Building Soil Health and Organic Matter in Ontario Agriculture

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Outline

• What is soil health?
• What are the benefits of soil health?
• How have soils been changing?
• How can soil health be improved?
• Shared leadership & collaborative approach
What is Soil Health?

Defined as:

“continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans”

Natural Resource Conservation Service, US Department of Agriculture

“the soil’s fitness to support crop growth without becoming degraded or otherwise harming the environment.”

Agriculture and Agri-food Canada, Health of Our Soils Report
What is Soil Health?

**Organic Matter**
- % Organic Matter

**Physical**
- Soil compaction
- Water infiltration
- Aggregate stability

**Chemical**
- pH
- Potassium
- Phosphorus
- Ca, Zn, Mg, Mn

**Biological**
- Potentially mineralizable nitrogen
- % Organic Matter
- Respiration
- Soil biota
The Soil Food Web

First trophic level: Photosynthesizers

Second trophic level: Decomposers
Pathogens, Parasites
Mutualists
Root-feeders

Third trophic level: Shredders
Predators
Grazers

Fourth trophic level: Higher level predators

Fifth and higher trophic levels: Higher level predators

Image credit: US Natural Resource Conservation Service
### Long-term Benefits of Soil Health & Conservation

#### Environmental Benefits
- Better water quality as nutrient and sediment runoff is minimized
- Reduced greenhouse gas emissions from soil carbon & fertilizers
- Better resilience to climate change and extreme weather
- Increased soil biodiversity

#### Economic Benefits
- Sustained long-term farmland productivity
- Long-term reduction in on-farm input needs (e.g. pest suppression, nutrient cycling, water retention)
- Contribute to long-term on-farm cost savings and profitability

#### Social Benefits
- Contribute to long-term security of local and global food supply
- Contribute to better food quality and nutrition

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Soil Health
Soil Health

Trend in Soil Organic Carbon

• Most of Ontario cropland (82%) estimated to be losing soil carbon
• Limited improvement over long term.
• Reduced tillage conserves soil carbon
• Conversion of perennial forages to annual crops decreases soil carbon
• Estimates based on modelling, not direct measurement

Source: Agriculture & Agri-food Canada
Changing Crop Trends 1976-2016

- Increasing percentage of land in annual crops:
  - 28% to 61% 1976-2016
- Long-term increases in soybeans and corn.
- Decreases in hay and pasture for livestock feeding.
- Simplified crop rotations.
- Tillage increasing after long decline.
- Increased use of cover crops.
- Heavier, faster equipment.
- Market-driven changes.
- Similar to other jurisdictions.

Source: Statistics Canada, Census of Agriculture.
Guiding Principles for Soil Health

• **Build soil organic matter**
  – Use manure, compost, residue

• **Diversify crops, plant cover**
  – Diverse crop rotations, cover crops

• **Minimize soil disturbance**
  – Reduce tillage if used, rotational grazing, reduce compaction, reduce erosion, optimize inputs

• **Keep living roots as much as possible**
  – Perennial crops, cover crops

• **Keep soil covered as much as possible**
  – Perennial crops, cover crops, retain residue

*Image credits: General Mills, AAFC*
Practices and Technologies to Build Soil Health

- Cover Crops
- Diverse crop rotations
- No Till
- Strip Till
- Organic amendments
- Soil test

Soil Health
Practices and Technologies to Build Soil Health

- Wind strips
- Buffer strips
- Windbreaks
- Grassed waterways
- Erosion control structures
- Reducing Compaction

Soil Health
Approaches to Soil Stewardship

• Education and Technology Transfer on soil best practices
  – Technical advice, peer-to-peer learning
  – Publications, workshops, meetings

• Risk assessment
  – Environmental Farm Planning
    • Identification of risks to soil
    • Promotion of soil best practices
  – Farmland Health Check Up

• Cost sharing on soil practice changes
  – Canadian Agricultural Partnership
  – Lake Erie Agriculture Demonstrating Sustainability
  – Conservation Authority programs

• Soil inventory and mapping

• Research - Guelph, other institutions, government, farm organizations
  – Development and refining of BMPs
A Collaborative Approach to Soil Health

- Shared responsibility and leadership among industry, government & other partners for sustaining productive soils
- Collaborative approach needed
- Soil Strategy to guide actions
- Gain support from farmers, farm groups and other partners.

Technical working group:
- Farm groups, academia, conservation groups, government
- Helped develop soil strategy
- Build support and shared responsibility
Soil Health

Farmers Reaping Rewards from Soil Care

Eric & Max Kaiser
No-till, rotation, cover crops, manure

Sara & Chris Wood
No-till & cover crops

Dave van Segbrook
Diverse crop rotations

Schuyler family
Systems approach: Soil maps, compost, reduced tillage

Barrie brothers
Long term no-till

Garlow Family
BMPs on challenging soils & rented land