Nutrient Management Planning Workbook

USDA-NRCS 590 Nutrient Managment Standard for Wisconsin

Use this page to do calculations:

Nutrient Management Planning Workbook

Objective:

To understand the different parts of a nutrient management plan that meets with the USDA-NRCS 590 Nutrient Managment Standard for Wisconsin. **You can use your own information or use the sample farm** to determine manure nutrient credits, legume credits, restrictions, fertility recommendations and fertilizer applications.

To use your own information, you will need manure spreader calibration information, soil test results, restriction maps and crop information.

SAMPLE FARM: HILLTOP ACRES

Operation Overview:

Hilltop Acres is a dairy operation located in Iowa County. The business is owned and operated by Fred Johnson. The farm operates 170 acres of cropland. Hilltop Acres owns 149 acres and rents the remaining 21 acres from a neighboring farm two miles away. The soil tests were taken in the fall and were analyzed at the UW Soil and Plant Analysis Laboratory in Madison.

Crop Information:

Crops grown include corn for grain and silage, winter wheat, oatlage with alfalfa seeding, and alfalfa. A typical rotation on the home farm is two years of corn rotated to oatlage with alfalfa seeding, and three years of established alfalfa. The rented farm is typically three years of corn rotated to one year of winter wheat. The last year of corn before wheat is a short season variety, which is taken for high moisture corn so Fred has enough time to plant the wheat. Corn silage is always taken from the home farm, usually from flat fields. Fred Johnson needs about 25 acres of corn silage each year. All fields going into corn, winter wheat, or oatlage with alfalfa seeding receive one pass with a chisel plow (no disk) in either the fall or spring (depending on manure spreading), and one pass with a field finisher. Yield goals for corn grain are 191-210 bu/a, corn silage 25.1-30 t/a, winter wheat 81-100 bu/a, oatlage 2.0-2.5 t/a, and alfalfa 6.6-7.5 t/a.

Crop Rotations:

6 Year Home Rotation:

Year 1: Corn grain
Year 2: Corn grain
Year 3: Oatlage/alfalfa seeding
Year 4: Alfalfa
Year 5: Alfalfa
Year 6: Alfalfa

4 Year Rented Rotation:

Year 1: Corn grain
Year 2: Corn grain
Year 3: Corn grain
Year 4: Wheat

Fertilizer Details:

Fred Johnson applies commercial fertilizers as needed, including 28% UAN, urea, and potash. Other than 28% UAN which is applied by his farm cooperative, Fred applies all his fertilizer. The previous year, Fred applied 250 lb/a of potash on all established alfalfa fields, and 150 lb/a of 9-23-30 on all corn fields. 50 gal/a of 28% UAN was also applied to all corn fields.

Manure Management:

Fred Johnson currently raises 65 milking and 3 dry cows, as well as 24 heifers 800-1,100 lb, 22 heifers 400-800 lb, and 23 heifer calves less than 400 lb. Of the manure produced, approximately 1,500 tons are collected and land spread on cropland each year.

Fred Johnson does not have significant manure storage, but he does have a small concrete stacking area he uses during the summer months. Any manure stacked in the summer is then spread on fields in the fall. Much of the manure produced in the summer is not collected as the older heifers (800-1,100 lb) and younger heifers (400-800 lb) spend 100% of their time on pasture from May to October. The milking and dry cows are also on pasture during the same time period, but only for about 50% of the time. Manure application rates are currently unknown. Fred's manure spreader was recently weighed, but final calculations have not been completed.

590 Restrictions:

The maps on pages 8 and 9 not only identify fields with acres and soil type, but also identify nutrient spreading restrictions including the Surface Water Quality Management Area (SWQMA), soil slopes that exceed 9% and 12% slope, and soil types with nitrogen application restrictions. The maps also include estimated residential well locations, along with concentrated flow channels.

Manure Crediting Worksheet

Use the partially filled out worksheet below or your own information to:

1. Calculate and fill in the spreading rate in tons/acre.

2. Calculate and fill in the manure credits.

To have your spreader calibrated, contact your local extension agent or land conservation. department.

Spreader Information: Hilltop Acres Side Slinger

STEP 1. DETERMINE LOAD WEIGHT

	Left wheel		Right wheel		
FULL					
Rear tractor axle	1,800		1,850		
Front spreader axle	2,300		2,450		
Rear spreader axle	2,550		2,500		full total lb
	6,650	+	6,800	=	13,450
EMPTY					
Rear tractor axle	950		1000		
Front spreader axle	800		775		
Rear spreader axle	750		775		empty total lb
	2,500	+	2,550	=	5,050

full total - empty total: 8,400 ÷ 2000 = 4.2 tons manure/load

Round this number down to avoid overcrediting.

STEP 2. DETERMINE SPREADING RATE

Method 1: Using field records, enter the number of loads applied on a known acreage.

# of loads		# of acres		loads /acre		tons manure/load		tons / acre
	÷		=		x		=	

Method 2: Estimation only. Using a measuring wheel, measure the area covered by a single load.

tons manure/load				ft wide		ft length		tons / acre estimate
[		x 43,560 ft²/acre]	÷	[	x	]	=	

On the rented farm, Fred spread 65 loads on 21 acres.

STEP 3. DETERMINE MANURE NUTRIENT CREDITS

Enter the available nutrient content of manure

	lb/ton		tons / acre		lb/acre
N		x		=	
P_2O_5		x		=	
K_2O		x		=	

Multiply the nutrient content by the spreading rate to get the pounds per acre of each nutrient.

Estimated Available Manure Nutrient Content for crop use in the first year after spreading solid manure.

(Manure nutrient content can vary greatly, manure analysis is encouraged.)

Animal	N more than 3 days*	N 1 hour to 3 days	N less than 1 hour	P_2O_5	K_2O
	lb/ton				
(>20% dry matter) Dairy	2	3	3	3	6
(11-20% dry matter) Dairy	2	2	3	3	5
Beef	3	4	5	6	10
Swine	7	9	12	10	8
Chicken	24	27	29	35	26

* Time to incorporation

Fred is applying solid dairy manure with 11-20% dry matter, incorporated after 3 days.

For assistance with scales, information about nutrient management, or more copies of this publication, please contact the Nutrient and Pest Management Program at our UW-Madison office by phone at **(608) 265-2660**, or email us at **npm@hort.wisc.edu** or visit our website at **ipcm.wisc.edu**

NPM

December 2012

Alfalfa Crediting Worksheet

Use the card below and either the provided information or your own information to answer the following questions:

1. What is the legume credit for the first year? ☐
2. Can a second year legume credit be taken? ☐ Yes ☐ No
3. Could you take a second year legume credit from alfalfa that is in poor condition at the time of kill? ☐ Yes ☐ No

Fred's alfalfa stands are in fair condition (3 plants per square foot). When he kills off the alfalfa, there is less than 8" of regrowth. His fields have medium-textured soils.

Nitrogen Credits for Alfalfa and Soybean in Wisconsin

First year credit:	MEDIUM & FINE TEXTURED SOILS > 8 inches of regrowth	MEDIUM & FINE TEXTURED SOILS < 8 inches of regrowth	SANDS & LOAMY SANDS > 8 inches of regrowth	SANDS & LOAMY SANDS < 8 inches of regrowth
Alfalfa (stand density)	Nitrogen Credit (lb N/acre)			
Good.....(70-100 % alfalfa, > 4 plants/ft^2)	**190**	**150**	**140**	**100**
Fair.....(30-70 % alfalfa, 1.5 - 4 plants/ft^2)	**160**	**120**	**110**	**70**
Poor.....(0-30 % alfalfa, < 1.5 plants/ft^2)	**130**	**90**	**80**	**40**

Second year credit: In the second cropping year following fair and good stands on medium and fine textured soil, you can take a 50 lb N/acre credit.

Soybean*

20 lb N /acre is available to crops following soybean in a rotation. **No credit** on sandy soils.

* When following UW N guidelines for corn or wheat, the soybean credit is included in the recommendation. For more information, see UWEX A2809 *Nutrient management guidelines for field, vegetable and fruit crops in Wisconsin*.

Restrictions Worksheet:

Use the information on the following page and the maps on pages 8 & 9 to answer the following questions:

1. If a field that is **not** contour plowed and has a pink slope area covering the majority of the field, can winter manure be spread on this field?

   ☐ Yes ☐ No

   What if the field was contour plowed? ☐ Yes ☐ No

2. How does a red slope area effect winter spreading?_____

_____

3. A Surface Water Quality Management Area (SWQMA) is an area within _____ ft from a lake, pond, or _____ ft from a stream or river.

4. Can a field within a SWQMA be spread on during the spring or fall? ☐ Yes ☐ No

   If so, are there any additional restrictions that must be followed? ☐ Yes ☐ No

5. If a field has a speckled area, what does this mean?

   _____

6. How many lbs of nitrogen from manure can be spread on a speckled area in the fall if soil temperatures are higher than 50° F (after September 15th)? _____

7. On N restricted soils, can you apply commercial nitrogen fertilizer in the fall on fall-seeded crops?

   ☐ Yes ☐ No

   If so, what is the restriction? _____

8. Can you spread manure on fields within 50 feet of a residential well?

   ☐ Yes ☐ No

Summary of Restrictions (USDA-NRCS 590 Nutrient Management Standard for Wisconsin)

Answers to some common questions about restriction maps. For more information, see pages 14 & 15.

Why do some soil types have a "Fall N Restriction"? Speckled pattern on map

5

Areas identified by a speckled pattern on the map are believed to be hazardous because of strong possibility that they are direct conduits to groundwater. These soils fit into at least one of the following categories:

- Highly permeable, allowing water to infiltrate very quickly, or
- Have less than 20 inches to bedrock, or
- Have less than 12 inches to the water table

How does a fall N restricted soil affect my farm management? Speckled pattern on map

For fields containing an N restricted soil type, the general rule of thumb is to restrict the majority of crop N applications to the spring. The following restrictions also apply and must be followed:

7

- Fall application of commercial N to these soils is prohibited, except for establishment of fall-seeded crops, in which case applications may not exceed 30 lbs of available N/acre.
- Manure N restrictions:
  - When manure is fall applied and soil temperatures are higher than 50°F:
    - Use a nitrification inhibitor with liquid manure and limit rate to 120 lb N/acre, or
    - Apply after Sept. 15 and limit rate to 90 lb N/acre, or
    - Apply to perennial or fall-seeded crops and limit rate to 120 lb N/acre or crop N need, whichever is less
  - When manure is fall applied and soil temperatures are lower than 50°F:
    - Limit the application rate to 120 lb N/acre or the crop's N need, whichever is less
- On irrigated fields:
  - Split N applications, applying the majority of N after crop establishment, or
  - Use a nitrification inhibitor with ammonium forms of N

6

Why do some soils have Winter Application restrictions? Red on map

2

Winter application of nutrients are prohibited on slopes greater than 12% due to high risk of erosion and nutrient losses (unless effective incorporation can occur at the time of application). Winter conditions are defined as having either frozen and/or snow covered soil. Areas that have been identified as having slopes greater than 12% are depicted in red on these maps.

What does it mean to have a soil labeled with "Winter Restrictions (if slope >9%)"? Pink on map

1

The 590 Nutrient Management Standard prohibits manure applications on slopes > 9% (unless it is contour plowed, in which case manure applications can be made on slopes up to 12%). Many areas in Wisconsin have been mapped as having slopes between 6-12%; these soils are depicted in pink on the 590 NM Application Restriction maps. Fields labeled with this (pink) restriction must be checked to determine their actual slope.

What is a SWQMA? blue crosshatch on map

3

A Surface Water Quality Management Area, or SWQMA, is defined as the area within 1,000 ft of lakes and ponds or within 300 ft of perennial rivers and streams. These areas are given special consideration due to the higher likelihood of soil and nutrients applied to these areas entering and polluting the water body.

How does a SWQMA designation affect how I apply nutrients to my fields?

Nutrient application restrictions within a SWQMA are different for winter and other parts of the year

Winter:
Nutrient applications are prohibited on frozen and/or snow covered soils in SWQMAs (fields within 1,000 ft of lakes/ponds, or within 300 ft of perennial streams).

4

Non-winter:
Nutrient applications on unfrozen/non-snow covered ground by SWQMAs are restricted in the following ways:

- Nutrient applications must be accompanied by at least ONE of the following:
  - Establishment of permanent vegetative buffers
  - Maintenance of greater than 30% residue or vegetative cover
  - Incorporation of nutrients within three days
  - Establishment of cover crops after application
- Unincorporated liquid manure application rates are restricted based on soil type and soil moisture.
- Maximum acceptable rates for unincorporated liquid (less than 12% solids) manure applications are shown in the table on page 14. If these rates are not enough to meet the desired nutrient application rate (consistent with the 590 standard), you can apply sequential applications. Wait at least 7 days or use the "allowable soil moisture description" below to make sure that the soil is dry enough for another application.

What other spreading restrictions should I be aware of? various symbols

8

- Manure should never be mechanically applied to areas within 50 feet of a potable drinking water well
- Nutrients should never be applied to the following features:
  - Surface water, established concentrated flow channels (including grassed waterways), or non-harvested permanent vegetative buffers
  - Any non-farmed wetland, sinkhole, nonmetallic mine, or well
  - Areas contributing runoff within 200 feet upslope of direct conduits to groundwater such as well, sinkhole, fractured bedrock at the surface, tile inlet, or nonmetallic mine, unless the nutrients are effectively incorporated within 72 hours
  - Land where vegetation is not removed mechanically or by grazing
  - Fields exceeding tolerable soil loss (T)

Restrictions Worksheet:

Use the information from the maps or your farm's information to answer the following questions:

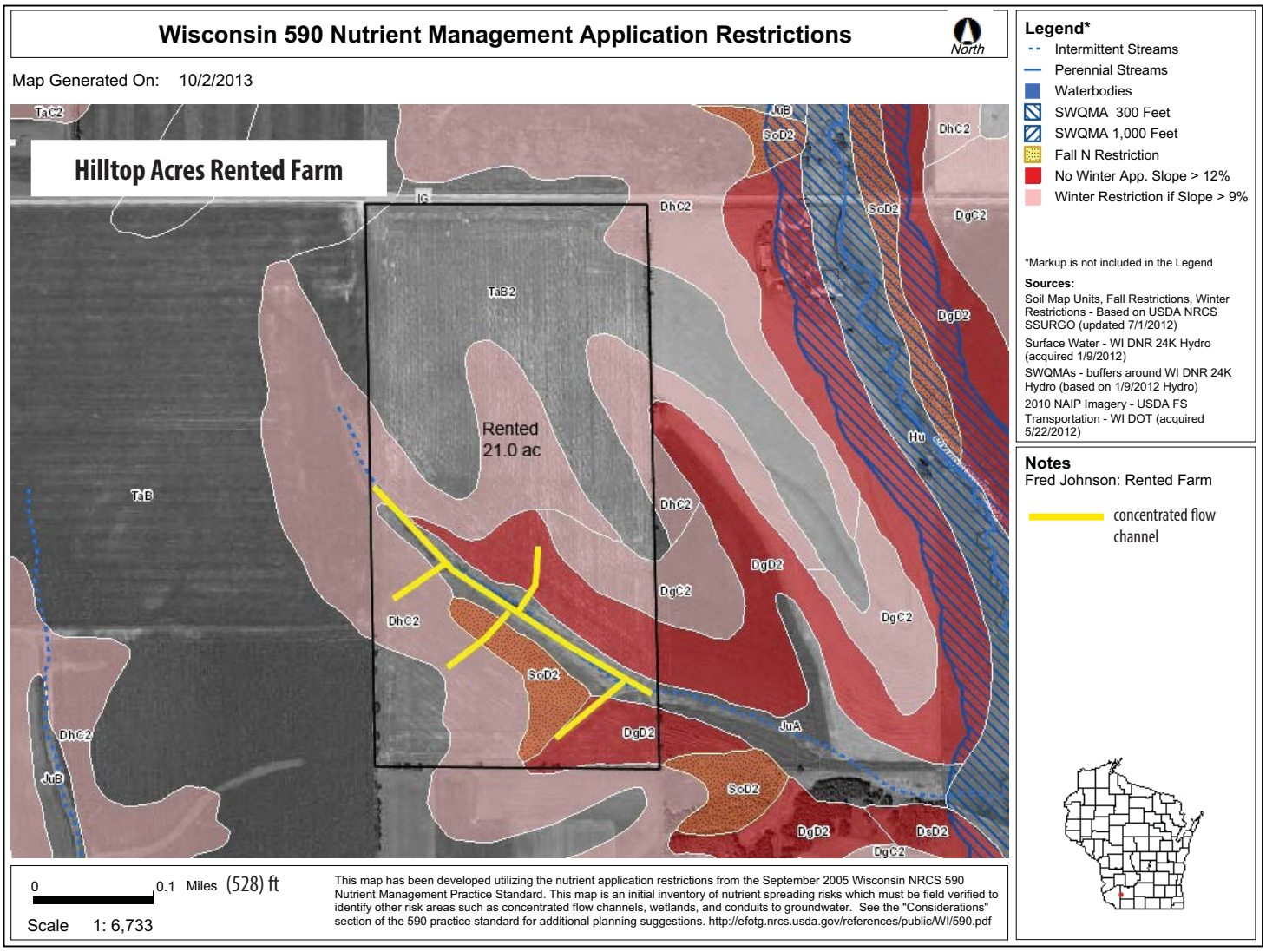
1. Which fields have winter restrictions? _____

2. Which fields have nitrogen restrictions? _____

3. Which fields are in SWQMA? _____

4. Are there any fields with a residential well within 50 feet of their edge? ☐ Yes ☐ No

   What is the restriction? _____



Special Note. The years in the table below are listed by ***cropping year***, not calendar year. For example, a fall application following harvest in the prior year would be listed as an application in the plan year.

Fred's Manure Spreading and Cropping Plan

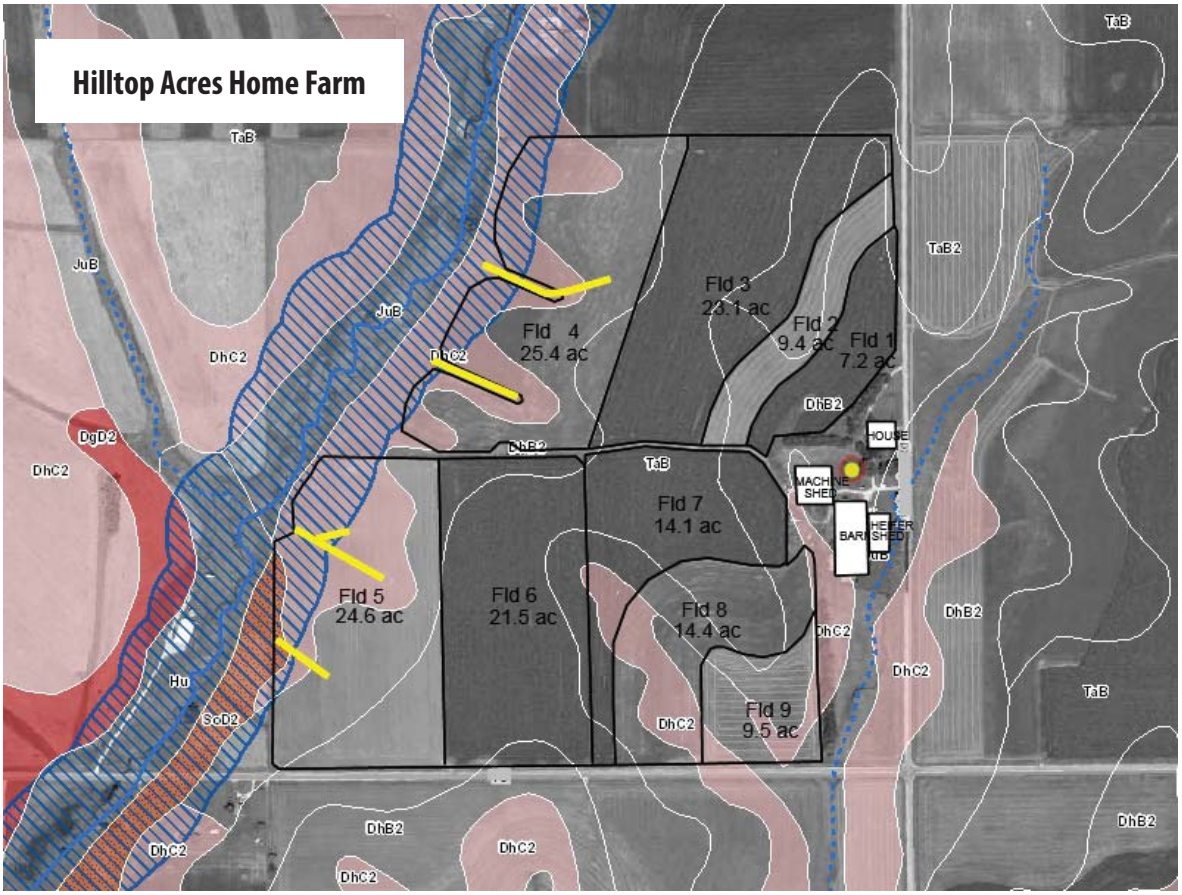
		Prior year		Plan year (* not yet implemented)	
Field	**Acres**	**Crop (rotation year)**	**Manure application rate/season**	**Crop (rotation year)**	**Manure application rate/season**
Field 1	7.2	Corn silage (1)	4.5 loads/acre winter	Corn grain (2)	4.5 loads/acre winter*
Field 2	9.4	Alfalfa (4)	--	Alfalfa (5)	--
Field 3	23.1	Corn silage (1)	4.5 loads/acre spring	Corn grain (2)	4.5 loads/acre winter
Field 4	25.4	Alfalfa (4)	--	Alfalfa (5)	--
Field 5	24.6	Alfalfa (6)	--	Corn silage (1)	4.5 loads/acre spring*
Field 6	21.5	Corn grain (2)	4.5 loads/acre fall	Oatlage/alfalfa seeding (3)	--
Field 7	14.1	Oatlage/alfalfa seeding (3)	4.5 loads/acre winter	Alfalfa (4)	--
Field 8	14.4	Alfalfa (5)	--	Alfalfa (6)	--
Field 9	9.5	Corn grain (2)	4.5 loads/acre winter	Oatlage/alfalfa seeding (3)	4.5 loads/acre fall
Rented	21	Wheat (4)	--	Corn grain (1)	3 loads/acre fall

5. Are there any applications that you may need to adjust for the plan year according to season because of spreading restrictions? ☐ Yes ☐ No

Wisconsin 590 Nutrient Management Application Restrictions

North

Map Generated On: 10/2/2013



Legend*
- Intermittent Streams
- Perennial Streams
- Waterbodies
- SWQMA 300 Feet
- SWQMA 1,000 Feet
- Fall N Restriction
- No Winter App. Slope > 12%
- Winter Restriction if Slope > 9%

*Markup is not included in the Legend

Sources:
Soil Map Units, Fall Restrictions, Winter Restrictions - Based on USDA NRCS SSURGO (updated 7/1/2012)
Surface Water - WI DNR 24K Hydro (acquired 1/9/2012)
SWQMAs - buffers around WI DNR 24K Hydro (based on 1/9/2012 Hydro)
2010 NAIP Imagery - USDA FS
Transportation - WI DOT (acquired 5/22/2012)

Notes
Fred Johnson: Home Farm

concentrated flow channel

well

0 0.1 Miles (528) ft

Scale 1: 7,068

This map has been developed utilizing the nutrient application restrictions from the September 2005 Wisconsin NRCS 590 Nutrient Management Practice Standard. This map is an initial inventory of nutrient spreading risks which must be field verified to identify other risk areas such as concentrated flow channels, wetlands, and conduits to groundwater. See the "Considerations" section of the 590 practice standard for additional planning suggestions. http://efotg.nrcs.usda.gov/references/public/WI/590.pdf

Fertility Recommendations Worksheet:

Use the soil test information on the following page to complete the worksheet for the rented farm's field.

Prior Year's Crop: ☐

Plan Year's Crop: ☐

Soil Test P (ppm): ☐

Soil Test K (ppm): ☐

Soil Yield Potential: ☐
hint: see yellow highlight on soil test report

Plan Year's Crop Yield Goal: ☐

Soil pH: ☐

Using the information from the previous worksheets, fill in the information for the rented field.

1. Was any manure applied to the rented field for the plan year? ☐ Yes ☐ No
   If yes, include the manure credits (from Manure Credit Worksheet, pg 4) in the brown boxes below.
2. Was there a legume crop on the rented field in the prior year that would provide a credit in the plan year? ☐ Yes ☐ No
   If yes, include the legume nitrogen credit (from Alfalfa Credit Worksheet, pg 5) below in the green boxes below.
3. Are there any spreading restrictions (see 590 explanations, pg 7)? ☐ Yes ☐ No
4. Does the pH need adjusting (hint: see yellow highlight on soil test report)? ☐ Yes ☐ No

Using the the soil test report, UWEX A2809 or NM Fast Facts, fill in the recommendation and calculate any adjustments:

see nutrient recommendations section of the soil test report	Recommendation (lb/a)		Manure Credits (lb/a)		Legume Credits (lb/a)		Adjusted Rec. (lb/a)
Nitrogen (N)	☐	subtract		subtract		equals	☐
Phosphorus (P)	☐	subtract				equals	☐
Potassium (K)	☐	subtract				equals	☐

Using the adjusted recommendation from above, determine remaining fertilizer needs. Hint: products to use:

- 28% UAN (28-0-0, approx. 28 lb of N in 10 gal of product)
- DAP 18-46-0 (18 lb of N & 46 lbs of P in 100 lbs of product)
- Potash 0-0-61 (61 lb of K in 100 lbs of product)

Will you be recommending any starter (9-23-30)?

☐ Yes ☐ No

☐ gal/a 28%

☐ lb/a DAP

☐ lb/a Potash

EXAMPLE:

Prior Year's Crop: Wheat
Plan Year's Crop: Corn grain
Soil Test P: 21
Soil Test K: 126

Soil Yield Potential: High Yield
Plan Year's Crop YG: 191-210
pH: 6.2

	Recommendation	Manure Credit	Legume Credit	Adjusted Rec
Nitrogen (N)	140	24	0	116
Phosphorus (P)	75	36		39
Potassium (K)	60	60		0

Using the adjusted rec., determine remaining fertilizer needs:
Starter: 150 lb/a 9-23-30
Adjusted rec: 116-39-0 less the starter of 13-34-45 = 103-5-0
40 gal/a 28% UAN
No DAP or Potash

SOIL TEST REPORT

Samples Analyzed By:
UW Soil & Plant Analysis Lab
8452 Mineral Point Road
Verona, WI 53593
(608) 262-4364

LAB #:

County:	Account No.
Iowa	000000
Date Received	Date Processed
10/15/2013	10/20/2013
Slope / Acres	Plow Depth
21	7"
Soil Name	
Tama	
Field Name	
Rented	
Previous Crop	
Wheat	

NUTRIENT RECOMMENDATIONS

Cropping Sequence	Yield Goal	Crop Nutrient Need N	Crop Nutrient Need P_2O_5	Crop Nutrient Need K_2O	Fertilizer Credit Legume N	Fertilizer Credit Manure N	Fertilizer Credit P_2O_5	Fertilizer Credit K_2O	Nutrients to Apply N	Nutrients to Apply P_2O_5	Nutrients to Apply K_2O
	per acre	lbs/a			lbs/a	lbs/a			lbs/a		
Wheat	81-100 bu	75	45	30							
Corn, grain	191-210 bu	140	75	60							
Corn, grain	191-210 bu	190	75	60							
Corn, grain	191-210 bu	190	75	60							

no peeking!

There is no lime recommendation.

SUGGESTED N APPLICATION RATES FOR CORN (GRAIN) AT DIFFERENT N:CORN PRICE RATIOS

Previous Crop	N:Corn Price Ratio ($lb/N:$/bu) 0.05 Rate[1]	0.05 Range	0.10 Rate[1]	0.10 Range	0.15 Rate[1]	0.15 Range	0.20 Rate[1]	0.20 Range
Loamy: High yield potential soils	lb N/a (Total to Apply)[2]							
Corn, Forage legumes, Leguminous vegetables, Green manures[3]	190	170-210	165	155-180	150	140-160	135	125-150
Soybean, Small grains[4]	140	125-160	120	105-130	105	95-115	90	80-105

[1] Rate is the N rate that provides the maximum return to N (MRTN).Range is the range of profitable N rates that provide an economic return to N within $1/a of the MRTN.
[2] These rates are for total N applied including N in starter fertilizer and N used in herbicide applications.
[3] Subtract N credits for forage legumes, leguminous vegetables, green manures, and animal manures. This includes 1st, 2nd, and 3rd year credits where applicable. Do not subtract N credits for leguminous vegetables on sand and loamy sand soils.
[4] Subtract N credits for animal manures and 2nd year forage legumes.

Guidelines for choosing an appropriate N application rate for corn (grain)
1) If there is > 50% residue cover at planting, use the upper end of the range.
2) For small grains on medium and fine textured soils, the mid-to-low end of the profitable range is most appropriate.
3) If 100% of the N will come from organic sources, use the top end of the range. In addition, up to 20 lb N/a in starter fertilizer may be applied in this situation.
4) For medium and fine textured soils with: > 10% organic matter, use the low end of the range; < 2% organic matter, use the high end of the range.
5) If there is a likelihood of residual N (carry-over N), then use the low end of the range or use the high end of the range and subtract preplant nitrate test (PPNT) credits.
6) For corn following small grain on medium and fine textured soils, the middle to low end of the range is appropriate.

ADDITIONAL INFORMATION

Fertilizer credit based on 1 year(s) of 20 tons/acre of surface dairy manure.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
Starter fertilizer (e.g.10+20+20 lbs N+P_2O_5+K_2O/a) is advisable for row crops on soils slow to warm in the spring.
Because of excessively high P levels, no P_2O_5 fertilizer or manure is recommended on this field.
If alfalfa will be maintained for more than three years, increase recommended K_2O by 20% each year.
N.R. = Not required for calculation of lime requirement when soil pH is 6.6 or higher.

TEST INTERPRETATION

Cropping Sequence	Very Low	Low	Optimum	High	Very High	Excessive
Wheat	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Corn, grain	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Corn, grain	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Corn, grain	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Rotation pH	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					

LABORATORY ANALYSIS

Sample Identification	Soil pH	O.M. %	Phosphorus ppm	Potassium ppm	60-69 Lime Req (T/a)	Calcium ppm	Magnesium ppm	Estimated CEC	Boron ppm	Manganese ppm	Zinc ppm	Sulfate-Sulfur ppm	Sulfur Avail. Index	Texture Code	Sample Density	Buffer pH
33	6.2	3.6	22	125												
34	6.1	4.2	35	112												
35	6.0	3.9	19	140												
36	6.3	3.6	22	125												
37	6.2	4.1	29	128												
Avg	**6.2**	**3.9**	**21**	**126**												

Fertility Spreading Plan Worksheet:

Use the information provided to make a plan for the Hilltop Acres Home Farm:

Given the following recommendations after all manure and legume credits are accounted for, come up with a plan that is easy to implement for all of the alfalfa fields on the home farm. **Any negative number in the "Over/Under Adjusted UW Recommendations" indicates that the recommendations have not been met.** Fred Johnson would like a plan he can apply the nutrients using a broadcast fertilizer spreader with the exception of the 28% UAN which will be applied by his local farm cooperative. The SnapPlus report below already has adjusted recommendations with manure and legume credits accounted for, use the negative numbers to determine fertilizer recommendations. A finished example is shown below.

SnapPlus Spreading and Nutrient Management Sorted By Crop Report

Crop Year	2014
Reported For	Hilltop Acres
Printed	2013-10-02
Plan Completion/Update Date	2013-07-29
SnapPlus Version 2.0 built on 2013-09-18	
C:\SnapPlus2\MySnapPlusData \ProducerPlans2013\JohnsonFred.snapDb	

Prepared for:
Hilltop Acres
attn:Fred Johnson
3895 Farmland Rd
Oatville, 51515

Alfalfa Fields						Crop Removal				Soil Test ppm		Adjusted Recs lb/ac			Planned Applications and Credits lb/ac			Over(+) Under(-) Adj. UW Recs lb/ac			Applications			
Name	Ac.	Slp %	Soil Series, Map Symbl & N Rea	Prior Crop	2014 Crop	Yield Goal	P2O5	K2O	Tillage	Avg P	Avg K	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	Product Name and Analysis	Appln Rate and Method	N-P2O5-K2O credit	Total Amt
02	9.4	4	DhB2	Alfalfa	Alfalfa	6.6-7.5	90	420	None	59	201	0	0	57	0	0	0	0	0	-57				
04	25.4	8	DhB2	Alfalfa	Alfalfa	6.6-7.5	90	420	None	29	137	0	45	420	0	0	0	0	-45	-420				
07	14.1	8	TaB	Oatlage w/ Alfalfa Seeding Spring	Alfalfa	6.6-7.5	90	420	None	158	206	0	0	45	0	0	0	0	0	-45				
08	14.4	8	TaB	Alfalfa	Alfalfa	6.6-7.5	90	420	None	54	145	0	0	210	0	0	0	0	0	-210				

63.3 planned Alfalfa acres

EXAMPLE: Established alfalfa fields:

What we know:

1. Fields 02, 07and 08 have K needs ranging from 45 to 210 lb/a.
2. Field 04 has a K need of 420 lb/a and P need of 45 lb/a.

Fertilizer % content (N-P-K)

For example, Potash (0-0-61) has zero N and P and 61% K, which means that you get 61 lbs of actual K in 100 lbs of Potash.

What we can do:

- To meet the needs of 210 lb/a K on fields 02, 07 and 08 Fred will need around 350 lb/a Potash (0-0-61), but will fall short on Field 04's need by 222 lb/a K.
- To make up for the 222 lb/a shortfall of K, Fred still needs apply 350 lb/a Potash (0-0-61) to field 04.
- To meet the needs of 45 lbs P on Field 04, Fred will need 100 lb/a DAP (18-46-0).

lb/a K needed → fertilizer analysis → lb/a Potash (0-0-61)

210 ÷ 0.61 = 344

lb/a P needed → fertilizer analysis → lb/a DAP (18-46-0)

45 ÷ 0.46 = 98

Fertilizer Spreader #1: 350 lb/a Potash: Fields 02, 04, 07, 08 (if trying to save money and fertilizer, cut rate in half for Field 02and Field 07, otherwise these fields will use excess Potash (0-0-61) in upcoming years)

Fertilizer Spreader #2: 100 lb/a DAP and 350 lb/a Potash: Field 04

Corn on Corn Fields							Crop Removal			Soil Test ppm		Adjusted Recs lb/ac			Planned Applications and Credits lb/ac			Over(+) Under(-) Adj. UW Recs lb/ac			Applications			
Name	Ac.	Slp%	Soil Map Symbl N Res	Prior Crop	2014 Crop	Yield Goal	P2O5	K2O	Tillage	Avg P	Avg K	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	Product Name and Analysis	Appln Rate and Method	N-P2O5-K2O credit	Total Amt
01	7.2	4	DhB2	Corn silage	Corn grain	191-210	75	60	FCND	92	196	190	0	0	36	54	90	-154	54	90	dairy 2-3-5	18 ton Winter Unincorp	36-54-90	130 ton
03	23.1	4	TaB	Corn silage	Corn grain	191-210	75	60	FCND	60	163	190	0	10	36	54	90	-154	54	80	dairy 2-3-5	18 ton Winter Unincorp	36-54-90	416 ton

30.3 planned Corn on Corn acres 545 planned ton dairy

Alfalfa Seeding Fields							Crop Removal			Soil Test ppm		Adjusted Recs lb/ac			Planned Applications and Credits lb/ac			Over(+) Under(-) Adj. UW Recs lb/ac			Applications			
Name	Ac.	Slp %	Soil Series, Map Symbl & N Res	Prior Crop	2014 Crop	Yield Goal	P2O5	K2O	Tillage	Avg P	Avg K	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	Product Name and Analysis	Appln Rate and Method	N-P2O5-K2O credit	Total Amt
06	21.5	4	TaB	Corn grain	Oatlage w/ Alfalfa Seeding Spring	2.0-3.5	30	120	FCND	46	171	20	0	0	0	0	0	-20	0	0				
09	9.5	8	DhB2	Corn grain	Oatlage w/ Alfalfa Seeding Spring	2.0-3.5	30	120	FCND	103	216	20	0	0	36	54	90	16	54	90	dairy 2-3-5	18 ton Fall Unincorp	36-54-90	171 ton

First Year Corn Silage Fields							Crop Removal			Soil Test		Adjusted Recs lb/ac			Planned Applications and Credits lb/ac			Over(+) Under(-) Adj. UW Recs lb/ac			Applications			
Name	Ac.	Slp %	Soil Map Symbl & N Res	Prior Crop	2014 Crop	Yield Goal	P2O5	K2O	Tillage	Avg P	Avg K	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	Product Name and Analysis	Appln Rate and Method	N-P2O5-K2O credit	Total Amt
05	24.6	8	DhB2 R	Alfalfa	Corn silage	25.1-30	100	230	FCND	18	107	190	100	270	156	54	90	-34	-46	-180	dairy 2-3-5	18 ton Spring Unincorp	36-54-90	443 ton

24.6 planned First Year Corn Silage acres 443 planned ton dairy

Use the reports above to start grouping fields by crop (already done in the sample SnapPlus report). Then figure out the needs for each group of fields. It is important to note how the fertilizer will be applied to come up with implementable rates (if using fertilizer spreaders recommend mixes of fertilizer to minimize passes in a field if possible). Use the following products: Starter (9-23-30), 28% UAN (28-0-0), DAP (18-46-0), Potash (0-0-61).

Nutrient content for liquid fertilizer

The analysis for 28% UAN is approx. 28 lb N per 10 gallons of product.

Wisconsin's Nutrient Management Standard 590 Summary

September 2005 Revision (1/17/06)

Criteria for All Sites

1. General Cases

A. Use UWEX soil fertility recommendations (A2809) to make a annual plan for each field.

B. Base the plan on realistic yield goals—no higher than 15% above the previous 3-5 year average.

C. Conduct routine soil testing at least once every four years.

1) Sample soils according to UWEX recs (A2100).
2) Analysis by a WDATCP-certified lab.

D. Annual phosphorus (P) and potassium (K) recommendations may be combined into a single application to meet the total nutrient needs over the crop rotation.

1) Combined annual application not allowed on frozen or snow-covered ground.
2) Do not apply commercial P fertilizer to fields with soil test P in the excessively high (non-responsive) range—**exception** of up to 20 lb/a of P2O5 starter for corn.
3) Credit all P and K starter fertilizer against crop needs.

E. Adjust soil pH to optimum ranges.

F. Nitrogen (N) applications shall not exceed annual crop need (or uptake).

1) **Exception:** If legumes, manures, and/or organic by-products are the only sources of N, N rate may exceed crop need by 20%.
2) Credit any starter N fertilizer in excess of 20 lbs/a.

G. Account for and utilize both first- and second-year legume-N credits.

H. Account for and utilize first-year available manure nutrient credits using either:

1) Laboratory manure-nutrient analysis.
2) UW estimates of first-year available nutrient content of manure.

I. Other organic byproducts applied to fields need to be analyzed for nutrient content and applied according to existing regulations.

J. Nutrients shall not run off fields during or immediately after application.

K. Nutrient applications based on plant tissue analysis shall be done in accordance with UW sampling, testing, and interpretation guidelines.

L. Where gleaming/pasturing occurs, do not allow the N and P manure additions to exceed the requirements of this standard.

2. Nutrient Application Prohibitions

A. Do not spread nutrients on:

1) Surface water, concentrated flow channels, vegetative buffers, non-farmed wetlands, sinkholes, gravel/sand pits, wells.
2) Non-cropland and/or non-pastured land—**exception:** establishment and maintenance nutrient requirements are allowed.
3) Areas within 50 feet of a well—applies to manure only.
4) Areas contributing runoff 200 feet upslope of direct conduits to groundwater (wells, sinkholes, surface fractured bedrock, tile inlets, or gravel/sand mines) unless nutrients are incorporated within three days.
5) Fields exceeding tolerable soil loss (T).

B. Frozen or snow-covered soil nutrient application prohibitions:

1) 1,000 feet of a lake, pond, flowage or within 300 feet of a river/perennial stream (SWQMAs),
2) Areas identified as direct conduits to groundwater or surface water,
3) P removal of the following growing season's crop is not to be exceeded when applying manure. Liquid manure applications limited to 7,000 gallons/acre,
4) Slopes greater than 9%—**exception:** Up to 12% for manure applications on contoured or contour stripped fields.
5) No commercial N or P fertilizer—**exception:** Grass pastures and winter grains not contained in above prohibition areas.

3. Nutrient Application Restrictions

A. Application rates for unincorporated liquid manure on non-frozen soils within a SWQMA are not to exceed Table 1 values.

1) No applications allowed on saturated soils.
2) Subsequent manure applications possible (as standard allows) after 7 days or after soil evaluation (Table 1).

B. All nutrient applications on non-frozen soil within a SWQMA shall be in conjunction with one or more of the following practices:

1) Permanent vegetative buffers,
2) Greater than 30% crop residue or vegetative cover after nutrient application,
3) Incorporation within 3 days of application leaving adequate residue to meet "T",
4) Cover crops established promptly following application.

Table 1. Maximum unincorporated liquid manure application rate within a SWQMA.

Soil Texture Class[1]	Maximum Application Rate < 30%[2]	Maximum Application Rate > 30%[2]	Allowable Soil Moisture Description for Applications
	----- gal/acre -----		
Fine	3,000	5,000	Easily ribbons out between fingers, slick feel.
Medium	5,000	7,500	Forms a ball, very pliable, slicks readily with clay.
Coarse	7,000	10,000	Forms a weak ball, breaks easily.

[1] Fine – clay, silty clay, silty clay loam, clay loam; Medium – sandy clay, sandy clay loam, loam, silt loam, silt; Coarse – loamy sand, sandy loam, sand. The coarse category also includes peat and muck.

[2] Crop residue or vegetative cover on the soil surface after manure application.

Criteria for Groundwater Protection

Applies to high permeability soils (sands, etc.), soils with less than 20 inches to bedrock, or soils with less than 12 inches to apparent water table. Also fields within 1,000 feet of a municipal well

1. N Application Restrictions:
   A. No fall applications of commercial N—**Exception:** Establishment of fall-seeded crops with a 30 lb N/acre maximum.
   B. Apply one of the following practices on irrigated fields, includes irrigated manure:
      1) Apply majority of N after crop establishment (sidedress or split), or
      2) Utilize a nitrification inhibitor with ammonium forms of N.
2. Manure-N Application Restrictions:
   A. When manure is applied in late summer/fall when soil temperatures are greater than 50° F, meet one of the following:
      1) Use a nitrification inhibitor with liquid manure and limit rate to 120 lbs N/acre,
      2) Apply after Sept. 15 and limit rate to 90 lbs N/acre,
      3) Apply to perennial or fall-seeded crops and limit rate to 120 lbs N/acre or the crop's N requirement —whichever is less.
   B. When manure is applied in fall and soil temperatures are 50° F or lower, limit rate to 120 lbs N/acre or the crop's N requirement—whichever is less.
3. P Leaching Restrictions:
   A. Where P additions to groundwater are identified, implement practices to reduce P delivery.

Criteria for Surface Water Protection

1. Where manure, fertilizers, or organic byproducts are applied:
   A. Avoid building soil test P values beyond the excessively high range for the most demanding crop in the rotation (30 to 50 ppm for most agronomic crops).
   B. Establish perennial vegetative cover in all areas of concentrated flow where gullies occur.
2. Develop a plan for managing P when manure or organic byproducts are applied using one of the following strategies. Selected strategy must be applied uniformly to all fields within a farm or tract.

A. Phosphorus Index (PI) Strategy:
   1) The PI assesses P delivery to surface waters from fields. See http://wpindex.soils.wisc.edu,
   2) The planned PI value for up to an 8-year rotation of each field shall be 6 or lower.
   3) P applications on fields with a PI > 6 are allowed only if needed according to UWEX soil fertility recs.

B. Soil Test P Strategy:
   1) P applications from all sources must be based on the following soil test P values:
      a) < 50 ppm P: Apply nutrients up to crop N need/removal,
      b) 50–100 ppm P: Do not applications P in excess of crop removal of P over a rotation (8 year max),
      c) > 100 ppm P: Eliminate P applications, unless required by highest P-demanding crop in the rotation.

      —**Exception:** If P (i.e. manure-P) must be applied, apply 25% less than the cumulative annual crop P removal over the rotation (8 year max).

      —**Exception:** For potatoes, Do not apply P applications that exceed rotational crop removal (8 year max) if soil tests are optimum, high, or excessively high for potatoes.

Criteria for Air Quality Protection

Where air quality is identified as a concern, use a management plan that minimizes N volatilization and particulate emissions while maintaining "T".

Criteria for Soil Quality Protection

1. Do not apply nutrients in a manner that does not permanently degrade the soil's physical, chemical, or biological conditions.
2. To the extent practical, do not apply nutrients to flooded or saturated soils when the potential for soil compaction is high.

May 2014

Nutrient Management Planning Workbook

USDA-NRCS 590 Nutrient Managment Standard for Wisconsin

For more information on this publication, contact Kim Meyer at kjmeyer6@wisc.edu

This publication is available from the Nutrient and Pest Management (NPM) Program.
web (ipcm.wisc.edu); phone (608) 265-2660; email (npm@hort.wisc.edu).