

FERTFACTS

ZINC FACT SHEET

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, the growth of 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 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 may be applied to the soil or in foliar sprays.

Soil application rates for zinc are variable and are influenced by such factors as soil type (texture, pH), the crop or pasture being grown, and the frequency of application. As zinc is immobile in the soil and not readily leached, soil applications can remain effective for several years provided fixation in the soil is not excessive. Higher application rates are required on clays than on sands to account for the higher fixation rates.

In pastures, zinc is broadcast at intervals of about 5 years, deficiency occurring most commonly on sandy soils. Zinc fortified grades of single superphosphate, e.g. **SuPerfect Zn 1%**, are available in southern Australia to apply zinc to pasture.

In annual crops, zinc can be applied pre-plant at a rate that will remain effective for up to 5 years. The zinc should be drilled into the soil, or if spread or sprayed on the soil surface, incorporated afterwards. Incorporation is necessary as zinc is immobile and will not be accessible by crop roots if left on the soil surface.

Zinc can also be applied at lower rates each time an annual crop is planted. Incitec Pivot manufactures **Granulock Supreme Z**, a zinc fortified MAP fertiliser, at its Phosphate Hill facility in North West Qld for this purpose. It is popular in grain crops and cotton. Granulock Supreme Z provides a more even distribution of zinc in the crop row, particularly in crops such as wheat and barley that are planted at narrow row spacings, than can be achieved with blends. The latter may not provide enough point sources of zinc in the crop row to ensure every plant has access to the applied zinc.

Zinc blends are more suited to crops planted at wider row spacings, and are used in vegetables, vines, tree crops, plantation crops (bananas) and sugarcane.

In sugarcane, zinc is best applied in the drill with the planting fertiliser, at a high enough rate to last a crop cycle (plant plus ratoons).

In tree, plantation and vine crops, zinc is 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 addition to zinc enriched fertilisers such as SuPerfect Zn 1%, Granulock Supreme Z and blends, Incitec Pivot Fertilisers markets two straight zinc sulphate fertilisers. These are:

- **Zinc Sulphate Monohydrate** is granulated fertiliser for dry application to the soil, on its own or in blends.
- **Liquifert Zinc (zinc sulphate heptahydrate)** is applied in solution (dissolved in water), either sprayed on the soil through a boom-spray, or to plant foliage as a foliar spray.

Foliar sprays can be used to compliment or as an alternative to soil applications of zinc. 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.

Yield will be foregone if deficiency is allowed to develop in annual crops before spraying. Where soil zinc levels are low and deficiency is anticipated, preventative sprays should be applied from soon after emergence.

Zinc chelate can be applied in solution, either to the soil or as a foliar spray. The chelate forms are less subject to fixation in the soil than is sulphate, but are much more costly.

Where zinc-based fungicides such as zineb and mancozeb are used, there may be no need to apply additional zinc to the soil and/or foliage (depending on the severity of any deficiency).

FURTHER READING

For further information, a copy of the Incitec Pivot Agritopic on "Zinc" is available if more detailed information is required. These can be obtained from your Incitec Pivot Fertiliser distributor.

COPYRIGHT

Copyright, 2010 - All rights reserved.

Copying or reproduction in whole, or in part, by any means, or transmission, or translocation into a machine language without the written permission of Incitec Pivot Limited, is strictly prohibited.

Incitec Pivot Limited 70 Southbank Bvd, Melbourne 3006
ABN 42 004 080 264 Freecall 1800 333 197 www.incitecpivot.com.au