Managing Spray Irrigation of Nutrients

Wisconsin Crop Management Conference

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The Manure Management Challenge

Manure is valuable for soil health and crops

Provides nitrogen, phosphorus and organic matter

Manure is a pollutant in lakes & streams

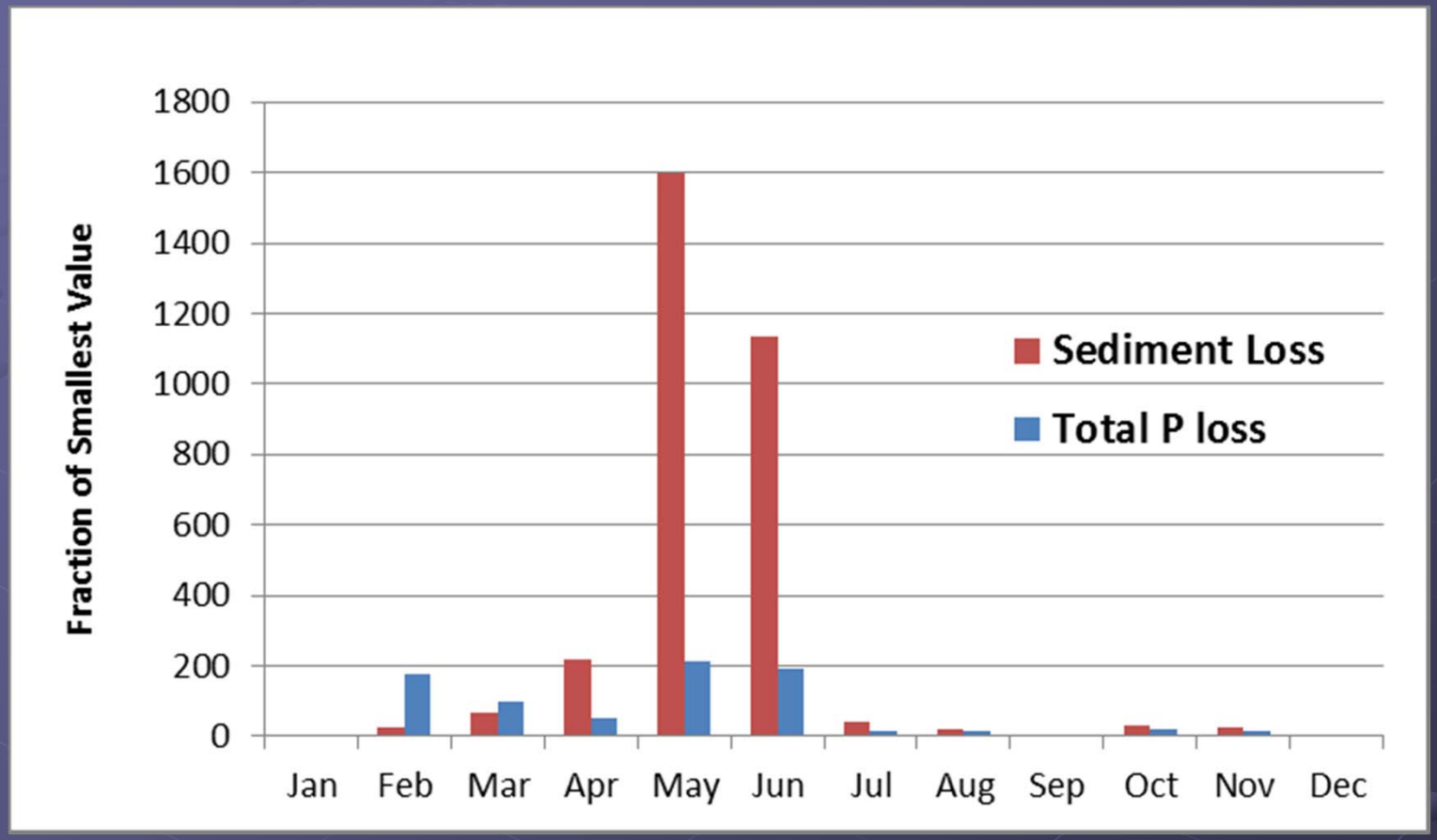
Cause excessive plant growth in natural waters
Deplete oxygen from natural waters
A source of bacteria / pathogens

The goal is to get manure in the root zone and keep it there . . . . .

On-Farm Water and Nutrient Management

Measure to Manage!

Mean Monthly Sediment & Total P Loss from Pioneer Farm 2003-08

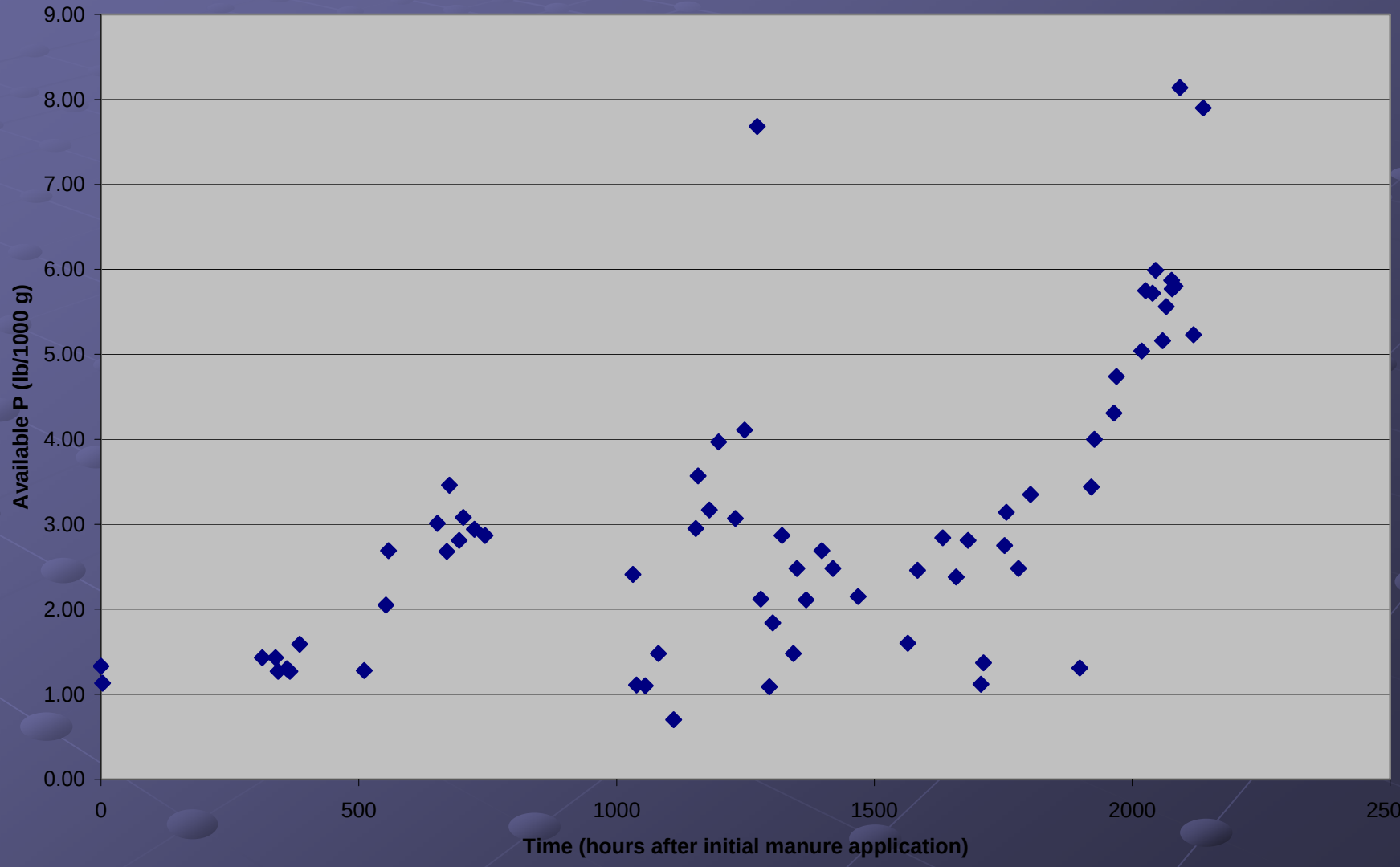


Late Winter and Spring are the times of maximum Sediment and total P loss in Wisconsin

UW Extension

Phosphorus Values Over Time

Source: Leverich and Wolkowski, Unpublished data



Manure Processing (Separation) Can Reduce This Environmental Risk

- **Partition manure into high and low P fractions**
  - Apply low P fraction (permeate) on high soil test P fields
  - High P fraction (concentrate) for low-P or distant fields
- **Better control of environmental impacts:**
  - More nutrient consistency for better nutrient management.
  - Distribute nutrients over full growing season, in small doses via "fertigation" with high N/low P liquid fraction

    versus

    large single quantities at potentially risky Spring and Fall periods
  - Less over-the-road manure hauling
  - Fewer lagoons needed

Manure Separation

Manure Processing (Separation) Can Reduce Environmental Risk: HO

COMPARISON OF 1st and 2nd YEAR MANURE NUTRIENT CREDITS BEFORE (BASE) AND AFTER SEPARATION: AS APPLIED (Pounds/1,000 Gallons)

AVERAGE COMPOSITION: Pounds/1,000 gallons

BASE: 2006-2009, NO Separation (Agitated Pit Manure)

	DM	N	P	K	S	Number Samples
AVERAGE Prior to Separation	3.0	7.2	3.6	13.2	0.9	200

AFTER SEPARATION: 2012 Crop Year

	DM	N	P	K	S	Number Samples
Solids (TONS)	29.2	3.3	2.7	6.3	0.8	6
UF Concentrate	3.9	9.9	7.2	16.0	0.7	42
UF Permeate	1.3	3.9	0.6	16.9	0.5	7

Manure Separation: Ultra-filtration

Manure Processing (Separation) Can Reduce Environmental Risk: HO

COMPARISON OF 1st and 2nd YEAR MANURE NUTRIENT CREDITS BEFORE (BASE) AND AFTER SEPARATION: AS APPLIED (Pounds/1,000 Gallons)

COEFFICIENT of VARIATION (CV): % of AVERAGE

BASE: 2006-2009, NO Separation (Agitated Pit Manure)

	DM	N	P	K	S	Number Samples
AVERAGE Prior to Separation	39%	20%	51%	29%	42%	200

AFTER SEPARATION: 2012 Crop Year

	DM	N	P	K	S	Number Samples
Solids (TONS)	4%	12%	21%	9%	35%	6
UF Concentrate	13%	19%	19%	15%	32%	42
UF Permeate	11%	5%	22%	9%	34%	7

Manure Separation: Ultra-filtration

Separated Manure Adds Considerable Nutrient Management Flexibility

These UF Manure Fractions can be “optimally” applied to meet specific crop nutrient needs with land applied UF-Concentrate **&** fertigation of UF-Permeate.

Example: Need

- 120 lbs/acre N
- < 60 lbs/acre P
- ~12K gallons/acre UF Permeate
- ~7.5K gallons/acre UF Concentrate

	Application Summary		
	Apply	19,324	Gallons/acre
	UF Perm	61.4%	11,869
	UF Conc	38.6%	7,456
This DUAL Application Applies	N/acre	120	Pounds
	P/acre	60	Pounds
	K/acre	320	Pounds

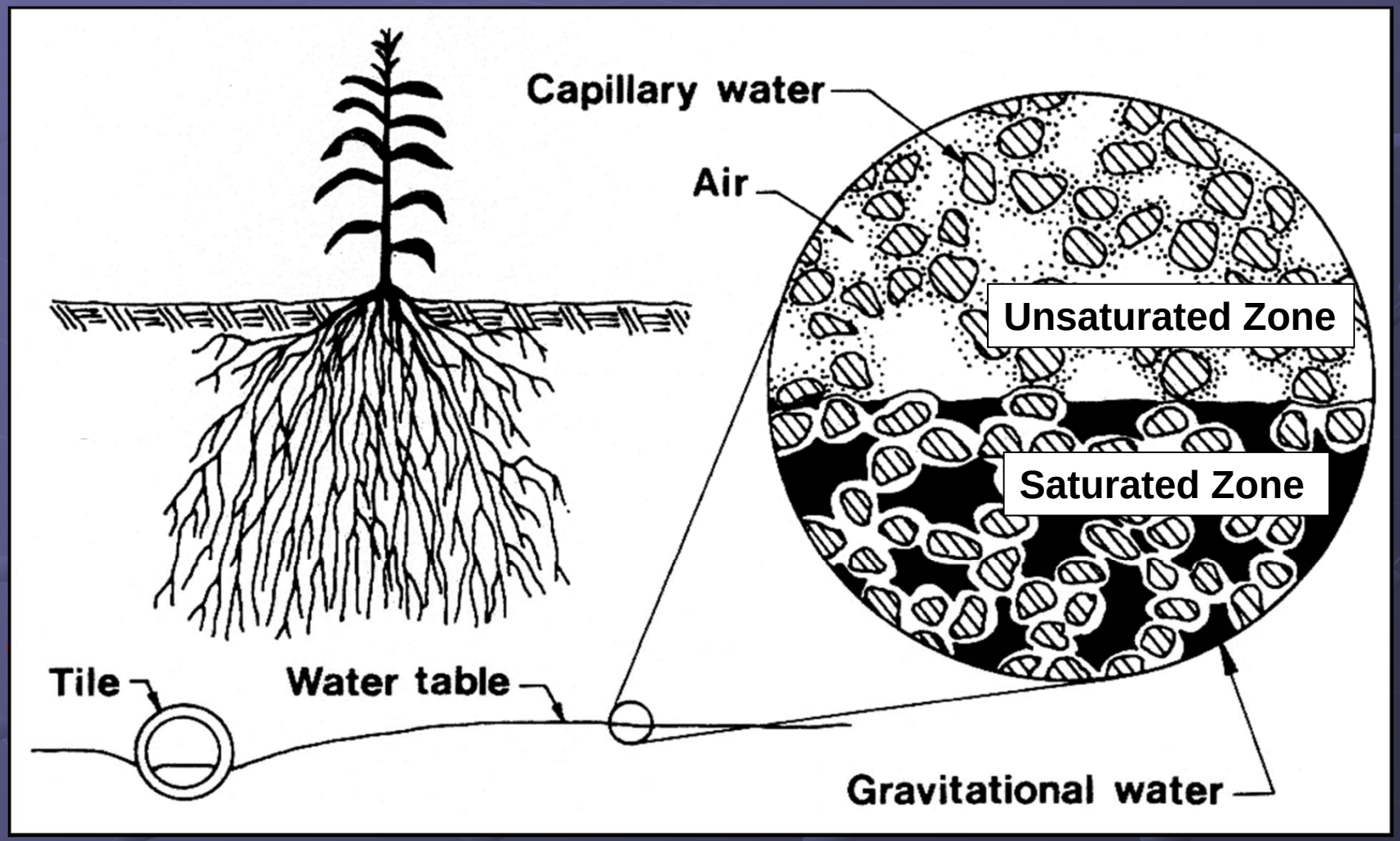
Manure Separation: Ultra-filtration

Mechanical Solids Separation

Spray application of the liquid fraction using a center pivot irrigation system

Keep Nutrients in the Root Zone

- Soil Water Retention -



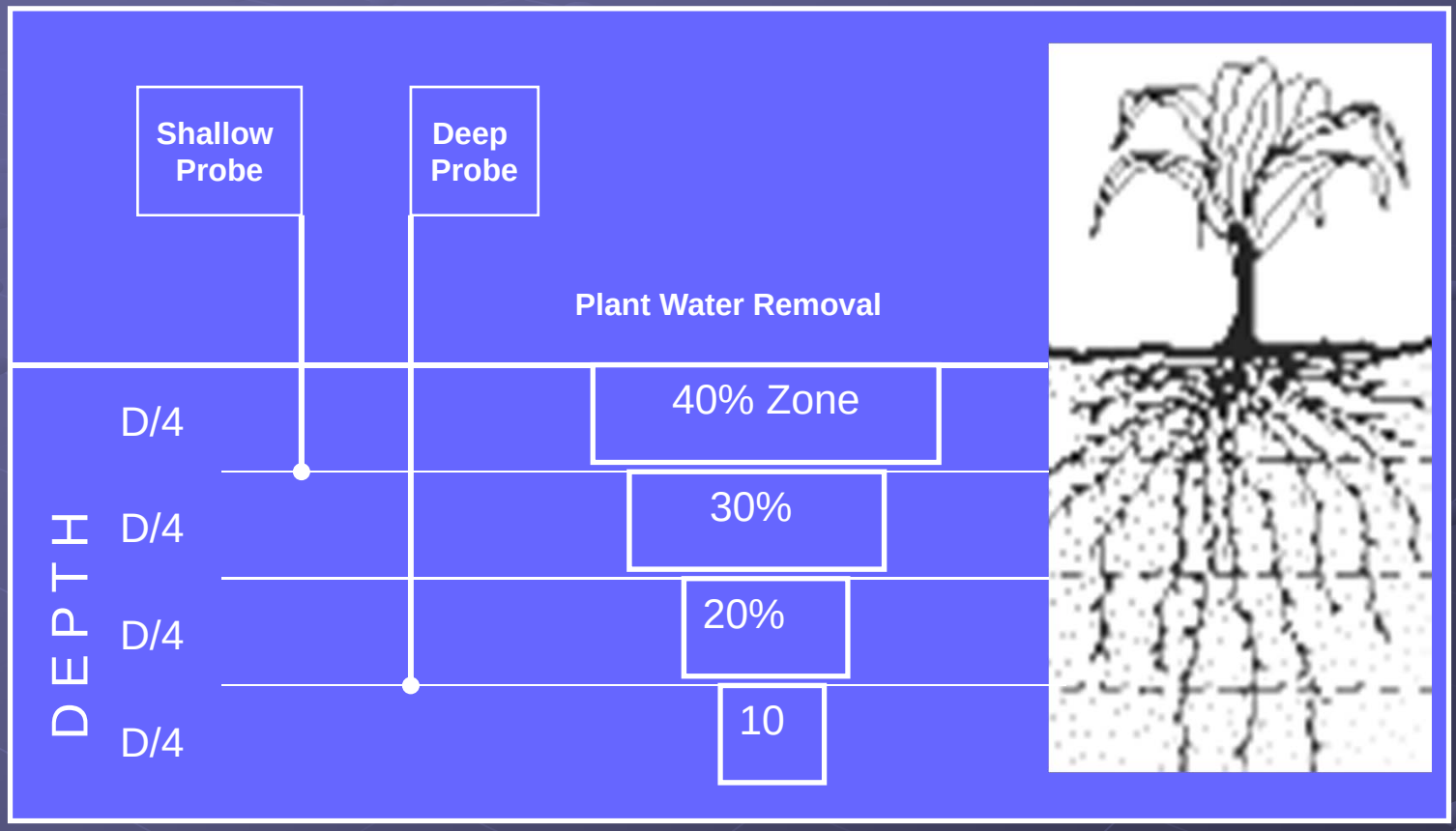
Keep Nutrients in the Root Zone

- Soil Water Retention -

Soil Texture	Total Pore Space (% by volume)	Field Capacity (% by volume)	Permanent Wilting Point (% by volume)	Total Available Water (% by volume)
Sandy	38	15	7	8
Sandy Loam	43	21	9	12
Loam	47	31	14	17
Clay loam	49	36	18	18
Silty clay	51	40	20	20
Clay	53	44	21	23

Keep Nutrients in the Root Zone

- Plant Water Removal Pattern -



The effective root depth is that portion of the root zone where the crop extracts the majority of its water

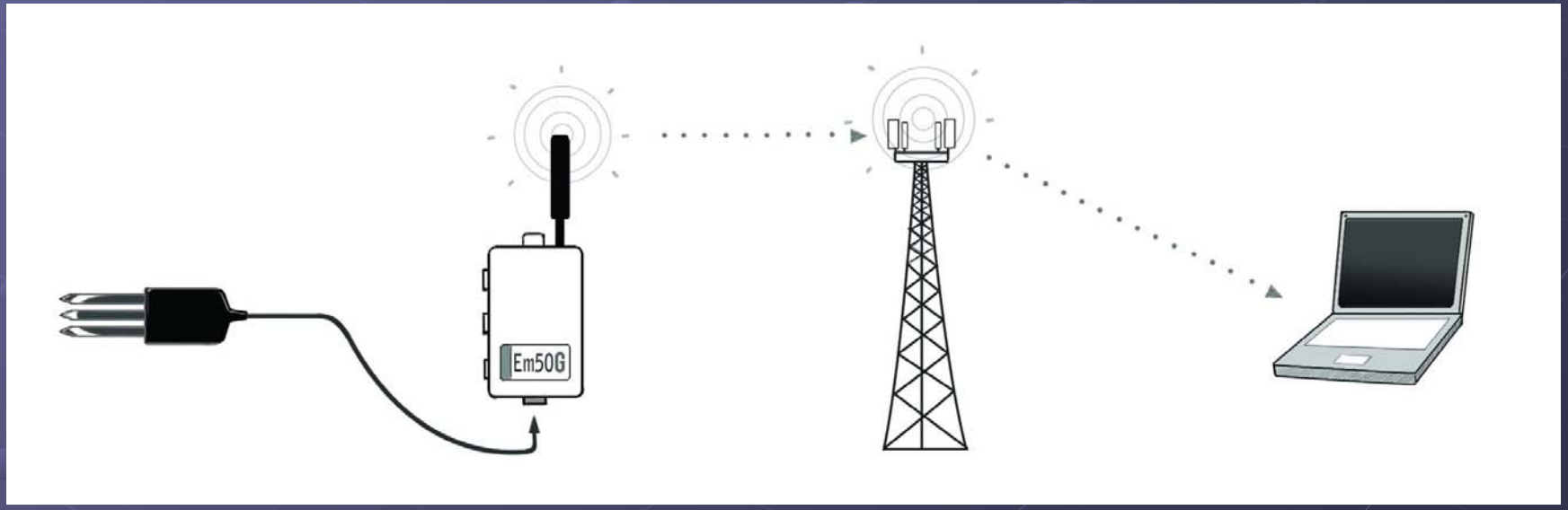

Soil moisture sensors are installed near the top and bottom of the root zone

Local System:
Soil moisture data are collected and relayed to an on site receiver and computer

Web-based System:

The data logger uses an internal cell modem to automatically send data to an internet server 4 to 6 times a day.

This system is more costly and requires that you have a cell phone data plan



Source: Decagon Devices, Inc. http://www.decagon.com

Keep Nutrients in the Root Zone

- WIS Irrigation Scheduler -

Day	Growing Season Date	AWON Reference ET (in/day)	Rainfall (in)	Irrigation (in)	Daily Crop ET (in)	Storage Change (in)	Plant Available Water (in)[2]	Drainage Volume (in)
51	07/10/09	0.2	0.03	0.00	0.21	-0.19	0.57	0.00
52	07/11/09	0.21	2.47	0.00	0.22	2.24	1.56	1.25
53	07/12/09	0.15	1.24	0.00	0.16	1.08	1.56	1.08
54	07/13/09	0.22	0.00	0.00	0.24	-0.24	1.32	0.00
55	07/14/09	0.26	2.10	0.00	0.28	1.82	1.56	1.59
56	07/15/09	0.27	0.00	0.00	0.30	-0.30	1.26	0.00
57	07/16/09	0.25	0.23	0.00	0.27	-0.04	1.23	0.00
58	07/17/09	0.25	0.01	0.00	0.27	-0.26	0.97	0.00
59	07/18/09	0.21	0.00	0.00	0.22	-0.22	0.74	0.00
60	07/19/09	0.23	0.00	0.00	0.25	-0.25	0.50	0.00
61	07/20/09	0.27	0.00	**1.35**	0.29	1.06	**1.56**	0.00
62	07/21/09	0.21	0.00	0.00	0.22	-0.22	1.33	0.00
63	07/22/09	0.23	0.06	0.00	0.25	-0.20	1.13	0.00
64	07/23/09	0.25	0.02	0.00	0.27	-0.25	0.88	0.00
65	07/24/09	0.23	0.06	0.00	0.25	-0.19	0.69	0.00
66	07/25/09	0.18	0.00	0.00	0.19	-0.19	0.50	0.00
67	07/26/09	0.24	0.00	**0.80**	0.27	0.53	**1.03**	0.00
68	07/27/09	0.22	0.00	0.00	0.24	-0.24	0.79	0.00
69	07/28/09	0.27	0.00	0.00	0.30	-0.30	0.49	0.00
70	07/29/09	0.24	0.01	0.00	0.26	-0.25	0.24	0.00
71	07/30/09	0.27	0.22	0.00	0.30	-0.08	0.15	0.00

Deep Drainage

Field Capacity = 1.56 in

Keep Nutrients in the Root Zone

- WISP Irrigation Scheduler -

WISP Field Status

Farm 1 - % Cover | Farm 1, Pivot 2 | New field (Pivot ID: 1376) | 2012-05-01

Field Data

Farm: Farm 1 - % Cover
Pivot: Farm 1, Pivot 2
Field/soil: New field (Pivot ID: 1376)
Crop: New crop (field ID: 1673) A v...

Root zone depth: 36.0 in
Emergence Date: 05/01/12
AD at field capacity: 1.80 in.
Initial soil moisture: 15 %
Target % (--) Update Target

Edit Observed Values Below

Date	Ref. ET	Rainfall	Irrigation	% Moisture	% Cover	Adj. ET	AD	Deep Drainage
2012-04-29	0.08	0.00	0.00	15.00	0	0.00	1.80	
2012-04-30	0.06	0.00	0.00	15.00	0	0.00	1.80	
2012-05-01	0.12	0.00	2.00	15.00	0	0.00	1.80	2.0
2012-05-02	0.19	0.00	0.00	14.97	0	0.01	1.79	
2012-05-03	0.19	0.00	0.00	14.94	0	0.01	1.78	
2012-05-04	0.15	0.00	0.00	14.94	0	0.00	1.78	
2012-05-05	0.13	0.00	0.00	14.93	1	0.00	1.78	

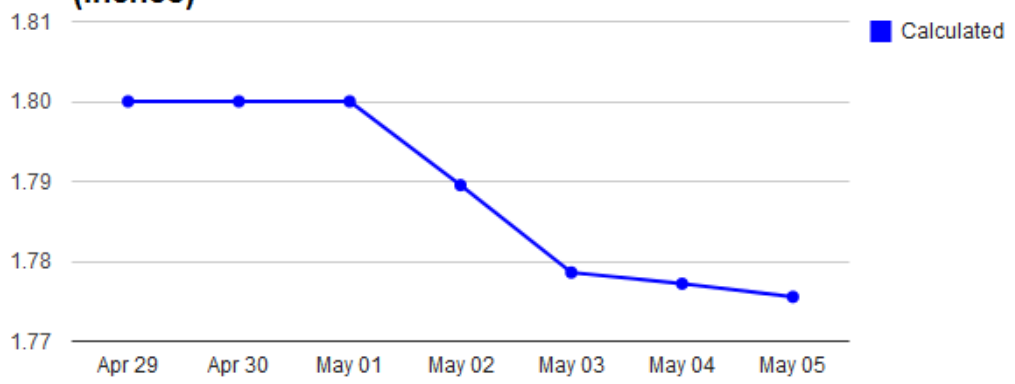
Deep Drainage

Seasonal Totals to Date

Report in CSV Format

Rainfall: 0.00 in.
Irrigation: 2.60 in.
ET: 0.35 in.
Drainage: 2.54 in.

Calculated / Projected Allowable Depletion (inches)



Keep Nutrients in the Root Zone

- WISP Irrigation Scheduler -

The Wisconsin Irrigation Scheduler (WIS) Excel spreadsheet is available at:

http://bse.wisc.edu/John_Panuska.htm

The Wisconsin Irrigation Scheduling Program (WISP) web-based tool is available at:

http://wisp.cals.wisc.edu/

QUESTIONS