THE UNIVERSITY of WISCONSIN MADISON

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DATE: December 14, 2015

RE: Soil database changes for nutrient application guidelines

The UWEX-Extension nutrient application guidelines are based on soil group and soil yield potential. All soil map units in Wisconsin are placed in a soil group and soil yield potential category using specific criteria in NRCS's SURGO database. Recently, NRCS updated the SURGO database. Subsequently, we updated the soil groups and soil yield potential of all map units affected by the changes in the SURGO database. This has resulted in a medium soil yield potential designation for some Kewaunee, Manawa and Hochheim soil map units in 20 central and eastern Wisconsin counties. Previously these soils had a high yield potential. The change in soil yield potential category represents a reduction in nitrogen recommendations when corn follows corn of 50 pounds of nitrogen per acre. We are concerned that a medium soil yield potential rating for these soils may not be accurate. Thus, we are rescinding this update for these specific soil map units (see Table 1). SnapPlus will be revised and posted to the website by December 15. Additionally, an Excel file containing soil groups and soil yield potentials will be revised and posted to the SnapPlus and UW Soil & Forage Analysis Lab webpages. We plan to investigate if changes in SURGO information resulted in appropriate interpretations of soil yield potential. Answers to questions about the soil yield potential rating and our decision are provided below.

Why should I be concerned about this?

NRCS Code 590 Nutrient Management states that producers must follow University of Wisconsin Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops (UWEX Pub. A2809). State regulations ATCP 50 and NR 243 cite NRCS 590. The result is that UW guidelines in UWEX Pub. A2809 are codified in all levels of nutrient management planning in Wisconsin. The updated soil group and yield potential information is presently in use by the UW Soil & Forage Analysis Lab as well as all DATCP certified soil test labs, and has been incorporated into the SnapPlus 15 release.

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What is the soil group?

Soil groups are based upon a soil's taxonomic classification using soil properties like texture (percentage of sand, silt, and clay) and organic matter content. Soil groups are used to interpret phosphorus and potassium soil test levels. There are three soil groups in Wisconsin: sandy (coarse-textured soils), loamy (medium- and fine-textured soils), and organic (peats, mucks, etc.).

What is the soil yield potential rating?

The soil yield potential is a relative ranking of a soil's ability to produce high corn yields along with the responsiveness of corn yield to nitrogen applications. For Loamy soils, there are two ratings: High and Medium. In general, high yield potential soils require more nitrogen and have a greater yield increase from applied nitrogen than medium yield potential soils.

What are the management implications of the yield potential rating?

High yield potential soils have recommended nitrogen application rates that are, depending on the prior crop, as much as 50 pounds per acre greater than medium yield potential soils.

How is soil yield potential determined?

In 2012, we revised UWEX Pub. A2809: Nutrient application guidelines for field, vegetable and fruit crops in Wisconsin. One major change was revising the way soil yield potential is determined. Previously soil yield potential rankings were assigned to a soil series based on a qualitative assessment by an expert. In a joint effort with NRCS staff, we developed a classification system that used properties in the NRCS database to identify soil map units with characteristics that will limit corn yield potential. The system allows for uniform, non-subjective rating of soil map units through a series of queries to the database. Soil properties that are used to determine soil yield potential include: soil drainage class, available water in the upper 60 inches of soil, and depth to bedrock. Following the October 2014 Soil Survey updates, we reran the queries so that new soil map units are rated and also to ensure that our ratings are based on the most current soil survey information.

Why is there a concern about the Kewaunee, Manawa, and Hochheim soil map units?

As a result of a focused study on these soils, NRCS mappers have identified a densic soil layer at depths that range from 10 to 40 inches. A densic layer is defined as having a high bulk density and low ability for roots to penetrate. The designation of a densic layer had the result of causing our query to return a yield limitation (low available water) for these soil map units, when formerly they had no identified limitation and were considered high soil yield potential.

Our concern is that our criteria used to determine soil yield potential were developed prior to the designation of densic soil layers in eastern Wisconsin. Thus, new queries of the database may not be returning an appropriate interpretation of soil yield potential in soils with a densic layer. Anecdotal information indicates that they are not generally limited by water availability. Additionally, there are four Kewaunee and two Hochheim sites in the UW's corn nitrogen response database where corn follows soybean on high yield potential soils (56 total sites). Inspection of corn yield response on these six sites does not suggest any substantial differences in yield response compared to other high yield potential soils.

This issue needs further investigation. It will likely not be resolved until after the 2016 growing season. While the investigation is ongoing, we propose that the soil map units, where soil yield potential interpretation changed because of the densic designation, will have the available water in the upper 60 inches reset back to the value in use from 2012 until Nov. 2015.

At this time, we feel the following items need to be completed to resolve the issue:

1. Dig soil pits in several maps units and identify depth of rooting and root proliferation in densic layers.
2. Investigate available water in the densic layer.
3. Investigate the potential for perched water tables above the densic layer to supply water to the crop.
4. Conduct replicated corn nitrogen response trials on a few of the soil map units in question, if collaborators can be identified. Studies should target fields that were corn in the previous growing season.

How does this affect the recommendations that the DATCP certified soil test labs provide?

The UW Soil & Forage Analysis Lab provides the DATCP certified private labs with a computer program to create nutrient recommendations consistent with those found in UWEX Pub A2809. The soils database changes were implemented at the DATCP certified soil test labs in late summer. Because of the consolidation of testing services at UW's lab in Marshfield and staffing changes associated with the consolidation, the UW Soil & Forage Analysis Lab is unable to make changes to the soils database at this time. We do not feel that this will cause too much of a problem, because clients must submit soil map unit information to get recommendations by map unit. A majority of clients submitting soil samples to the UW Soil & Forage Analysis Lab provide only the soil series name and do not provide information about the soil map unit. The UW Soil & Forage Analysis Lab will provide DATCP certified labs with an updated nutrient recommendation computer program when an updated program is available.

Table 1. Soil maps units with densic designation. 2015 available water capacity (AWC) as determined with densic layers as a restriction. 2012 AWC will replace 2015 AWC until investigation of the densic layer's impact on soil yield potential is complete.

Map Unit Key	Area Symbol	County	Map Unit Symbol	Map Unit Name	Comp Name	Drainage class	2015 AWC (in. in top 60 in.)	2012 AWC (in. in top 60 in.)	% of county area	Reason for lower AWC in 2015
422943	WI001	Adams	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.92	1.3	26 to 40 in to densic material
422948	WI001	Adams	MbA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.61	0.3	20 to 25 in to densic material
426187	WI009	Brown	HoB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	8.01	0.7	15 to 24 in to densic material (dense gravelly loam till)
426188	WI009	Brown	HoC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	8.01	0.1	10 to 18 inches to densic material
426193	WI009	Brown	KhB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.58	12	26 to 40 in to densic material
426194	WI009	Brown	KhB2	Kewaunee silt loam, 2 to 6 percent slopes, eroded	Kewaunee	Well drained	5.0	8.58	5.9	20 to 29 in densic material
423576	WI027	Dodge	HnB	Hochheim silt loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.6	7.93	0.3	15 to 24 in to densic material (dense gravelly loam till)
423578	WI027	Dodge	HnD2	Hochheim silt loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.4	7.93	0.6	16 to 24 in to densic material
422238	WI029	Door	KhB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.90	4.1	26 to 40 in to densic material
422251	WI029	Door	McA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.49	1.7	20 to 25 in to densic material
425444	WI039	Fond du Lac	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	8.05	0	15 to 24 in to densic material
425445	WI039	Fond du Lac	HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.8	8.05	0.3	12 to 24 in to densic material
425446	WI039	Fond du Lac	HmC	Hochheim loam, 6 to 12 percent slopes	Hochheim	Well drained	5.0	8.05	0.1	10 to 18 inches to densic material
425447	WI039	Fond du Lac	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	8.05	0.8	10 to 18 inches to densic material
425448	WI039	Fond du Lac	HmD	Hochheim loam, 12 to 20 percent slopes	Hochheim	Well drained	4.3	8.05	0.2	12 to 24 in to densic material
425449	WI039	Fond du Lac	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	8.05	0.3	12 to 24 in to densic material

Map Unit Key	Area Symbol	County	Map Unit Symbol	Map Unit Name	Comp Name	Drainage class	2015 AWC (in. in top 60 in.)	2012 AWC (in. in top 60 in.)	% of county area	Reason for lower AWC in 2015
425450	WI039	Fond du Lac	HmE	Hochheim loam, 20 to 30 percent slopes	Hochheim	Well drained	4.3	8.05	0.3	12 to 24 in to densic material
425465	WI039	Fond du Lac	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.52	1.7	26 to 40 in to densic material
425466	WI039	Fond du Lac	KnB2	Kewaunee silt loam, 2 to 6 percent slopes, eroded	Kewaunee	Well drained	5.0	8.52	0.7	20 to 29 in densic material
425505	WI039	Fond du Lac	MaA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.27	0.6	20 to 25 in to densic material
423715	WI047	Green Lake	MaA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.35	0.2	20 to 25 in to densic material
422315	WI061	Kewaunee	KhB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.59	4.8	26 to 40 in to densic material
422330	WI061	Kewaunee	McA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.31	3.1	20 to 25 in to densic material
422561	WI087	Outagamie	KhB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.42	3.7	26 to 40 in to densic material
425969	WI089	Ozaukee	HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.8	8.17	5.3	12 to 24 in to densic material
425970	WI089	Ozaukee	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	8.17	1.6	10 to 18 inches to densic material
425971	WI089	Ozaukee	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	8.17	0.5	12 to 24 in to densic material
425980	WI089	Ozaukee	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.47	15.3	26 to 40 in to densic material
425990	WI089	Ozaukee	MaA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.48	6.5	20 to 25 in to densic material
422684	WI115	Shawano	McA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.31	0.1	20 to 25 in to densic material
423886	WI117	Sheboygan	HmB2	Hochheim silt loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.6	8.24	5.7	17 to 24 in todensic material
423888	WI117	Sheboygan	HmD2	Hochheim silt loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.4	8.24	1.6	16 to 24 in to densic material
423898	WI117	Sheboygan	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.56	13.2	26 to 40 in to densic material
423908	WI117	Sheboygan	MbA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.16	6.5	20 to 25 in to densic material
425728	WI131	Washington	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	7.98	2.3	15 to 24 in to densic material

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425729	WI131	Washington	HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.8	7.98	3.1	12 to 24 in to densic material
425730	WI131	Washington	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	7.98	7.2	10 to 18 inches to densic material
425731	WI131	Washington	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	7.98	3.3	12 to 24 in to densic material
425732	WI131	Washington	HmE	Hochheim loam, 20 to 30 percent slopes	Hochheim	Well drained	4.3	7.98	0.8	12 to 24 in to densic material
423962	WI137	Waushara	KnB	Kewaunee loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.2	8.63	0.8	20 to 40 in to densic material
423965	WI137	Waushara	MbA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.28	1	20 to 25 in to densic material
422778	WI139	Winnebago	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	7.80	0.6	15 to 24 in to densic material
422788	WI139	Winnebago	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.76	10.9	26 to 40 in to densic material
422856	WI600	Calumet and Manitowoc	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	8.07	4.4	15 to 24 in to densic material
422857	WI600	Calumet and Manitowoc	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	8.07	1.5	10 to 18 inches to densic material
422858	WI600	Calumet and Manitowoc	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	8.07	0.6	12 to 24 in to densic material
422867	WI600	Calumet and Manitowoc	KnB	Kewaunee loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.2	8.54	16.7	20 to 40 in to densic material
422880	WI600	Calumet and Manitowoc	MbA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.06	11.4	20 to 25 in to densic material
424047	WI601	Kenosha and Racine	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	8.08	0.1	15 to 24 in to densic material
424048	WI601	Kenosha and Racine	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	8.08	0.1	10 to 18 inches to densic material
424049	WI601	Kenosha and Racine	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	8.08	0	12 to 24 in to densic material
425850	WI602	Milwaukee and Waukesha	HmB	Hochheim loam, 2 to 6 percent slopes	Hochheim	Well drained	5.0	7.89	1.9	15 to 24 in to densic material
425851	WI602	Milwaukee and Waukesha	HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	Hochheim	Well drained	4.8	7.89	2.3	12 to 24 in to densic material

Map Unit Key	Area Symbol	County	Map Unit Symbol	Map Unit Name	Comp Name	Drainage class	2015 AWC (in. in top 60 in.)	2012 AWC (in. in top 60 in.)	% of county area	Reason for lower AWC in 2015
425852	WI602	Milwaukee and Waukesha	HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	Hochheim	Well drained	4.8	7.89	3.7	10 to 18 inches to densic material
425853	WI602	Milwaukee and Waukesha	HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	Hochheim	Well drained	4.3	7.89	1.6	12 to 24 in to densic material
425854	WI602	Milwaukee and Waukesha	HmE2	Hochheim loam, 20 to 30 percent slopes	Hochheim	Well drained	4.3	7.89	0.4	12 to 24 in to densic material
425863	WI602	Milwaukee and Waukesha	KnB	Kewaunee silt loam, 2 to 6 percent slopes	Kewaunee	Well drained	5.3	8.70	0.7	12 to 24 in to densic material
425873	WI602	Milwaukee and Waukesha	MaA	Manawa silt loam, 0 to 3 percent slopes	Manawa	Somewhat poorly drained	5.0	9.29	0.3	20 to 25 in to densic material