

MANAGING NUTRIENTS AFTER A DROUGHT

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Introduction

There is a strong possibility that there will be excess (carryover or residual) N in the soil profile after the 2012 corn crop is harvested because the corn was too affected by drought to use all of the applied N. If soybean is the previous crop, there is a low likelihood of excess N remaining in the soil profile. Regardless of previous crop, some of the P and K applied last year will be available for the 2013 crop if the field was impacted by drought.

Nitrogen

Profitability of the 2013 crop may be improved by adjusting N application rates on fields where there is residual nitrate left over from the 2012 crop. Situations where there may be residual nitrate in drought impacted fields include: corn grown in 2012, manure applied after 2011 harvest, 2011 crop was a forage legume, and if fall and winter precipitation is below normal. Residual nitrate is not likely where the 2012 crop was soybean.

To adjust corn N applications in 2013 in fields where residual nitrate is likely, a preplant nitrate test (PPNT) can be taken prior to planting corn in the spring. The PPNT value should then be subtracted from the top end of the corn MRTN rate guidelines. For more information on the PPNT consult UWEX Publication A2809 *Nutrient application rates for field, vegetable, and fruit crops in Wisconsin*. Where a PPNT is not taken, but residual nitrate is expected, growers can adjust corn N rates by using the low end of the corn MRTN range. Another method that can be used to adjust 2013 N application rates is to take a N credit based on the formula below.

$$2013 \text{ N credit} = (\text{total N applied in 2012} - 2012 \text{ yield in bu/a}) \div 2$$

The decision to adjust 2013 N application rates should be based on the potential for residual N. In an effort to assess residual soil nitrate following the 2012 corn crop, a soil nitrate monitoring network was developed. Soil samples were collected from 0 to 1, 1 to 2, and in some cases, 2 to 3 feet deep in fields throughout the state after corn was harvested and after adequate rainfall occurred to allow sampling with depth. Table 1 provides a summary of residual nitrate amounts and field history. The amount of nitrate remaining in the soil profile is highly variable. For a spring PPNT, a background of 50 lb N/a is normal. Thus profile nitrate concentrations greater than 50 lb/a represent amounts of N that could potentially be credited to the 2013 crop. Coarser textured soils typically had lower amounts of residual N. Fields with higher N application rates and/or manure application tended to have higher residual N. These results suggest that growers should strongly consider taking soil samples for PPNT in the spring to adjust N applications to improve profitability.

Soil samples will also be collected from these fields in spring 2013. Information collected by the soil nitrate monitoring network can be found at: <http://uwlab.soils.wisc.edu/soilnitratemonitoring/>

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Phosphorus and Potassium

In some fields, it is likely that not all of the P and K fertilizer applied this past spring was used by the 2012 crop and will be available for the 2013 crop. Thus, recommended P and K applications may be reduced. Take credit for unused P and K using the following formula.

Nutrient credit =

$$2012 \text{ fertilizer applied} - \{2012 \text{ fertilizer applied} \times (\text{yield achieved} \div \text{expected yield})\}$$

Example K₂O credit:

- The expected corn yield used to determine 2012 fertilizer application rates was 200 bu/a
- The actual corn yield was 120 bu/a
- The K fertilizer application rate was 250 lb K₂O/a
- K₂O credit = $250 - \{250 \times (120 \div 200)\} = 100 \text{ lb K}_2\text{O/a}$

Issues with Fall 2012 Soil Sampling

Agronomists and growers have some concern about the effects of drought on soil test results.

Sampling very dry soil may provide erroneous soil test results for several reasons:

1. It is difficult to sample to the desired depth consistently.
2. The soil core does not stay intact, particularly very dry surface soil, and some of the soil is lost between taking the probe out of the ground and placing the sample in the bucket.
3. Soil test P and K may be lower with smaller differences for P and larger differences for K.
4. pH may be slightly lower because of salt build up with lack of rain.

Once rainfall has occurred, soils will begin to re-equilibrate and the effects of dry conditions on soil test P, K and pH will diminish. It is hard to provide an exact amount of rainfall that is needed to alleviate the effects of dry conditions on soil test results because it depends upon how dry the soil was, soil mineralogy, and likely other site specific conditions. However, if the soil is moist enough to push a probe into the ground to the desired sampling depth consistently, it is likely that the soil has re-equilibrated. Given all of the above, soil test results, particularly K, might be different than expected.

Summary

There is a possibility for excess nitrate to carryover into spring. Consider adjusting N application rates using a preplant nitrate test (PPNT) for corn if growing corn in 2013 and the 2012 crop was corn. In addition, consider moisture levels in the soil profile and the long-range precipitation outlook before selecting a N fertilizer rate. If soil moisture levels are low and less than average precipitation is predicted, consider using lower N application rates because lack of water will impact the corn yield more than somewhat lower N application rates.

If 2012 yield levels were substantially different than expected at planting, consider taking P & K credits. If fall 2012 soil test results are quite different than expected, consider sampling again in spring to make adjustments for 2013 or next fall to better plan for 2014.

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References

Laboski, C.A.M., and J.B. Peters. 2012. Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin. UWEX Publication A2809. p 88.

Table 1. Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	4	5	26	27	60	58	59	9
Town	Coloma	Grand Marsh	Strong's Prairie	Strong's Prairie	Delmar	Wheaton	Wheaton	Dorchester
County	Adams	Adams	Adams	Adams	Chippewa	Chippewa	Chippewa	Clark
Soil Series	Billett	Richford	Delton	Plainfield	Withee	Seaton	Meridian	Withee
Surface texture	sandy loam	loamy sand	sand	sand	silt loam	silt loam	loam	silt loam
2012 Corn Yield, bu/a	236	268	105	35	180	190	97	115
Total Fertilizer N rate applied, lb N/a	216	209	182	136	0	0	163	115
Manure applied	None	None	None	None	Dairy	Dairy	None	None
Rate of Manure	.	.	.	.	12000 gal/a	15 T/a	.	.
Precipitation†	22.6	25.8	.	.	15.4	15.4	15.4	19.25
Irrigation	11.6	12.7	.	.	.	.	.	.
Fall Sampling Date	11/16/12	11/16/12	11/1/12	11/1/12	11/19/12	11/19/12	11/19/12	11/1/12
Soil Nitrate								
0-1', lb N/a	0	2	12.4	9.2	40.8	44.4	24.4	68
1-2', lb N/a	15	0	24.8	7.2	22	22.4	8.8	35.2
2-3', lb N/a	3	2	.	.	.	.	.	103
0-2', lb N/a	15	2	37	16	63	67	33	.
0-3', lb N/a	18	3	.	.	.	.	.	9

† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

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Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	7	8	1	53	54	46	66	37
Town	Neillsville	Owen	Arlington	Arlington	Lewiston	Portage	Steuben	Cottage Grove
County	Clark	Clark	Columbia	Columbia	Columbia	Columbia	Crawford	Dane
Soil Series	Loyal	Withee	Plano	Plano	Yahara	Ossian	.	Plano
Surface texture	silt loam	silt loam	silt loam	silt loam	fine sandy loam	silt loam	.	silt loam
2012 Corn Yield, bu/a	160	150	133	168	135	150	.	198
Total Fertilizer N rate applied, lb N/a	165	136	209	166	144	96	.	140
Manure applied	None	None	None	None	None	Beef	.	None
Rate of Manure	.	.	.	.	.	20 T/a	.	.
Precipitation †	23.25	21.25	19.5	21.5	21.5	20.5	.	19
Irrigation	.	.	.	.	.	.	.	.
Fall Sampling Date	11/1/12	11/1/12	11/13/12	11/14/12	11/14/12	11/1/12	11/23/12	11/18/12
Soil Nitrate								
0-1', lb N/a	15.6	95.2	83	23.2	28.8	169.6	33.6	58.4
1-2', lb N/a	3.2	50.4	86	26.4	27.6	34.8	18.4	64
2-3', lb N/a	.	.	5	.	.	.	7.6	.
0-2', lb N/a	19	146	169	50	56	204	52	122
0-3', lb N/a	.	.	174	.	.	.	60	.

† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

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Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	38	55	2	3	57	34	33	61
Town	Cottage Grove	Roxbury	Sun Prairie	Waterloo	Clear Creek	Fairchild	Otter Creek	Lancaster
County	Dane	Dane	Dane	Dodge	Eau Claire	Eau Claire	Eau Claire	Grant
Soil Series	Salter	Seaton	Ringwood	Pella	Eleva	Seaton	Arenzville	.
Surface texture	silt loam	silt loam	silt loam	silty clay loam	Sandy loam	Silt loam	Silt loam	.
2012 Corn Yield, bu/a	135	4 T DM/a	96	184	80	135	202	.
Total Fertilizer N rate applied, lb N/a	170	163	200	205	70	128	92	.
Manure applied	None	None	None	None	None	None	Dairy	.
Rate of Manure	.	.	.	.	.	.	5000 gal/a	.
Precipitation †	19	11.6	21.3	21.3	15.4	15.4	15.4	.
Irrigation	.	.	.	.	.	.	.	.
Fall Sampling Date	11/18/12	11/18/12	11/13/12	11/13/12	11/14/12	11/14/12	11/14/12	11/16/12
Soil Nitrate								
0-1', lb N/a	48	65.6	17	148	43.6	9.6	28.8	31.6
1-2', lb N/a	56	52.8	128	74	21.6	0.4	16.4	5.6
2-3', lb N/a	.	.	40	20	.	.	.	.
0-2', lb N/a	104	118	144	221	65	10	45	37
0-3', lb N/a	.	.	184	242	.	.	.	.

† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

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Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	28	56	11	10	12	64	65	62
Town	Marquette	Moscow	Black River Falls	Hixton	Melrose	Darlington	Darlington	Shullsburg
County	Green Lake	Iowa	Jackson	Jackson	Jackson	Lafayette	Lafayette	Lafayette
Soil Series	Granky	Richwood	Sebbo	Merit	Seaton	.	.	.
Surface texture	loamy fine sand	silt loam	loam	silt loam	silt loam	.	.	.
2012 Corn Yield, bu/a	12 T/a	70	125	130	200	.	.	.
Total Fertilizer N rate applied, lb N/a	18	177	138	.	164	.	.	.
Manure applied	Dairy	None	None	None	None	.	.	.
Rate of Manure	45 T/a	.	.	.	.	.	.	.
Precipitation †	.	14.5	22.59	22.59	22.59	.	.	.
Irrigation	.	.	.	.	.	.	.	.
Fall Sampling Date	11/6/12	11/20/12	10/30/12	10/25/12	11/2/12	11/20/12	11/20/12	11/20/12
Soil Nitrate								
0-1', lb N/a	32.8	71.2	47.6	46	30	24	33.2	46.4
1-2', lb N/a	17.6	79.6	9.6	53.6	58	5.6	14.4	25.2
2-3', lb N/a	.	.	.	.	.	0	0.8	2.8
0-2', lb N/a	50	151	57	100	88	30	48	72
0-3', lb N/a	.	.	.	.	.	30	48	74

† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

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Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	63	17	16	18	20	19	36	35
Town	Shullsburg	Gleason	Merrill	Abbots-ford	Birnam-wood	Mosinee	Durand	Pepin
County	Lafayette	Lincoln	Lincoln	Marathon	Marathon	Marathon	Pepin	Pepin
Soil Series	.	Padus	Magroc	Loyal	Kennan	Mosinee	Dramen	Bear Pen
Surface texture	.	loam	silt loam	silt loam	sandy loam	sandy loam	loamy sand	silt loam
2012 Corn Yield, bu/a	.	.	150	.	15 T DM/a	.	60	220
Total Fertilizer N rate applied, lb N/a	.	45	3	.	.	95	122	180
Manure applied	.	Paper Mill Fiber Cake	Liquid	.	Liquid	.	None	None
Rate of Manure	.	unknown	5200 gal/a	.	6000 gal/a	.	.	.
Precipitation †	.	20	18	18	16	16	20	20
Irrigation	.	.	.	.	.	.	.	.
Fall Sampling Date	11/20/12	10/5/12	10/5/12	10/17/12	10/18/12	10/18/12	10/29/12	10/29/12
Soil Nitrate								
0-1', lb N/a	19.6	64	47.6	162.8	4.8	14.8	39.2	49.2
1-2', lb N/a	7.6	68.4	31.2	162.4	4.8	37.6	18.8	7.2
2-3', lb N/a	0.8
0-2', lb N/a	27	132	79	325	10	52	58	56
0-3', lb N/a	28

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† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	24	44	40	41	39	52	47-A
Town	Amherst	Erin Prairie	Arcadia	Eleva	Galesville	Kewaskum	West Bend
County	Portage	St. Croix	Trempealeau	Trempealeau	Trempealeau	Washington	Washington
Soil Series	Rosholt	Sattre	Seaton	Gale	Downs	Lamartine	Mayville
Surface texture	sandy loam	silt loam	silt loam	silt loam	silt loam	silt loam	silt loam
2012 Corn Yield, bu/a	10	197	140	105	170	120	123
Total Fertilizer N rate applied, lb N/a	30	64	0	100	111	138	112
Manure applied	Dairy	Turkey	Broiler	None	None	None	Dairy
Rate of Manure	8000 gal/a	18000 gal/a	5 T/a	.	.	.	4000 gal/a
Precipitation †	.	24	16.6	18.5	16.6	20.3	20.3
Irrigation	.	.	.	.	.	.	.
Fall Sampling Date	10/26/12	11/16/12	10/29/12	11/21/12	10/29/12	11/13/12	11/7/12
Soil Nitrate							
0-1', lb N/a	27.6	29.2	45.2	56	15.2	51.6	42
1-2', lb N/a	52.8	14	15.6	62.8	5.2	21.6	56
2-3', lb N/a
0-2', lb N/a	80	43	61	119	20	73	98
0-3', lb N/a

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† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	47-B	48	49	50	25	51	21	23
Town	West Bend	West Bend	Fremont	Fremont	Wautoma	Fremont	Cary	Hansen
County	Washington	Washington	Waupaca	Waupaca	Waushara	Winnebago	Wood	Wood
Soil Series	Mayville	Theresa	Tutsin	Borth	Richfield	Nebago	Kent	Elk mound
Surface texture	silt loam	silt loam	Loamy Sand	Sandy Loam	Loamy Sand	Fine Sand	silt loam	Sandy Loam
2012 Corn Yield, bu/a	123	90	160	220	15	100	26 T/a	12 T/a
Total Fertilizer N rate applied, lb N/a	112	151	218	218	146	94	0	0
Manure applied	Dairy	Dairy	None	None	None	Dairy	Dairy	Dairy
Rate of Manure	4000 gal/a	2000 gal/a	.	.	.	20 T/a	12000 gal/a	12000 gal/a
Precipitation †	20.3	20.3	21	21	.	19	.	.
Irrigation	.	.	.	.	.	.	.	.
Fall Sampling Date	11/7/12	11/7/12	11/7/12	11/7/201	10/26/12	11/7/12	10/22/12	10/22/12
Soil Nitrate								
0-1', lb N/a	247.2	54.4	14	114	10.4	78.4	54.4	61.2
1-2', lb N/a	68.8	64.4	0	50.8	5.2	46.4	4	56
2-3', lb N/a	.	.	0	16.8	.	35.6	.	.
0-2', lb N/a	316	119	14	165	16	125	58	117
0-3', lb N/a	.	.	14	182	.	160	.	.

† Amount of precipitation from the time soil thawed in spring until the fall soil sampling.

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Table 1 (continued). Field information and amount of nitrates in the soil profile at various locations in Wisconsin after corn harvest in 2012.

Location ID	6	22
Town	Marshfield	Richfield
County	Wood	Wood
Soil Series	Withee	Hiles
Surface texture	silt loam	silt loam
2012 Corn Yield, bu/a	157	51 T/a
Total Fertilizer N rate applied, lb N/a	159	165
Manure applied	None	None
Rate of Manure	.	.
Precipitation[†]	23.8	.
Irrigation	.	.
Fall Sampling Date	11/16/12	10/22/12
Soil Nitrate		
0-1', lb N/a	19	134
1-2', lb N/a	15	34
2-3', lb N/a	3	.
0-2', lb N/a	34	168
0-3', lb N/a	36	.

[†] Amount of precipitation from the time soil thawed in spring until the fall soil sampling.