

Use of DRAINMOD-NII to predict nitrogen losses under conventional and organic farming practices in Minnesota, USA

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Co-authors and Acknowledgements



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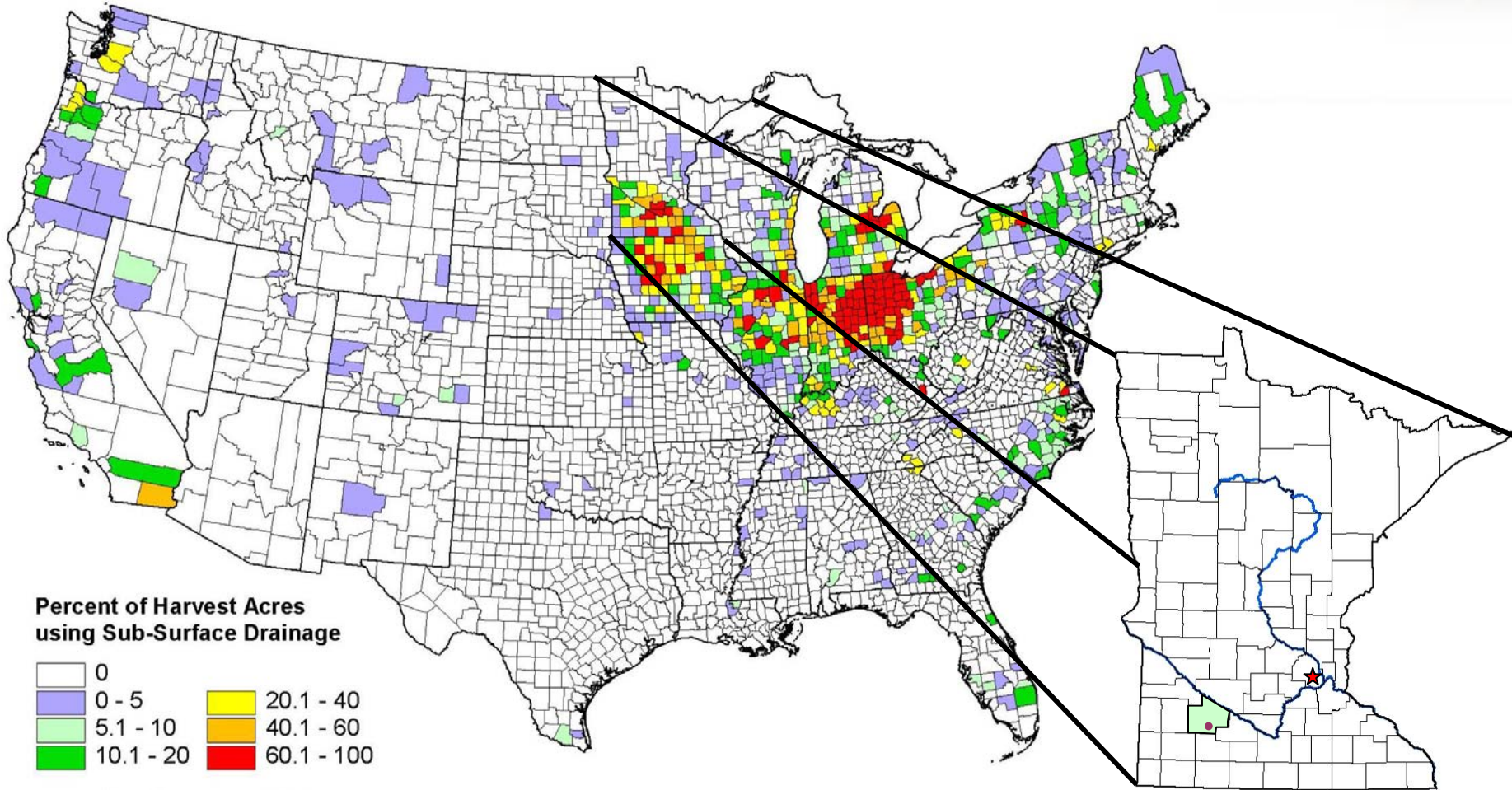


- OVERVIEW

- Background
- Objectives
- Field Experiment
- DRAINMOD NII

Extent of subsurface drainage ('92)

20.6 million ha of corn-belt



Source: 1992 NRI; 1992 Census of Agriculture

Objectives



- Evaluate differences between drainage discharge and nitrogen from organic and conventional cropping systems.
- Compare predicted flow and load results of DRAINMOD NII with observed values for this field experiment.

FIELD EXPERIMENT

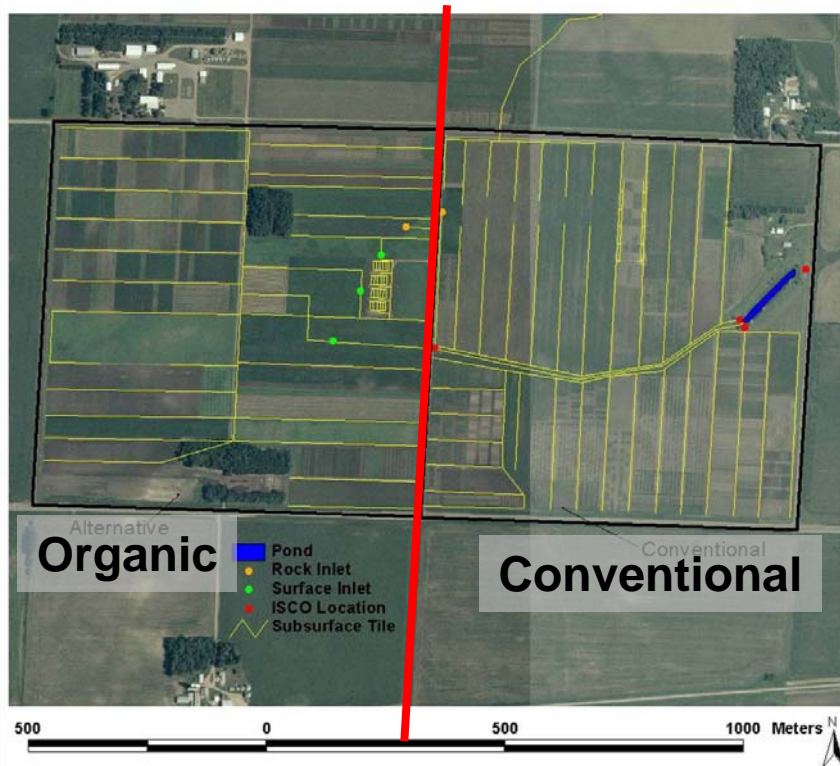
Site description



- Located at the University of Minnesota Southwest Research & Outreach Center near Lamberton, MN
- Two adjacent fields totaling 65 hectares each
 - ~49 hectares of the Elwell Agroecology Farm is organically managed



Drainage system



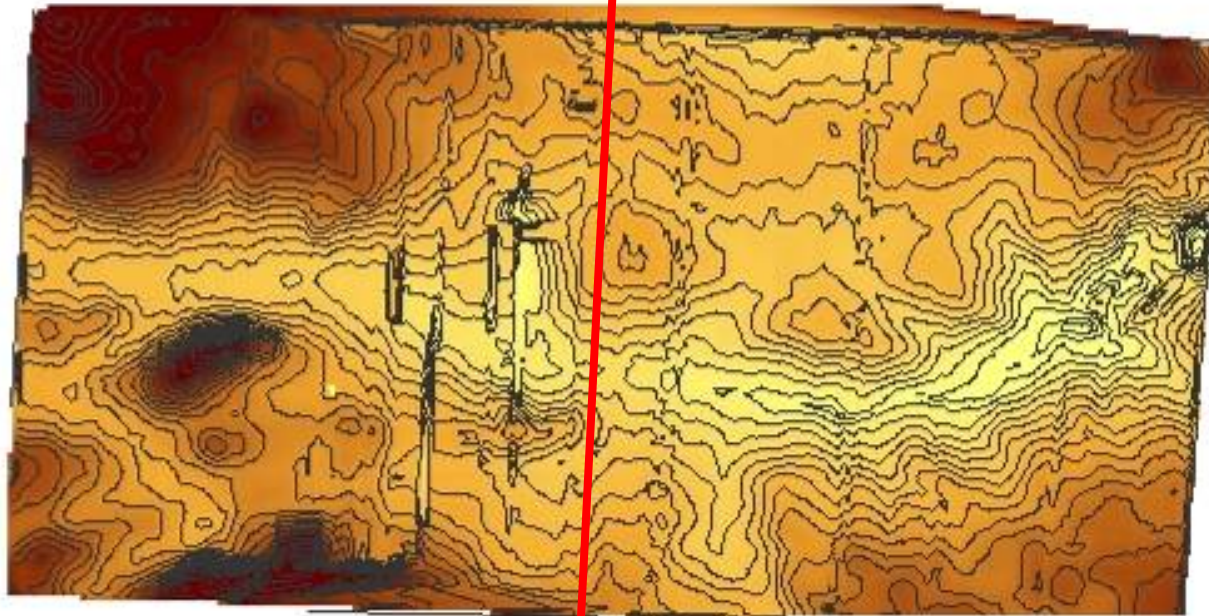
- 55 m spacing
- ~1.2 m depth
- 12 and 15 cm dia. tile
- Area drained
 - 58.2 ha, Organic
 - 46.9 ha, Conventional
- Tile density
 - 204 m/ha, Organic
 - 230 m/ha, Conventional

DEM



Organic

Conventional

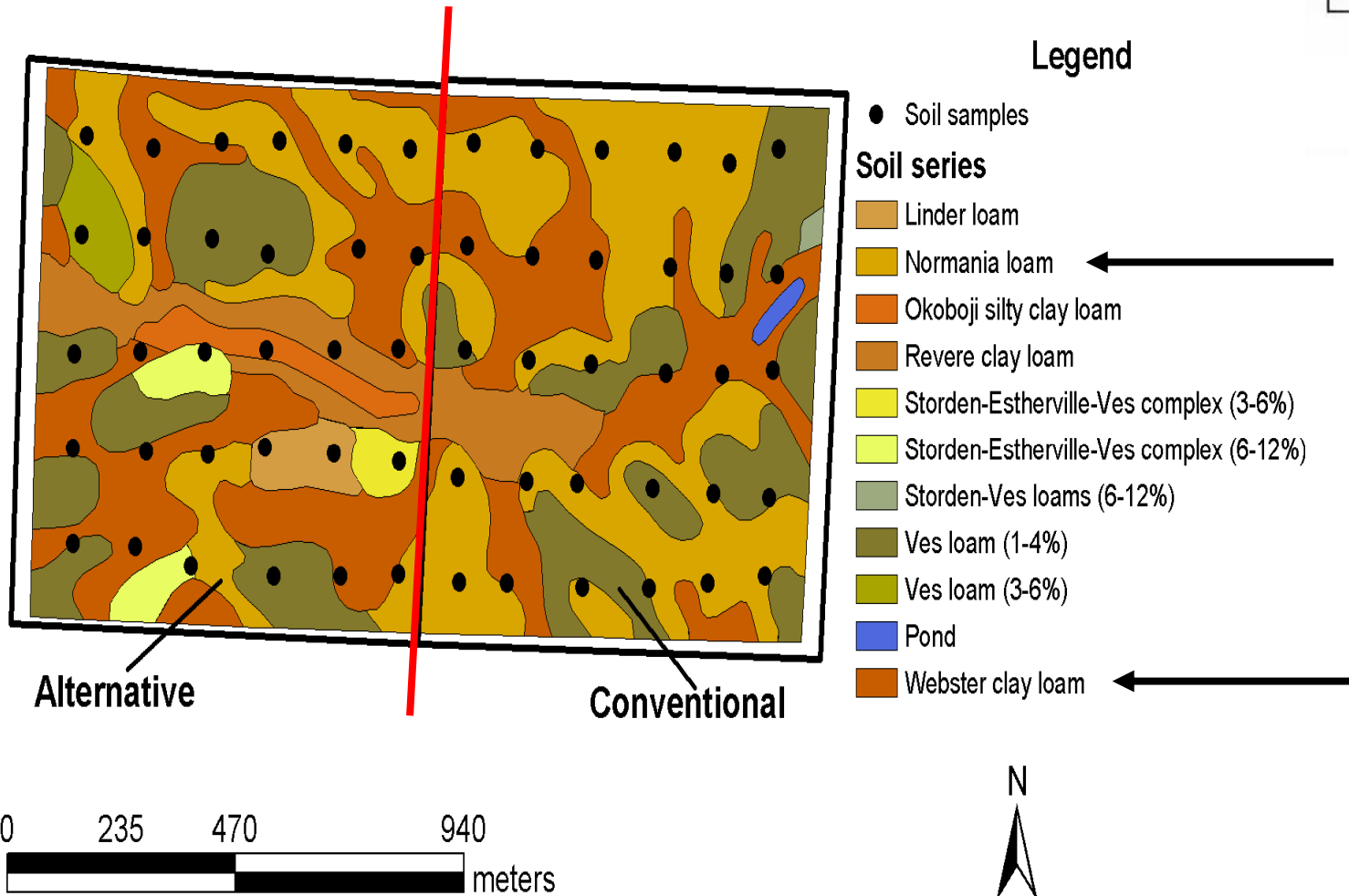


DEM

Value



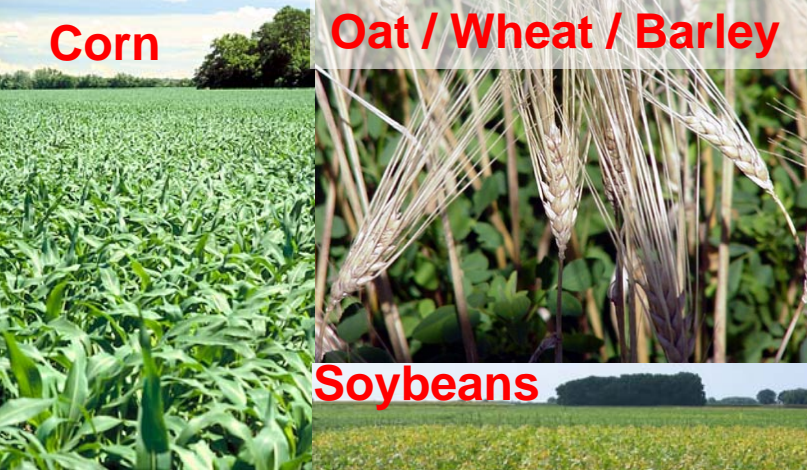
Soils



Crops and Vegetation



Organic (OR)



Conventional (CN)



Cropping practices



Crop	Crop area (ha)					
	2002		2003		2004	
	OR	CN	OR	CN	OR	CN
Corn	8.4	35.2	17.5	29.9	15.2	28.4
Soybean	15.3	14.8	7.3	20.7	12.5	23.1
Small Grains	16.1	0.8	19.0	0.9	13.5	0.9
Alfalfa	8.9	1.5	6.2	1.5	8.5	0.6
Native Grasses	5.6	0.0	5.6	0.0	5.4	0.0

Nitrogen application



- Organic sources
 - Beef and hog manure
 - Beef compost
 - Legume plowdown
- Conventional source
 - Anhydrous ammonia

		N Rate (kg/ha) [†]	
		OR	CN
	2002	69.9	95.9
	2003	147.7	108.8
	2004	100.2	95.9

DRAINMOD NII

HYDROLOGY

Flow measurement – Water sample collection



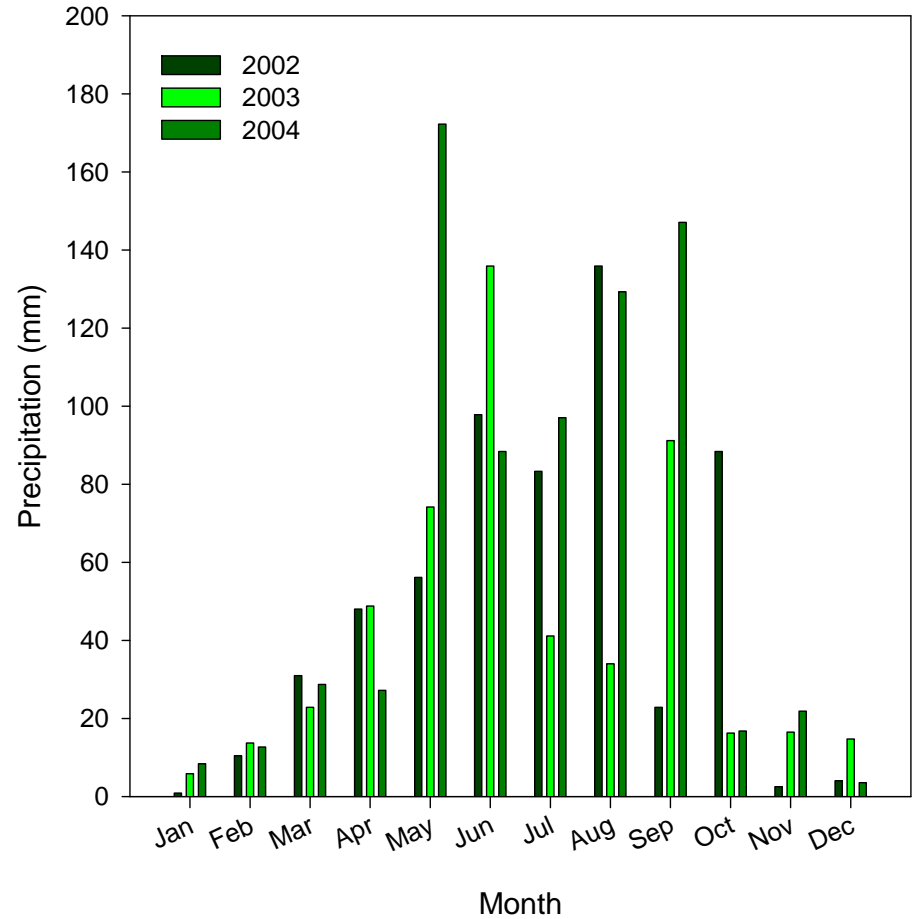
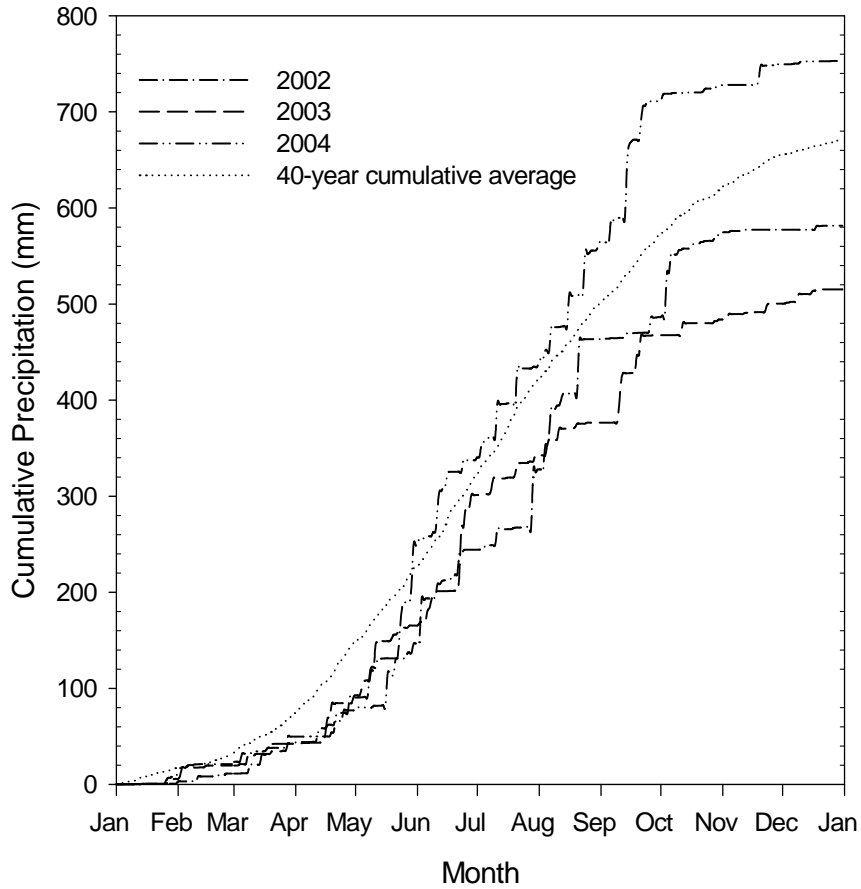
Alternative



Conventional



Precipitation



DRAINMOD NII - hydrology



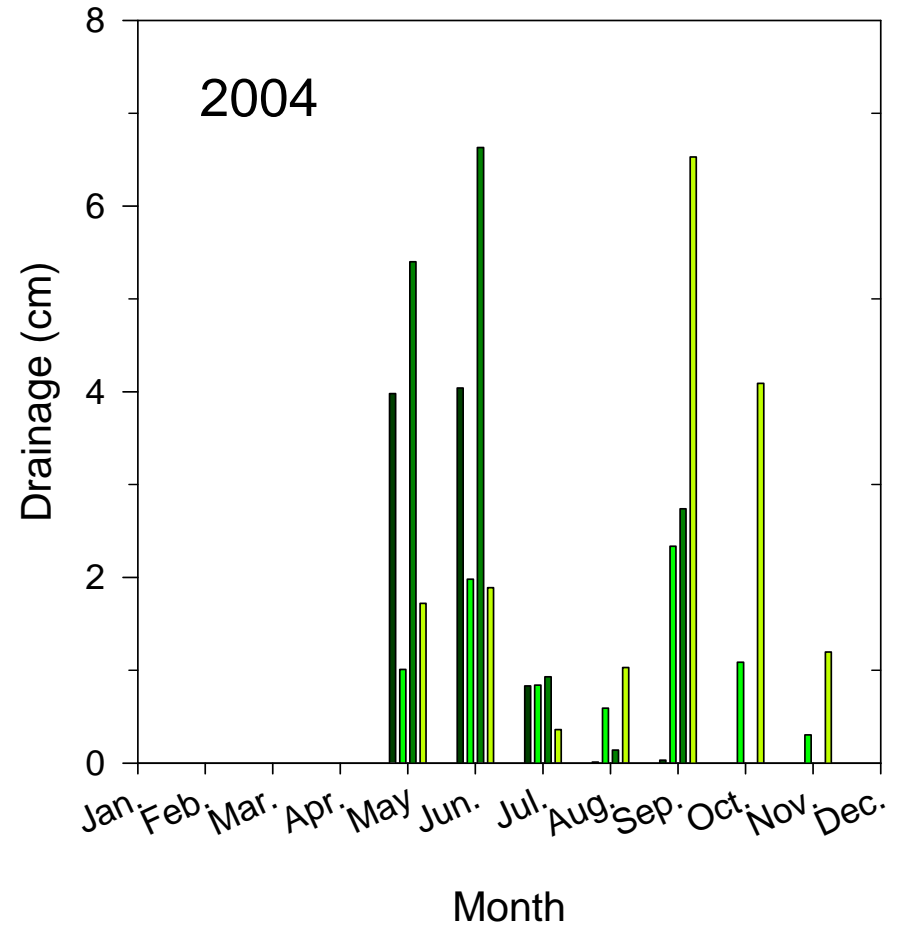
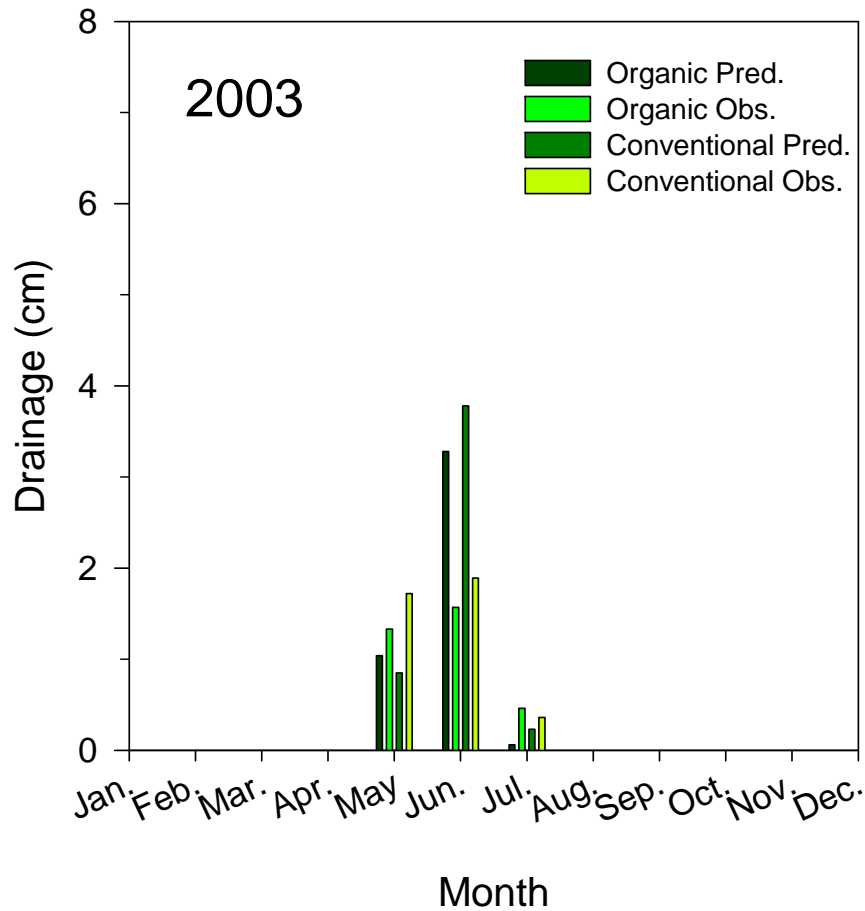
- Soil properties
 - organic
 - conventional
- ET
 - biodiversity
- Growing season
- Rooting depths
- Surface storage

Drainage



Crop System	Nitrate-nitrogen					
	2002		2003		2004	
	Obs.	Pred.	Obs.	Pred.	Obs.	Pred.
	cm					
Organic	9.0	11.0	3.4	4.4	8.2	8.9
Conventional	11.7	10.0	4.0	4.9	19.1	15.8

Monthly drainage



NITROGEN

Data Collection



- Weekly grab samples
 - 1000 mL sample
 - **$\text{NO}_3\text{-N}$** , $\text{NH}_4\text{-N}$, Total N, Dissolved Reactive-P (DRP), Total P.
 - Flow
- Storm events
 - Up to 24, 1000 mL samples.
 - **$\text{NO}_3\text{-N}$** , $\text{NH}_4\text{-N}$, Total N, DRP, Total P, sediment.
 - Flow.



DRAINMOD NII - Nitrogen



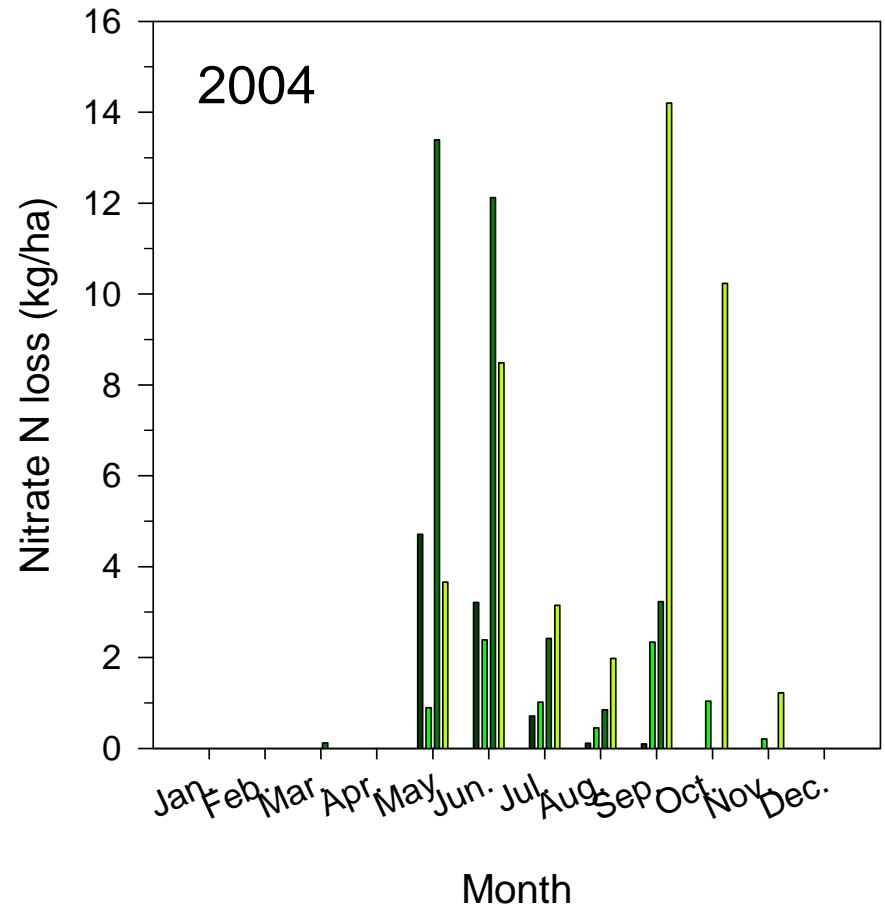
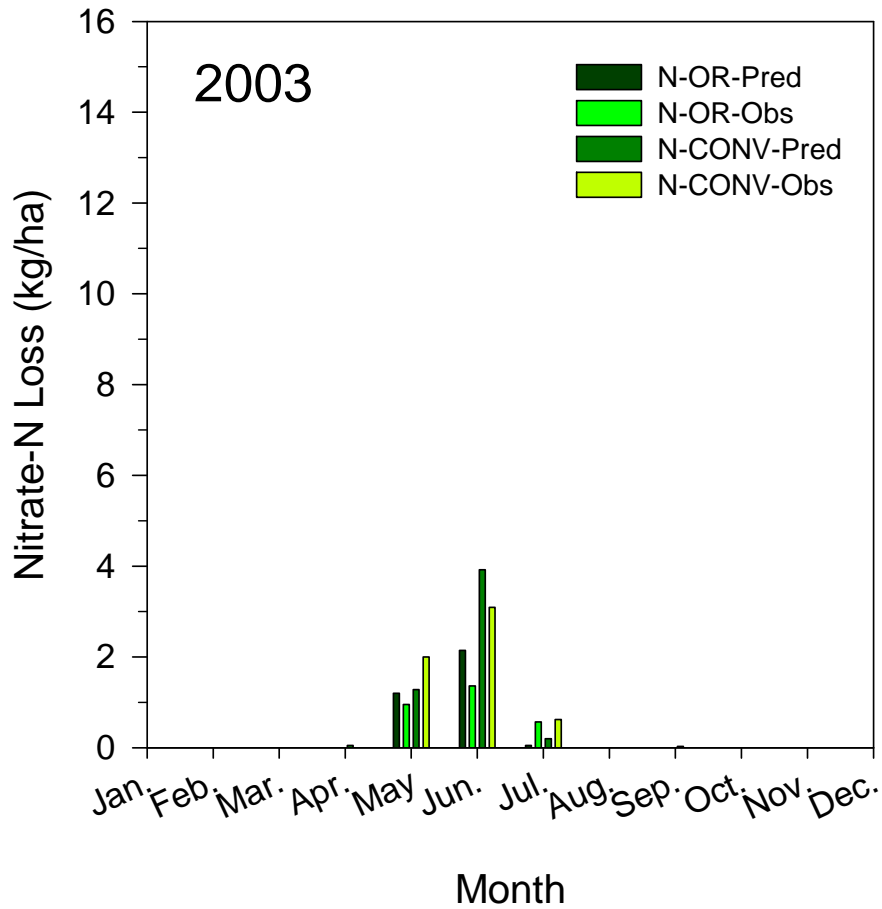
- N rate
- Growing season
- Residual soil N

Nitrogen loss



Crop System	Nitrate-nitrogen					
	2002		2003		2004	
	Obs.	Pred.	Obs.	Pred.	Obs.	Pred.
	kg/ha					
Organic	6.3	6.3	2.9	3.4	8.3	8.8
Conventional	17.2	15.1	5.7	5.5	43.0	32.2

Monthly N loss



Summary



- Cropping system had an affect on drainage and nitrogen loss
 - KEY FACTORS
 - Soil properties
 - Soil management
 - Nitrogen management
 - Precipitation
 - Topography



Conclusions



- DRAINMOD NII performed reasonably well for these two different cropping systems.
- Farming practices that incorporate biodiversity in the cropping system can reduced nitrogen loss to the environment



THANK YOU!

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References

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