Nutri-Facts

Agronomic information on nutrients for crops

It's Understood – Chloride, Molybdenum, Cobalt and Vanadium Are Required by Plants

Chloride
It's Understood — Plants Need Chloride

Until recently, chloride (Cl) was thought to be unimportant as a plant nutrient. We now know Cl increases crop yields by correcting deficiencies and by suppressing many disease organisms.

Chloride is involved in energy reactions in plants, specifically the chemical breakdown of water in the presence of sunlight. It activates several enzymes and is involved in transporting cations such as potassium (K), calcium (Ca) and magnesium (Mg) within the plant. It helps to control water loss and plant moisture stress.

Research has shown that Cl diminishes the effects of fungal root diseases such as take-all and common root rot on small grains. It also helps suppress infections of small grain fungal leaf and head diseases and lowers the incidence of stalk rot in corn.

The micronutrients described here - Cl, Mo, V and Co - are not as well known as others. However, improved understanding of their roles in plants can increase productivity.

Chloride in the Soil

Chloride is not held by soil organic matter or clays. It is easily leached and is one of the first elements removed from minerals by weathering processes. That's why most of the world's Cl is found in oceans and seas. Chloride does not produce chlorine and has no detrimental effects on soil organisms.

Chloride and Crop Production

Although soil fertility levels needed for optimum crop growth are not well defined for Cl, about 60 pounds per acre of Cl per surface 2 feet of soil seems to be adequate for small grains. The most practical fertilizer source is potassium chloride (KCl), which contains about 47 percent Cl.

Chloride can be broadcast preplant, applied at seeding or topdressed in late winter with nitrogen (N). Due to potential salt injury, care should be taken in the amount of Cl placed directly with the seed.

Higher rates can be applied preplant or topdress. Research has shown that there is no significant difference in timing effects. However, heavy winter rains can reduce carryover of Cl in sandy soils. Since Cl is highly mobile in the soil, it should be managed accordingly. **Table 1** shows wheat response to Cl.

Table 1. Wheat responds to Cl. (Kansas)

Chloride rate, lb/A	Wheat yield, bu/A Year 1	Year 2	Year 3	Year 4 *
0	37	55	62	77
30	45	61	66	—
60	—	61	69	80
Soil test Cl	—	low	low	med-high

* Average of six varieties

Chloride can have negative effects on some crops...tobacco, some soybean varieties, potatoes and certain tree crops. Effects differ by variety or root stock and intended crop use.

Molybdenum
It's Understood — Molybdenum Is Required by Plants

Molybdenum (Mo) is an essential plant nutrient. Only a few ounces of Mo per acre can correct yield-limiting deficiencies.

Molybdenum is needed by the plant in the synthesis and activation of nitrate reductase, an enzyme which reduces nitrate to ammonium in the plant. It is also required for the symbiotic fixation of N by bacteria living in legume root nodules. Molybdenum is necessary for the conversion of inorganic phosphorus (P) to organic forms in the plant. Molybdenum deficiency symptoms show as a general yellowing and stunting of the plant. A deficiency can trigger N deficiency symptoms in legumes because legumes must have Mo to fix N from the air.

Molybdenum in the Soil

Unlike the other micronutrients, Mo availability in the soil increases with higher soil pHs. **Figure 1** shows the relationship.

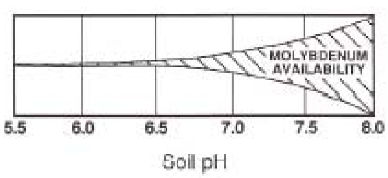

Figure 1. Soil pH affects Mo availability.

Sandy soils are more likely to be deficient in Mo than finer-textured soils. Heavy P fertilization increases Mo uptake by plants from the soil, while sulfur (S) fertilization reduces Mo uptake and can induce a Mo deficiency.

Correcting Molybdenum Deficiencies

Because of the relationship between soil pH and Mo availability, liming acid soil often corrects Mo deficiencies, as shown in **Table 2.** This is possible, however, only when the soil contains sufficient Mo to meet crop needs.

Table 2. Soybean response to Mo at various soil pH levels.

	Soybean yield, bu/A	
Soil pH	With Mo	Without Mo
5.6	41	32
6.0	40	35
6.4	41	42

Tennessee

Molybdenum-containing fertilizers can be mixed with NPK fertilizers, applied as foliar sprays or used as a seed treatment. Seed treatment is probably the most common method of correcting a Mo deficiency because of the very small amounts of the nutrient that are required.

Vanadium

Although it is relatively obscure, vanadium (V) has been shown to have a role in plant nutrition. Foliar application to cotton has increased lint cotton yields, both dryland and irrigated, by 50 pounds per acre without increasing the crop's water requirements. Vanadium also increased cotton grade.

Best results have been obtained when applications were made in early morning while temperatures were cool. A one-time application, about two weeks prior to square initiation to early bloom, has given best results. Optimum application rate was 0.05 pounds per acre.

Cobalt

Although cobalt (Co) has not been proven essential for higher plant growth, nodulating bacteria need it for fixing atmospheric N in legumes.

While these micronutrients don't receive the attention given to major nutrients, they are important— it's understood. ■

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Item #09-0012
Reference #97093