Surface Residues/Cover (Shredded & signs of Life; Cobwebs (Fungi))

What’s under the residue?

Residue should be shredded

Brushing back the residue should show evidence of soil organisms breaking down residue. Remember this is habitat and if you provide it the organisms will come.

Cobwebs evidence of microbe activity

Rudy Garcia
Regional Soil Health Specialist (AZ, CO, NM, UT)
Natural Resources Conservation Service
What’s under the residue?

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Cobwebs evidence of microbe activity.

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Earthworms are present

Earthworms bury litter

Brown’s Ranch
Same Field

June 16, 2009
Corn planted into
previous years’ cover
crop residue

July 1, 2009
Rapid residue
decomposition

Saprophytic fungi

Drilosphere: Zone of earthworm influence

- Redistributes plant litter
- “Carbon” throughout the soil the profile
- Soils are enriched with N, P, and humified organic matter
- Increase water infiltration
- Provide a bio pore for plant roots
- Homogenize soil surface
- Increase bio-diversity in soils

- Shred Organic Matter
- Stimulate Microbial Decomposition
- Bury Organic Matter

Giant Australian earthworm

Megascolides australis
can get up to 11 feet!
Loose soil has a slower rate of drying compared to packed soil, because the water films are discontinuous and moisture is not readily conducted to the surface.

Corn planted into Cover Crop (Reduced Evaporation - More Soil Moisture)

Importance of Surface Cover in conserving moisture

Living Plants (protects & feeds soil life)

Taking crop residues away from the fields will compromise agricultural sustainability
Information is from Adam Daugherty, District Conservationist in TN. He’s been working with some high biomass level cover crops and has some interesting results related to moisture and temperature.
Lower Soil Temperature

Surface Temperature: 77 °F

Soil with Cover

Soil Moisture was at Field Capacity

Soil Temperature: 74 °F at 1 inch depth

Lower Soil Temperature (reduced ET)

Surface Temperature: 133 °F

Bare Soil

Soil Moisture was at about 50% of Field Capacity

Soil Temperature: 100 °F at 1 inch depth

Pecan Orchard south of Las Cruces, NM. (Temperature measurements with & without cover. Taken on April 20, 2015 at about 2:00 pm)

Air Temperature was 76 °F.

When soil temperature reaches

140 F  Soil bacteria die
130 F  100% moisture is lost through evaporation and transpiration
113 F  Some bacteria species start dying
100 F  15% moisture is used for growth
95 F  85% moisture lost through evaporation and transpiration
70 F  100% moisture is used for growth

J.J. McEntire, WUC, USDA SCS, Kernville TX, 3-58 4-R-12198. 1956

rudy.garcia
Runoff and Erosion Results

Soils with cover
Soils without cover

Rainfall Simulator Demonstration

Infiltration Results

Higher Drought Tolerance
Rainfall Simulator Demonstration

Raindrop impact destroys soil aggregates and disperses soil particles

(more water stored in the soil profile)

Importance of Surface Cover!!!
(Living Plants & Residues)
COMMUNITY DYNAMICS (Succession)

Degree of variation in populations

- Plant volume & height increases
- Micro-organisms build soil structure & depth
- Age structure is more balanced

Soil surface condition is key

Simple community
Great fluctuation

Complex community
Stability
Did you know that burying a pair of underwear in your field can help you determine how healthy your soil is? Shawna Olson met up with NDSU Soil Health Specialist Abbey Wick at the SHARE farm near Mooreton, N.D., to see the project, which has become a Twitter sensation known as "Soil Your Undies."

FIGURE 6. Residue cover – relative soil loss relationship. With 30% residue cover, soil loss is reduced 70%.
(V) **Drilosphere** (earthworms): Bio-pores, castings & mittens are present. Soil is well-aerated & has good soil tilth.
**Drillosphere: Zone of earthworm influence**

- Redistributes plant litter “Carbon” throughout the soil the profile
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**Earthworms**

- Poor soils contain 250,000 earthworms per acre while good soils contain 1,750,000 per acre
- 1 or less per shovel indicates poor soil health
- 10 or more per shovel indicates good soil health
- Burrowing through lubricated tunnels forces air in and out of soil

Earthworm casts contain

- 11% of the humus
- 7X the nitrogen
- 11X the phosphorus
- 9X the potash

than surrounding soil

Earthworms are present

Earthworm castings

As you transition to SHMS, you might notice enhanced conditions for earthworms - the earthworm now occupies radish hole.
Earthworms are Soil Engineers

Notice that many of the fine roots are growing out of the earthworm tunnels/castings.

Helps us get more carbon deeper into the soil profile - more water – more biological activity
April 29, 2014 evaluating soil of the cover crop field:
Worms underneath decomposing cow pie.
Brad McIntyre farm. Caldwell Id.
165 worms per cubic foot. = 7.2 million worms per acre.
(5) Crop Condition: “vigorous” & “uniform” growth (high yielding). Pollinators & beneficial arthropods are abundant.
Crop Condition (Vigorous & Uniform growth)
HEALTHY SOILS = NUTRITIOUS FOOD

Photos: Sena, NM
### Beneficial Arthropods

**Build it... they will come!**

162,000 weed seeds/1 sq. meter of a farm field. 137,000 to 161,000 predators per acre of corn canopy.

Approximately 10 percent of weed seeds are eaten per day by Millipedes, Small crickets, Isopods, Field Crickets and Carabid Beetles.

Jan 9, 2015. Dr. Jonathan Lundgren SD ARS/USDA.

<table>
<thead>
<tr>
<th>Costa Rica</th>
<th>150 Plants &amp; Animals</th>
<th>24 Hours - Forest</th>
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| Cape Town, South Africa | 100 Plants & Animals | 24 Hours - Grassland |

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<thead>
<tr>
<th>Iowa Corn Field</th>
<th>8 Plants &amp; Animals</th>
<th>24 Hours</th>
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Pollinators (very important!)
Cover Crops Enhance Pollinators & Wildlife

Use plant species that enhance forage opportunities for pollinators by using diverse legumes and other forbs.

Pollinators: Flowering plants that support pollinators also support beneficial predatory & parasitic insects.

Beneficial Insectary: Many of the nectar sipping & pest-eating insects that are attracted to flower pollen will also pollinate your fruit and vegetable crops & increase your yields.
Integrated Pest Management & Healthy Soils

Diversity in Crop Rotation & Cover Crops

Maintain Balance in the Biological, Physical & Chemical components of the soil (Management is the KEY!)

Soil Food Web (SFW)

Healthy Soil

Implement a Soil Health Management System to achieve an effective IPM Program
- Prevention
- Avoidance
- Monitoring
- Suppression

The importance of Diversity!

Costa Rica: 150 Plants & Animals (24 Hours - Forest)

Cape Town, South Africa: 100 Plants & Animals (24 Hours – Grassland)

Iowa Corn Field: Plants & Animals (24 Hours)

Photo: Sena, NM

• Prevention
• Avoidance
• Monitoring
• Suppression