

La Fertilidad del Suelo en Cultivo de Vegetales

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WSU-Prosser

WATER

GIS AND
MAPPING

NUTRIENTS

TESTING

CHEMISTRY

SOILS

PLANTS





Los Nutrientes esenciales de la planta derivado del suelo

- Macronutrientes
 - Nitrógeno (N)
 - Fosforo (P)
 - Potasio (K)
 - Azufre (S)
 - Calcio (Ca)
 - Magnesio (Mg)
- Micronutrientes
 - Boro (B)
 - Cloro (Cl)
 - Cobre (Cu)
 - Hierro (Fe)
 - Manganeso (Mn)
 - Molibdeno (Mo)
 - Zinc (Zn)



Los Nutrientes Esenciales de la Planta Derivado del Suelo

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 - **Manganeso (Mn)**
 - **Molibdeno (Mo)**
 - **Zinc (Zn)**

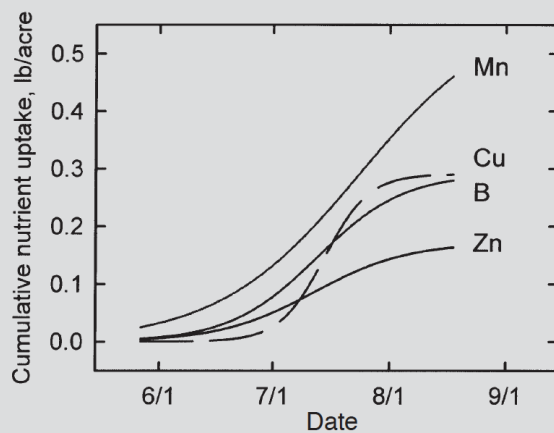
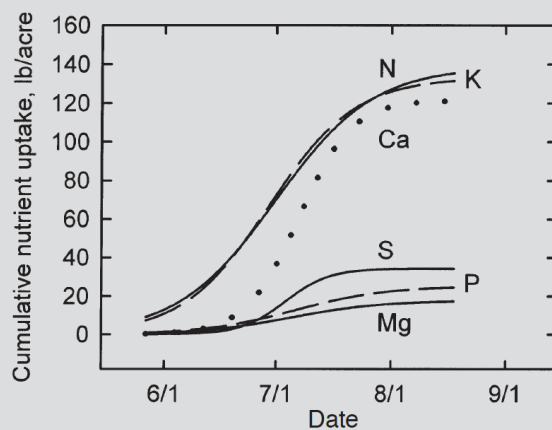
La forma de determinar la necesidad del nutriente

- El requisito del cultivo
- La oferta del suelo



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- La oferta del suelo



Onions/Cebollas, PNW 546

CASCADE ANALYTICAL, INC.
3019 G. S. Center Rd.
Wenatchee, WA 98801
(509) 662-1889
Fax: (509) 662-8183
1-800-545-4206

Batch: 929720
Grower: _____
Account: 147
Sampler: Dr. Joan Davenport
PO Number: _____

1008 W. Altatum Rd.
Union Gap, WA 98903
(509) 452-7707
Fax: (509) 452-7773

--- SOIL ANALYSIS RESULTS ---

WSU/IAREC
24106 N Bunn Rd
Prosser, WA 99350-9687
Lab Number: 09-S010761

Report Date: 6/29/09
Date Received: 6/19/09
Date Sampled: 6/14/09

Sample Id: Vit. Cent. 3309

Test Requested	ppm	meq/100g	XTES	Relative Level	Optimum Range
Potassium	246	0.531	3.01	Above Optimum	128-288
Calcium	3390	16.9	80.7	Optimum	600 - 4000
Magnesium	388	3.19	15.2	Optimum	90 - 480
Sodium	54.5	0.237	1.13		
Sum of Exchangeable Bases		21.0		Ca/Mg Ratio 5.	

Test Requested	Results	Relative Level	Optimum Range
pH	7.4	Excess	6.0-7.0
Lime Req	0.0 Tons/A	Optimum	0
Soluble Salts	0.73 mmho/cm	Optimum	<1.0
Phosphorus	18.1 ppm	Optimum	8-20
Boron	0.22 ppm	Below Optimum	0.5-1.0
Sulfate - S	16. ppm	Above Optimum	6-20
Organic Matter	1.4 %	Optimum	0.8-2
Estimated Nitrogen Release			
Nitrate	13.7 ppm	Optimum	5-15
Zinc	1.0 ppm	Optimum	1-10
Iron	28.4 ppm	Optimum	5-30
Copper	1.4 ppm	Optimum	0.2-2
Manganese	4.7 ppm	Optimum	2-10

Please keep results in your reference files. Test every other year.

Approved By: *Joan Davenport*

Calcium & Magnesium Ratio: Heavy (Clay) 10:1, Medium (loam) 5:1, Light (sandy) 2:1 The relative levels and optimum ranges are suggestions that have been established for tree fruits. Please consult your fieldstaff or county extension agent before using the guidelines for fertilizer application.

Cascade Analytical uses procedures established by WSLPTP for soil analysis. Cascade Analytical makes no warranty of any kind and client assumes all risk & liability from the use of these results. Cascade Analytical, Inc.'s liability to the client as a result of use of Cascade's test results shall be limited to a sum equal to the fees paid by the client to Cascade Analytical, Inc. for analysis.



La interpretación del análisis del suelo

Test Requested	ppm	meq/100g	%TEB	Relative Level	Optimum Range
Potassium	246.	0.631	3.01	Above Optimum	120-200
Calcium	3390	16.9	80.7	Optimum	600 - 4000
Magnesium	388.	3.19	15.2	Optimum	90 - 480
Sodium	54.5	0.237	1.13		
Sum of Exchangeable Bases		21.0		Ca/Mg Ratio 5.	

Test Requested	Results		Relative Level	Optimum Range
pH	7.4		Excess	6.0-7.0
Lime Req	0.0 Tons/A		Optimum	0
Soluble Salts	0.73 mmho/cm		Optimum	<1.0
Phosphorus	18.1 ppm		Optimum	8-20
Boron	0.22 ppm		Below Optimum	0.5-1.0
Sulfate - S	16. ppm		Above Optimum	6-20
Organic Matter	1.4 %		Optimum	0.8-2
Estimated Nitrogen Release		42. lbs		
Nitrate	13.7 ppm	27.4 lbs	Optimum	5-15
Zinc	1.0 ppm		Optimum	1-10
Iron	28.4 ppm		Optimum	5-30
Copper	1.4 ppm		Optimum	0.2-2
Manganese	4.7 ppm		Optimum	2-10

La interpretación del análisis del suelo

Soil Test Results							
Phosphorus	Olsen	mg/kg	3	pH 1:1		8.3	
Potassium	Olsen	mg/kg	133	E.C. 1:1	m.mhos/cm	0.14	
Boron	DTPA	mg/kg	0.13	Est Sat Paste E.C.	m.mhos/cm	0.36	
Zinc	DTPA	mg/kg	0.8	Effervescence		High	
Manganese	DTPA	mg/kg	0.8				<u>Lbs/Acre</u>
Copper	DTPA	mg/kg	0.7	Ammonium - N	mg/kg	1.2	5
Iron	DTPA	mg/kg	7	Organic Matter W.B.	%	1.2	ENR: 42
Calcium	NH4OAc	meq/100g	20.5	Depth	Nitrate-N	Sulfate-S	Moisture
Magnesium	NH4OAc	meq/100g	1.7	inches	mg/kg lbs/acre	mg/kg	Inches
Sodium	NH4OAc	meq/100g	0.11	0 - 12	6.1 24	5	
Total Bases	NH4OAc	meq/100g	22.6	Totals	6.1 24	5	
				Sum of Tested N: 71 lbs/acre N			

Other Tests:

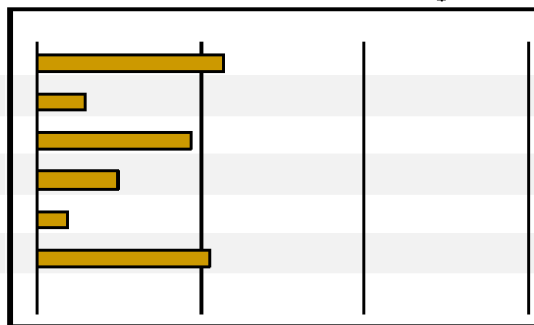
Interpretation Guide

Fertilizer recommendations for

of HOPS after HOPS

Low Medium High

Nitrogen	71	lbs/acre
Phosphorus	3	mg/kg
Potassium	133	mg/kg
Sulfur	5	mg/kg
Boron	0.13	mg/kg
Zinc	0.8	mg/kg
Manganese	0.8	mg/kg



140 lbs/acre of Nitrogen
190 lbs/acre of P2O5
75 lbs/acre of K2O
25 lbs/acre of Sulfur
2 lbs/acre of Boron
0 lbs/acre of Zinc
0 lbs/acre of Mn

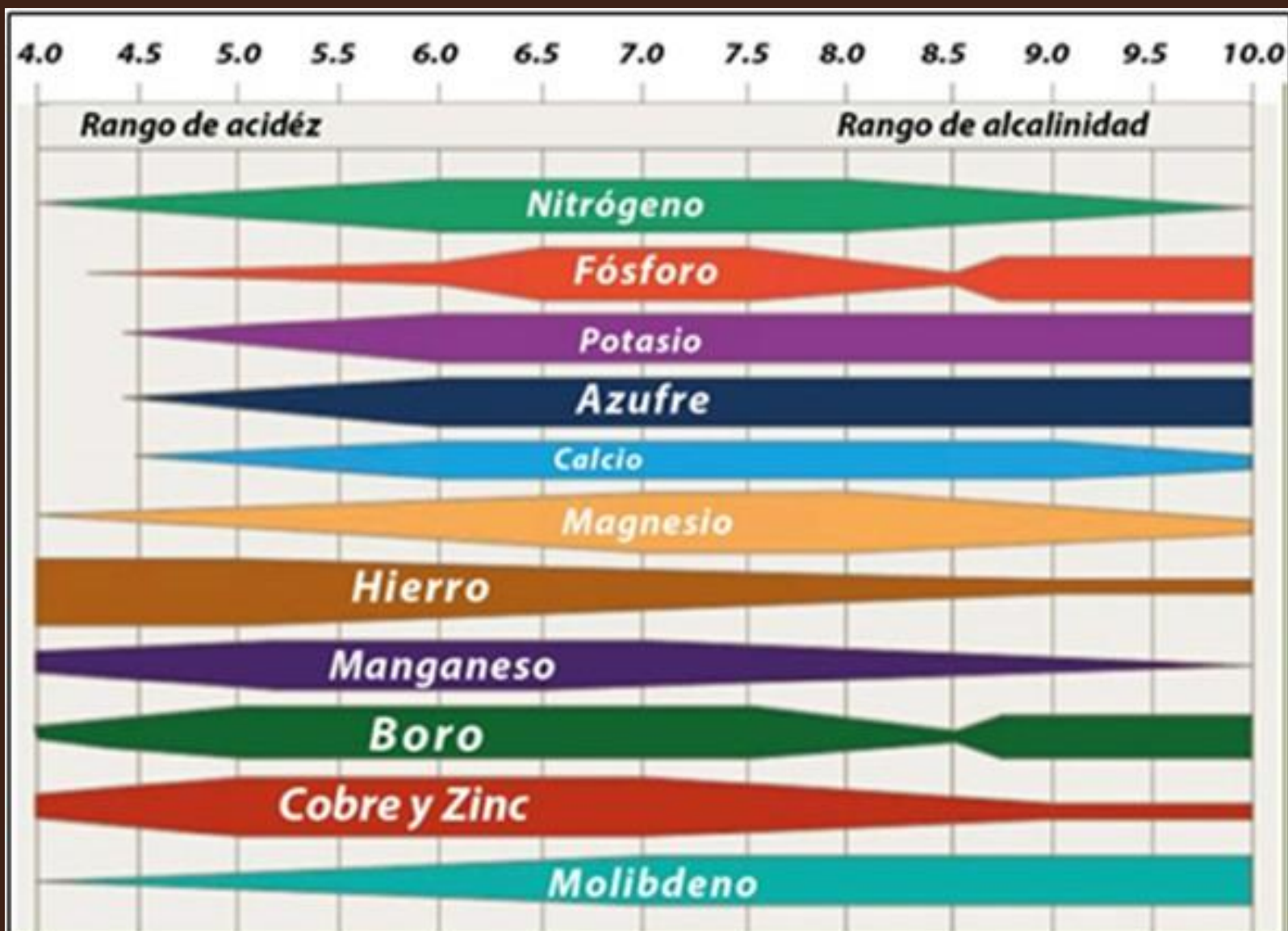


Figura 1. Disponibilidad de nutrientes respecto al pH del suelo.



Ejemplo del Manejo de Nitrógeno – Maíz Dulce (Elote)

- Análisis del Suelo $\text{NO}_3\text{-N}$
 - 13.7 ppm (mg/kg)
 - 27 libras/Acre
- Sistema de Pivotes
 - Antes de siembra (1/2)
 - Durante la temporada (1/2)

Table 2.—N fertilization rates according to total soil test values.

$\text{NO}_3\text{-N}$ Soil test (lb/a)	N Application (lb/a) ¹		
	After nonlegume crop ²	After beans and peas ³	After productive alfalfa, clover
0	200	160	140
40	160	120	100
80	120	80	60
120	80	40	20
160 ⁴	40	0	0
200 ⁴	0	0	0

¹These application rates are suggested for silt loam, loam, and clay loam soils. For sandy soils, increase the application rates by 40 lb N/a.

²When straw is incorporated after September 1, increase the N fertilizer rate by 30–50 lb/a.

³After beans and peas and low-producing alfalfa and clover.

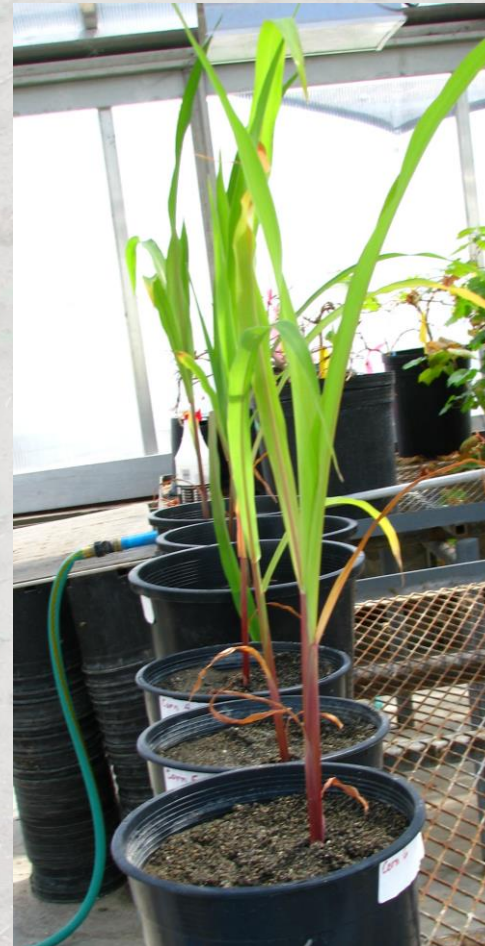
⁴For early plantings into cool soil, apply 20–30 lb N/a in a 2-inch x 2-inch band.

Maíz Dulce, de FG 62

La Falta de Nitrógeno en Maíz Dulce (Elote)



Sana



Bajo N

Manejo de Fosforo- Ejemplo Cebolla

- Análisis del Suelo
 - P - Olsen
 - 3 ppm
- Efervescencia
 - Alta
- Una palabra sobre Olsen P y pH

Bicarbonate (Olsen) soil test P 0 to 12 inches (ppm)	Soil lime concentration (%) ^a			
	0	5	10	15
	P fertilizer application rate (lb P ₂ O ₅ per acre) ^b			
	Not fumigated before planting			
0	160	200	240	280
5	100	140	180	220
10	40	80	120	160
15	0	20	60	100
20	0	0	0	40
above 25	0	0	0	0
	Fumigated before planting			
0	200	240	280	320
5	140	180	220	260
10	80	120	160	200
15	20	60	100	140
20	0	40	20	80
25	0	0	0	20
above 30	0	0	0	0

^aSoil lime concentration as determined by calcium carbonate equivalent test.

^bTo convert from the oxide (P₂O₅) to the elemental form (P) multiply by 0.43.

Cebollas, de PNW 546



Bajo P en Maíz Dulce— Después de que el suelo se calienta



Planta entera



Hoja



Potasio- Análisis del Suelo (Olsen) de 133 mg/kg

- Maíz Dulce
- Agregaremos K
- Cebolla
- No se necesita K

Table 4.—K fertilization rates for sweet corn.

If the soil test for K is (ppm)	Apply this amount of potash (K ₂ O)	
	(lb/a)	(kg/ha)
0–100	120–180	135–200
100–200	60–120	65–135
over 200	0	0

Potassium (K) soil test ^a 0 to 12 inches (ppm)	K fertilizer application rate	
	(lb K per acre)	(lb K ₂ O per acre)
0	200	240
50	100	120
above 100	0	0

^aSoil test K as determined by sodium bicarbonate (Olsen) extraction.

Bajo K en Maiz Dulce



Sana



Bajo K

Micronutrientes

Boro

- Típicamente bajo en WA
- Móvil en suelo (lixiviación)
- Fácil aplicar demasiado
- Muestra - 0.22 mg/kg
- Aplicación típica de 2 - 3 libras/Acre cada año

Zinc

- Típicamente bajo en WA
- Regulado por pH
- Amarrado al largo plazo
- Muestra - 0.7 mg/kg



Zinc



- Cebolla

Onions are sensitive to zinc deficiency. Deficiencies usually occur on white, high lime subsoils that have been exposed by land leveling or erosion. Soils are considered marginal at 0.8 to 1.0 ppm DTPA extractable Zn. Deficient Zn concentrations in leaf tissue probably are 10 to 20 ppm (dry wt. basis), based on data from other crops. Zinc deficiency can be corrected by soil or foliar Zn applications. There is insufficient data to support specific recommendations.

- Maíz

Sweet corn has a relatively high requirement for Zn. An application of Zn is suggested when the Zn soil test value is below 0.8 ppm.

Where Zn is required, either 10 lb/a (10 kg/ha) of Zn should be broadcast and worked into the soil prior to planting, or 3 to 4 lb/a (3 to 4 kg/ha) of Zn should be banded with the fertilizer at planting time. An application of 10 lb Zn/a should supply Zn needs for 2 or 3 years.

To correct Zn deficiency during the growing season, thoroughly wet plants with a solution containing 1 lb (0.5 kg) Zn in 50 to 100 gal (190–380 liters) of water.

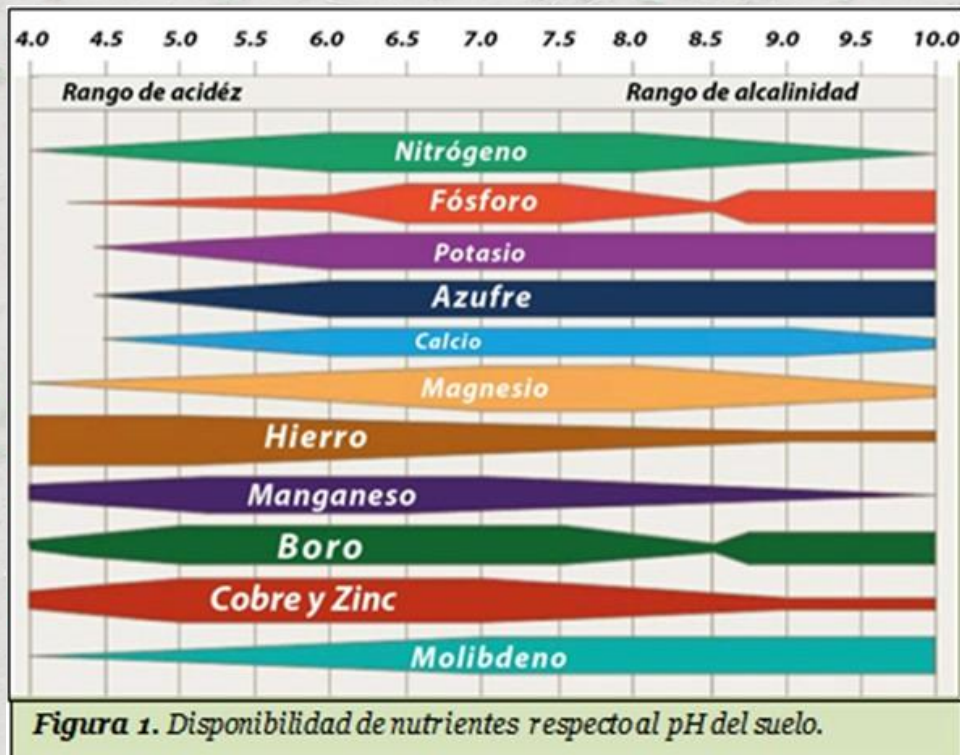
Toxicidad de Boro

- http://ecoursesonline.iasri.res.in/pluginfile.php/1761/mod_page/content/3/Chapter_1_5_7.JPG



Pensamientos finales de pH del suelo y 'cal libre'

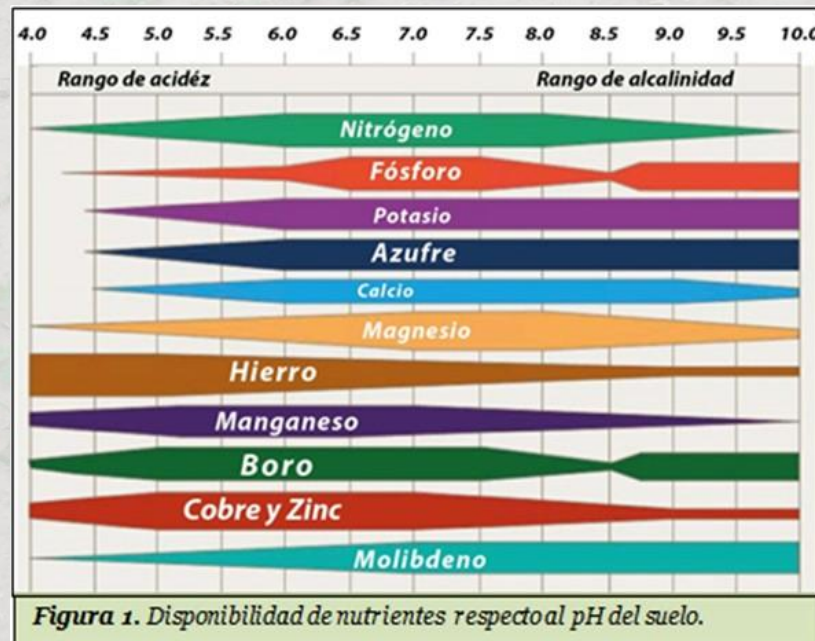
- Cal libre— medido como efervescencia o porcentaje





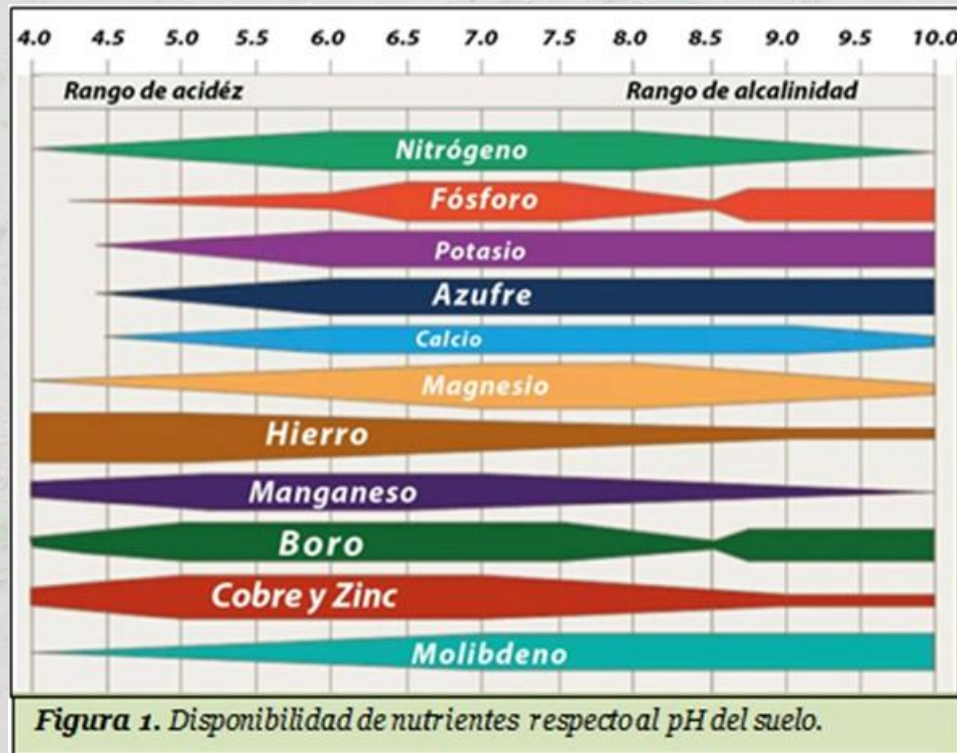
Pensamientos finales de pH del suelo y 'cal libre'

- pH alto
- Cal libre alto
- Micronutrientes bajos, hierro (Fe) es un problema
- La aplicación foliar, usualmente quelatos



Pensamientos finales de pH del suelo y 'cal libre'

- Uso de fertilizante N baja el pH a largo plazo
- Es un gran problema en cebolla
- Antes de siembra aplica cal 500 – 1,000 libras/A



Referencias

- Gardener, E. H., N. S. Mansour, H. J. Mack, T. L. Jackson, and J. Burr. 2000. Sweet Corn Eastern Oregon - East of the Cascades. Oregon State University FG 62.
- Sullivan, D. M., B. D. Brown, C. C. Shock, D. A. Horneck, R. G. Stevens, G. Q. Pelter, and E. B. G. Feibert. 2001. Nutrient Management for Onions in the Pacific Northwest. PNW 546.



Preguntas?

