

Using the Quick Test to Measure Nitrate in Soil and Water

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Regulations on N management have become stricter

Table C.1-3. Compliance Dates for Nitrogen Discharge Targets and Limits

Compliance Pathway 1 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) + A_{IRR} - R =$	Compliance Date		
	Target	500	12/31/2023
Target	400	12/31/2025	
Limit	300	12/31/2027	
Limit	200	12/31/2031	
Limit	150	12/31/2036	
Limit	100	12/31/2041	
Limit	50	12/31/2051	

Reductions in fertilizer N will require crediting for all sources of plant available nitrogen

- Residual mineral N in soil (Nitrate and ammonium)
- N in irrigation water
- Nitrogen mineralization from soil, amendments, and previous crop residues

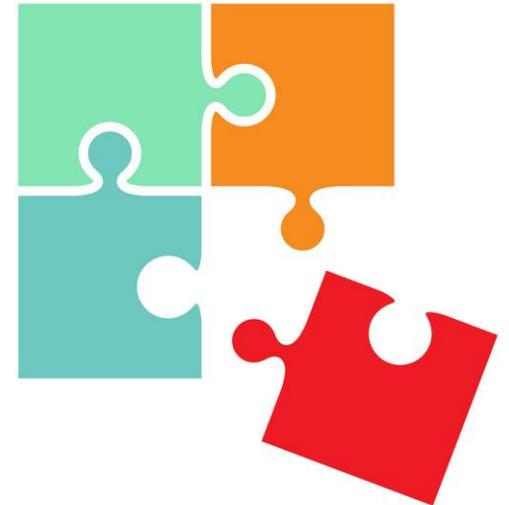
soil



water



crop residue

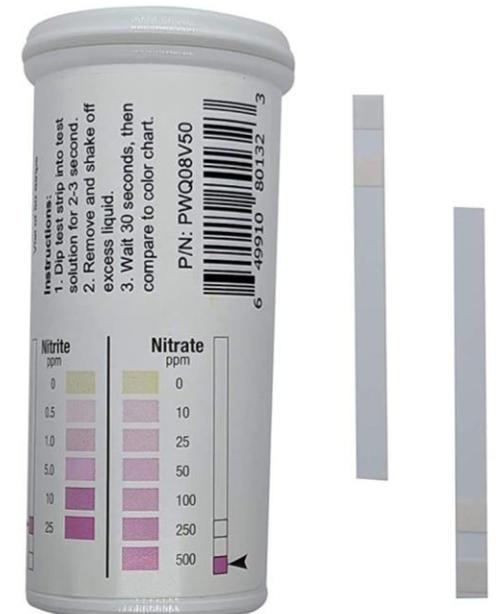


The Nitrate Quick Test can help you estimate how much soil mineral N is available to your crop



Materials

1. 50 ml polyethylene centrifuge test tubes
2. Test tube rack
3. Nitrate test strips (Mquant, Bartovation)
4. 0.01 M Calcium Chloride dihydrate extractant (5.6 g CaCl to 1 gal distilled water)
5. Soil probe
6. 1-gallon buckets
7. Cooler and blue ice

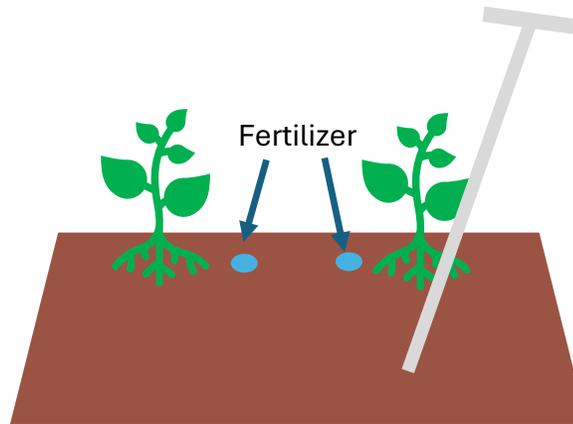
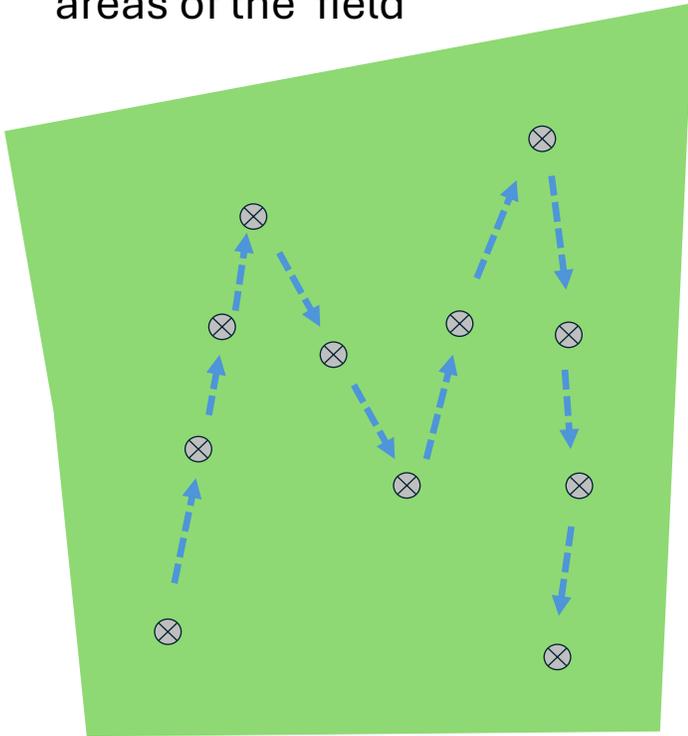


Use a soil probe and a bucket for each depth

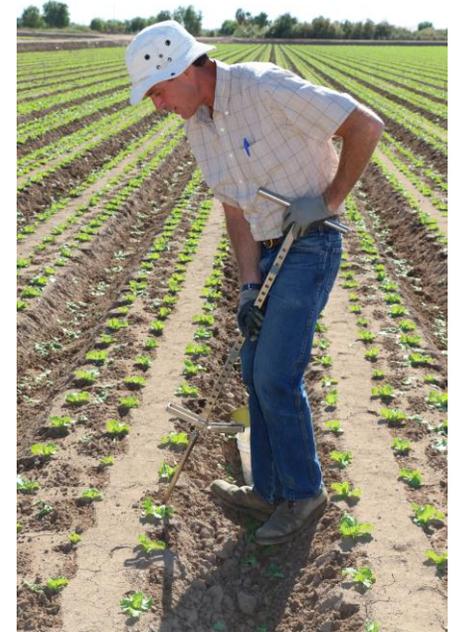


Collecting a representative soil sample for the nitrate quick test

Collect a minimum of 10 to 20 cores representing all areas of the field



Soil probe inserted next to seedline, but angled to under the placement of fertilizer



Soil nitrate quick test procedure

1. Mix subsamples into one uniform composite soil sample
2. Slowly add soil to the tube to raise the solution (CaCl) level to the 40 ml mark (10 ml of soil volume)
3. Tighten cap onto the tube
4. Shake the sample for at least 2-3 minutes (consistent with shake time)
5. Wait for the sediment to settle and the supernatant to become clear
6. Dip test strip into the **clear** supernatant and **start timer**
7. At color development time (1 minute or 30 seconds depending on brand) quickly compare the color of the strip (nitrate pad) with the color key on the container to estimate the concentration of **nitrate** in solution.
8. Convert nitrate concentration to nitrate-N concentration in dry soil using the factors in the table (see blog article)
9. Convert nitrate-N to lbs of N per 1 ft of depth by multiplying by a factor of 4*

* Can adjust the factor if you have information about the soil texture or soil bulk density.

Tips on using the soil nitrate quick test

- Sample as close as possible to the date of a planned fertilizer application
- Use separate 1-gallon buckets for each sample depth
- Discard top inch of soil (salts tend to accumulate near the surface)
- Sieve sub samples with a screen to create a uniform soil sample
- For clay soils you may need to pitch soil from individual cores to get a representative sample
- Add the correct volume of soil to the tube (10 ml: raise solution level to the 40 ml mark)
- After wetting the test strip, blot off extra solution by touch it to a paper towel
- For some soils textures (clay) you may need to wait several hours or overnight for the supernatant to become clear
- Accurately time the development time of the strips (1 minute, 30 seconds depending on brand of strips) using the timer on your phone
- Store the nitrate strips in the refrigerator or carry them in a cooler with blue ice
- Use standard nitrate solutions to periodically check the accuracy of the strips

Techniques for selecting a uniform subsample for testing

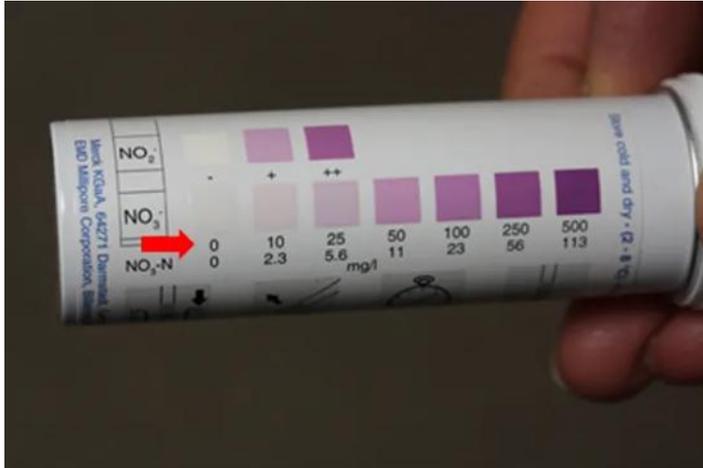
Sieving



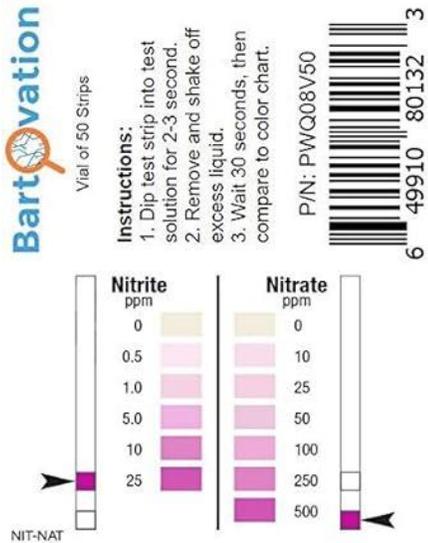
Pinch method



Convert the strip reading to nitrate-N concentration in the soil



soil texture	correction factor	
	Moist	Dry
sand	2.3	2.6
loam	2.0	2.4
clay	1.7	2.2



Nitrate strip reading (ppm NO_3) \div correction factor = ppm NO_3 -N in dry soil

Example:

1. Moist sandy soil
2. strip reading is 50 ppm Nitrate
3. 50 ppm Nitrate \div 2.3 = 21.7 ppm Nitrate-N

There are several brands of nitrate strips to choose from



Hach Aquachek



LaMotte Insta-Test



Bartovation

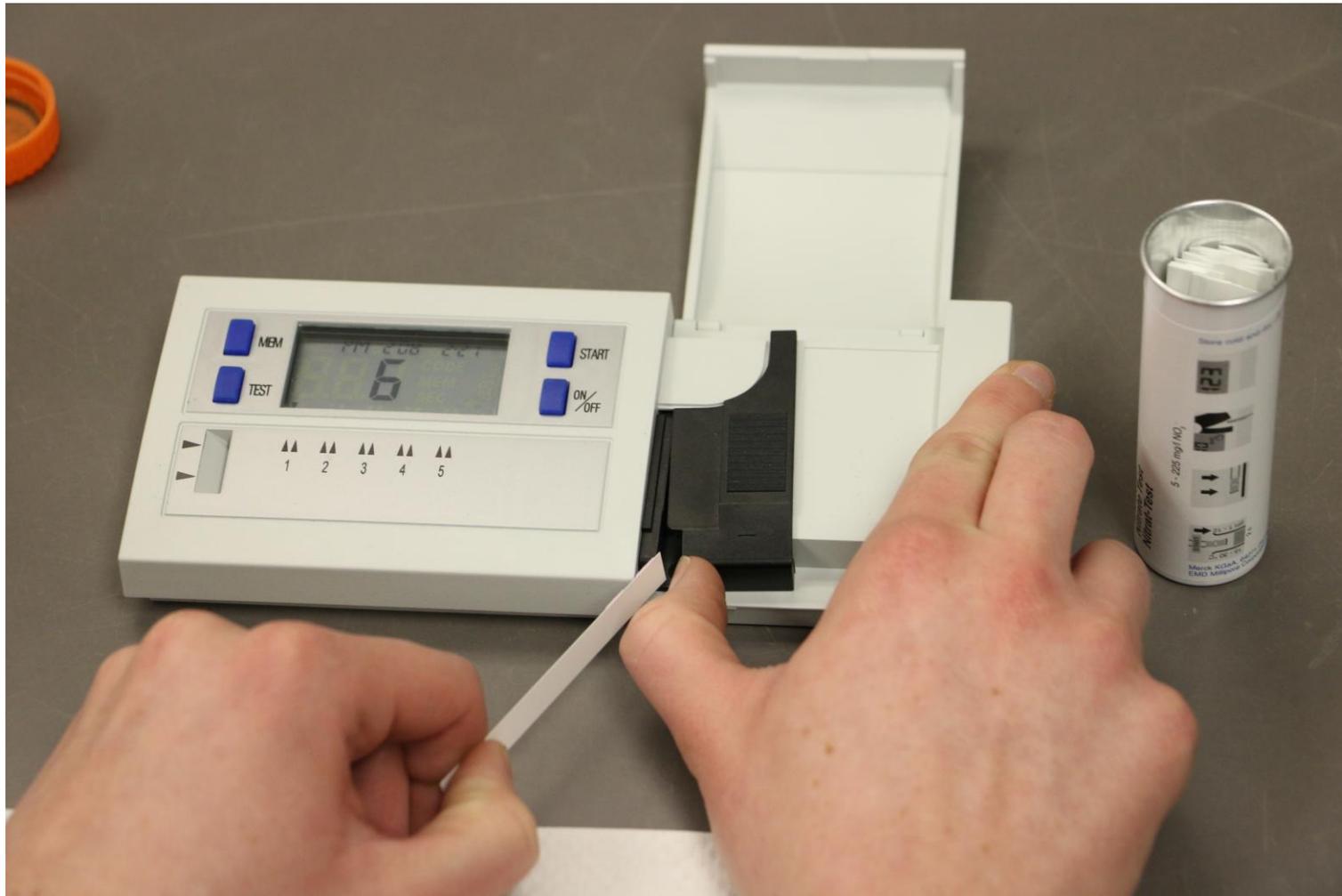


WaterWorks



Mquant

The reflectoquant reader can provide an accurate reading of the nitrate test strip



Converting from parts per million nitrogen to lbs of nitrogen per acre

Rule of thumb: multiply ppm soil nitrate-N value by a factor of 4

Example: 22 ppm nitrate-N $\times 4 = 88$ lbs N/acre in the 0 to 1 foot depth

Conversion factors from ppm soil nitrate N to lbs N/acre

soil texture	Bulk density g/cc	soil sample depth	
		1 ft	0.5 ft
sandy loam	1.6	4.3	2.2
loam	1.5	4.1	2.1
clay loam	1.3	3.5	1.8
clay	1.2	3.3	1.7

Another source of plant available nitrogen is irrigation water



**Well water
(2 to 80 ppm Nitrate-N)**



**Recycled water
(15 to 35 ppm N as Ammonium + Nitrate)**

Nitrate test strips can be use to evaluate N concentration of irrigation water after an irrigation:



Determine average nitrate concentration in irrigation water



Calculating N applied from irrigation water:

Applied water (inches) x NO₃-N conc. (ppm) x 0.227

= lbs N/acre

Example:

- ✓ Applied water = 2 inches
- ✓ Nitrate-N concentration = 30 ppm

2 inches x 30 ppm NO₃-N x 0.23

= 13.8 lbs N/acre

Crediting for N in water and residual soil N

Soil Nitrate



Current N status of Soil

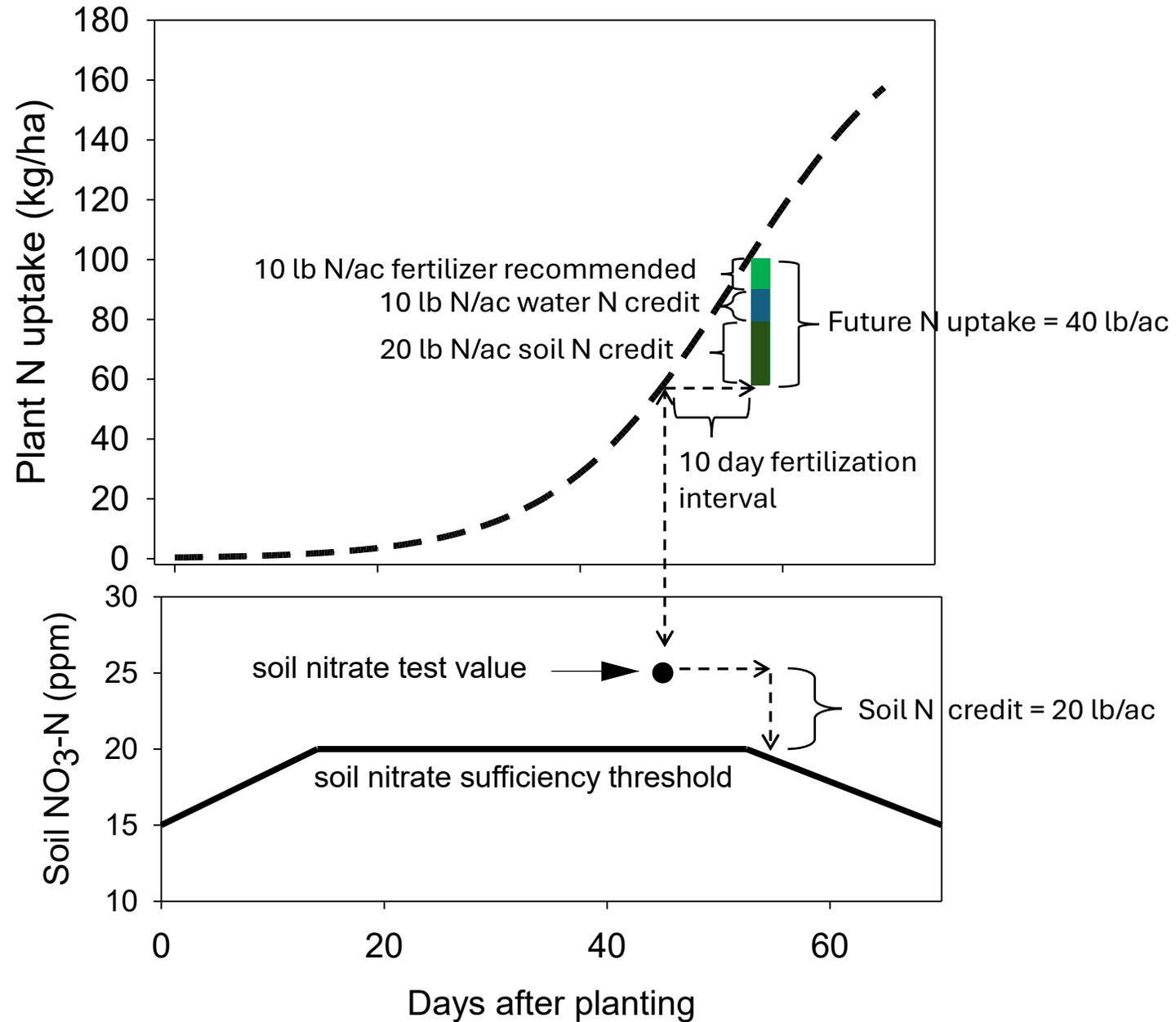
N in water



+

Future N contribution

Determining how much N fertilizer to apply



CropManage can help with nitrogen fertilizer decisions



Edit Fertilization Event

Event Date * 1/23/2025

Fertilizer Type * 20-0-0-5 - Wet Fertilizer Details

Days To Next Fertilization * 14

Soil Sample * 1/23 - 15.79 ppm N

Choose the soil sample date used to calculate this recommendation

Recommendation lbs N/acre **Fertilizer Unit**

12.66 gal/acre

Recommendation Summary

Include N Contribution From Water in Recommendation

Cancel **Create**

Edit Fertilization Event

Blending of Water from Various Water Sources

Water Source	N Concentration	% Used for Planting
Well 1	25 ppm	50 %
Well 2	15 ppm	50 %
Average N Concentration	20 ppm	100% ✓

Recommended Irrigation Amount Inches **Hours**

4.2 hours ⓘ

Calculate Contribution for: 4.2 hours

N Contribution from Water 0.91 gal/acre ⓘ

Cancel **Update Recommendation With N Contribution**

Edit Fertilization Event

Event Date * 1/23/2025

Fertilizer Type * 20-0-0-5 - Wet Fertilizer Details

Days To Next Fertilization * 14

Soil Sample * 1/23 - 15.79 ppm N

Choose the soil sample date used to calculate this recommendation

Recommendation lbs N/acre **Fertilizer Unit**

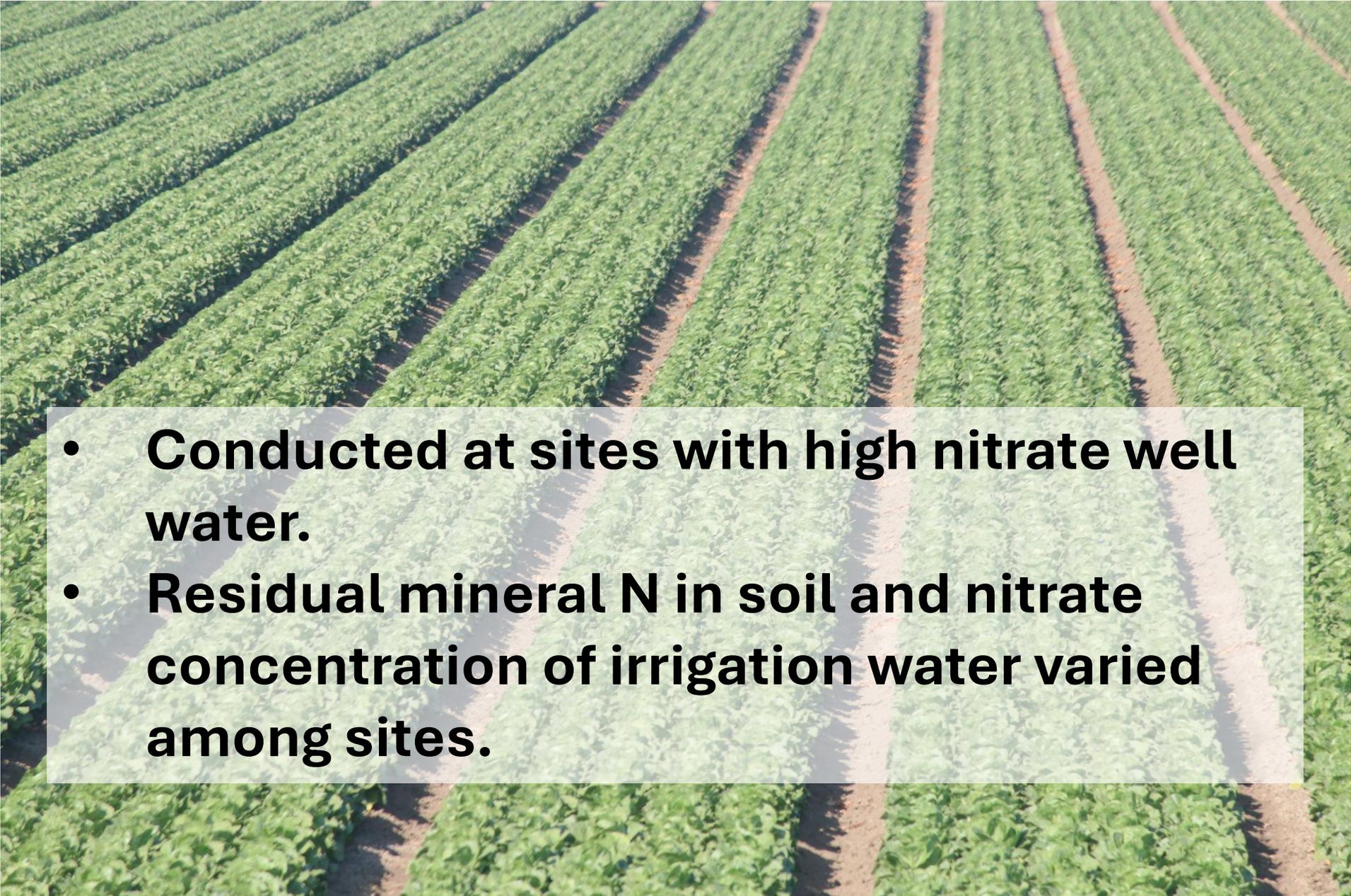
11.75 gal/acre

Recommendation Summary

N Contribution from Water: 0.91 gal/acre ⓘ Edit Clear

Cancel **Create**

Commercial Field Trials 2014 - 2019

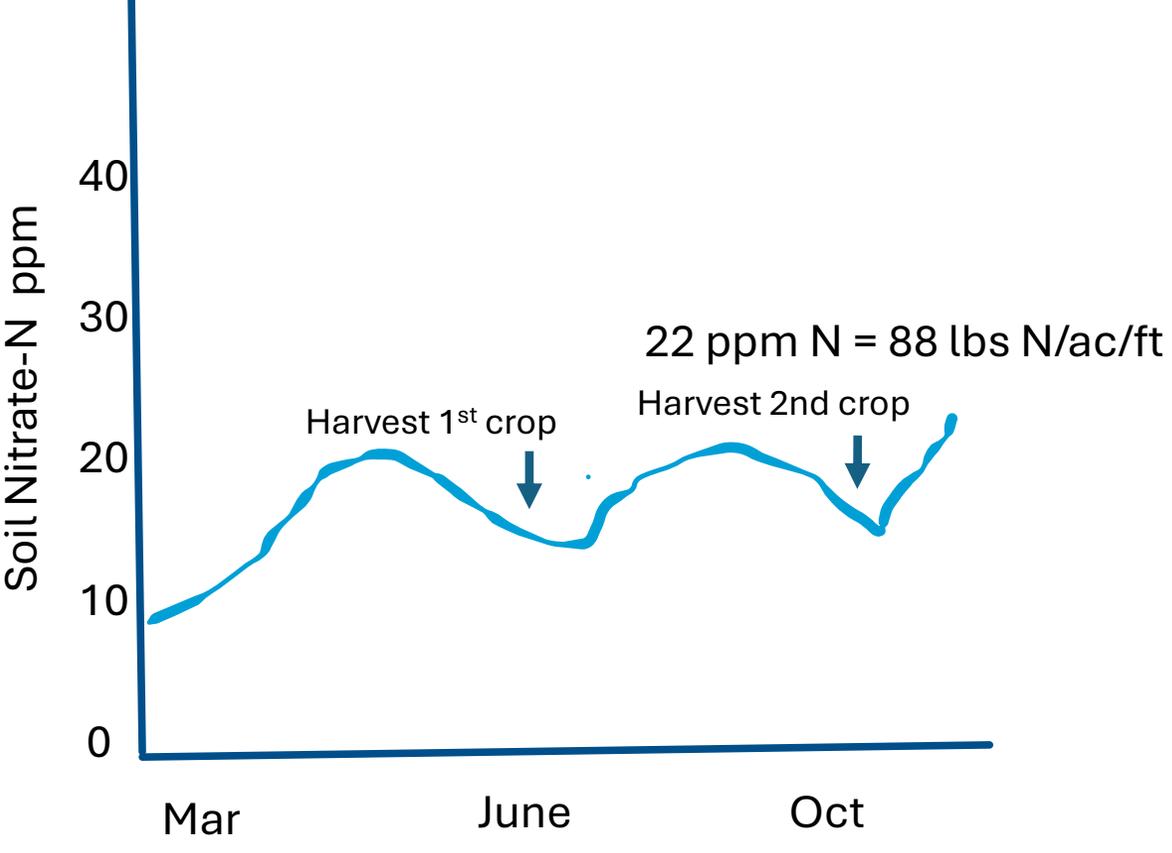
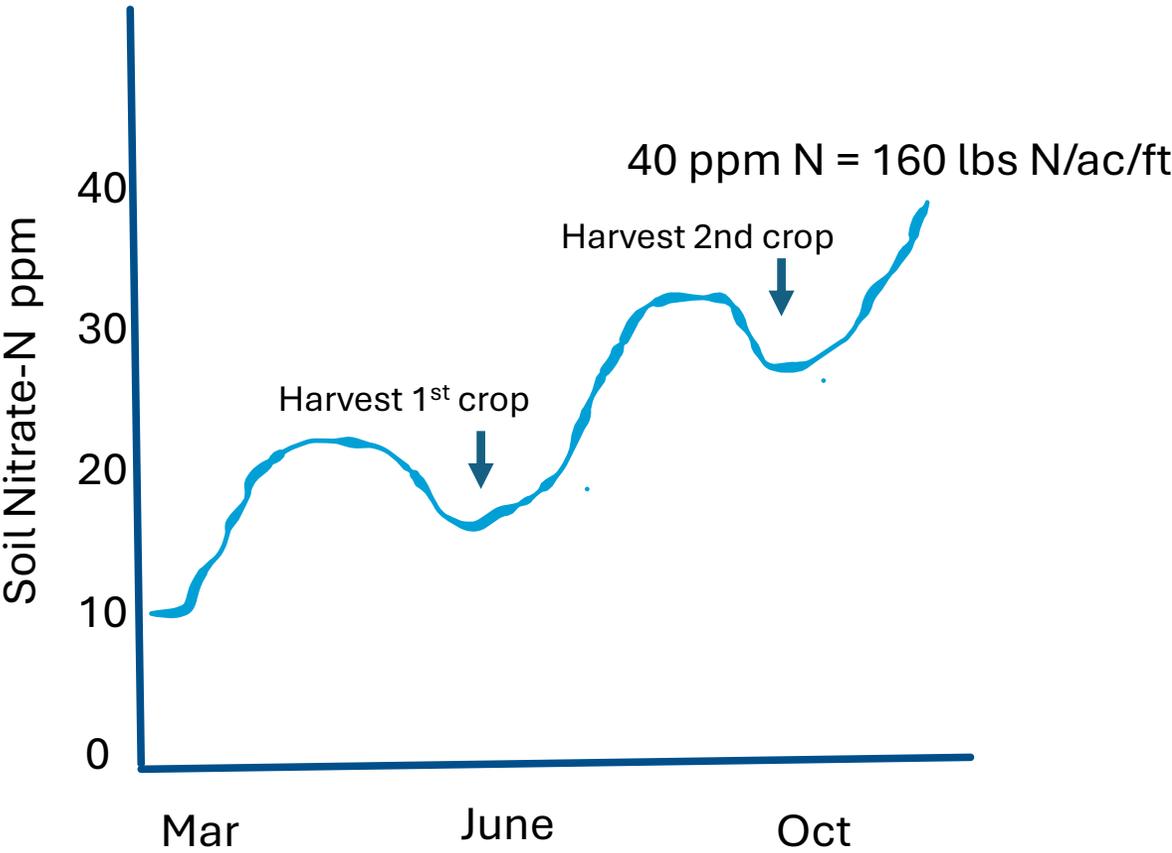


- **Conducted at sites with high nitrate well water.**
- **Residual mineral N in soil and nitrate concentration of irrigation water varied among sites.**

How much fertilizer could potentially be saved by crediting N in water and soil?

crop	year	treatment	nitrate-N	N	N	Commercial Yield	Relative yield	Final soil N
			conc. water	applied in water	applied in fertilizer			
			ppm	---- lbs N/ac	----	lbs/ac	%	ppm
1 iceberg lettuce	2014	CM	37	19	27	20655	107	11
		GR	37	19	54	19364	100	15
2 iceberg lettuce	2014	CM	31	81	118	11334	128	11
		GR	31	81	250	8861	100	26
3 broccoli	2015	CM	11	35	118	7746	96	.
		GR	11	35	206	8068	100	.
4 iceberg lettuce	2016	CM	32	36	140	54692	102	8
		GR	32	45	154	53573	100	24
5 iceberg lettuce	2016	CM	84	101	32	41928	99	18
		GR	84	120	62	42387	100	12
6 iceberg lettuce	2017	CM	80	90	7	44758	108	34
		GR	80	68	63	41526	100	61
7 iceberg lettuce	2017	CM	42	78	118	27185	121	29
		GR	42	85	155	22511	100	46
9 romaine lettuce	2017	CM	26	26	128	40515	110	16
		GR	26	27	120	36832	100	13
8 iceberg lettuce	2018	CM	66	145	92	40014	96	15
		GR	66	115	155	41496	100	25
10 romaine lettuce	2019	CM	17	15	129	27177	105	12
		GR	17	13	191	25789	100	31
Average		CropManage	43	63	91	31600	107	17
		Grower Practice	43	61	141	30041	100	28

Evaluating nitrate in the soil profile post-season can help you reflect on how efficiently N was managed



Summary

Testing soil and water for nitrate-N can account for available sources of nitrogen for your crops and reduce fertilizer requirements.

Nitrate test strips can be used to determine nitrate concentration in soil and irrigation water.

Soil nitrate represents the N already present in the soil and nitrate in irrigation water represents N that will be applied in the future.

Please call us if you have any questions on how to use or interpret the soil nitrate quick test!

A wide-angle photograph of a rural landscape. In the foreground, a large, weathered barn with a green roof stands on the left. To its right, a line of farm equipment, including tractors and trailers, is parked. The middle ground is dominated by a vast, flat expanse of agricultural fields, some of which are planted in rows of crops. A dirt road or path runs vertically through the center of the fields. In the background, rolling hills and mountains are visible under a clear blue sky. The overall scene is bright and sunny, with a clear horizon line.

Thank You!