Practical-12

Identification of Deficiency Symptoms of Nutrients in Vegetable Crops

Exercise 12.1: Identification of symptoms caused by nutrient deficiency in vegetable crops

OBJECTIVE:

- Identification of deficiency symptoms of nutrients in vegetable crops.

Delivery schedule: 01 period.

Student's expectations/learning objective:

- Importance of nutrients in crop production.
- To demonstrate the identification of deficiency symptoms of nutrients in different vegetable crops.

Pre-learning required: Role of nutrients in vegetables.

Handouts/material required: Paper sheet and pen to note down the instruction, hand lens *etc.*

Introduction

Vegetable crops require nutrients for growth and development and they are absorbed from the soil. You might have learnt about essential plant nutrients and their deficiency symptoms in chapter IV of theory class. Plant nutrients are classified as macronutrients and micronutrients. The most important macronutrients are nitrogen (N), phosphorus (P) and potassium (K) and soils are most likely to be deficient in these nutrients. Hence, these are required in relatively large amounts for plant growth. The other major nutrients, also called secondary nutrients, are calcium (Ca), magnesium (Mg) and sulfur (S). They are also required in relatively large amounts but are less likely to be deficient. Micronutrients are essential for plant growth, but plants require them in relatively small amounts. They include boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), chlorine (Cl) and nickel (Ni). The deficiency of any of these nutrient elements can limit plant growth and development and ultimately affect the yield. Most soils contain sufficient amount of the micronutrients required for plant growth but at certain time, the deficiency may occur. However, soils may

be lacking in some of the macro nutrients, particularly nitrogen, phosphorus and potassium. Therefore, it becomes important to ensure the presence of all the essential elements supplied by the soil in the adequate quantities and in right chemical forms for plant use. This is done by supplying organic matter and by the judicious use of fertilizers in order to supplement the nutrients required by the plants from soil to increase crop yield.

Procedure/methodology

The nutrient deficiencies often show visual symptoms. It is difficult to identify specific plant nutrient deficiencies without plant tissue testing because many deficiencies show symptoms very similar to one another. Many a time, nutrient deficiency symptom is confused with some abiotic problems such as pesticide drift or as a biotic plant disease. As a thumb rule, biotic symptoms tend to appear in asymmetrical patterns, while nutrient deficiency symptoms tend to be symmetrically distributed over the plant tissue surface. In addition, plants may be under some additional stress (*e.g.,* water, insect or disease) or if more than one nutrient is deficient, visual symptoms may be misleading. The nutrient deficiency symptoms can be identified by following these steps

Step 1: We need to have knowledge about the characteristic features of a healthy crop plant to identify symptoms of distress

Step II: Identify where symptoms are appearing *i.e.* new leaves, old leaves, edge of leaf, veins *etc.*): This can be observed by whether the nutrient is mobile or immobile in the plant. The deficiency symptoms of mobile nutrients appear first on older parts of the plant *e.g.* N, P, K and Mg, while the deficiency symptoms of immobile nutrients can be seen first on new growth *e.g.* Ca, Cu, B, Fe, Mn and Zn.

Step III: Identify the pattern of symptoms: The visual identification of a nutrient deficiency is to determine the characteristics of the symptoms *e.g.*

- Leaves may appear chlorotic or yellow in color or
- There may be necrotic or dead spots.
- Symptoms may appear on the leaf tips or on interveinal areas.

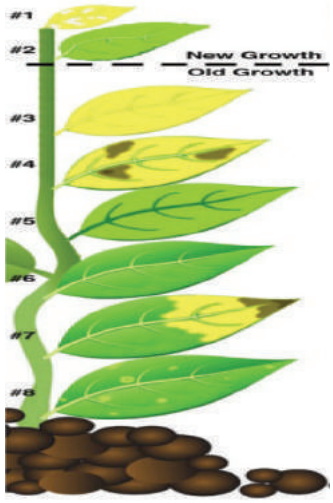


Figure1
Source:www.aquariumslife.com

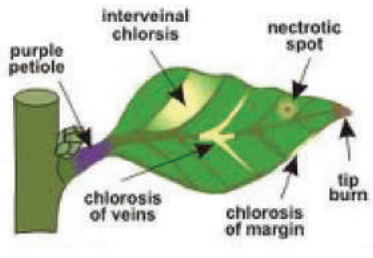


Figure 2:
Source- www.flairform.com

The dichotomous key can be used to aid in the visual diagnosis of common nutrient deficiencies in plants on the basis of appearance of symptoms first on old leaves (Figure 3) or new leaves (Figure 4).

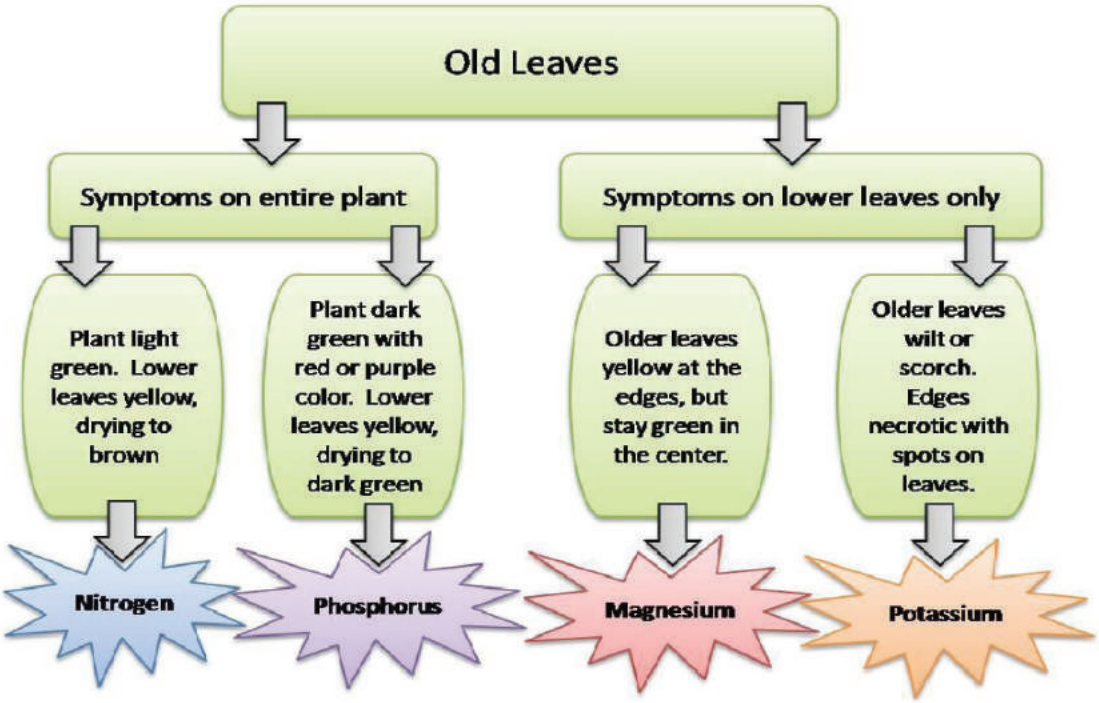


Figure 3: Guide to visual diagnosis of common essential plant nutrient deficiencies symptoms appearing first on old leaves (Source: bay.ifas.ufl.edu).

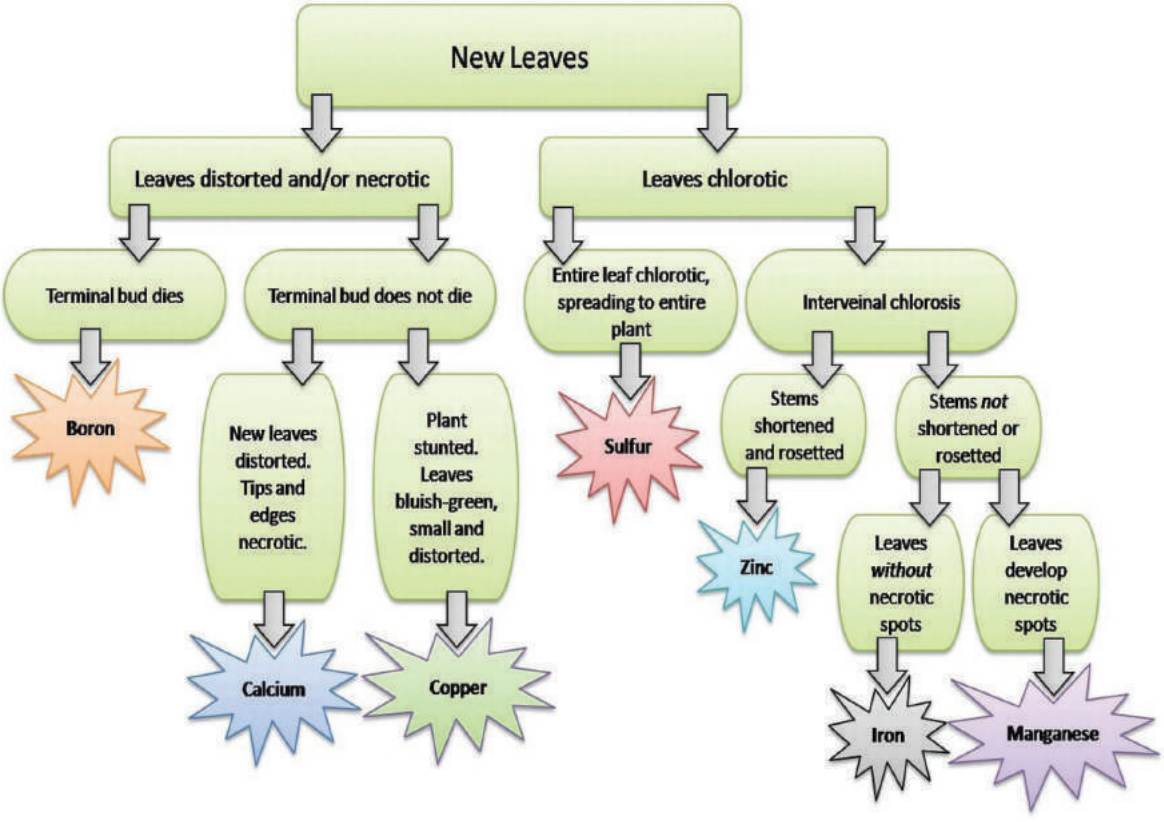


Figure 4: Guide to visual diagnosis of common essential plant nutrient deficiencies symptoms appearing first on new leaves (Source: bay.ifas.ufl.edu).

Step IV: Compare symptoms with chart

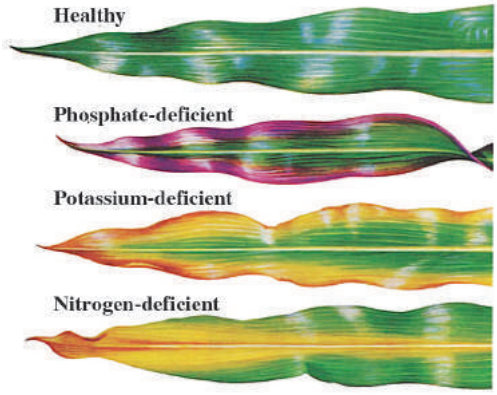
DEFICIENCY SYMPTOM CHART

1. NITROGEN

- Growth is seriously restricted and leaves become small.
- Uniform yellowing of the leaves including veins.
- The leaves become stiff and erect and crops show characteristics 'V' shaped yellowing at the tip of lower/ older leaves and dies prematurely.

2. PHOSPHORUS

- Growth is restricted and in contrast to nitrogen, the foliage remains dark green.
- Growth of the plant is stunted.
- Leaves become small, erect, unusually dark green with a greenish red, greenish brown or purplish tinge; the rear side shows bronzy appearance.
- Margin of leaves tend to curl upward and inward and die prematurely.



Characteristic nitrogen, phosphorus and potassium deficiency symptoms

Source: www.bio.miami.edu

3. POTASSIUM

- Stems and roots become weak and spindly.
- Symptoms appear especially on older leaves which look burnt along the margins of leaves (scorching) extending to the centre of leaf base which also become necrotic.
- Yellowing in leaves starts from tips or margins.
- Plants easily lodge and become sensitive to disease infestation especially the roots.
- Fruit and seed production is impaired and also their quality is affected.

4. CALCIUM

- Young leaves and shoots are affected mostly.
- The bud leaves becomes chlorotic white with the base remaining green. About one-third chlorotic portion of the tip hook downwards and become brittle.

Deficiency of Ca and Mg results in 'Blossom end rot' in tomato

- In extreme cases, its deficiency results in death of terminal bud.
- Deficiency affects fruit quality and results in 'Blossom end rot' in tomato fruits.

5. MAGNESIUM

- Leaf tips and margins of older leaves turn upward and chlorosis and mottling occur.
- It causes yellowing, but differs from that of N. The yellowing takes in between the veins and the veins remains green. A streaking pattern of chlorotic tissue running parallel to the veins.
- Some dead spots appear on leaves and leaves become reddish color.
- The necrosis (death of tissues) only on margin.

'Mg' deficiency

6. SULPHUR

- The leaves become small and yellowish.
- The leaf veins are paler than inter-veinal portion.

Normal leaf vs leaf showing sulphur deficiency

7. IRON

- Roots become short and slender
- The youngest leaves become yellow and interveinal yellowing develops near the base of the older leaves.
- The principle veins remain green and other portions of leaf turn yellow and later on become white.

Iron deficiency (yellowing of young leaves)

8. ZINC

- Size of leaves and internodal length get reduced.
- Leaf lamina become chlorotic and the veins remain green especially in older leaves.

Zinc deficiency

9. BORON

Boron deficiency causes cracking in tomato

- Young tissues are most affected.
- Yellowing on the tip of the mature leaves gradually spread around the margins and the main vein become reddish-brown.
- Abnormal development of the growing points with the apical meristems eventually becoming stunted and later on the apical meristem wither.
- Root tips become swollen and discolored.
- Flowers and fruits abort.

10. COPPER

- Wilting and twisting of dark green young leaves with numerous dead spots on leaf blades.
- Chlorosis of veins occurs and leaves lose their luster.
- Copper is rarely deficient

11. MANGANESE

Manganese deficiency

- The young leaves become bright yellow green and develop dark brown interveinal areas usually initiating from the leaf tip. Severely affected leaves wither and drop off.
- Small diffused yellow areas develop on the older leaves which may become brown later.

12. MOLYBDENUM

Whip tail
Source: www1.agric.gov.ab.ca

- Chlorosis starts from older leaves and progress further to younger leaves.
- It causes death of interveinal areas and then of the whole leaf.
- Its deficiency causes 'Whip Tail' in cauliflower.

13. CHLORINE

- Wilting of leaves which in turn become reddish bronze in color
- Stunted roots with abnormal thickening near tips

14. NICKEL

- Necrosis initiating from the tip of leaf occurs.

References

1. Shober A L and Denny G C. Identifying Nutrient Deficiencies in Ornamental Plants1. http://edis.ifas.ufl.edu/pdffiles/SS/SS53000.pdf
2. Tucker MR. Essential Plant Nutrients: their presence in North Carolina soils and role in plant nutrition. http://www.ncagr.gov/agronomi/pdffiles/essnutr.pdf
3. Uchida R. Essential Nutrients for Plant Growth: Nutrient Functions and Deficiency Symptoms. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/pnm3.pdf
4. Plant nutrition. http://en.wikipedia.org/wiki/Plant_nutrition

Exercise 12.1: Identification of nutrient deficiency symptoms

Procedure:

1. Visit nearby vegetable gardens and try to find nutrient deficiency symptoms by observing vegetable crops intermittently.
2. Record your observations.
3. Collect the samples and make herbarium.

DATA SHEET

S. No.	Crop	Plant part showing symptoms	Characteristics of symptoms	Possible nutrient
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				