Soil Fertility Briefs

Carrie Laboski & John Peters
Soil Science Department
University of Wisconsin-Madison

UW Extension

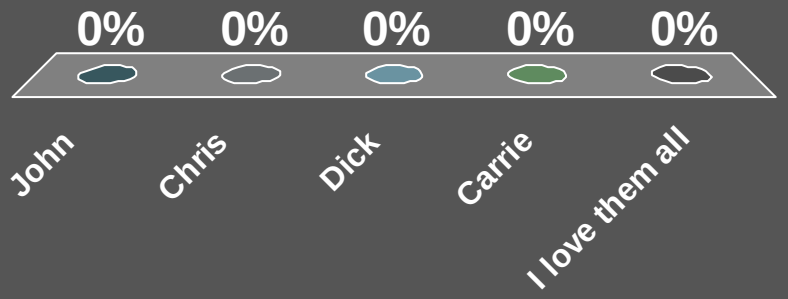
College of Agricultural & Life Sciences
University of Wisconsin-Madison

Using the remote responders

- Push button corresponding to your answer
- When green light flashes your answer is transmitted
- If you push the wrong button, you're out of luck
  - Only one response per remote
- Let's practice

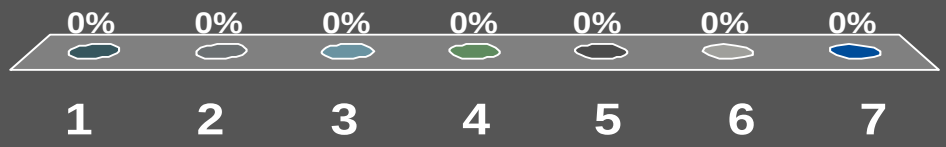
Who is your favorite soil scientist?

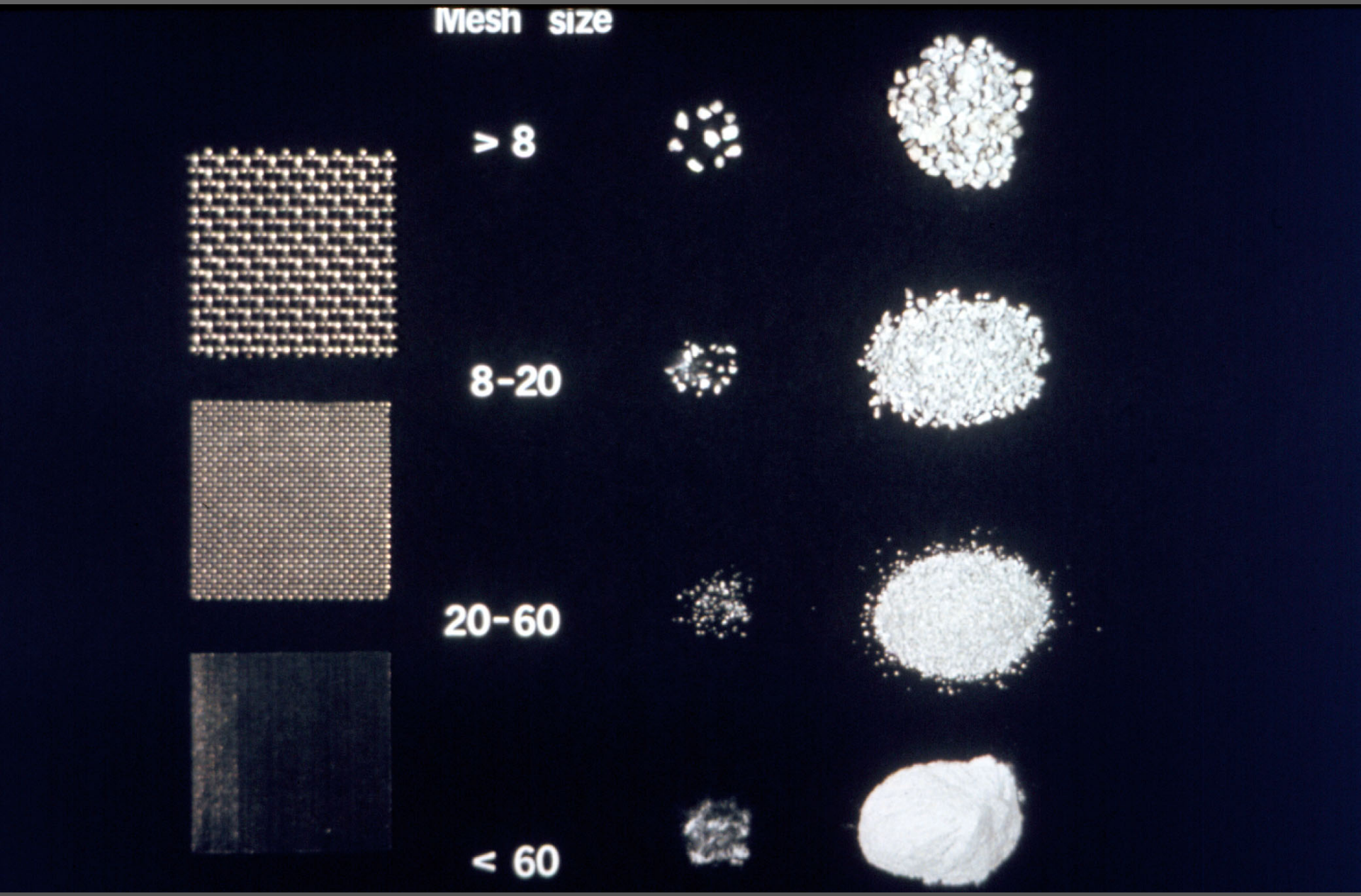
1. John 
2. Chris 
3. Dick 
4. Carrie 
5. I love them all

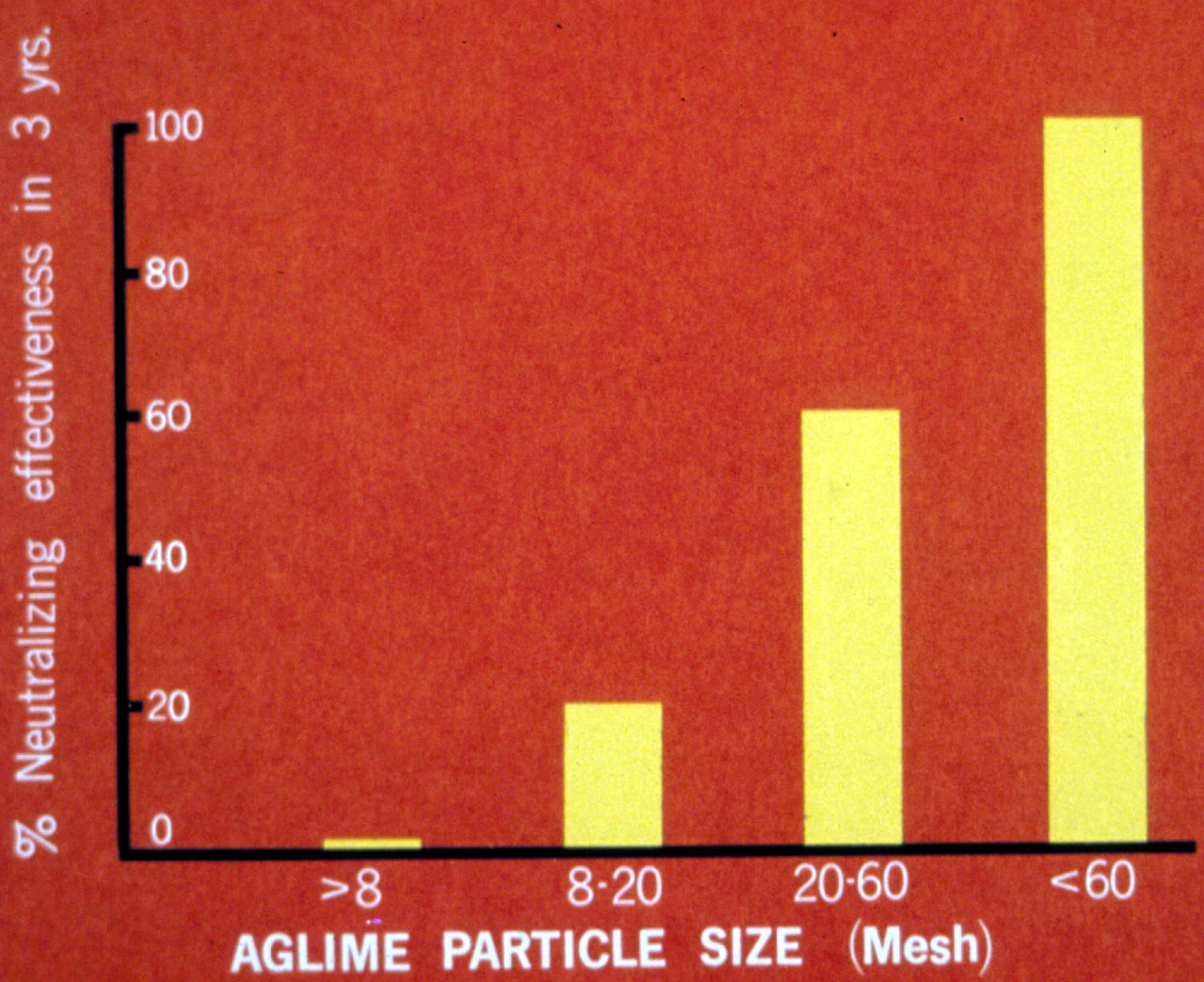


What factors are used in calculating the NI of a liming material?

1. Fineness – as measured by sieving
2. Purity – a lab evaluation of the $CaCO_3$ equivalency of the material
3. Total Ca content
4. Percent absorbed by the field within the first year following application
5. ★ 1 & 2 are correct
6. 1 & 3 are correct
7. 1, 2, 3, & 4 are correct




Mesh size
> 8
8-20
20-60
< 60


% Neutralizing effectiveness in 3 yrs.
100
80
60
40
20
0
>8
8-20
20-60
<60
AGLIME PARTICLE SIZE (Mesh)

The purity factor ($CaCO_3$) Equivalent

Table 6-5. Liming materials and their calcium carbonate ($CaCO_3$) equivalent

Liming material	Neutralizing agent	$CaCO_3$ equivalent of pure material (%)
Dolomitic limestone	$CaCO_3 \cdot MgCO_3$	110–118
Papermill lime sludge	Mainly $CaCO_3$	*
Marl	Mainly $CaCO_3$	variable
Calcitic limestone	$CaCO_3$	100
Water treatment lime waste	$CaCO_3$	variable
Wood ash	K_2CO_3, $CaCO_3$, $MgCO_3$	20–90
Fly ash	CaO, $Ca(OH)_2$, $CaCO_3$	variable
Hydrated lime	$Ca(OH)_2$	135
Air-slaked lime	$Ca(OH)_2 + CaCO_3$	100–135

* *According to the Wisconsin Lime Law, one cubic yard of papermill lime sludge is equivalent to one ton of aglime having a neutralizing index of 60–69.*

Calculating the Neutralizing Index of a liming material

Example 2: Lime B (90% calcium carbonate equivalent)

Screen size	Screen analysis		Effectiveness factor		
	%				
greater than 8 mesh	5.0	x	0.0	=	0.0
8 to 20 mesh	25.0	x	0.2	=	5.0
20 to 60 mesh	20.0	x	0.6	=	12.0
less than 60 mesh	50.0	x	1.0	=	50.0
			Total	=	67.0

NI = 67.0 x 90% = 60.3

What is the lime recommendation for this field?

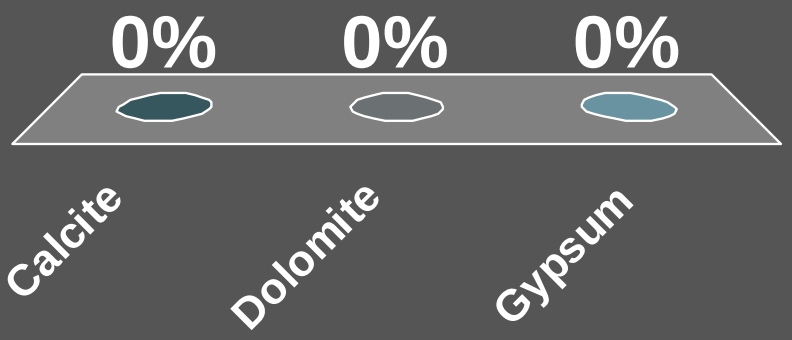
Crop rotation – corn, corn, wheat, corn
Soil pH 5.8, Organic matter 3.0%, Sikora buffer pH 6.4

0%	★1.	0
0%	2.	2 T/a
0%	3.	4 T/a
0%	4.	6 T/a
0%	5.	8 T/a
0%	6.	10 T/a
0%	7.	12 T/a

Target pH	Lime recommendation equation
	T/a of 60-69 lime to apply
5.2	36.1 – (3.29 x BpH) – (2.67 x pH)
5.4	48.2 – (4.84 x BpH) – (3.03 x pH)
5.6	51.0 – (5.40 x BpH) – (2.67 x pH)
5.8	57.2 – (5.55 x BpH) – (3.50 x pH)
6.0	72. 7 – (7.59 x BpH) – (3.78 x pH)
6.3	103 – (12. 6 x BpH) – (3.18 x pH)
6.5	134 – (17.2 x BpH) – (2.73 x pH)
6.6	152 – (20. 3 x BpH) – (2.17 x pH)
6.8	195 – (28.4 x BpH) + (0.144 x pH)

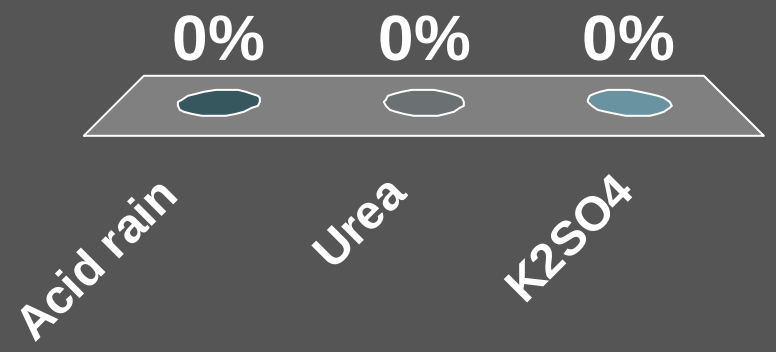
Which of these products that contain significant amounts of calcium is not a liming material?

1. Calcite (40% Ca, 0% Mg)
2. Dolomite (22% Ca, 14% Mg)
3. ★ Gypsum (22% Ca, 0% Mg)



What is not a cause of soil acidification?

1. Acid rain
2. Urea
3. ★ Potassium sulfate

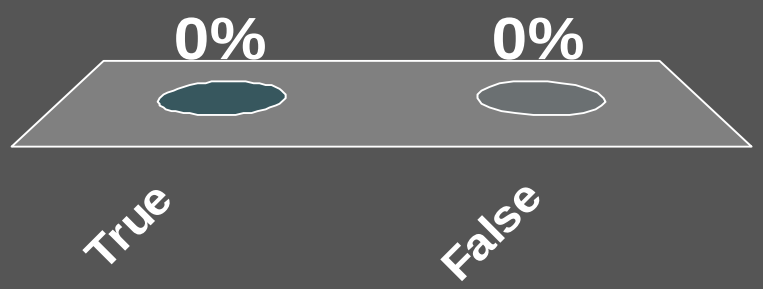


A farmer is required to use a WDATCP certified lab for all of the situations listed below except when?

0%	1.	A producer accepts, or is offered, cost sharing for nutrient management
0%	2.	A producer accepts, or is offered, cost sharing for manure storage
0%	3.	A producer voluntarily continues participation in the farmland preservation program (FPP)
0%	4.	A producer is regulated under a DNR WI pollution discharge elimination system permit (WPDES)
0%	5.	A producer only operates farms in another state, not in Wisconsin.
0%	6.	A producer is regulated under a county manure storage or livestock siting ordinance

Soil testing on any WI soil requires WI certified soil testing labs to follow UW soil testing procedures, and recommendations may be provided by either the lab or the NM planner.

★1. True
2. False



What available P test is required to be used in WI by WDATCP Certified Laboratories?

0% 1. Mehlich 3

0% ★2. Bray 1

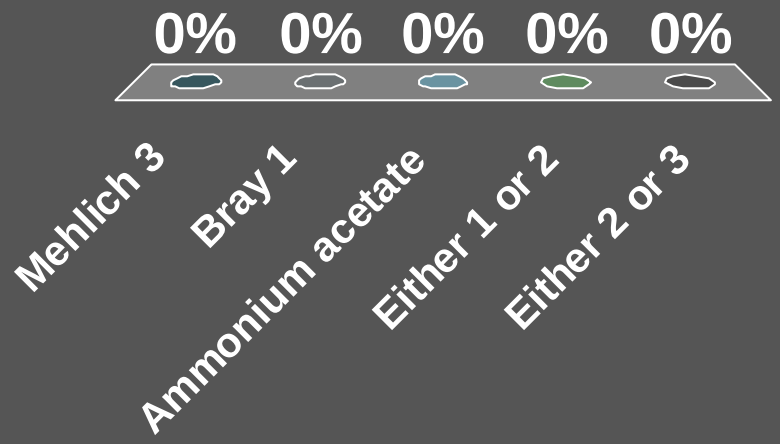
0% 3. Olsen

0% 4. Either Mehlich 3 or Bray 1

0% 5. Either Olsen or Bray 1

What exchangeable K test is required to be used in WI by WDATCP Certified Laboratories?

1. Mehlich 3
2. ★ Bray 1
3. Ammonium acetate
4. Either 1 or 2
5. Either 2 or 3



What deficiency is shown in these photos?

0%	1.	K
0%	2.	Ca
0%	★3.	Mg
0%	4.	P
0%	5.	N
0%	6.	S

Which one is not a possible cause of the deficiency?

0%	1.	Low pH
0%	2.	Liming with calcitic lime only
0%	★3.	No-till
0%	4.	Large applications of potash or excessively high soil test K levels

More Mg deficiency & low pH

pH: 4.7 to 6.0

5 acre grid samples

All grid points averaged to get whole field rec.

Some grid points may have missed the bad areas

Soil sampling is the 1st and most important step in getting good fertility recommendations

What is this deficiency?

0%	1.	K
0%	2.	Zn
0%	3.	S
0%	★4.	Mn

Mn soil tests …….

0%	1.	are used on all soils.
0%	★2.	are used only on soils with OM ≤ 6%.
0%	3.	are used only on soils with OM > 20%.
0%	4.	are not useful.

Mn interpretation categories

	If OM ≤ 6.0%	If OM > 6.0%
	Soil test * (ppm Mn)	pH
Low	0-10	>6.9
Optimum	11-20	6.0-6.9
High	>20	<6.0

* 0.1 N phosphoric acid

Relative Crop Need for Mn

Crop	Relative Need
Alfalfa	Low
Clover	Low
Corn	Medium
Pasture grasses	Medium
Soybean	High
Wheat	High

Mn recommendations

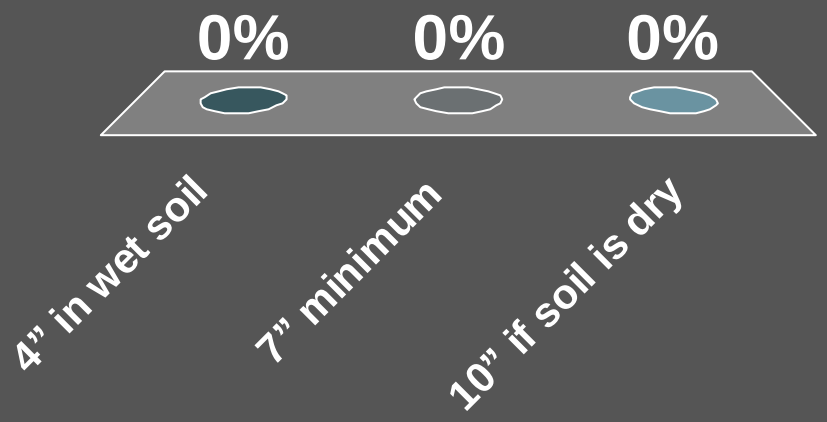
- Soil applications (sulfate forms only)
  - If soils are low in Mn & relative crop need is medium or high, then apply 3 – 5 lb Mn/a as starter fertilizer, may also need a foliar application
- Foliar applications
  - Medium relative need & low soil test: 1 lb Mn/a as sulfate or 0.15 lb Mn/a as chelate
  - High relative need & low soil test: 1.25 lb Mn/a as sulfate or 0.2 lb Mn/a as chelate
- This means that when soybean is grown on soils with OM > 6.0% and pH > 6.9, then Mn may be deficient
  - If deficiency appears, then multiple foliar applications may be needed
    - R1 and R3 were best timing in past WI research (Randall et al. 1975)

Which condition does not promote urea volatilization?

0%	1.	Surface application
0%	2.	Warm weather
0%	3.	Moist soil
0%	4.	No-till
0%	5.	Soil pH>7
0%	★6.	All of these may promote volatilization
0%	7.	None of these promote volatilization

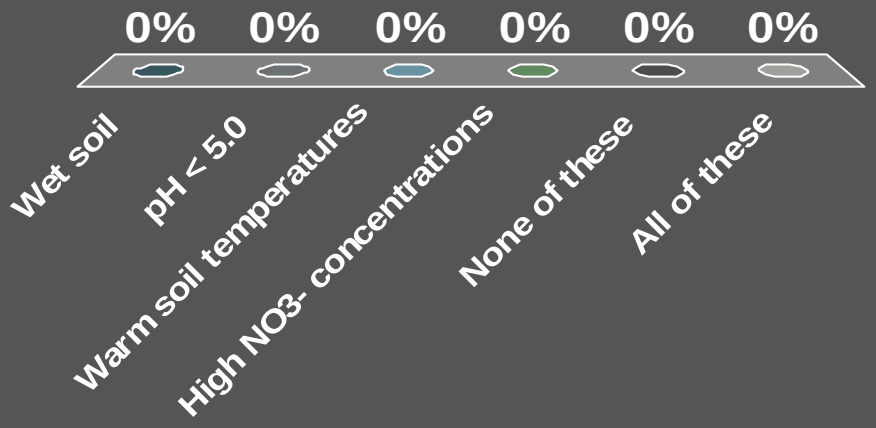
How deep should NH_3 be placed to reduce NH_3 loss and seedling injury?

1. 4” in wet soil
2. ★ 7” minimum
3. 10” if soil is dry



Which condition does not promote denitrification?

1. Wet soil
2. ★ pH < 5.0
3. Warm soil temperatures
4. High NO_3^- concentrations
5. None of these
6. All of these



Nitrogen Fertilizer Prices 11/15/07

Product	$/ton	$/lb N
NH_3	600	0.37
Urea	470	0.51
UAN (28%)	325	0.58
ESN	530	0.60
Super U		
Agrotain	$65/gal	0.58 (4 qt/T urea)
Agrotain Plus	$3.50/lb	0.68 (15 lb/T UAN)
N Serve	$34/gal	$8.50/acre

N:Corn Price Ratio

Price of N ($/lb N)	Price of corn ($/bu)								
	3.40	3.60	3.80	4.00	4.20	4.40	4.60	4.80	5.00
0.36	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
0.40	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08
0.44	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
0.48	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10	0.10
0.52	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10
0.56	0.16	0.16	0.15	0.14	0.13	0.13	0.12	0.12	0.11
0.60	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.13	0.12
0.64	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13
0.68	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14
0.72	0.21	0.20	0.19	0.18	0.17	0.16	0.16	0.15	0.14

N Guidelines for Corn

Nitrogen Guidelines for Corn in Wisconsin

SOIL	PREVIOUS CROP	N:Corn Price Ratio (see other side) 0.05	0.10	0.15	0.20
		LBS N/ACRE (total to apply)[3]			
high/very high yield potential soils	**Corn**, Forage legumes, Legume vegetables, Green manures[4]	**165**[1] 135-----■----190[2]	**135** 120--■---155	**120** 100---■--135	**105** 90--■--120
	Soybean, Small grains[5]	**140** 110-----■---160	**115** 100--■--130	**100** 85--■--115	**90** 70---■-100
medium/low yield potential soils	**Corn**, Forage legumes, Legume vegetables, Green manures[4]	**120** 100---■---140	**105** 90--■--120	**95** 85-■--110	**90** 80-■-100
	Soybean, Small grains[5]	**90** 75--■---110	**60** 45--■-70	**50** 40-■-60	**45** 35-■-55
sands/ loamy sands	Irrigated—**All crops**[4]	**215** 200--■--230	**205** 190--■--220	**195** 180--■--210	**190** 175--■-200
	Non-irrigated—**All crops**[4]	**120** 100---■---140	**105** 90--■--120	**95** 85-■--110	**90** 80-■-100

1-3-2006-10M

[1] Maximum return to N (MRTN) rate. [2] Range within $1/acre of MRTN rate. [3] Includes N in starter. [4] Subtract N credits for forage legumes, legume vegetables, animal manures, green manures. [5] Subtract N credits for animal manures and second year forage legumes.

P_2O_5 and K_2O Fertilizer Prices 11/15/07

Product	$/ton	$/lb P_2O_5 or K_2O (N is $0.51/lb)
MAP	540	0.41
DAP	514	0.36
Potash	350	0.29

The change in the value of the N, P, and K in 4000 gals of liquid dairy manure (10 yrs)

First year available nutrients only

1997 - $25 (0.30, 0.28, 0.12)

2007 - $46 (0.49, 0.36, 0.30)

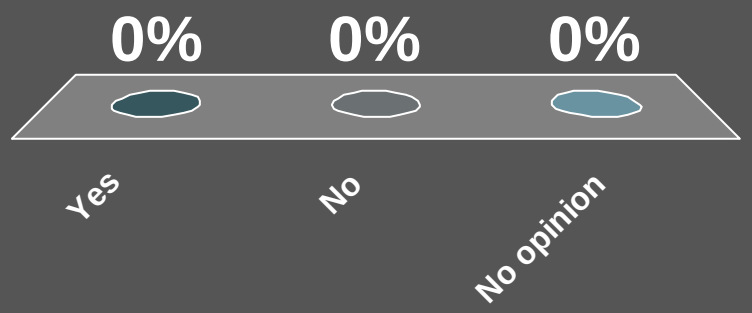
Prioritize Fertilizer Applications

- Use a current soil test
- Make sure soil pH is adequate for rotation
- Credit nutrients in manure and legumes
- Apply fertilizer 1st to lowest testing fields
- Apply some fertilizer to all fields likely to respond
- Defer applications on soils testing high, very high, or excessively high
  - Be careful with this strategy for crops with high removal rates (eg. alfalfa & corn silage)

Quick Survey

Did you like using this technology?

1. Yes
2. No
3. No opinion



Would you like to see the technology used more?

1. Yes
2. No
3. No opinion