

PLANT NUTRITION

Prakash Kulkarni

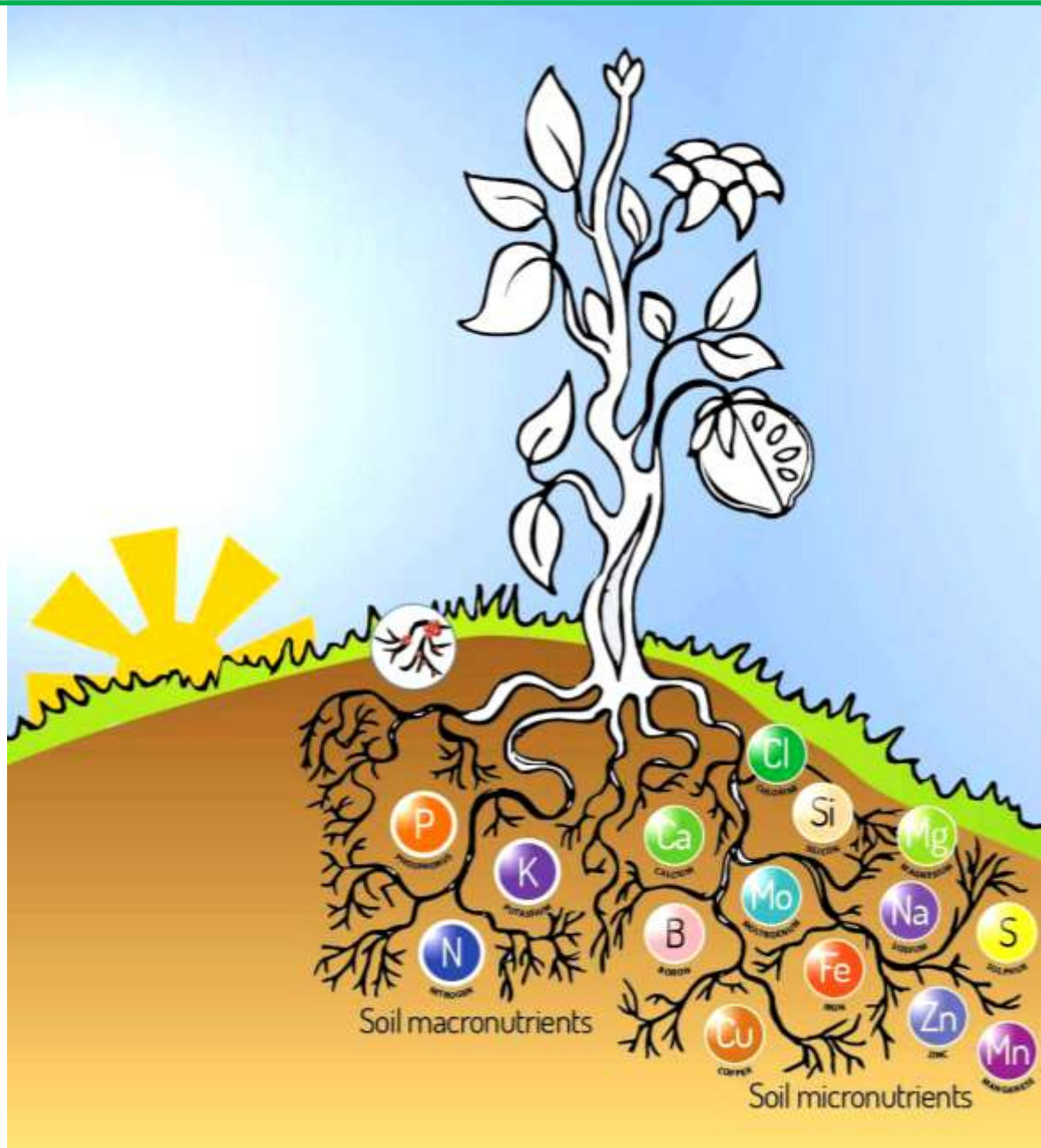
Agricultural Technologist, Pune

E mail - krishibodh@gmail.com

Cell - 93706 71620

"Plant Nutrition"

is the study of the Chemical elements & compounds necessary for **plant** growth, **plant** metabolism & their external supply.



Essential nutrients for plant growth

Introduction

Plants require certain elements for their normal growth when any of these elements are not available to plants, it will develop definite deficiency symptoms.

Plant Nutrients Classifications

- **Primary Nutrients**
 - Nitrogen (N)
 - Phosphorus (P)
 - Potassium (K)

Secondary Nutrients

- Calcium (Ca)
- Magnesium (Mg)
- Sulfur (S)

Micronutrients (Trace Elements)

- Zinc (Zn)
- Iron (Fe)
- Manganese (Mn)
- Molybdenum (Mo)
- Copper (Cu)
- Boron (B)

Primary Nutrients

Nitrogen (N)

Function :

- Promotes rapid vegetative growth.
- Gives plants healthy green colour.

Deficiency Symptoms :

- Stimulated growth, pale yellowish colour.
- burning tips and margins of leaves starting at the bottom of the plant.

Nitrogen (N) Deficiency Symptoms



Maize



Citrus



Grapes



Banana

Phosphorus (P)

Function :

- Stimulates early growth and root formation.
- Hastens maturity.
- Promotes seed production.
- Makes plants hardy.

Deficiency Symptoms :

- Small root growth, Spindly stalk, Delayed maturity.
- Purplish discoloration of leaves.
- Dying of tips of older leaves, Poor fruit & seed development.

Phosphorous (P) Deficiency Symptoms



Potato

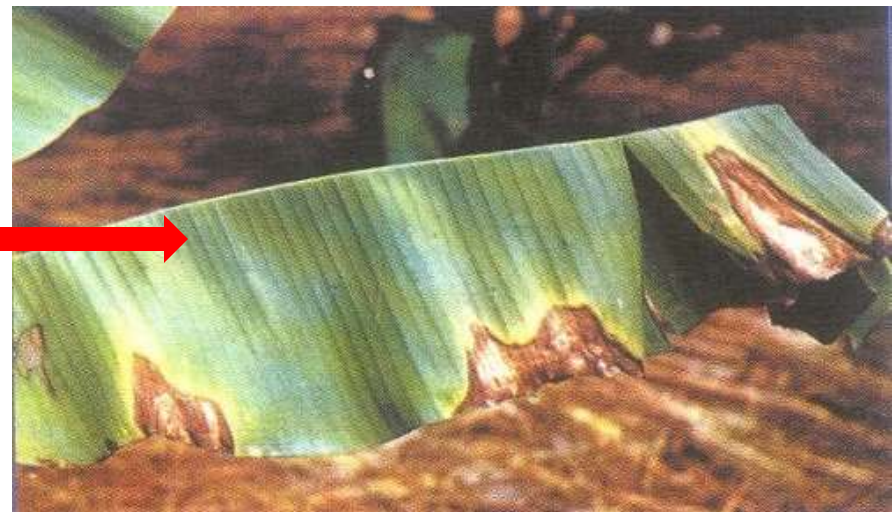


Citrus



Tomato

Banana



Potassium (K)

Function :

- Improves plant ability to resist disease & Cold.
- Aids in the production of carbohydrates.

Deficiency Symptoms :

- Slow growth
- Margins on leaves develop a scorched effect on the older leaves.
- Weak stalk, shriveled seed & fruits.

Potassium (K) Deficiency Symptoms



Grape



Potato



Citrus



Tomato

Secondary Nutrients

Calcium (Ca)

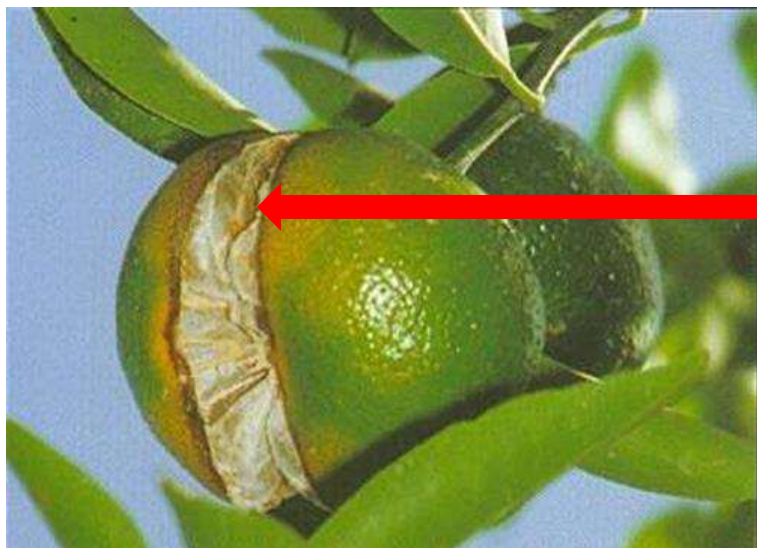
Function :

- Aids in the movement of carbohydrates in plants
- Essential to healthy cell walls & root structure

Deficiency symptoms :

- Terminal bud dies under severe deficiency
- Margins of younger leaves scalloped
- Blossoms shed prematurely
- Weak stalk & stem structure

Calcium (Ca) Deficiency symptoms



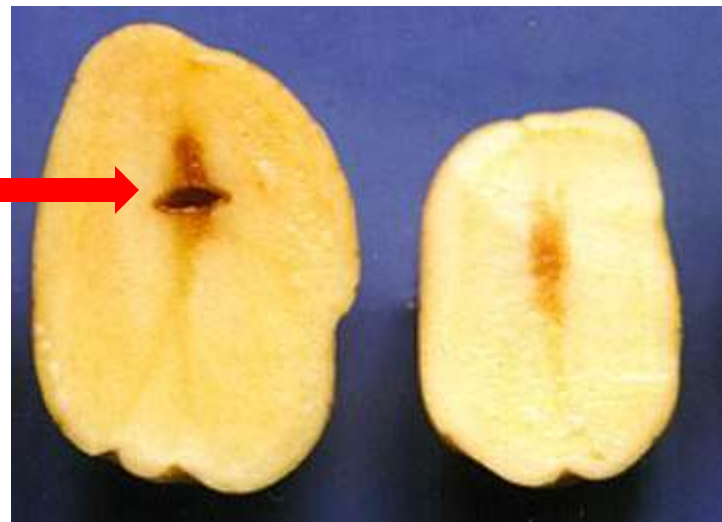
Citrus



Tomato



Banana



Potato

Magnesium (Mg)

Function :

- An ingredient of chlorophyll.
- Aids in the translocation of starch within the plant.
- Essential for formation of oils & fats.

Deficiency symptoms :

- Yellowing of leaves between veins starting with lower leaves.
- Leaves abnormally thin.
- Tissue may dry & die.
- Leaves have tendency to curve upward.

Magnesium (Mg) Deficiency symptoms Photo



Citrus



Grape



Tomato



Potato

Sulfur (S)

Function :

- Aids in the formation of oils and parts of protein molecules.

Deficiency symptoms :

- Young leaves light green to yellowish in colour.
- In some plants, older tissue may be affected also.
- Small spindly plants.
- Retarded growth and delayed maturity.
- Interveinal chlorosis on corn leaves.

Sulfur (S) Deficiency Symptoms



Potato

Tomato



Banana



Micronutrients

Zinc (Zn)

Function :

- An essential constituent of several enzymes.
- Controls synthesis of indole acetic acid (IAA) an important growth regulator.
- Zinc is most often needed by crops like Grapes, Citrus, Pomegranate, Apple, Beans, Tomato, Onion, Cotton and Rice

Deficiency symptoms :

- Decreased stem length and resetting of terminal leaves
- Reduced fruit bud formation
- Mottled leaves and stripping of corn leaves

Zinc (Zn) Deficiency symptoms



Citrus



Grape



Potato



Tomato

Iron (Fe)

Function :

- Essential for formation of chlorophyll.
- releases energy from sugars & starches.

Deficiency Symptoms :

- Leaves yellowish or white. (young leaves first)
- Veins green, affected leaves curl up.

Iron (Fe) Deficiency Symptoms



Grape



Citrus



Potato



Tomato

Copper (Cu)

Function :

- Promotes formation of vitamin A, excess is very toxic

Deficiency symptoms :

- Started growth, die back of terminal shoots in trees
- Poor pigmentation, wilting & eventual death of leaf tips.
- Formation of gum pockets around central pith in oranges

Copper (Cu) Deficiency Symptoms



Tomato

Citrus



Manganese (Mn)

Function :

- Serves as an activator for enzymes in growth processes.
- Assist iron in chlorophyll formation.
- Generally required with zinc in foliar spraying of Citrus.

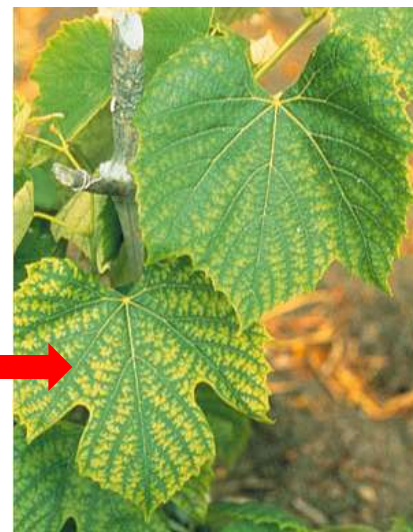
Deficiency symptoms :

- Interveinal chlorosis of young leaves.
- Gradation of pale color next to veins.
- Development of gray specks (oats).
- Interveinal white streaks (wheat) or Interveinal brown spots (barley).

Manganese (Mn) Deficiency Symptoms



Citrus



Grape



Potato



Tomato

Molybdenum (Mo)

Function :

- Required for N Utilization.
- Needed to transform NPN into amino acids.
- & legumes can not fix atmospheric N symbiotically without Mb.

Deficiency Symptoms :

- Stunting & lack of vigor. Very similar to N deficiency due to the key role of Mb plays in N utilization.
- Whiptail in cauliflower & yellow spotting in citrus.

Molybdenum (Mo) Deficiency Symptoms



Tomato



Citrus

Boron (B)

Function :

- Aids in assimilation of calcium, amount required is extremely small.

Deficiency Symptoms :

- Death of terminal growth causing lateral buds to develop & produce "witches broom" effect.
- Thickened, curled, wilted & chlorotic leaves.
- Soft & neurotic spots in fruit & tubers.
- Reduced flowering or improper pollination.

Boron (B) Deficiency Symptoms



Grape

Potato



Tomato

Citrus



Role of Each Plant Nutrient

	N	P	K	Ca	Mg	S	B	Cu	Fe	Mn	Zn
Yield	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Fruits Size	▲	▲	▲	▲	▲		▲				
Fruits Number	↕	▲			▲		▲				▲
Fruit Weight	▲	▲	▲	▲	▲		▲				
Firmness	▼	▲		▲							
TSS	▲		▲								
Bitter Pit	▲	▲	▲	▼	▲		▼				▼
Internal breakdown	▼	▼		▼							
Fruit Rots	▲			▼							
Acidity/Vitamin C			↕	▲			▲				
Coloration	▼	▲	▲		▲					▲	▲
Alfalfa Greening	▲			▼							

Increase - ▲

Decrease - ▼

Neutral - ↕

Crops - susceptibility for nutrient deficiency

Crops	Cu	Fe	Mn	Zn	B	Mo
Field crops						
Maize					++	
Cotton		+++		+++	+++	
Rice		++	+++	+++		
Fruit Crops						
Citrus	++	+++	+++	+++	+++	
Apple/Pear	++	++	+++	+++	+++	
Peach		+++	+++	+++		
Vegetables						
Chillies		+++	+++	+++		
Melon		+++	+++	+++		
Tomato	++	+++	++	++	++	++
Potato			+++	++	++	
+ = Susceptibility						

Factors influencing availability of micronutrients in soil

Details	Cu	Fe	Mn	Zn	B	Mo
pH > 7.0	---	---	--	---	-	++
pH < 5.5	++	+++	+++	++	--	-
Water-logged soil	+	--	++	+		
Drought	---	---	---	-	---	-
High humus content	---	++	++	++	++	-
High P-content	-	---	-	---	-	+++
Sand	---	---	--	---	-	-
Compaction	+	++	+	+	+	+
+ = availability - = deficiency						

Mineral Management

- The Pie chart highlights how the minerals (elements) impact one another.
- Too much of any major cation or anion will shut down another mineral (element) in the same group.

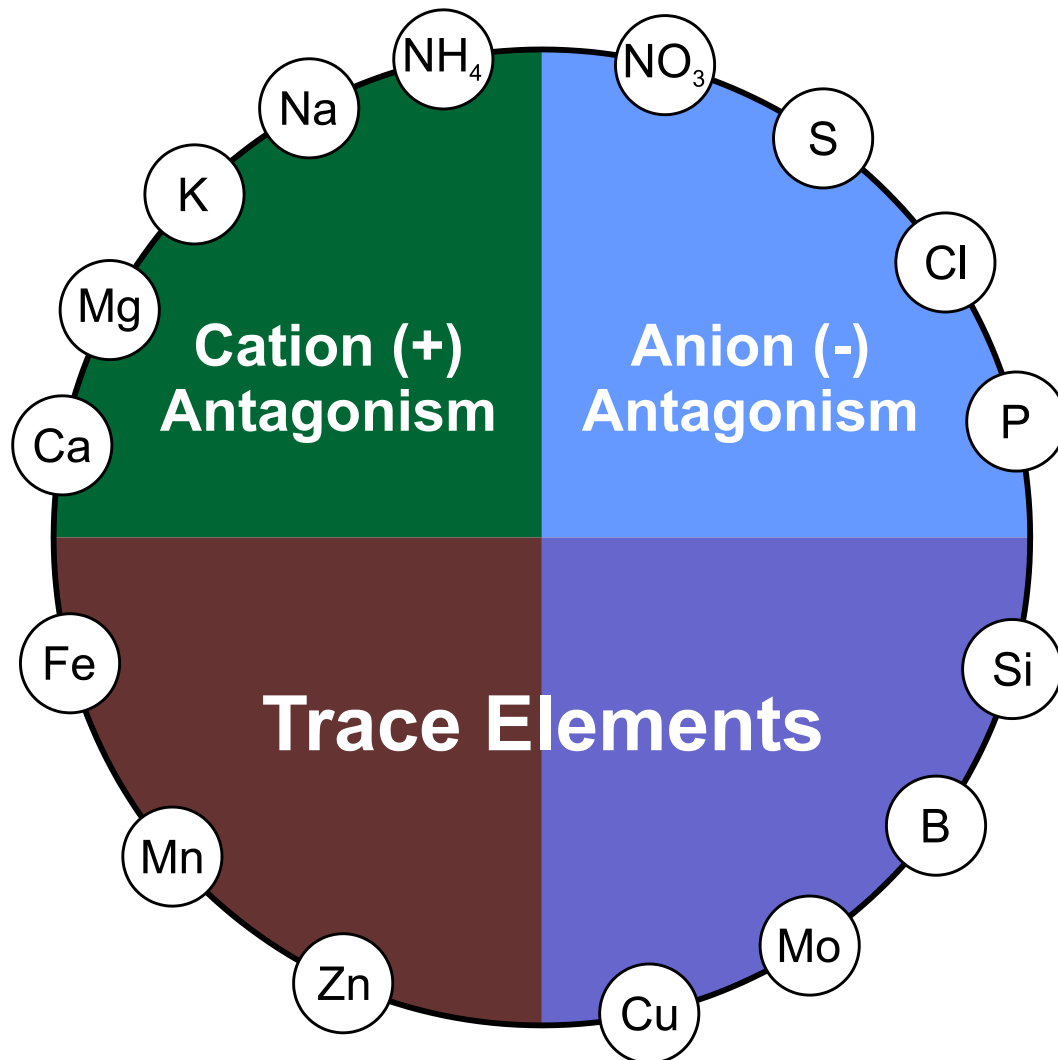
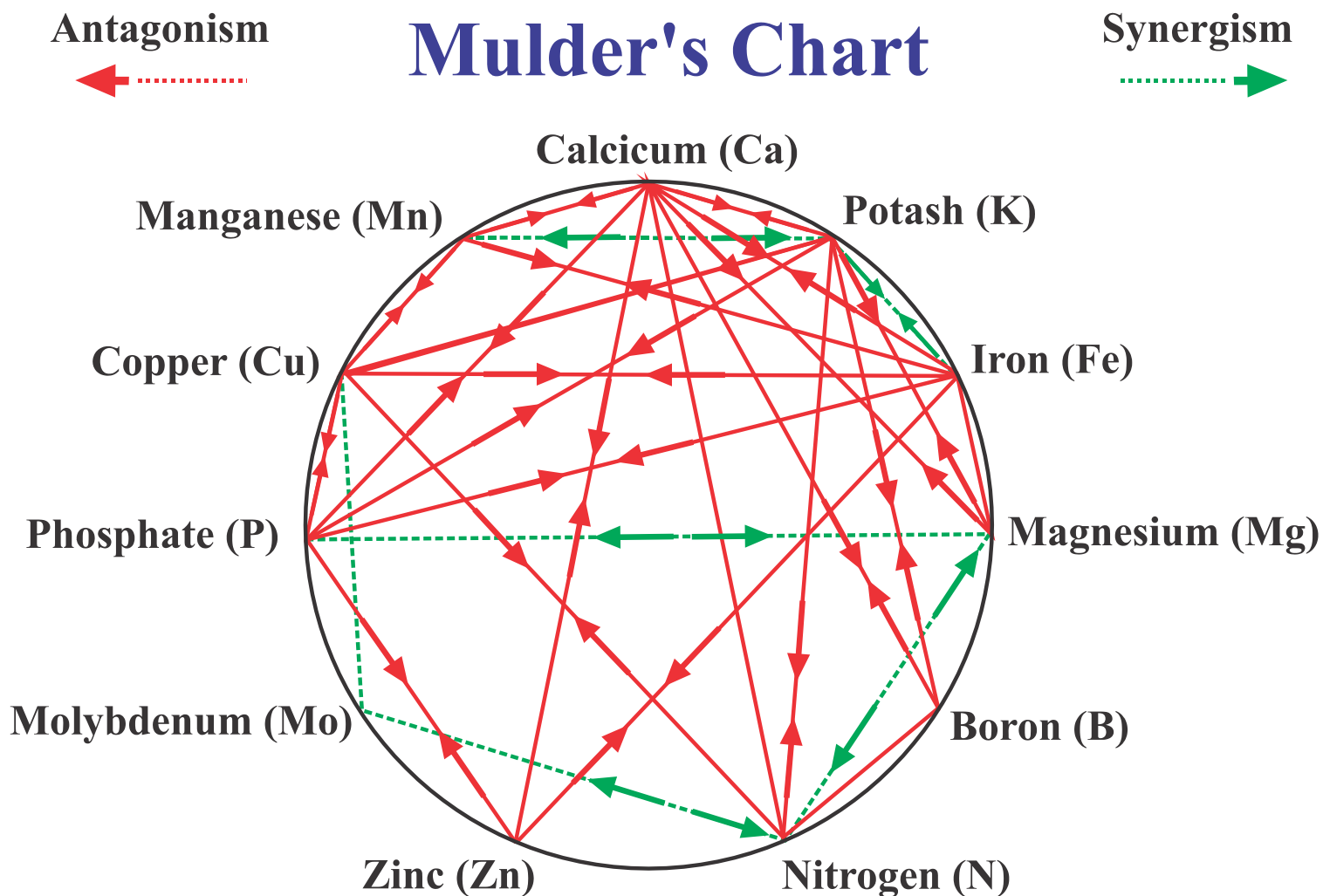


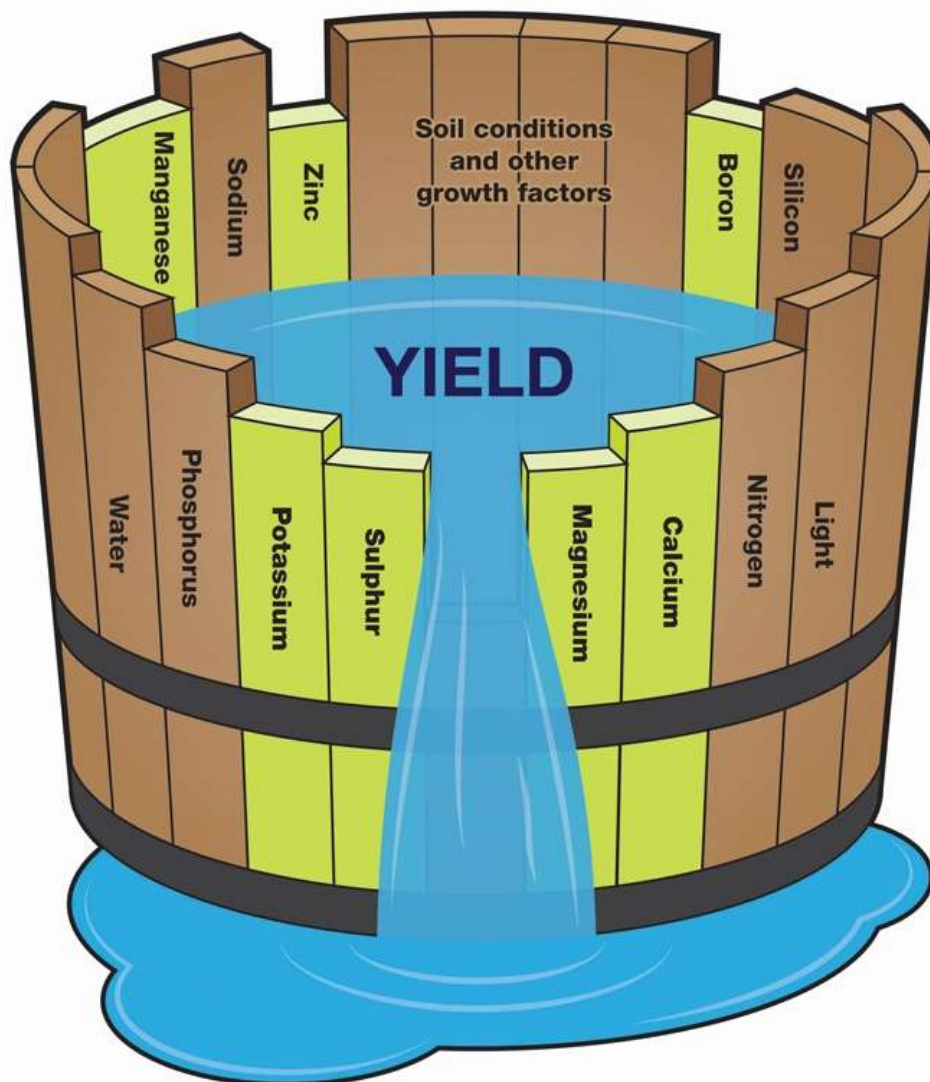
Table of Antagonistic Elements

Excess element	Nutrient(s) affected
Nitrogen	Potassium, Calcium
Potassium	Nitrogen, Calcium, Magnesium
Calcium	Boron, Magnesium, Phosphorus
Magnesium	Calcium, Potassium
Iron	Manganese
Manganese	Iron, Molybdenum, Magnesium
Copper	Molybdenum, Iron, Manganese, Zinc
Zinc	Iron, Manganese
Molybdenum	Copper, Iron
Sulfur	Molybdenum

Mulder's Chart of Mineral Interactions



Law of Minimum in Soil Fertility



SOIL TEST

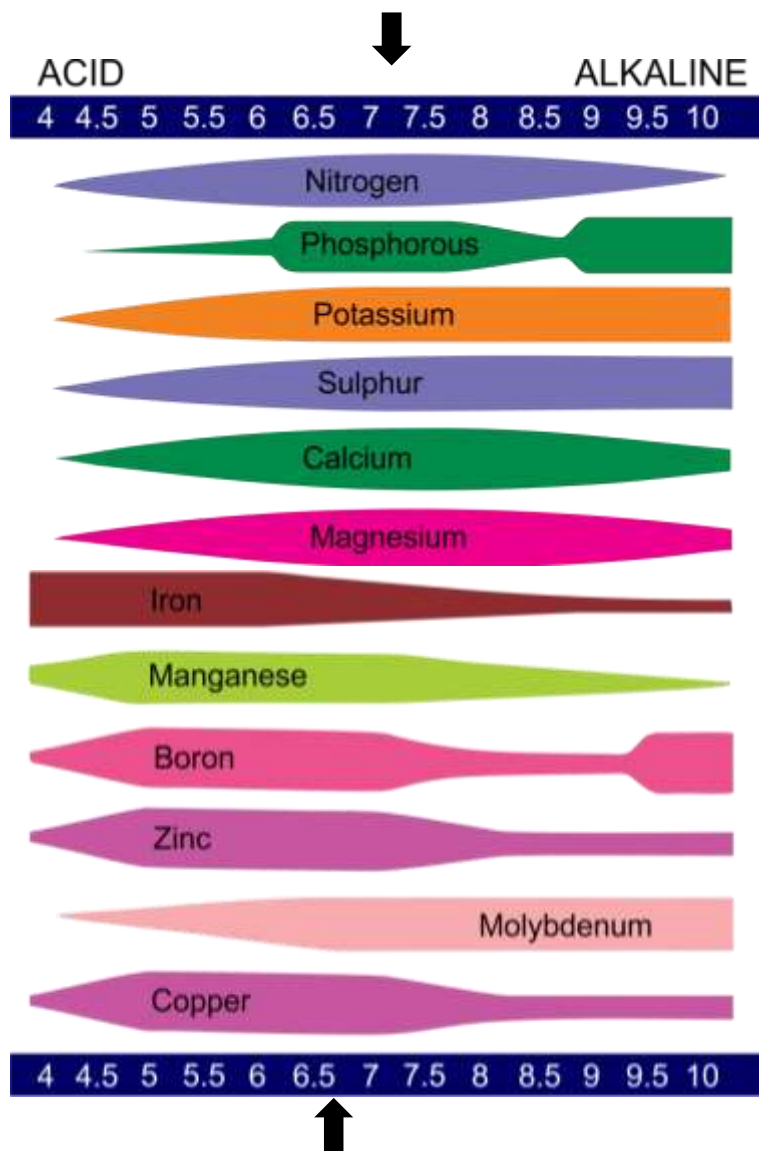
- Soil Test may refer to one or more wide variety of soil analysis conducted for one of several possible reasons.
- Possibly the most widely conducted soil tests are those done to estimate the plant - available concentrations of plant nutrients, in order to determine fertilizer recommendation in agriculture.

Importance of Soil Testing

Introduction

- The Farmers find it extremely difficult to know the proper type of fertilizer, which would match his soil.
- In using a fertilizer he must take in to account the requirement of his crops & the characteristics of the soil.
- The basic objective of soil testing program is to give farmers a service leading to better & more economic use of fertilizers & better soil management practices for increasing agricultural production.
- High yielding crops can not give potential yields without overcoming deficiencies.

Soil pH related to nutrient availability chart



“It More Valuable
Than Oil. It’S Our
Soil!”