Norm Dueck, CCA

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Norm Dueck CCA

HEARTLAND

SOIL & CROP SOLUTIONS

Vanderhoof, BC

- Crop Consulting • Soil Nutrient Recommendations
- Ag Coaching Services (annual retainer) • Field Scouting
- Soil & Plant Tissue Sampling

Creating Growing Environments

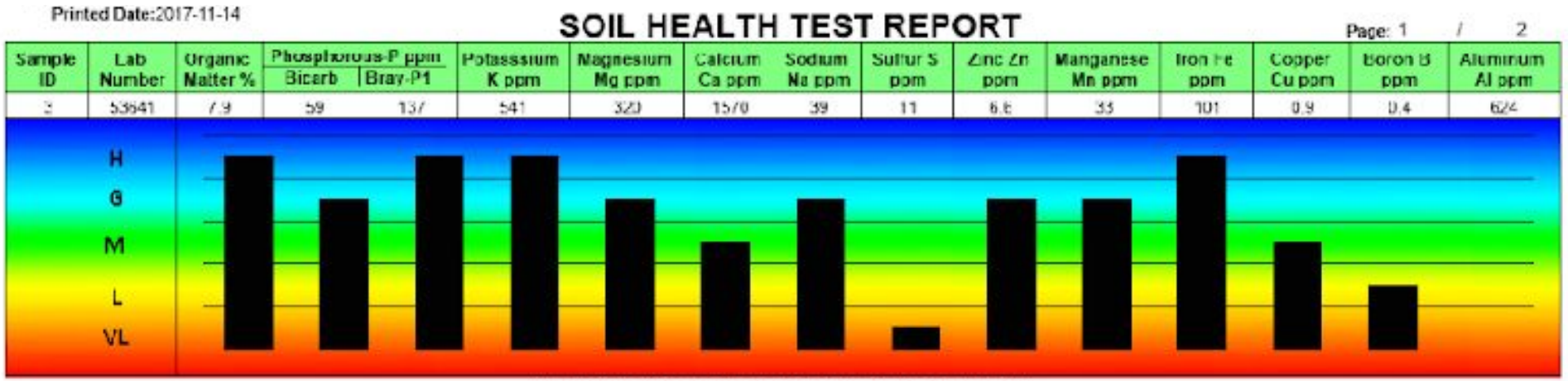
Balanced Nutrition…

What, Why and How?

- Key elements (nutrients)
- Nutrient uptake
- Nutrient Interactions

Also tie in…

Soil sample interpretation



Printed Date:2017-11-14

SOIL HEALTH TEST REPORT

Page: 1 / 2

Sample ID	Lab Number	Organic Matter %	Phosphorous-P ppm		Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Aluminum Al ppm
			Bicarb	Bray-P1											
2	53641	7.9	59	137	541	320	1570	39	11	6.6	35	101	0.9	0.4	624

Acknowledgements:

- Some slides are borrowed from…
  - Greg Patterson – President of A&L Labs
  - Geoff Doell – Growth Agronomics
  - Abdelbasset El Hadrami – OMEX Canada
  - Brent Tarasoff – Fieldquest consulting
  - Mosaic fertilizer
  - IPNI photo library
  - Mike Dolinksi
  - Taurus

Discussion

- "Experts" in Our Industry in the Dark Ages?
  - If it doesn't work, put more on…the "Moron principal"
  - City people don't get it!
  - Do WE get it?

- New Technology and Information
  - Seed & fertilizer placement?
  - Variability within a field?
  - Soil & Plant tissue sampling?

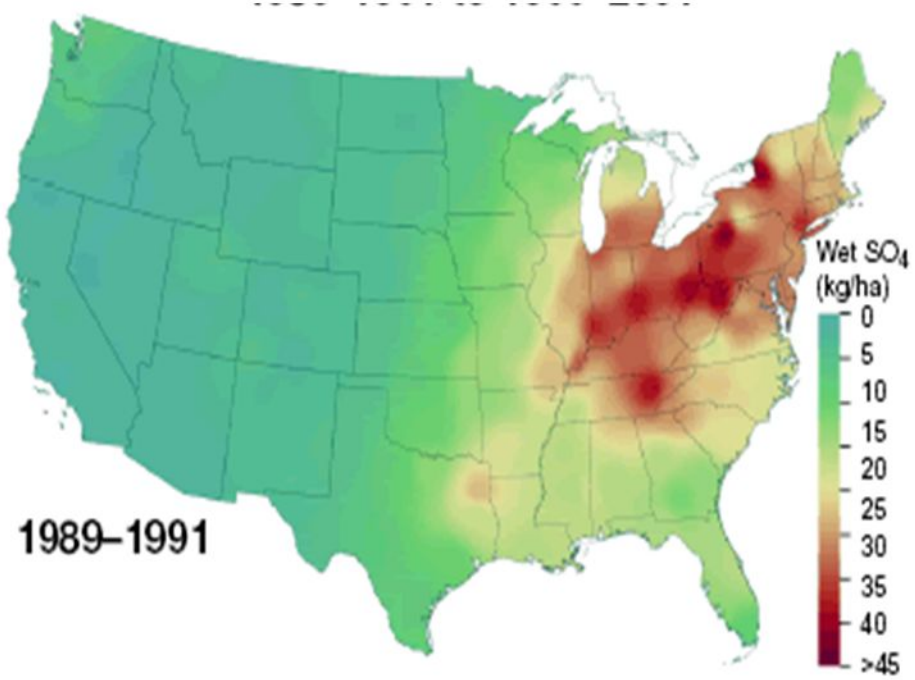
Discussion

- Soil test levels dropping
  - Rising cost of crop inputs
- Environmental pressures
  - What Can We Do – What are the opportunities?

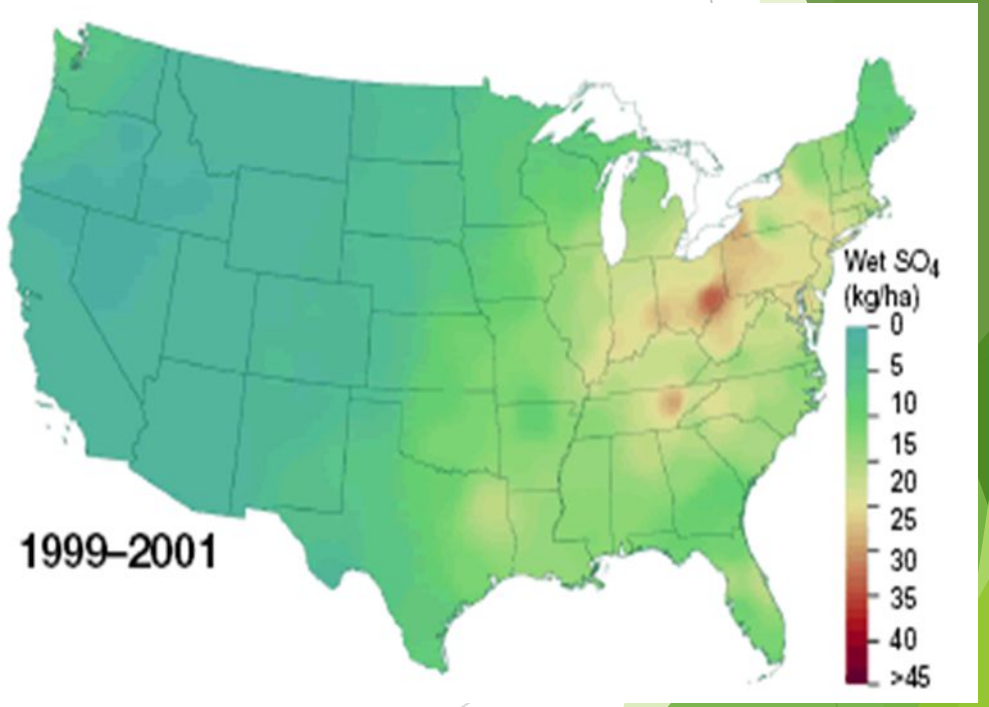
  - Can all soils be balanced?
    - Maybe not.

Why add nutrients…?

Sulfate levels from 1989 to 1991



Sulfate levels from 1999 to 2001



EVERY FIELD HAS SOMETHING LIMITING ITS YIELDS

- Limiting Factors…
  - Nutrients
  - Excess water/Poor drainage
  - Drought
  - Choice of
  -
  -
  -
  - M actions
  - Climate

Law of the Minimum

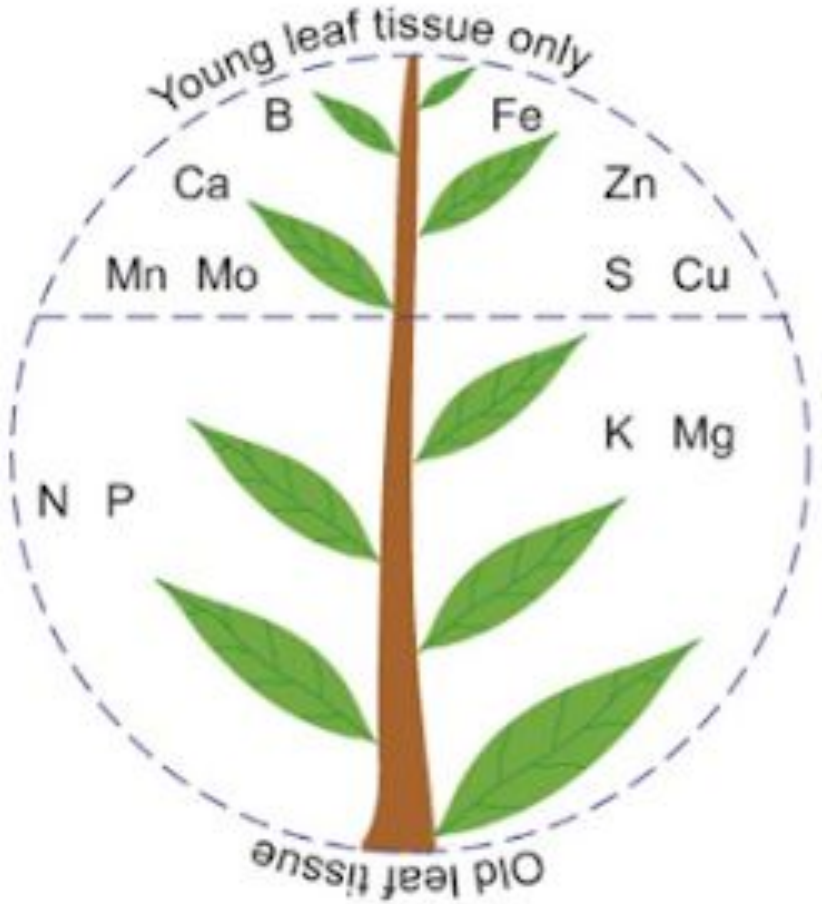
Blame it on the Weather!!!


PROOF OF
GLOBAL WARMING
1720
1900
1950
1970
1980
1990
2010

Which tools to use?

- Visual
  - Boots on the ground
- Plant Tissue
  - In-crop
  - Plan for next season
- Soil Sample
  - After Crop Removal

Field diagnosis



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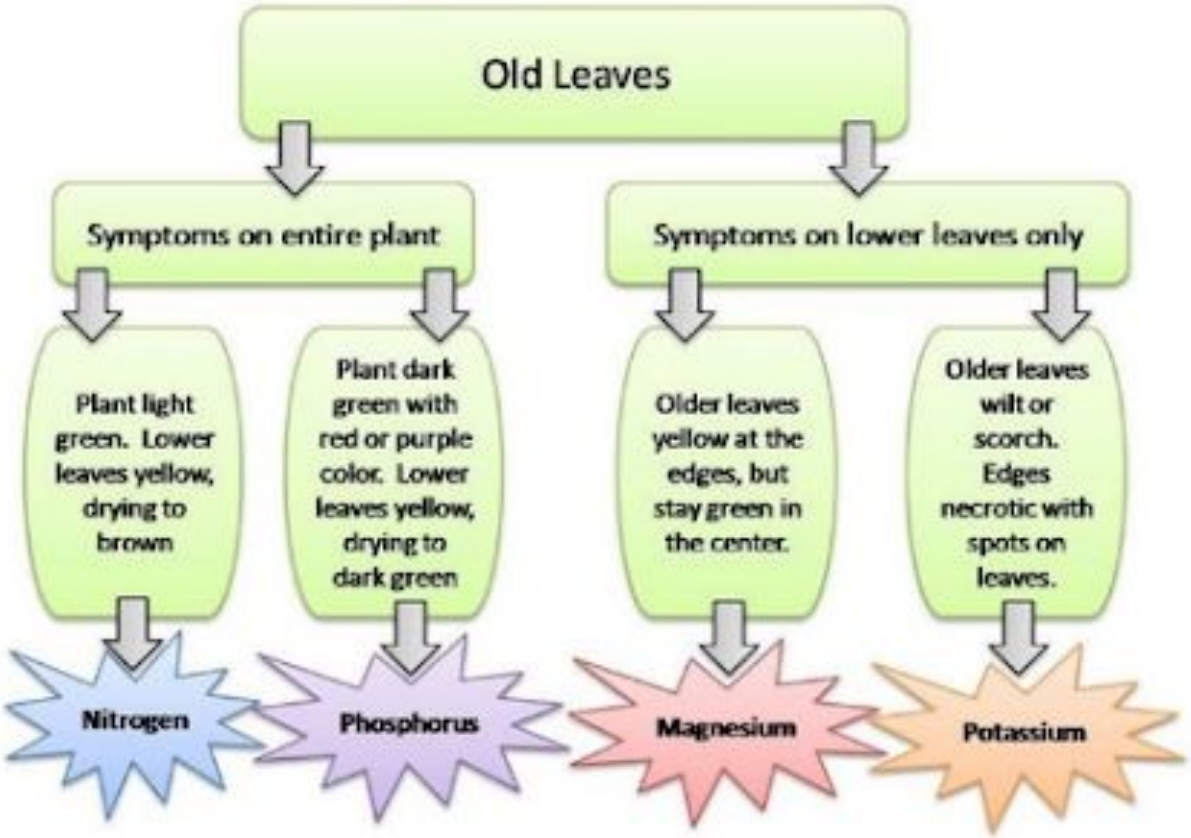

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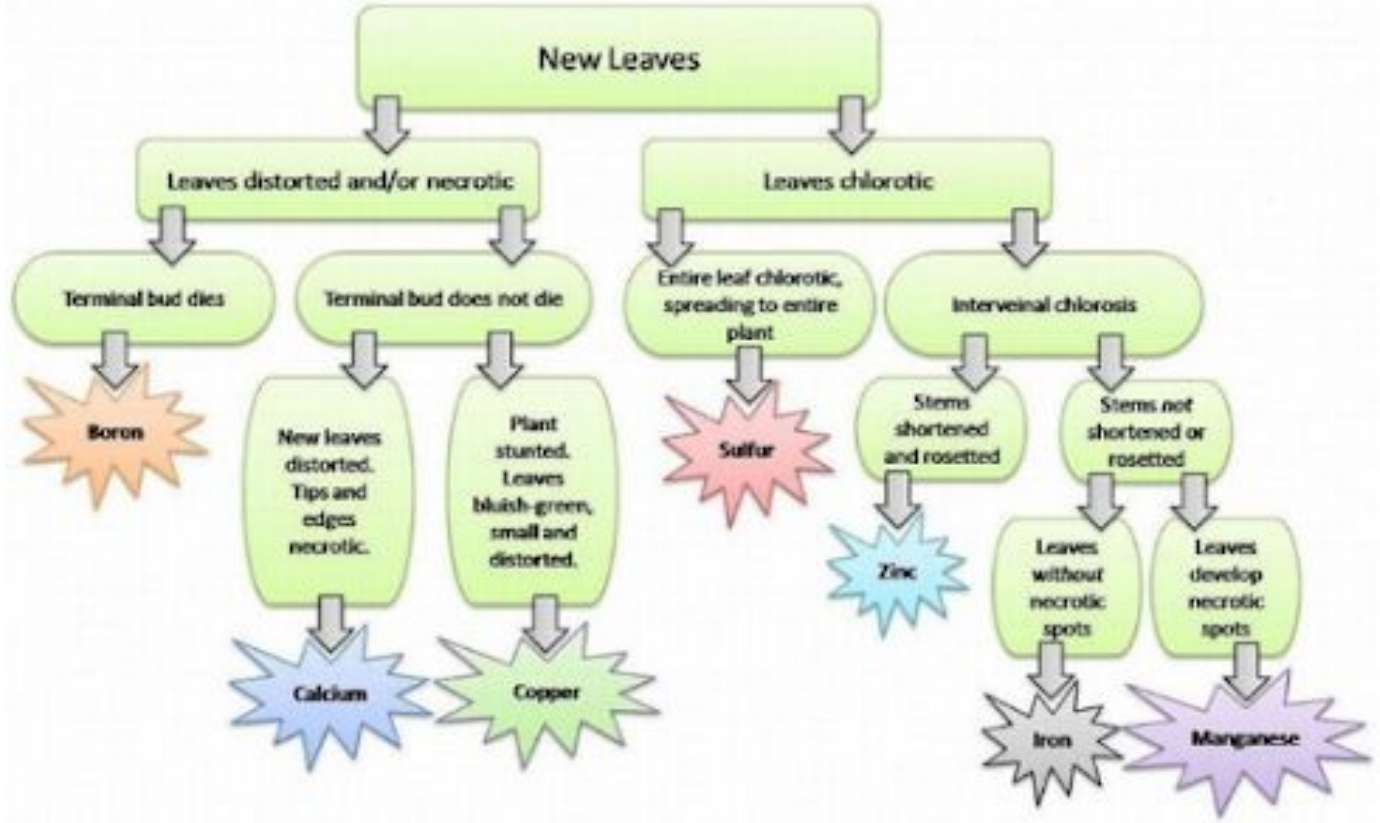
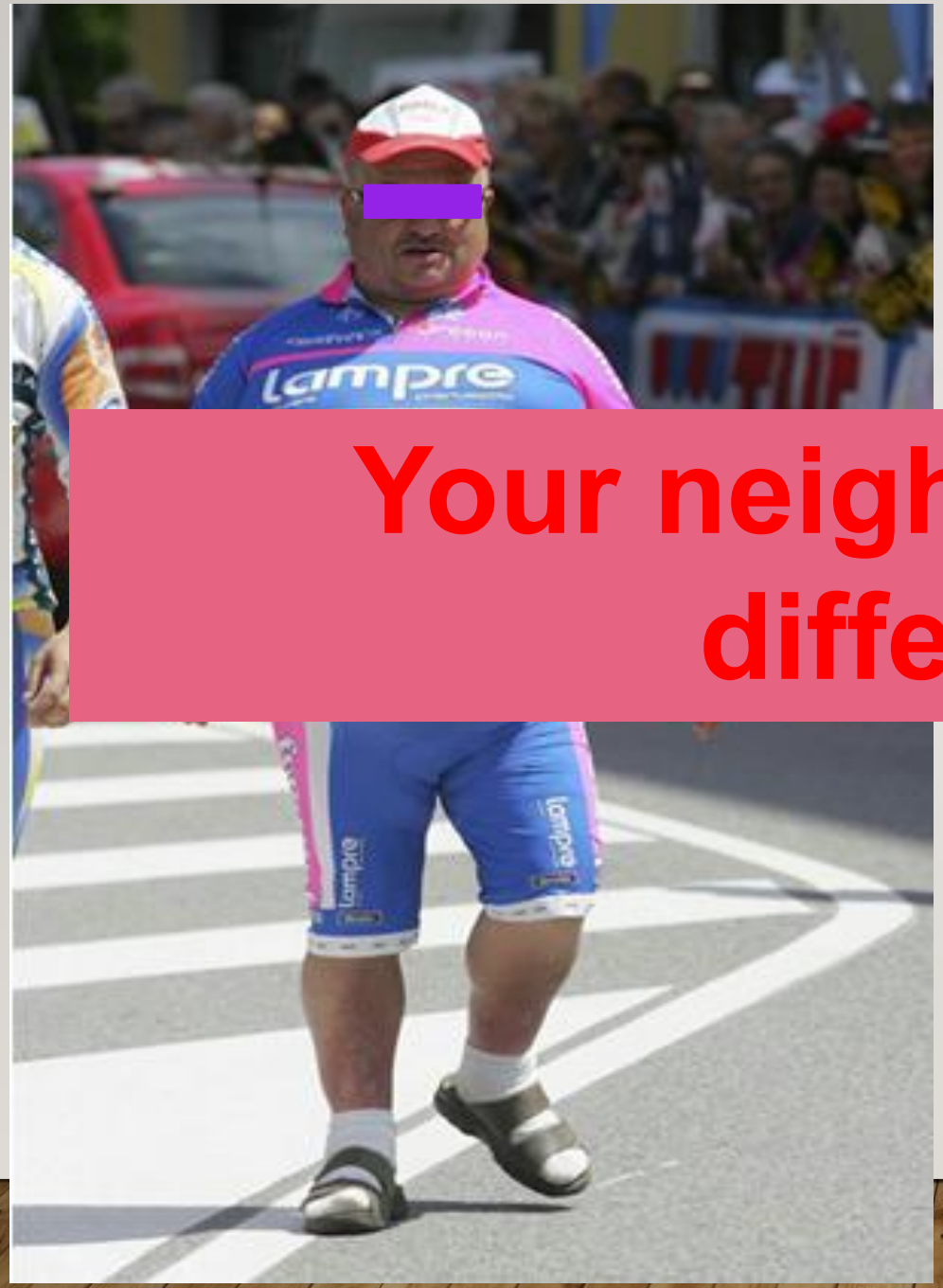


Perhaps a Soil Test?

- Take Inventory!
- What's in your bank account?
- Your soil **is** your bank account!

You can't count what you don't measure!



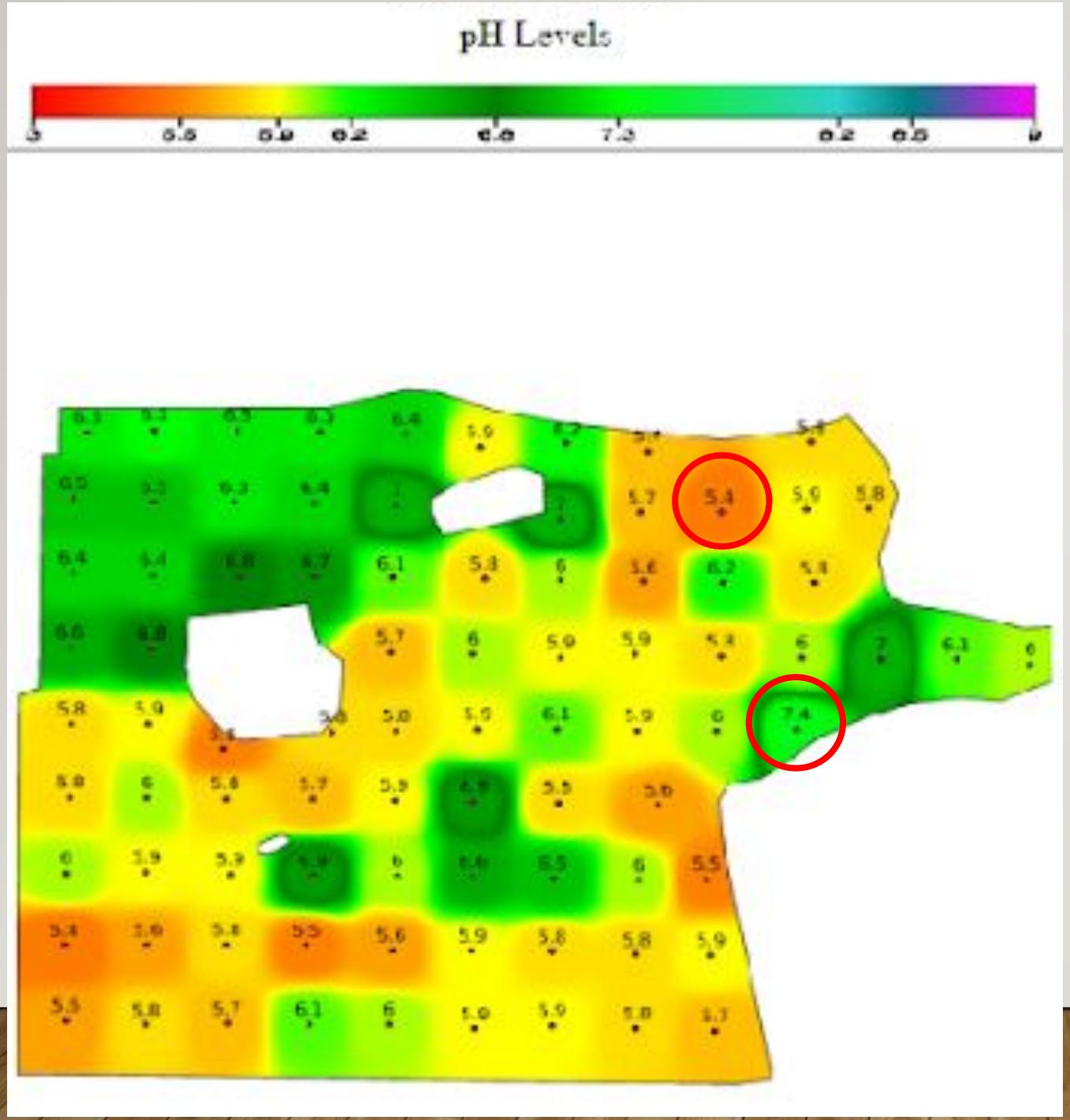
Your neighbor's soil is different!!!

T ALL!

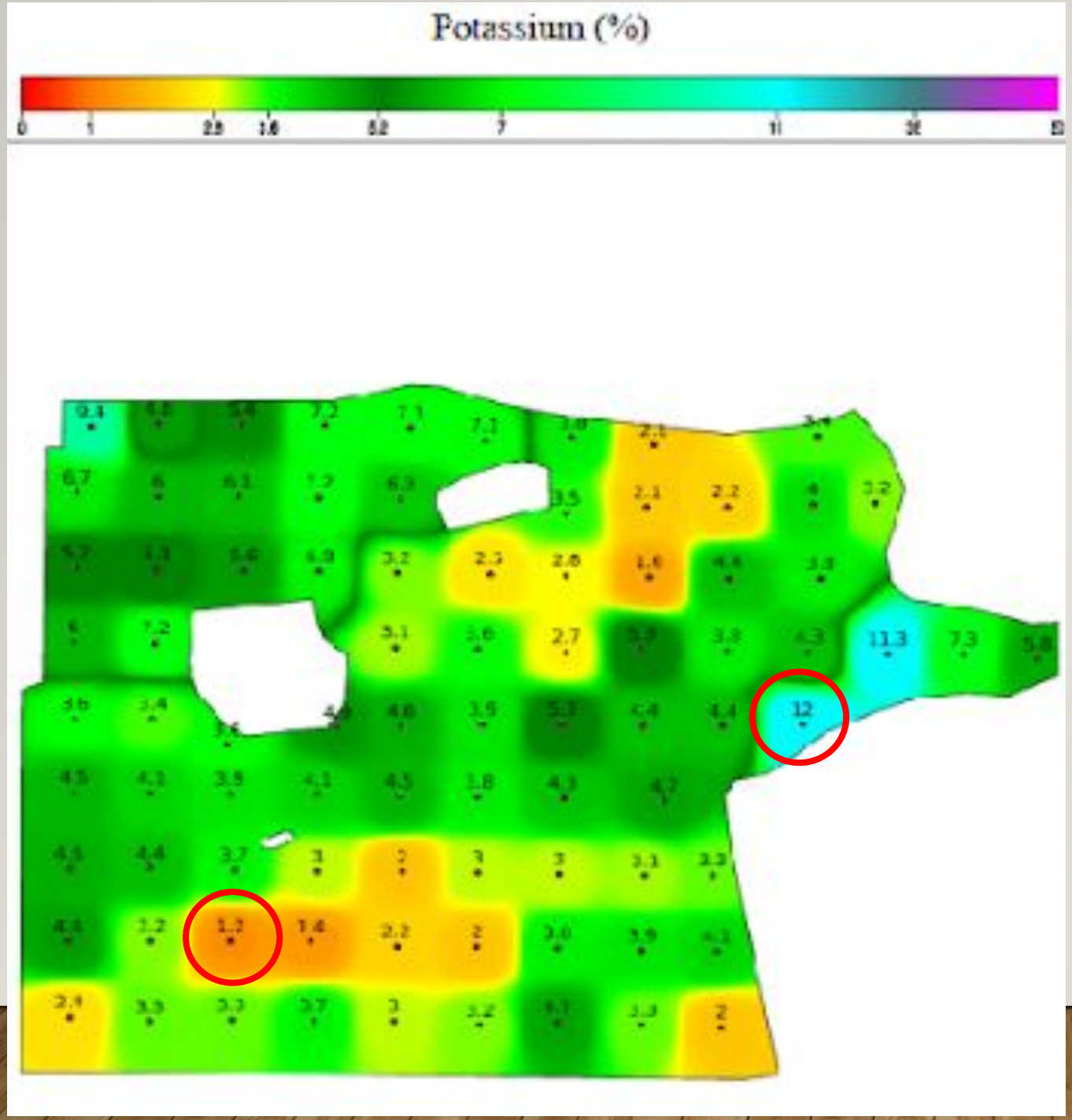
LD

…OR,

EFFICIENTLY RELEASE THEM.



- **Variability**



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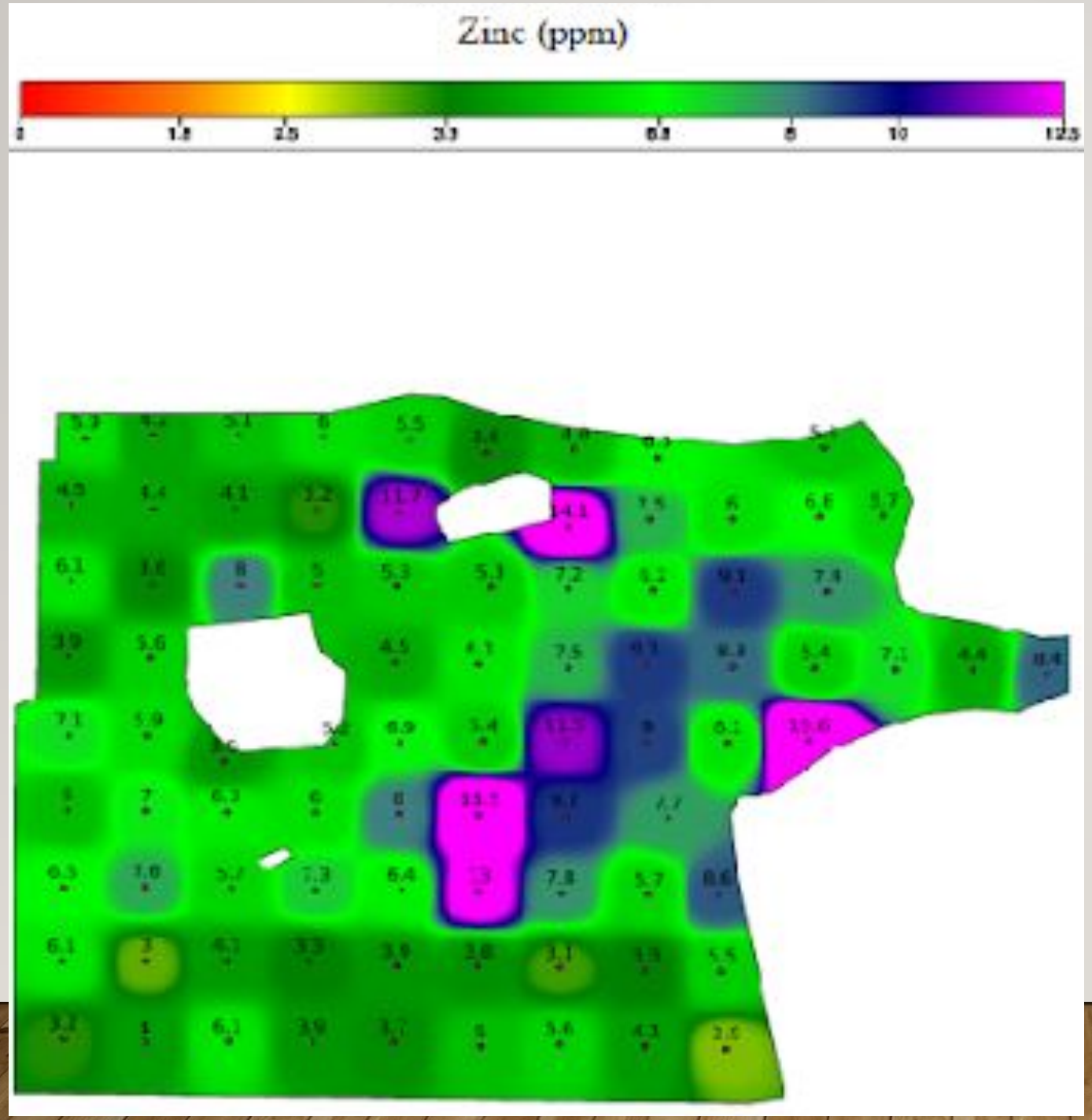
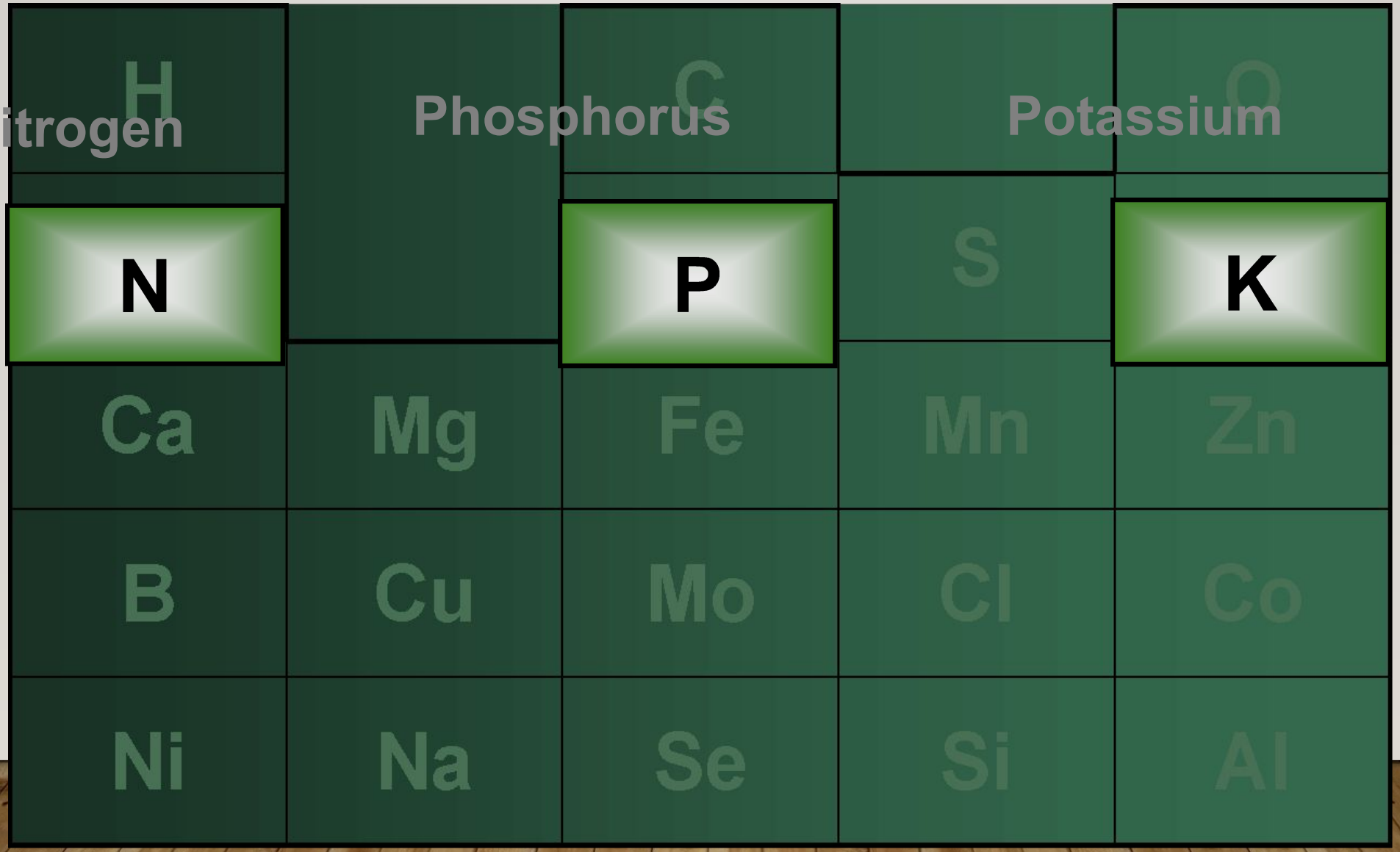
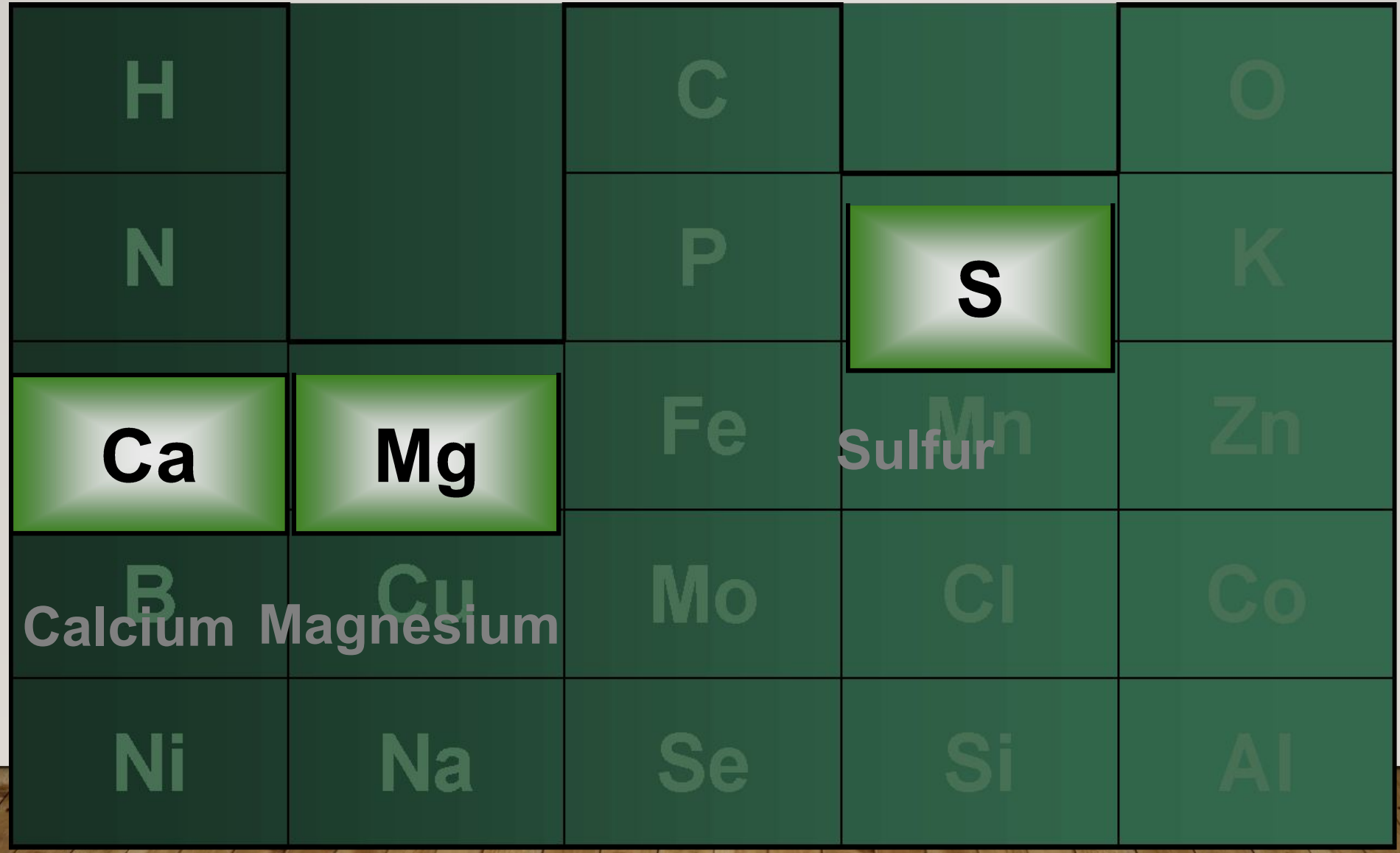


- **Variability**

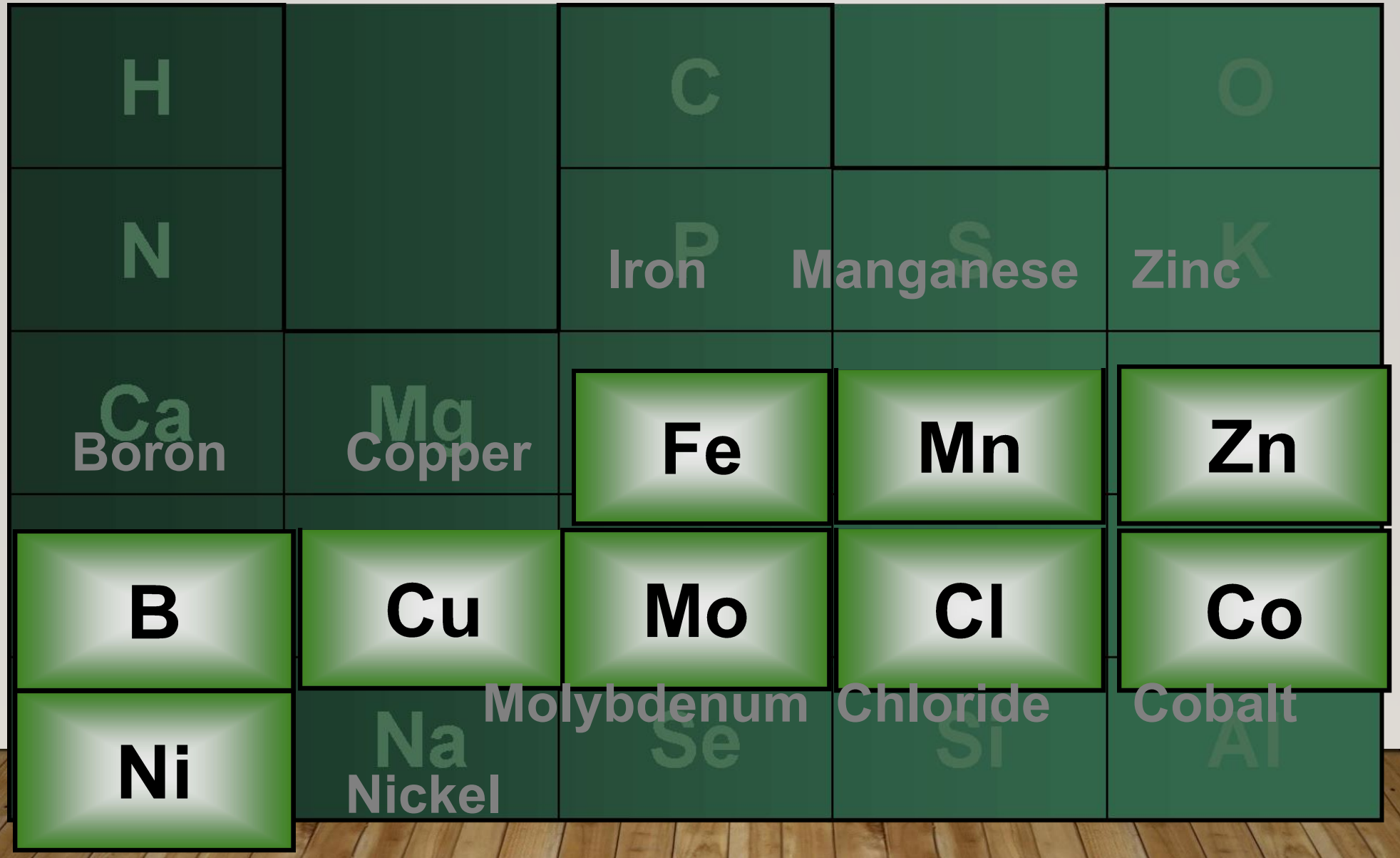
ESSENTIAL ELEMENTS (PRIMARY)



ESSENTIAL ELEMENTS (SECONDARY)



Essential Elements (micronutrients)



Beneficial Elements (micronutrients)

H		C		O
N		P	S	K
Ca	Mg	Fe	Mn	Zn
B	Cu	Mo	Cl	Co
Ni	Sodium	Selenium	Silicon	Aluminum

Na **Se** **Si** **Al**

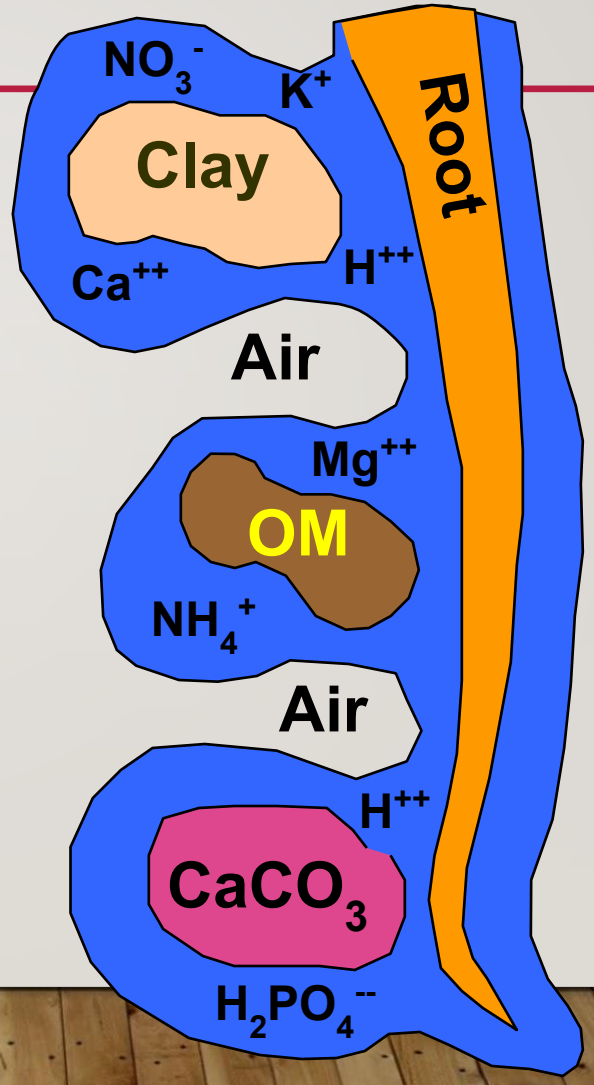
HOW DO PLANTS UPTAKE NUTRIENTS?

- Soil-water solution
- 98% obtained in soil-water solution
- 2% directly from soil

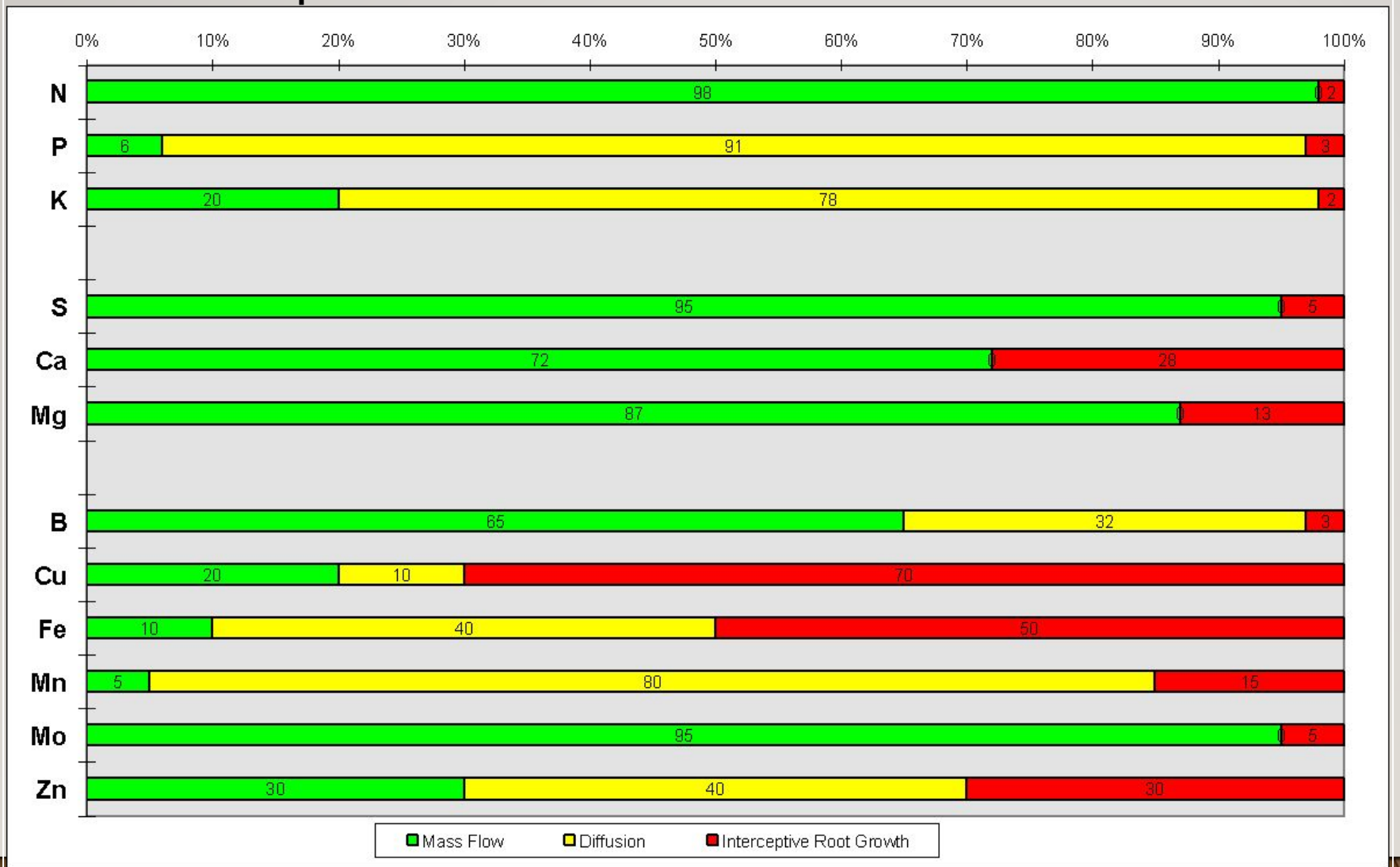
HOW NUTRIENTS REACH ROOTS

Nutrient Uptake

- Mass flow with water
- Diffusion from soil to roots
- Root interception

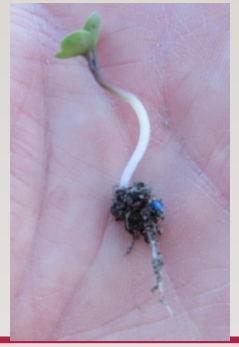


Percentages of Nutrient Uptake Through Roots by Mass Flow, Diffusion and Interceptive Root Growth

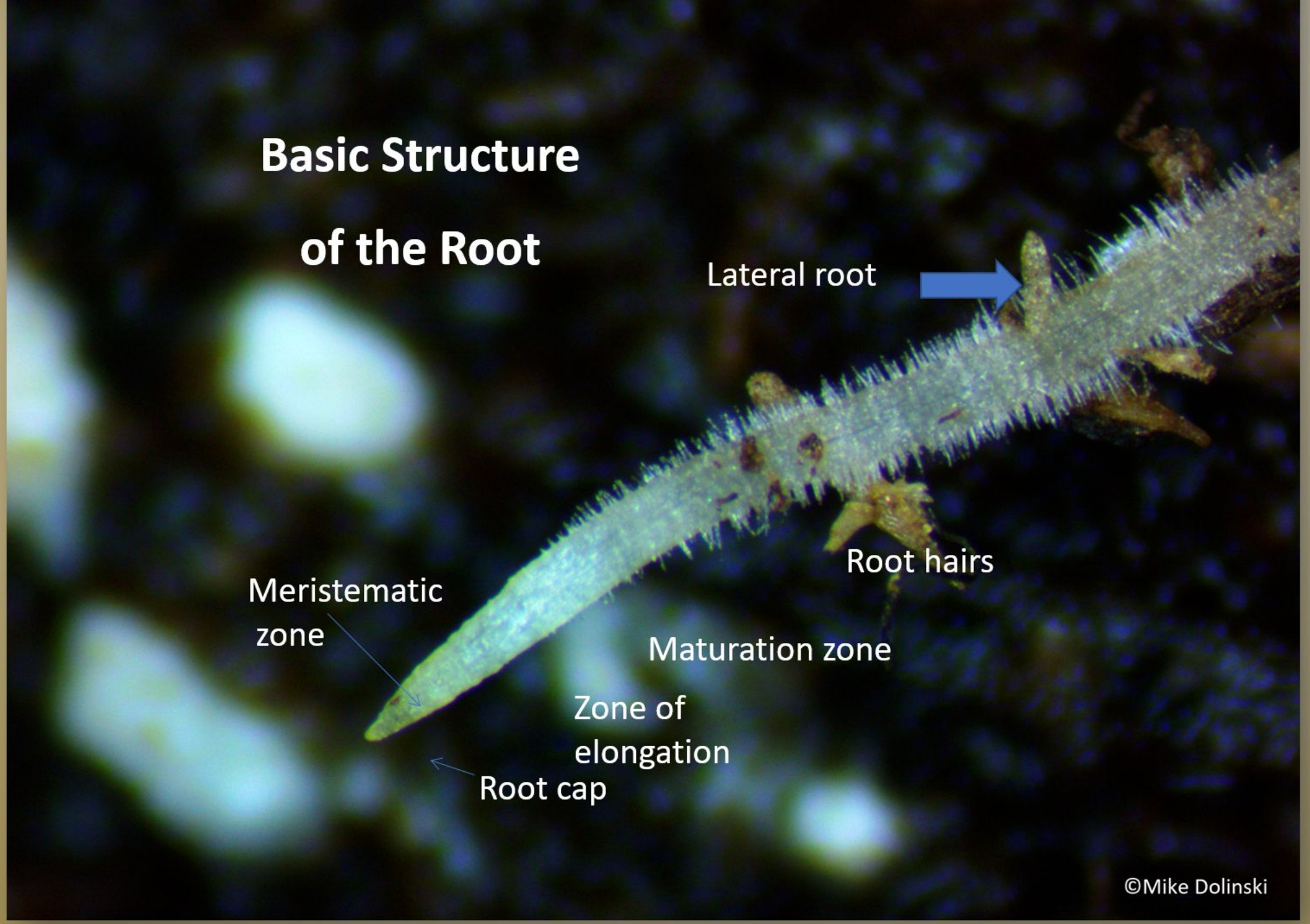


Compiled from data in BARBER and OLSEN 1968, DENNIS 1971

ROOT EFFICIENCY



- The root hair increases the surface area of the root by 20 times
- The root hair is the primary point of uptake of water and nutrients.
- Root hair lives for 3 - 6 days then dies
- Plant must constantly be producing new root hairs


Basic Structure
of the Root
Lateral root
Root hairs
Meristematic
zone
Maturation zone
Zone of
elongation
Root cap
©Mike Dolinski

KEY FACTORS…

- Base Saturation of cations
- K/Mg Ratio
- Boron, Zinc & other micros
- CEC (Cation Exchange Capacity)
- pH & Buffer pH
- **Key roles in certain nutrients**

- **Base Saturation of cations**
  - Limited space on a soil particle
  - K, Mg, Ca, H & Na
  - How much of each is enough?
  - How much is too much?

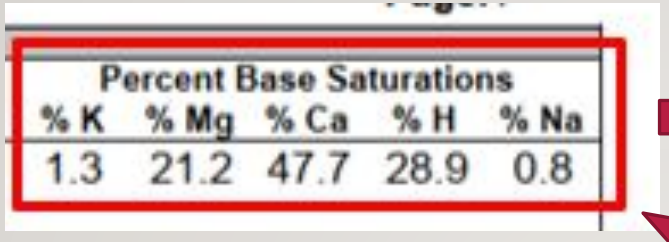
- **Base Saturation of cations**

Who are your 'board' members?

- **Base Saturation of cations**

- *Who is the dominant member?*
- *Is the <u>wrong</u> member in charge?*

Base Saturation of cations



Percent Base Saturations				
% K	% Mg	% Ca	% H	% Na
1.3	21.2	47.7	28.9	0.8

= 100

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

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Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
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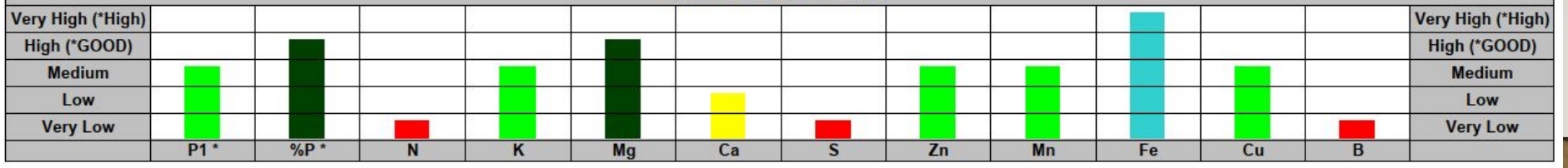
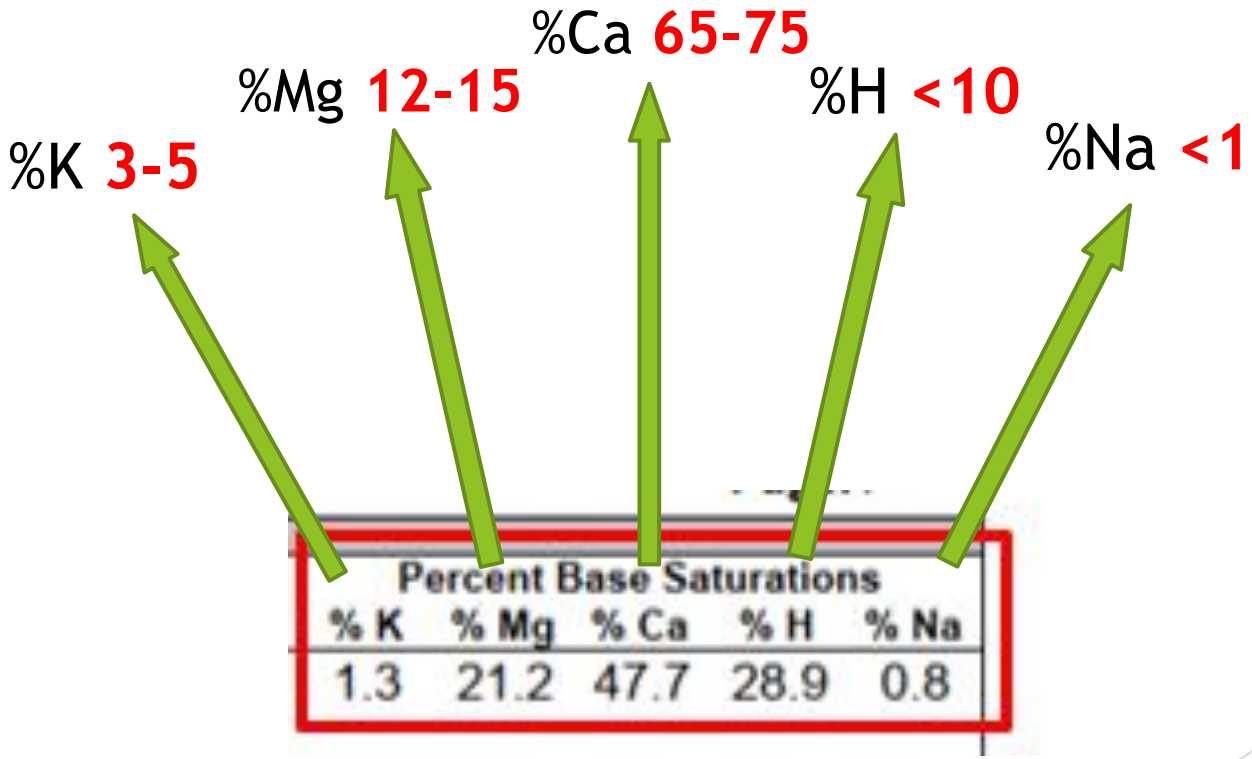


- **Base Saturation of cations**

Ideal Ranges…

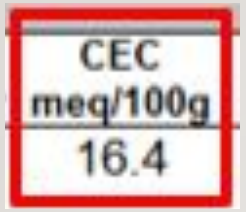


- **C.E.C.** *(Cation Exchange Capacity)*

Soil Test Interpretation

%SATURATON CATIONS	0 - 6	7 - 15	16 - 25	25+
% K SAT	4 - 6	3 - 5	2 - 4	2 - 3
% Mg SAT	10 - 20	8 - 20	5 - 20	5 - 20
% Ca SAT	60 - 80	60 - 80	60 - 80	60 - 80

- **C.E.C.** *(Cation Exchange Capacity)*



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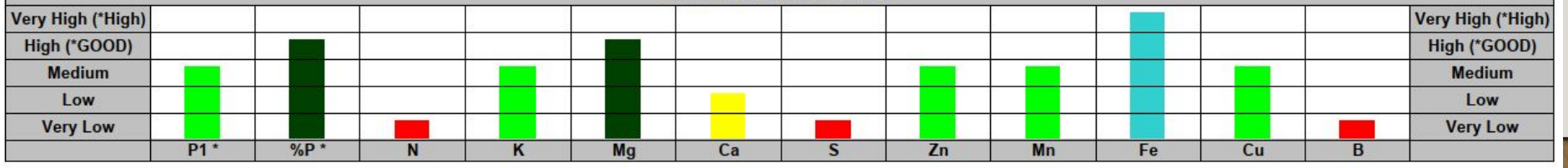


- **C.E.C.** *(Cation Exchange Capacity)*

  - Indicates soil texture
  - High CEC – more clay
  - Low CEC – more sand
  - Helps determine nutrient holding capacity

- **Hydrogen (H)**
  - Too much is NOT good
  - Need small amount only - <10%
  - Torching effect on root tips
  - Occurs naturally from rood growth & manure and fertilizer applications

- **Sodium (Na)**

  - Too much is NOT good
  - Need small amount only - <1%
  - Often associated with irrigation water or high water table

PRIMARY NUTRIENTS

Nitrogen (N) –

is needed for vegetative growth and dark green color. (easily leached out)

Nitrogen is the most important nutrient.

Deficiency signs –

reduced growth & yellowing of lower leaves.

Yellowing is called Chlorosis

NITROGEN BALANCED FERTILITY N:K RATIO

- Ratio N:K in Early season 1:3 progressing to a ratio through the season of 1:1
- Developed countries in the 60's and 70's fairly balanced at 1:0.8 to a current N:K use of **1:0.36**
- Developing countries little change 1:0.10 –1:0.13 except South America has increased to 1:0.96 because of the response soybeans have to K

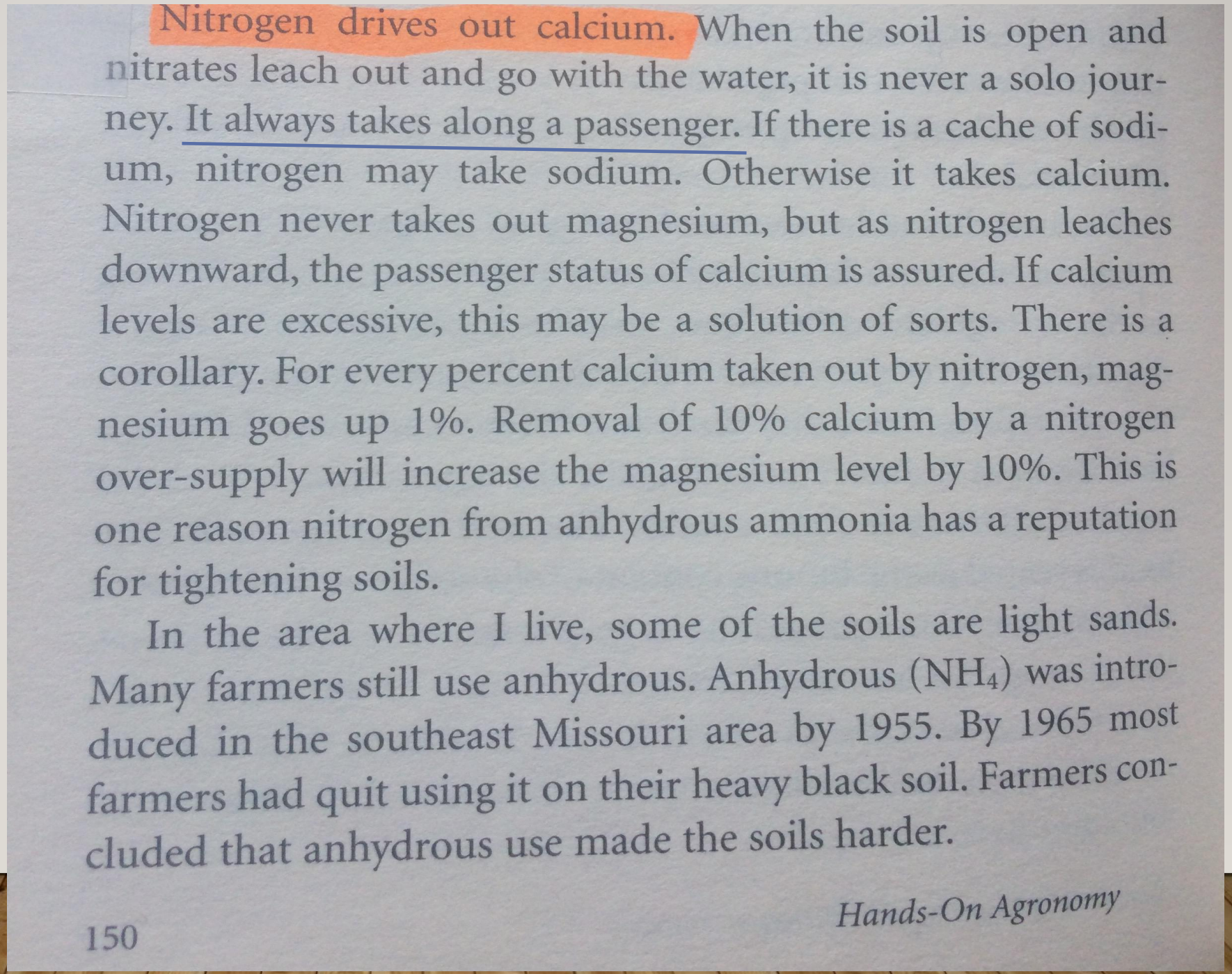
TOO MUCH NITROGEN

- Leaf Nitrogen level affects plant susceptibility.
- Pathogens such as mildew target plant cells with high Nitrate Nitroge
- High N content produc
walls & poor di
- Nit
plan
- Ensu
Sulp

Remember the "Moron" principle?

- **Nitrogen (N)**

Hands-On Agronomy… Neil Kinsey



Nitrogen drives out calcium. When the soil is open and nitrates leach out and go with the water, it is never a solo journey. It always takes along a passenger. If there is a cache of sodium, nitrogen may take sodium. Otherwise it takes calcium. Nitrogen never takes out magnesium, but as nitrogen leaches downward, the passenger status of calcium is assured. If calcium levels are excessive, this may be a solution of sorts. There is a corollary. For every percent calcium taken out by nitrogen, magnesium goes up 1%. Removal of 10% calcium by a nitrogen over-supply will increase the magnesium level by 10%. This is one reason nitrogen from anhydrous ammonia has a reputation for tightening soils.

In the area where I live, some of the soils are light sands. Many farmers still use anhydrous. Anhydrous (NH_4) was introduced in the southeast Missouri area by 1955. By 1965 most farmers had quit using it on their heavy black soil. Farmers concluded that anhydrous use made the soils harder.

- **Nitrogen (N)**

Nitrate Nitrogen ppm NO3-N lbs/ac	
1 VL	2

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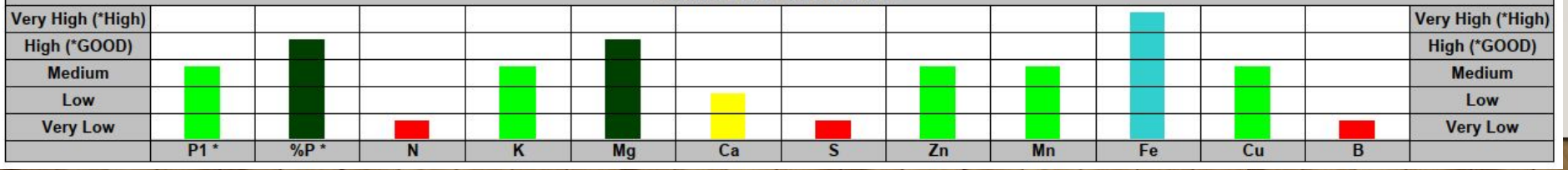
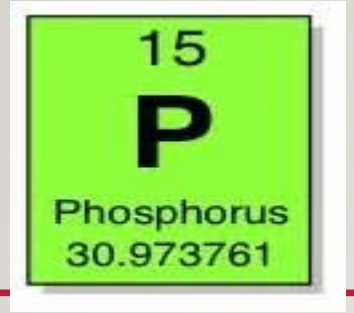




PHOSPHORUS

- Phosphorus plays a crucial role in the reproduction of seed plants.
- It promotes rapid root growth.
- Unlike nitrogen, phosphorus is very immobile in soil. However, since a large portion of a plant's phosphorus is found in seeds and fruit, the soil must be replenished annually.
- Deficiency symptoms include a purple tinge to the leaves.

PRIMARY NUTRIENTS IN AGRICULTURE

- 2. Phosphorus (P) – important for seedling and young plant growth and develop good root system. (not easily leached out)
- AKA – Party Animal
- Deficiency signs-

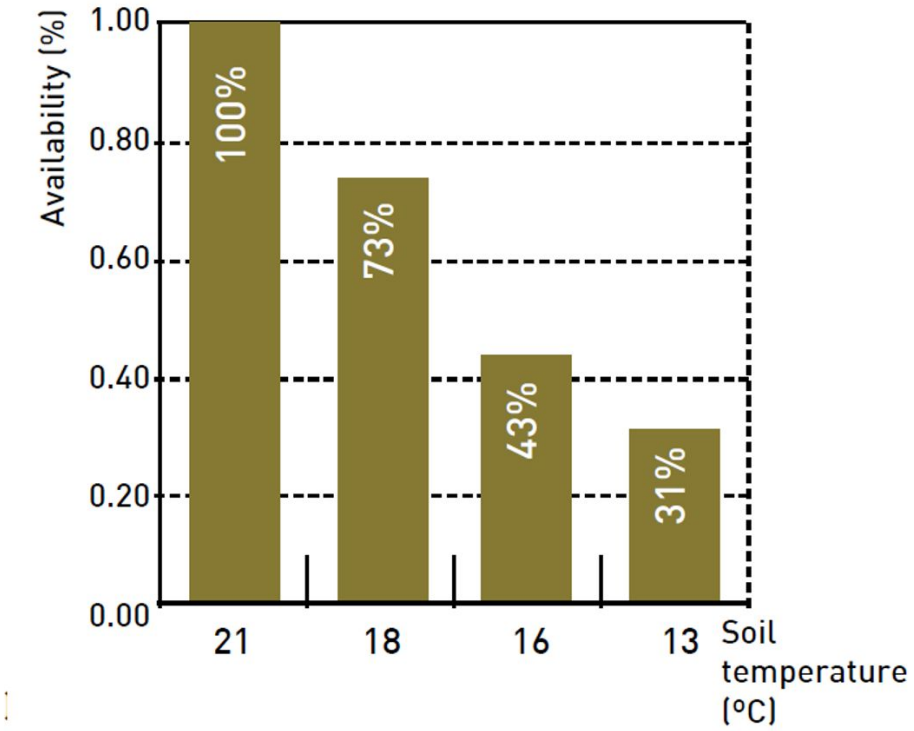
  reduced growth, poor root systems, reduced flowering. Also thin stems and browning or purpling of foliage.

LOW MG, HIGH K ADDITION LEADING TO PHOS DEFICIENCY

PHOSPHATE

TAURUS

A Drop from 21 Degree's C to 13 Degree's C Reduces Phosphorus Availability by almost 70%



Phosphorus (P)

Phosphorus - P ppm	
Bicarb	Bray-P1
28 M	45 M

Saturation %P
8 G

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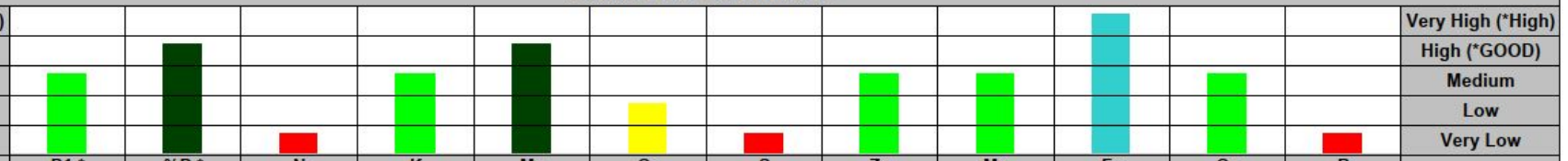


Potassium (K)

BENEFITS

1. Yield potential
2. Stalk strength, lodging resistance
3. Improves winter hardiness
4. Protein production
5. Carbohydrate production; sugar translocation
6. Enzyme functions
7. Cell division

IDEAL BALANCE

3-5% Saturation

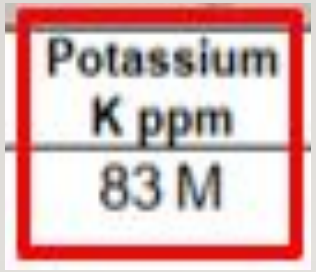
Potassium (K)

- can be leached (if sandy, acid soils)
- Deficiency signs –
  - reduced growth, shortened internodes and some burn, scorched marks (brown leaves).
- Too Much (K) – can cause nitrogen or Mg deficiency.

POTASSIUM DEFICIENCY

- Determines rate of chemical reactions
- High K in soil solution = High K in plants
- Deficiency appears in older leaves first

- **Potassium (K)**



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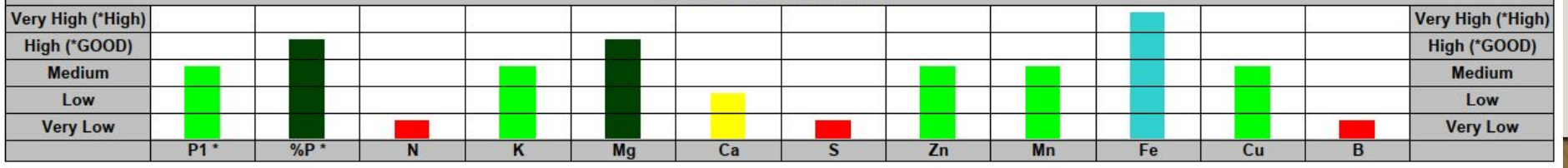


Magnesium

BENEFITS

1. Key element in chlorophyll
2. Protein production
3. Enzyme functions
4. Energy release in cells
5. Aids phosphorus uptake
6. Oil formation
7. Starch translocation

IDEAL BALANCE

12-15% Saturation

(240 X C.E.C. X % saturation/200 = ppm)

BEST SOURCES

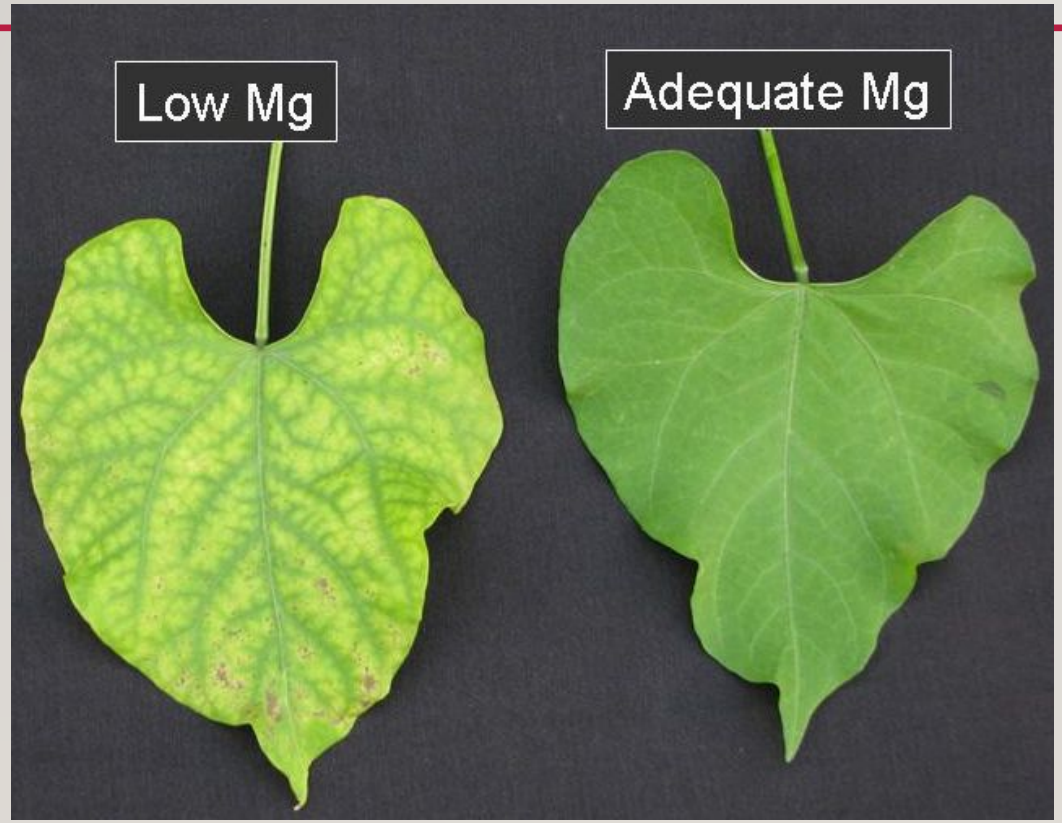
Magnesium Sulfate (Mg 9%, S 12%)

Sul-Po-Mag (0-0-22-22S -11Mg)

COMMENTS

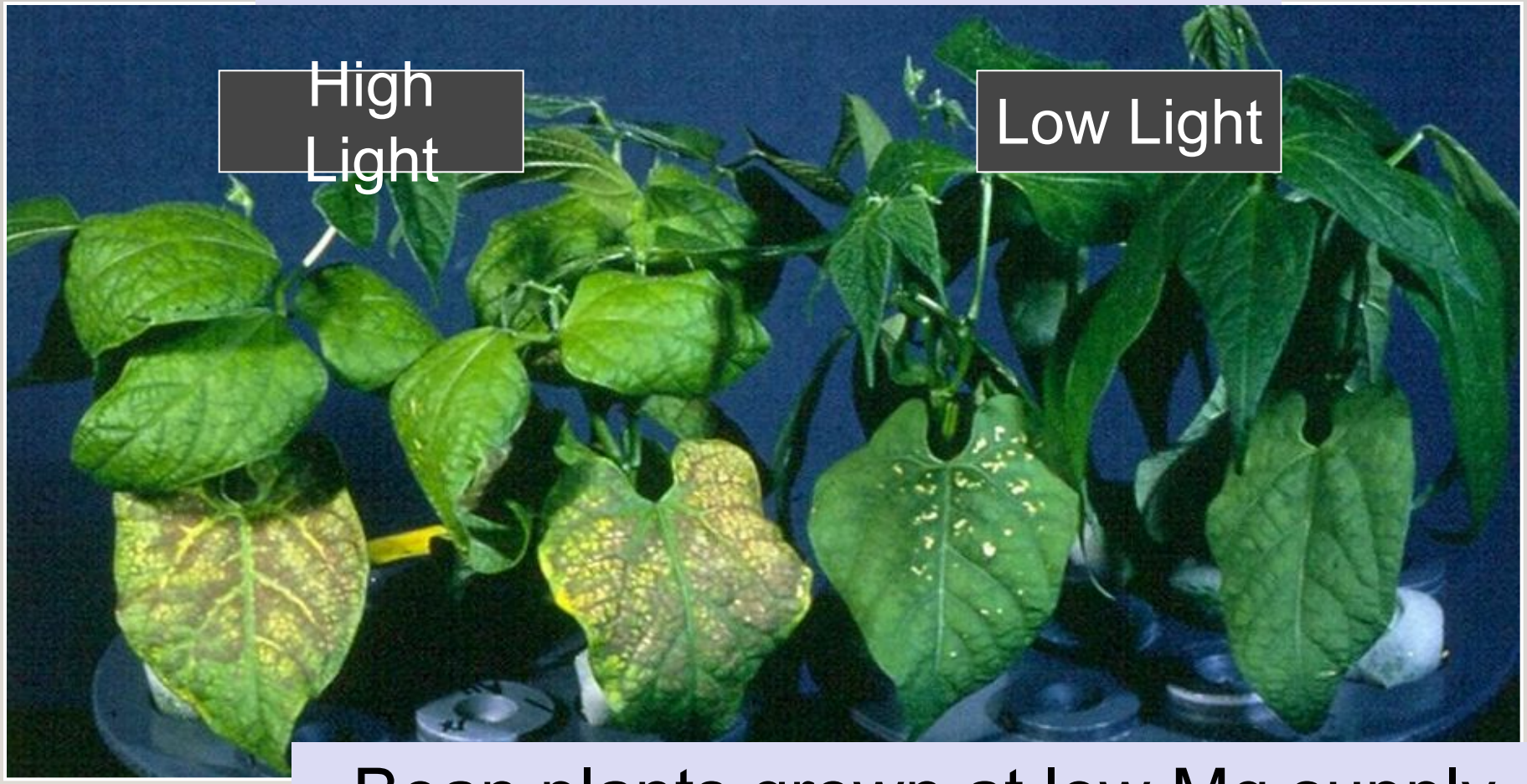
- An excess can cause problems:
  - — Tightens soil
  - — Hard to balance soil
  - — Ties up potassium
  - — Reduces nitrogen utilization

LEAF YELLOWING IN THE FORM OF INTERVEINAL CHLOROSIS ON OLDER LEAVES IS VERY CHARACTERISTIC FOR MG DEFICIENCY IN CROP PLANTS



Up to 35% of the total Mg in plants is bound in chloroplasts

Mg-deficient plants highly sensitive to high light



Bean plants grown at low Mg supply

Cakmak and Kirkby, 2008, Physiol Plant

Magnesium (Mg)

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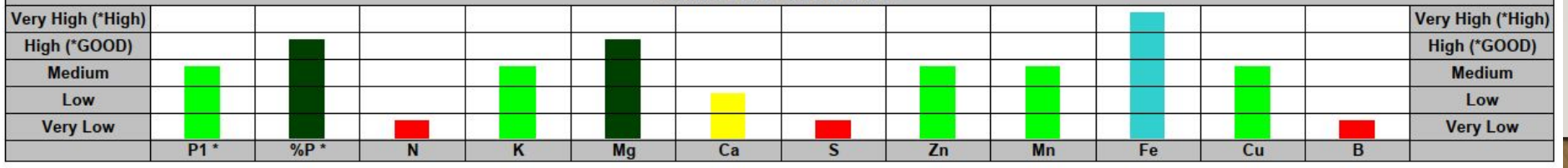


Calcium

BENEFITS

1. Improves soil structure
2. Stimulates soil microbes & earthworms
3. Mobilizes nutrients into plant
4. Increases nitrogen utilization, protein content
5. Root & leaf growth
6. Cell division
7. Builds cell walls
8. Enzyme function
9. Increases sugar content of plant
10. Promotes overall plant health
11. High quality grain or fruit

IDEAL BALANCE

70-80% Saturation

(400 X C.E.C. X %saturation/200 = ppm)

Side note...

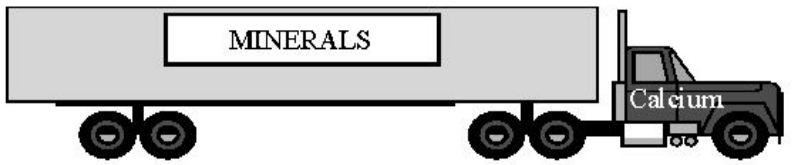
Ca = cement

Cu = rebar

B = mortar

COMMENT

The trucker of all nutrients



CALCIUM

- **pH**
- **Cell Division and Elongation**
- **Cell Wall**
- **Proper Working and Permeability of Cell Membranes**
- **Root Growth/and root function**
- **Storage Quality and Disease resistance**
- ***Healthy Soils Require Calcium***

Calcium (Ca)

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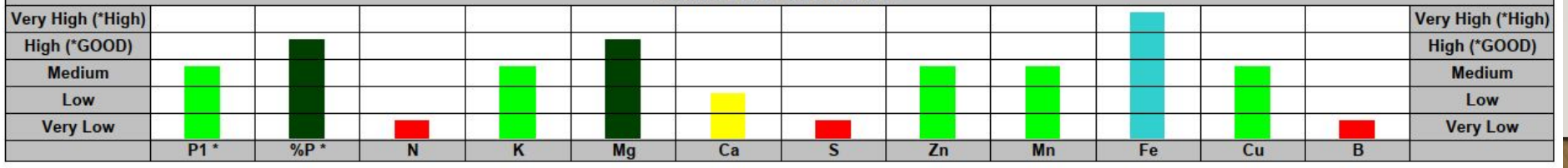

SULFUR

Sulfur

Main Function in Plants

- Constituent of proteins
- Involved in respiration
- Involved in nodule formation

Primary Sources

- Soil organic matter & Rainwater

Sulfur

BENEFITS

1. More useable protein (high quality, complete)
2. Makes soil nitrogen more available
3. Loosens, aerates soil
4. Reduces excess soil magnesium
5. Lowers soil pH
6. Energy release in cells
7. Part of vitamin B_1 & biotin

BEST SOURCES

Bio-Cal (5% S)

Ferti-Cal (5%S)

Huma-Cal (5%)

Ammonium Sulfate (21-0-0-24S)

Calcium Sulfate (gypsum) (Ca 23%, S 17%)

Potassium Sulfate (0-0-50-17S)

Sulfate Trace Minerals

IDEAL BALANCE

50 ppm or 100# per acre

COMMENTS

- Sulfur builds humus
- Needs to be present in a 10:1 ratio of N:S
- Sulfur helps make deep green plants

- **Sulphur (S)**

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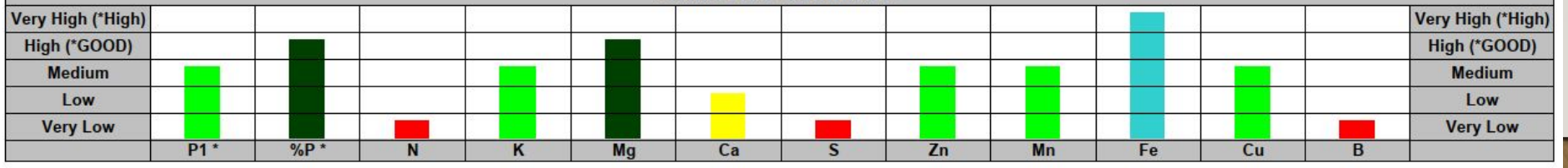

KEY MICRO-NUTRIENTS…

Zinc

- Is important for early root development.
- No zinc = plant cannot complete life cycle
- Very important in human health!

Response of cereals to zinc on Zn-deficient soils under field conditions			
Crop	No. of Experiments	Range of Response (bu/A)	Average Response (bu/A)
Wheat	686	0-28.8	5.34
Rice	250	0-107.70	18.83
Corn	257	0-54.17	11.31
Barley	7	2.04-15.02	6.31
Oats	3	2.79-22.89	10.6
(Nayyar, 1990)			

ZINC – FOR GROWTH, HEALTH & REPRODUCTION

Insufficient uptake

- Chlorosis of mid-leaf region, leading to grey-white patches.
- Stunted plants, short internodes, few tillers.
- Poor root development & microbial colonisation (PGPRb).
- Poor flowering, seed set & finishing.

Induced by

- Excessive Ca, P, Cu
- Deficient Mg, S, Zn

Action

- Soil applied as oxysulphate with carrier
- Foliar Mn (with Zn, Mg, S)

ZINC

- Zinc deficiencies typically show up on poorly drained, sandy, low organic matter, very high organic matter or badly eroded soils.
- Typically as pH increases Zinc availability decreases.
- High applications of phosphorous can cause deficiencies
- Plays an important role in plant growth regulation and root formation.
- **Terminal growth areas are effected first.**

Zinc

BENEFITS

1. Contributes to test weight
2. Increases ear size in corn
3. Promotes silking in corn
4. Hastens maturity
5. Chlorophyll formation
6. Enzyme functions
7. Regulates plant growth
8. Increases plant leaf size.

IDEAL BALANCE

5+ppm or 10# per acre

COMMENT

- Extremely important in phosphorus uptake and utilization within the plant.

- **Zinc…**

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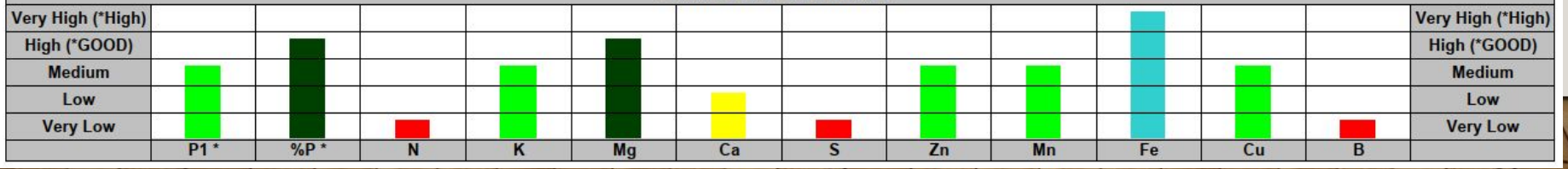

KEY MICRO-NUTRIENTS…

Boron

- Key role in nodulation.
- Plays structural role in cell wall
- Low boron – limited Ca uptake
- If Ca is the truck, boron is the driver
- Crucial during seed-set

- Moves sugars in plant!

Herbivory

most
least

intermediate

0 0.5 1 3 5

Soil Fertility (g)

Boron in animal & human health…

Recent research has shown that boron plays a role in animal metabolism and it has been predicted that it is only a matter of time before boron's essentiality in animals is completely established (Nielsen,1996) Research has shown a link between higher boron consumption and lower prostate cancer in men. When men were divided into quartiles based on their consumption of boron, the men in the highest quartile of boron consumption had a 61% lower risk of developing prostate cancer." Boron has also been shown in vitro to inhibit certain breast cancers and prostate cancers (Zhang, 2001).

Boron's role in plant physiology

Root elongation and Nucleic acid metabolism

One of the most rapid responses to boron deficiency is inhibition or cessation of root elongation, giving the roots a stubby and bushy appearance. Timing studies showed that cessation of root elongation occurs as soon as 3 hours after the boron supply is interrupted and becomes more severe after 6 hours and finally comes to a halt after 24 hours. After the boron supply is restored root elongation becomes rapid again. Between 6-12 hours there is a dramatic increase in the activity of IAA oxidase in the roots which falls rapidly when boron is resupplied (Marschner, 1995).

There is a general agreement among scientists that when boron is withdrawn there is both a decrease in the rate of cell division and an inhibition in elongation growth.

It is well documented that there is a decrease in DNA content and rate of DNA synthesis when boron is withheld (Marschner, 1995).

- **Boron…**
  - Need to be over 1ppm…over 2 is better

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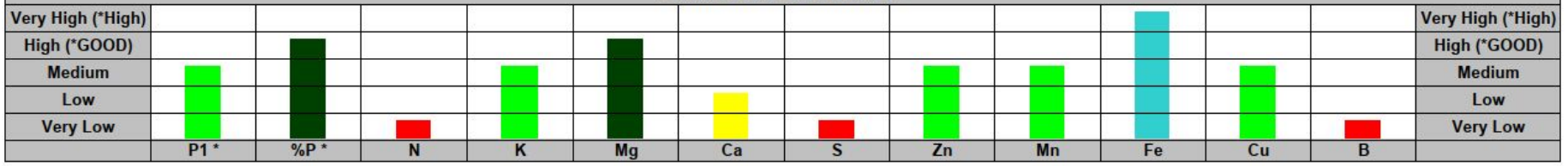
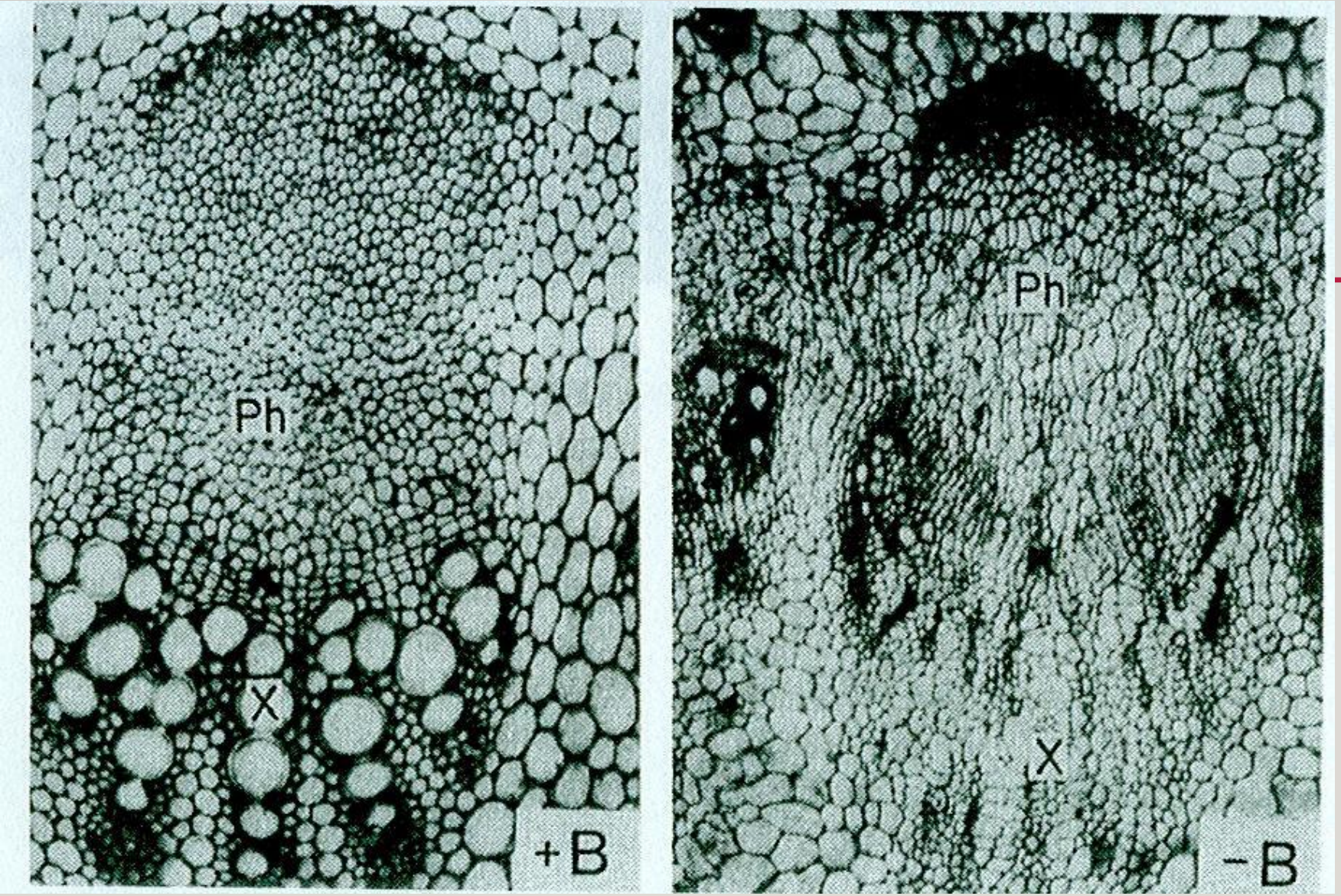
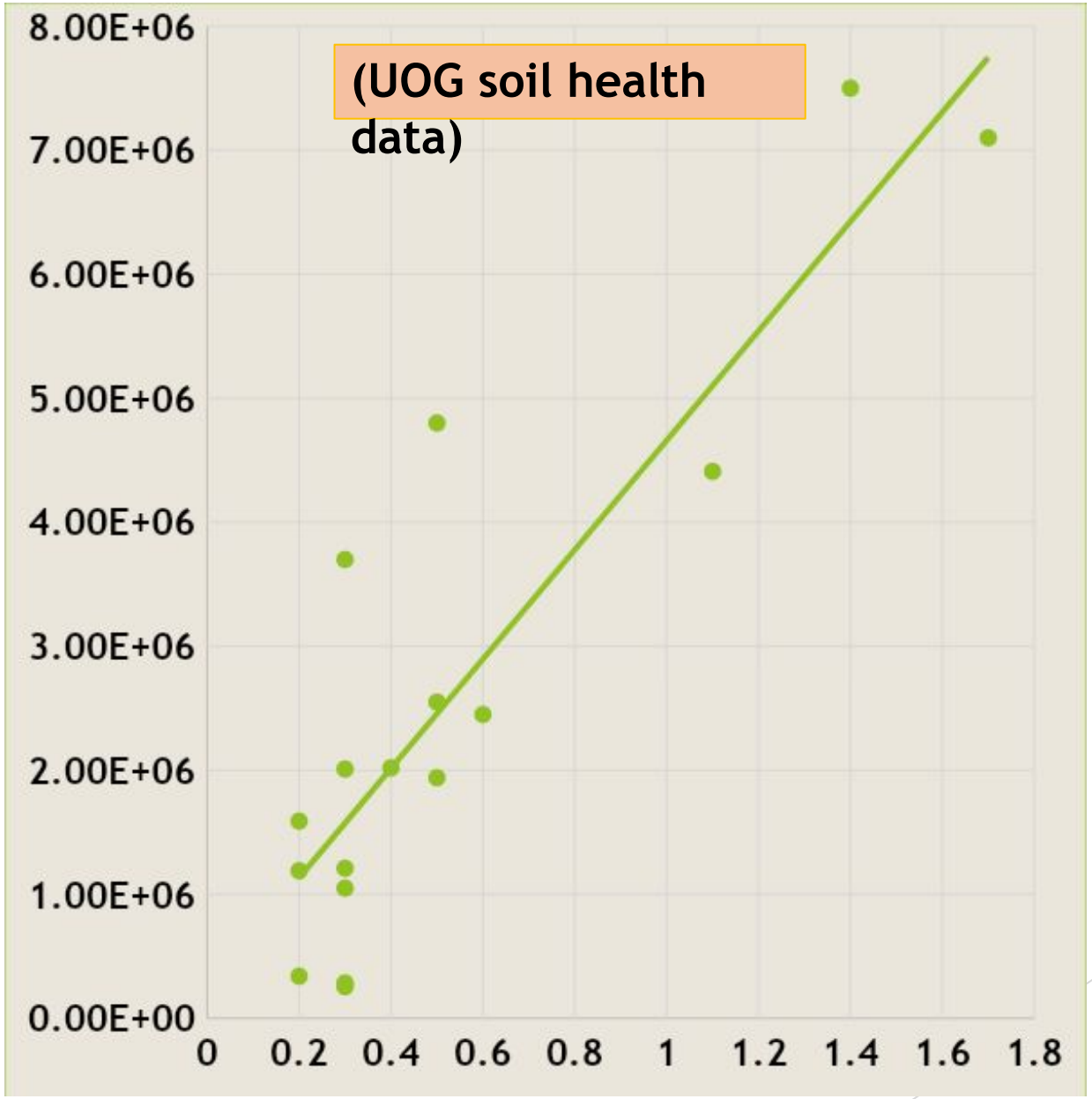



©Mike Dolinski



In boron-sufficient plants (left) vs boron-deficient plants (right) cell expansion continues in the phloem and xylem but not cell differentiation

Rhizobium vs Soil Boron



- **K/Mg Ratio**
  - % K divided by % Mg
  - Ideal… 0.25 to 0.35

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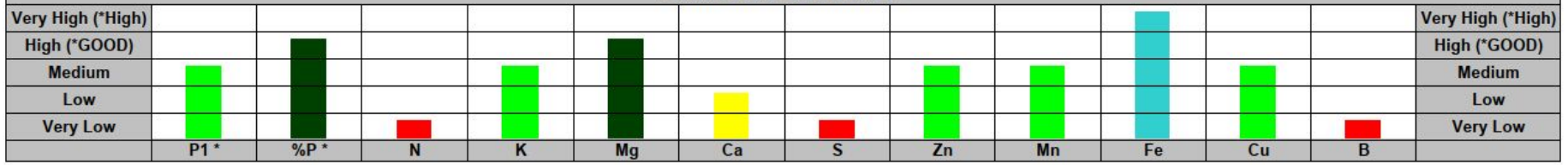
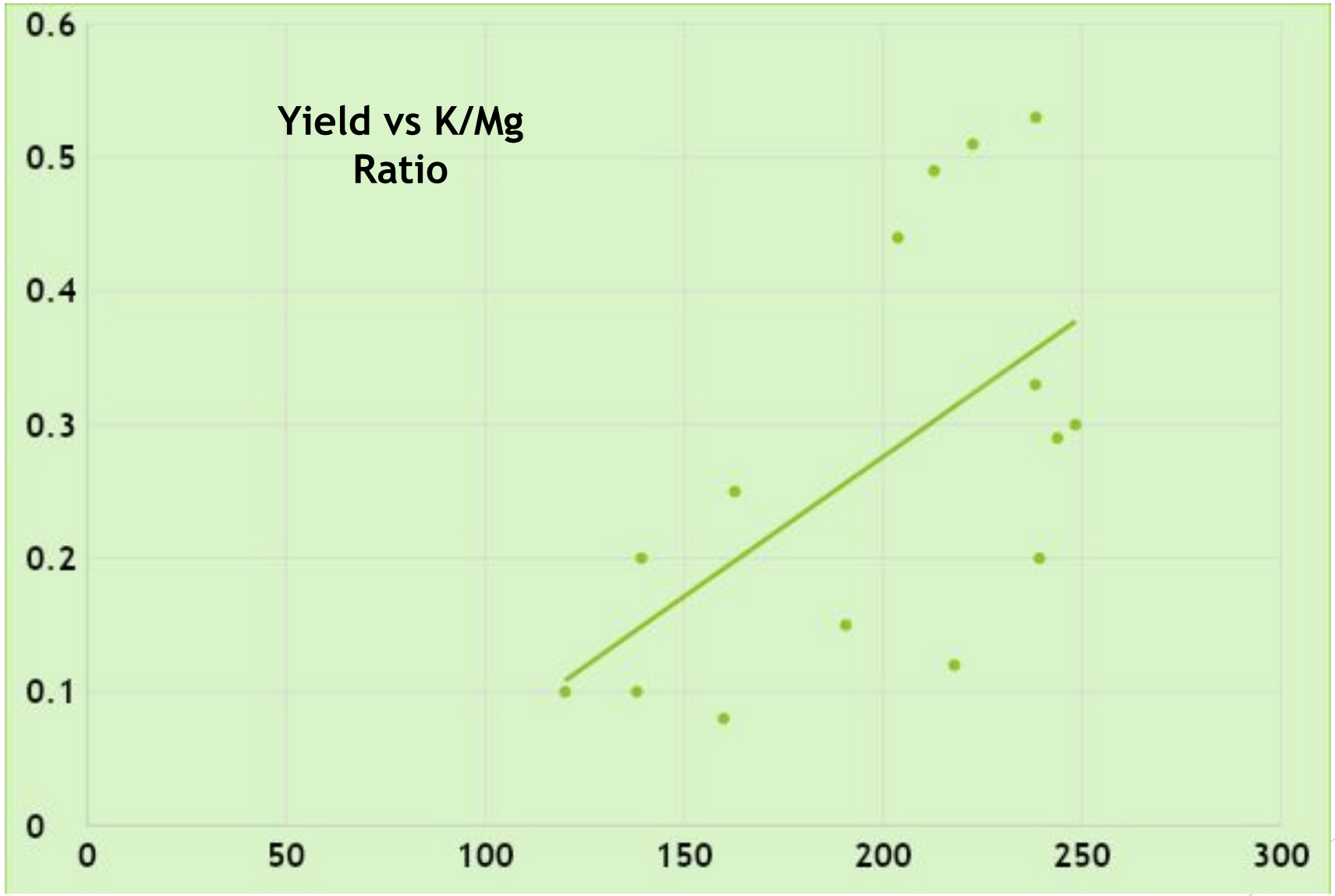


Identified low producing sites of 2015, based on NDVI



- **Manganese…**
  - Natural disease fighter
  - Plays key role during early stages of disease pressure

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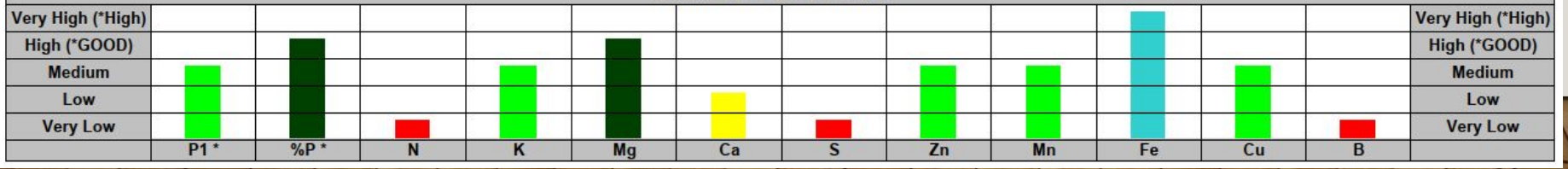

- **pH**
  - Soil pH measures hydrogen ion activity
  - It indicates acidity of the soil solution (active acidity)
  - Or, the total amount of Hydrogen in the soil solution

- **Buffer pH**

  - Buffer pH is a measurement of the amount of hydrogen ions which must be replaced and neutralized by liming
  - It indicates the total acidity (active + reserve) of the soil
  - Or, the amount of Hydrogen on the soil particle

- **pH & buffer pH**

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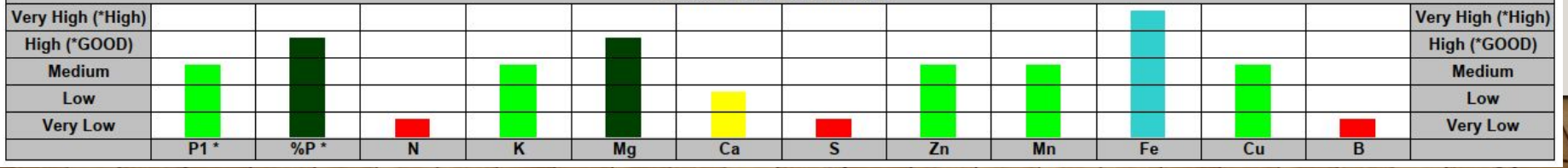
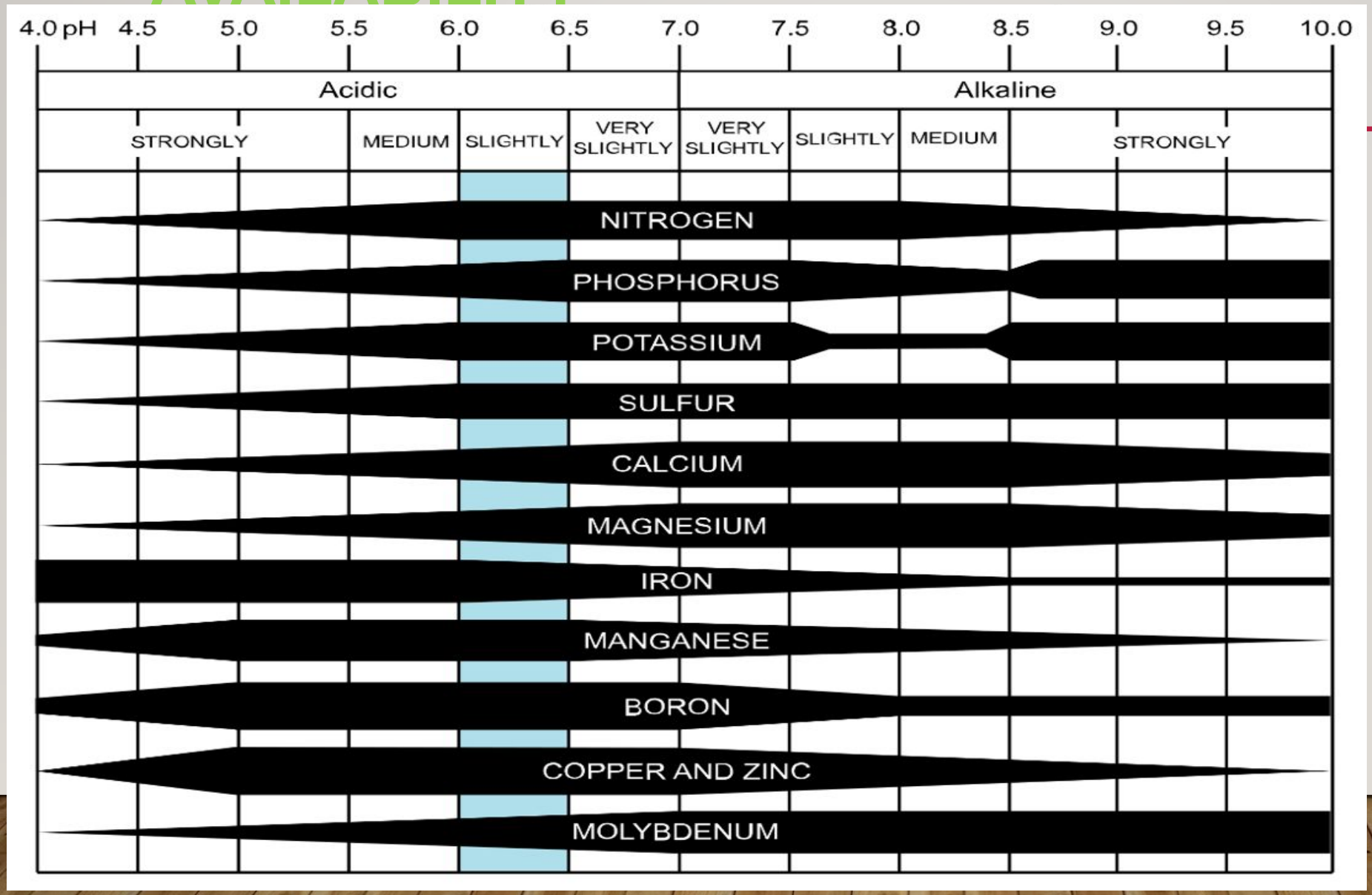
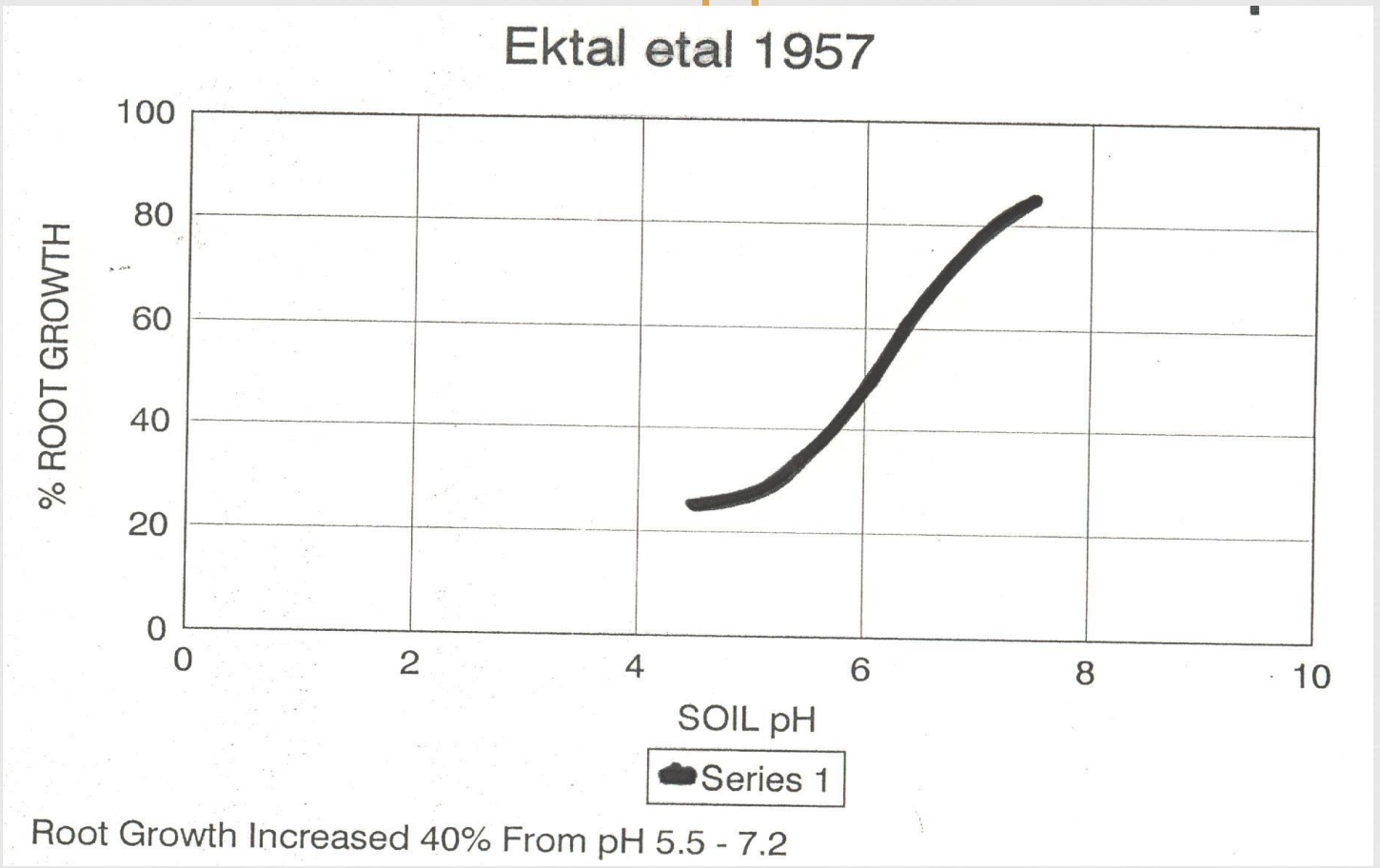


PH EFFECT ON NUTRIENT AVAILABILITY



ROOT GROWTH AND SOIL pH

Soil and Buffer pH



Root Growth Increased 40% From pH 5.5 - 7.2

FERTILIZER EFFICIENCY

Soil and Buffer pH

Soil pH	% Fertilizer Efficiency			% Fertilizer Wasted
	N	P	K	
5.0	53	34	52	54
5.5	77	48	77	33
6.0	89	52	100	20
7.0	100	100	100	0

Dr. Cliff Snyder

OTHER ROLE PLAYERS…

- Organic Matter (OM)

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

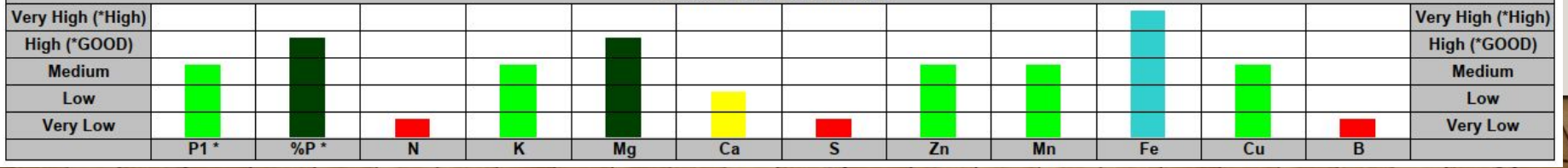
Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



- **Iron (Fe)**
  - Below 80ppm ideal

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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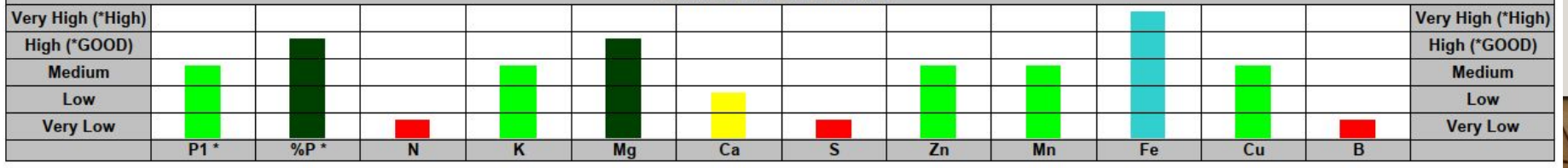
GRAPHIC SUMMARY



- **Copper (Cu)**

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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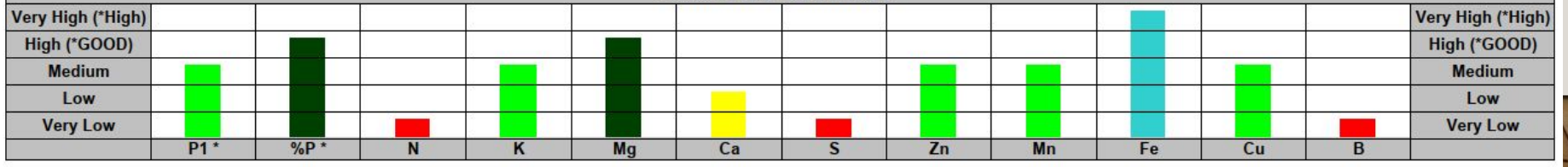
GRAPHIC SUMMARY



- **Aluminum (Al)**
  - Over 400ppm – toxic to roots

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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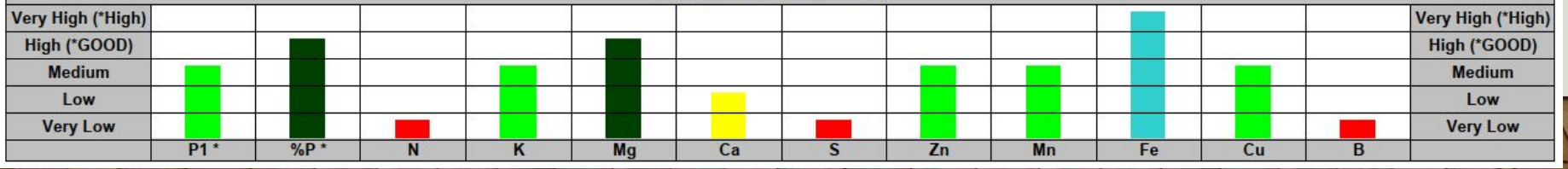
GRAPHIC SUMMARY



- ***ENR (estimated N release)***

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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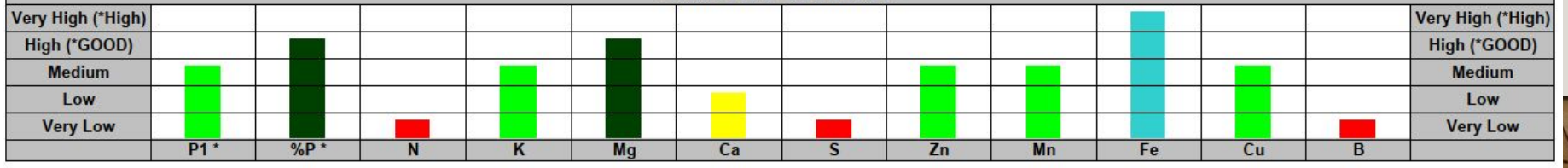
GRAPHIC SUMMARY



- ***Chloride (Cl)***

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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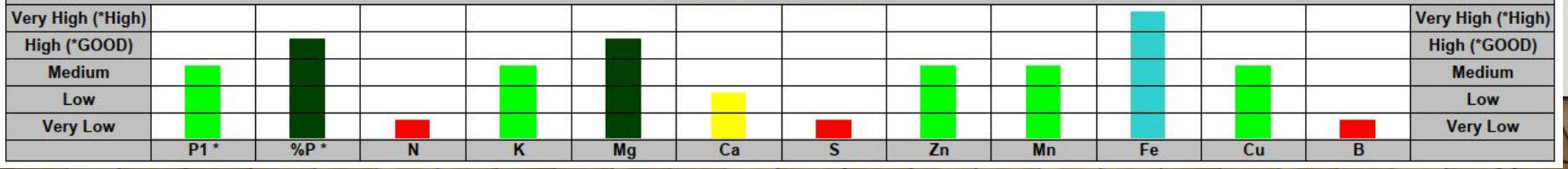
GRAPHIC SUMMARY



- ***Molybdenum (Mo)***

Report Date:2018-10-15 **Print Date:**2019-04-13

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
32825-1		6	53511	6.9	28 M	45 M	83 M	419 H	1570 L	6.3	6.6	16.4	1.3	21.2	47.7	28.9	0.8

Sample Number	Sulfur ppm S	lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
32825-1	8 VL	14	1 VL	2	4.9 M	21 M	108 VH	0.8 M	0.1 VL	0.2 VL	8 G	761	0.3 G	0.06	82	11 L	31 M	

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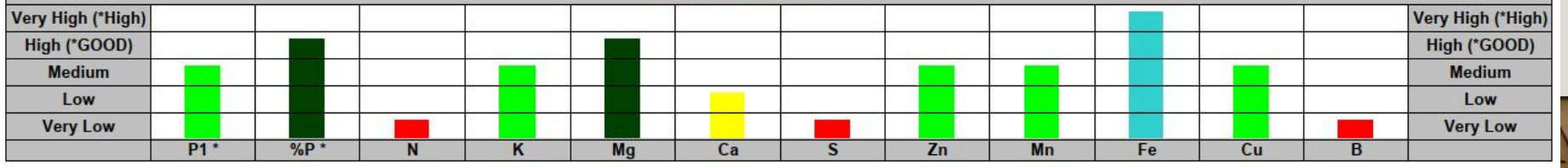
GRAPHIC SUMMARY



PLANT TISSUE TESTING…

- Why tissue test?
  - It compliments soil test
  - Can confirm what soil is saying
  - Inexpensive
  - Can expose hidden hunger

- Barley - yellowing

PLANT TISSUE TESTING…

Report Number: C18192-50052
Account Number: 07219

A & L Canada Laboratories Inc

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Date Received: 2018-07-11 Date Reported:

Date Printed: 2018-07-12

PLANT ANALYSIS REPORT

To: HEARTLAND SOIL SSG
560 SPRUCE ST
VANDERHOOF, BC V0J 3A0

Attn: NORM DUECK
250-964-3775

For: Dueck, Norm

Sample ID: 1

Field: MAIN 85 - UARK
Farm: MAIN

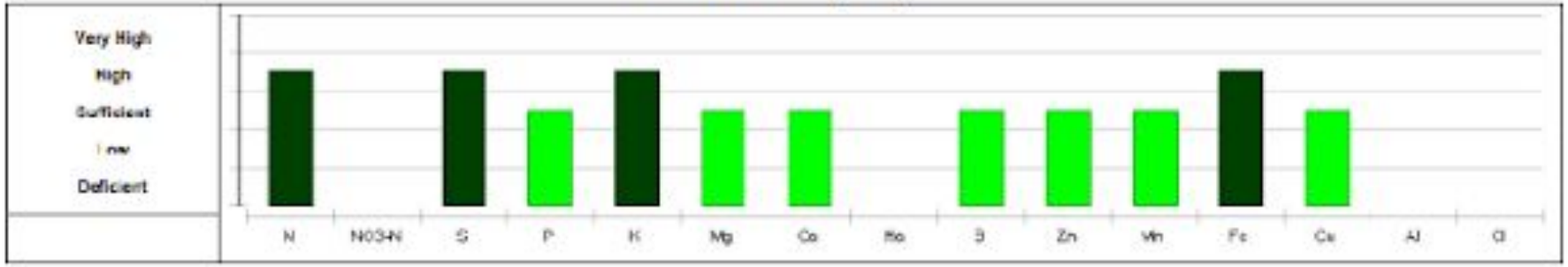
Plant Type: Barley
Growth Stage: Early - Pre Boot Stage
Plant Part: Leaf

Grower Code: 07219044

Date Sampled	Lab Number	Nitrogen (%)	Nitrate Nitrogen (%)	Sulfur (%)	Phosphorus (%)	Potassium (%)	Magnesium (%)	Calcium (%)	Sodium (%)	Boron (ppm)	Zinc (ppm)	Manganese (ppm)	Iron (ppm)	Copper (ppm)	Aluminum (ppm)	Chloride (%)
2018-07-07	1920143	5.02	0.4046	0.46	0.50	5.52	0.22	0.96	0.09	11.11	53	40	152	7.08	22	
Normal Range		2.50 5.50		0.30 0.45	0.35 0.60	3.00 5.50	0.20 0.60	0.30 1.20		7 20	20 60	30 100	50 150	7 15		

	N/S	N/K	P/S	P/Zn	K/Mg	K/Mn	Fe/Mn	Ca/B
Actual Ratio	10.9	0.9	1.1	94	25.3	1387	3.6	882
Expected Ratio	11.0	1.1	1.2	111	11.3	625	1.1	500

Nutrient Sufficiency Ratings:



- A&L recommends a foliar application when Mg, B, P, Zn or Mn are low or deficient at this plant stage. Follow the recommended product label rates.
- A&L Recommends a followup tissue sample 14 days after foliar treatment to monitor progress.

PLANT TISSUE TESTING…

Report Number: 010132-00052
Account Number: 07219

Date Received: 2018-07-11 Date Reported:

A & L Canada Laboratories Inc

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Date Printed: 2018-07-12

PLANT ANALYSIS REPORT

To: HEARTLAND SOIL SSG
560 SPRUCE ST
VANDERHOOF, BC V0J 3A0

Attn: NORM DUECK
250 964-0775

For: Dueck, Norm

Field: MAIN 85 - LIGHT
Farm: MAIN

Grower Code: 07219044

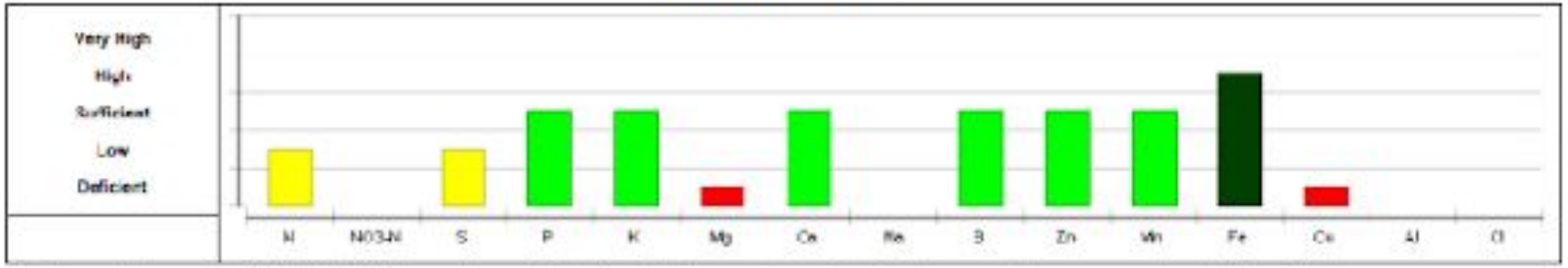
Sample ID: 2

Plant Type: Barley
Growth Stage: Early - Pre Boot Stage
Plant Part: Leaf

Date Sampled	Lab Number	Nitrogen (%)	Nitrate Nitrogen (%)	Sulfur (%)	Phosphorus (%)	Potassium (%)	Magnesium (%)	Calcium (%)	Sodium (%)	Boron (ppm)	Zinc (ppm)	Manganese (ppm)	Iron (ppm)	Copper (ppm)	Aluminum (ppm)	Chloride (%)
2018 07 07	1020141	2.33	0.0127	0.28	0.36	3.76	0.12	0.66	0.04	14.73	31	32	153	4.87	15	
Normal Range		2.50 5.50		0.30 0.45	0.35 0.60	3.00 5.50	0.20 0.60	0.30 1.20		7 20	20 60	30 100	50 150	7 15		

	N/S	N/K	P/S	P/Zn	K/Mg	K/Mn	Fe/Mn	Ca/B
Actual Ratio	8.2	0.6	1.3	119	32.1	1187	4.6	462
Expected Ratio	11.0	1.1	1.2	111	11.3	625	1.1	500

Nutrient Sufficiency Ratings



These plants are low in NITROGEN. This condition could be due to inadequate nitrogen fertilization, poor drainage, excessive rainfall or leaching.
- These plants are deficient in MAGNESIUM. This condition may be due to low soil magnesium, excess soil potassium, low soil pH or poor drainage. A&L recommends

IN SUMMARY…

- **Why is soil nutrition important?**
  - Healthier, nutrient-dense crop
  - Increases ROI with better fertilizer utilization
  - Long-term health of soil…future generations
  - Image – do city folks care?
  - Sustainable – what are you leaving your kids?

IN SUMMARY…

- **Why soil Sample?**
  - Knowing your soil, allows for balanced fertility, which provides consistent yields and quality while at the same time builds a more sustainable Ecology of the soil and ultimately improves soil Health

Questions…

Discussion…

Norm Dueck, CCA

Agronomy and Business
Development Representative

A & L Canada Laboratories Inc.

2136 Jetstream Road

London, ON N5V 3P5

Cell: 250-570-1798
A & L Office: 519-457-2575

www.alcanada.com

Local Soils…

Report Number: C17291 10312
Account Number: 95000

To: RACHAEL ROUSSIN
PO BOX 1232
ROSSLAND, BC V0G 1Y0

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

C17291-10312

For: JAMIE HAYNES

Farm: JAMIE HAYNES

Reported Date:2017-10-20 **Printed Date:**Oct 24, 2017

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
JH1	JH FIELD 1	15	01340	4.0	22 M	43 M	363 VH	305 L	4330 VH	7.5		25.5	3.7	10.0	85.1		1.4
JH2	JH FIELD 1B	15	01341	4.2	39 M	84 G	481 VH	185 M	1650 M	6.4	6.9	12.3	10.0	12.5	67.1	9.6	0.7
JH3	JH FIELD 1C	15	01342	4.5	24 M	30 L	145 M	465 H	3150 M	8.3		21.6	1.7	18.0	73.0		7.5
JH4	JH FIELD 1C ALK	15	01343	5.3	14 M	21 M	150 M	1180 H	4110 VL	8.1		45.9	0.8	21.4	44.8		33.2

Sample Number	Sulfur S ppm	Sulfur S lbs/ac	Nitrate Nitrogen NO3-N ppm	Nitrate Nitrogen NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm
JH1	26 VL	117	2 VL	9	0.8 VL	28 M	52 VH	0.9 M	0.9 M		3 L	391	0.0 G	0.37	52		84 H
JH2	14 VL	63	2 VL	9	1.8 L	24 M	68 VH	1.0 M	0.6 M		12 H	883	0.3 G	0.80	54		21 M
JH3	92 VH	414	6 L	27	1.2 L	52 VH	61 VH	1.7 H	0.9 M		8 H	513	0.0 G	0.09	57		374 VH
JH4	2038 VH	9171	7 L	32	0.8 VL	45 H	88 VH	2.1 H	1.4 H		7 H	391	0.0 G	0.04	66		3504 VH

W VL = VERY LOW, L = LOW, M = MEDIUM, H = HIGH, VH = VERY HIGH, G = GOOD, MA = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

Local Soils…

Report Number: C17291-10313
Account Number: 95000

To: RACHAEL ROUSSIN
PO BOX 1232
ROSSLAND, BC V0G 1Y0

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

C17291-10313

For: GREG MCDONALD

Reported Date:2017-10-20 Printed Date:Oct 30, 2017

SOIL TEST REPORT

Page: 1 / 1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
GM1	GM FIELD 1	15	01346	5.4	31 G	62 H	495 VH	400 M	4250 H	7.3		26.3	4.8	12.7	80.8		1.9
GM2	GM FIELD 2	15	01347	5.3	47 G	103 H	726 VH	240 L	3160 H	6.8	6.9	21.0	8.9	9.5	75.4	5.6	0.6

Sample Number	Sulfur S ppm		lbs/ac	Nitrate Nitrogen NO3-N ppm		lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm
GM1	28	VL	126	7	L	32	1.5 L	38 H	58 VH	1.5 H	1.1 M		5 M	686	0.0 G	0.38	67		116 VH
GM2	15	VL	68	5	L	23	3.1 M	34 H	67 VH	1.3 H	0.8 M		19 H	693	0.1 G	0.94	66		28 L

W VL = VERY LOW, L = LOW, M = MEDIUM, H = HIGH, VH = VERY HIGH, G = GOOD, MA = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

Local Soils…

Report Number: C18292-10232
Account Number: 95000

To: KOOTENAY + BANDERY FARM ADVISO
PO BOX 1232
ROSSLAND, BC V0G 1Y0

Attn: RACHAEL ROUSSIN

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

C18292-10232

For: JAMIE HAYNES

Farm: HAYNES FARM
Field: BARB+FLOYD

Reported Date:2018-10-23 **Printed Date:**Oct 23, 2018

SOIL TEST REPORT

Page: 1 / 1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
BARB1		0	67928	4.2	28 M	50 M	192 H	162 M	1380 M	6.3	6.9	10.0	4.9	13.5	69.0	11.8	0.7
FLOYD1		0	67929	2.8	31 M	50 M	258 VH	131 M	1240 M	6.4	6.9	9.2	7.2	11.9	67.4	12.9	0.7

Sample Number	Sulfur S ppm	Sulfur S lbs/ac	Nitrate Nitrogen NO3-N ppm	Nitrate Nitrogen NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm
BARB1	10 VL		8 L		3.0 M	22 M	60 VH	1.2 H	0.2 VL		10 G	664	0.4 G	0.36	54		17 M
FLOYD1	11 VL		7 L		3.8 M	22 M	54 VH	1.0 M	0.3 VL		12 H	561	0.3 G	0.61	40		14 M

W VL = VERY LOW, L = LOW, M = MEDIUM, H = HIGH, VH = VERY HIGH, G = GOOD, MA = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

SOIL FERTILITY GUIDELINES (lbs/ac)

Local Soils…

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C19277-10159
Account Number:00495

To:OKANAGAN FERTILIZER LTD.
P.O. BOX 770
603 OLD VERNON RD
ENDERBY, BC V0E 1V0
Attn:KEN CLANCY
250-838-6968

For:PA-VAN RANCH

Report Date:2019-10-08 **Print Date:**2019-12-03

SOIL TEST REPORT

Sample Number	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
SOUTHALF/	05487	2.7	42 M	112 G	62 L	180 H	950 M	24 H	6.3	6.9	7.7	2.1	19.5	61.7	15.3	1.4
PIVOTSOUT	05488	2.6	51 M	151 H	33 L	117 H	690 M	20 H	6.0	6.9	5.8	1.5	16.9	59.6	20.5	1.5
PIVOTNORT	05489	3.3	53 G	145 H	62 L	86 L	520 VL	16 M	5.5	6.6	8.3	1.9	8.6	31.2	57.5	0.8

Sample Number	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	Nitrate Nitrogen NO3-N ppm	K/Mg Ratio	ENR	Field ID	Chloride Cl ppm	Molybdenum Mo ppm
SOUTHALF/	8 VL	2.0 L	28 M	122 VH	0.7 M	0.1 VL	0.2 VL	12 G	1239	0.9 G	6 L	0.11	39			
PIVOTSOUT	7 VL	3.3 M	22 M	162 VH	0.4 L	0.1 VL	0.2 VL	28 H	703	1.1 M	4 VL	0.09	38			
PIVOTNORT	7 VL	3.4 M	26 M	142 VH	0.5 M	0.1 VL	0.2 VL	25 H	730	1.7 M	12 M	0.22	45			

CE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO TOXIC, T = PHYTO TOXIC, ST = SEVERE PHYTO TOXIC

Local Soils…

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C15266-10138
Account Number:00495

To:OKANAGAN FERTILIZER LTD.
P.O. BOX 770
603 OLD VERNON RD
ENDERBY, BC V0E 1V0
Attn:KEN CLANCY
250-838-6968

For:PA-VAN RANCH

Report Date:2015-09-25 **Print Date:**2018-06-22

SOIL TEST REPORT

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Sample Number	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
NW	53057	2.8	52 G	130 H	48 L	125 M	920 M	23 H	6.6	6.9	7.1	1.7	14.8	65.2	16.8	1.4
SW	53058	2.8	42 M	92 M	27 VL	115 H	610 M	20 H	6.2	6.9	5.4	1.3	17.9	57.0	22.2	1.6
NE	53059	2.4	58 G	181 H	43 L	95 M	680 L	21 H	6.2	6.8	6.8	1.6	11.7	50.1	35.2	1.3
SE	53060	3.3	59 G	151 H	45 L	135 H	960 M	22 H	6.3	6.9	7.3	1.6	15.4	65.6	16.2	1.3

Sample Number	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	Nitrate Nitrogen NO3-N ppm	K/Mg Ratio	ENR	Field ID	Chloride Cl ppm	Molybdenum Mo ppm
NW	6 VL	2.9 L	17 M	181 VH	0.5 M	0.1 VL	0.2 VL	22 H	742	0.4 G	3 VL	0.11	40			
SW	6 VL	2.0 L	20 M	175 VH	0.5 M	0.1 VL	0.1 VL	17 H	708	0.9 G	2 VL	0.07	40			
NE	6 VL	3.5 M	26 M	193 VH	0.3 L	0.1 VL	0.1 VL	27 H	865	0.8 G	2 VL	0.14	36			
SE	8 VL	2.9 L	30 H	148 VH	0.7 M	0.1 VL	0.2 VL	15 G	1293	1.0 G	6 L	0.10	45			

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Local Soils…

Report Number: C19294-10630
Account Number: 95000

To: KOOTENAY AND BOUNDARY FARM ADV
PO BOX 1232
ROSSLAND, BC V0G 1Y0

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

C19294-10630

For: JAMIE HAYNES

Reported Date: Printed Date: Oct 23, 2019

SOIL TEST REPORT

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Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
JHNOR		12	27926	3.2	52 G	108 G	405 VH	129 M	1080 M	6.2	6.9	8.8	11.9	12.3	61.6	13.5	0.7
JHR		12	27927	4.4	45 M	90 G	451 VH	187 M	1420 M	6.2	6.9	11.1	10.4	14.1	64.1	10.6	0.7

Sample Number	Sulfur S ppm		Sulfur S lbs/ac	Nitrate Nitrogen NO3-N ppm		Nitrate Nitrogen NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm
JHNOR	24	H	86	8	L	29	2.9 L	20 M	64 VH	1.1 M	0.4 L		16 H	874	0.7 G	0.97	44		14 M
JHR	33	H	119	10	M	36	4.1 M	20 M	68 VH	1.1 M	0.2 VL		16 H	731	0.4 G	0.74	56		19 M

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Local Soils…

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
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Report Number:C19277-10159
Account Number:00495

To:OKANAGAN FERTILIZER LTD.
P.O. BOX 770
603 OLD VERNON RD
ENDERBY, BC V0E 1V0
Attn:KEN CLANCY
250-838-6968

For:PA-VAN RANCH

Report Date:2019-10-08 **Print Date:**2019-12-03

SOIL TEST REPORT

Page:1

Sample Number	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
SOUTHALFA	05487	2.7	42 M	112 G	62 L	180 H	950 M	24 H	6.3	6.9	7.7	2.1	19.5	61.7	15.3	1.4
PIVOTSOUT	05488	2.6	51 M	151 H	33 L	117 H	690 M	20 H	6.0	6.9	5.8	1.5	16.9	59.6	20.5	1.5
PIVOTNORT	05489	3.3	53 G	145 H	62 L	86 L	520 VL	16 M	5.5	6.6	8.3	1.9	8.6	31.2	57.5	0.8

Sample Number	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	Nitrate Nitrogen NO3-N ppm	K/Mg Ratio	ENR	Field ID	Chloride Cl ppm	Molybdenum Mo ppm
SOUTHALFA	8 VL	2.0 L	28 M	122 VH	0.7 M	0.1 VL	0.2 VL	12 G	1239	0.9 G	6 L	0.11	39			
PIVOTSOUT	7 VL	3.3 M	22 M	162 VH	0.4 L	0.1 VL	0.2 VL	28 H	703	1.1 M	4 VL	0.09	38			
PIVOTNORT	7 VL	3.4 M	26 M	142 VH	0.5 M	0.1 VL	0.2 VL	25 H	730	1.7 M	12 M	0.22	45			

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Local Soils…

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Report Number:C18249-10187
Account Number:00495

To:OKANAGAN FERTILIZER LTD.
P.O. BOX 770
603 OLD VERNON RD
ENDERBY, BC V0E 1V0
Attn:KEN CLANCY
250-838-6968

For:PA-VAN RANCH

Report Date:2018-09-08 **Print Date:**2018-09-10

SOIL TEST REPORT

Sample Number	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
NORTHFAR	09121	3.9	50 G	126 H	81 M	75 VL	1300 VL	21 L	5.8	6.4	14.6	1.4	4.3	44.5	49.2	0.6
NORTHFAR	09122	4.4	48 G	122 H	115 M	88 VL	950 VL	18 L	5.7	6.2	15.4	1.9	4.7	30.8	62.1	0.5
HOMENEWS	09123	3.2	38 M	91 G	66 L	218 H	1300 M	29 H	6.4	6.9	9.8	1.7	18.6	66.4	12.0	1.3
HOMENEWS	09124	2.2	58 G	153 H	88 M	109 M	810 L	28 H	6.1	6.8	7.7	2.9	11.8	52.6	31.0	1.6

Sample Number	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	Nitrate Nitrogen NO3-N ppm	K/Mg Ratio	ENR	Field ID	Chloride Cl ppm	Molybdenum Mo ppm
NORTHFAR	13 M	2.9 L	17 M	76 VH	0.6 M	0.2 VL	0.2 VL	9 G	1720	1.4 M	7 L	0.33	51			
NORTHFAR	9 L	3.2 M	18 M	90 VH	0.6 M	0.1 VL	0.2 VL	11 H	1468	1.4 M	5 L	0.40	56			
HOMENEWS	12 VL	2.7 L	18 M	110 VH	0.8 M	0.2 VL	0.2 VL	16 H	722	0.4 G	8 L	0.09	44			
HOMENEWS	10 VL	3.1 M	23 M	153 VH	0.5 M	0.2 VL	0.2 VL	28 H	706	0.7 G	4 VL	0.25	34			

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Local Soils…

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C15266-10138
Account Number:00495

To:OKANAGAN FERTILIZER LTD.
P.O. BOX 770
603 OLD VERNON RD
ENDERBY, BC V0E 1V0
Attn:KEN CLANCY
250-838-6988

For:PA-VAN RANCH

Report Date:2015-09-25 **Print Date:**2018-06-22

SOIL TEST REPORT

Page:1

Sample Number	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
NW	53057	2.8	52 G	130 H	48 L	125 M	920 M	23 H	6.6	6.9	7.1	1.7	14.8	65.2	16.8	1.4
SW	53058	2.8	42 M	92 M	27 VL	115 H	610 M	20 H	6.2	6.9	5.4	1.3	17.9	57.0	22.2	1.6
NE	53059	2.4	58 G	181 H	43 L	95 M	680 L	21 H	6.2	6.8	6.8	1.6	11.7	50.1	35.2	1.3
SE	53060	3.3	59 G	151 H	45 L	135 H	960 M	22 H	6.3	6.9	7.3	1.6	15.4	65.6	16.2	1.3

Sample Number	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	Nitrate Nitrogen NO3-N ppm	K/Mg Ratio	ENR	Field ID	Chloride Cl ppm	Molybdenum Mo ppm
NW	6 VL	2.9 L	17 M	181 VH	0.5 M	0.1 VL	0.2 VL	22 H	742	0.4 G	3 VL	0.11	40			
SW	6 VL	2.0 L	20 M	175 VH	0.5 M	0.1 VL	0.1 VL	17 H	708	0.3 G	2 VL	0.07	40			
NE	6 VL	3.5 M	26 M	193 VH	0.3 L	0.1 VL	0.1 VL	27 H	865	0.8 G	2 VL	0.14	36			
SE	8 VL	2.9 L	30 H	148 VH	0.7 M	0.1 VL	0.2 VL	15 G	1293	1.0 G	6 L	0.10	45			

CE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

Aluminum (al) Toxicity

Tip of Root Hair