MICRONUTRIENTS

FACT SHEET

Our experience in the past years both from a soil and a tissue analysis view, have shown that the most commonly deficient micronutrients are Zinc and Manganese, followed by Boron. The most common by far is Zinc, second Manganese with Boron more specific to specialty crops and Boron sensitive crops.

Zinc requirements by a plant are quite complex and act as either a major metal component of an enzyme or as a functional, structural or regulatory cofactor of a large number of enzymes.

One major role of Zinc in the plant is in the production of IAA (Indoleacetic Acid Synthesis). This auxin promotes leaf area and bud growth in plants. Zinc deficient plants will exhibit small inefficient leaves.

Other nutrients such as P, and soil conditions can greatly effect the uptake of Zinc by plants, therefore the placement of Zinc in certain cropping systems becomes very important. An example of this is in cool, wet, heavy soils in the spring even with good soil zinc levels, highly sensitive crops may not be able to pick up the required zinc without further application in the seed band.

Manganese is absorbed by the root system primarily as Mn^{2+}, however it can be found in soil in three different forms, Mn^{2+}, Mn^{3+}, Mn^{4+}. The $Mn4^{+}$ form is highly stable and a very inert oxide. This form is usually associated with pH value of 8 or greater. The Mn^{3+} form is less stable and favours a soil pH near the neutral range. The Mn^{2+} form that is taken up by the root favours acid soil conditions.

High organic soils or soils that have had a lot of cereal straws incorporated can tie up Mn. Bacteria from that break down organic matter, particularly cereal straw require Mn to function and can tie up soil Mn rendering it unavailable to plants. In spring where high straw residues have been plowed down even a soil with optimum Mn levels, Mn may still be unavailable for a period of time when the small seed is germinating or during seedling growth. Later when the bacteria die off and release the Mn back to the soil Mn will again be available to the plant and this temporary Mn deficiency often times goes undetected. In some seasons when this Mn ties up, it can cause poor or slow germination and rhizoctonia will be a problem. In some cases due to this cereal straws plowed down have been associated with rhizoctonia problems.

Mn levels in a soil less than 33 ppm can cause Mn deficiency or hidden hunger symptoms in highly Mn sensitive crops. Since Mn is much more unstable than most micronutrients in soils the most efficient method of treatment is foliar. However building soil levels to optimum levels still falls under Best Management Practices and will ensure a more reliable supply throughout the season rather than depending on foliars completely. A foliar program should be used as a supplemental treatment particularly in extreme Mn deficient soils or highly sensitive crops.

Our findings and field trials show that an application of 15 pounds per acre of Mn broadcast (40 pounds of 36% Mn) for 3 years will raise soil Mn levels to optimum levels in most cases. This however doesn't show an economical return in all crops in the cropping years of application, but it does pay on a long term basis as this poor field will be brought back to top production once these levels have been reached.

In very deficient soils the soil amendment should be supplemented with a foliar shortly after emergence, to ensure available Mn to that crop. Once optimum Mn levels are achieved we seldom see the need for additional Mn application, however this should be monitored through soil and tissue test.

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Boron nutrition is very complex in a plant. Although required in very small amounts soil applications are critical. B does not move by phloem therefore if applied foliar it may not reach the fruit and roots where it is required.

Application of Boron is best applied broadcast to the soil and worked in. Boron is very water-soluble and can be leached easily in course soils. Band application of Boron is not advisable because of its toxicity and difficulty in blending such a small amount of material evenly.

PLACEMENT OF MICRONUTRIENTS

Granulated micronutrients are available in a number of forms with varying degrees of solubility in soils.

True oxides are very stable and when applied to soils will require a period of time before they breakdown and become available to crops. This oxide form if granulated properly from fine oxide product, can be used effectively to build micronutrient levels or reserves in a field where levels are low.

Sulfates are very soluble, and available to crops. These materials when applied broadcast or band applied are readily available for crop uptake and would be the best choice when designing a planter mix for cold soil application.

Oxy Sulfates are materials that can be a good soluble source for immediate availability along with a good source of a more long lasting supply of the nutrient for long term availability. Usually a 70/30 split sulfate to oxide works best.

QUALITY CONTROL

To ensure that your product is doing the job for you and your customer you must first choose the product for the job. Broadcast for soil building or band placement for immediate availability.

Most products require that they meet only a total minimum guarantee, which indicates the amount of micronutrient contained as a percentage in the material. This does not give you the relative availability of the micronutrient. This will however give you a good representation of what is required to meet blend guarantees when blending the product.

When selecting a material that you will be using predominantly in a band application or planter mix, solubility becomes most important. The solubility of a material will give you an indication of the amount of nutrient that will be available for plant uptake quickly, which is usually what you want in planter mixes.

A planter mix should be used as a plant starter not a complete feed, therefore the nutrients placed in the starters should be very soluble and available to the young germinating seedlings.

Levels of micro's used and proportions used of other nutrients are important when availability is critical. Too much soluble P will induce Zinc and Mn deficiency. High pH planter mixes will also induce nutrient deficiency in many soils and soil conditions. Therefore when using Micro's in a band when quick availability is required the proper balance of all nutrients and types of products used in the planter mix is critical for optimum effect and utilization of inputs.

The water-soluble test we perform at A & L is an AOAC method but not a method recognized by the federal government used today. When selecting a micronutrient product from a supplier we suggest that you perform both a total nutrient and a soluble so that you can choose which source of micro is best suited to the method of placement you will recommend.

CONTAMINANTS IN FERTILIZERS

The Federal Government in Cooperation with the MOEE is looking at contaminant materials that fertilizers contain. The biggest concerns are heavy metals. At the present time the only restrictions are as follows (see attached). These levels however are under review and may change in the near future. It is a good idea to know what these levels are.

THE ROLE OF Zn, Mn, and BORON IN PLANTS

ZINC

Needed for synthesis of auxins and protein

Essential for uniform maturity and seed formation.

Aids in chloroplast formation and internodal and cell elongation.

Enzyme activator

Increase leaf size, fruit size and quality.

Important for Calcium translocation in plant tissue.

MANGANESE

Acts as a coenzyme, important in oxidation-reduction reactions.

Aids in nitrogen utilization and assimilation.

Assimilates CO_2 in Photosynthesis.

Essential for phosphorus and magnesium uptake.

Aids in chlorophyll synthesis.

BORON

Aids in translocation of calcium, sugars and growth regulators.

Essential for reproduction aids in formation of pollen tube.

Required for protein synthesis.

Important for early growth, flowering, and fruit set.

Maintains balance between sugar and starch.

Helps regulate auxin.

Necessary for cell division and differentiation, shoot and root tip development.

Aids in terminal bud growth and blossom retention.

Aids in fruit formation and quality.