Nutrient Deficiencies

Nutrient Disorders in Rice

Leaf symptoms | Plant symptoms | Likely environments

N — Nitrogen

- Narrow, short, and erect with light-green color and chlorotic (less or no color) tip.
- Affects older leaves first (unlike S deficiency, which affects younger leaves).

- Stunted with reduced tillering; low grain number.
- Entire field appears yellowish.
- Appears during tillering and panicle initiation when plant N demand is high.

- Soils low in organic matter (OM).
- Alkaline and calcareous soils with low OM and high ammonium volatilization losses.

P — Phosphorus

- Narrow, short, very erect, "dirty" dark green color.
- Red and purple color in some varieties.

- Thin and spindly stems.
- Stunted with greatly reduced tillering and retarded development.

- In direct-seeded rice (high planting density, shallow root system).
- Sandy soils with low OM.
- Calcareous, acid-sulfate, peat, saline, sodic, or volcanic soils.
- Problem soils with other nutrient disorders.

K — Potassium

- Yellowish brown margins or dark brown necrotic (dead) spots on older leaf tips.
- Symptoms later spread over the whole leaf.
- Yellow stripes along interveins.

- Stunted with smaller leaves, short and thin stems.
- Similar to tungro disease, but less patchy in the field.
- Reduced number of spikelets per panicle, % of filled grains, and 1000-grain weight.

- Greater risk at higher yield (hybrid cultivars).
- Sandy (low CEC), degraded acid, "old" acid-sulfate, poorly drained, or organic soils.
- Clay soils with high K fixation.

Zn — Zinc

- Droopy and dry lower leaves with dusty brown spots and streaks.
- Midribs chlorotic near base of younger leaves.
- Reduced blade size.

- Stunted with uneven growth and reduced tillering.
- Symptoms appear 2–4 weeks after transplanting.
- Higher spikelet sterility.
- Delayed maturity.

- High soil pH (≥7 anaerobic conditions).
- After large application of P fertilizer (Zn immobilization).
- High HCO_3^- in irrigation water.
- Calcareous soils with high OM.
- High dose of manure/residues.
- Excessive liming.

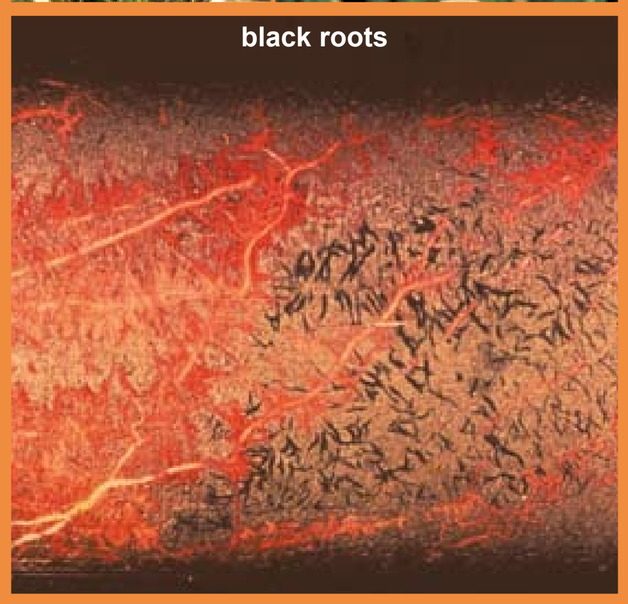
Fe — Iron

- Tiny brown spots on lower leaves starting from the tip and spreading toward the base.
- Whole leaf is orange-yellow to brown and dies.

- Stunted, greatly reduced tillering.
- Coarse, sparse, damaged root system with dark brown to black coating on root surfaces.
- Symptoms appear in first 1–2 weeks (sometimes >2 months).

- High application of undecomposed organic residues.
- Long period of submergence between crops (ratooning).
- Poor drainage in inland valleys next to acid upland soils.
- Acid clayey, young acid-sulfate, kaolinitic (low CEC), or acid peat soils.

Sulfide



- Interveinal chlorosis of emerging leaves (similar to Fe deficiency).

- Poorly developed root systems with coarse, sparse, dark brown to black roots (similar to Fe toxicity).

- Well-drained sandy soils or degraded paddy soils with low Fe status.
- Poorly drained organic and acid-sulfate soils.

S — Sulfur

- Light green or pale yellow leaves with necrotic tips.
- Chlorosis more pronounced in young leaves.
- Paler yellow than N-deficient plants but no necrosis of lower leaves.

- Stunted with reduced tillering.
- Plant development and maturity delayed by 1–2 weeks.
- Symptoms more pronounced during vegetative growth.

- Soils low in OM, degraded soils rich in Fe-oxides, sandy soils.

Mg — Magnesium

- Orange-yellow interveinal chlorosis on older leaves.
- Younger leaves and flag leaf affected when deficiency is severe.
- Green coloring appears as a "string of beads" (in contrast to stripes in K deficiency).
- Droopy and wavy leaves.

- Reduced number of spikelets and 1000-grain weight.
- Reduced grain quality (milled rice %, protein and starch content).

- Large K application on Mg-deficient soils.
- Acid soils with low CEC in upland and lowlands.
- Sandy soils with high percolation rates and leaching.
- Leached, old acid-sulfate soils.

Fe — Iron

- Interveinal yellowing and chlorosis of emerging leaves.

- Stunted growth with narrow leaves.
- If severe, entire plant discolors and dies.
- Symptoms often disappear one month after planting.

- Upland soils.
- High-pH alkaline or calcareous soils after submergence.
- Soils with high P or excessive use of fertilizer P.
- Lowland soils low in OM.
- Lowland soils irrigated with alkaline irrigation water.

Cu — Copper

- Bluish green with chlorotic streaks on either side of the midrib.
- Dark brown necrotic lesions on the tips of younger leaves.
- New leaves do not unroll and leaf tip looks needle-like.

- Reduced tillering and pollen viability.
- Spikelet sterility and unfilled grains.

- Soils high in OM (peat).
- Sandy soils derived from quartz.
- Overlimed acid soils.
- Excessive Zn in the soil.

Salinity

- White tips with chlorotic patches on some leaves.
- Symptoms appear first on young leaves.

- Reduced germination, plant height, and tillering.
- Poor root growth.
- Patchy growth in the field.
- Increased spikelet sterility.
- Rice most sensitive during early growth (1–2-leaf stage), and at flowering.

- Saline coastal, saline acid-sulfate, or acid sandy saline soils.
- Neutral to alkaline saline, saline-sodic, and sodic inland soils.

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