

Aluminum toxicity



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What it does

Aluminum (Al) toxicity in soil inhibits the growth of plant shoots by causing nutrient deficiencies of Magnesium, Calcium, and Phosphorus.

It can also lead to drought stress and plant hormone imbalance.



Why and where does it occur

Al toxicity is relatively rare in irrigated rice systems.

It rarely occurs in lowland rice except in some soils where there is very slow soil reduction after flooding.

Al toxicity occurs on the following soils:

- Acid upland soils (Ultisols, Oxisols) with large exchangeable Al content. Al toxicity often occurs together with Mn toxicity.
- Acid sulfate soils, particularly when rice is grown as an upland crop for a few weeks before flooding.
- Flooded soils with pH <4, before Fe toxicity symptoms appear.

How to identify

- Check for leaf discoloration.
- Orange-yellow interveinal chlorosis can be found on leaves.
- When severe, discolored areas can die. Yellow to white mottling of inter-veins is followed by leaf tip death and leaf margin scorch.
- Also check for poor stunted growth and deformed roots in susceptible varieties.

Why is it important

Al toxicity is one of the major factors in limiting crop production on acid upland soils, and can be a major source of yield loss. In soil having pH <5, Al^{3+} is released to the soil which ultimately enters into the root-tip cells and ceases root development of crops.

How to manage

To prevent Aluminum toxicity:

- Grow tolerant varieties.
- Contact your local agriculture office for an up-to-date list of available varieties.
- Delay planting until pH has increased sufficiently after flooding (to immobilize Al).
- Provide crops with sufficient water to maintain reduced soil conditions.
- Prevent the topsoil from drying out.
- Manage fertilizers efficiently.
- Recycle straw or ash in the field to replenish the micronutrients in the soil.

There is currently no practical treatment option for curing/skipping aluminum toxicity. Where possible:

- Apply 1 to 3t lime/ha to raise pH of soil. Determine the exact amount of lime needed, based on a lime requirement test.
- Perform laboratory tests and procedures. Ameliorate subsoil acidity to improve root growth below the plow layer by leaching Ca^{2+} into the subsoil from lime applied to the soil surface. Supply anions SO_4^{2-} or NO_3^- to accompany Ca^{2+} moving into the subsoil by applying gypsum, green manure crop, or urea with additional lime to neutralize the acidity generated in nitrification. Cl^- is not an effective counter anion to repel down Ca^{2+} from top soil.
- On acid upland soils, install soil erosion traps and incorporate 1 t ha⁻¹ of reactive rock phosphate to alleviate P deficiency.



Assam Agribusiness and Rural Transformation Project (APART)

The World Bank is the funding agency of APART

Department of Agriculture, Assam is the nodal department for implementation of APART

ARIAS Society is the State Level coordinating and monitoring agency for APART

Assam Agricultural University is the leading Agricultural University of the state and implementing agency of APART, imparting research and scientific support.

IRRI is the rice global leader providing technical and hand holding support in the implementation of APART