Management Systems Impact on Soil Quality

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Organic amendments are important to maintain and/or improve soil quality.

The objective of the study was to evaluate the impact of conventional vs. organic system on soil quality.
Materials and Methods
A randomized complete block no-till expt. was established on Wooster-Riddles silt loam in 2000 for continuous corn. Treatments were:

**Conventional:** Fertilizers + herbicides

**Organic:** Compost + dairy manure + cover crops (weed control by cultivator)

Treatments were replicated 6 times.
Soil cores were collected at 0-15 cm depth, composited, 2-mm sieved, and analyzed for biological, chemical and physical properties.
Soil biological quality indicators

Total microbial biomass ($C_{mic}$)
$C_{mic} : C_{Org}$
Basal respiration (BR)
Specific maintenance respiration ($qCO_2$)
$C_{mic}$ cell death quotient ($qD$)
Mineralizable C ($C_{Min}$)
Soil chemical quality indicators

Total organic carbon ($C_{\text{Org}}$)
Total nitrogen (TN)
Available phosphorus (P)
Total reducing sugars
Active organic C ($C_{\text{active}}$)
Particulate organic matter (POM)
POM phosphorus (POM-P)
POM nitrogen (POM-N)
POM carbon (POM-C)
Soil physical quality indicators

Bulk density ($\rho_b$)
Total porosity ($st$)
Mean weight diameter (MWD)
Geometric mean diameter (GMD)
Macroaggregates (Mag)
Microaggregates (Mig)
Aggregate ratios (AR)
Aggregate stability (AS)
The **inductive additive approach** was used for

**Normalization**
**Summation**, and
**Average**

of measured properties into soil biological, chemical, and physical quality indices.

The indices were then averaged to calculate an overall soil quality index.
Results and Discussion
Results showed that soil quality indicator properties were significantly higher in organic compared with conventional system.
The organic system as compared to conventional system had:

29% better soil biological quality

36% better soil chemical quality

16% better soil physical quality.
Soil biological quality

Management system

Org

Conv.
Overall, organic system had 26% better soil quality than conventional system.
In a 7 year period (2000 to 2007), organic system improved soil quality by 45% compared to only 7% improvement in a conventional no-till system.
Regression analyses showed that soil biological, chemical and physical quality each accounted for significant variability in overall soil quality.
Overall soil quality index

Soil biological quality index

\[ r^2 = 0.81^{**} \]
Soil chemical quality index

Overall Soil Quality Index

$r^2 = 0.84^{**}$
Overall Soil Quality Index

Soil physical quality index

$r^2 = 0.74^*$
Overall Soil Quality Index

Soil quality indices

- Biological quality ($r^2 = 0.81$)
- Chemical quality ($r^2 = 0.84$)
- Physical quality ($r^2 = 0.74$)
Conclusions

The organic no-till system as compared to conventional system had better biological, chemical, and physical quality.

In a 7 year period, the organic system improved soil quality by 45% compared to only 7%.

Improving soil biological and physical qualities are more important than chemical quality for improving overall soil quality.
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