FACT SHEET

March 2022

ZINC

ZINC IN SOILS

The total quantity of zinc available is higher in clay soils and lower in sandy soils. However, it's availability for plant uptake is greater in acid soils and less in alkaline soils (pH>7). Availability reduces by 100-fold for each unit increase in 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 plant 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 has been placed. Crop uptake is therefore reliant on plant roots growing to/intercepting the applied zinc rather than zinc moving 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:

- Restrictions to root growth or that reduces the rate that zinc diffusions towards crop roots may induce zinc deficiency. This includes soil compaction, high water tables, residual herbicide products, 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 roots of most crops (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, continually cultivated or non-host crops are grown, VAM populations will decline, increasing the likelihood that zinc responses will occur. 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

Zinc is the most common trace element deficiency in Australian non-leguminous crops and only exceeded by molybdenum deficiency in legume-based pastures.

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

- Increased nutrient demand of higher yielding crop.

- Declining soil fertility which is a result of nutrient depletion or development of less fertile soils.
- Reduced zinc availability due to a decline in of soil organic matter or elevation of soil pH levels:
    - Correction of lower soil pH with lime.
    - Irrigation with alkaline water.
    - Cultivation, land levelling or erosion exposing or bringing more alkaline sub-soil to the surface.
- Improved fallow management practices with greater dependance on residual herbicides for weed control. Bare fallows reduce soil VAM populations, while some herbicides may also affect root growth and VAM.
- Lower unintentional application of zinc as an impurity in superphosphate fertilisers. The phosphorus fertilisers used in Australia since the 1980s typically contain lower amounts of 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. Waterlogging tends to increase zinc deficiency e.g., flood irrigated cotton on vertosols where zinc deficiency is often accompanied by visible symptoms of iron deficiency.

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%, at a rate that it will remain effective for five years before a repeat application is necessary. In crops, zinc can be applied pre-plant during the fallow and incorporated into the soil by cultivation at a rate that will remain effective for several years.

With a shift to minimum tillage, zinc will be applied annually at lower rates during the seeding operation with the starter fertilisers. Granulock Z which is a zinc enriched ammonium phosphate fertiliser containing 1% Zn was developed for this purpose. Granulock Z is used in grain, cotton and forage crops. As each fertiliser granule in Granulock Z contains zinc, the spatial distribution of zinc in the crop row is far better than blended fertilisers which utilise concentrated zinc fertilisers 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 adequate zinc.

More concentrated zinc fertilisers i.e., Granulock Big Z (Zn 10%) or Zinc Sulfate Monohydrate (Zn 33%), 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 with each annual fertiliser application or on a less frequent basis, with 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 (Zn 22%) 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, 2-3 sprays of zinc sulfate heptahydrate at 1 kg/ha are recommended at 3, 5 and 10 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 other zinc products but have a higher price point.

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

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).

WARNING

This information is for use as a guide only. The use of fertilisers is not the only factor involved in producing a top yielding crop or pasture. Local soil, climatic and other conditions should also be taken into account as these could affect crop or pasture responses to applied fertiliser.

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