NUTRIENT DEFECIENCES IN PLANTS –FIELD IDENTIFICATION TIPS

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What is a plant nutrient deficiency

- When plants have limited access of vital plant essential elements it leads to deviations in crop growth and development.
- Plants need specific elements in different quantities at various crop growth stages
- Content of various elements required should be balanced correctly.

Plant needs of essential elements

- Essential elements can be grouped into four categories based on their origin or the relative amount a plant needs in order to develop properly
- Non mineral essential elements are derived from the air and water.
- Non mineral, primary and secondary elements are also referred to as macronutrients and secondary nutrients since they are required in relatively large amounts by plants.
- Micronutrients are required in very small, or trace amounts by plants.
- Although micronutrients are required by plants in very only in small quantities, they are equally essential to plant growth.

How does a nutrient deficiency occur

- Due to short supply of the nutrient in soil/plant
- Impaired absorption from soil due to soil condition like Acidity, salinity,
- Damaged or undeveloped roots;
- Insufficient or excessive irrigation, water logging
- Improper pH range
- Specificity on nutrients at different growth stages, a few examples
- More N requirement in the active growth stage
- More P and K requirement in blooming and fruiting stage
- Absence of nutrient cause stunted growth and complete crop loss
- Timely addition of supplements can avert crop loss

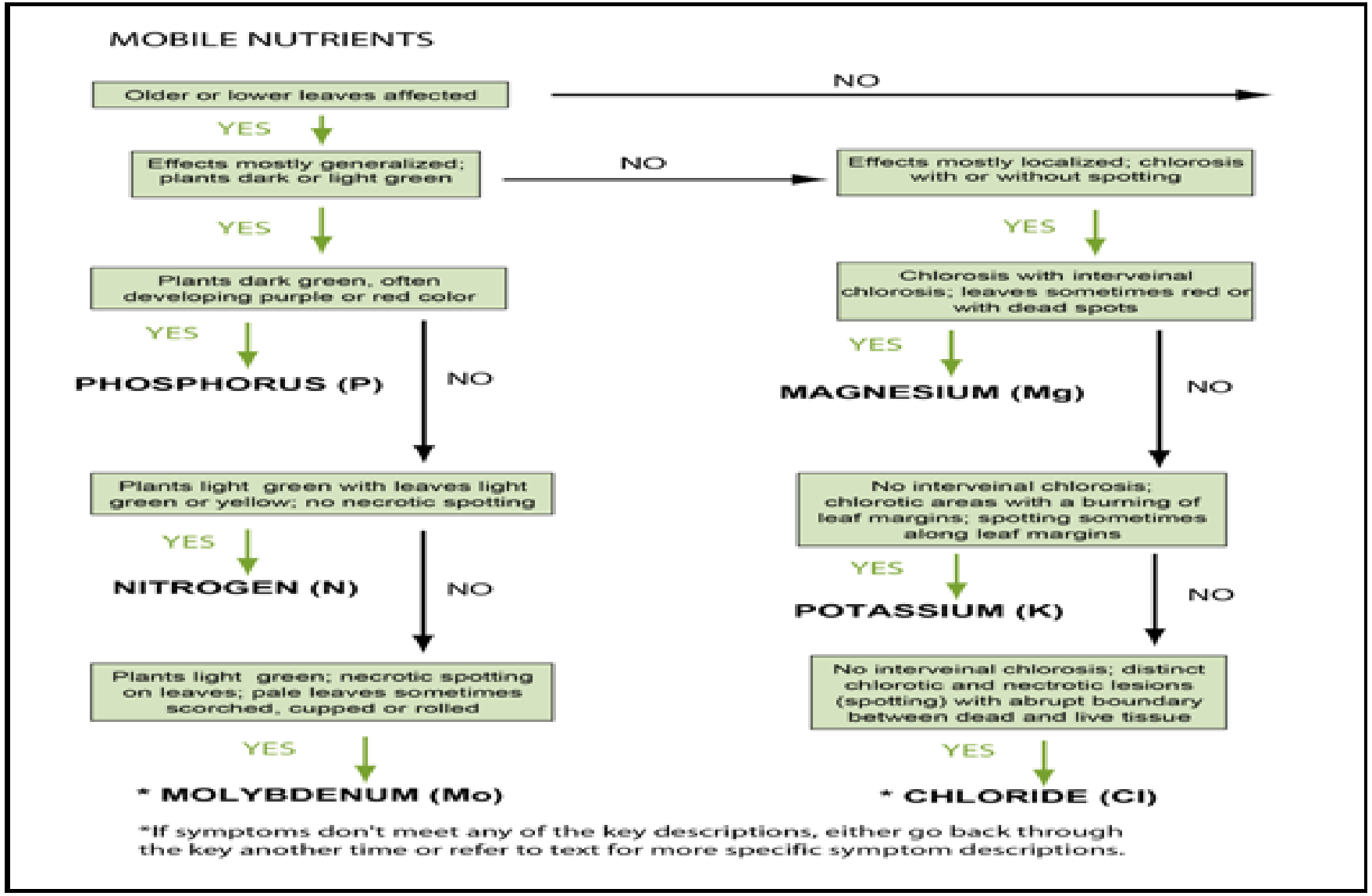
Overall considerations in identification

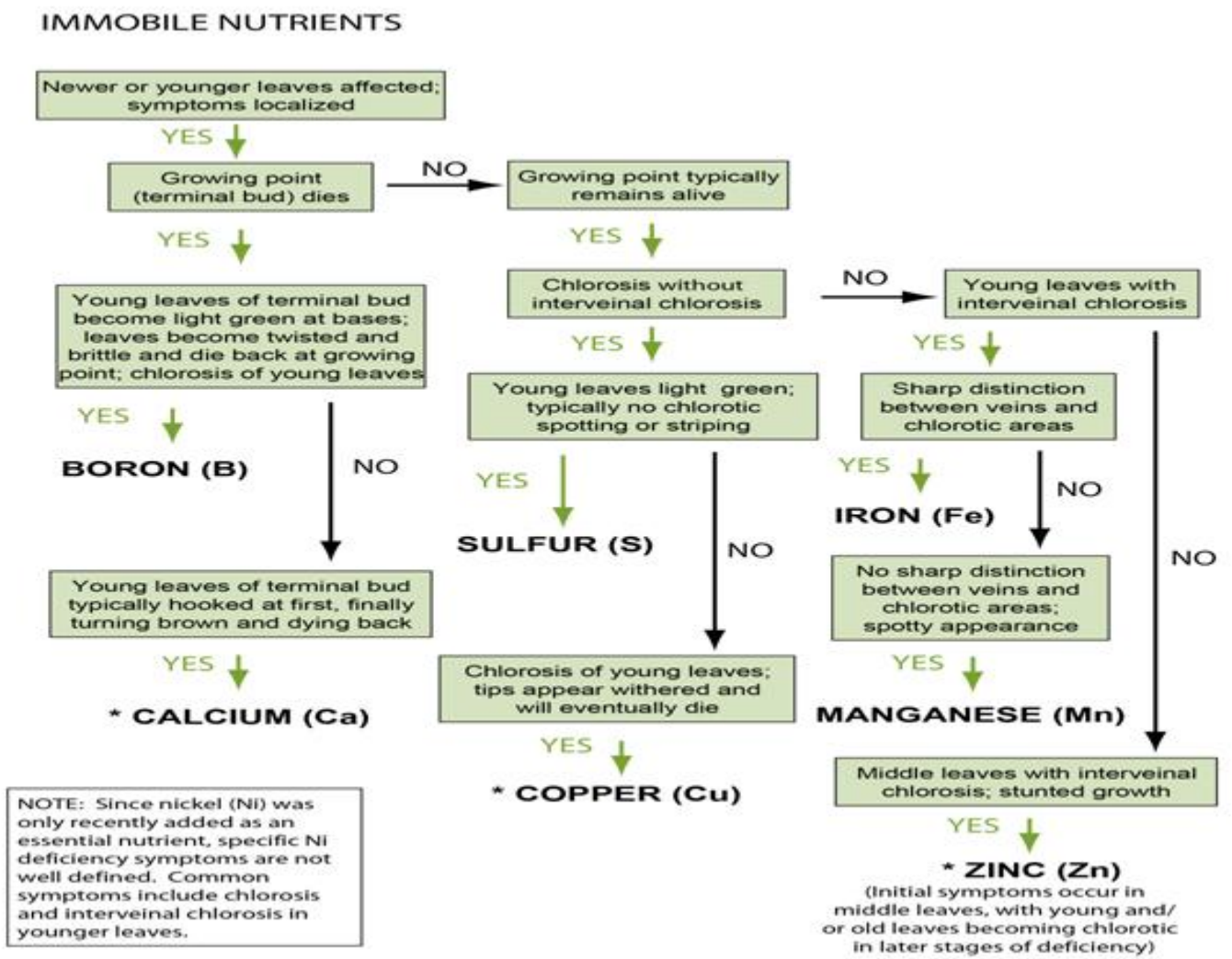
- Nutrient deficiency is the main cause of stunted plant growth often leading to complete crop losses.
- Deficiency for macro secondary and micronutrients can be diagnosed visually, and prompt and correct identification can save crop
- Visual symptoms of nutrient deficiency in plants comprise malformation, discoloration, dotting, crinkling, and even necrosis.
- When a visual examination is not feasible, satellite monitoring is another convenient way of preliminary nutrient deficiency diagnostics.
- Manifestations of deficiency of different elements can be similar, so it is critical to identify the specific element lacking and to provide it on time.

Identification keys for nutrient deficiencies

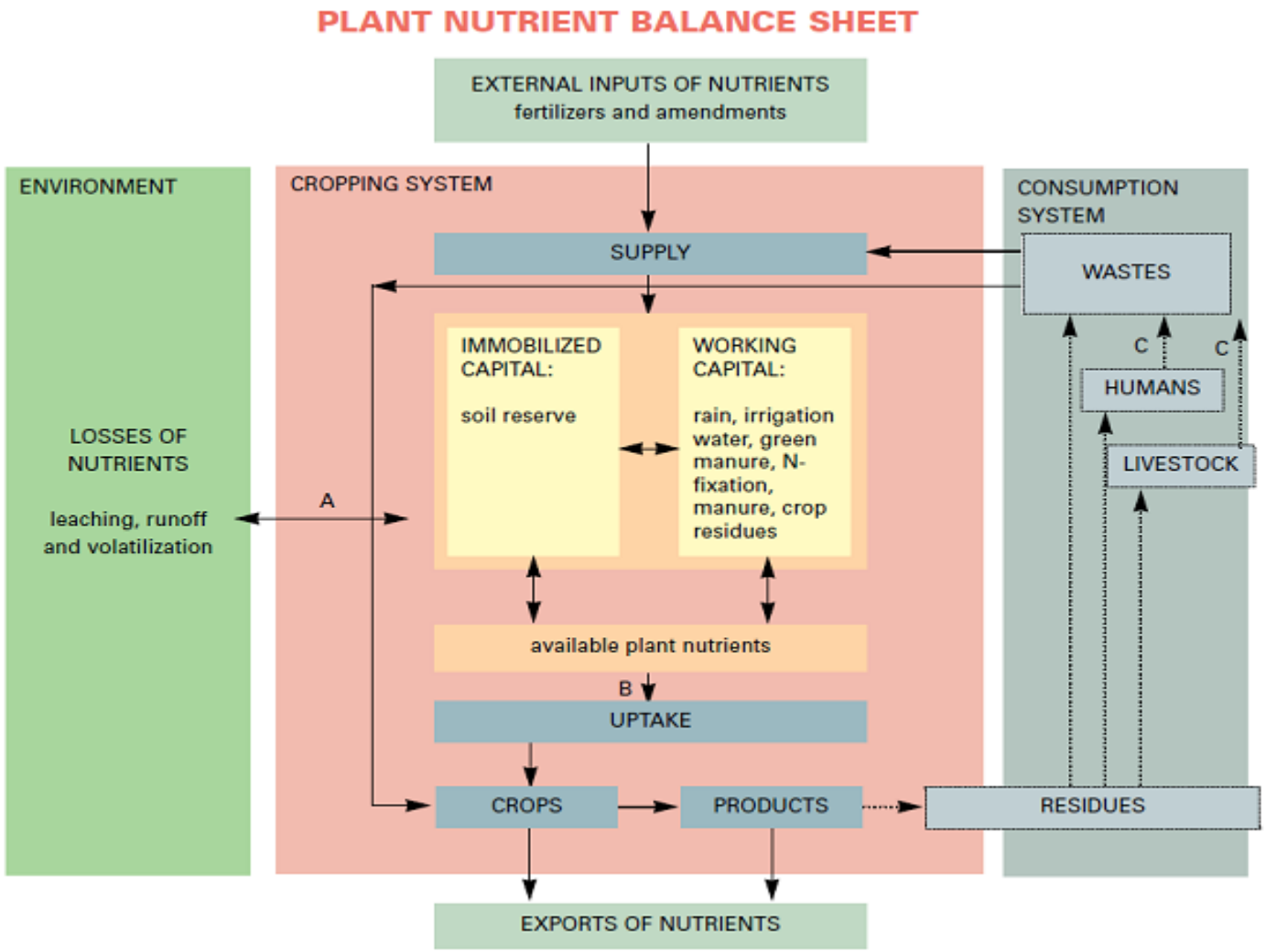
- Keys can be used for identifying nutrient deficiencies based on common symptoms.
- Consists of different alternative statements about plant structures and their appearance
- If possible, it may be helpful to have a healthy plant on hand for comparison purposes. Beginning at the top of the key, read the first statement and determine whether the statement applies to the plant being evaluated
- If the statement describes the plant's symptoms, proceed along the 'YES' arrow to the next statement.
- If not, follow the 'NO' arrow to an alternative statement.
- Continue this process until the probable nutrient responsible for the deficiency is identified
- Descriptions in this key are generalized to accommodate common symptoms seen in crops
- Deficiency symptoms differ among crop types under the field situations

Identification keys for nutrient deficiencies.





Nutrient Management Module No. 9: Montana State University-Bozeman, 2009



(FAO, 1998)

A: Reduction of plant nutrient losses by minimizing runoff and regulating drainage

B: Addition of soil N by introducing legumes and cover crops

C: Reduction of N losses by proper organic matter management

Addition of nutrients to soil

- Nutrients added to the soil basically through two ways viz., natural means such as rain, weathering of parent material,
- Fixation of atmospheric nitrogen in soil and plant by microorganisms
- Application of fertilizers, organic manures like cattle dung and urine, compost and soil amendments.

Removal of nutrients from soil

- Crop removal, weeds, soil erosion, volatalization and leaching.
- The main nutrient loss from the soil is caused through crop uptake.
- The values for uptake however vary depending on planting density and yield levels.
- Locally available data are best for interpretations

Average uptake and removal of major and secondary nutrients by crops (dry matter basis)

Crops	Total removal (kg ha^{-1})					
	N	P	K	Ca	Mg	S
Rice	84	14	89	21	9	9
Wheat	125	22	92	16	14	14
Sugar cane	180	26	270	132	-	26
Cassava	202	32	286	131	108	15
Onion	133	22	177	16	18	34
Tomato	84	21	185	31	8	28
Coffee	253	19	232	143	33	27
Ground nut	170	30	110	39	20	15

Nutrient Interactions

- Many chemical reactions occur at the root zone during the process of nutrient absorption
- Some are benefitial, while some are detrimental to plant nutrient uptake
- Chemical interactions can enhance or interfere with the uptake of some elements based on the concentration of other elements and whether they are synergistic or antagonistic (Rietra *et.al*, 2015).
- Synergism, describes an interaction between two or more factors where the combined effect is greater than the sum of their individual effects. Examples are;
- Increased nitrogen levels in the soil create a demand for more magnesium,
- More of potassium leads to greater manganese requirement
- More of copper leads to increased molybdenum requirement.
- Antagonism means excess of a nutrient causing decrease in the uptake of other elements

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Essential Elements Showing Antagonism

Excess elements in soil	Nutrient uptake affected
Nitrogen	Potassium, calcium
Potassium	Nitrogen, calcium. magnesium
Phosphorus	Zinc, iron, copper
Calcium	Boron, magnesium, phosphorus
Magnesium	Calcium, potassium
Iron	Manganese
Manganese	Iron, molybdenum, magnesium
Copper	Molybdenum, iron, manganese, zinc
Zinc	Iron, manganese
Molybdenum	Copper, iron
Sodium	Potassium, calcium, magnesium

Reference

Soil Fertility Handbook, 2018,Department of Agriculture &Farmer's Welfare, Thiruvanathapuram,1-256


Thank You