SEED ENTERPRISE MANAGEMENT INSTITUTE (SEMIs)

Seed Production Field Diagnostics

Short Course

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Abiotic Disorders In Seed Production

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- Abiotic plant problems are sometimes termed “physiological disorders
- Abiotic disorders” refers to a wide array of plant problem
- “Abiotic” to indicate that the symptom is not caused by a biological agent such as an insect, mite or pathogen.
- Abiotic disorders are associated with non-living causal factors such as weather, soils, chemicals, mechanical injuries, prolonged drought, cultural practices and, in some cases, a genetic predisposition
- Abiotic stressors can also predispose plants to pathogens

Abiotic Disorders In Seed Production

- Genetic mutations and reversions
- Chimeras - Leaf variegation
- Low-temperature injury
- Sunscald and frost cracking
- Frost injury
- Drought and heat
- Flooding

- Lightning and hail
- Nutrient deficiencies and excesses
- Salt injury
- Herbicides
- Pesticides
- Air pollution

- Plants suffering from nutrient or physiological disorders, the plant exhibits disease-like symptoms
- Nutrient disorders are sometimes mistaken for a disease
- Nutrient deficiencies lack visible signs, they are often mistaken for virus diseases
- Nutrient disorders may result in a reduction in yield

Soil nutrients

Macro-nutrients
Constitute main elements required by plant for basic functioning

- Phosphorous (P),
- Potassium (K),
- Nitrogen (N),
- Calcium (Ca),
- Magnesium (Mg)
- Sulfur (S).

Micro-nutrients (trace elements)
Required in very small amounts but are essential for normal growth

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

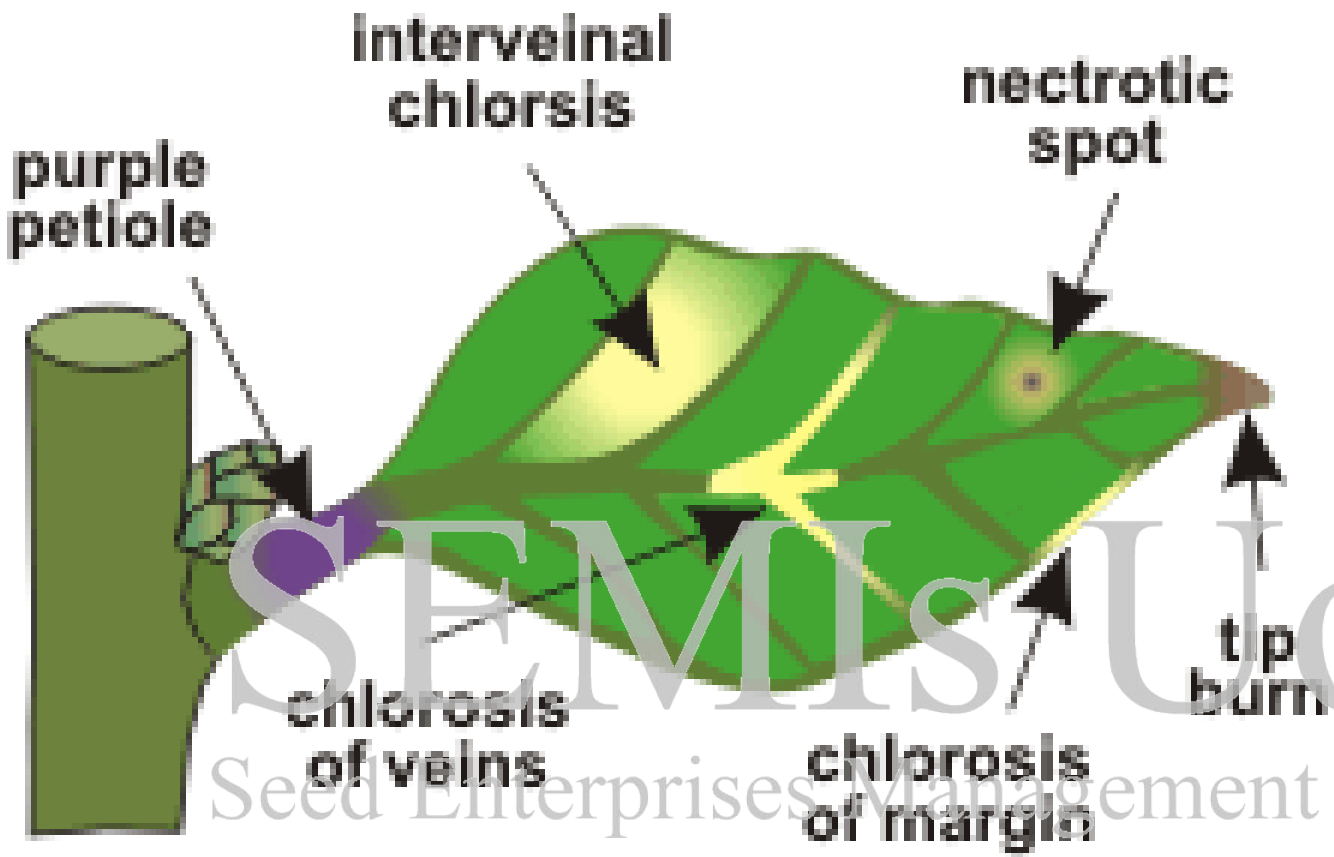
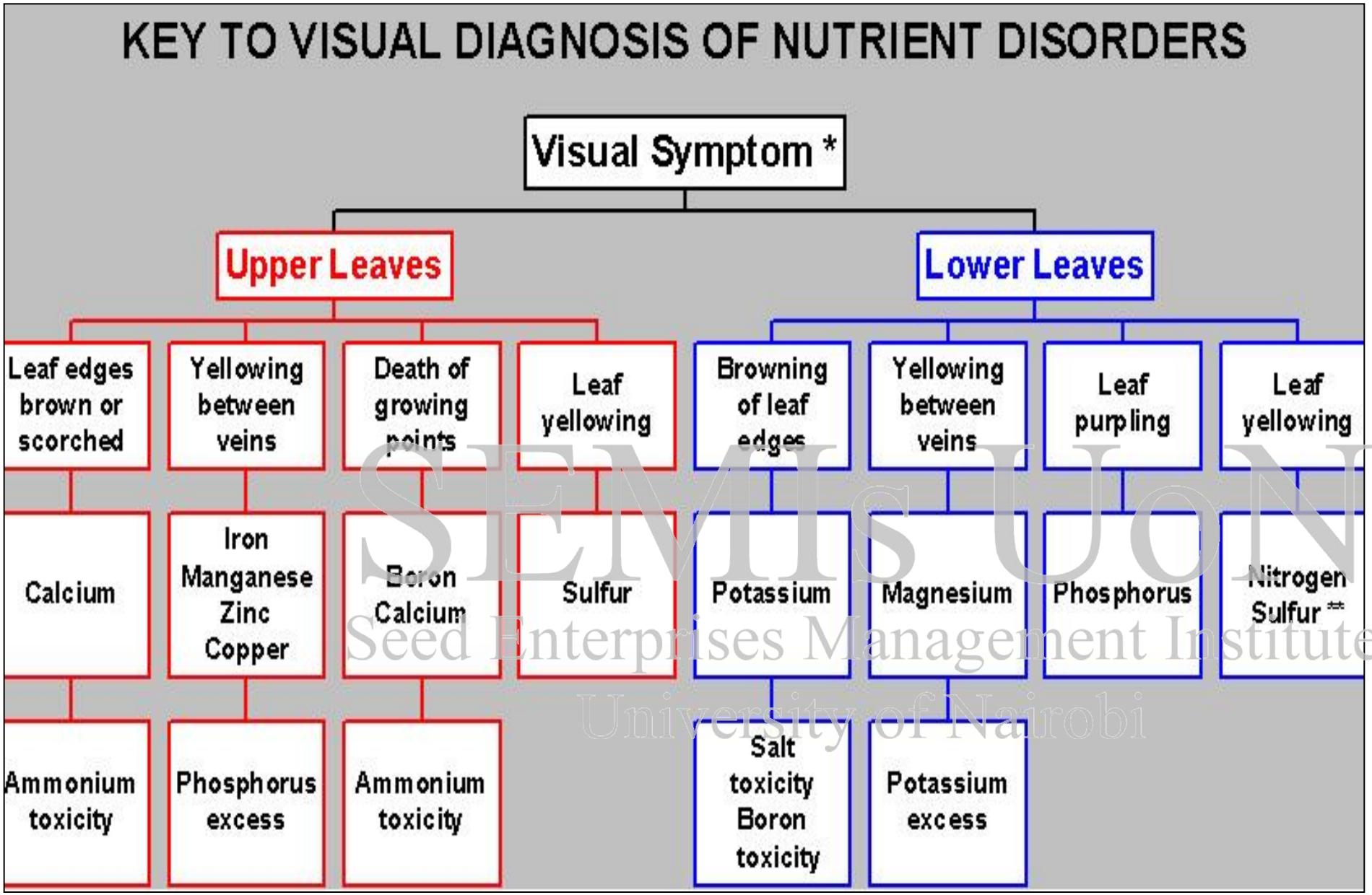
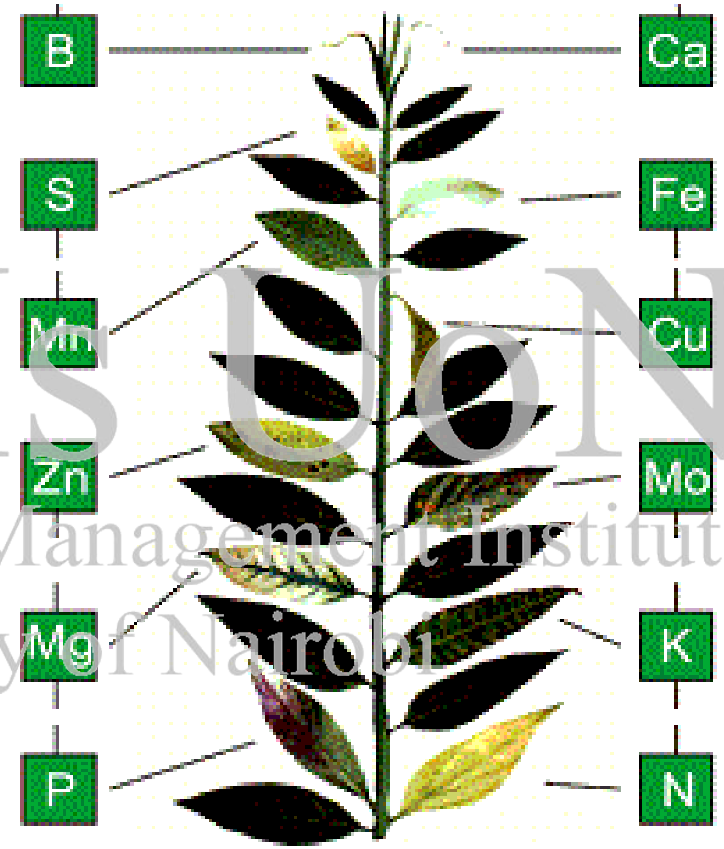


Fig 15.1 Some common leaf abnormalities resulting from nutrient deficiencies.

Nutrient deficiencies

- symptoms of nutritional disorders occur in defined patterns and are specific for each nutrient
- Symptoms are first seen in older leaves for some deficiencies, and in young leaves and/or tissues for others
- mobile nutrients (N, P, K and Mg) deficiencies are first seen in older leaves;
- immobile nutrients (Ca, B, Cu, Zn and Fe) deficiencies are first seen in youngest leaves and/or growing tissue
- pesticide toxicity or disease symptoms may resemble nutrient deficiencies or toxicities
- symptoms of nutritional disorders are often species or variety dependent
- soil and plant tissue analysis should be used to help confirm whether the symptoms truly are nutritional
- Magnesium deficiencies are often confused with viruses and other nutrient problems. However, symptoms of viruses are typically manifested in the young,





SYMPTOMS OF ABIOTIC DISORDERS

LEGUMES

Iron Deficiency of Peanut

Iron deficiency in cowpea

Iron

Iron deficiency

Manganese Deficient Soybean

Manganese Deficiency of Peanut

Molybdenum

Molybdenum Deficiency of Peanut (Right) Grown in Strongly Acid Soil (PH

Molybdenum Deficiency of Peanut (Right) Grown in Strongly Acid Soil (PH 4.5)

SYMPTOMS ON CEREALS

a healthy corn plant leaf is deep green and glossy

a leaf from a plant with nitrogen deficiency yellows down the midvein starting at the tip and moving back towards the stem

a leaf displaying phosphorus deficiency turns red-purple along the leaf margins

a leaf from a potassium-deprived plant features firing and yellowing along the leaf margins

Phosphorus

Potassium

Potassium

Potassium deficiency in corn, lower leave

Potassium deficiency
Not chiseled (left), chiseled (right)

Potassium

Nitrogen

Nitrogen

Wheat

Nitrogen deficiency

Potassium deficiency

Phosphorus deficiency

Magnesium

Sulphur

Boron

Manganese

Manganese deficiency

Zinc

Zinc Deficiency of Rice

Zinc Deficiency of maize

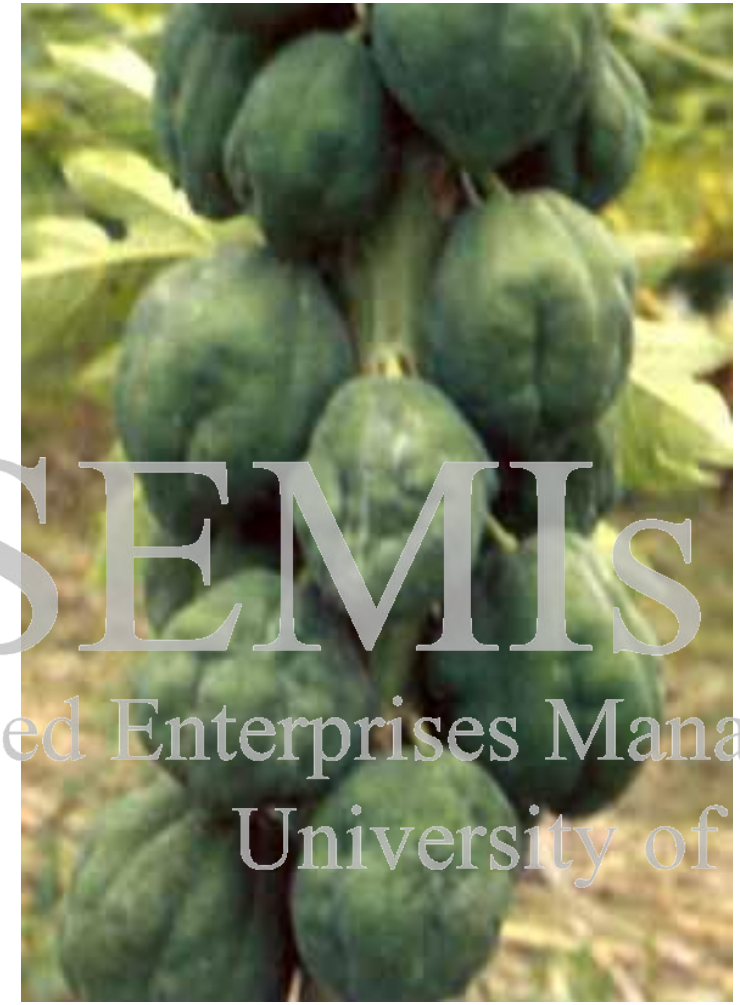
Zinc

Iron

Copper

Calcium

Boron Deficiency in Papaya



MANAGEMENT OF NUTRIENT DEFICIENCIES

Conditions leading to nutrient deficiency

N - infection by root pathogens such as root-knot nematodes Nitrogen deficiencies can cause increased susceptibility to certain leaf pathogens such as *Alternaria solani,* while excessive plant N levels may result in increased susceptibility to other pathogens

P - acid and clay soils are particularly prone to P deficiency. Cool conditions or poor oxygen availability to the roots can lead to P deficiency

Fe - Most soils have adequate supplies of Fe; availability decreases as soil pH increase

K - availability reduced by presence of competing cations such as $Ca)^{2+}$ and $NH_4^{+;}$ Potassium can also be readily leached from sandy soils. Plant uptake of K may be reduced by certain environmental conditions including temperature, soil moisture, and oxygen availability.

Deficiency	Symptoms	Remedies
Phosphorous (P)	Poor germination, seedling establishment & plant growth; leaves may be dull bluish/greyish-green or have red pigment in leaf bases and dying leaves; oldest leaves may turn yellow & drop.	Apply phosphorus fertilisers & manure
Potassium (K)	Yellowing on older leaves; scorching of edges and/or interveinal region	Apply K fertilizer rate
Nitrogen (N)	Poor plant growth; older leaves are pale green to yellow and they eventually dry and drop; fruit and tubers are small.	Add N fertilizer improve irrigation management.

Calcium (Ca)	**Retarded growth; yellowing & distortion of young leaves; blossom end rot in cucurbits and tomatoes**	**Side dress with a Ca fertilizer**
Magnesium (Mg)	Growth retarded; chlorotic patches between the veins of older leaves; a triangle of green remains at base of leaf; leaf margins may burn.	Application of fertilizer or weekly foliar sprays
Sulfur (S)	Yellowing of young leaves while older leaves remain dark green; growth stunted.	Application of sulfate compounds.
Boron (B)	Bushy stunted growth & dying growing tips; internal brown rot, brittle plant tissue & split easily; hollow areas in stems.	Application of boron-fertilizers

Iron (Fe)	**Leaves turn yellow/bleached between vein margins; stunting & abnormal growth; fruit may not mature.**	**Spray iron sulphate; reduce soil pH below 7.5**
Manganese (Mn)	Yellow patches between veins; reduced flower formation.	Foliar sprays with manganese sulphate
Molybdenum (Mo)	stunted, pale green or yellow stunting & pale green or yellowish green colour between the veins & along edges of leaves; leaf tissue of margins dies;	Liming to increase soil pH to 6.5; foliar applications of sodium or ammonium molybdate.
Zinc (Zn)	Stunted & pale with creamy yellow interveinal area; distorted young leaves.	Application of Zn foliar spray
Copper (Cu)	Chlorosis in young leaves; tips of leaves distorted; stunted growth.	Apply a copper fertiliser

NUTRIENT TOXICITIES AND CHEMICAL INJURY

Nutrient toxicities

- Chloride toxicity – Caused by saline water and soil conditions; plants wilt when soil moisture seems adequate; test and monitor irrigation water quality; plants vary in their tolerance to salinity.

- Manganese toxicity – Yellowing of margins of older leaves; poor root development; favoured by acidic, waterlogged soil; lime soil to correct pH.

- Ammonium toxicity "jelly butt" – Poor emergence followed by wilting and death of seedlings; browning of the central root tissue; favoured by excess ammonium from fertiliser or poultry manure in cold wet soil.

Nutrient toxicity

Broadcast nitrogen solution

Broadcast solution nitrogen

Nutrient toxicity

Seed-placed urea stand loss and biuret damage

Granular urea

Nutrient toxicity

Two examples of improper use of non-selective herbicide.

Salt injury on taxus.

Leaf cupping/ curling due to a growth regulator herbicide.

Physiological disorders

- Tipburn (physiological/nutritional) – a result of a calcium transport problem within the plant.
- Blossom end rot (physiological/nutritional) – caused by a deficiency of calcium or insufficient calcium uptake and translocation to growing points.
- Riciness of cauliflower.
- Gomasho (grey speck) of cabbage and Chinese cabbage.
- Measles on smooth skinned melons and cucumbers.

Management

- Investigate weather patterns
- Analyze plant nutrient status
- Look for drainage and compaction
- Check for irrigation problems
- Get a chemical use history
- Plant nutrient deficiencies are best diagnosed using plant tissue analysis. As opposed to soil nutrient analysis, plant tissue analysis allows one to determine plant nutrient uptake rather than plant nutrient availability


THANK YOU FOR THE AUDIENCE
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