Minnesota Long-Term Agricultural Network – A New Approach

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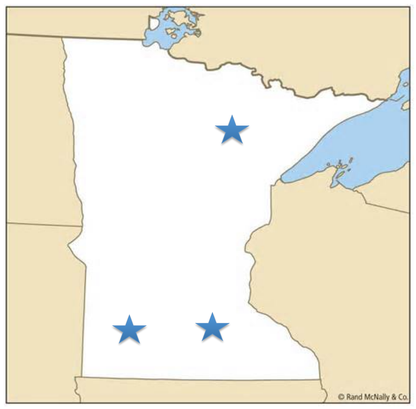
http://ltarn.cfans.umn.edu

- The University of Minnesota recently initiated a Long-Term Agricultural Research Network (LTARN) that provides a regional platform for the development of novel and adaptive agricultural production strategies.
- The LTARN is focused on strategies that facilitate the study of critical biophysical interactions between plants, soils, and microbes with goal of improving overall system efficiency, productivity, and stability.
- Understanding tradeoffs between the need for greater productivity per unit area, reduced short and long-term risks, and greater system stability/resiliency of agriculture is a critical component of this work.

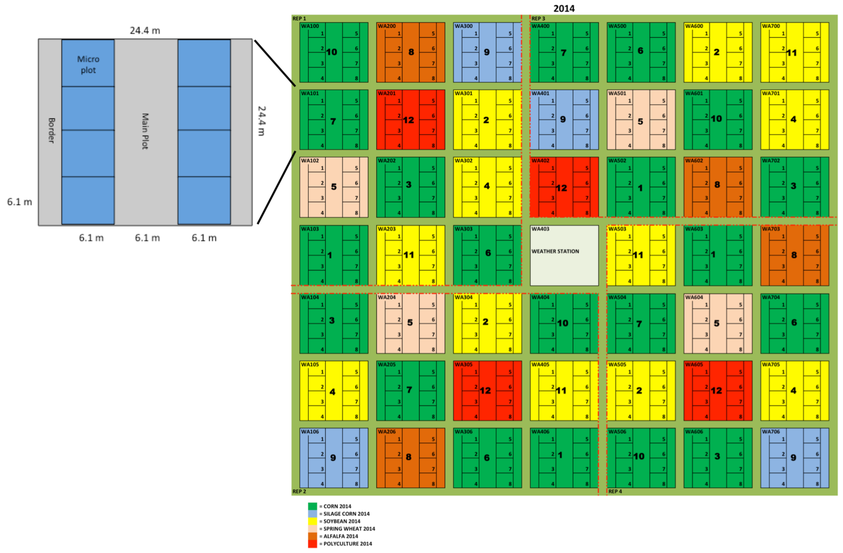


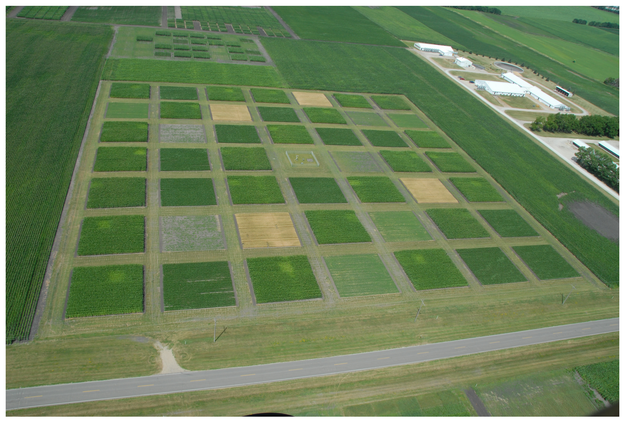
Current LTARN Sites

A series of six cropping system models, including both annual and perennial crop sequences, are established at all network nodes in a large-plot replicated design. Cropping system models range from simple 2-crop rotation to complex perennial-based cropping systems

Cropping System Model	*Representative Crops for MN*
1) 2-crop rotation (2 phases)	Corn/Soybean
2) 3-crop rotation (3 phases)	Corn/soybean/wheat
3) Annual/perennial (3 phases)	Corn/corn/alfalfa/alfalfa/alfalfa
4) Perennial polyculture (1 phase)	Grass-based polyculture
5) Intensification strategy I (2 phases)	Corn/soybean + cover crops
6) Intensification strategy II (1 phase)	Silage corn fb pennycress/SB

Experimental Layout





Weather Data
Wind speed
Wind direction
Rainfall
Air temperature
Relative humidity
Barometric pressure
Solar radiation
Snow depth
Pan evaporation

Agronomic Data
Plant population
Grain yield
Stover dry matter
Whole plant dry matter
Harvest index
Seed weight
NIR analysis
Elemental analysis
PAR (above and below canopy)
Leaf area index
Plant height
Growth stage
Weed/insect/disease incidence

Soil Data
Soil temperature
EC
Volumetric water content
Matric potential
Soil moisture retention
pH, P, K, OM
Soil Nitrate
Bulk Density
Cation Exchange
Texture

Nematodes

Microbial community
composition and function

Remote sensing
NDVI/PRI and IR Temperature

Multidisciplinary research within the LTARN employs both short- and long-term studies across locations using a network model that provides uniformity and continuity to research. Our approach is strongly linked to education and outreach.

Network Design (phase II)

✓In Phase I of the LTARN, research is conducted across a relatively uniform parcel of land at each site. The goal is to understand processes at a large scale, i.e. site-to-site.

✓In phase II, the goal is to understand effects of variability in terrain, i.e. at the field scale, where variability in terrain and other landscape characteristics become an important factor.

✓In this phase, we will identify representative fields at each site that are typical of local soil and terrain features in the area.

✓This allows us to improved scalability and extrapolation based on an understanding of processes affected by water, incoming solar radiation, soil movement, etc. at the macro- and field-scales.

✓A field site is being established in 2015 at the SROC in Waseca as a model for other nodes in the network.

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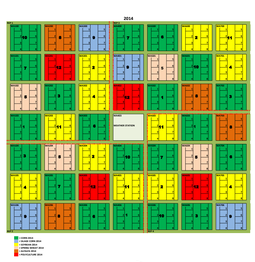

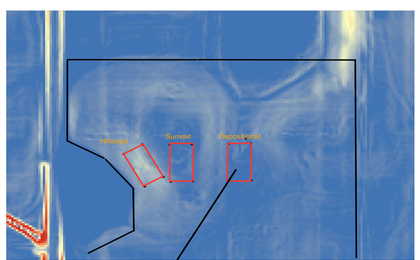

Native Polyculture	Corn phase of Corn/Soybean fb pennycress	Corn phase of corn/soybean rotation	Soybean phase of corn/soybean rotation
Corn phase of Corn/Corn/3 yrs alfalfa	Switchgrass	Soybean phase of Corn/Soybean fb pennycress	Alfalfa phase of Corn/Corn/3 yrs alfalfa

40 ft

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