ZINC

FACT SHEET
April 2017

ZINC IN SOILS

Zinc is present in higher amounts in clay soils, while sandy soils are low in zinc. Its availability for plant uptake is affected by pH, being most available in acid soils, and less available at high pH.

On acid sandy soils, zinc deficiency is mostly caused by a low total zinc content; whereas on alkaline clay soils, the total zinc level may be high but deficiency occurs due to low availability.

Deficiency is also more likely to occur on soils low in organic matter.

Zinc is not mobile in the soil. It tends to stay where it is placed. Plant roots therefore have to grow to the zinc, rather than have the zinc move in the soil solution to the roots.

ZINC IN PLANTS

In addition to the factors discussed above, other factors that affect the uptake of zinc are:

- Anything that restricts root growth or the rate of diffusion of zinc in the soil to the roots may induce zinc deficiency. This includes soil compaction, high water tables, growing plants in containers or pots, and low soil temperatures. Cold weather may restrict root development and slow down the microbiological release of zinc from soil organic matter.

- VAM (vesicular arbuscular mycorrhiza) is a beneficial fungi which infects the roots of most crops plants (canola is an exception). The mycelium (fungal threads) act like fine root hairs, effectively increasing the root surface area. This greatly increases plant uptake of immobile nutrients such as phosphorus and zinc. VAM are dependent on plants for survival. If land is fallowed for a long period, e.g. 12 months, or non-host crops are grown, VAM populations will decline, increasing the likelihood that responses to zinc will be obtained. Before the importance of VAM was known, the occurrence of zinc deficiency after an extended fallow was known as Long Fallow Disorder.

Zinc is taken up by plant roots as Zn^{2+}. It has low mobility within plants. The ease with which zinc is transferred from old to young tissue is depressed further in zinc deficient plants.

DEFICIENCY SYMPTOMS

With the exception of molybdenum deficiency in legume-based pastures, zinc is the most common trace element deficiency in Australian agriculture, and the most common trace element deficiency in non-leguminous crops.

The incidence of zinc deficiency and demand for zinc fertilisers has increased in Australia since the 1980s. There are several reasons for this, including:

- Higher crop yields, increasing the demand on the soil for nutrients.
- Declining soil fertility, as a result of nutrient depletion or expansion onto poorer classes of land.
- Reduced zinc availability in some soils and districts, due to or loss of soil organic matter; or increases in soil pH as a result of:
  - the use of lime;
  - irrigating with alkaline water; or
  - cultivation, land levelling or erosion exposing or bringing more alkaline sub-soil to the surface.
- Changed fallow management practices, with greater use being made of herbicides for weed control. Bare fallows reduce soil VAM populations. Some herbicides may also affect root growth and VAM.
- Finally, zinc has unintentionally been applied as an impurity in phosphorus fertilisers, being derived from the phosphate rock from which they were made. The phosphorus fertilisers used in Australia since the 1980s typically contain a lot less zinc than those used in the past.

Plants suffering from zinc deficiency often show chlorosis in the interveinal areas of the leaf. These areas are pale green to white in colour. In monocotyledons (cereals and grasses), chlorotic bands develop on either side of the midrib of the leaf. Symptoms are usually most marked in the seedling stages, and tend to disappear as the crop matures. In fruit trees, leaf development is affected with unevenly distributed clusters or rosettes of small, stiff leaves being formed at the end of young shoots. Water-logging tends to increase zinc deficiency, e.g. in paddy rice where zinc deficiency is often accompanied by visible symptoms of iron toxicity.

ZINC FERTILISATION

Zinc can be applied to the soil or as a foliar spray.

When applied to the soil, it is usually applied in combination with other nutrients.

In pasture, zinc is normally applied with Superphosphate, e.g. SuPerfect Zn 1%, the zinc being applied at a rate that will remain effective for about five years before a repeat application has to be made.

In crops, zinc can be applied pre-plant while land is being fallowed, and then incorporated into the soil, at a rate that will remain effective for several years.

More commonly, though, it will be applied annually at a lower rate with the planting fertiliser whenever a crop is being planted or sown. Granulock Z, a zinc enriched ammonium phosphate fertiliser containing 1% Zn, is manufactured with this in mind. Granulock Z is used in grain, cotton and forage crops. As each fertiliser granule in Granulock Z contains some zinc, the spatial distribution of zinc in the crop row is far better than in blends in which more concentrated zinc fertilisers are used as blend ingredients. This is particularly important in winter cereals planted at narrow row spacings. In crops such as wheat and barley, the use of concentrated zinc additives in blends will not provide enough point sources of zinc in the crop row to ensure every plant has access to the applied zinc.

More concentrated zinc fertilisers, i.e. Granulock Big Z (10% Zn) or Zinc Sulfate Monohydrate (33% Zn), may be used as a source of zinc in blends for crops planted at wide row spacings, and in perennial crops.

In tree, plantation and vine crops, fertilisers containing zinc should be applied in a broad band along the canopy edge, where the roots are most active. Considerable flexibility exists in how frequently zinc is applied. It can be applied each time fertiliser is applied, annually, or on a less frequent basis, the rate being adjusted accordingly.

In sugarcane, Zinc Sulfate Monohydrate is used in planting mixtures at a rate that will last the entire crop cycle (plant crop plus ratoons).

Foliar sprays of Zinc Sulfate Heptahydrate (22% Zn) can be used to compliment or as an alternative to soil applications of zinc in annual and perennial crops (but not pasture or sugarcane).

In annual crops, zinc sprays should be applied early in the growing season. In grain crops, two sprays of zinc sulfate heptahydrate at 1 kg/ha are recommended at 3 and 5 weeks after emergence.

Where a deficiency is identified in tree, plantation and vine crops, foliar sprays provide the quickest response. They can also be used on a routine basis in these crops. Foliar sprays of zinc should be applied to new flushes of growth, e.g. in the spring. More than one spray may be required. Late season sprays approaching harvest are usually ineffective.

Chelates may also be used for soil and foliar application. Chelated trace elements are less subject to fixation in the soil than is sulfate, but are more costly.

Zinc products are also available that may be coated onto fertiliser granules.

Where zinc-based fungicides such as Zineb and Mancozeb (Dithane M45) are used in horticultural crops, there may be no need to apply additional zinc to the soil and/or foliage (depending on the severity of any deficiency).