

## NICKEL, COBALT AND MOLYBDENUM: SMALL AMOUNTS HAVE BIG EFFECTS ON NITROGEN

BY KYLE LILLY, CERTIFIED CROP ADVISER AND SENIOR PRODUCT MANAGER, COMPASS MINERALS PLANT NUTRITION

Maintaining adequate levels of nitrogen (N) in the soil is something most growers have on their minds during the growing season. Many find that more than half of the N added to their cropland is lost to the environment, providing a poor return on investment. As the industry has become more aware of nitrogen inefficiencies and continues to explore established tools to improve N function — from split applications, controlled release fertilizers and N stabilizer technologies — advancements are on the horizon.

One new option that has shown great promise in improving nitrogen function is the use of micronutrients as physiological tools. Like a baker using yeast to make bread rise, growers are using micronutrients to improve N use in the plant.

### NICKEL

Nickel (Ni) is an essential plant micronutrient that does not get much attention. A plant's Ni requirement is the lowest of all essential elements, but it is required for the conversion of urea-N into plant-available ammonia-N. Without Ni, toxic levels of urea accumulate, leading to necrosis initiating on the tip of the leaf (Figure 1).



Figure 1. Severe leaflet tip necrosis due to nickel deficiency in nitrogen-fixing plants. Credit: Dr. Patrick Brown, University of California, Davis (Source: <http://edis.ifas.ufl.edu/hs1191>)

### COBALT

Cobalt (Co) has been proven to be a beneficial nutrient, but it is not considered essential for all plants. Before ruling Co out, however, it's important to remember that this nutrient is necessary for N fixation in legumes. There is still much to be learned about the role of Co in plant nutrition, but some observed benefits include extended leaf and nodule life, which reduces stress, allowing plants to continue to build yield.

## MOLYBDENUM

Molybdenum (Mo) may be difficult to pronounce, but it also plays an important role in nitrogen metabolism because it acts as a key to unlocking unusable N and making it available to the plant. In non-legumes, Mo helps regulate the conversion of nitrate into proteins. In legumes, N fixation is critical for productive plants, and Mo is needed by the root nodule bacteria for proper N fixation. For example, a 60-bushel-per-acre soybean crop will take up 315 pounds per acre of N, mostly from the atmosphere. N fixation can be improved by ensuring the soil has adequate Mo levels.

When looking for Mo deficiency, it's easy to mistake it as a nitrogen deficiency. Figure 2 shows Mo deficiency in soybeans that don't have enough of the nutrient for proper N uptake to facilitate the conversion process.



Figure 2. Soybeans showing Mo deficiency in the foreground. (Source:[http://www.ipni.net/publication/nutrifacts-na.nsf/0/71D0B217A35EEF1E85257D9600742FC6/\\$FILE/NutriFacts-NA-13.pdf](http://www.ipni.net/publication/nutrifacts-na.nsf/0/71D0B217A35EEF1E85257D9600742FC6/$FILE/NutriFacts-NA-13.pdf))

Kyle Lilly's agronomic expertise working in specialty fertilizer has played a pivotal role in developing and implementing products within the Compass Minerals Plant Nutrition portfolio. Lilly received his master's degree in soil science from the University of Wyoming and his bachelor's degree in chemistry from Luther College. He is a certified crop adviser and certified professional soil scientist.



## NI, CO AND MO NUTRITION TO IMPROVE LEGUME NITROGEN FUNCTION AND CROP GROWTH

Foliar fertilizers are used extensively to correct or prevent nutrient deficiencies. Compass Minerals Plant Nutrition conducted research that found foliar applications of Ni, Co and Mo improved soybean yield by maintaining N supply throughout the crop cycle. ProAcqua® Pulse Ni (0-6-4, 1% Mg, 0.5% Co, 10% Mo, 1.5% Ni, 6% Zn) was applied at 4 to 8 ounces per acre between V3 and R3 on soybeans at five different locations over two years. The total yield increase average was 7.3 percent.

The presence of Ni, Co and Mo in ProAcqua Pulse Ni is designed to extend the life of nodules in nitrogen-fixing crops by delaying ethylene production. Crops produce ethylene when under stress. This is especially common in late vegetative to flowering growth-cycle stages when soil moisture levels are less than ideal. A foliar application of Ni, Co and Mo may help reduce crop stress and improve N efficiency, resulting in higher yields. In the future, micronutrients may be another established tool to improve N function.