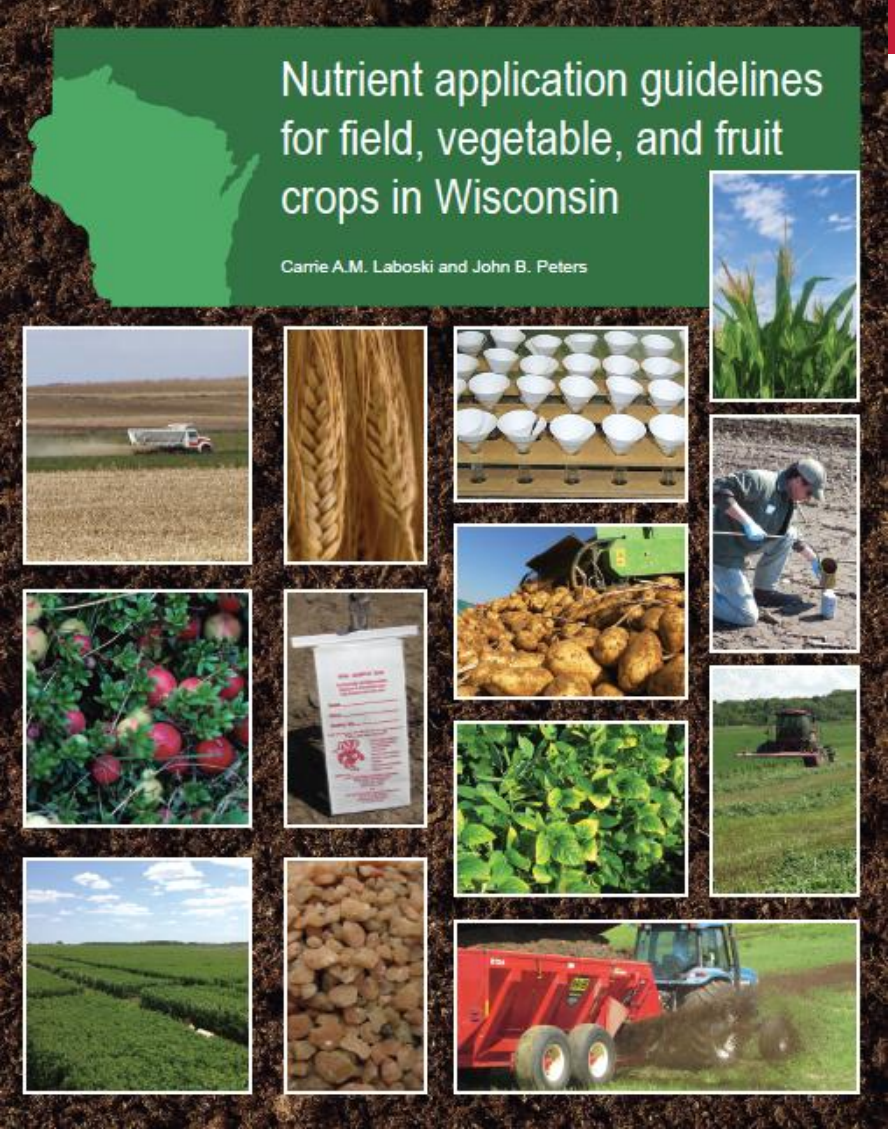


A2809 IX: 50 years in the making

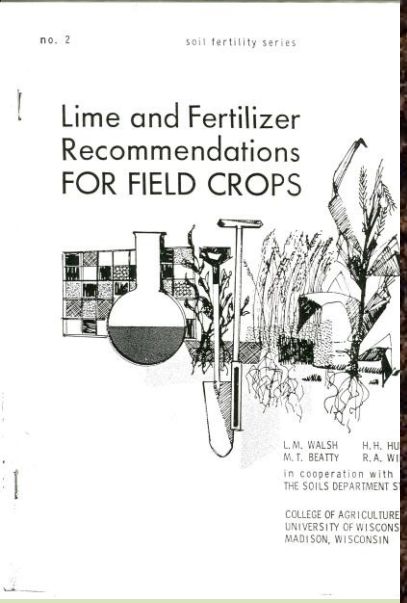
Soil, Water, & Nutrient Management Meetings

Nov. 29 – Dec. 6, 2012

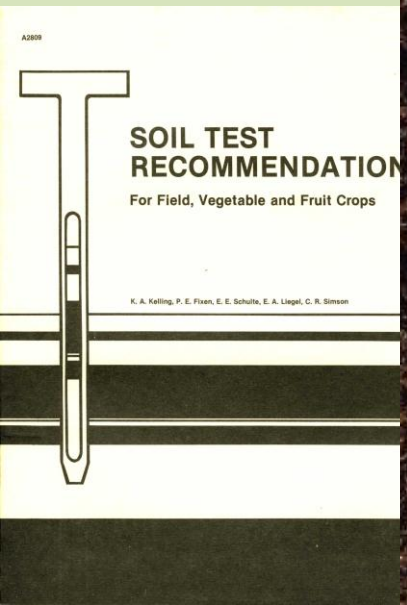
Carrie Laboski & John Peters

COLLEGE OF AGRICULTURAL & LIFE SCIENCES
University of Wisconsin-Madison

UW Extension



1962



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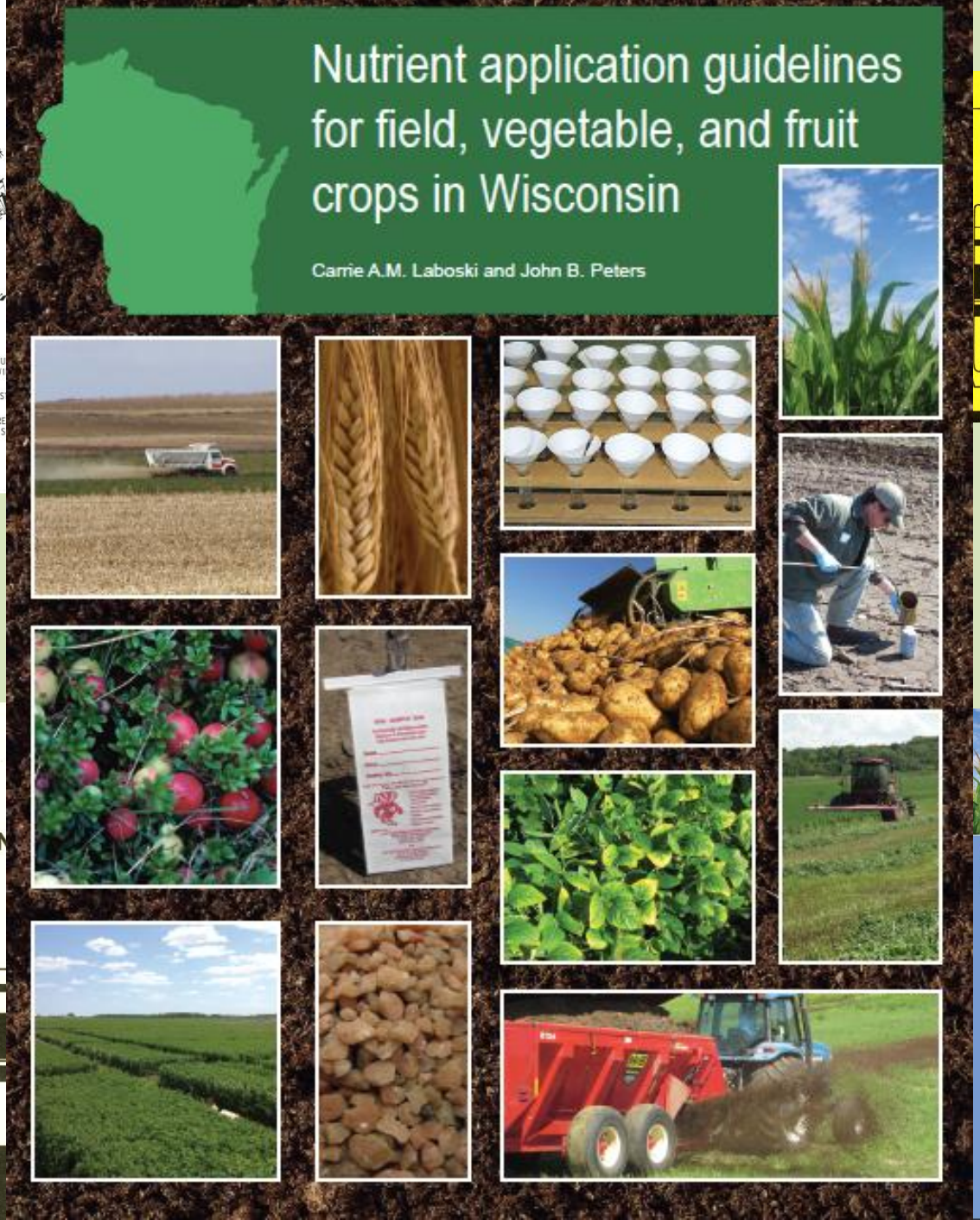
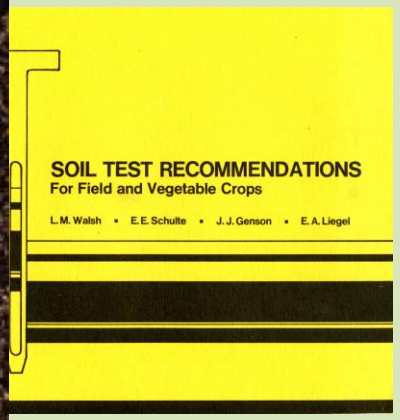
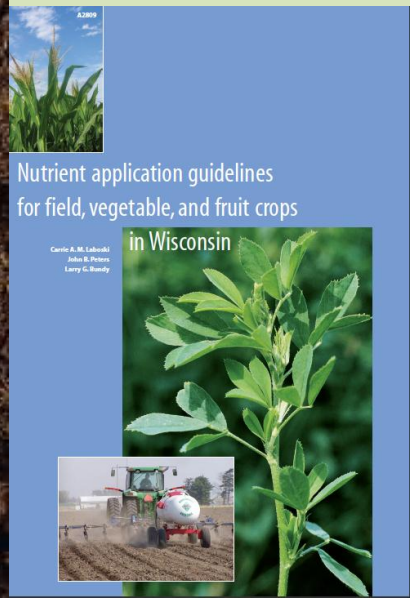




1976

2006



Chapter 2: Soil testing

- Discarding samples
  - If the average soil test P is:
    - ≤ 35 ppm, samples that exceed the average by > 5 ppm may be removed and the average recalculated
    - > 35 ppm P, no samples will be discarded
  - If the average soil test K is:
    - ≤ 175 ppm, samples that exceed the average by > 20 ppm may be removed and the average recalculated
    - >175 ppm K, no samples will be discarded
- The number of samples that can be discarded depends on the total number of samples collected for the field

Chapter 4: Soil and Crop Info.

Soil Groups

- Organic soils (group O)
  - taxonomic soil order is histosols
- Sandy soils (group S)
  1. the upper 8 inches has a weighted average sand content greater than or equal to 75%,
  2. the subgroup or great group contains “Psam” and the weighted average sand content in the upper 8 inches is 65% or more, or
  3. the taxonomic particle size class matches sandy, and the weighted average sand content in the upper 8 inches is 65% or more
  - In general, group S soils have a sand or loamy sand texture
- Loamy soils (group L)
  - If a soil is not group S or O, then it is group L
  - medium- to fine-textured, sandy loam or finer textured soils

Old Table 4.4 eliminated to avoid confusion

Table 4.4. Accepted corn and alfalfa yield levels for each yield potential category [a]

Yield potential code [b]	Relative yield potential	Accepted yield goals	
		Corn (bu/a)	**Alfalfa** (ton/a)
1	Very high	131–220	3.5–8.5
2	High	101–180	3.0–7.0
3	Medium	81–160	2.5–5.5
4	Low	61–140	1.0–4.0

[a] These are the levels allowed by the laboratory computer program that generates nutrient rate guidelines.

[b] Refer to Table 4.1 for yield potential codes for specific soils or to Table 4.2 for yield potential codes by county.

Soil yield potential (YP)

- Soil YP is a relative ranking of a soil's ability to produce high corn yields along with the responsiveness of corn yield to nitrogen (N) fertilizer
- All sandy soils are low (sandy YP)
- Organic soils
  - High YP, if mesic
  - Medium YP, if frigid

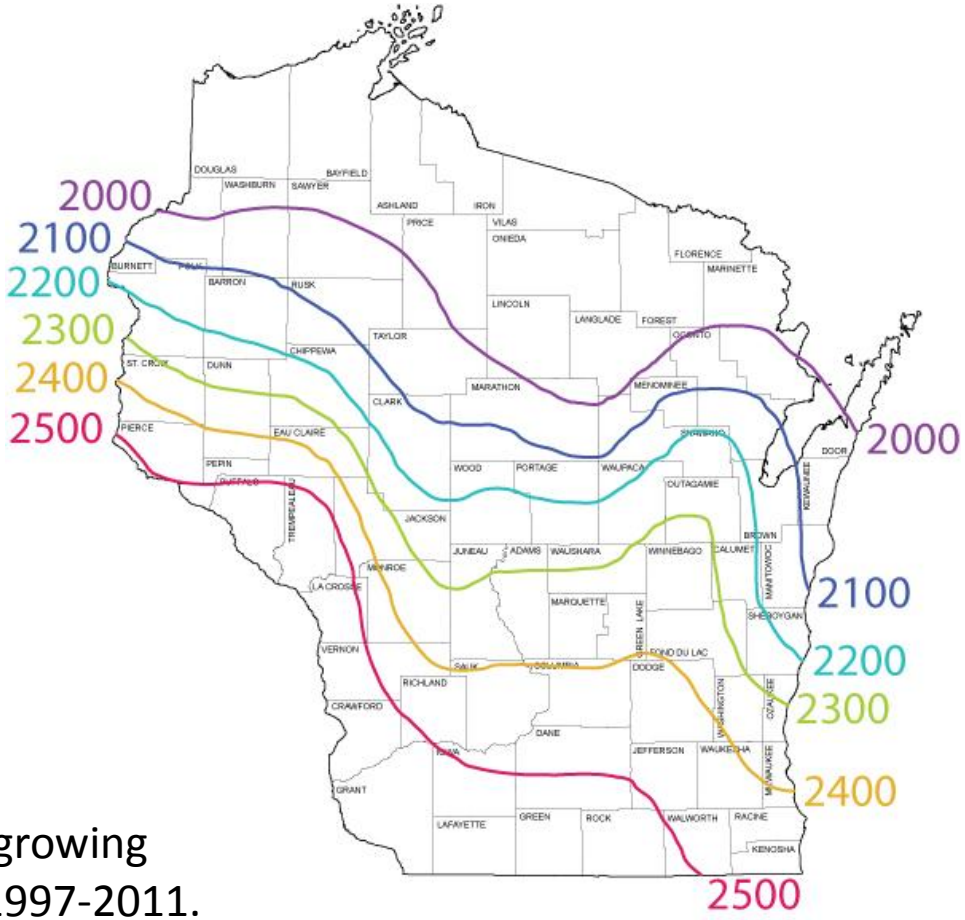
Soil yield potential (YP)

- Loamy soils are medium or high YP
  - Defined by soil properties
  - If at least one of the properties is limiting then the soil is medium YP

Soil Property	Interpretation that limits YP to medium
Drainage class	excessively drained somewhat excessively drained poorly drained very poorly drained
Available water in the top 60” of soil	Very low (< 3 inches) and low (3–6 inches)
Depth to bedrock (lithic contact)	<30”

Additional criteria for loamy soil YP

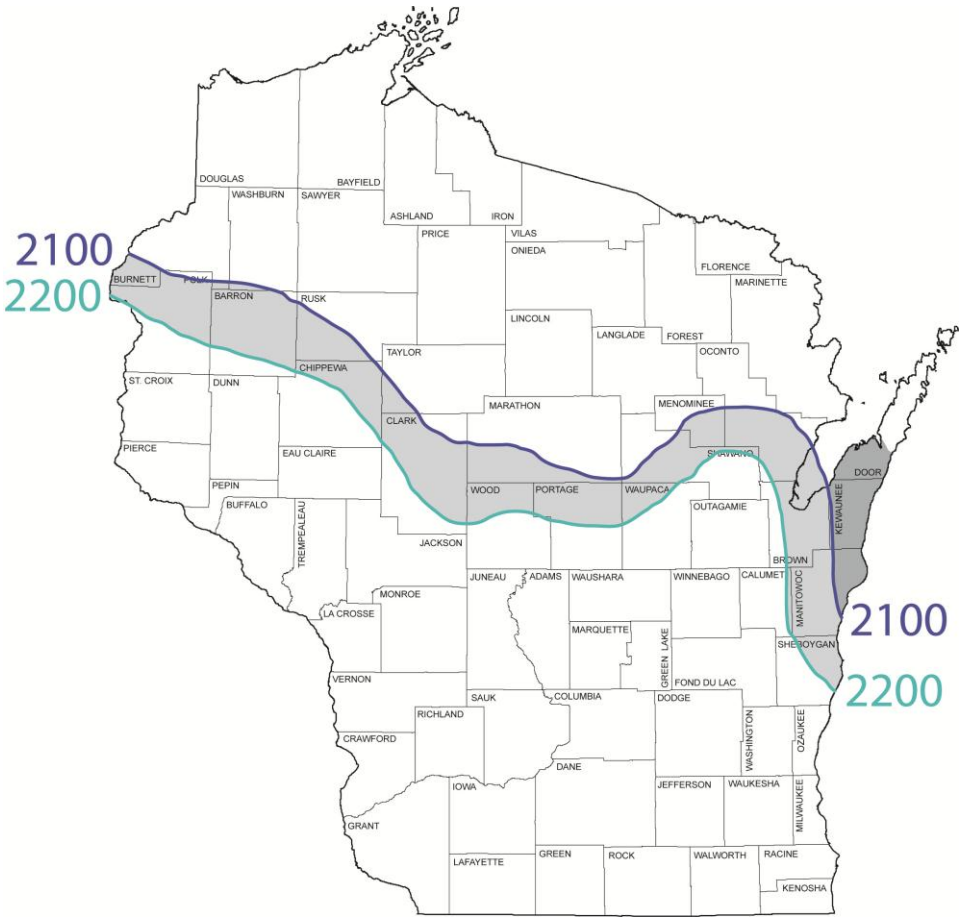
- If a soil's location has, on average, <2100 GDD, it should be considered medium YP regardless of soil property limitations



Average accumulated (May 1 to Sept. 30) growing degree day (GDD) isolines for Wisconsin, 1997-2011.
http://www.soils.wisc.edu/uwex_agwx/thermal _models

Additional criteria for loamy soil YP

- Soils with no soil property limitations on yield potential are in a transition area if:
  1. 2100 to 2200 GDD; or
  2. <2100 GDD and a mesic temperature regime are in a transition area
- In the transition area, growers and agronomists should choose the most appropriate YP based upon experience

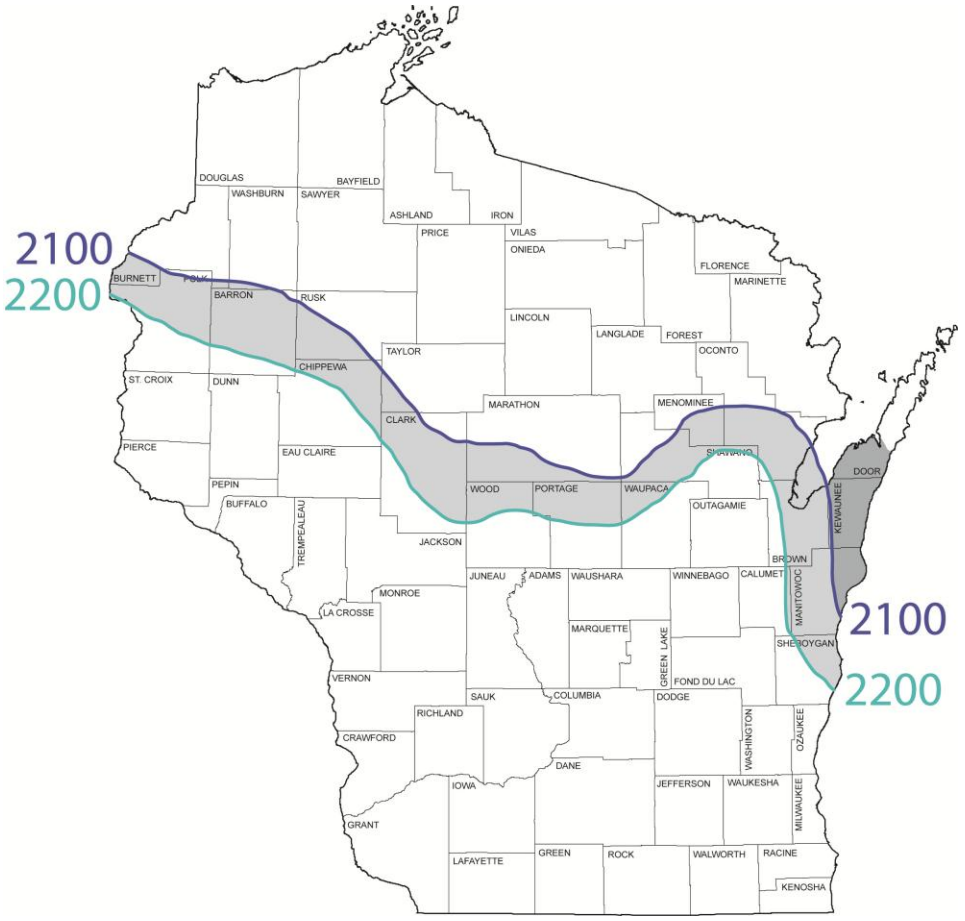


Additional criteria for loamy soil YP

- Medium YP loamy soils that have >2200 GDD or are in a transition area can be considered high YP if,
  - Irrigated
  - Artificially drained (e.g., tiled)
- If loamy soils are limited by shallow depth to bedrock and field evaluation demonstrates that there is more than 30” of soil over bedrock throughout a majority of the field,
  - then the soil can be considered high YP

All High YP soils in the following counties will be Medium YP in SnapPlus

- Ashland
- Bayfield
- Burnett
- Douglas
- Florence
- Forest
- Iron
- Langlade
- Lincoln
- Marinette
- Oneida
- Price
- Sawyer
- Vilas
- Washburn



Soil map units

- Each map unit was evaluated for soil group and YP
- Not all map units within a soil series interpret the same
  - The interpretation of the majority of the map units is presented in A2809 and is acceptable for obtaining a nutrient recommendation
  - For more site specific recommendations use the interpretation for individual map units
    - Will be in SnapPlus and
    - http://uwlab.soils.wisc.edu/a2809-soil-map-unit-info/

Examples

	Soil Group	Soil YP	Drainage class	AWC	Bedrock depth	Soil temp. regime
Dodgeville*	**L**	**M**	**W**	**L**	**.**	**M**
DgB	L	M	W	L	.	M
DgB2	L	M	W	L	.	M
DgC2	L	M	W	L	.	M
DgD2	L	M	W	L	.	M
DgE2	L	M	W	L	.	M
DhA	L	H	W	M	.	M
DhB	L	H	W	M	.	M
DhB2	L	H	W	M	.	M
DhC2	L	H	W	M	.	M
DhD2	L	H	W	M	.	M
DlB2	L	M	W	L	S	M
DlC2	L	M	W	L	S	M
DlD2	L	M	W	L	S	M
DmB2	L	M	W	L	.	M
DmC2	L	M	W	L	.	M
DmD2	L	M	W	L	.	M
DnB2	L	H	W	M	.	M
DnC2	L	H	W	M	.	M
DnD2	L	H	W	M	.	M

19 of 23 map units for Dodgeville soil series in Iowa Co.
Total # of Dodgeville map units statewide = 48

	Soil Group	Soil YP	Drainage class	AWC	Bedrock depth	Soil temp. regime
Delton*	**S**	**S**	**W**	**M**	**.**	**M**
DeA	S	S	W	M	.	M
DeB	S	S	W	M	.	M
DeC	S	S	W	M	.	M
DsA	S	S	W	L	.	M
DeB	S	S	MW	M	.	M
DeC2	S	S	W	M	.	M
DeB	S	S	W	M	.	M
DfA	L	H	W	M	.	M
DfB	L	H	W	M	.	M
DfC2	L	H	W	M	.	M

- For this soil, the difference in soil group between map units results in:
  - Different P and K interpretation categories
  - Corn N rate guidelines

YP for some soils changed

	Soil Group	Soil YP	Drainage class	AWC	Bedrock depth	Soil temp. regime
Waymor	L	H	W	M	.	M
Drummer	L	M	P	H	.	M
Billett*	L	H	W	M	.	M
Dunnville*	L	H	W	M	.	F
Gale*	L	H	W	M	.	M

Crop

- Yield levels were increased
  - Corn – 270 bu/a
  - Soybean – 105 bu/a
  - Wheat – 120 bu/a
  - Alfalfa – 9.5 ton/a
- Crop demand levels revised – more on this in Chapter 7
- Hop and switchgrass were added
- Grass hay and pasture clarified

Soil test reports

- If no yield goal is listed, P and K recommendations are based on the median value of the accepted yield range
- If no soil name or map unit is given, no recommendations will be given

Chapter 6: Nitrogen

Selecting a soil

- The predominant agronomic soil in the field should be selected for determining nutrient application rates
- On page 37 (nitrogen chapter), applies to all nutrients

Corn MRTN Updated

- Added new sites from 2010 & 2011
  - In April 2010 new sites from 2006 – 2009 were added and MRTN updated
- Removed sites older than 1995

Table 6.1. Suggested nitrogen (N) application rates for corn at different nitrogen:corn grain price ratios.

	Nitrogen:Corn price ratio			
	0.05	**0.10**	**0.15**	**0.20**
Soil and previous crop	total lb N/a to apply[a]			
Loamy: high yield potential soil				
Corn, forage legumes, legume vegetables, green manures[d]	**190**[b] 170 -------- 210[c]	**165** 155 -------- 180	**150** 140 -------- 160	**135** 125 -------- 150
Soybean, small grains[e]	**140** 125 -------- 160	**120** 105 -------- 130	**105** 95 -------- 115	**90** 80 -------- 105
Loamy: medium yield potential soil				
Corn, forage legumes, legume vegetables, green manures[d]	**145** 130 -------- 160	**125** 115 -------- 140	**115** 105 -------- 125	**105** 95 -------- 110
Soybean, small grains[e]	**130** 110 -------- 150	**100** 85 -------- 120	**85** 70 -------- 95	**70** 60 -------- 80
Sands/ loamy sands				
Irrigated—all crops[d]	**215** 200 -------- 230	**200** 185 -------- 210	**185** 175 -------- 195	**175** 165 -------- 185
Non-irrigated—all crops[d]	**140** 130 -------- 150	**130** 120 -------- 140	**120** 110 -------- 130	**110** 100 -------- 120

[a] Includes N in starter.

[b] Rate is the N rate that provides the maximum return to nitrogen (MRTN).

[c] Range is the range of profitable N rates that provide an economic return to N within $1/a of the MRTN rate.

[d] Subtract N credits for forage legumes, legume vegetables, animal manures, and green manures. This includes first-, second-, and third-year credits where applicable. Do not subtract N credits for leguminous vegetables on sand and loamy sand soils.

[e] Subtract N credits for animal manures and second-year forage legumes.

Table 6.2. Suggested nitrogen (N) application rates for wheat at different nitrogen:wheat price ratios.

Soil group	Previous crop	PPNT (lb NO_3-N/a)	Nitrogen:Wheat price ratio 0.05	0.075	0.1	0.125
			total lb N/a to apply[a]			
Loamy						
	Corn	< 50[b] or no PPNT	**75** 65--------85	**70** 55--------80	**60** 50--------70	**55** 40 -------- 65
		51 to 100	**45** 35--------55	**40** 30--------50	**35** 25--------40	**30** 20 -------- 35
		> 100	**0** 0--------0	**0** 0--------0	**0** 0--------0	**0** 0 -------- 0
	Soybean, small grain	All[c]	**55** 45--------65	**50** 40--------60	**45** 35--------50	**40** 35 -------- 45
Sandy						
	All	—[d]	**105** 95--------115	**100** 95--------110	**90** 80--------100	**85** 70 -------- 95

[a] On loamy soils with < 2% organic matter, add 30 lb N/a to all rates. On soils with more than 10% organic matter, reduce rates by 30 lb N/a. Reduce N rates by 10 lb N/a for spring wheat on all soils. No N is required on organic soils. Manure N credits must be subtracted from these values.

[b] If wheat follows a forage legume or leguminous vegetable, use the MRTN rate for wheat following corn with PPNT< 50 and take the legume credit.

[c] Previous crop soybean or small grain: If a PPNT is taken and the PPNT is < 50 lb N/a, use the top end of the profitable range; if the PPNT is 51 to 100 lb N/a, use the bottom end of the profitable range; if the PPNT is > 100 lb/a, no additional N is needed. Do not take a soybean legume credit.

[d] PPNT is not recommended on group S (sand and loamy sand) soils.

Chapter 7: Phosphorus & Potassium

2006 soil test P & K interpretations for corn

Soil Group	VL	L	O	H	VH	EH
	Soil test P, ppm					
A	< 5	5 - 10	11 - 15	16 - 25	--	> 25
B	< 10	10 - 15	16 - 20	21 - 30	--	> 30
C	< 10	10 - 15	16 - 20	21 - 30	--	> 30
D	< 8	8 - 12	13 - 18	19 - 28	--	> 28
E	< 12	12 - 22	23 - 32	33 - 42	--	> 42
O	< 12	12 - 22	23 - 32	33 - 42	--	> 42
X	< 5	5 - 8	9 -15	16 - 25	--	> 25
	Soil test K, ppm					
A	< 60	60 - 80	81 - 100	101 - 140	--	> 140
B	< 70	70 - 90	91 - 110	111 - 150	--	> 150
C	< 60	60 - 70	71 - 100	101 - 140	--	> 140
D	< 70	70 - 100	101 - 130	131 - 160	--	> 160
E	< 45	45 - 65	66 - 90	91 - 130	--	> 130
O	< 45	45 - 65	66 - 90	91 - 130	--	> 130

2006 soil test P & K interpretations for group A soils

Crop	VL	L	O	H	VH	EH
	Soil test P, ppm					
corn	< 5	5 - 10	11 - 15	16 - 25	--	> 25
soybean	--	< 6	6 - 10	11 - 20	--	> 20
alfalfa	< 10	10 - 15	16 - 23	24 - 32	--	> 32
	Soil test K, ppm					
corn	< 60	60 - 80	81 - 100	101 - 140	--	> 140
soybean	< 50	50 - 80	81 - 100	101 - 120	121 - 140	>140
alfalfa	< 70	70 - 90	91 - 120	121 - 150	151 - 220	> 220

Table 7.1. Soil test phosphorus (P) interpretation categories. Choose the highest demanding crop in your rotation to set the soil test interpretation categories for the rotation. If the desired crop is not listed on the table, consult Table 4.2 to determine its demand level.

	Soil test category				
	Very low (VL)	Low (L)	Optimum (O)	High (H)	Excessively high (EH)
Soil group[a]	soil test P ppm[b]				
Demand level 1: corn grain, soybean, clover, small grains (but not wheat), grasses, oilseed crops, pasture					
Loamy	< 10	10–15	16–20	21–30	> 30
Sandy, Organic	< 12	12–22	23–32	33–42	> 42
Demand level 2: alfalfa, corn silage, wheat, beans, sweet corn, peas, fruits					
Loamy	< 12	12–17	18–25	26–35	> 35
Sandy, Organic	< 18	18–25	26–37	38–55	> 55
Demand level 3: tomato, pepper, brassicas, leafy greens, root, vine, and truck crops					
Loamy	< 15	15–30	31–45	46–75	> 75
Sandy, Organic	< 18	18–35	36–50	51–80	> 80
Demand level 4: potato					
Loamy	< 100	100–160	161–200	> 200	
Sandy, Organic	< 30	30–60	61–90	91–120	> 120

[a] See Chapter 4: Soil and crop information for more details on soil groups.

[b] ppm (wt/vol; g/m^3)

Group X removed

- Did not work as it was intended
- Bundy research showed Bray is neutralized if carbonates are calcitic, not dolomitic in origin
- If the soil test P value is <5 ppm and the soil pH is >7.5, use Web Soil Survey to determine if the soil contains carbonates that are calcitic in origin (e.g., marl)
  - If so, then assume that the soil test is in the optimum category and monitor the crop for P deficiency symptoms

Table 7.2. Soil test potassium (K) interpretation categories. Choose the highest demanding crop in your rotation to set the soil test interpretation categories for the rotation. If the desired crop is not listed on the table, consult Table 4.2 to determine its demand level.

	Soil test category					
	Very low (VL)	Low (L)	Optimum (O)	High (H)	Very high (VH)	Excessively high (EH)
Soil group[a]	soil test K ppm[b]					
Demand level 1: corn grain, soybean, clover, small grains (but not wheat), grasses, oilseed crops, pasture						
Loamy	< 70	70–100	101–130	131–160	161–190	> 190
Sandy, Organic	< 45	45–65	66–90	91–130	—	> 130
Demand level 2: alfalfa, corn silage, wheat, beans, sweet corn, peas, fruits						
Loamy	< 90	90–110	111–140	141–170	171–240	> 240
Sandy, Organic	< 50	50–80	81–120	121–160	161–200	> 200
Demand level 3: tomato, pepper, brassicas, leafy greens, root, vine, and truck crops						
Loamy	< 80	80–140	141–200	201–220	221–240	> 240
Sandy, Organic	< 50	50–100	101–150	151–165	166–180	> 180
Demand level 4: potato						
Loamy	< 80	80–120	121–170	171–190	191–220	> 220
Sandy, Organic	< 70	70–100	101–130	131–160	161–190	> 190

[a] See Chapter 4: Soil and crop information for more details on soil groups.

[b] ppm (wt/vol; g/m^3)

Table 7.4. Phosphorus (P) and potassium (K) fertilizer application rate guidelines.

Crop name	Yield goal (per acre)	P_2O_5 rate guidelines					K_2O rate guidelines					
		VL	L	O	H	EH	VL	L	O	H	VH	EH
		lb P_2O_5/a to apply[a]					lb K_2O/a to apply[b]					
Alfalfa, seeding	1.5–2.5 ton	65	55	25	15	0	160	145	105	55	25	0
Alfalfa, established[c]	2.6–3.5 ton	80	70	40	20	0	235	220	180	90	45	0
	3.6–4.5 ton	90	80	50	25	0	295	280	240	120	60	0
	4.6–5.5 ton	105	95	65	35	0	355	340	300	150	75	0
	5.5–6.5 ton	120	110	80	40	0	415	400	360	180	90	0
	6.6–7.5 ton	130	120	90	45	0	475	460	420	210	105	0
	7.6–8.5 ton	145	135	105	55	0	535	520	480	240	120	0
	8.6–9.5 ton	155	145	115	60	0	595	580	540	270	135	0
Apple, establishment[d]	all	200	150	—	—	—	275	200	—	—	—	—
Asparagus	2,000–4,000 lb	90	65	10	5	0	120	90	20	10	5	0
Barley, grain	25–50 bu	55	45	15	10	0	60	45	15	10	5	0
	51–75 bu	65	55	25	15	0	65	50	20	10	5	0
	76–100 bu	75	65	35	20	0	75	60	30	15	10	0
Barley, grain + straw[e]	25–50 bu	75	65	35	20	0	120	105	75	40	20	0
	51–75 bu	85	75	45	25	0	130	115	85	45	20	0
	76–100 bu	95	85	55	30	0	140	125	95	50	25	0

Chapter 8: Secondary & Micros

Sulfur

Guidelines for determining when sulfur application may be needed

- If the potential for a soil to retain SO_4 (Table 8.1) is low or medium and no manure has been applied in the past two years, a S application will most likely be needed for crops with a medium or high relative need for S. Sulfur application guidelines are provided in Table 8.2. The relative S need for each crop is provided in Table 8.3.
- If the soil is organic or if a significant amount of manure was recently applied, a profitable yield response to applied fertilizer S is unlikely.
- For most other soil and cropping conditions, verify the need for S using tissue testing while considering the relative S need of the crop to be grown.

Table 8.1. Potential for a soil to retain sulfate in the root zone.

Surface texture[a]	Subsoil texture	Potential for retaining sulfate in the root zone
Sandy	sandy	low
Sandy	loamy	medium
Loamy	sandy	medium
Loamy	loamy	high
Organic	—	very high

[a] Refer to Chapter 4 for definitions of sandy, loamy, or organic.

Table 8.2. General sulfur (S) fertilizer recommendations.

Crop	S application rate (lb S/a)
Forage legumes	
Incorporated at seeding	25–50
Topdressed on established stands	15–25
Corn, small grains, vegetable, and fruit crops	10–25

Chapter 9: Nutrient Credits

Manure

Manure

- All book values are now based on actual Wisconsin samples from 1998-2012
- No 2nd and 3rd year credits for P and K
  - Soil testing will track these nutrients
- 1st year available P_2O_5 now credited at 80% of total P_2O_5 in manure
  - UW research has demonstrated 100% availability in small plots at low/optimum soil test P levels

Manure: N availability

- Now have three categories for time to incorporation of applied manure
  - < 1 hr or injected
  - 1 to 72 hr
  - > 72 hr or not incorporated

- Different availability levels reflect potential for loss of ammonium-N

Table 9.1. Estimated nutrient availability for various manures.

	N			P_2O_5	K_2O	S
	Time to incorporation					
	> 72 hours or not incorporated	1 to 72 hours	< 1 hour or injected			
First-year availability	% of total					
Beef: liquid (≤ 11.0% DM)[a]	30	40	50	80	80	55
Beef: solid (> 11.0% DM)	25	30	35	80	80	55
Dairy: liquid (≤ 11.0% DM)[a]	30	40	50	80	80	55
Dairy: solid (> 11.0% DM)	25	30	35	80	80	55
Goat	25	30	35	80	80	55
Horse	25	30	35	80	80	55
Poultry (chicken, duck, and turkey)	50	55	60	80	80	55
Sheep	25	30	35	80	80	55
Swine	40	50	65	80	80	55
Veal calf	30	40	50	80	80	55
Second-year availability	% of total					
All species	10	10	10	0	0	10
Third-year availability	% of total					
All species	5	5	5	0	0	5

[a] If dry matter (DM) is < 2.0% and NH_4-N is > 75% of total N, the following equation for first-year N availability may be used in an effort to better account for the high concentration of NH_4-N that may be found in these manures: first-year available N = NH_4-N + [0.25 x (Total N – NH_4-N)], assuming manure is injected or incorporated in < 1 hour.

Dairy Manure

- Dairy manure now has four DM groupings

Dairy Manure Grouping	Dry Matter (%)
Liquid	< 4.0
Slurry	4.1 – 11.0
Semi-solid	11.1 – 20.0
Solid	> 20.0

- Used to categorize/group book value nutrient contents

Table 9.2. Typical total nutrient content of manures tested in Wisconsin (1998–2012).

	Dry Matter (DM)	N	P_2O_5	K_2O	S
Solid manure	%	lb/ton			
Beef	29	13	8	12	1.9
Dairy: semi-solid (11.1–20.0% DM)	15	8	4	6	0.8
Dairy: solid (> 20.0% DM)	33	9	4	7	1.2
Goat	43	13	7	10	2.0
Horse	33	10	6	8	1.3
Poultry: chicken	57	49	44	33	3.0
Poultry: duck	36	12	10	9	1.8
Poultry: turkey	59	51	44	31	3.8
Sheep	34	19	9	24	2.2
Swine	19	18	13	10	2.0
Liquid manure	%	lb/1,000 gal			
Beef	3	16	7	15	1.6
Dairy: liquid (< 4.0% DM)	2	14	4	14	1.1
Dairy: slurry (4.1–11.0% DM)	6	24	8	21	2.2
Goat	4	17	8	19	1.7
Poultry	2	12	7	9	1.3
Swine: finish (indoor pit)	5	43	18	28	3.2
Swine: finish (outdoor pit)	2	18	7	10	1.0
Swine: (farrow-nursery, indoor pit)	2	21	8	13	1.0
Veal calf	1	9	3	16	0.6

Table 9.3. Estimated first-year available nutrient content of manures.[a]

	N			P_2O_5	K_2O	S
	Time to incorporation					
	> 72 hours or not incorporated	1 to 72 hours	< 1 hour or injected			
Solid manure	lb/ton					
Beef	3	4	5	6	10	1
Dairy: semi-solid (11.1–20.0% DM[b])	2	2	3	3	5	1
Dairy: solid (> 20.0% DM)	2	3	3	3	6	1
Goat	3	4	5	6	8	1
Horse	2	3	4	5	6	1
Poultry: chicken	24	27	29	35	26	2
Poultry: duck	6	7	7	8	7	1
Poultry: turkey	26	28	31	35	25	2
Sheep	5	6	7	7	19	1
Swine	7	9	12	10	8	1
Liquid manure	lb/1000 gal					
Beef	5	6	8	6	12	1
Dairy: liquid (< 4.0% DM)	4	6	7	3	11	1
Dairy: slurry (4.1–11.0% DM)	7	10	12	6	17	1
Goat	4	5	6	6	15	1
Poultry	6	7	7	6	7	1
Swine: finish (indoor pit)	17	22	28	14	22	2
Swine: finish (outdoor pit)	7	9	12	6	8	1
Swine: (farrow-nursery, indoor pit)	8	10	14	6	10	1
Veal calf	3	4	4	2	13	1

[a] These estimates are based on the typical total nutrient contents of manures tested in Wisconsin (Table 9.2) multiplied by the estimated first-year nutrient availability (Table 9.1).

[b] DM = dry matter

Compare 1st year availabilities: new vs. old

	N	P_2O_5	K_2O		
Manure analysis, lb/1,000 gal	24	9	20		

	N, > 72 hr	N, 1-72 hr	N, <1 hr	P_2O_5	K_2O
NEW, lb/1,000 gal	7.2	9.6	12	7.2	16
OLD, lb/1,000 gal	7.2	9.6	9.6	5.4	16

	N	P_2O_5	K_2O		
Manure analysis, lb/ton	10	5	9		

	N, > 72 hr	N, 1-72 hr	N, <1 hr	P_2O_5	K_2O
NEW, lb/ton	2.5	3	3.5	4	7.2
OLD, lb/ton	3	4	4	3	7.2

Field crop legume rotation N credits

Table 9.6. Field crop legume rotational nitrogen (N) credits.

Crop	Medium-/ fine-textured soils	Sandy soils
	------lb N/a to credit--------	
Soybean[a]	20	0
Leguminous vegetables: pea, snap, lima, or dry bean	20	0

[a] Soybean credit does not apply to corn or wheat grown after soybean. See Chapter 6: Nitrogen for N rate guidelines for corn or wheat grown after soybean.

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