1.40</td>
<td>1.63</td>
<td>&gt;1.80</td>
</tr>
<tr>
<td>Sandy clay loam, clay loam</td>
<td>&lt;1.40</td>
<td>1.60</td>
<td>&gt;1.75</td>
</tr>
<tr>
<td>Silt, silt loam</td>
<td>&lt;1.40</td>
<td>1.60</td>
<td>&gt;1.75</td>
</tr>
<tr>
<td>Silt loam, silty clay loam</td>
<td>&lt;1.40</td>
<td>1.55</td>
<td>&gt;1.65</td>
</tr>
<tr>
<td>Sandy clay, silty clay, clay loam</td>
<td>&lt;1.10</td>
<td>1.49</td>
<td>&gt;1.58</td>
</tr>
<tr>
<td>Clay (&gt;45 percent clay)</td>
<td>&lt;1.10</td>
<td>1.39</td>
<td>&gt;1.47</td>
</tr>
</tbody>
</table>
EARTHWORM COUNT

dig a hole 12” X 12” X 12”

count the worms

https://www.youtube.com/watch?v=OcpXeSRGdXA 3 min
# WHAT IS THE DIFFERENCE BETWEEN EARTHWORMS & NIGHTCRAWLERS?

<table>
<thead>
<tr>
<th>NIGHTCRAWLERS  (DEW WORMS)</th>
<th>EARTHWORMS  (RED WIGGLERS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Much larger- 14”</td>
<td>• Smaller- 4”</td>
</tr>
<tr>
<td>• Grayer</td>
<td>• Reddish</td>
</tr>
<tr>
<td>• Thicker</td>
<td>• Used in composting-eat up to ½ their weight a day</td>
</tr>
<tr>
<td>• Burrow during the day up to 6.5’ deep</td>
<td>• Can buy from garden supply catalogues</td>
</tr>
<tr>
<td>• Earthmoving</td>
<td>• Toxic to snakes</td>
</tr>
<tr>
<td>• Used for bait</td>
<td></td>
</tr>
</tbody>
</table>
SOIL HEALTH ASSESSMENT

FIELD ASSESSMENT SCORE = 2.86
ORGANIC N 245#

FIELD ASSESSMENT SCORE = 1.9
ORGANIC N 59#
NO-TILL

BENEFITS INCLUDE: INCREASED ORGANIC MATTER, FUEL SAVINGS, IMPROVED SOIL STRUCTURE, INCREASED EARTHWORMS AND MYCORHYZAE, INCREASED INFILTRATION, REDUCED RELIANCE ON CHEMICALS
NO TILL

A system for planting crops without plowing, using herbicides to control weeds and resulting in reduced soil erosion and the preservation of soil nutrients.
# ECONOMICS OF NO-TILL-TIME & FUEL

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Spring Grain</th>
<th>Winter Wheat</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional</td>
<td>No-Till</td>
<td>No-Till</td>
</tr>
<tr>
<td>Labor</td>
<td>minutes</td>
<td>gallons</td>
<td></td>
</tr>
<tr>
<td>Fall&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Spring&lt;sup&gt;b&lt;/sup&gt;</td>
<td>25</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Summer&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>32</td>
<td>25</td>
</tr>
</tbody>
</table>

<sup>a</sup> Machinery labor from August 21 to December 31.

<sup>b</sup> Machinery labor from January 1 to May 20.

<sup>c</sup> Machinery labor from May 21 to August 20.
NO-TILL RESIDUE

CORN INTO CORN

SOYBEANS INTO CORN
ORGANIC MATTER & SOIL ORGANISMS

ORGANIC MATTER IS THE HOUSE
CARBON IS THE FOOD
SOIL ORGANISMS LIVE IN THE HOUSE & MAKE THE FOOD INTO FERTILIZER
As C:N ratio goes down, 8:1-15:1 N & P available below 8 C limited, above 15 N limited.

Organic N & P go up.
SOIL ORGANIC MATTER

Anything that was alive and is now in or on the soil and decomposed into humus. Humus is the material that was decomposed by microorganisms.

It takes about 10# of organic material to decompose into 1# organic matter.
WHY IS ORGANIC MATTER IMPORTANT?

- RESERVOIR OF NUTRIENTS
  - 1% = 23-30# N/ac
  - Anhy Ammonia $391.75/T = .20/#
    - $0.20/lb X 30 # N/ac = $6/ac!!
  - Urea $309.28/T
    - $0.15/lb X 30 = $4.50/ac
  - 32-0-0 $294.00/T
    - $0.15 X 30 = $4.50/ac

- WATER HOLDING CAPACITY
  - 1% = 16,500 gal/Ac water holding capacity
  - Water allocations
  - Drought resistance

- BETTER SOIL STRUCTURE
  - improved permeability
HOW TO BUILD ORGANIC MATTER - BUILD CARBON

- ADD COMPOST OR MANURE
- NO TILLAGE
- AVOID SOIL EROSION
- CROP ROTATION
- COVER CROPS
SOIL CRITTERS

Mycorrhizae fungi

Nematodes

Earthworms

Arthropods

Protozoa
COVER CROPS

BENEFITS: WARMER SOIL IN WINTER, COOLER IN SUMMER, CONSERVE SOIL WATER, NITROGEN FIXATION AND NITROGEN SCAVENGING, BREAK UP HARD PAN/PLLOW LAYER, REDUCE EROSION
## Cover Crop Economics (Long Term Analysis)

The long-term analysis assumes the continued utilization of cover crops modeled in the short term analysis, and also captures additional benefits that may be realized over time with the continued use of cover crops in rotation. Refer to the "Instructions" worksheet and "References and Citations" worksheet for more information and guidance on entering the long-term analysis.

### General Information

The lifespan refers to the length of time being analyzed and assumes a continued use of cover crop in the farming rotation, based on the information entered into the Short Term Analysis.

- **Analysis Lifespan (years)**: up to 50 years
- **Discount Rate**: 3%
- **Current Soil Organic Matter (SOM) (%)**: 2
- **Estimate of years of mgmt change to increase SOM 1%**: 10
- **Estimate of maximum potential SOM (%)**: 4

The Analysis Lifespan (years) must be greater than the Estimate of years of mgmt change to increase SOM 1% in order for the long-term analysis results to begin capturing the long-term benefits.

### Costs

The costs shown below are based on the information entered into the short term analysis and amortized over the long term analysis lifespan.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Price ($/ac/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Crop Establishment &amp; Mgt ($)/ac/yr</td>
<td>$56.25</td>
</tr>
<tr>
<td>Other Costs ($)/ac/yr</td>
<td>$7.81</td>
</tr>
<tr>
<td><strong>Total Cost ($/ac/yr)</strong></td>
<td><strong>$63.06</strong></td>
</tr>
</tbody>
</table>

### Benefits

The benefits below are based on the information entered into the short term analysis and amortized over the long term analysis lifespan.

<table>
<thead>
<tr>
<th>Benefit Description</th>
<th>Benefit ($)/ac/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct nutrient credit ($)/ac/yr</td>
<td>$7.91</td>
</tr>
<tr>
<td>Herbicide/insecticide/fungicide input reduction ($)/ac/yr</td>
<td>$3.01</td>
</tr>
<tr>
<td>Yield Increase ($)/ac/yr</td>
<td>$8.70</td>
</tr>
<tr>
<td>Erosion Reduction ($)/ac/yr</td>
<td>$21.13</td>
</tr>
<tr>
<td>Grazing Benefit ($)/ac/yr</td>
<td>$47.35</td>
</tr>
</tbody>
</table>

## Economic Analysis of Cover Crops Summary

**12/12/2016**

### Scenario Description

A soybean/corn rotation where producer is establishing fall cover crops. The cover crop established after corn harvest is grazed in fall and/or spring depending on weather and cover crop establishment timing. The forage provided by the cover crop offsets some of the typical winter feeding expenses.

### Short Term Analysis

**Rotation Information**

- **Baseline Yield (bu/ac)**: Soybeans 90, Corn 225
- **Crop Value ($/bu)**: Soybeans $9.25, Corn $3.02

**Cost Summary**

- **Cover Crop Establishment and Management ($/ac)**: Soybeans $51.60, Corn $59.04
- **Other Cost ($/ac)**: Soybeans $0.00, Corn $16.30
- **Total Costs ($/ac)**: Soybeans $51.60, Corn $75.34

**Benefits Summary**

- **Direct Nutrient Input Reduction ($/ac)**: Soybeans $0.00, Corn $16.50
- **Herbicide, fungicide, insecticide Input Reduction ($/ac)**: Soybeans $3.00, Corn $3.00
- **Yield Increase ($/ac)**: Soybeans $16.65, Corn $0.00
- **Erosion Reduction ($/ac)**: Soybeans $21.09, Corn $21.09
- **Grazing Benefit ($/ac)**: Soybeans $37.70, Corn $57.70
- **Total Benefit ($/ac)**: Soybeans $78.44, Corn $99.29

**Short Term Analysis Results**

- **Total Cost ($/ac)**: Soybeans $51.60, Corn $75.34
- **Total Benefit ($/ac)**: Soybeans $78.44, Corn $99.29
- **Net Benefit ($/ac)**: Soybeans $26.84, Corn $22.95

### Long Term Analysis

**Long Term Analysis Details**

- **Analysis Lifespan**: 25
- **Discount Rate**: 3%
- **Current Soil Organic Matter (SOM) (%)**: 2
- **Estimate of years of mgmt change to increase SOM 1%**: 10
“plants fix dirt”
Rick Haney
DISCOVER THE COVER-COVER CROPS
USING COVER CROPS TO MANAGE YOUR HEARD OF SOIL MICROORGANISMS

- [https://www.youtube.com/watch?v=VHM CJSxQAg0](https://www.youtube.com/watch?v=VHM CJSxQAg0) 1 min

Photo on the left shows cover crop rows shaded by a canopy of corn. At right, cover crop in full growth after corn harvest and withering of stalks.
WHAT TO PLANT?
WHAT ARE YOUR OBJECTIVES?

COVER CROP TURNIP

COVER CROP ROOTS

Cover crops can:

- Increase soil organic matter
- Increase nitrogen balance in the soil
- Suppress pests (weeds)
- Provide habitat for beneficial insects
- Enhance soil biological activity
- Control erosion
- Prevent compaction

What do you want your cover crop to do?
Managing Cover Crops Profitably

MULTIPLE USES AND BENEFITS

DIVERSITY
HOW TO PLANT

BROADCAST RATE X 1.5
<table>
<thead>
<tr>
<th>Cover Crop Spp.</th>
<th>Planting Date Zone I, II</th>
</tr>
</thead>
<tbody>
<tr>
<td>barley, spring</td>
<td>3/15-5/15 or 8/1-9/1</td>
</tr>
<tr>
<td>buckwheat</td>
<td>5/1-9/1</td>
</tr>
<tr>
<td>canola /rapeseed</td>
<td>3/15-4/15 or 7/1-9/15</td>
</tr>
<tr>
<td>chickling vetch</td>
<td>3/15-4/15 or 8/1-9/15</td>
</tr>
<tr>
<td>chickpea (desi-type)</td>
<td>4/15-5/15</td>
</tr>
<tr>
<td>clover, arrowleaf</td>
<td>3/15-5/15 or 8/15-9/15</td>
</tr>
<tr>
<td>clover, Berseem/Persian</td>
<td>3/15-5/15 or 7/15-9/15</td>
</tr>
<tr>
<td>clover, Crimson</td>
<td>3/15-5/15 or 7/15-15</td>
</tr>
<tr>
<td>clover, red</td>
<td>NA</td>
</tr>
<tr>
<td>clover, sweet</td>
<td>8/1-9/15 or 11/1-5/15</td>
</tr>
<tr>
<td>corn (BMR)</td>
<td>NA</td>
</tr>
<tr>
<td>cowpea</td>
<td>NA</td>
</tr>
<tr>
<td>Ethiopian Cabbage</td>
<td>7/15-9/15</td>
</tr>
<tr>
<td>faba bean</td>
<td>3/15-4/15 or 7/15-9/1</td>
</tr>
<tr>
<td>flax</td>
<td>3/15-5/10 or 7/1-9/1</td>
</tr>
<tr>
<td>Hybrid Brassica</td>
<td>3/15-4/15 or 7/1-9/15</td>
</tr>
<tr>
<td>lentil, spring</td>
<td>3/15-4/15 or 7/1-9/15</td>
</tr>
<tr>
<td>millet, foxtail (German)</td>
<td>5/15-8/1</td>
</tr>
<tr>
<td>millet, pearl</td>
<td>5/15-8/15</td>
</tr>
<tr>
<td>millet, proso</td>
<td>5/15-8/15</td>
</tr>
<tr>
<td>mustard, brown, oriental or yellow</td>
<td>3/15-4/1 or 7/15-9/1</td>
</tr>
<tr>
<td>oats</td>
<td>3/15-5/1 or 8/1-9/1</td>
</tr>
<tr>
<td>pea, spring field</td>
<td>3/15-4/15 or 7/15-9/1</td>
</tr>
<tr>
<td>pea, spring forage</td>
<td>3/15-4/15 or 7/15-9/1</td>
</tr>
</tbody>
</table>

### WHEN TO PLANT

<table>
<thead>
<tr>
<th>Cover Crop Spp.</th>
<th>Planting Date Zone I, II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phacelia</td>
<td>3/15-5/15 or 7/15-9/15</td>
</tr>
<tr>
<td>radish</td>
<td>7/15-8/20</td>
</tr>
<tr>
<td>rye (cereal)</td>
<td>8/1-10/15</td>
</tr>
<tr>
<td>ryegrass (annual)</td>
<td>3/15-5/15 or 8/1-9/15</td>
</tr>
<tr>
<td>ryegrass (Italian)**</td>
<td>3/15-5/15 or 8/1-9/15</td>
</tr>
<tr>
<td>safflower</td>
<td>3/15-5/1 or 8/1-9/15</td>
</tr>
<tr>
<td>sorghum, grain or forage</td>
<td>5/15-8/15</td>
</tr>
<tr>
<td>soybean</td>
<td>NA</td>
</tr>
<tr>
<td>sudangrass</td>
<td>5/15-8/15</td>
</tr>
<tr>
<td>sudan-sorghum hybrid</td>
<td>5/15-8/15</td>
</tr>
<tr>
<td>sunflower</td>
<td>5/15-8/16</td>
</tr>
<tr>
<td>Sunn Hemp</td>
<td>6/1-8/1</td>
</tr>
<tr>
<td>triticale</td>
<td>8/1-9/15</td>
</tr>
<tr>
<td>triticale,spring</td>
<td>3/15-5/1 or 8/1-9/1</td>
</tr>
<tr>
<td>turnip</td>
<td>7/15-8/20</td>
</tr>
<tr>
<td>vetch, common</td>
<td>3/15-4/15 or 7/15-9/15</td>
</tr>
<tr>
<td>vetch, hairy or crown</td>
<td>8/1-9/15 or 11/1-5/15</td>
</tr>
<tr>
<td>vetch, woolypod (Lana)</td>
<td>3/15-4/15 or 7/15-9/15</td>
</tr>
<tr>
<td>wheat (winter)</td>
<td>8/15-9/20</td>
</tr>
</tbody>
</table>
TERMINATION METHODS & GUIDELINES

ROLLER
MECHANICAL
CHEMICAL
OVER WINTER
HARVESTED
TIMING
GRAZING COVER CROPS

Incorporating grazing of cover crops into a cash crop operation is a reliable way to capture short term benefits from cover crops and increase the overall profitability of the operation. To maximize the long term soil health benefits of the cover crops, grazing must be managed to balance the forage needs of the livestock with the needs of the living organisms in the soil. Over grazing cover crops can have a negative effect on long-term soil health benefits.
## Grazing Economics - Cost Analysis

### Analysis

<table>
<thead>
<tr>
<th>Costs</th>
<th>Cover Crop Before Corn</th>
<th>Grazing Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Crop Seed ($/acre) -</td>
<td>$19.00</td>
<td>Fence ($/acre) $1/</td>
</tr>
<tr>
<td>Winter Triticale, 20 lbs/acre, $0.31/lb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purple Top Turnip, 4 lbs/acre, $1.70/lb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Oats, 20 lbs/acre, $0.30/lb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover Crop Planting ($/acre)</td>
<td>$20.00</td>
<td>Watering Facilities ($/acre)$2/</td>
</tr>
<tr>
<td>Cover Crop Termination ($/acre)</td>
<td>$10.00</td>
<td></td>
</tr>
<tr>
<td>Total Cost ($/acre)</td>
<td>$49.00</td>
<td>Total Cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$120.69</td>
</tr>
</tbody>
</table>

### Benefits

<table>
<thead>
<tr>
<th>Cover Crop Before Corn</th>
<th>Grazing Value ($/acre) - 2.7 AU/ac, 35 lb/AU/day forage demand, 42 days grazing, $80.00/ton forage value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$158.76</td>
</tr>
</tbody>
</table>

$1/$ Indicates a one-time cost
$2/$ Indicates a recurring cost
**GRAZING ECONOMICS -- RESULTS**

**Results**

**Short Term**
Grazing Infrastructure One Time Investment Cost ___ $120.69/ac
Cover Crop mix for grazing before Corn net benefit ___ $109.76/ac
Year 1 Net Cost ___ $10.93/ac

**Long Term**
If the farmer continues to utilize cover crops in his rotation he will experience improvements in the physical and biological properties of the soil. One way to measure this improvement is through soil organic matter. For each 1 percent increase in soil organic matter (based on increasing the active carbon content in the soil) approximately 20 lb/acre of plant-available nitrogen becomes available. Additionally, the water-holding capacity of the soil increases, reducing the risk of drought-induced yield reductions in dryland farming systems. Assuming it takes this farmer 10 years to increase soil organic matter 1 percent, the additional benefits after year 10 are $27.50/acre/year.

**Long Term Benefits**

<table>
<thead>
<tr>
<th>Benefit Description</th>
<th>Net Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Fertility ($/acre/year) - 20 lbs/acre plant available N at $0.55/lb</td>
<td>$11.00</td>
</tr>
<tr>
<td>Water Storage ($/acre/year) - avoided yield reduction due to drought</td>
<td>$16.50</td>
</tr>
<tr>
<td>Total Long Term Benefits ($/acre/year)</td>
<td>$27.50</td>
</tr>
</tbody>
</table>

**Combining the Short Term and Long Term Results**

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Net Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years 1</td>
<td>$10.93/ac</td>
</tr>
<tr>
<td>Years 2-10</td>
<td>$109.76/ac</td>
</tr>
<tr>
<td>Years 11-20</td>
<td>$137.26/ac</td>
</tr>
<tr>
<td>Years 21-30</td>
<td>$164.76/ac</td>
</tr>
</tbody>
</table>

- Chart showing net benefit progression over years.
NUTRIENT & PEST MANAGEMENT

Benefits: Cleaner drinking water, less pollution of streams & rivers, fewer chemicals, optimize on farm nutrients, reduce fertilizer costs, prevent excessive nutrient build-up
SOIL TEST PROCEDURE

PROPER SAMPLING

GARBAGE IN - GARBAGE OUT

Guidelines for Soil Sampling

SCN: The only way to know is to take a Soil Sample

Funding provided by the Nebraska Soybean Board
GRID SAMPLING FOR PRECISION AG
UNDERSTAND WHAT YOUR REPORT TELLS YOU

- Depth of sample
- Organic Matter
- Nitrogen—parts per million and/or pounds
- Phosphorus
- Potassium
- pH above 7—alkaline, below 7—acid, 7—just right!
WATER TEST—ONCE EVERY 5 YEARS

N pounds/ac applied = 
[(average inches pumped for current crop x ppm nitrate) x 2.7] divide by 12 inches

Example 10” pumped \( \times \) 14 ppm \( \times \) \( \frac{2.7}{12} \) = 31.5 #/ac N

31.5 # N \( \times \) $0.15/# = $4.72/ac
Nitrate Levels in Water

- **Good levels!**
  - Typical levels for surface waters is 0.1 ppm or below.
- **Bad levels!**
  - 2-9 ppm this level increases algal and plant growth.
  - This can lead to winter kills
    - Run off from sewage or fertilizer runoff causes an increased in algal growth.
    - Algae dies and decomposes which results in poor water clarity.
    - There is low dissolved oxygen.
    - Aquatic plant growth is inhabited.
    - This is stressful on fish and organisms especially when the water body freezes during the winter.
  - Levels from 10-12 can lead to premature eutrophication of an aquatic system.
  - Levels above 10 ppm can call infants to have methemoglobinemia. Which is a condition of having oxygen poor blood.

Nitrate levels in the water have already been paid for! Use them to fertilize your crops!!
MORE SHORT TERM ECONOMIC BENEFITS OF COVER CROPS

• Increase OM
  - \((\text{OM}\% \times \text{RYG}) \times 0.14 = \#\text{N/AC}\)
  - \(\text{RYG} = 5\ \text{yr average} + 5\%\)
  - 200 bu/ac ave = 210 RYG
  - 2% \(\text{OM} \times 210\ \text{RYG} = 420\)
  - 420 \(\times 0.14 = 58.8\#\text{A AVAILABLE N}\)

• “Trap Crop” to scavenge Nitrogen, Phosphorus and Potassium
  - 5 year study in Ohio found 250\# N, 23\# P and 239\# K were recycled by oilseed radish and present just ahead of spring planting
  - 10-40\# trapped above ground portion
  - But don’t forget the roots
  - 80-100\# is combined with manure application
  - Substantial N in the roots
  - Availability based on the C:N ratio

• Natural means of suppressing soil diseases and pest. Serves as mulch to reduce weeds.
  - Could rye be an answer to some of our “resistance” problems?
MANURE APPLIED

KNOW WHAT TO APPLY

TO AVOID THIS
MANURE TESTS

MANURE IS BENEFICIAL TO INCREASED SOM. IF MANURE IS NOT INCORPORATED WITH TILLAGE IT CAN BE BENEFICIAL TO OVERALL SOIL HEALTH AND GOOD SOURCES OF N & P
NRCS NUTRIENT BUDGET FOR CORN

NE-CPA 38b NUTRIENT BUDGET JOBSHEET FOR GRAIN CORN

KNOWING WHAT YOU HAVE AND WHAT YOU NEED!

### Annual Nutrient Budget Jobsheet (NE-CPA-38b) for grain corn

**Section 1 - Producer/Field/Crop Information**
- **Producer Name**
- **Site #**
- **Tract #**
- **Field #**
- **Acres**
- **Tillage Practices:**
- **Current Crop**
- **Prior Crop / Yield**
- **Crop Year**
- **Realistic Yield Goal (RYG)**: 0.0
- **6-Year Average Yield (units)**: (105% of 5-Yr. Ave. Yield)
- **Legal Description**
- **County**

**Crop Year**
- **Crop**
- **Credible (lb./acre)**
- **O.M.**
- **Soil pH**
- **Soil Organic Matter (O.M.)**

**Section 2 - Risk Assessments**
- **Risk Assessment**
- **Soil Test Information**
  - **Soil Test Values (ppm)**
  - **Top Layer (in.)**
  - **Bottom Layer (in.)**

**Section 3 - Soil Test Information**
- **Soil Test Depths**
- **Application Timing(s)**
  - **Pre-Emergent**
  - **Surface**
  - **Spring, Preplant**
  - **Sidedress or Split**
  - **Fall**

**Section 4 - Nutrient Budget**
- **NEEDS ( UNL Nutrient Recommendations) (lb./acre)**
- **CREDITS (lb./acre)**
  - **Organic-N**
  - **Soil Nitrate-N Residual**
  - **Soil Organic Matter (O.M.)**
  - **Legume Type**
  - **Irrigation Well Water**
  - **Organic-N Credits for Prior Applied Manure**
- **TOTAL CREDITS (sum of items 7-11)**
- **NUTRIENTS REQUIRED (= Needs - Credits)**

**Section 5 - Planned Nutrient Application**
- **FORMULATION/FORM (lb./acre)**
- **Rate (units)**
  - **Liquid, Dry**
  - **N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O**

**Section 6 - Actual Nutrients Applied**
- **ACTUAL NUTRIENT APPLIED**
  - **Rate (units)**
  - **N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O**
- **Actual Yield**
- **Source & Rate**
  - **Source & Rate**

**Notes**
- **Check box if planned rates are listed on Soil Sample Report**
- **If application was not uniform include map with field information.**
- **Provide info relating to unusual weather conditions affecting actual yields.**
- **If application was not uniform include map with field information.**

---

**TABLE 1. Inorganic N Leaching Risk Assessment**

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Coarse</th>
<th>Medium</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>(High)</td>
<td>(Med-Low)</td>
<td>(Low)</td>
</tr>
</tbody>
</table>
“T” CHART
QUICK ECONOMIC EVALUATION
## EVALUATE THE CONSERVATION TREATMENT

**IS IT AFFORDABLE?**

**IS IT PROFITABLE?**

**HOW LONG TO GET MY MONEY BACK**

**WHAT IS THE RETURN ON THE INVESTMENT?**

**WHAT IS THE NET GAIN TO COVER EXPENSES?**

### CONSERVATION TREATMENT EFFECTS INFORMATION

|-------------------|--------------------------|---------------------|------------------------------------------|

<table>
<thead>
<tr>
<th>CONSERVATION TREATMENT:</th>
<th>RESOURCE PROBLEMS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residue Management, Direct Seeding</td>
<td>Productivity, Erosion, Water Quality</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POSITIVE EFFECTS (Benefits)</th>
<th>NEGATIVE EFFECTS (Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop Yield Increase 8 Bushels/Year X $4/Bu = $32/Year</td>
<td>No-Till Drill $15,000/2,000 Acres = $7.50/Acre</td>
</tr>
<tr>
<td>Crop Quality Improvement</td>
<td>Annual Cost (7%, 10 Years) $7.50 X .142 = $1.07/Acre/Year</td>
</tr>
<tr>
<td>Pheasant/Quail Habitat Improvement</td>
<td>Increased Herbicide Cost = $25.00/Acre/Year</td>
</tr>
<tr>
<td>Reduced Erosion = 2 Tons</td>
<td>Increased Risk of New System</td>
</tr>
<tr>
<td>Water Quality Improvement</td>
<td></td>
</tr>
<tr>
<td>Total Benefits = $32/Acre/Year</td>
<td>Total Costs = $26.07/Acre/Year</td>
</tr>
</tbody>
</table>
# NRCS “T” Chart Example

**LEVEL I GREEN:**
Qualitative Statements

**LEVEL II BLUE:**
Units of Measurements, Dollars

**LEVEL III RED:**
Economic & Financial Analysis

## Conservation Treatment Effects Information

<table>
<thead>
<tr>
<th>Conservation Treatment:</th>
<th>Resource Problems:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture Seeding, Brush &amp; Weed Control</td>
<td>Plant Productivity, Erosion, Profitability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>“+” Positive Effects (Benefits)</th>
<th>“-” Negative Effects (Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage Quality Improvement</td>
<td>Goose Habitat Increases Trespassing</td>
</tr>
<tr>
<td>Reduced Erosion, 2 Tons/Acre</td>
<td>Brush Control $50/Acre</td>
</tr>
<tr>
<td>Water Quality Improvement</td>
<td>Reseed Pasture $65/Acre</td>
</tr>
<tr>
<td>Goose Habitat Improves Bird Watching</td>
<td>$115/Acre</td>
</tr>
<tr>
<td>Forage Increase 3 AUMs Year X $12/AUM = $36/Ac/Year</td>
<td>7% Interest, 10 Years = .142 X $115 = $16.33</td>
</tr>
<tr>
<td>Total Benefits = $36/Ac/Year</td>
<td>Annual Installation Cost = $16.33/Acre/Year</td>
</tr>
<tr>
<td></td>
<td>Weed Control $15.00/Acre/Year</td>
</tr>
<tr>
<td></td>
<td>Total Costs = $31.33/Acre/Year</td>
</tr>
</tbody>
</table>
T CHART TEMPLATE

<table>
<thead>
<tr>
<th>CONSERVATION TREATMENT EFFECTS INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSERVATION MANAGEMENT UNIT:</td>
</tr>
<tr>
<td>CONSERVATION TREATMENT: KM5 #</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>POSITIVE +</td>
</tr>
</tbody>
</table>

**Pros:**

- Improved water quality
- Increased biodiversity

**Cons:**

- Higher costs of implementation
- Potential displacement of local communities

---
SOIL HEALTH SUMMARY

A COMPLEX ISSUE

HTTP://WWW.NRCS.USDA.GOV/WPS/PORTAL/NRCS/DETAIL/SOILS/HEALTH/ASSESSMENT/?CID=STELPRDB1237337
PRACTICES TO IMPROVE SOIL HEALTH

- REDUCE OR ELIMINATE TILLAGE
- COVER CROPS
- NUTRIENT MANAGEMENT
- INTEGRATED PEST MANAGEMENT
WHAT NEEDS CONSIDERED TO IMPROVE SOIL HEALTH

SOIL STRUCTURE
SOIL ORGANIC MATTER
MICROORGANISMS
BULK DENSITY/COMPACTION
INFILTRATION
WATER HOLDING CAPACITY
SOIL TEMPERATURE
REDUCE EROSION
SOIL HEALTH TESTS

Soil Quality Test Kit Guide

- Bulk Density
- Respiration
- Infiltration
- Stability
- Earthworm
- Slake

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beth.hiatt@ne.usda.gov
• http://www.bing.com/videos/search?q=Organic+Farming+FIELD+CROPS+YOU TUBE&view=detail&&mid=7D2656FDFEFFC9D2150E7D2656FDFEFFC9D215 0E 19 min-Weed Contr

PUT IT ALL TOGETHER!!

NO-TILL

COVER CROPS

INTEGRATED PEST MANAGEMENT

NUTRIENT MANAGEMENT-LEGUMES

Additional practices:
  Organic No-till
  Buffer strips
  Irrigation water management
• QUESTIONS?

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THANK YOU FOR YOUR ATTENTION!

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