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_{Org})
Total nitrogen (TN)
Available phosphorus (P)
Total reducing sugars
Active organic C (C_{active})
Particulate organic matter (POM)
POM phosphorus (POM-P)
POM nitrogen (POM-N)
POM carbon (POM-C)

Soil physical quality indicators

Bulk density (ρb)
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

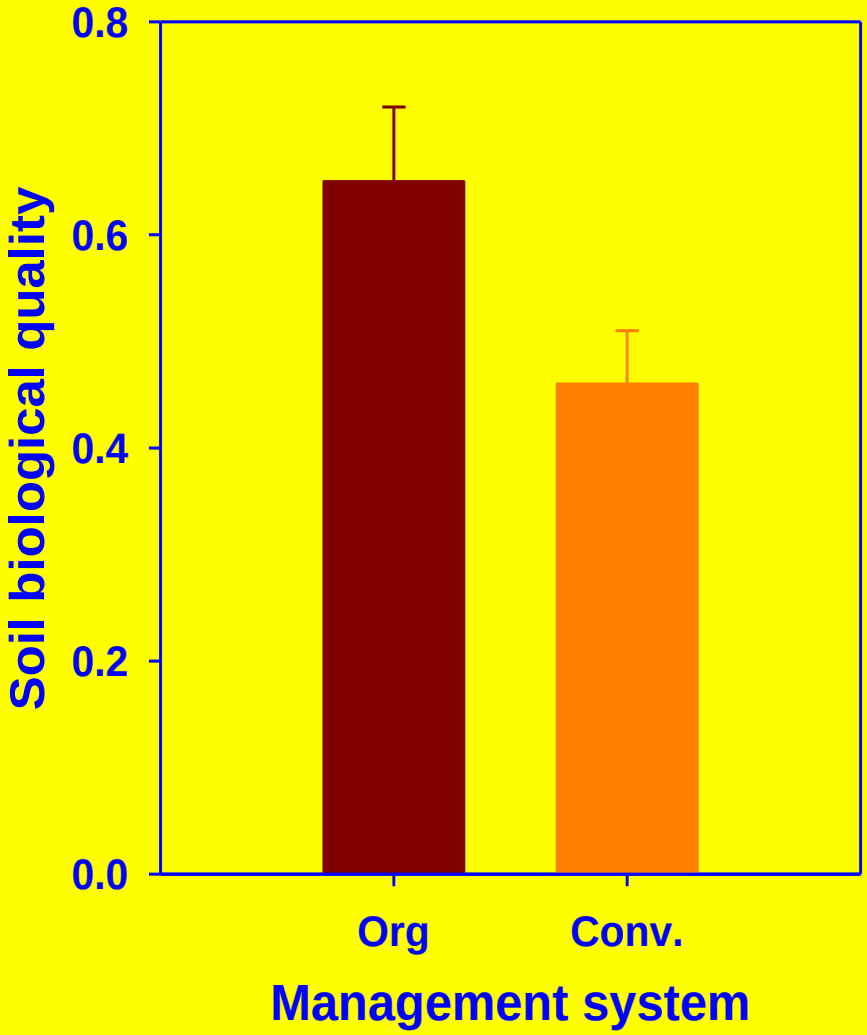
Results showed that soil quality indicator properties were significantly higher in **organic** compared with **conventional** system.

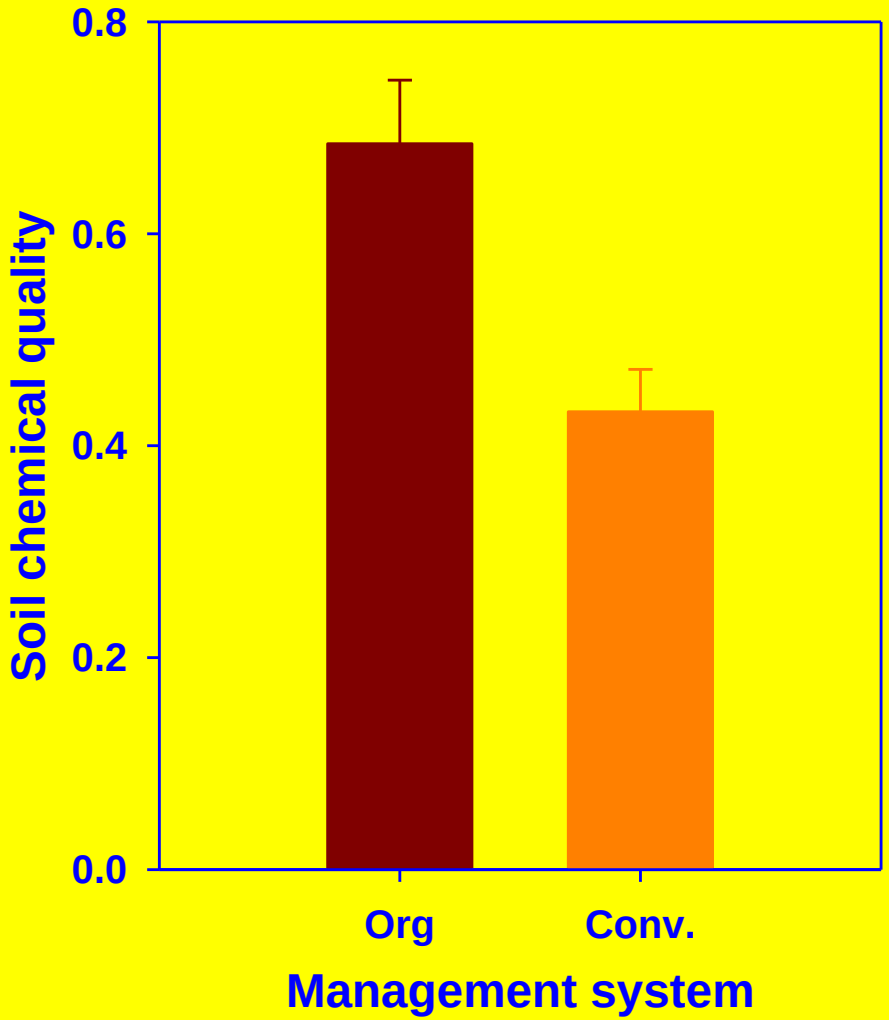
The organic system as compared to conventional system had:

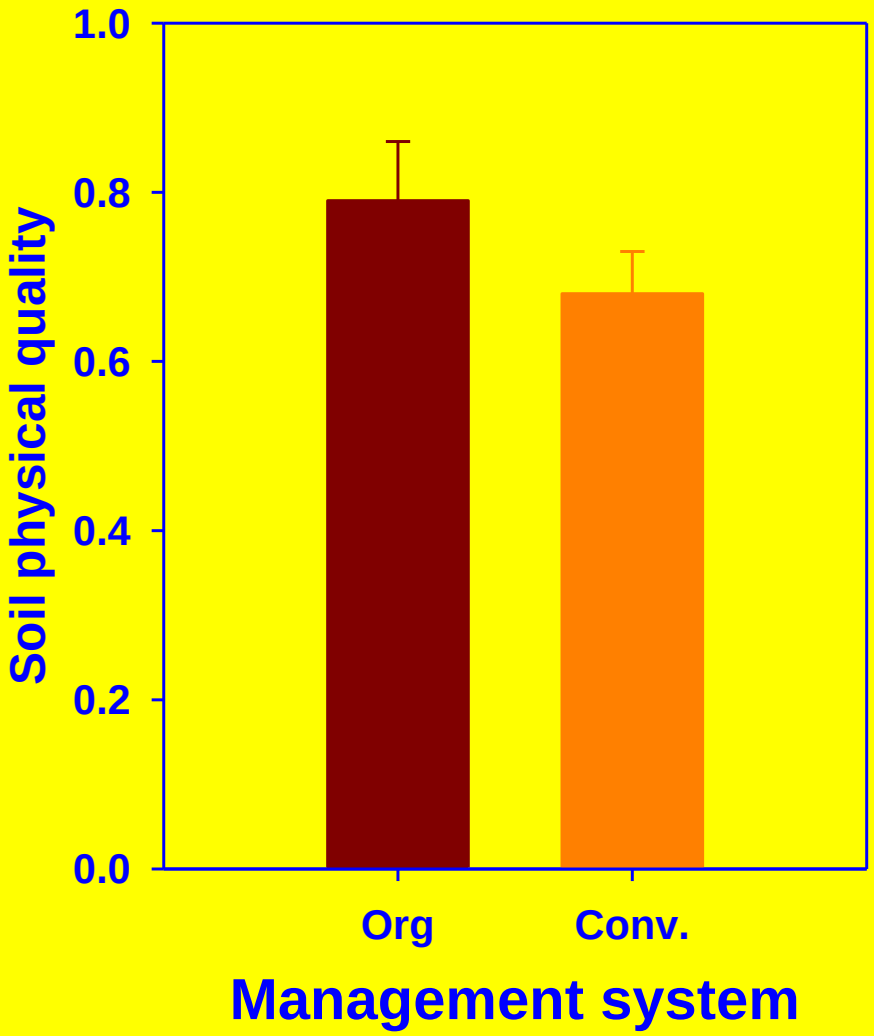
29% better soil biological quality

36% better soil chemical quality

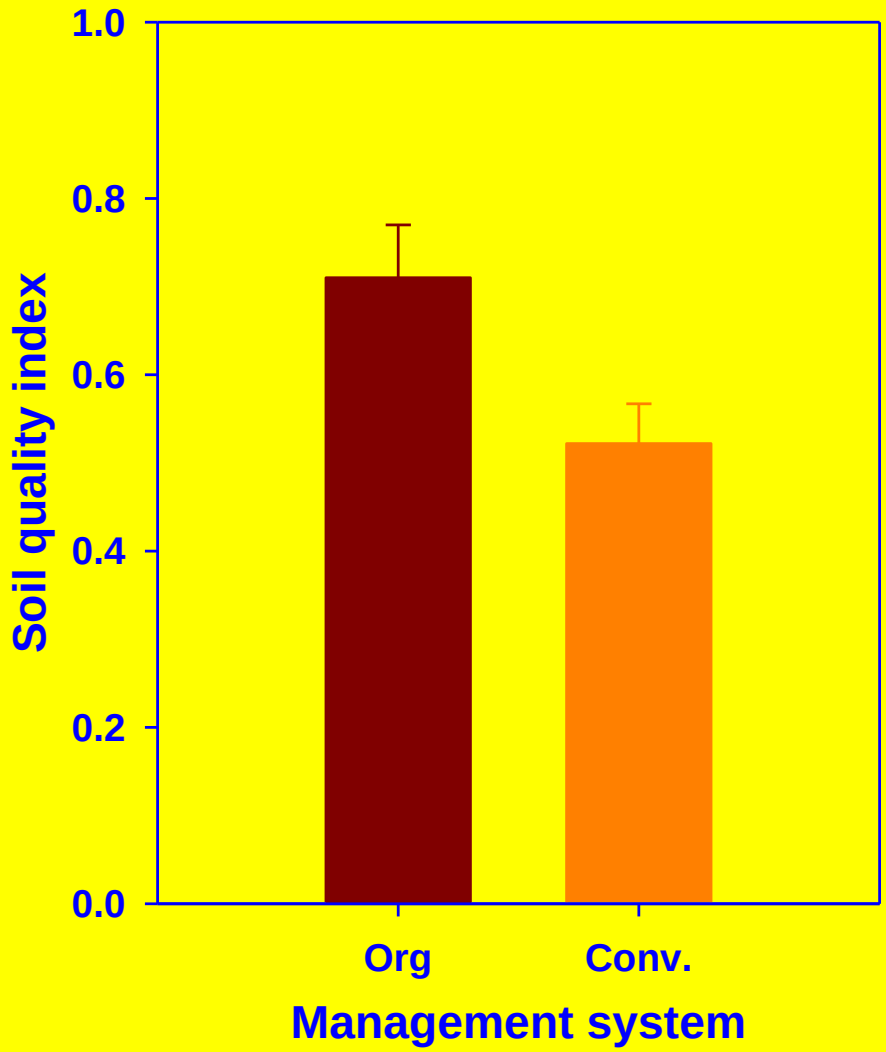
16% better soil physical quality.


0.8
0.6
0.4
0.2
0.0
Soil biological quality
Org
Conv.
Management system

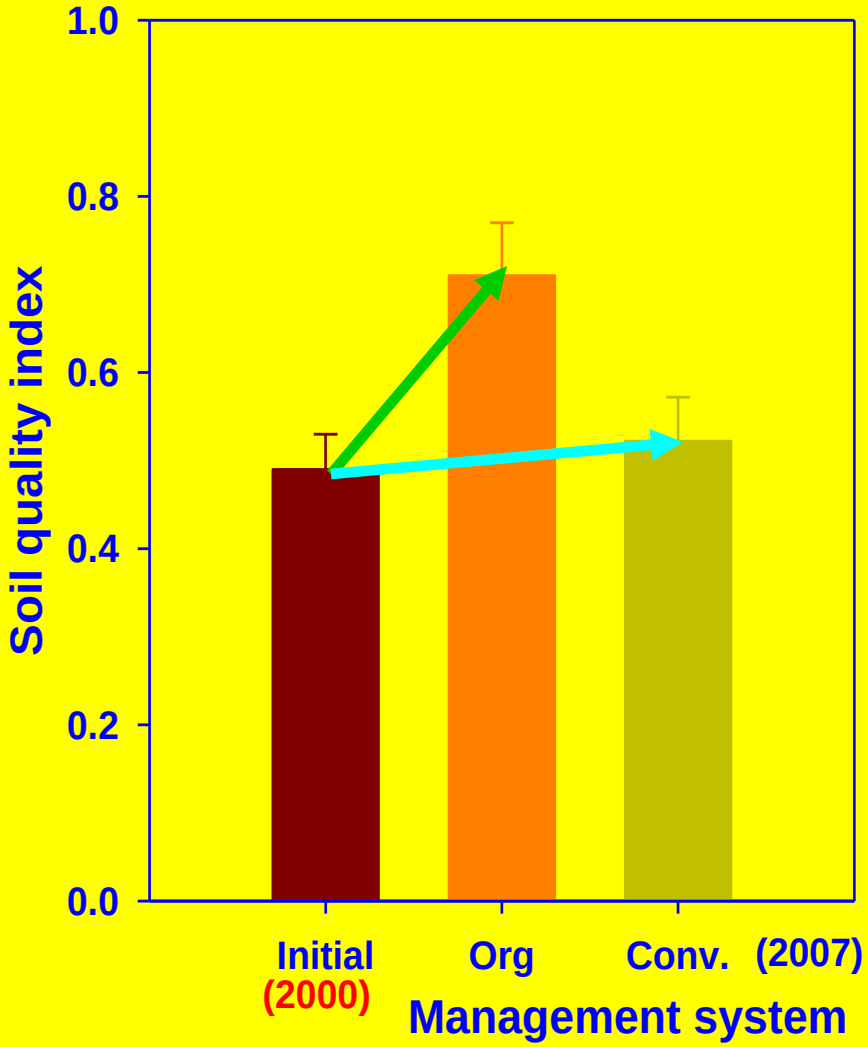

0.8
0.6
0.4
0.2
0.0
Soil chemical quality
Org
Conv.
Management system


1.0
0.8
0.6
0.4
0.2
0.0
Soil physical quality
Org
Conv.
Management system

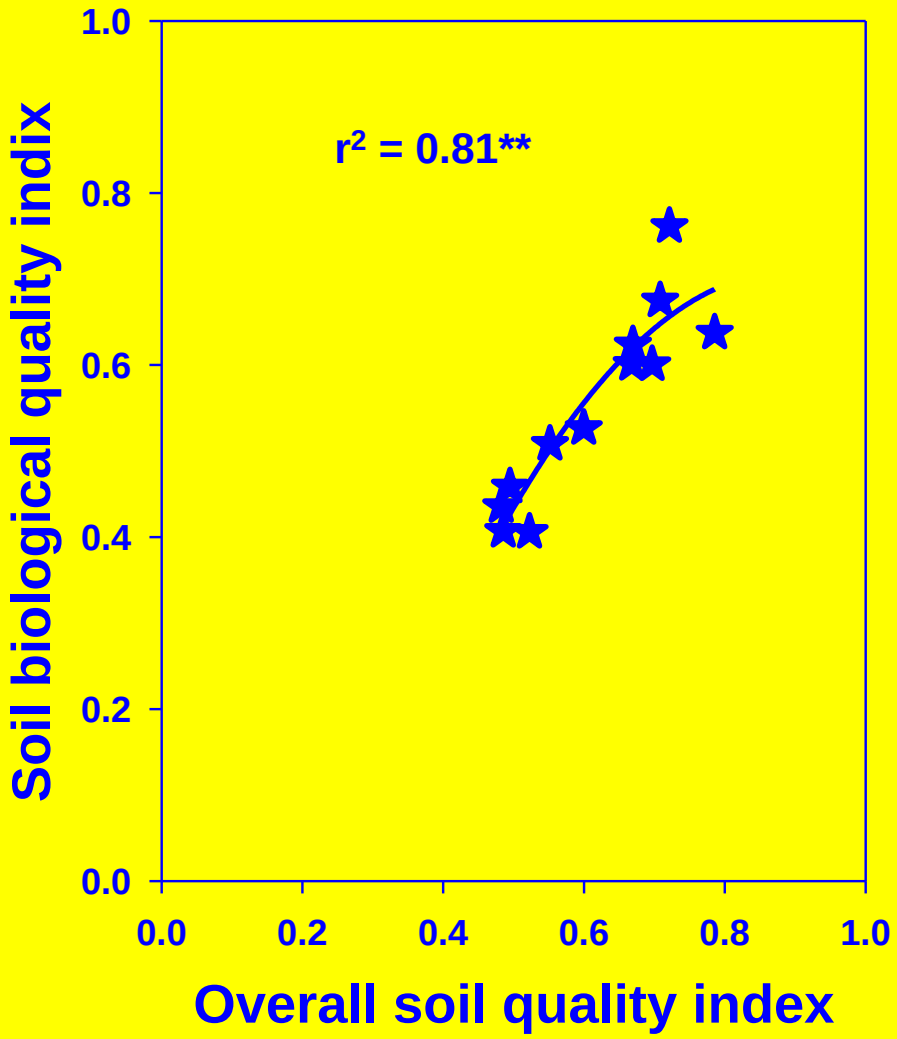
Overall, organic system had 26% better soil quality than conventional system.

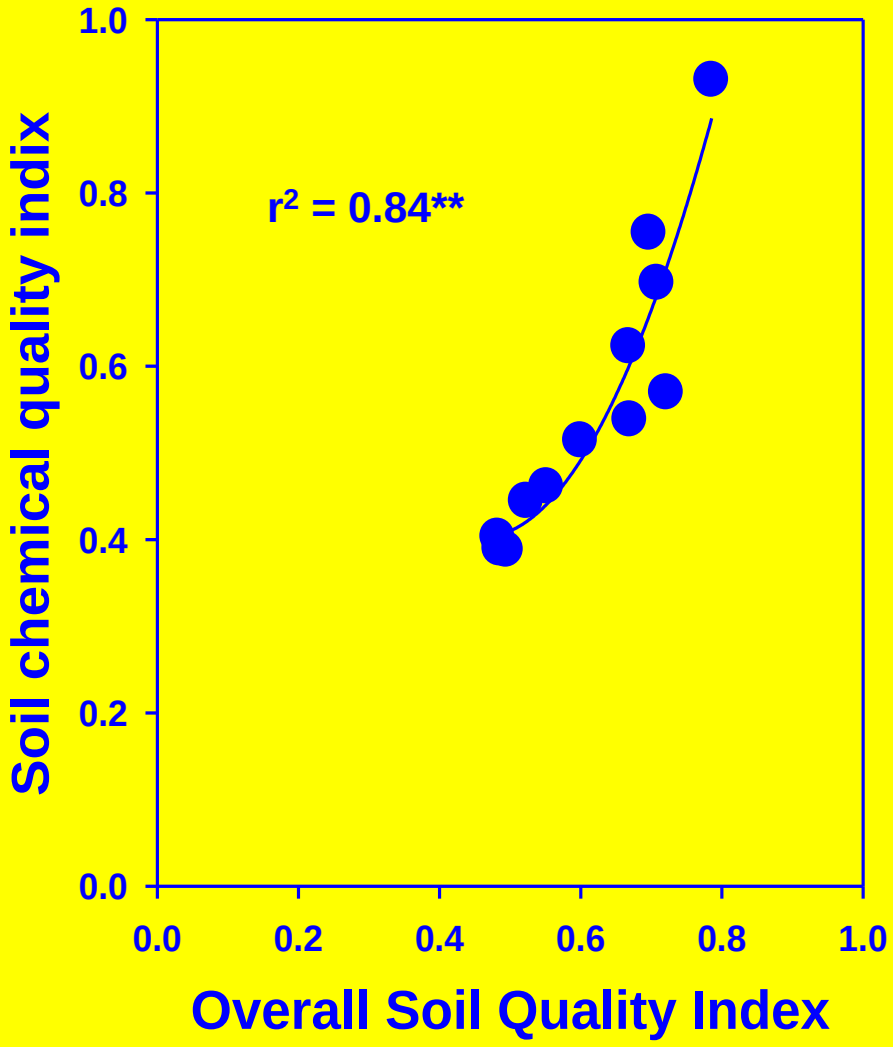

1.0
0.8
0.6
0.4
0.2
0.0
Soil quality index
Org
Conv.
Management system

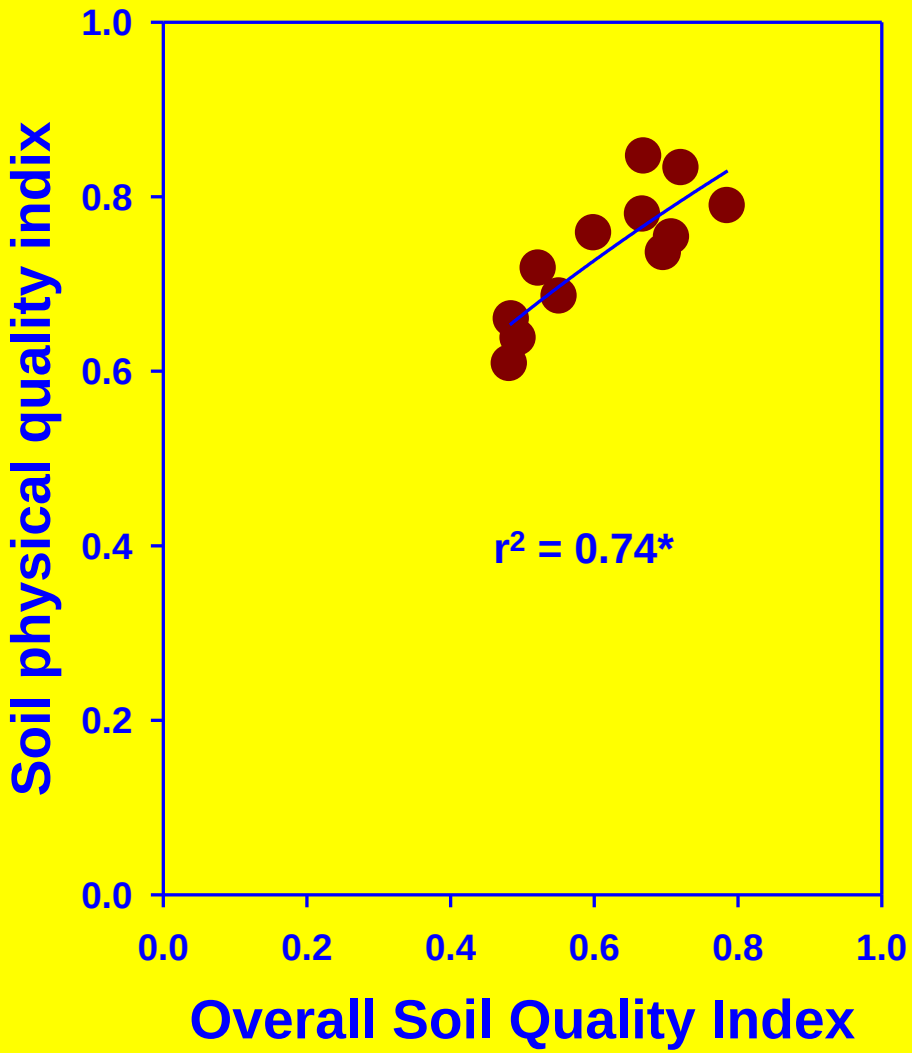
In a 7 year period (2000 to 2007), organic system improved soil quality by 45% compared to only 7% improvement in a conventional no-till system.

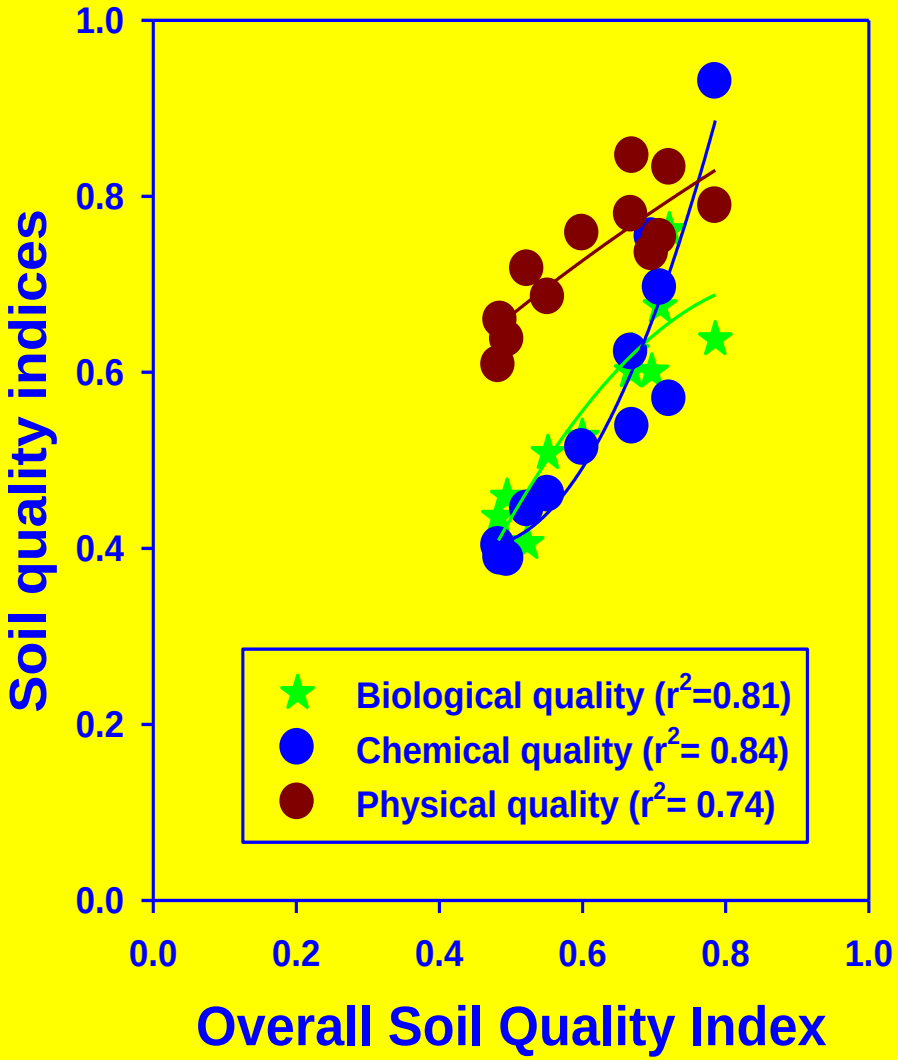

1.0
0.8
0.6
0.4
0.2
0.0
Soil quality index
Initial
(2000)
Org
Conv.
(2007)
Management system

Regression analyses showed that soil biological, chemical and physical quality each accounted for significant variability in overall soil quality.


1.0
0.8
0.6
0.4
0.2
0.0
Soil biological quality indix
r2 = 0.81**
0.0
0.2
0.4
0.6
0.8
1.0
Overall soil quality index


1.0
0.8
0.6
0.4
0.2
0.0
Soil chemical quality indix
r2 = 0.84**
0.0
0.2
0.4
0.6
0.8
1.0
Overall Soil Quality Index


1.0
0.8
0.6
0.4
0.2
0.0
Soil physical quality indix
r2 = 0.74*
0.0
0.2
0.4
0.6
0.8
1.0
Overall Soil Quality Index


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Soil quality indices
Overall Soil Quality Index
Biological quality (r2=0.81)
Chemical quality (r2= 0.84)
Physical quality (r2= 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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