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Wet Conditions and Change in Soil Profile Nitrate

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Abstract
I wrote an ICM News article February 21, 2013, that provided a summary of fall soil profile nitrate sampling results following the 2012 corn harvest. As I cautioned in that and other articles, the amount of nitrate-N that might remain for a 2013 corn crop depends on springtime rainfall. Unfortunately, much of Iowa has received considerable precipitation since soils thawed, especially the eastern two-thirds of Iowa. The two maps of the Midwest region show the total precipitation and deviation from normal since March 7, 2013. Tile lines are flowing again, and nitrate in the profile will move with percolating water. Not all of the precipitation entered the soil, but the amounts received and comments from ISU Extension and Outreach field agronomists who have sampled soil profiles this spring for moisture content suggest the soil profiles in most of the state have been recharged. Therefore, we have lost the opportunity to use much of the profile nitrate carried over from last year. Also, this spring's precipitation after the dry fall reminds us why profile sampling for nitrate is not a routine practice in much of the Corn Belt.

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Wet Conditions and Change in Soil Profile Nitrate

By John Sawyer, Department of Agronomy

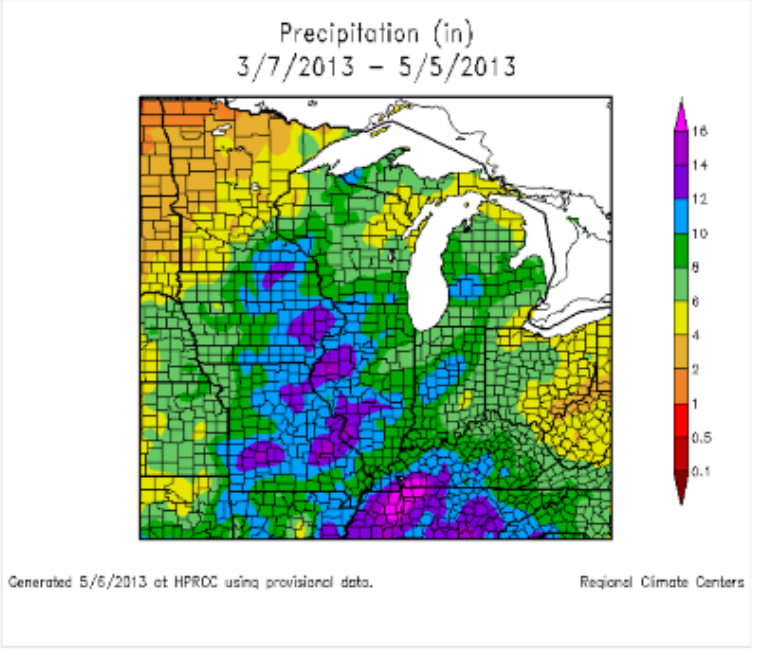
I wrote an ICM News article February 21, 2013, that provided a summary of fall soil profile nitrate sampling results following the 2012 corn harvest. As I cautioned in that and other articles, the amount of nitrate-N that might remain for a 2013 corn crop depends on springtime rainfall. Unfortunately, much of Iowa has received considerable precipitation since soils thawed, especially the eastern two-thirds of Iowa. The two maps of the Midwest region show the total precipitation and deviation from normal since March 7, 2013. Tile lines are flowing again, and nitrate in the profile will move with percolating water. Not all of the precipitation entered the soil, but the amounts received and comments from ISU Extension and Outreach field agronomists who have sampled soil profiles this spring for moisture content suggest the soil profiles in most of the state have been recharged. Therefore, we have lost the opportunity to use much of the profile nitrate carried over from last year. Also, this spring's precipitation after the dry fall reminds us why profile sampling for nitrate is not a routine practice in much of the Corn Belt.

Soil Profile Nitrate Changes Since Last Fall

Iowa State University Extension and Outreach field agronomists have been collecting soil profile samples this spring at the same locations as last fall. Unfortunately, with the spring weather not all sites could be sampled by the time of this article. However, with samples that have been collected so far, a few things are clear. One, samples collected before the large spring rains still had high nitrate-N amounts. Two, samples collected after the large spring rains show nitrate movement deeper into the profile. Three, samples collected after the large spring rains generally have less total profile nitrate-N than last fall. The following table has several examples. In most, but not all cases, the amount of nitrate-N decreased from fall to the spring sampling. The southwest Iowa samples were collected in early April (before the largest rains), with the rest collected in late April.

Preliminary profile nitrate-N in two or three foot sample.				
Area of Iowa	Soil Texture	Fall 2012	Spring 2013	Precipitation from Fall to Spring
		lb NO_3-N/acre		inch
NW	Silty clay loam	244	196	8.3
NW	Silty clay loam	72	96	8.3
NW†	Silty clay loam	84	112	9.2
NW†	Silty clay loam	224	140	6.2
NW†	Loam	192	68	8.0
NE	Loam	104	32	16.5
NE	Loam	164	64	15.5
NE	Silt loam	28	36	15.3
S	Silt loam	100	48	8.0
S	Silty clay loam	136	180	8.0
S	Silt loam	212	160	8.0
SW†	Silt loam	68	116	3.7
SW†	Silt loam	156	92	3.7
SW†	Silt loam	196	104	3.7
W	Silt loam	176	142	9.9
W	Silt loam	244	72	9.9

† Two foot depth.
Precipitation is from the fall soil sampling date to spring sampling date.



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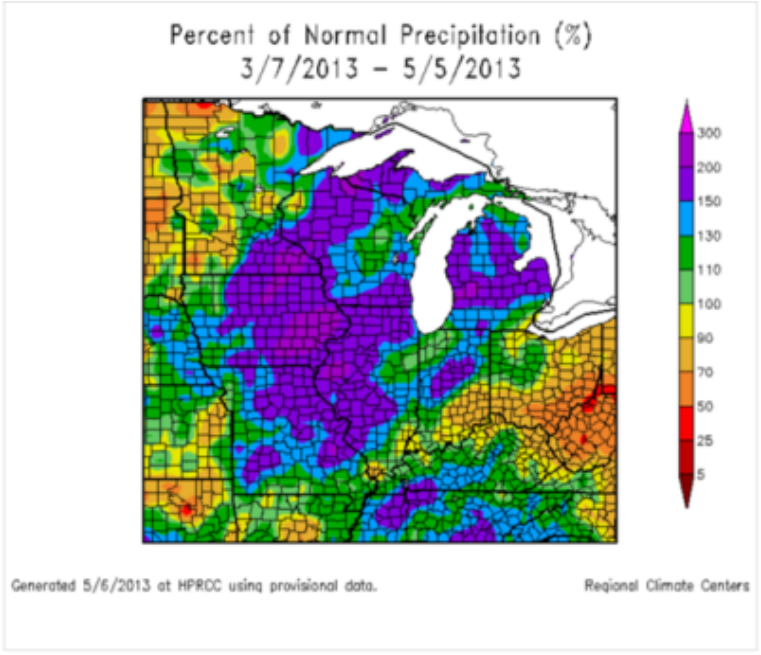

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As mentioned in previous articles, spring preplant profile sampling near crop planting can sometimes give the best indication of the amount of nitrate-N in the soil profile that might carry over to a corn crop. This certainly is the case this spring. If you still consider there could be elevated nitrate-N levels in fields from last year's drought-damaged corn, and the field will be planted to corn again this year, sampling is the best approach to determine if a nitrogen amount can be subtracted from the normal application rate. Profile sampling is most viable for the northwest area of Iowa where rainfall has been about normal this spring. You can refer to the previously mentioned ICM News article to find suggested sampling procedures.

Nitrogen Applications for 2013 Corn

From the soil nitrate samples collected so far this spring, it is clear that the carryover nitrate-N moved deeper into the profile or was lost to tile flow. With the cold soil temperatures this spring, it is unlikely nitrate was lost by denitrification. Reports from stream monitoring are indicating increased nitrate-N concentrations, as would be expected where tile drainage contributes significantly to stream flow. In many fields, the change in soil profile nitrate-N from last fall is quite dramatic, and unfortunately means less opportunity to account for nitrate-N carryover to 2013 corn crops. However, some fields still have carryover nitrate-N amounts that should be used to adjust nitrogen application rates. The precipitation maps are quite reminiscent of rainfall patterns of just a few years ago, and we know that in high rainfall years response to applied nitrogen is large, due to loss of soil derived mineralized N, carryover nitrate, and applied fertilizer and manure nitrogen. We'll see if this weather pattern continues for 2013. With the overall wet spring and decrease in carryover profile nitrate, consider near normal nitrogen application rates. See the Corn Nitrogen Rate Calculator for suggested rates.

John Sawyer is a professor in the Department of Agronomy with research and extension responsibilities in soil fertility and nutrient management. He can be contacted at jsawyer@iastate.edu.