Soil Health Principles and Practices in Organic Farms

Z. Kabir, Ph.D.
Regional Soil Health Specialist for CA, NV & Pacific Islands Area
National Soil Health Division
USDA-NRCS
Davis, CA

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Soil Health Definition

Soil Health is the Continued Capacity of the Soil to Function as a Vital Ecosystem that Sustains Plants, Animals and Humans

This is an ideal soil; however, in our soil, proportions are changing due to intensive Ag practices causing:

- Soil erosion
- Organic matter depletion,
- Compaction
- Disappearing soil life
Soil Depth in Walsh County, North Dakota

1960: 34 inches
2014: 15 inches
A 56% Loss

Soil Organic Matter Levels

1960: 8%
2014: < 3%
A 62% Loss
DOMINANT FARMING SYSTEMS: POOR SOIL HEALTH…?

Photos: Bianca Moebius-Clune
Soil Health Principles To Support High Functioning Soils

- Minimize Disturbance
- Maximize Soil Cover
- Maximize Biodiversity
- Provide Continuous Living Roots

Image courtesy of Barry Fisher, NRCS-SHD
Organic Agriculture and Soil Health Principles

- Living Roots
- Soil Cover
- Biodiversity
Organic Agriculture and Soil Health Principles

- Living Roots
- Biodiversity
- Soil Cover
- Minimize disturbance
Three of the four Soil Health Principles applied
Tillage can cause:

- Soil organic matter loss
- Air pollution
- Reduce Aggregate stability
- Reducing soil biology
- Increase evaporation
- Increase runoff
Russell Ranch, UC Davis, 1993 - 2001; long-term farming system evaluation

**Agro-chemical based** – no cover crop - representative of typical California Central Valley system

**Intermediate system** – Fertility from Winter Legume Cover Crop (WLCC) and some supplemental inorganic fertilizers; occasional pesticides and herbicides

**Managed according to USDA guidelines** – WLCC and organic fertility from composted poultry manure
Russell Ranch, UC Davis, 2002 - 2008; long-term farming system evaluation

• Farming Systems
  - Conventional
  - Low Input
  - Organic

• Tillage Practices
  - Standard Tillage
  - Conservation Tillage
Runoff as a % of Rainfall in Organic Systems

Kabir & Horwath, Russell Ranch, UC Davis
Nutrient Concentrations in Runoff

CCT = Conventional-conservation tillage
CST = Conventional-Standard tillage
LCT = Low-input-Conservation Tillage
LST = Low-input-Standard Tillage
OCT = Organic-Conservation tillage
OST = Organic-Standard tillage
Weeding Time in Different Farming Systems in two tillage Practices

Kabir & Lanini
Weed Biomass in Conservation (CT) and Standard Tillage (ST) in Organic System

Weed biomass (g 0.75 m$^{-2}$)

Tillage treatments

CT

ST

Kabir & Lanini
A Nationwide Survey of Organic farmers:

- **Weed management** is by far the greatest obstacle, much more frequently cited than:
  - Pest or disease control;
  - Soil fertility;
  - Cost of inputs;
  - Marketing; or
  - Organic certification.
Agricultural Management Practices and Soil Health

Choose practices that feed the soil organisms and protect their habitat (soil aggregate)

Tend to Reduce Soil Health
- Aggressive tillage
- Annual/seasonal fallow
- Mono-cropping
- Annual crops
- Excessive inorganic fertilizer use
- Excessive crop residue removal
- Broad spectrum fumigants/pesticides
- Broad spectrum herbicides

Tend to Promote Soil Health
- No-till or conservation tillage
- Cover crops; Relay crops
- Diverse crop rotations
- Perennial crops
- Organic fertilizer use (manures)
- Crop residue retention
- Integrated pest management
- Weed control by mulching, cultivation

Conventional vs. Organic: Areas of Sustainability

Roganold & Wachter, 2016
Conclusion

- A systems approach is needed for successful organic farming systems that use all four soil health principles
Thank You

Any Question?

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