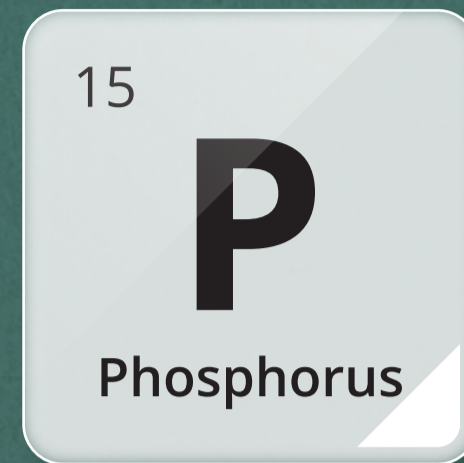


# Periodic Table of Turf Health

## Primary macro-nutrients



- Key function in plants
- Chlorosis of older leaves / slow growth
- Waterlogged / neglected soils

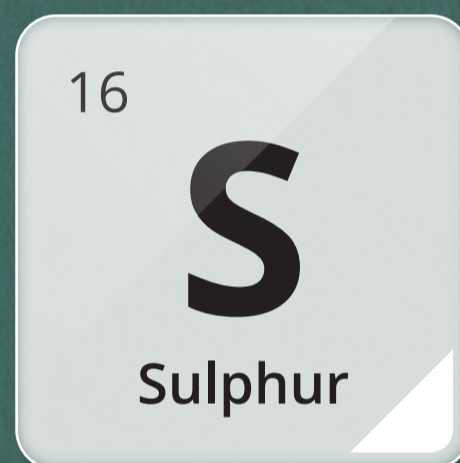


- Synthesis of DNA and energy production
- Purpling of leaves
- Calcium-rich soils / high pH

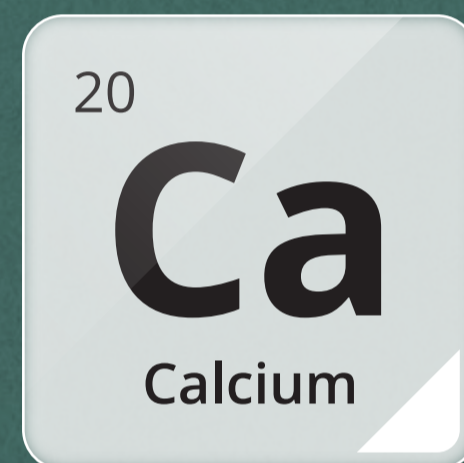


- Enzyme activity, cell turgor, stomata control
- Chlorosis at leaf tip and blade edges
- Under-fertilised soils. Leaching from sandy soils

## Secondary macro-nutrients



- Protein synthesis, chloroplast function, Photosynthetic energy conversion
- Light green leaves
- Using granular fertilisers that do not contain sulphur

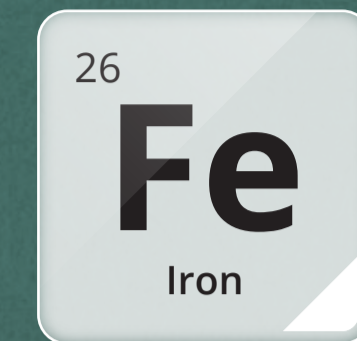


- Cell wall structure, and cell division in growing points
- Blackening of new growth
- Inconsistent water availability / acidic pH / using liquid fertilisers lacking calcium



- The central atom in the chlorophyll molecule
- Interveinal chlorosis of OLDER leaves
- Excess calcium or potassium

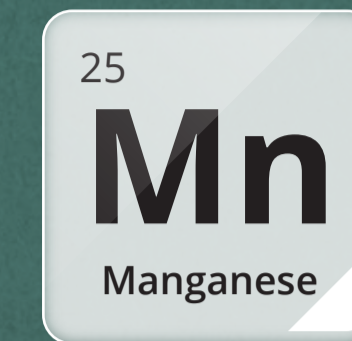
## Micro-nutrients



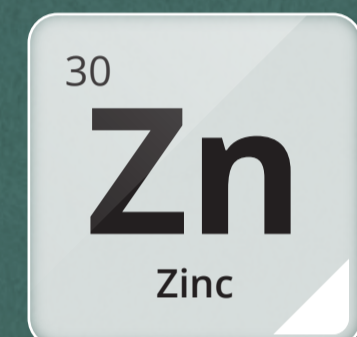
- Component of the chlorophyll molecule
- Chlorosis of YOUNG leaves
- High soil pH



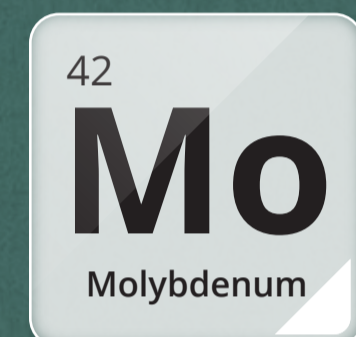
- Numerous functions in flowering, fruiting, and metabolism
- Symptoms only visible when flowering/seeding
- Systems with no fertiliser addition and very low organic matter



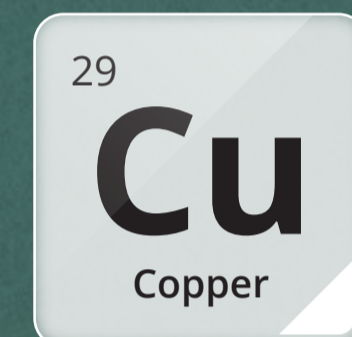
- Chloroplast formation
- High soil pH



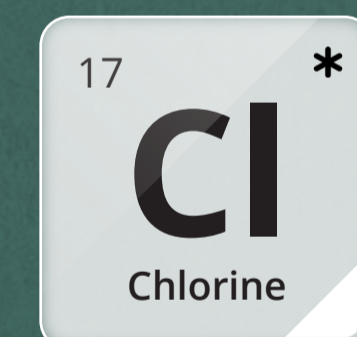
- Auxin synthesis and functioning of numerous enzymes
- Interveinal chlorosis, grey brown spots
- High pH (not as extreme as iron)



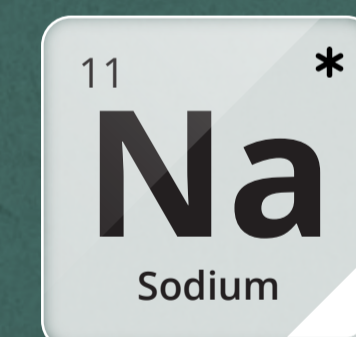
- Functioning of enzymes involved in nitrogen metabolism
- Low soil pH



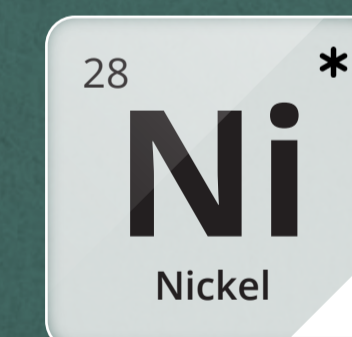
- Photosynthesis, enzyme functioning, lignin synthesis
- High pH (not as extreme as iron)



- Osmotic functioning
- Near impossible to be deficient

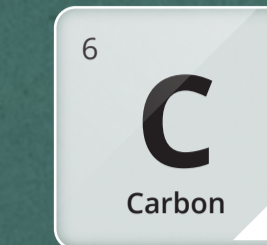


- Only essential in plants possessing C4 (e.g. bermuda grass & Zoysia) and CAM (e.g. Cacti) photosynthesis. Toxic when applied to most plants
- Near impossible to be deficient

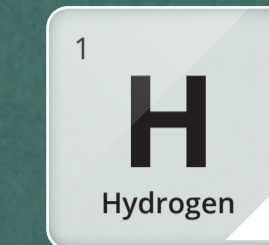


- Urease activity
- Near impossible to be deficient

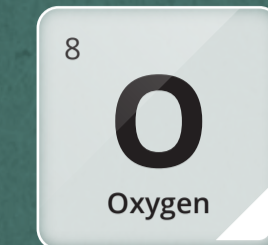
## Non-mineral nutrients



Obtained from CO<sub>2</sub> in the air

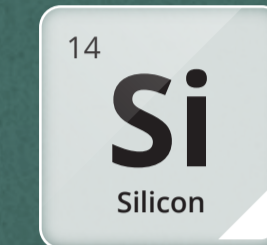


Obtained from water (H<sub>2</sub>O)

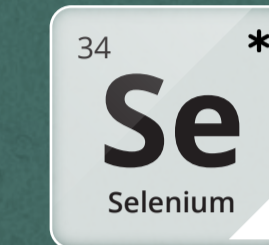


Obtained from CO<sub>2</sub> and water

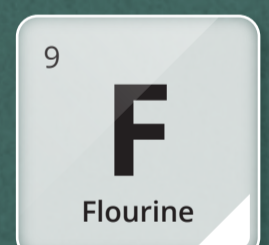
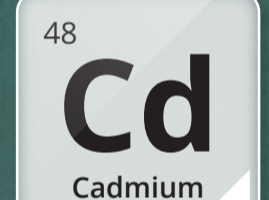
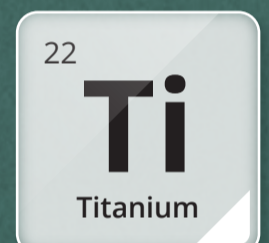
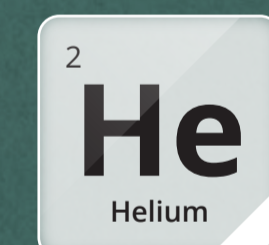
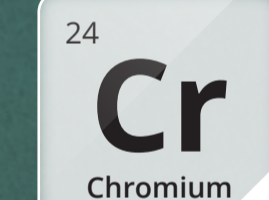
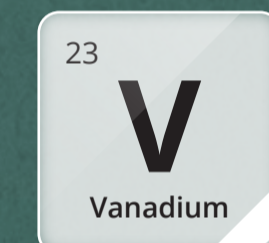
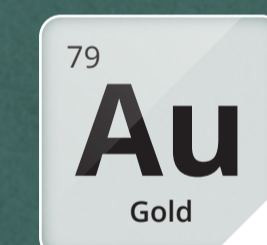
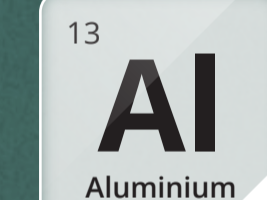
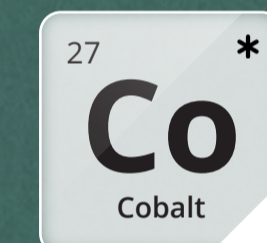
## Non-essential elements



Not essential for plant survival, but major benefits to stress tolerance and physical strength, especially in grasses



Required for grazing animal health, but not plants



Some reports of minor beneficial effects

Examples of some elements particularly toxic to plants

Examples of some elements that are neither beneficial nor toxic

## Key

- Key function in plants
- Common symptom of deficiency
- Where deficiencies commonly occur
- \* Never add in fertiliser as never deficient and high risk of toxicity to either humans or the plants



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