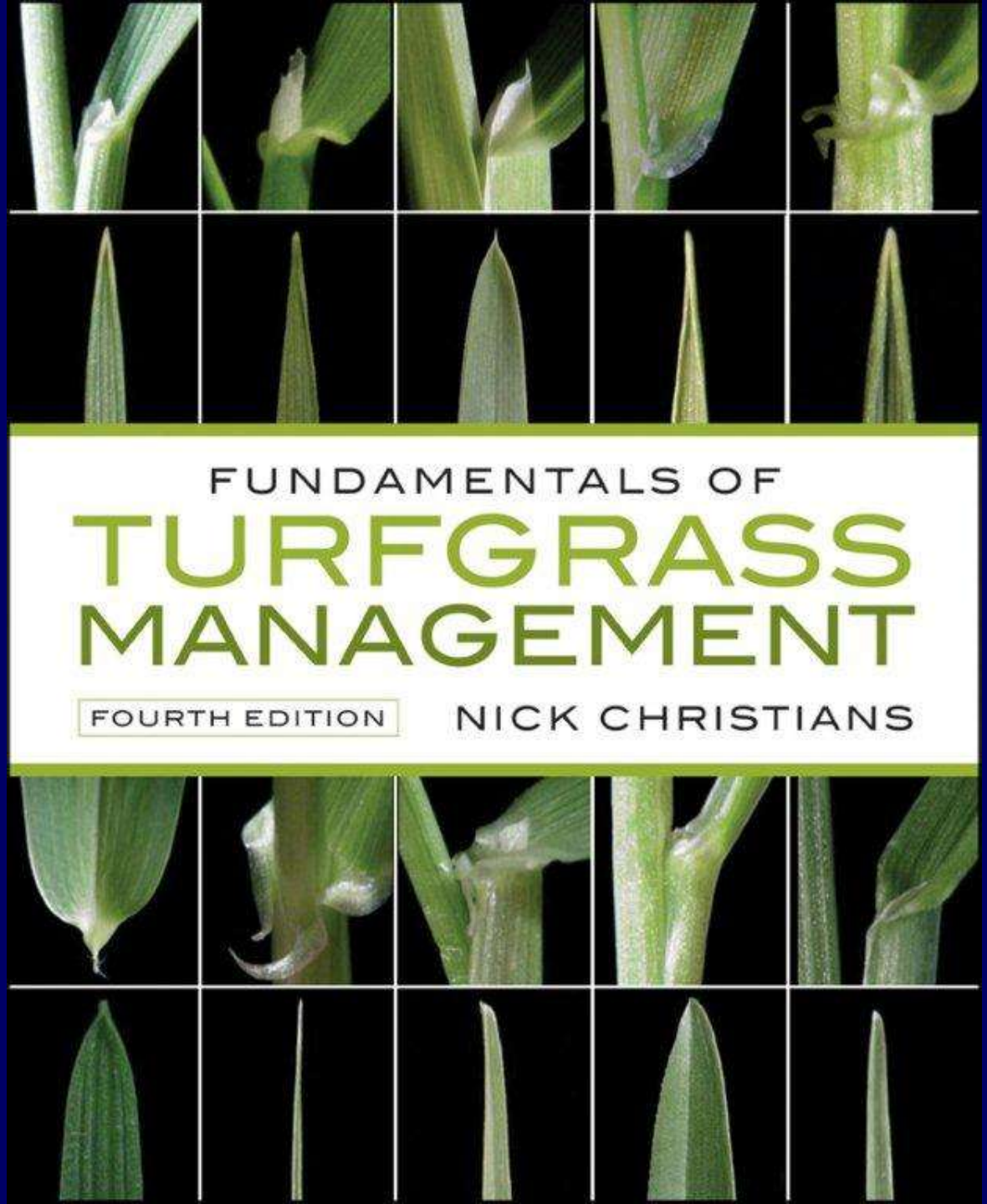
FERTILITY MANAGEMENT OF SAND-BASED SYSTEMS

NICK CHRISTIANS
IOWA STATE UNIVERSITY


FUNDAMENTALS OF
TURFGRASS
MANAGEMENT
FOURTH EDITION
NICK CHRISTIANS

IOWA TURFGRASS BLOG

iaturf.blogspot.com

BASIC PRINCIPLES AND TERMINOLOGY

REPORT NO.	809629	I.D. NO.	95635	DATE REC'D.	07-Dec-93	DATE REPORTED	08-Dec-93	SAMPLE WILL BE KEPT UNTIL	07-Jan-94	LABORATORY NUMBER	

Scotts ProTurf

Soil Analysis

Conducted by

HARRIS LABORATORIES INC.

THIS ANALYSIS RUN FOR:

RANDY CARPENTAR
MEADOWS FARMS GC
4300 FLAT RUN RD
LOCUST GROVE VA 22508

THIS ANALYSIS REQUESTED BY:

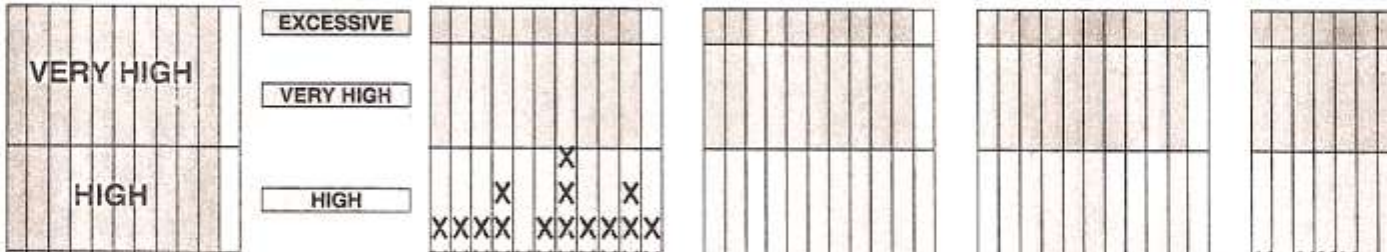
Robert Herring
7303 Native Dancer Dr
Midlothian VA 231126170
PH804-739-1050 77L

ALL NUTRIENT RESULTS EXPRESSED IN PPM

CODE →	1	2	3	4	5	6	7	8	9
Sample Description	GRN11	GRN12	GRN13	GRN14	GRN15	GRN16	GRN17	GRN18	PG
CEC	3.4	2.8	3.1	4.2	4.4	3.2	2.5	4.1	2.7
Soil pH	6.7*	6.7*	6.7*	6.9*	6.4	6.8*	7.1*	6.8*	6.7*
Buffer pH	----	----	----	----	7.2	----	----	----	----
Soluble Salts	0.14	0.14	0.12	0.18	0.18	0.20	0.14	0.18	0.23
Exchangeable Calcium (Ca)	454*	366*	417*	597*	641	452*	334*	586*	344*
Exchangeable Magnesium (Mg)	104	92	102	119	116	97	79	115	90
Exchangeable Sodium (Na)	10	10	9	10	10	8	7	14	16
% H Base Saturation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% K Base Saturation	5.4*	5.2*	4.8*	3.7*	4.0*	3.8*	5.3*	4.0*	7.5*
% Mg Base Saturation	25.8*	27.5*	27.2*	23.7*	22.0*	25.1*	26.4*	23.3*	27.3*
% Ca Base Saturation	67.5	65.7	66.8	71.5	73.0	70.1	67.1	71.2	62.7
% Na Base Saturation	1.3	1.6	1.3	1.0	1.0	1.1	1.2	1.5	2.5

CODING INFORMATION

	Sample Description	Composite Information	Plant Variety	Sample Nature
1	GRN11		GART	
2	GRN12		GART	



FIRST THREE LINES FILLED WITH INFORMATION

CEC

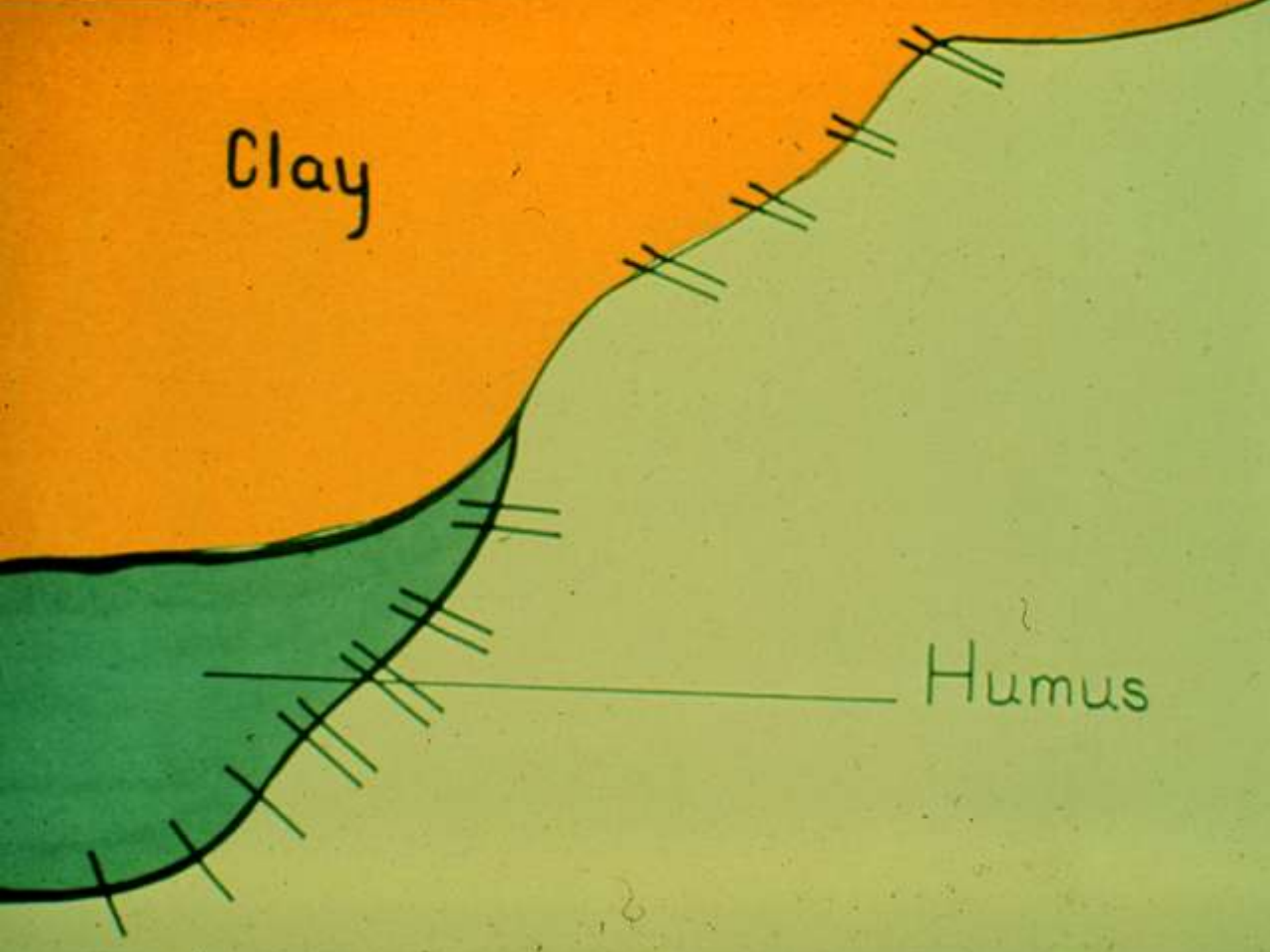
pH

BUFFER pH

CATION EXCHANGE CAPACITY (CEC)

THE ABILITY TO EXCHANGE CATIONS

ELEMENT	SYMBOL	CATION
Hydrogen	H	H^{+}
Calcium	Ca	Ca^{++}
Magnesium	Mg	Mg^{++}
Potassium	K	K^{+}
Sodium	Na	Na^{+}


Clay
Humus


60-65%
= Ca++
= Ca++
= Ca++
= Ca++
= Ca++
= Ca++
Clay
Root
Humus
10-20%
= Mg++
= Mg++
5-10%
- K+
- K+
5%
- NH4+
5-20%
- H+
Ca++ =
Mg++ =
Mg++ =
H+ -
Ca++ =
Ca++ =
K+ -
NH4+ -

CATION EXCHANGE CAPACITY

SOIL TYPE	meq/100g
• SAND	• <1 - 8
• CLAY	• 80 - 120
• ORGANIC MATTER	• 150 – 500
• CLAY LOAM SOIL	• 25 – 30
• SAND-BASED ROOT ZONE	• <1 - 14

CATION EXCHANGE CAPACITY

1 milliequivalent (meq)

6.02×10^{20}

602,000,000,000,000,000,000

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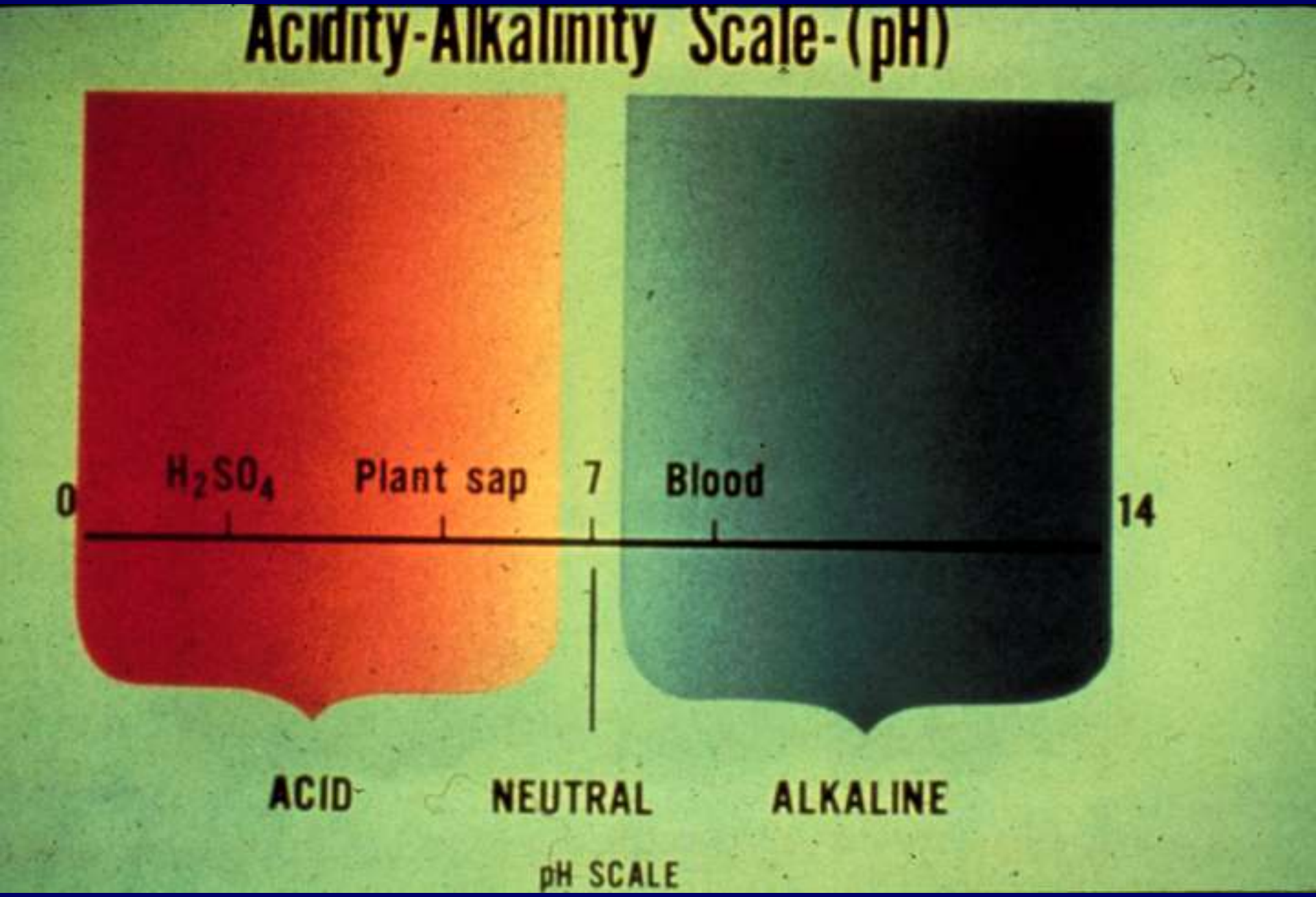
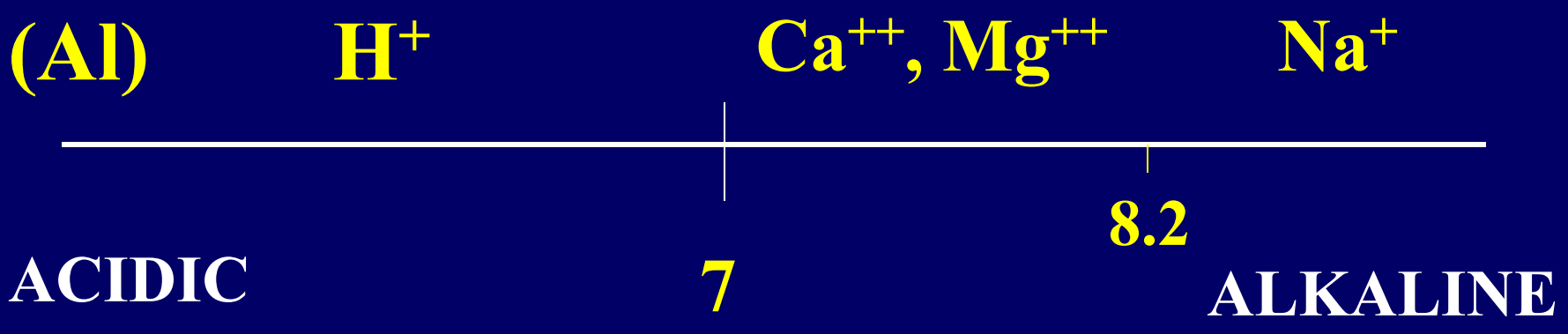
pH


Acidity-Alkalinity Scale-(pH)
0
H_2SO_4
Plant sap
7
Blood
14
ACID
NEUTRAL
ALKALINE
pH SCALE

pH



HOW SOIL pH AFFECTS AVAILABILITY OF PLANT NUTRIENTS

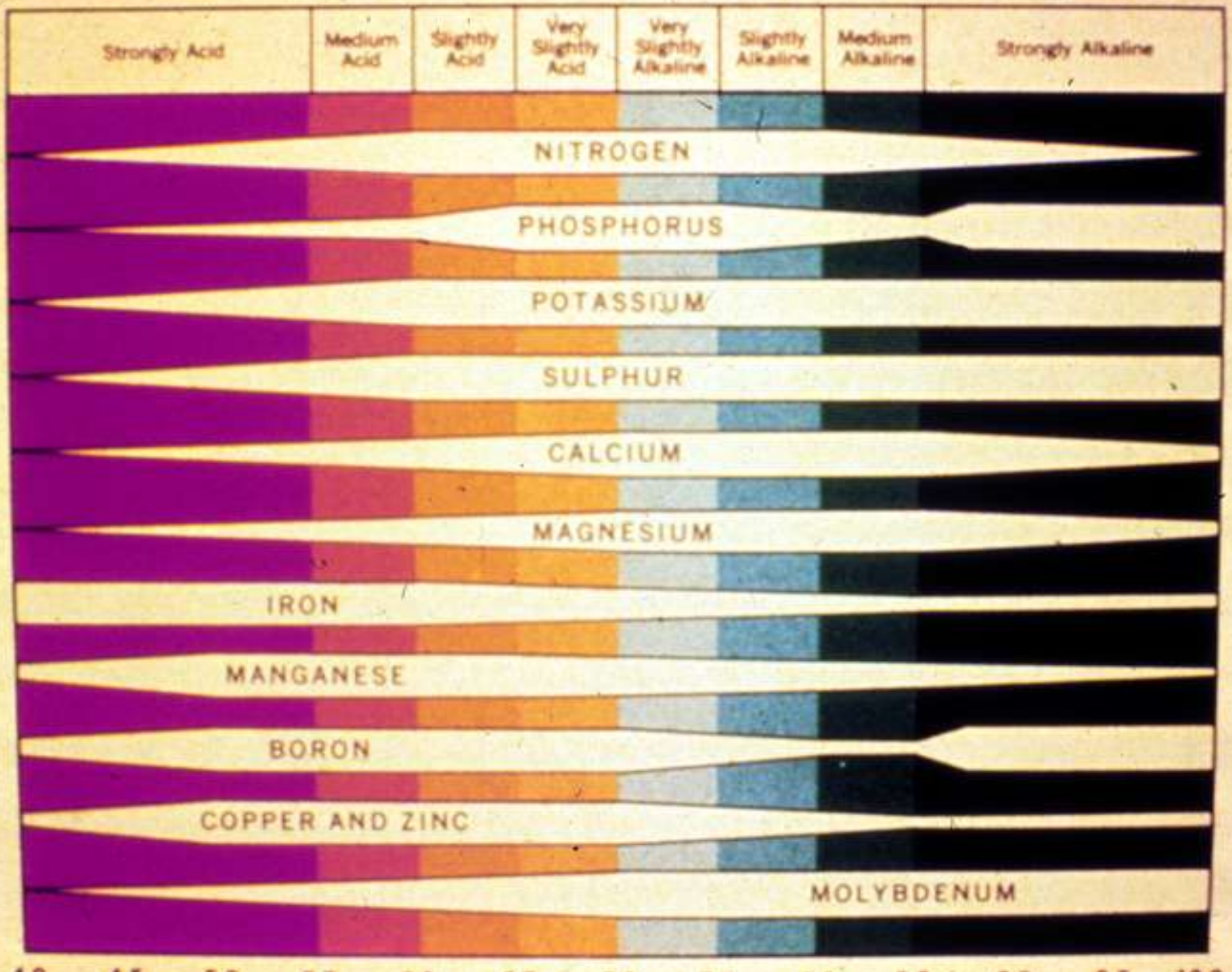


Chart 8

LIMING

LIME

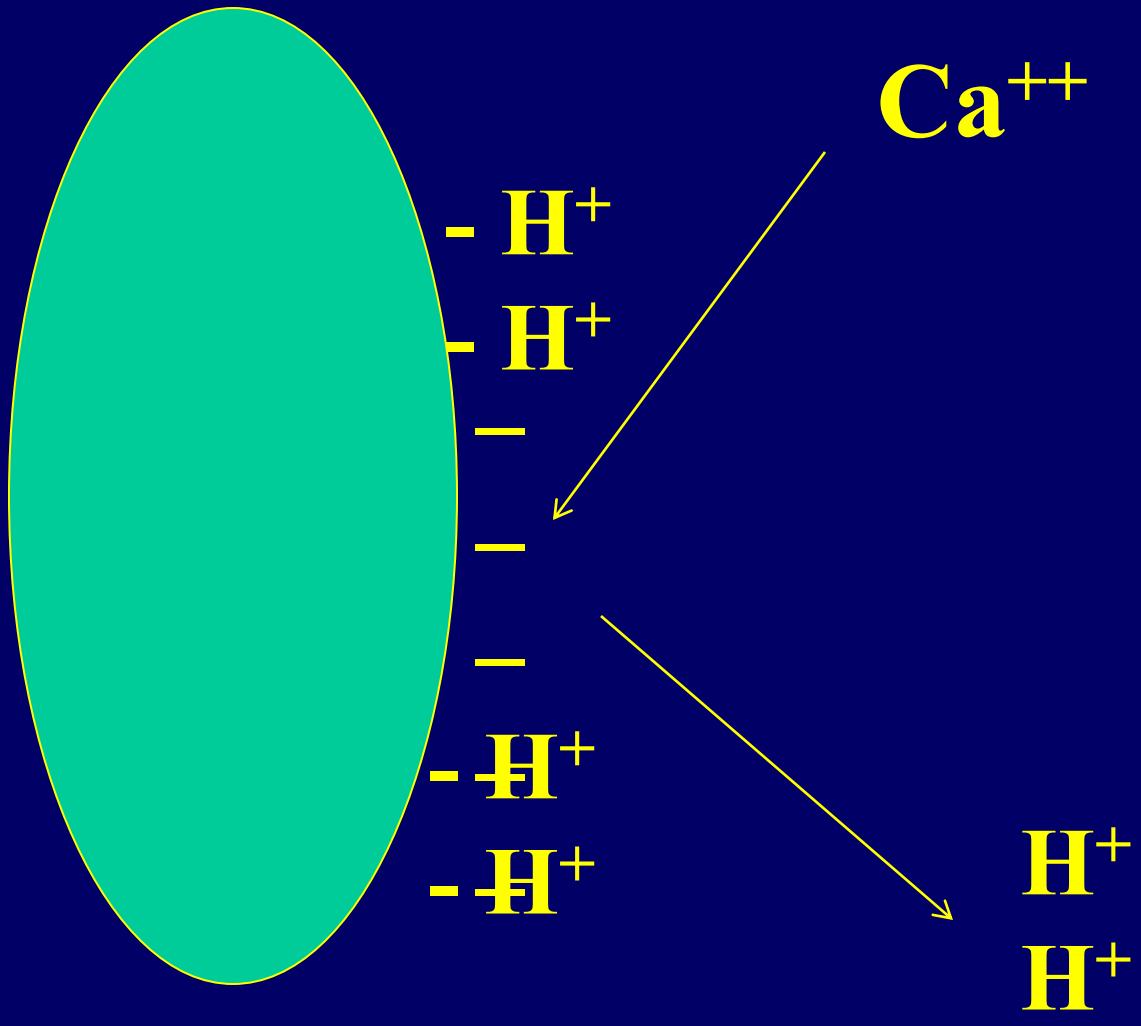
CALCIUM CARBONATE

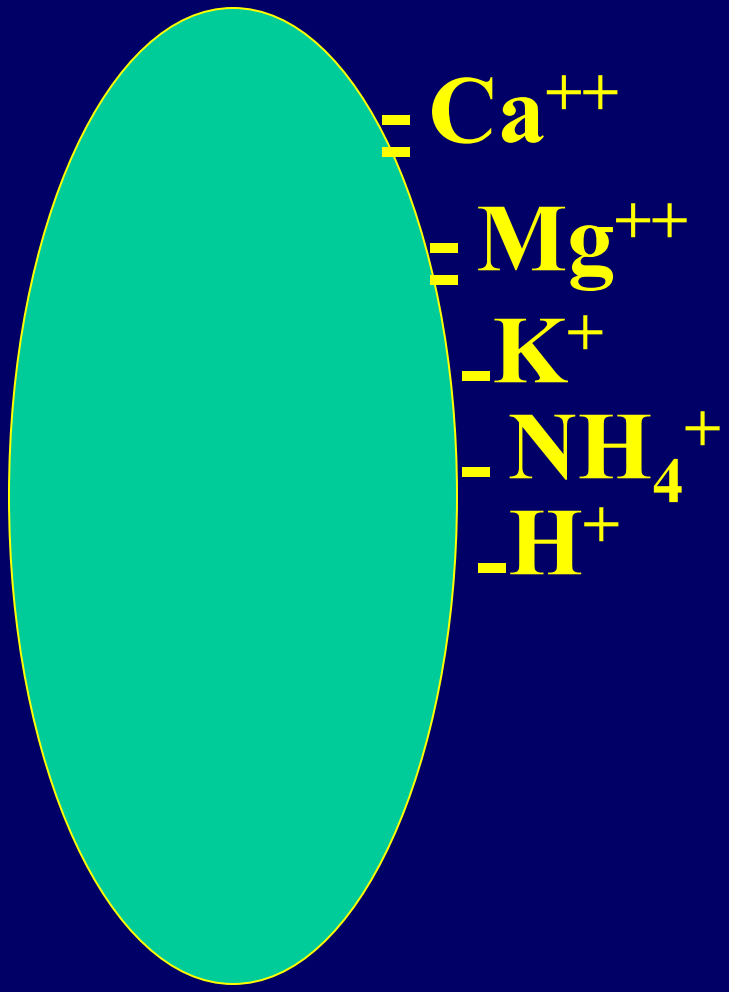
$CaCO_3$

LIME

RAISES

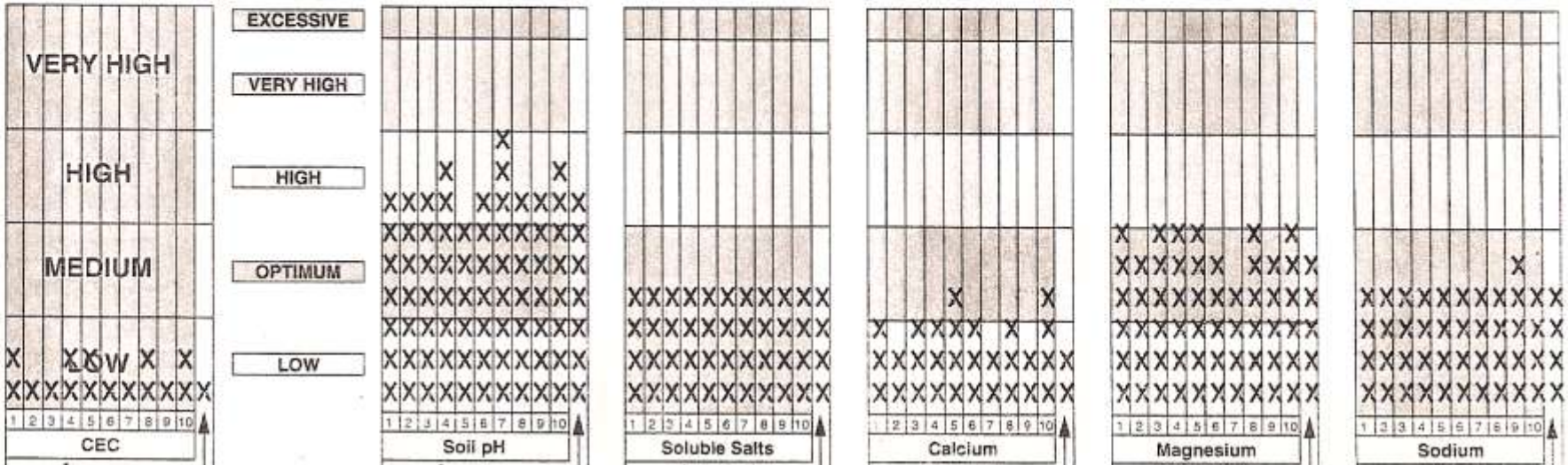
pH


Ca++
- H+
- H+
H+
H+


Ca^{++}
Mg^{++}
K^{+}
NH_4^{+}
H^{+}

BUFFER pH

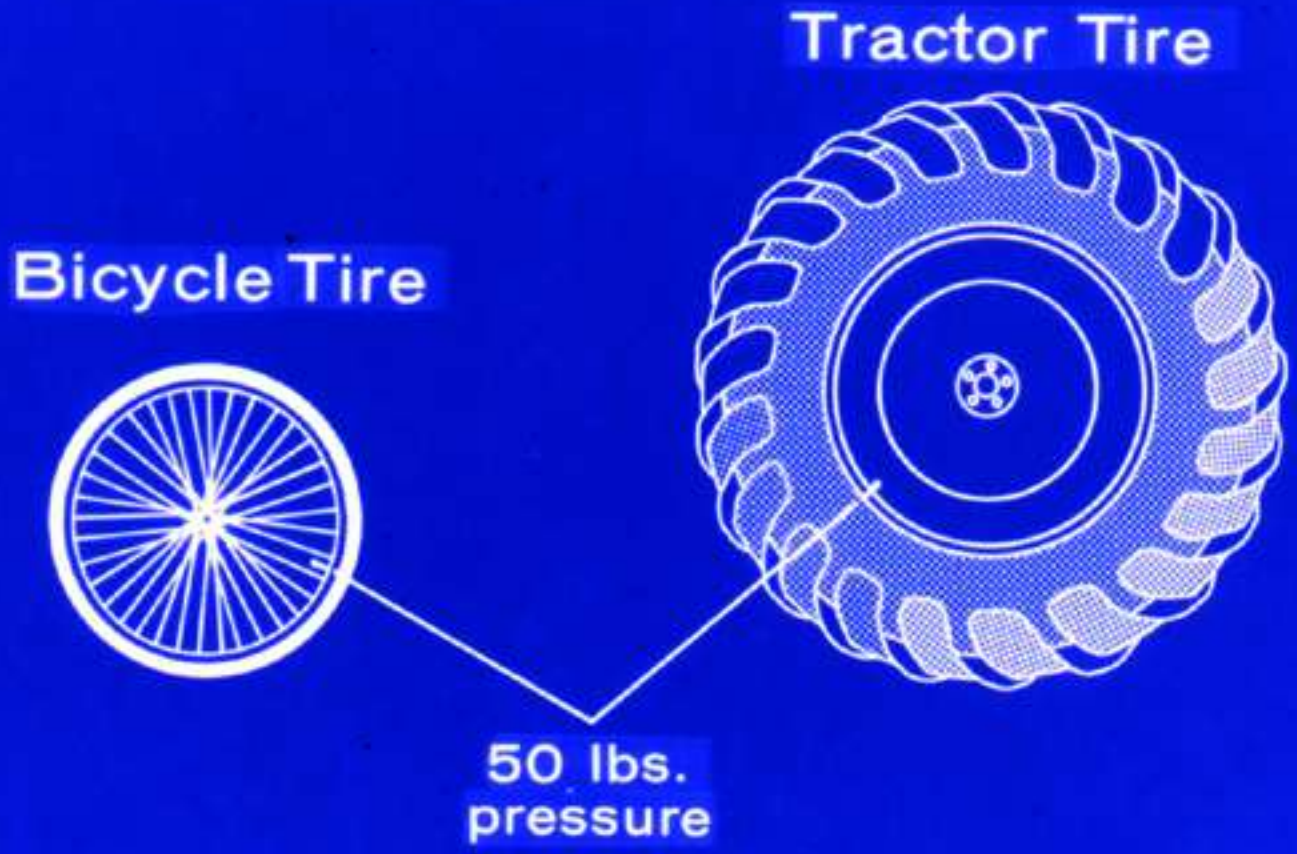
Sample Description	GRN11	GRN12	GRN13	GRN14	GRN15	GRN16	GRN17	GRN18	PG	WARMUP	
CEC	3.4	2.8	3.1	4.2	4.4	3.2	2.5	4.1	2.7	4.3	3.5
Soil pH	6.7*	6.7*	6.7*	6.9*	6.4	6.8*	7.1*	6.8*	6.7*	7.0*	6.8*
Buffer pH	-----	-----	-----	-----	7.2	-----	-----	-----	-----	-----	7.2
Soluble Salts	0.14	0.14	0.12	0.18	0.18	0.20	0.14	0.18	0.23	0.13	0.16
Exchangeable Calcium (Ca)	454*	366*	417*	597*	641	452*	334*	586*	344*	627	482*
Exchangeable Magnesium (Mg)	104	92	102	119	116	97	79	115	90	119	103
Exchangeable Sodium (Na)	10	10	9	10	10	8	7	14	16	8	10
% H Base Saturation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
% K Base Saturation	5.4*	5.2*	4.8*	3.7*	4.0*	3.8*	5.3*	4.0*	7.5*	4.2*	4.8*
% Mg Base Saturation	25.8*	27.5*	27.2*	23.7*	22.0*	25.1*	26.4*	23.3*	27.3*	22.8*	25.1*
% Ca Base Saturation	67.5	65.7	66.8	71.5	73.0	70.1	67.1	71.2	62.7	72.2	68.8
% Na Base Saturation	1.3	1.6	1.3	1.0	1.0	1.1	1.2	1.5	2.5	0.8	1.3



BUFFERING

RESISTANCE TO CHANGE

BUFFERING

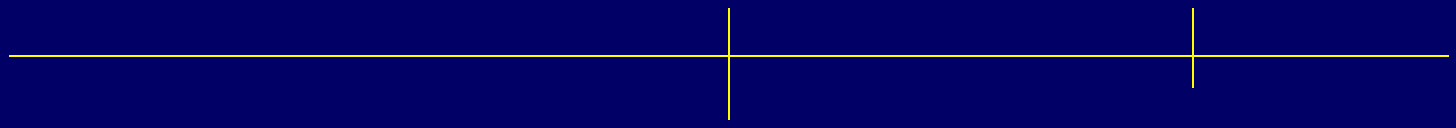


pH

Acidic — Basic

0 — 7 — 14

HIGH pH SANDS



HOW SOIL pH AFFECTS AVAILABILITY OF PLANT NUTRIENTS

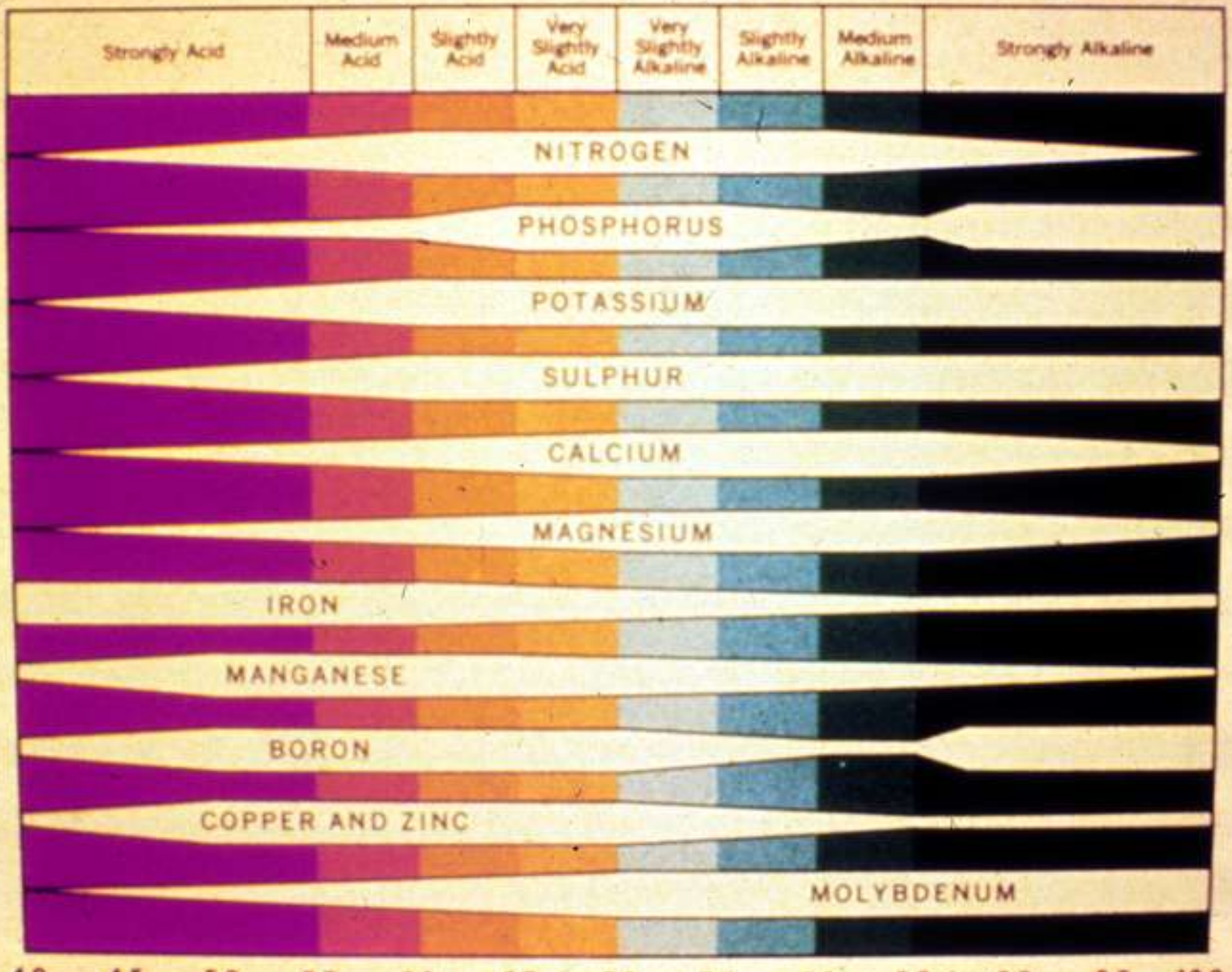


Chart 8

FERTILITY

17 ESSENTIAL ELEMENTS

- CARBON C
- HYDROGEN H
- OXYGEN O
- PHOSPHORUS P
- POTASSIUM K
- NITROGEN N
- SULFUR S
- CALCIUM Ca
- IRON Fe
- MAGNESIUM Mg
- BORON B
- MANGANESE Mn
- COPPER Cu
- ZINC Zn
- MOLYBDENUM Mo
- CHLORINE Cl
- NICKEL Ni

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MACRONUTRIENTS

- 1000 mg/kg (ppm) or more
- C, H, O, N, P, K, S, Mg, AND Ca

MICRONUTRIENTS

- Less than 100 mg/kg (ppm)
- Mo, Cu, Zn, Mn, B, Fe, Cl, and Ni

NITROGEN (N)

VARIES WITH SEVERAL FACTORS

- SPECIES
- SOIL TYPE
- ENVIRONMENTAL CONDITIONS
  - RAINFALL
  - TEMPERATURE

NITROGEN (N)

COOL-SEASON

3 TO 5 LBS N/1000FT^2

WARM-SEASON

1 LB N/1000FT^2/GROWING MONTH

NITROGEN (N)

MANAGEMENT

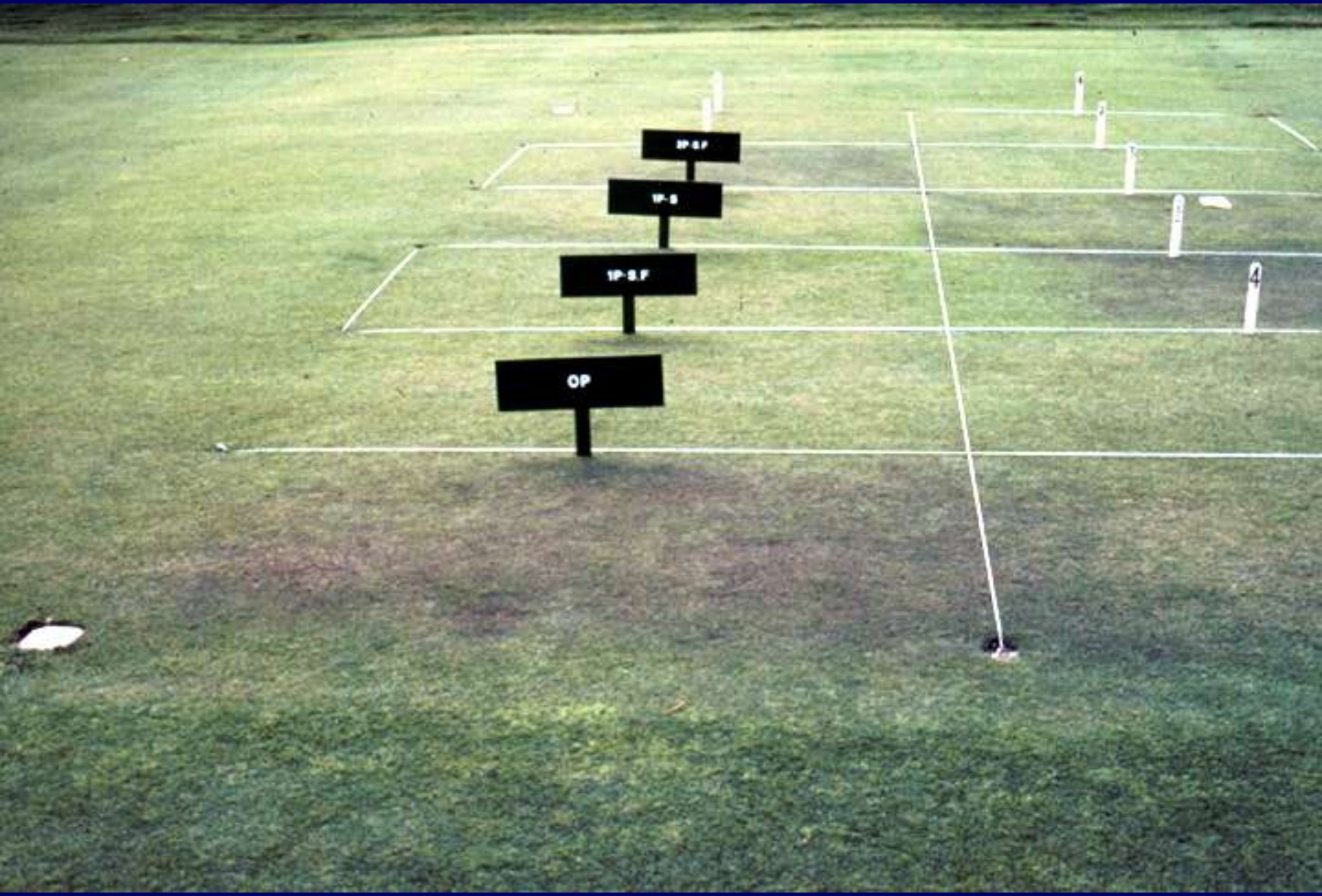
COLOR, CLIPPINGS

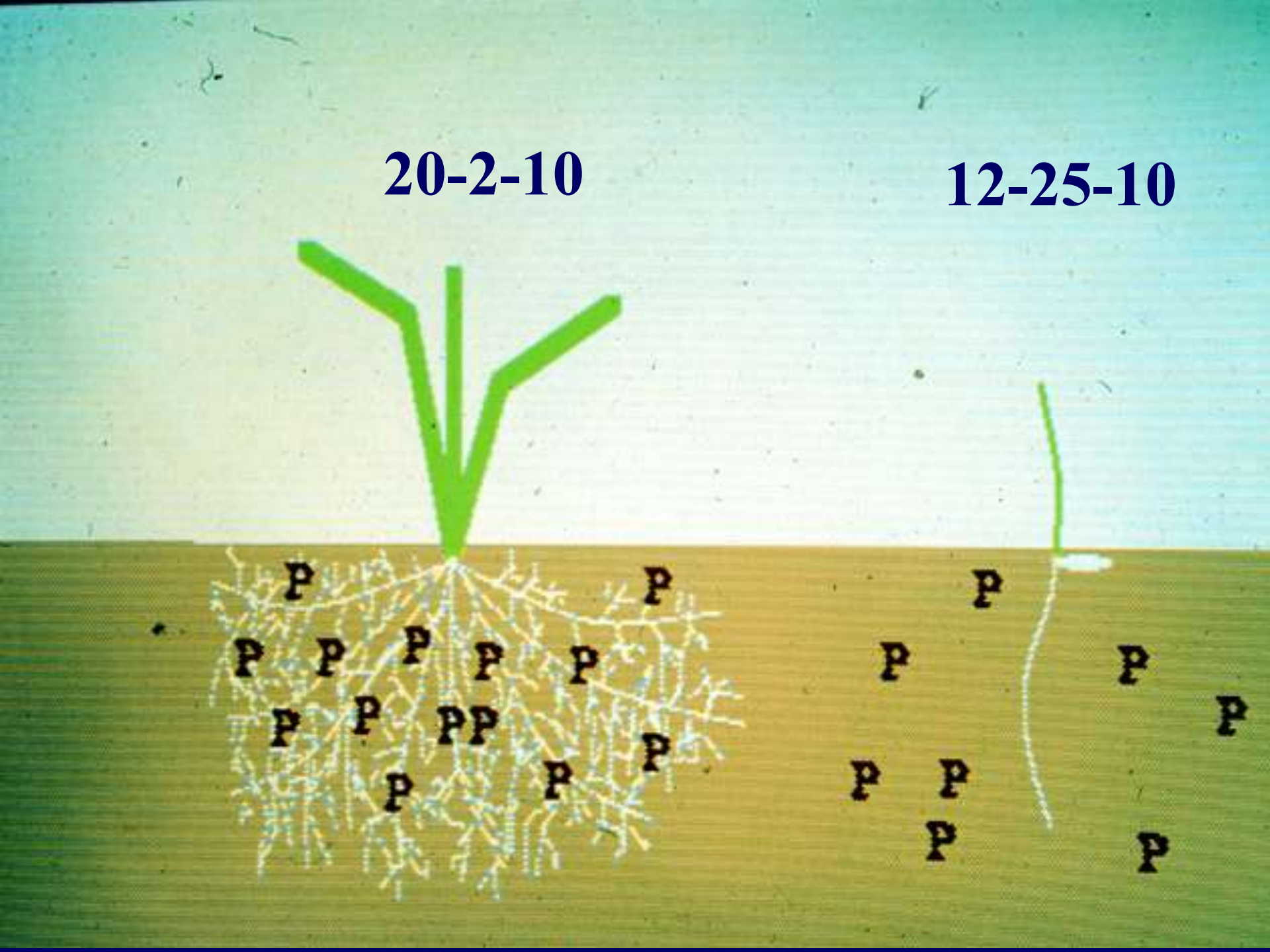
NOT TOO LITTLE,
NOT TOO MUCH

P DEFICIENCY SYMPTOMS

INITIALLY DARK GREEN

PURPLE DISCOLORATION


OP


20-2-10
12-25-10

PHOSPHORUS

PPM		LB/A	KG/HA
• 0 - 5	VERY LOW	0 - 10	0 - 11
• 6 - 10	LOW	12 - 20	13 - 22
• 10 - 20	ADEQUATE	20 - 40	22 - 45
• 20 -	HIGH	40 -	45 -

POTASSIUM (K)

- MYSTERY ELEMENT
- NOT A PART OF BIOCHEMICALS
- ACTS AS COFACTER
- STOMATAL CONTROL

STRESS

POTASSIUM (K)

PPM		LB/A	KG/HA
0-40	VERY LOW	0-80	0-90
41-175	LOW	81-350	91-392
175-250	ADEQUATE	350-500	392-560
250-	HIGH	500-	560-

HOW ABOUT THE SAND-BASED SYSTEM?

SPOON FEEDING

- N CAN LEACH FROM SAND
- APPLY WHAT IS NEEDED
- 0.2 TO 0.5 LB N EVERY 14 TO 21 DAYS
- VARIES WITH ENVIRON. CONDITIONS-IRRIGATION
- SLOW RELEASE N

PHOSPHORUS (P)

DEPENDS ON PARENT MATERIAL OF SAND

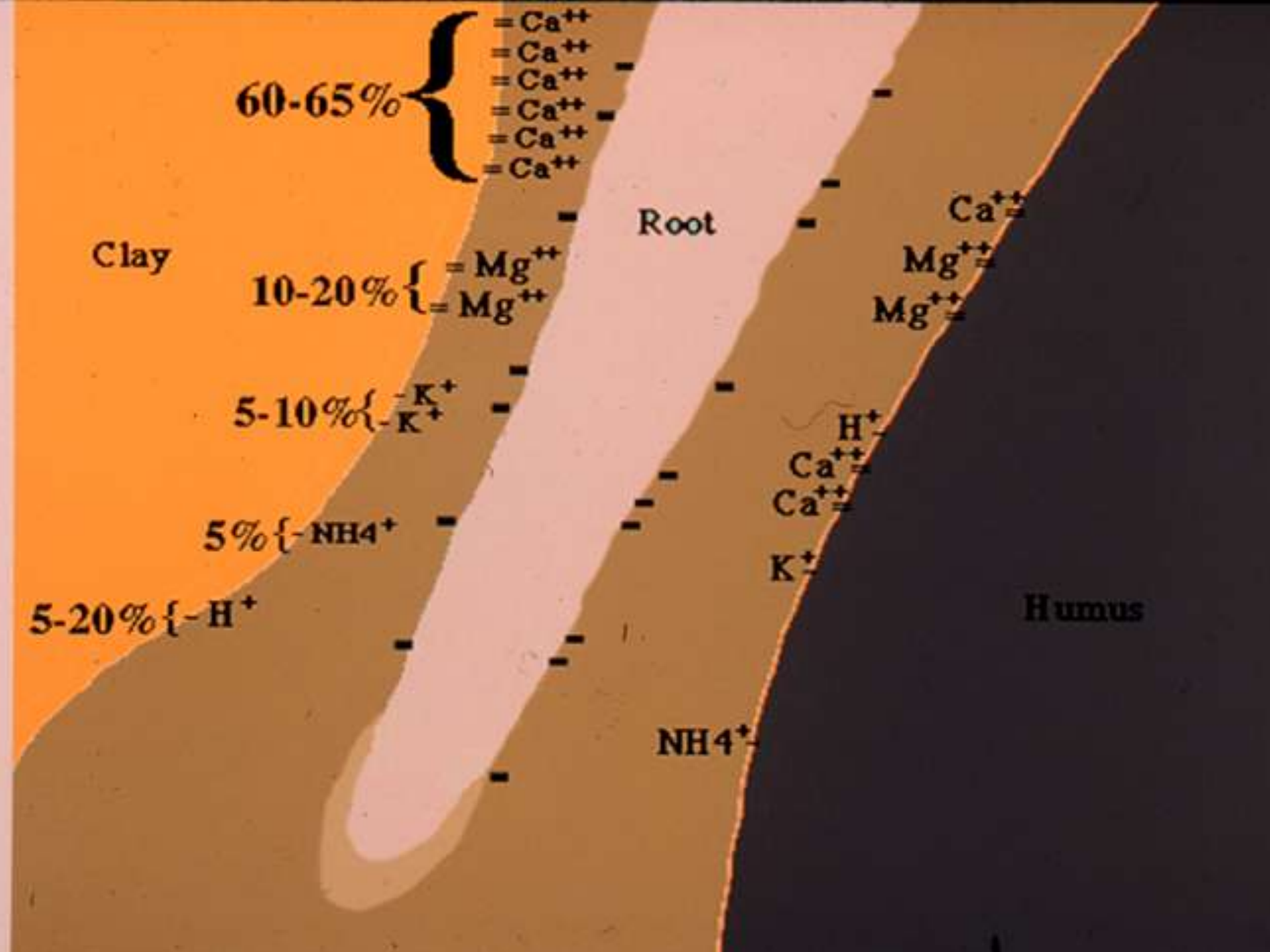
DO SOIL TEST

PHOSPHORUS (P)

SPOON FEEDING

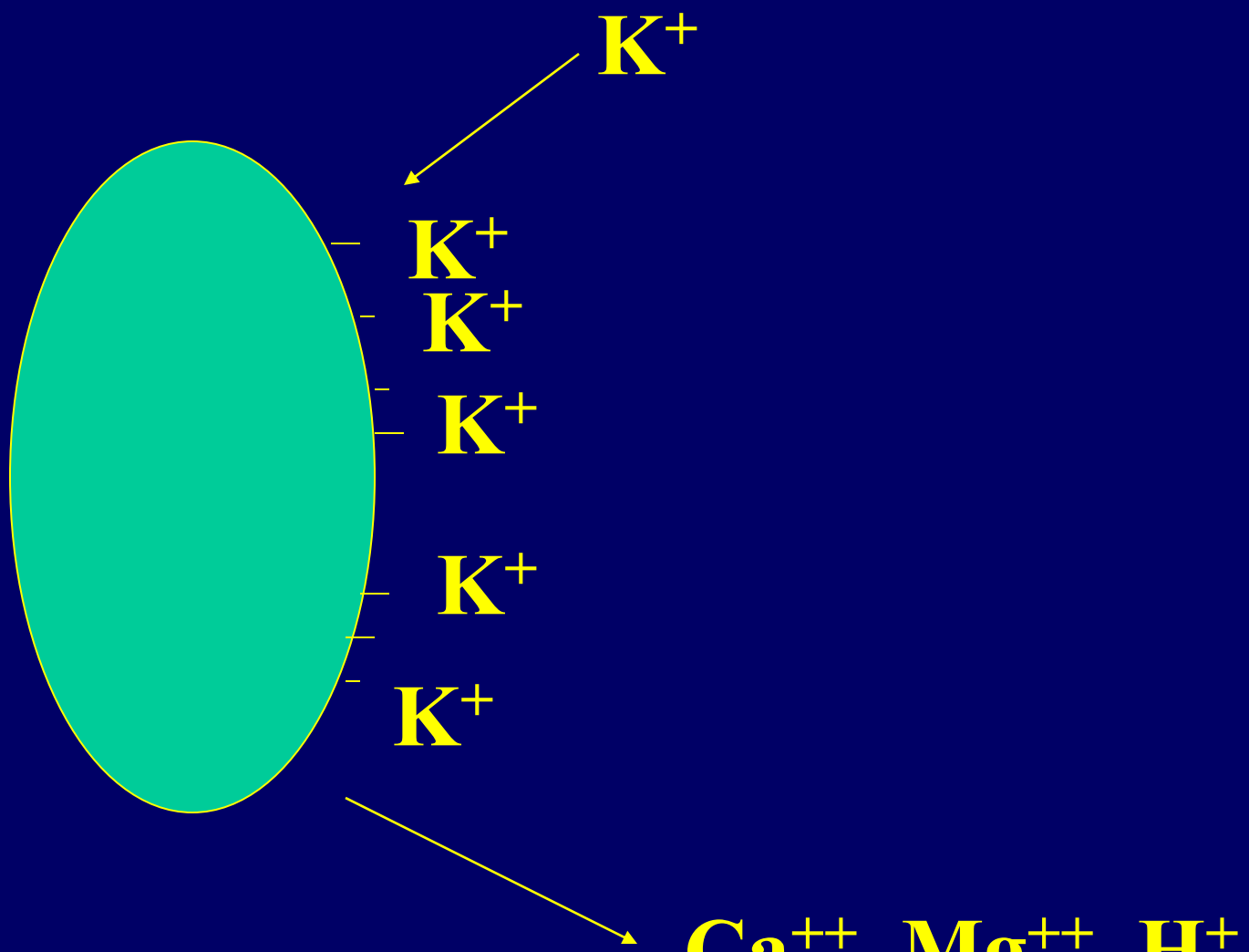
LIQUID SOURCES

POTASSIUM (K)


60-65%
= Ca++
= Ca++
= Ca++
= Ca++
= Ca++
= Ca++
Clay
Root
Humus
10-20%
= Mg++
= Mg++
5-10%
- K+
- K+
5%
- NH4+
5-20%
- H+
Ca++ =
Mg++ =
Mg++ =
H+
Ca++ =
Ca++ =
K+
NH4+

SAND-BASED SYSTEMS ARE DIFFERENT THAN SOIL

CEC 2 vs CEC 25


K+
K+
K+
K+
K+
K+
Ca++, Mg++, H+

SPOON FEEDING

- DO NOT TRY TO BUILD UP K LEVEL
- CAN SATURATE CEC SITES
- APPLY WHAT IS NEEDED
- 0.1 TO 0.3 LB K EVERY 14 TO 21 DAYS
- ENCAPSULATED K?

OTHER NUTRIENTS

HOW SOIL pH AFFECTS AVAILABILITY OF PLANT NUTRIENTS

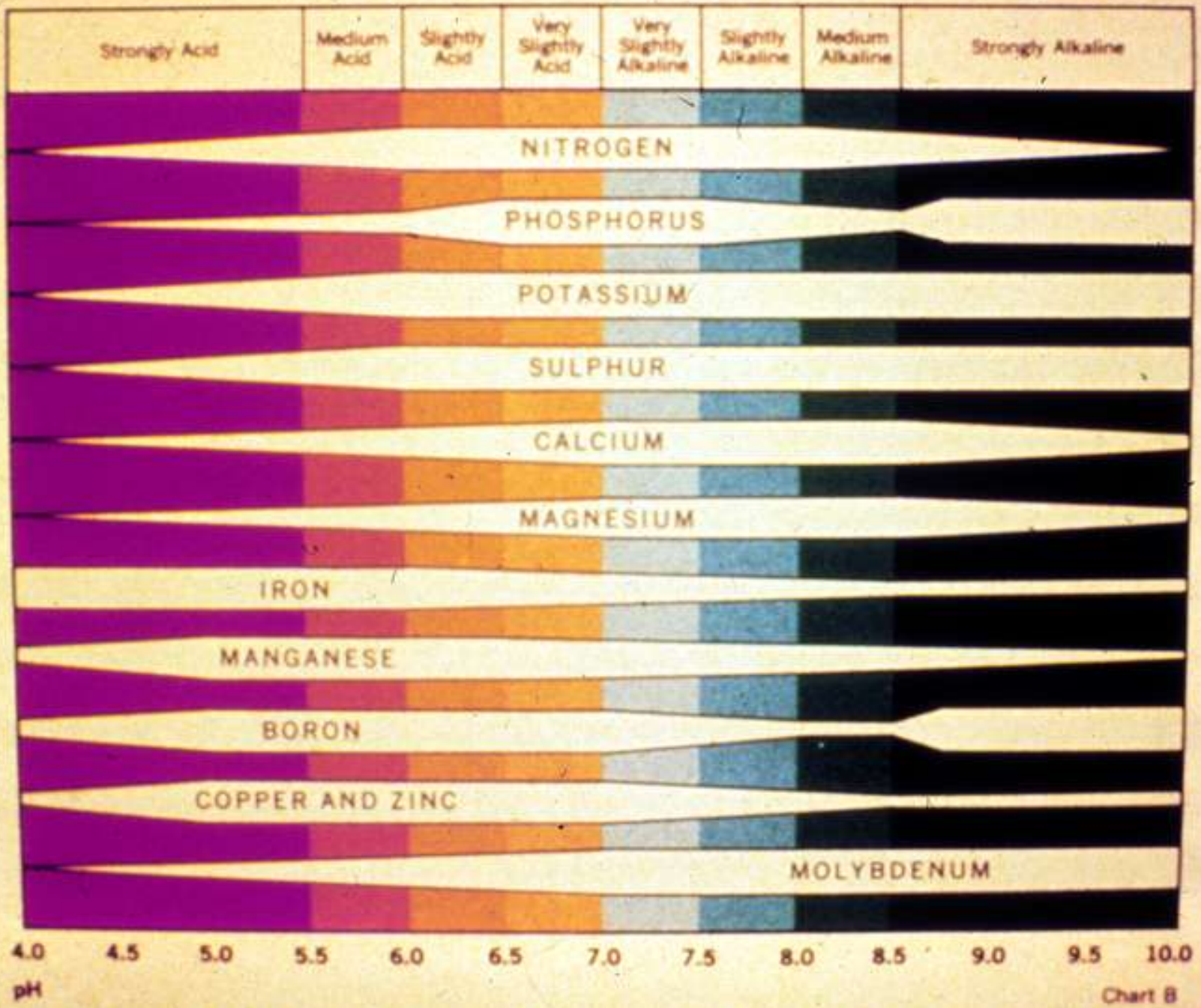


Chart 8

MAGNESIUM (Mg)

- CENTER OF CHLOROPHYLL
- SYMPTOM - CHLOROSIS
- LOW pH AND LOW CEC

IRON (Fe)

- COFACTOR FOR CHLOROPHYLL FORMATION
- SYMPTOM - CHLOROSIS
- HIGH pH
- MOST COMMON OF ALL MICRONUTRIENT DEFICIENCIES

CALCIUM

- YOUNGER LEAVES TURN REDDISH-BROWN
- FADES TO RED
- LOW pH CONDITIONS

Ca/Mg Ratios

SULFUR (S)

- YELLOWING OF YOUNGER LEAVES
- SLOW GROWTH
- RARE IN MOST OF U.S. BECAUSE OF HIGH SULFUR COAL
- MAY SEE IT IN DRYER PARTS OF CENTRAL US

MANGANESE

- YELLOWING SIMILAR TO IRON DEFICIENCY
- VEINS REMAIN GREEN - TIPS MAY REMAIN GREEN
- LEAVES DROP

Zinc (ZN)

COPPER (Cu)

BORON