Ten Ways that Cover Crops Enhance Soil Health

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What’s happening underneath our feet?
#1 Cover crops feed the soil food web
When there are no living roots, soil organisms go short on food
“Feeding all the soil organisms below ground in one acre is like feeding two African elephants.” Jerry Hatfield, USDA-ARS

Credit: Soil Health Institute, Illustrator: Chelsea Wright
Can we harvest solar energy with cover crops an extra 7-8 months of the year to feed the soil?
#2 Cover crops increase earthworms

EARTHWORMS & SOIL HEALTH

Middens of *Lumbricus terrestris* (common nightcrawler) were counted at rye sites (5 on-farm and 1 research farm) in June 2016:

- **No-Till without cover crop**
  - 24 MIDDENS/M²
  - 96,000 MIDDENS/ACRE
- **No-Till with rye cover crop**
  - 33 MIDDENS/M²
  - 133,000 MIDDENS/ACRE

Across all sites (with rye for 7+ years), 38% more earthworms were present compared to strips without cover crop.

These midden counts are consistent with earthworms counts (*L. terrestris* and *Aporrectodea* spp.) conducted via electrical extraction at the same research farm site in April 2015:

- **No Cover Crop**: 9.2 earthworms/m²
- **Rye Cover Crop**: 29.6 earthworms/m²

Earthworms are a tangible, early biological indicator of soil health!

* Iowa Learning Farms
Earthworms are soil engineers.
WORM TYPES

Nightcrawlers (anecic)

Red worms (epigeic)

Pale/gray worms (endogeic)

http://ecoserv.weebly.com/worms.html
#3 Cover crops build soil carbon and organic matter
The diagram illustrates the changes in soil organic matter over time after the start of cultivation. The graph shows the decline in soil organic matter from active (labile, unprotected) to passive (stabilized and protected) over 130 years. The start of cultivation is marked at the beginning of the graph, followed by a decrease in soil organic matter, which stabilizes after 100 years when the land is put back into native vegetation. The graph emphasizes the importance of sustainable land management to maintain soil health.

Soil organic matter

- Soil water holding capacity
- Feeds soil organisms
- Supply of crop nutrients
- Improves crop rooting
#4 Cover crops help manage soil nutrients
Nitrogen input – output model

Get a bushel of corn for every pound of nitrogen fertilizer applied
Nitrogen impacted by soil microbes
Scavenging nutrients

Cover crops can increase the amount of nutrients available for the next crop by taking up nutrients that remain in the soil and holding them in plant tissue until they are released the next spring, when they can be used by the following crops.  Courtesy: Cover Crop Solutions
#5 Cover crops keep the soil covered
Cereal rye mulch layer in soybeans
#6 Cover crops add biodiversity

**ABOVE GROUND**

*and more importantly*

**BELOW GROUND**
Crimson clover, hairy vetch, and rye
Extension of Corn Root Surface Area through Mycorrhizal Fungi
#8 Cover crops reduce compaction
Soil aggregates = Soil building blocks

BUILDING A SOIL AGGREGATE

Involves both:
- Biological
  - AMF communities
  - Release of Glues
- Physical
  - Hyphae entangle soil particles
  - Dry wet cycles
  - Squeeze particle together

From NRCS
Which is less expensive?
#9 Cover crops support integration of livestock with row crops
Soils developed with herbivores
Cover crops can be very high quality forage
#10 Cover crops help stop erosion
Cover crop impact on water erosion

Living and dead cover crop leaves and stems intercept raindrops

Cover crop root channels and earthworm tunnels get rain to infiltrate

Cover crop roots anchor the soil and residue in place

http://wiki.ubc.ca/LFS:SoilWeb
Cover crop impact on wind erosion

Photo credit: Bruce MacKellar, Michigan State Univ.
Erosion connection to soil health

Most intense biological activity near the surface

Most nutrients and organic matter near the surface
cover crop benefits

- Improve soil health
- Increase yields
- Build soil organic matter
- Improve rainfall infiltration
- Prevent soil erosion
- Scavenge nitrogen
- Economic returns
- Provide nitrogen (legumes)
- Reduce soil compaction
- Encourage pollinators and beneficial insects
- Control weeds

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BUILDING SOIL HEALTH