Crop water use and it's role in ensuring resilience in a changing climate

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Resilient Agriculture 2014

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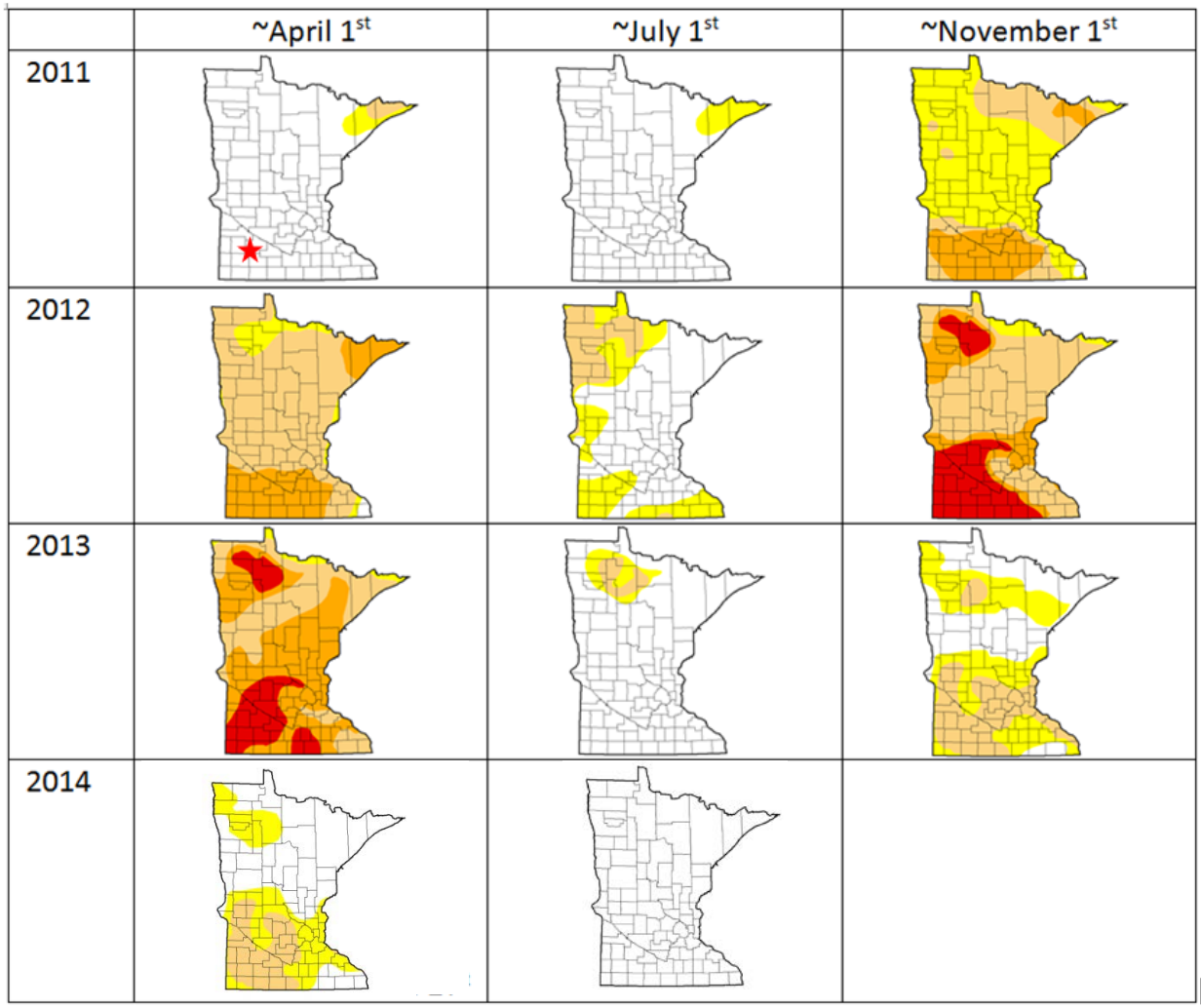
Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems

Drought conditions since 2011



- http://droughtmonitor.unl.edu/DataArchive/MapArchive.aspx

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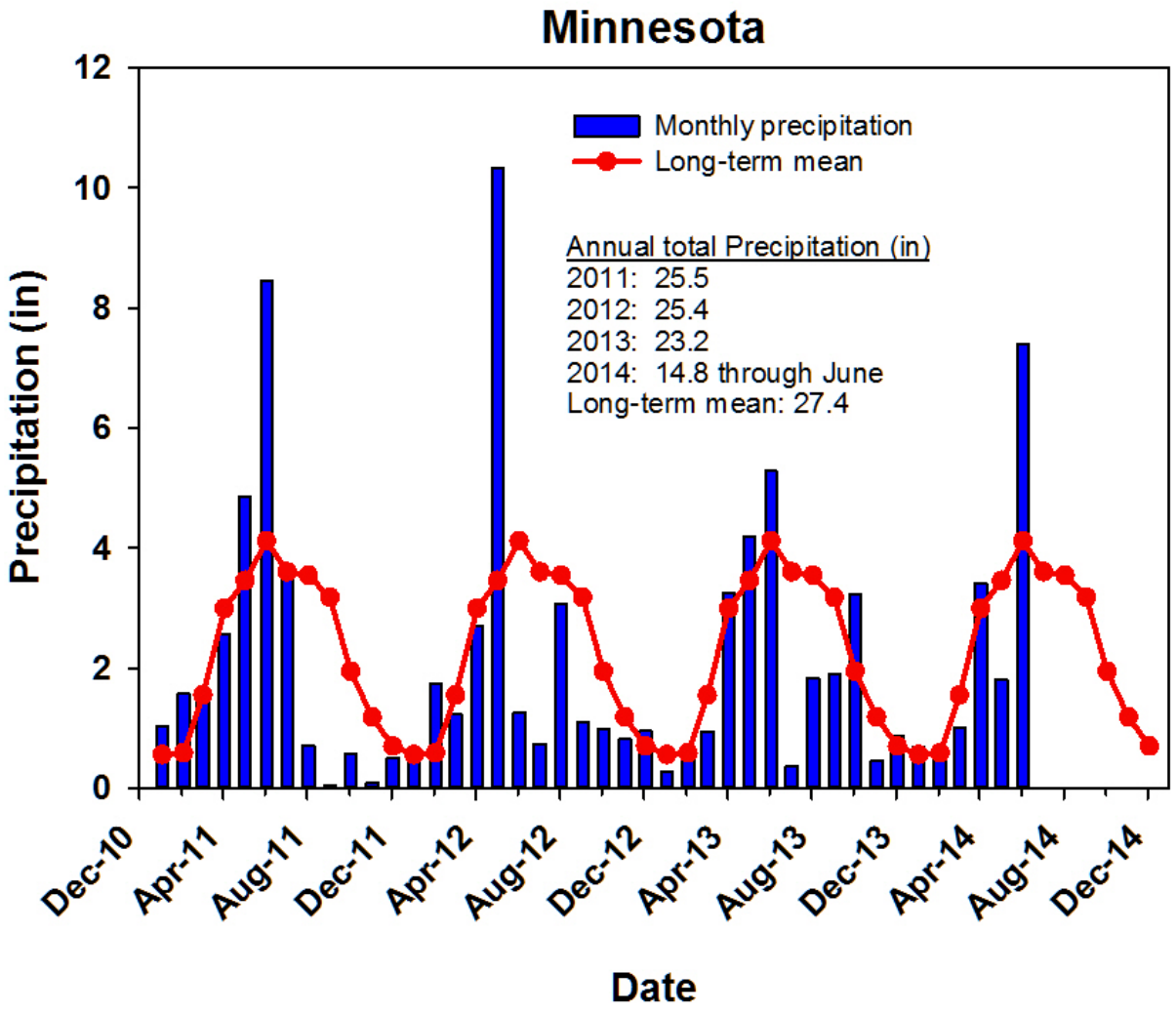
Monthly precipitation



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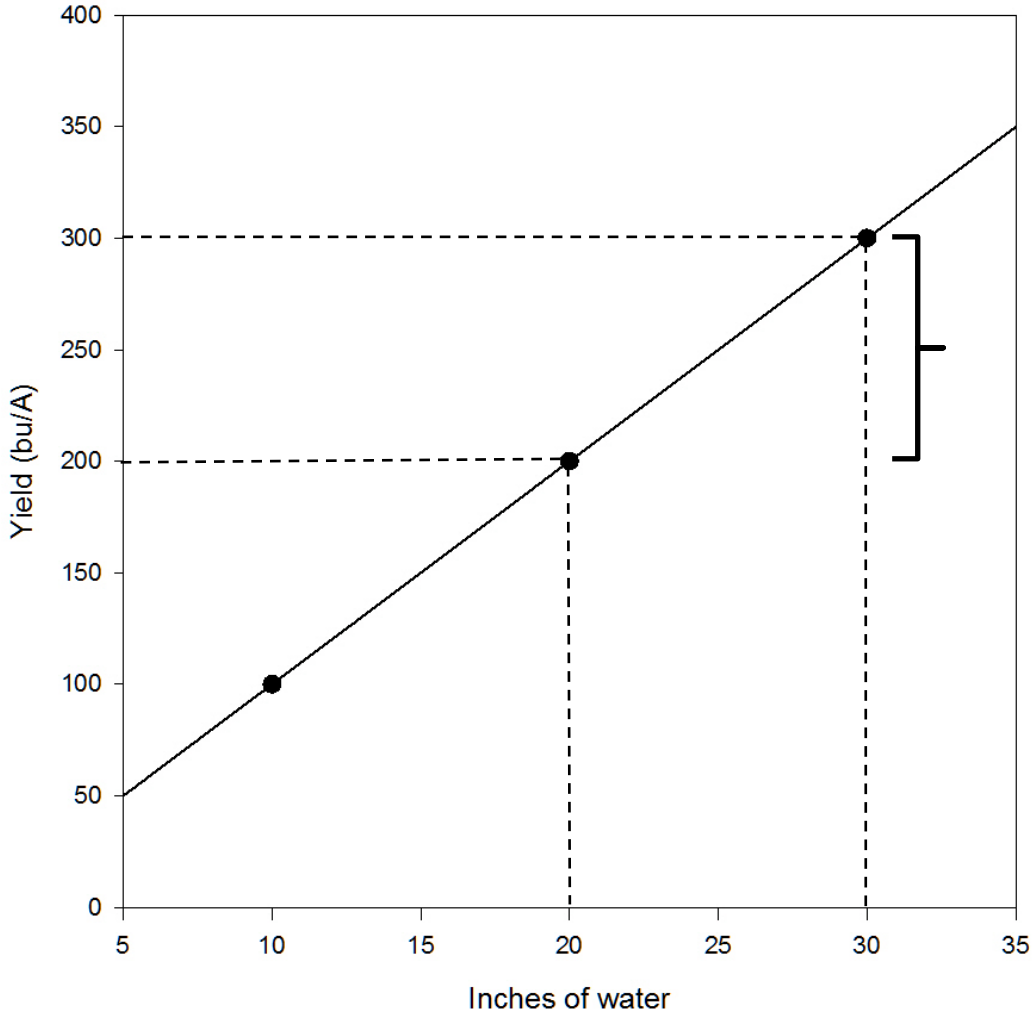
How many inches **water** would it take to produce a 300 bu/A corn crop?



Water deficit:
need 10 more inches of water
to grow 300 bu corn

*The challenge facing producers is that in most of the Corn Belt, the **soil water storage** plus **seasonal** rainfall is less than 30 inches per year.*

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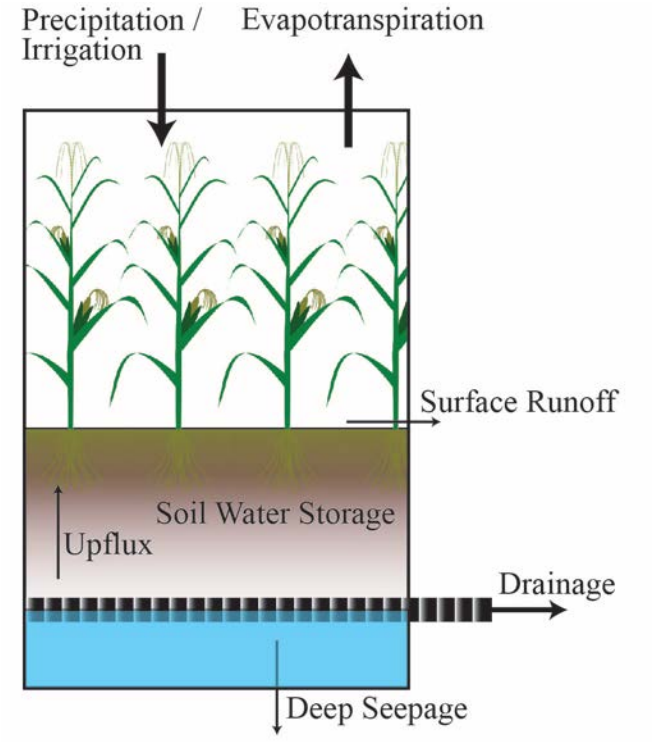
Soil Water Balance

$$\Delta S = P + D + R + Ds + ET$$



ΔS = change in soil water storage

P = precipitation

D = drainage

R = runoff

Ds = deep seepage

ET = evapotranspiration

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Projects

Minnesota

VICMS – Crop rotations

Organic and conventional:
corn-soybean,
corn-soybean-oat/alfalfa-alfalfa,
corn-soybean-wheat/red clover;
perennial vegetation

Ohio

NAEW – Crop rotations

Organic and conventional:
corn-soybean-wheat/red clover

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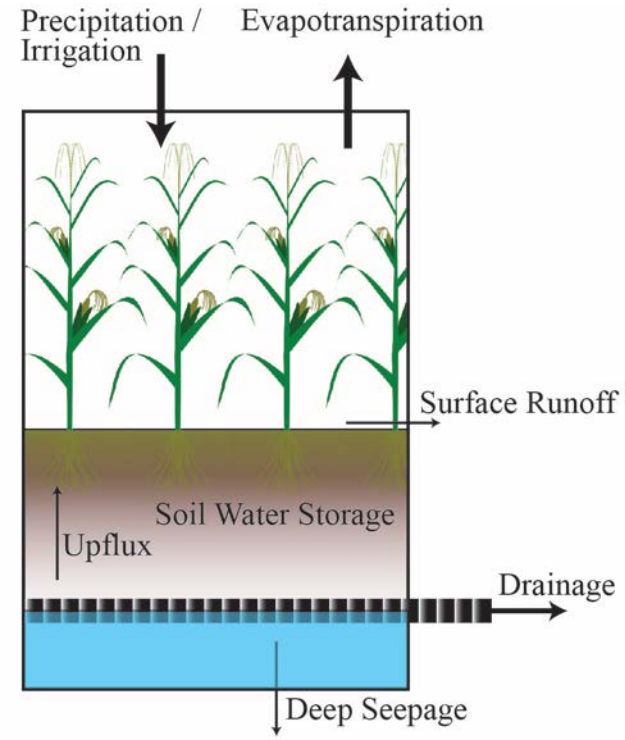
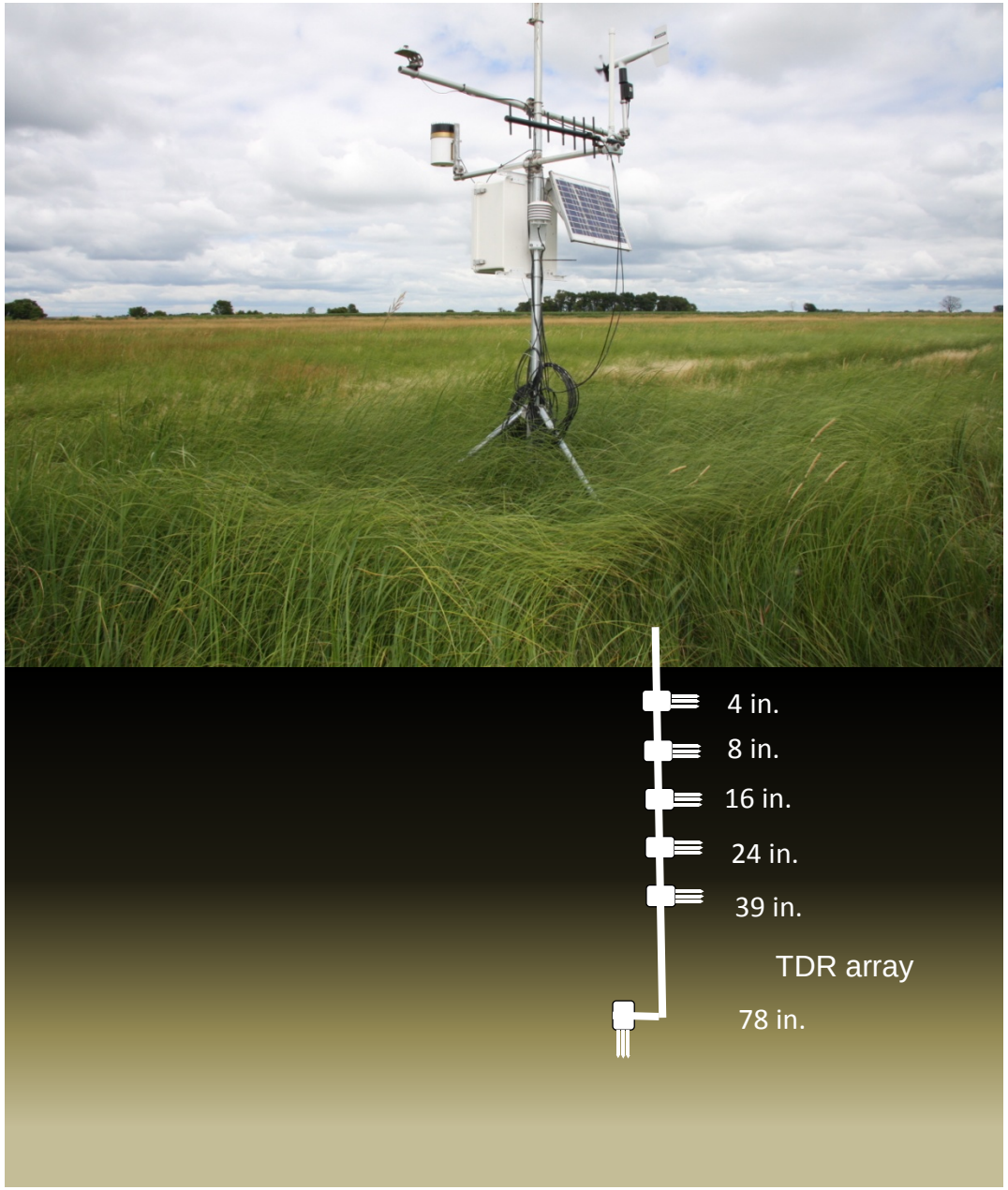
Direct/Indirect measurements:

Precipitation
Evapotranspiration
Weather Parameters
Soil water movement
Drainage Volume





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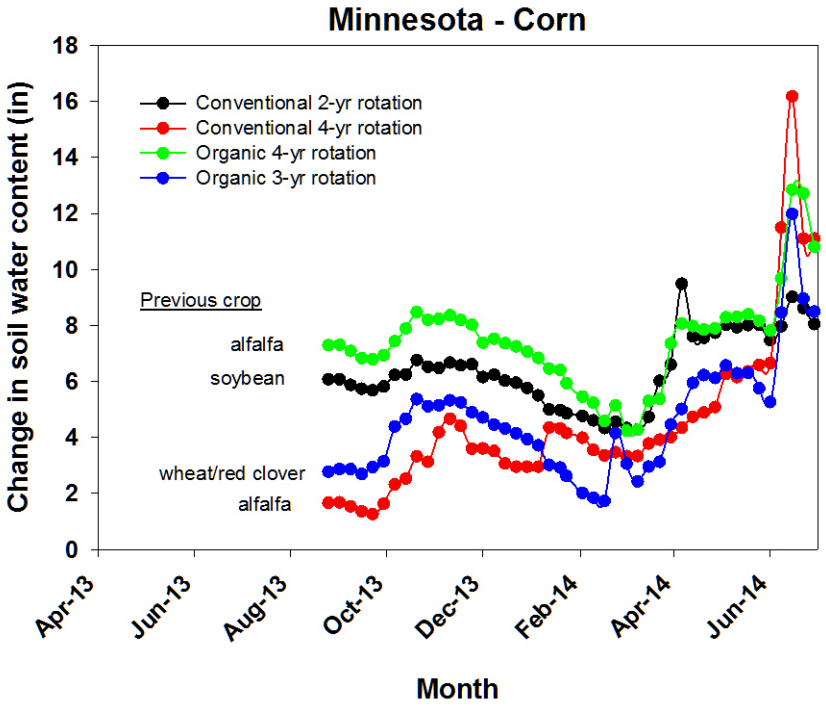
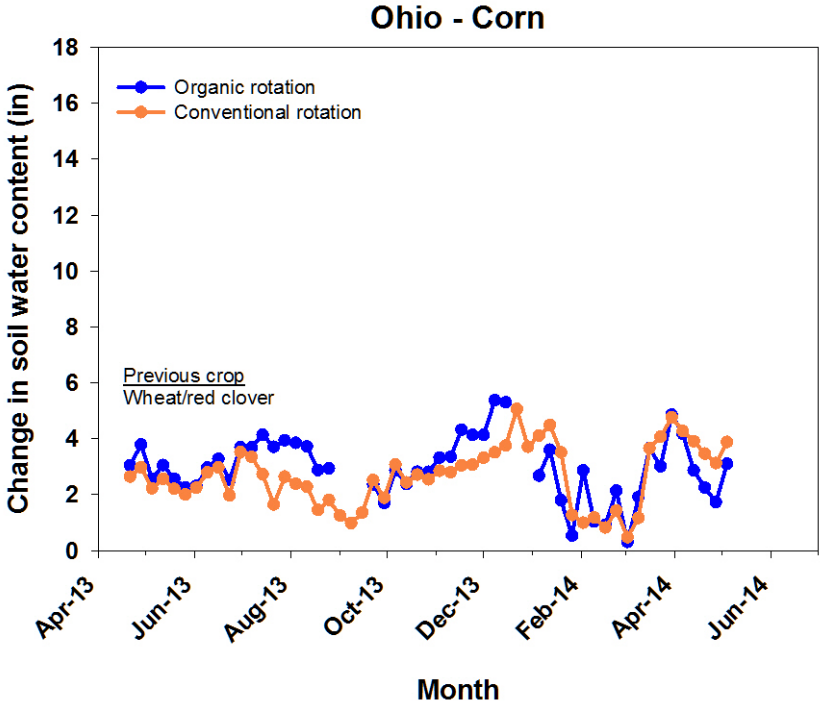
Change in soil water content





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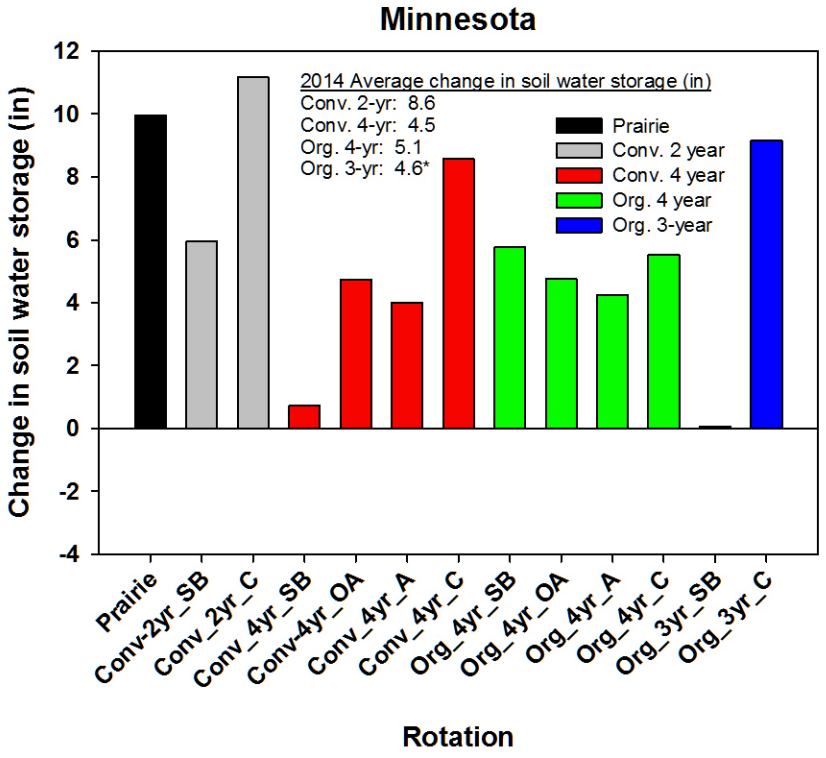
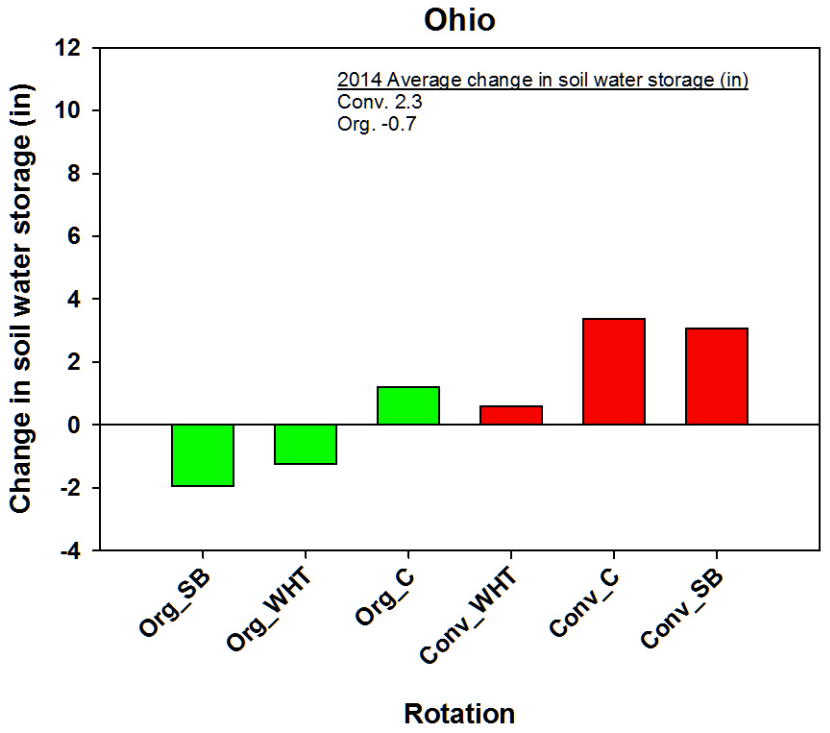
Change in soil water storage*





*Does not yet account for all water balance components: drainage, deep seepage, runoff or evapotranspiration). These components are either being measured directly (i.e. drainage, runoff) or indirectly quantified by modeling (Soil & Water Assessment Tool, SWAT).

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Summary

- Measured or modeled soil water balance components will be used to compute crop water use and Water Use Efficiency.
- Results from this work will:
  - provide important information that will allow farmers to design cropping systems in a way that are productive, profitable and environmentally responsible.
  - provide more detail and insight into the linkage between field-scale management decisions and watershed-scale hydrologic responses.

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Conclusions

What we know

- The occurrence of extreme weather variability (too wet, too dry, too hot, too cold) is becoming more common.
- A combination of management and technology will be needed to improve crop water use in the future.
  - irrigation
  - drainage
  - crop rotation
  - tillage
  - residue management
  - genetics
  - cover crops

Soil and Water Management and Conservation

- Decrease soil water evaporation.
- Increase infiltration.
- Increase and maintain soil biological activity.
- Increase soil organic matter.
- Maintain surface residue.
- Reduce the cross-sectional area of tillage.
- Reduce the number of tillage passes.
- Reduce drainage water losses.
- Reduce runoff.

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