Proceedings of the 11th Nutrient Management Conference

11th Annual
NUTRIENT MANAGEMENT CONFERENCE

Sessions 9:05 a.m.-3:40 p.m.

GENERAL SESSION

8:15 a.m. *Registration*

9:00 a.m. *Welcome*
Tom Rothman — University of Minnesota

9:05 a.m. *Lessons Learned in 2018, Opportunities for 2019*
Brad Carlson — University of Minnesota Extension
Dave Nicolai — University of Minnesota Extension
Gary Prescher — Minnesota Corn Research & Promotion Council

9:55 a.m. *Phosphorus Management Challenges Confronting the US*
Dr. Heidi Peterson — International Plant Nutrition Institute

10:50 a.m. *Break*

11:05 a.m. *Get the Most Out of Sulfur Application by Applying at Right Time*
Dr. Dan Kaiser — University of Minnesota

12:00 *Lunch*

BREAKOUT SESSION #1

1:00 p.m. *Residue Management and Potential Effects on P Availability in a Continuous Corn System*
Dr. Paulo Pagliari — University of Minnesota

1:55 p.m. *Phosphorus Management and Water Quality*
Dr. Lindsay Pease — University of Minnesota

2:50 p.m. *Lessons Learned from Spring Creek Farms*
Tim Radatz — MAWRC

BREAKOUT SESSION #2

1:00 p.m. *Evaluation of the Haney Soil Health Test as a Corn Nitrogen Management Tool*
Dr. Matt Yost — Utah State University

1:55 p.m. *Irrigation and Nitrogen Management*
Dr. Vasudha Sharma — University of Minnesota

2:50 p.m. *Managing Micronutrients for Soybeans*
Dr. Dorivar Ruiz-Diaz — Kansas State University

3:40 p.m. *Adjourn*

Lessons learned from Spring Creek Farms

Tim Radatz

February 19th, 2019

11th Annual Nutrient Management Conference – St. Cloud

radatz@mawrc.org

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA

On What It's Like For You When You Have A Lot Of Kids ...

"You know what it's like having a fourth kid? Imagine you're drowning, then someone hands you a baby."

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Discovery Farms is a farmer led water quality research and educational program, provides credible research, and communicates results

MINNESOTA DEPARTMENT OF AGRICULTURE

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

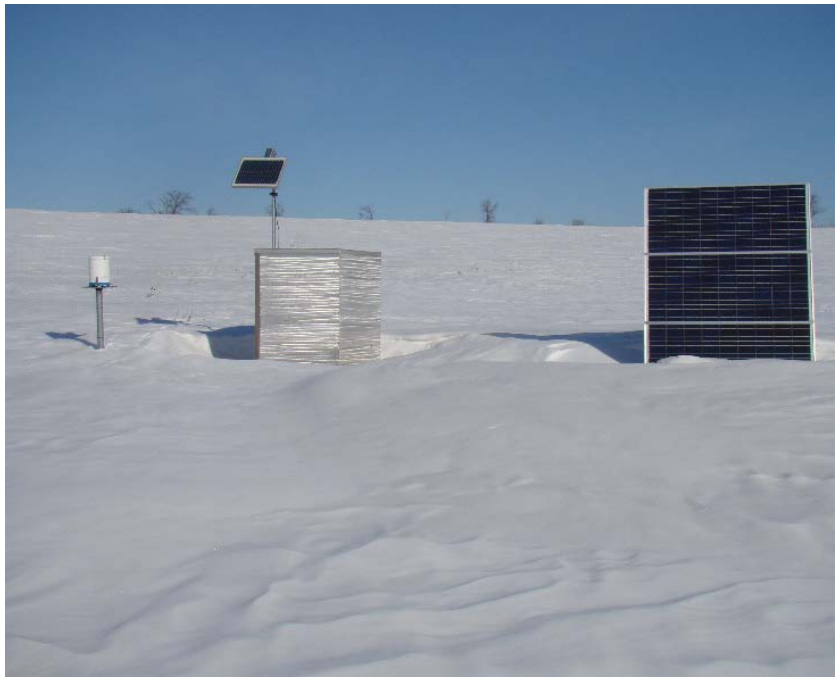
DISCOVERY FARMS MINNESOTA

Edge-of-field surface runoff and tile drainage data is collected 365 days a year

Weather • Soil

Flow • Sediment

Nitrogen • Phosphorus



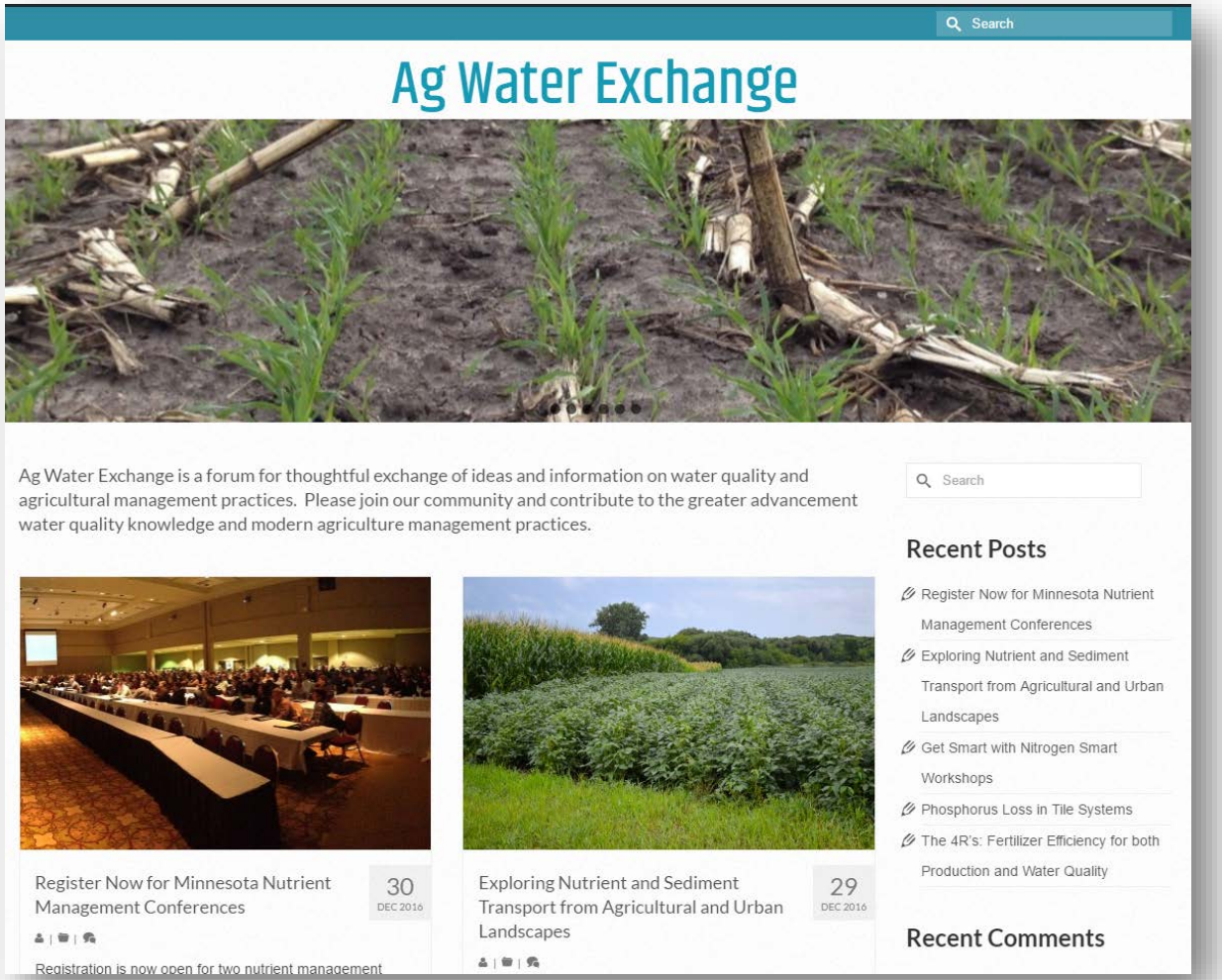
Flow Volume X Concentration (ppm) = Loss (lb/ac)

MAWRC MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

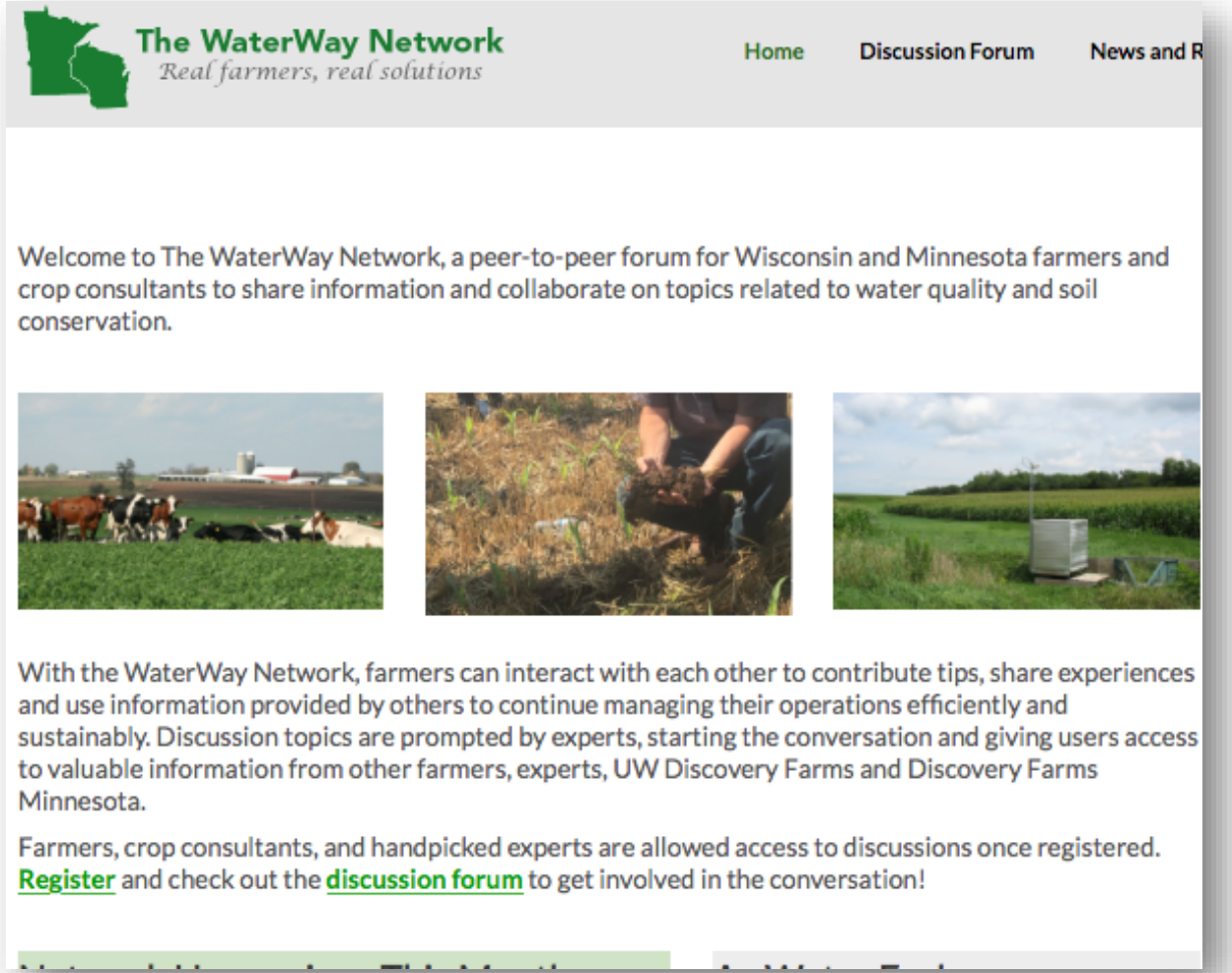
MINNESOTA DEPARTMENT OF AGRICULTURE

DISCOVERY FARMS MINNESOTA

AgWaterExchange.com

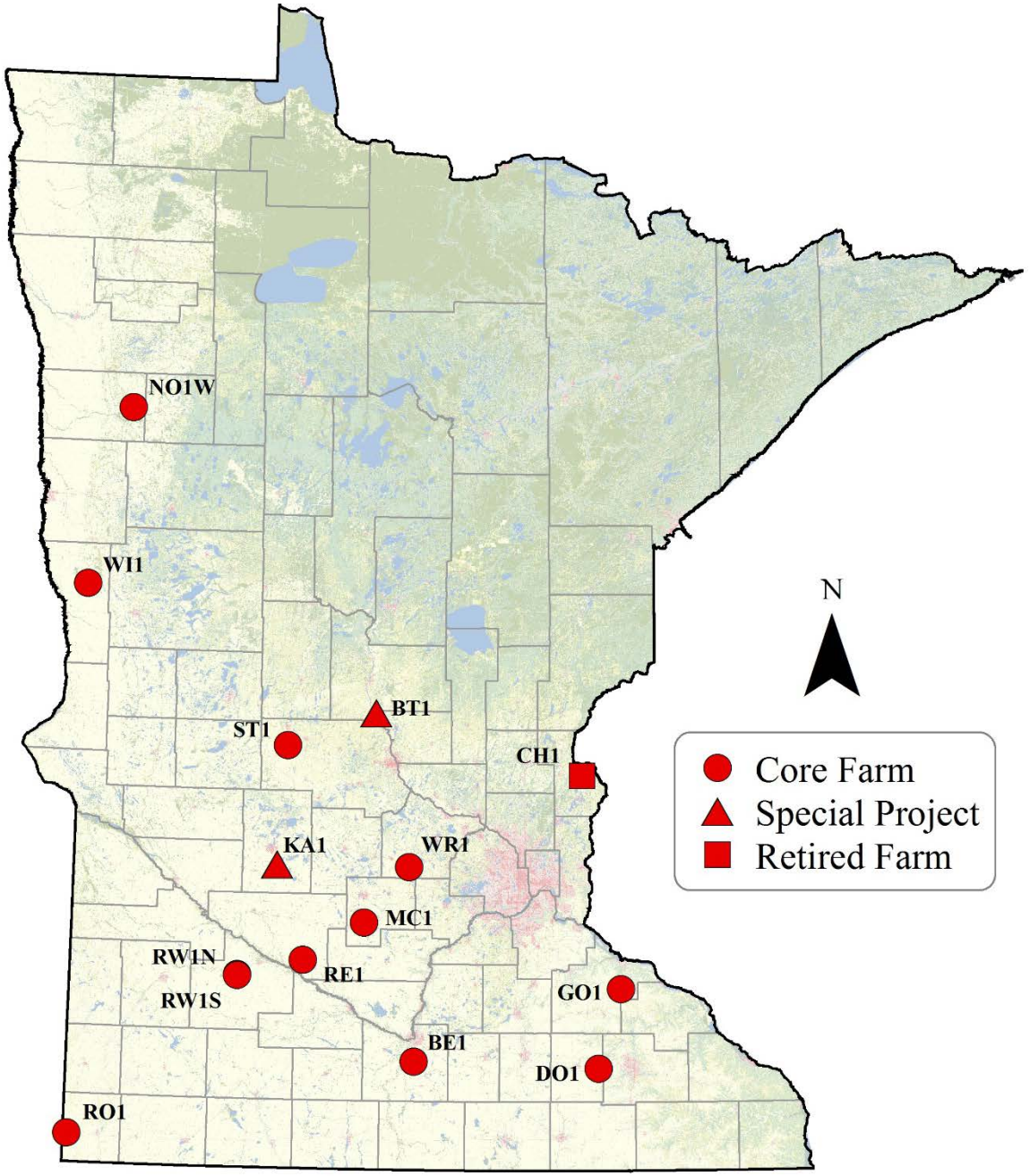


WaterWayNetwork.org



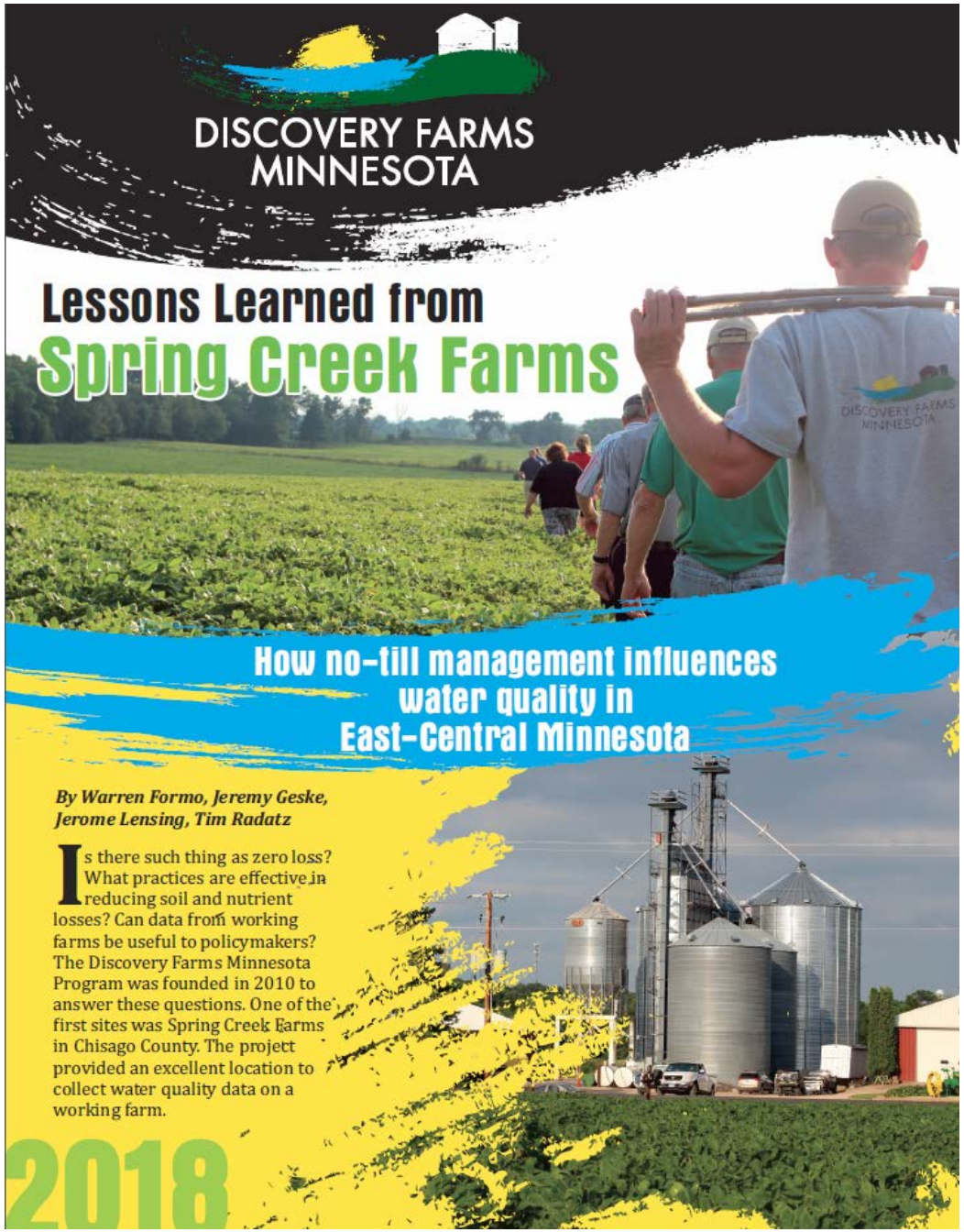
MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA



MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA



DISCOVERY FARMS MINNESOTA

Lessons Learned from Spring Creek Farms

How no-till management influences water quality in East-Central Minnesota

By Warren Formo, Jeremy Geske, Jerome Lensing, Tim Radatz

Is there such thing as zero loss? What practices are effective in reducing soil and nutrient losses? Can data from working farms be useful to policymakers? The Discovery Farms Minnesota Program was founded in 2010 to answer these questions. One of the first sites was Spring Creek Farms in Chisago County. The project provided an excellent location to collect water quality data on a working farm.

2018

www.discoveryfarmsmn.org

Resources Page

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

John & Jewell Peterson

Why did you choose to participate in the Discovery Farms program?
I was curious to see what the data would be. It was a way to give and learn at the same time. It has been a good learning experience. We are innovative and we like to try different things to become more efficient and more profitable. At the same time, we want to leave our fields in better shape for future generations. Participating in Discovery Farms helps validate what we are doing and identify ways to improve our management practices.

What instilled your conservation ethic?
The desire to leave our land in excellent condition for the next generation. We chose no-till because it was different, it was a challenge, and you could still be profitable. Farming is a constant challenge because every year is different. You take the good that you learn from each year and strive to improve.

What have you taken away from the program?
The amount of water that drops on the land annually is incredible. You don't realize it until you see that flume gathering water from your field. It has changed the way we think about reducing erosion and keeping nutrients on the land for our crops. The data shows we have been doing a good job of minimizing losses, but there is always room for improvement. It has been a good learning experience.

Participating in Discovery Farms helps validate what we are doing and identify ways to improve our management practices.

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA

Chisago SWCD

CLEAN WATER LAND & LEGACY AMENDMENT

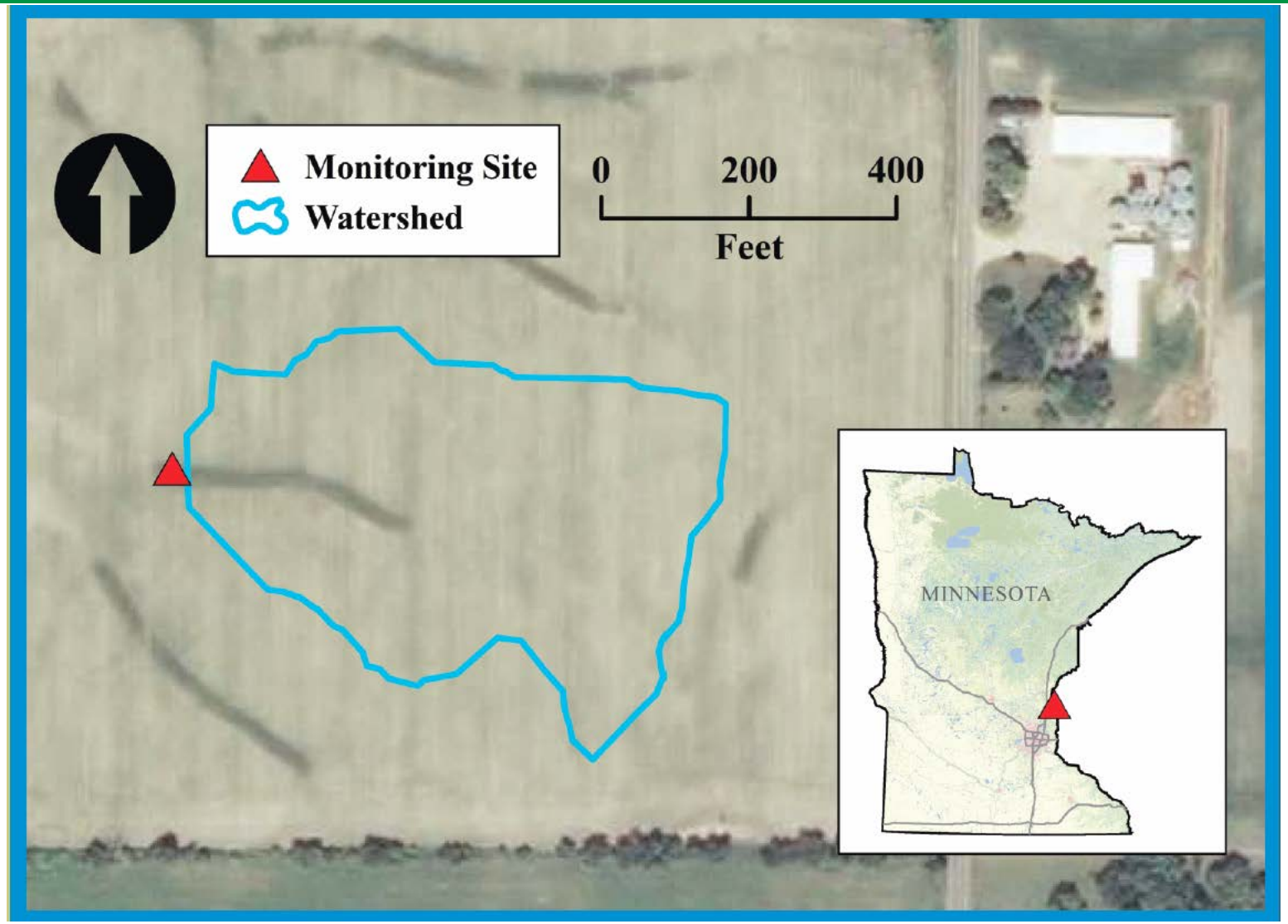
MINNESOTA SOYBEAN RESEARCH & PROMOTION COUNCIL

DEPARTMENT OF AGRICULTURE

MinnesotaCorn GROWERS ASSOCIATION

MAWRC MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA



Drainage Area (ac)	Average Slope (%)	Soil Type	Drainage Class	Tile Drainage
6.1	3.40%	Cushing Loam	Well Drained	No

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA

Description	2011	2012	2013	2014	2015	2016
Soil Test pH (0-6 in)	6.4	7.3	7.4	7.2	7.1	7
Soil Test Organic Matter (0-6 in; %)	1.6	2	1.1	1.8	1.8	1.9
Soil Test P (Bray; 0-6 in; ppm)	39	57	41	30	36	20
Soil Test K (0-6 in; ppm)	119	102	83	94	97	71

Description	2011	2012	2013	2014	2015	2016
CROP	CORN	SOYBEAN	CORN	SOYBEAN	CORN	SOYBEAN
Fertilizer timing, placement, and source	May 14, banded, 6-16-40; June 10, broadcast, urea & ammonium sulfate; June 23, broadcast, urea	None	May 4, broadcast, 6-16-40; June 4, broadcast, urea & ammonium sulfate; June 13, broadcast, urea	None	June 15, broadcast, urea & ammonium sulfate, July 1, broadcast, super U & ammonium sulfate	None
Nitrogen application rate (lb/ac)	180	None	181	None	207	None
Phosphorus application rate (P2O5 lb/ac)	60	None	60	None	13	None
Potassium application rate (K2O lb/ac)	100	None	128	None	8	None
Tillage	None	None	None	None	None	None

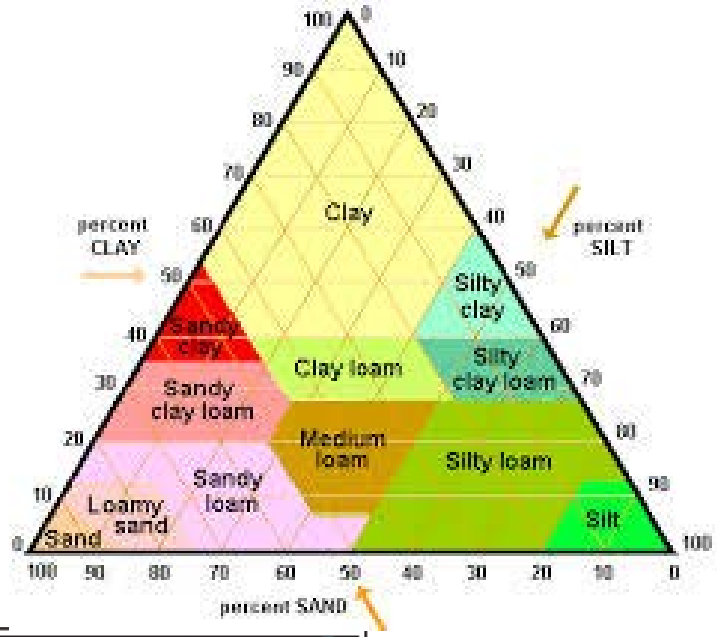
MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA

No-till corn-soybean management works well for this soil and climate

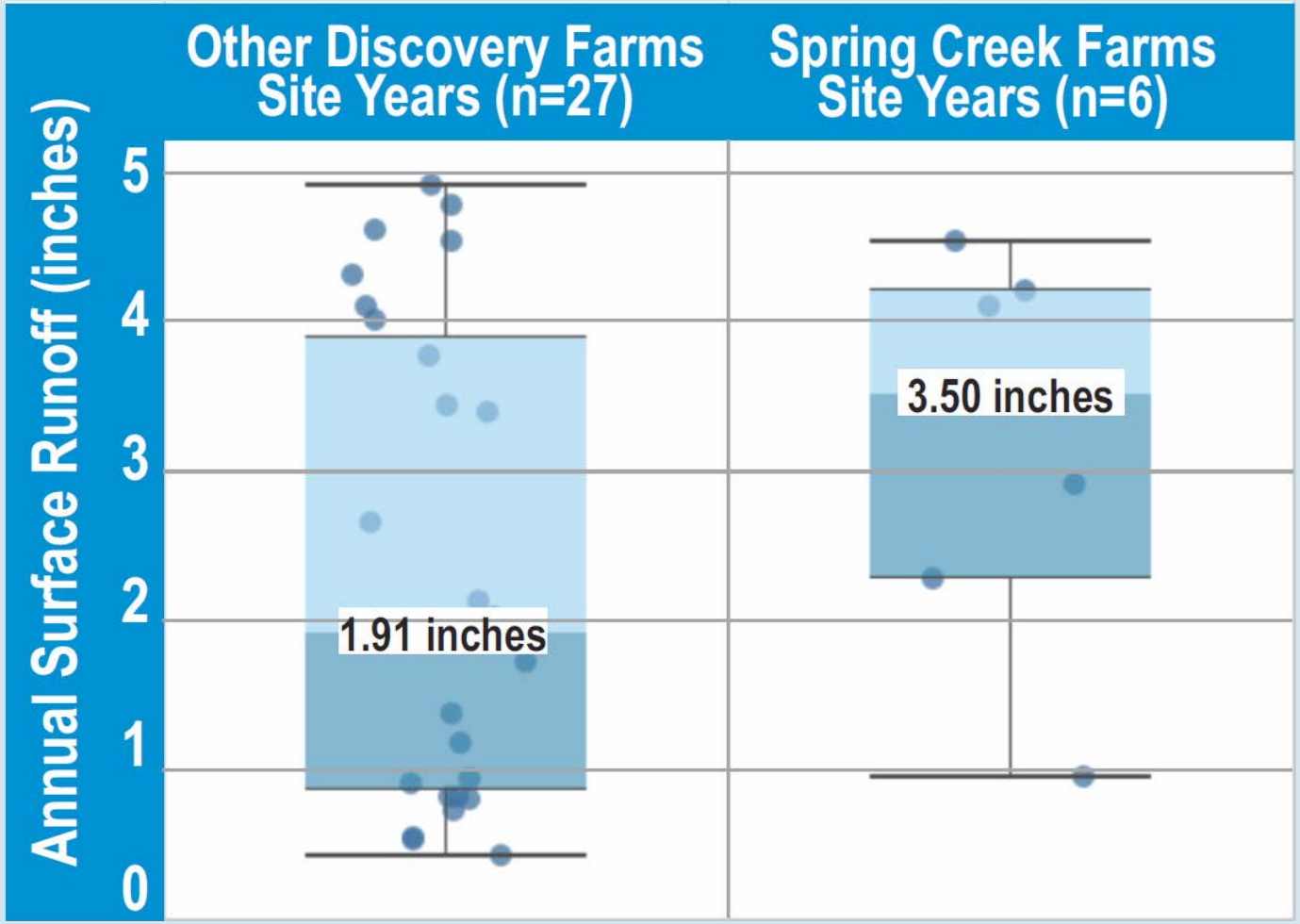


Year	Crop	County Average Yield (bu/ac)	Spring Creek Farm Yield (bu/ac)
2011	Corn	131	200
2012	Soybean	37	48
2013	Corn	125	169
2014	Soybean	28	52
2015	Corn	173	190
2016	Soybean	46	66

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Annual surface runoff amounts were like other locations and farming systems



Annual runoff at Spring Creek Farms compared to other Discovery Farms sites.

11% of precipitation left as surface runoff

Surface runoff occurred on 12 days per year

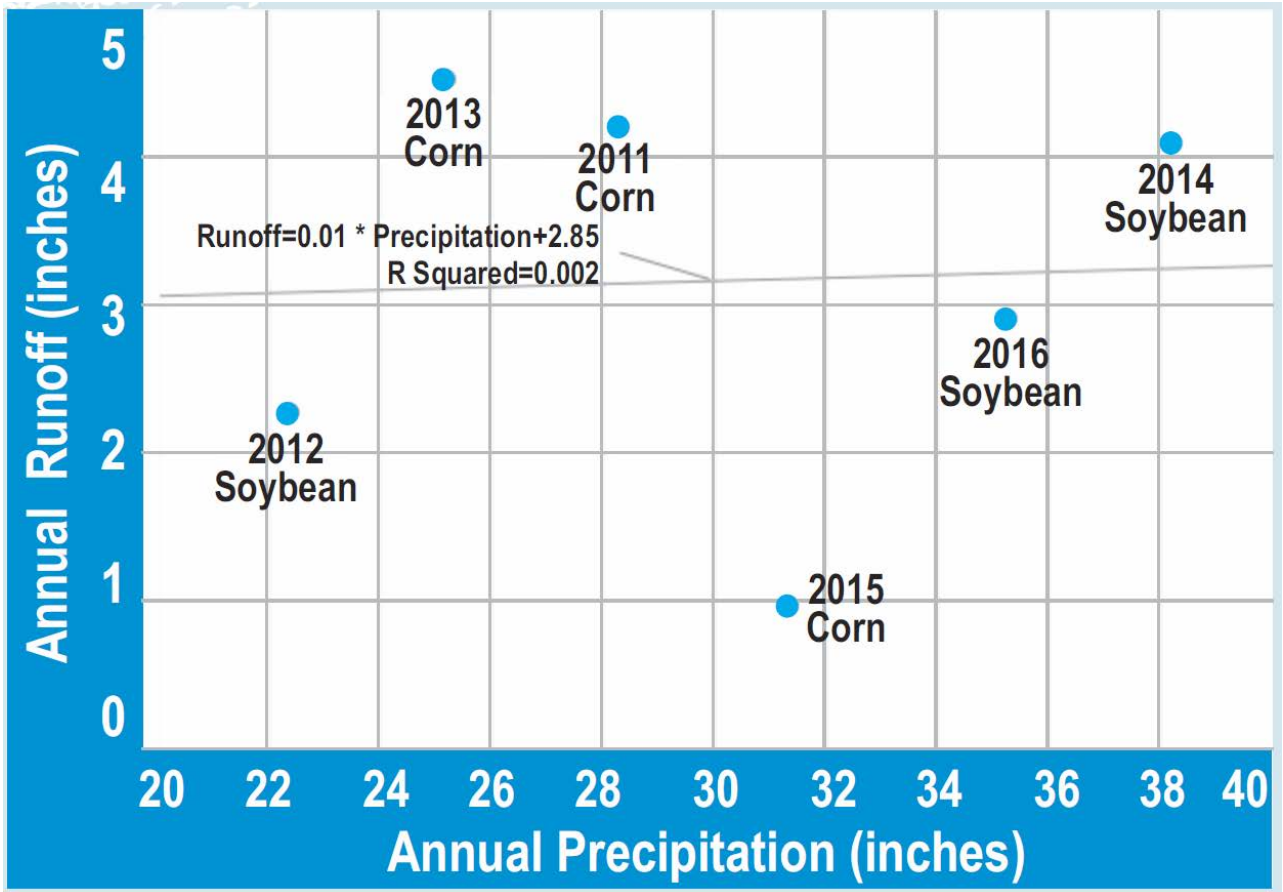
Even with high infiltration rates still periods of the year where runoff happens!

57% during frozen soil

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

The amount of annual precipitation had little impact on the amount of annual surface runoff



Annual precipitation and runoff at Spring Creek Farms

Why is this?

Precipitation timing

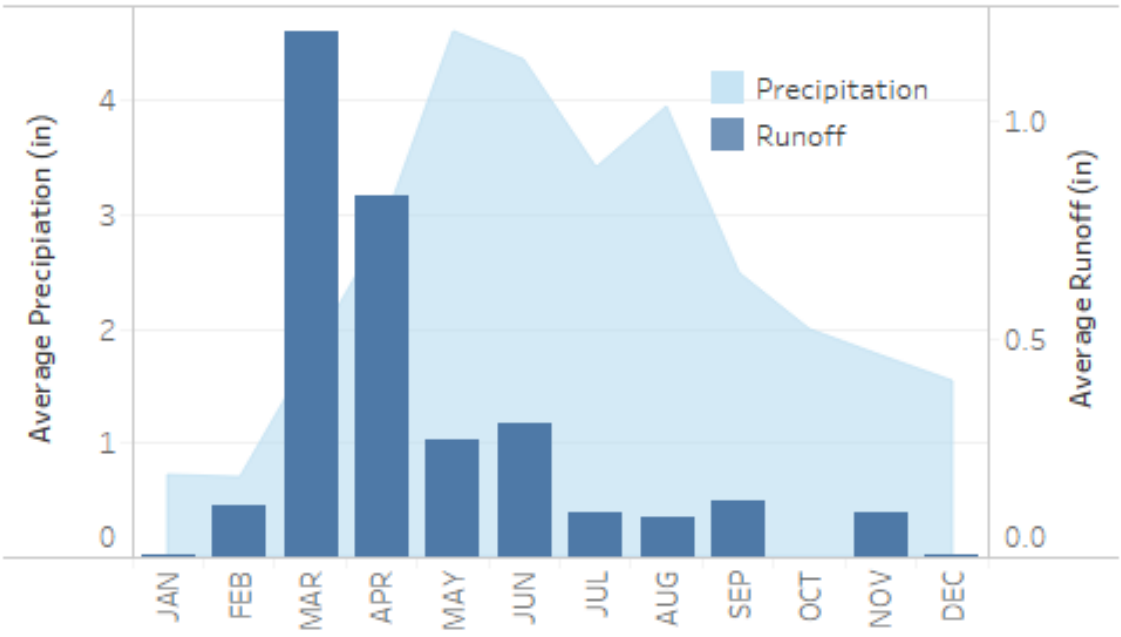
Precipitation intensity

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA

The amount of annual precipitation had little impact on the amount of annual surface runoff

Precipitation timing



Precipitation intensity

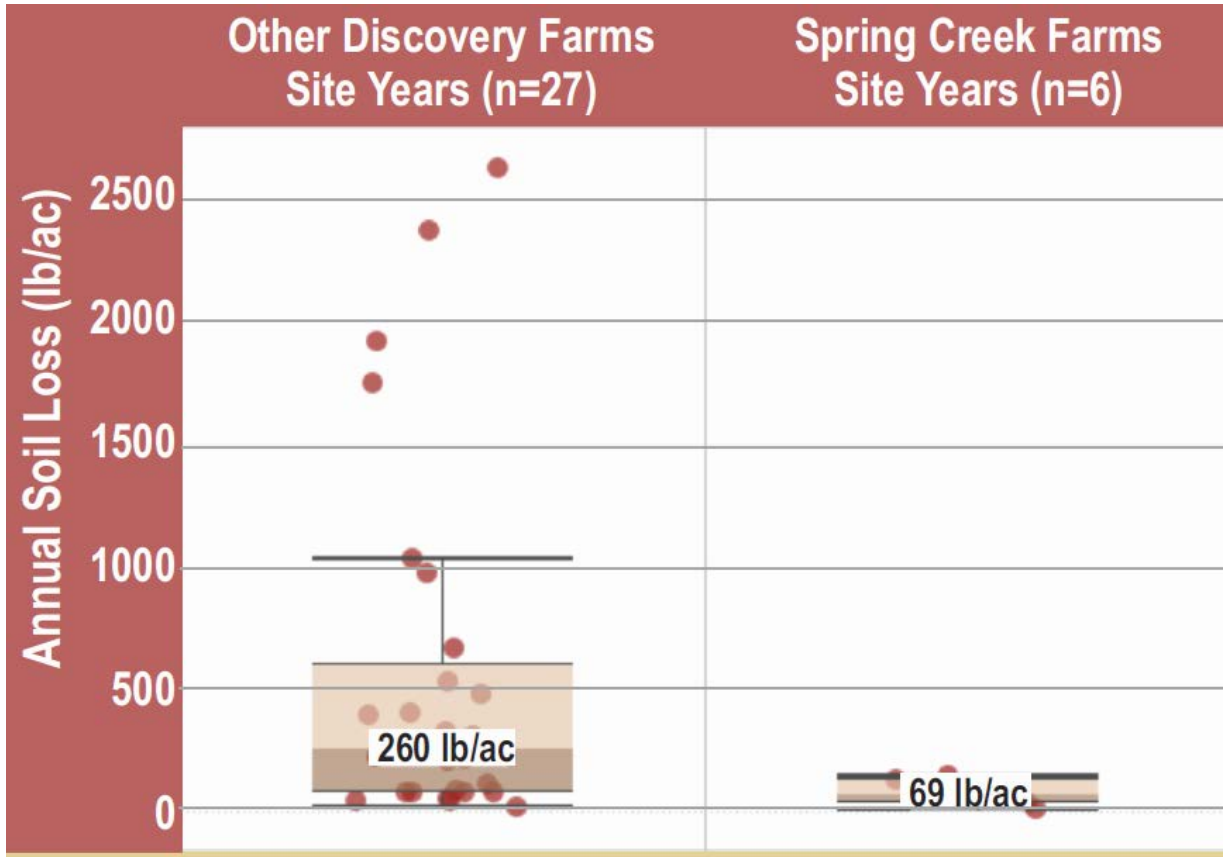
Date	Precipitation (inches)	Intensity (inches per hour)	Runoff (inches)
7/6/2105	2.06	0.17	0.02
8/22/2105	1.56	0.62	0.34

■ Precipitation and runoff from two events in 2015 at Spring Creek Farms

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

The no-till planting system was very effective at reducing soil losses



Annual soil loss at Spring Creek Farms compared to other Discovery Farms sites

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Phosphorus losses from agricultural fields is traditionally thought to be mostly sediment bound

Soil Loss ↑ Phosphorus Loss ↑ ✓

Soil Loss ↓ Phosphorus Loss → 🤔

Total Phosphorus = Particulate P (soil bound) + Dissolved P

Best management practices to reduce soil loss can increase the risk of dissolved phosphorus loss

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

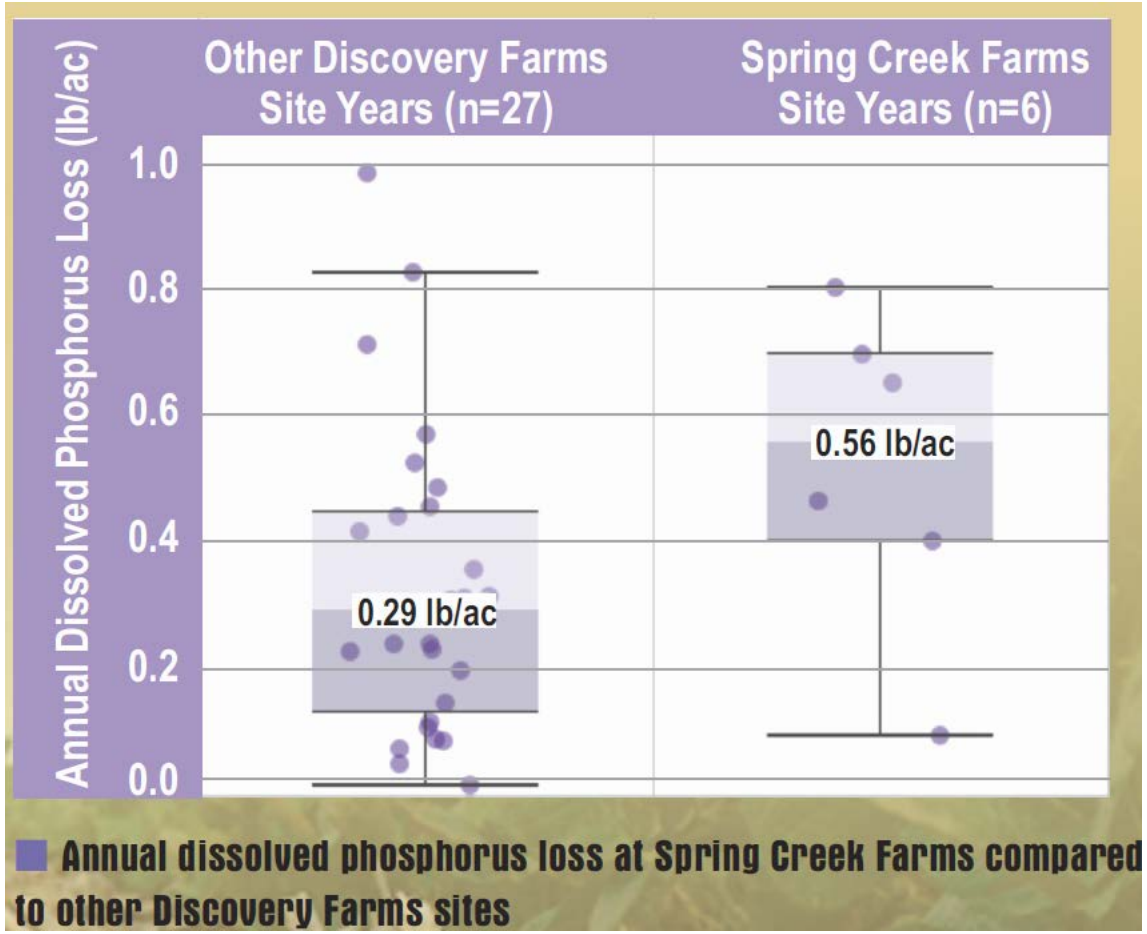
DISCOVERY FARMS MINNESOTA

Total phosphorus losses were like other sites because of increased dissolved phosphorus losses

Total Phosphorus at Spring Creek Farms was similar to conventionally tilled systems

Even though soil loss was much lower

Increase in dissolved phosphorus



Annual dissolved phosphorus loss at Spring Creek Farms compared to other Discovery Farms sites

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Most of the phosphorus lost in no-till planting systems is in the dissolved form

Conventional till systems: 40% DP, 60% PP

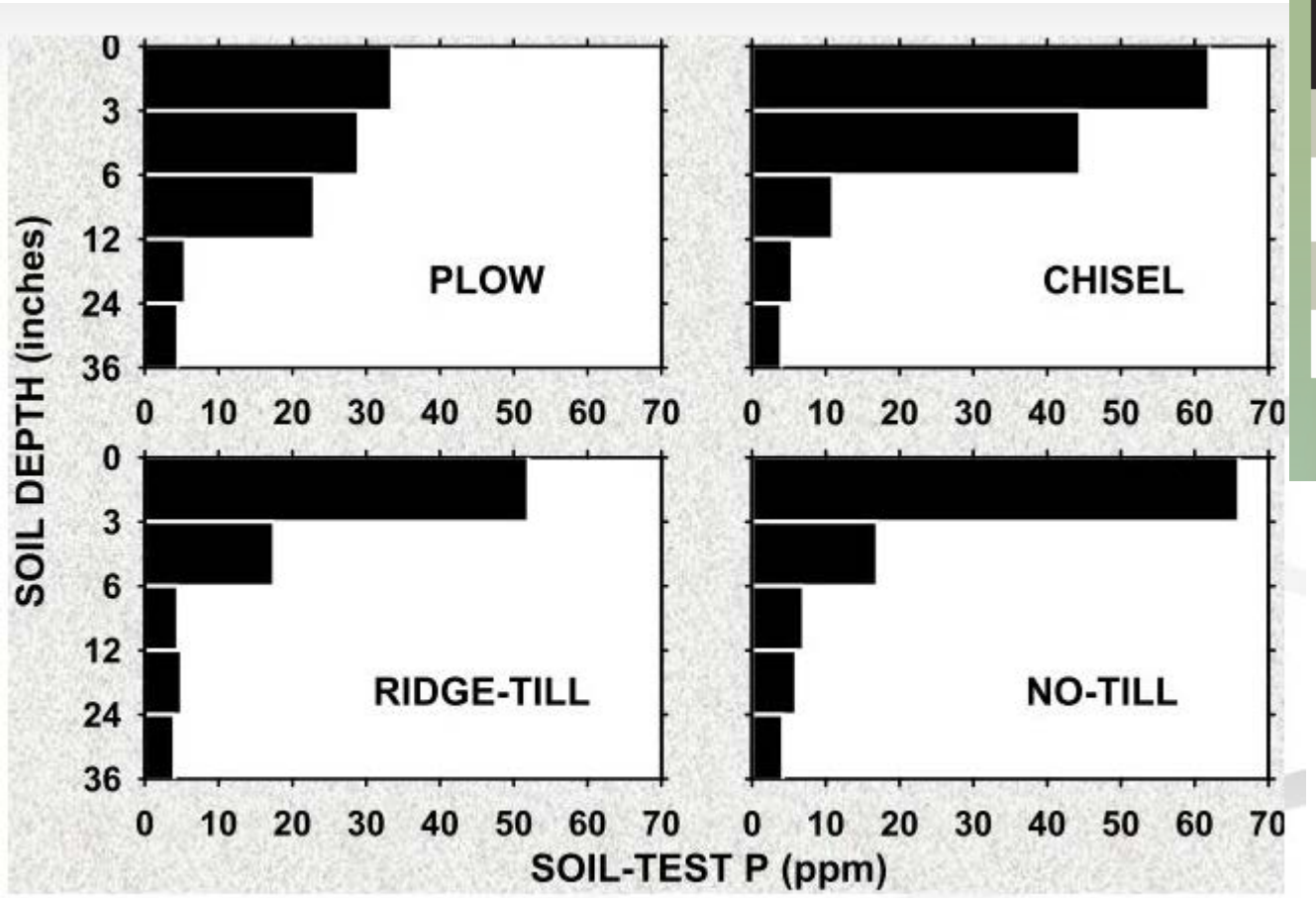
No-till systems: 60% DP, 40% PP

Higher DP losses originate from higher residue systems and stratified soil phosphorus

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Most of the phosphorus lost in no-till planting systems is in the dissolved form



Mallarino, ISU

Depth (in)	Soil Test P (Bray; ppm)	Soil Test K (ppm)
0 to 3	75	123
3 to 6	39	81
6 to 9	18	71
9 to 12	12	60

■ Incremental depth soil samples at Spring Creek Farms

High Residue

=

Higher Risk of DP

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

What can be done to combat both risk of soil loss and dissolved phosphorus loss?

The key is to balance soil disturbance and fertilizer and manure incorporation

Match tillage/incorporation to landscape

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

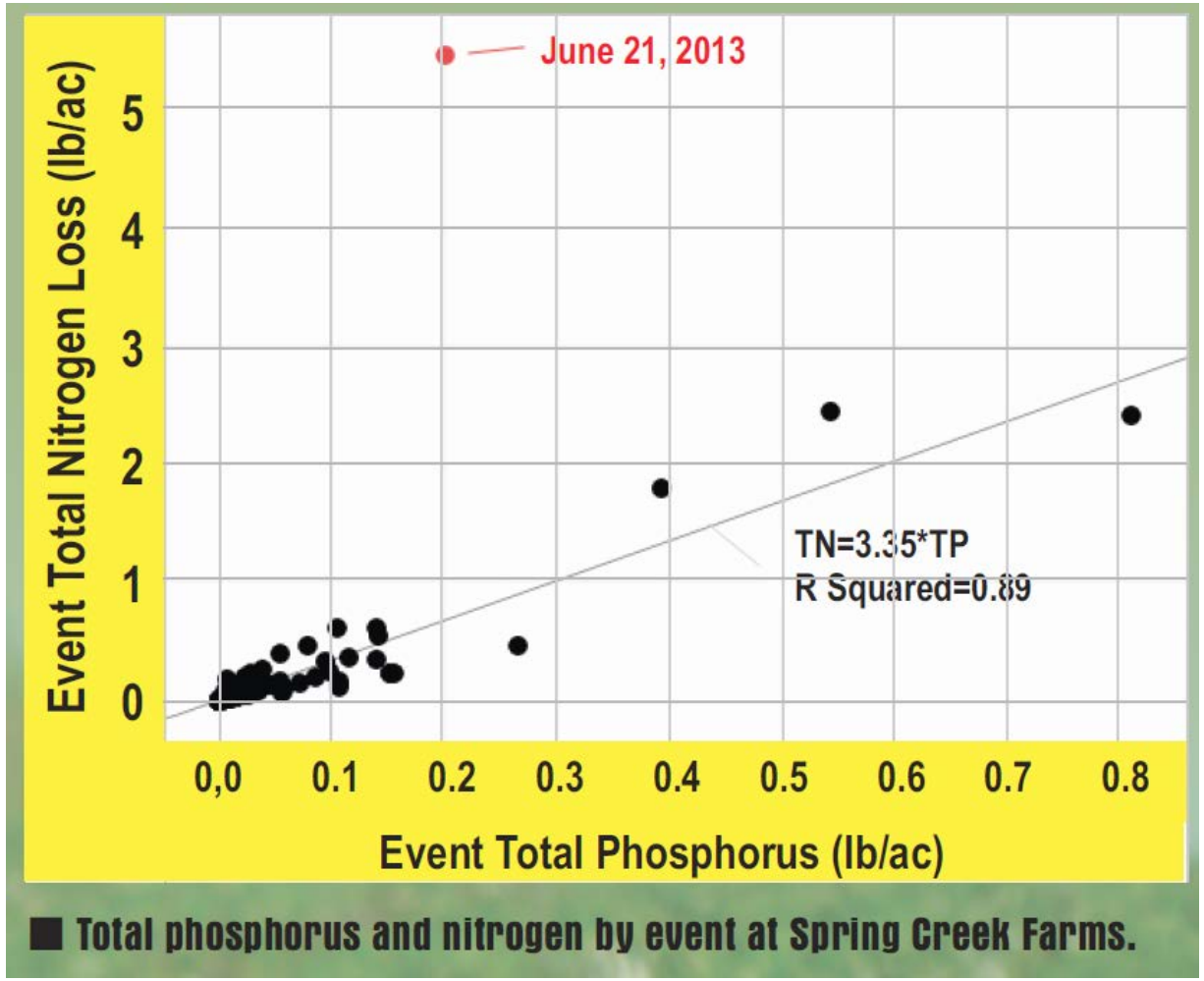
Timing of fertilizer applications matters

Split applications mean more applications

↑ This is a totally revolutionary thought (this is sarcasm)

Great for spreading out nitrogen loss risk

However need to be aware of field and weather conditions with each application



■ Total phosphorus and nitrogen by event at Spring Creek Farms.

This event altered products and timings of splits for Spring Creek Farms

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS MINNESOTA

Agricultural management and water quality complemented (and still complement) each other at Spring Creek Farms because of the thoughtful uses of conservation and nutrient management practices

Tim Radatz
radatz@mawrc.org

MAWRC
MINNESOTA AGRICULTURAL WATER RESOURCE CENTER

DISCOVERY FARMS
MINNESOTA