

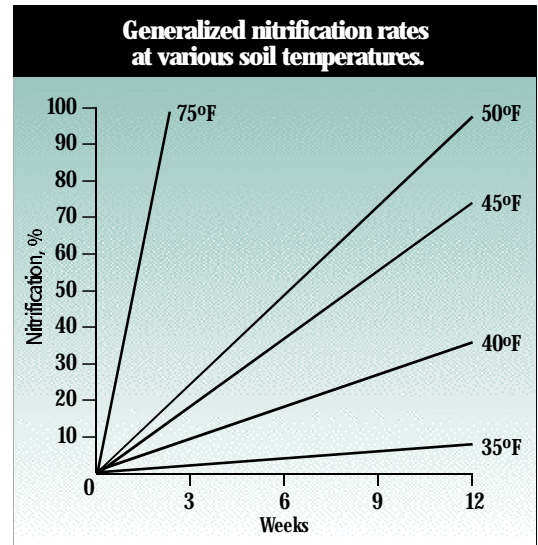
# Using the Nitrate Present in Soil and Water in Your Fertilizer Calculations



The information contained in this Fact Sheet is intended to help the grower reduce the amount of nitrogen fertilizer applied. A determination that irrigation water or soil is "high in nitrate" does not necessarily mean that it contains enough nitrate-nitrogen to eliminate the need for additional nitrogen fertilizer. However, by using this Fact Sheet, the grower may be able to replace a portion of the fertilizer normally applied with the nitrate-nitrogen already present in the soil or water.

## N Availability

- Nitrate is the form of nitrogen used in a crop's growth cycle.
- Nitrogen that starts as urea or ammonia must go through a conversion to nitrate before it is available to the crop.
- Hydrolysis converts urea to ammonia in 3-5 days.  
**hydrolysis** \hi-drā-lə-səs\ *n*: a chemical decomposition involving the addition of the elements of water.
- Nitrification converts ammonia to nitrate at a rate that depends on soil temperature (graph).  
**nitrification** \ni-trə-fə-kā-shən\ *n*: the oxidation (as by bacteria) of ammonium salt to nitrite and then to nitrate.



Conversion Factors In Water:		
1 gallon of water	<i>weighs</i>	8.333 lbs
1 cu. ft. of water	<i>equals</i>	7.481 gallons
<b>When You Know</b>	<b>Multiply By</b>	<b>To Find</b>
acre-inches	27,150	gallons
acre-feet	325,850	gallons
<b>When You Know</b>	<b>Divide By</b>	<b>To Find</b>
gallons	27,150	acre-inches
gallons	325,850	acre-feet
<b>When You Know</b>	<b>Multiply By</b>	<b>To Find</b>
ppm NO <sub>3</sub>	0.226	ppm NO <sub>3</sub> -N
ppm NO <sub>3</sub> -N	4.43	ppm NO <sub>3</sub>

Conversion Factors In Soil:		
<i>When You Know</i>	<i>Multiply By</i>	<i>To Find</i>
ppm NO <sub>3</sub> -N	2	lbs N/acre (6" sample)
ppm NO <sub>3</sub> -N	4	lbs N/acre (12" sample)
ppm NO <sub>3</sub>	0.452	lbs N/acre (6" sample)
ppm NO <sub>3</sub>	0.904	lbs N/acre (12" sample)

Equivalents:		
1 mg/L	equals	1 ppm
1 unit N	equals	1 lb N/acre

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All of the nitrate-nitrogen present in the soil or water is in a usable form; there are no inhibitors to plant uptake.

Percent Nitrogen Forms in Standard Nitrogen Solutions <sup>1</sup>					
	Nitrate	Ammonia	Urea	lbs N/gal <sup>1</sup>	lbs/gal <sup>2</sup>
CAN-17	11.6	5.4		2.15	12.60
AN-20	10.0	10.0		2.10	10.50
UREA-20			20.0	1.87	9.33
UAN-28	7.0	7.0	14.0	2.98	10.66
UAN-32	7.8	7.8	16.4	3.54	11.06

<sup>1</sup>pounds of N per gallon of solution at 60°F

<sup>2</sup>material weight of solution at 60°F

# Using the Nitrate Present in Soil and Water in Your Fertilizer Calculations

Nitrogen Fertilizer Requirements of Cool-Season Vegetable Crops Grown Under California Conditions <sup>1</sup>				
Crop	Approximate Nitrogen Requirements (lb/acre-week)			
Broccoli <sup>1</sup>	Early Growth 5-15 <sup>2</sup>	Mid Season 10-20	Button Formation 15-30	Head Development 10-20
Cabbage	Early Growth 5	Mid Season 35	Curling 40	Heading 55
Celery	Early Growth 5	Mid Season 15	Late Season 25	
Garlic	Early Growth 5	Mid Season 10	Bulbing 15	
Lettuce <sup>1</sup>	Early Growth 5-10	Cupping 10-20	Head Filling 15-30	
Onion	Early Growth 5	Mid Season 15	Bulbing 10	

<sup>1</sup> Values were determined when fertilizer was added through the drip irrigation system and should serve as a general guide, with fertilizer additions being subject to soil/tissue N O<sub>3</sub>-N levels.

<sup>2</sup> Higher values represent N needs in low residual N soils and/or under rapid growth (high temperature) conditions.

Conversion Table for Nitrate in Irrigation Water			
Nitrate (NO <sub>3</sub> -N) ppm	Nitrate (NO <sub>3</sub> ) ppm	lb N/acre-inch	lb N/acre-foot
N (NO <sub>3</sub> -N)	NO <sub>3</sub> = N x 4.43	lbs N/ac-in = N x 0.23	lbs N/ac-ft = N x 2.71
10	44	2	27
20	89	5	54
30	133	7	81
40	177	9	108
50	221	11	136
60	266	14	163
70	310	16	190
80	354	18	217
90	398	20	244
100	443	23	271
120	531	27	325
140	620	32	380
160	708	36	434
180	797	41	488
200	885	45	542
225	997	52	610
250	1107	56	678

The USEPA drinking water maximum contaminant level (MCL) for NO<sub>3</sub>-N is 10 ppm; the MCL for NO<sub>3</sub> is 45 ppm.

**Remember to take into account the efficiency of your irrigation system when crediting irrigation water N.**

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<sup>i</sup> Western Fertilizer Handbook: Second Horticulture Edition. California Fertilizer Association.

<sup>ii</sup> Production Guide: Nitrogen and Water Management for Coastal Cool-Season Vegetables, 1998. G.S. Pettygrove, S.R. Grattan, B.R. Hanson, T.K. Hartz, L.E. Jackson, T.R. Lockhart, K.F. Schulbach, and R. Smith. Publication 21581, Division of Agriculture and Natural Resources, University of California, Oakland CA. This publication can be ordered from ANR Communication Services at 800-994-8849 or on the Internet at <http://commserv.ucdavis.edu/ucce/>.