

A Nitrogen Calculator Summary

A Minnesota Department of Health Study including project partners Emmons & Olivier Resources, Inc., Great Plains Institute, the Minnesota Rural Land Water Association, and with additional support from Dr. Kevin Maarick & Grant Moser of the University of Wisconsin, Stevens Point (Nitrate Leaching Calculator).

Land use comparisons of past (agricultural) and future (solar with prairie) and the use of nitrogen-based fertilizers. Corn, soybean, and rye crops have previously been farmed on the properties and were used in nitrogen calculator scenarios. The agricultural scenarios are being compared to a single scenario simulating future land use of solar arrays with native prairie being planted underneath the panels. The location for comparison was selected based on an area located within a drinking area (DWSMA) which is at-risk for high levels of nitrate contamination based on site geology and relation to drinking water area.

Inputs for each scenario are included based on a 14-acre field, located in Melrose, MN

1.) MANAGEMENT SCENARIO 1

Crop = Corn

Fertilizer (urea, potash, mesz) = 223 lb/acre
 Yield (poor yield) = 100 bushels/acre
 Field Organic Matter (OM) = < 2%

- vs. -

Crop = Bluestem Grass

Fertilizer (urea, potash, mesz) = 0 lb/acre
 Yield (poor yield) = 0 bushels/acre
 Field Organic Matter (OM) = < 2%

SCENARIO 1 (corn) - Potential Leachable Nitrogen			
Land Cover: Corn		Land Cover: Bluestem Grass	
Leachable N (lb/acre)	132.7	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	58.7	Nitrate-N (mg/L)	7.7
Scenario 1 Totals for Potential Leachable Nitrogen			
Leachable N (lb/acre)			65.8
Field-Weighted Nitrate-N (mg/L)			29.1

2.) MANAGEMENT SCENARIO 2

Crop = Corn

Fertilizer (urea, potash, mesz) = 223 lb/acre
 Yield (poor yield) = 100 bushels/acre
 Field Organic Matter (OM) = < 2%

- vs. -

Crop = Bluestem Grass

Fertilizer (urea, potash, mesz) = 0 lb/acre
 Yield (poor yield) = 0 bushels/acre
 Field Organic Matter (OM) = < 2%

SCENARIO 2 (soybeans) - Potential Leachable Nitrogen			
Land Cover: Soybeans		Land Cover: Bluestem Grass	
Leachable N (lb/acre)	190.5	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	84.3	Nitrate-N (mg/L)	7.7
Scenario 1 Totals for Potential Leachable Nitrogen			
Leachable N (lb/acre)			103.9
Field-Weighted Nitrate-N (mg/L)			46

3.) MANAGEMENT SCENARIO 3

Crop = Rye

Fertilizer (urea, potash, mesz) = 223 lb/acre
 Yield (poor yield) = 52 bushels/acre
 Field Organic Matter (OM) = < 2%

- vs. -

Crop = Bluestem Grass

Fertilizer (urea, potash, mesz) = 0 lb/acre
 Yield (poor yield) = 0 bushels/acre
 Field Organic Matter (OM) = < 2%

SCENARIO 3 (rye) - Potential Leachable Nitrogen			
Land Cover: Rye		Land Cover: Bluestem Grass	
Leachable N (lb/acre)	132.7	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	58.7	Nitrate-N (mg/L)	7.7
Scenario 1 Totals for Potential Leachable Nitrogen			
Leachable N (lb/acre)			75
Field-Weighted Nitrate-N (mg/L)			33.2

Full Input Summary for Corn vs. Bluestem Grass Management Scenario

Environmental Factors and Other Conditions	Corn	Bluestem Grass
<p>Soil</p> <p>Soil Organic Matter Content [?] <input type="text" value="<2%"/></p> <p>Soil Drainage Classification [?] <input type="text" value="Well drained"/></p>	<p>Crop Information</p> <p>Crop Type [?] <input type="text" value="Corn"/></p> <p>Harvest Material / Units [?] <input type="text" value="Grain, shelled (Bushels)"/></p> <p>Yield [?] <input type="text" value="100"/></p> <p>Acres [?] <input type="text" value="14"/></p>	<p>Crop Information</p> <p>Crop Type [?] <input type="text" value="Bluestem"/></p> <p>Harvest Material / Units [?] <input type="text" value="Early bloom (Tons)"/></p> <p>Yield [?] <input type="text" value="0"/></p> <p>Acres [?] <input type="text" value="14"/></p>
<p>Change in N Storage</p> <p>Change in Inorganic N [?] <input type="text" value="0"/></p> <p>Change in Organic N [?] <input type="text" value="-7.5"/></p>	<p>Nitrogen Inputs</p> <p>Fertilizer</p> <p>Form [?] <input type="text" value="Urea / Soil pH < 7"/></p> <p>Application Method [?] <input type="text" value="Surface Broadcast"/></p> <p>Rate (lbs N/acre) [?] <input type="text" value="223"/></p> <p>Manure and Previous Year Manure Credits</p> <p>Manure [?] <input type="text" value="0"/></p>	<p>Nitrogen Inputs</p> <p>Fertilizer</p> <p>Form [?] <input type="text" value="Urea or UAN / Soil pH > 7"/></p> <p>Application Method [?] <input type="text" value="Surface Broadcast"/></p> <p>Rate (lbs N/acre) [?] <input type="text" value="0"/></p> <p>Manure and Previous Year Manure Credits</p> <p>Manure [?] <input type="text" value="0"/></p>
<p>Precipitation</p> <p>Nitrate-N Concentration (mg/L) [?] <input type="text" value="0.5"/></p> <p>Annual Total (inches) [?] <input type="text" value="32"/></p>	<p>Cover Crop Residue (lbs N/acre)</p> <p>Did you plant a cover crop?</p> <p>[?] <input checked="" type="radio"/> No <input type="radio"/> Yes</p>	<p>Cover Crop Residue (lbs N/acre)</p> <p>Did you plant a cover crop?</p> <p>[?] <input checked="" type="radio"/> No <input type="radio"/> Yes</p>
<p>Irrigation</p> <p>Is this field irrigated?</p> <p>[?] <input checked="" type="radio"/> No <input type="radio"/> Yes</p>		

NITROGEN BALANCE

Crops & Environmental Factors

	Scenario 1	Scenario 2
Crop Type	Corn	Bluestem
N Content	0.735 Per Bushel	22.5 Per Ton
Yield	100	0
Acres	14	14
Soil Org Matter %	<2%	<2%
Soil Drainage	Well drained	Well drained
Recharge Estimate (in.)	10	10
Irrigation Applied (in.)	0	0

Inputs (lbs N/acre)

	Scenario 1	Scenario 2
Fertilizer	223	0
Manure	0	0
Symbiotic N fixation (legumes)	0	0
Irrigation	0	0
Precipitation	3.6	3.6
Dry Deposition	3.6	3.6
Crop Seed	0	0
Nonsymbiotic Fixation	3	3
Total N Input Per Acre	233.2	10.2

Outputs (lbs N/acre)

	Scenario 1	Scenario 2
Harvested material (Main Crop)	70	0
Ammonia Loss	33.4	0
Denitrification	13.8	0.4
Erosion	0	0
Runoff	0	0
Miscellaneous Gaseous	2.3	0.1
Ammonia at Senescence	3.5	0
Total N Output Per Acre	123	0.5

Change in N Storage (lbs N/acre)

	Scenario 1	Scenario 2
Change in Inorganic N	0	0
Change in Organic N	-7.5	-7.5
Total Storage Change	-7.5	-7.5

Cover Crop Residue (lbs N/acre)

	Scenario 1	Scenario 2
Crop Type	1	
N Content	0	0
Yield	0	0
Total Cover Crop Residue	0	0

Potential Leachable Nitrogen (Corn vs. Bluestem)			
Land Cover: Corn		Land Cover: Bluestem Grass	
Leachable N (lb/acre)	132.7	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	58.7	Nitrate-N (mg/L)	7.7
Totals for Field:			
Leachable N (lb/acre)			65.8
Field-Weighted Nitrate-N (mg/L)			29.1