MICRONUTRIENT FERTILITY FOR SOYBEANS

Micronutrients are essential elements that are used in small quantities [< 1 lb./acre] by plants to conduct critical metabolic processes. If a necessary micronutrient is limited or unavailable, plant abnormalities, reduced growth, and lower yield will result.

Micronutrients used by plants include boron [B], chlorine [Cl], copper [Cu], iron [Fe], manganese [Mn], molybdenum [Mo], and zinc [Zn]. The amount of these micronutrients is usually sufficient in most soils to meet crop needs.

Most micronutrients are weakly mobile or immobile in plants. Thus, deficiency symptoms will usually appear most severely in the newest plant tissues–e.g. the newest soybean trifoliate.

Soil and plant analysis are both useful for determining levels of micronutrients in soil and plant tissue, respectively. However, soil tests for them are not as precise as those for pH, phosphorus [P], and potassium [K].

Plant tissue analysis can reliably determine the level of most micronutrients in the sampled plant part, and the results can aid in diagnosing a visual problem. Regrettably, once a micronutrient deficiency is detected, the plant has already suffered irreversible yield loss. Thus, results from these analyses can only be used to prevent such deficiencies in a future crop.

Deficiency of micronutrients in soybean production systems is an oft-discussed topic. However, this topic does not receive the attention accorded to deficiencies of the macronutrients Nitrogen [N], P, K and sulfur [S], probably because there is not a wealth of evidence showing that micronutrient deficiencies are soybean yield limiters in the manner of the macronutrients.

In an article titled "Soybean response to broadcast application of boron, chlorine, manganese, and zinc", authors Sutradhar, Kaiser, and Behnken present results from a four-year study conducted on 35 sites in Minnesota to evaluate soybean response to broadcast applications of boron [B], chlorine [Cl], manganese [Mn], and zinc [Zn]. The objectives of the study were to determine how applications of these micronutrients affected soybean tissue nutrient concentration and grain yield, and the relationships between soil and plant tissue tests.

In the studies, soil samples were collected from the 0 to 6-in. depth and analyzed appropriately for P, K, B, Cl, Mn, and Zn. The newest fully developed soybean trifoliate leaf with petiole was sampled for tissue nutrient analysis when soybean was at the R1 [beginning flower] growth stage. Concentrations of B, Cl, Mn, and Zn in the tissue samples were determined with appropriate analysis procedures.

Findings from this research follow.

- Plant tissue nutrient concentrations indicated that micronutrient levels in soils at the study sites were sufficient for maintaining soybean yield.
- Concentrations of micronutrients in sampled leaf tissue were all well above defined sufficiency levels, thus indicating that the soil reservoir of each micronutrient was sufficient without additional fertilization.
- Tissue micronutrient concentrations of B, Mn, and Zn were seldom increased by micronutrient fertilization compared to a non-fertilized control.
- There was no significant effect of micronutrient fertilization on soybean seed yield compared to non-fertilized controls.
- The results indicate that a yield response to direct application of micronutrients is unlikely for soybeans.
- Increasing soybean seed yield resulted in greater removal of the tested micronutrients from soil. Thus, a continuing period of above-average yields will result in the removal of micronutrients at a pace that exceeds the

heretofore perceived normal rate.

- Trifoliate B, Mn, and Zn concentrations were not appreciably related to their respective soil test results or to seed yield. Thus, tissue micronutrient concentration should not be used to determine when micronutrient fertilizers should be applied.
- Soil-test B, Cl, and Zn levels were not related to soybean seed yield when each micronutrient was not applied. Thus, soil tests for these minerals will not be a good predictor of deficiency.
- The authors concluded that soybean seed yield may respond to Mn application if soil-test Mn is less than 20 ppm.

Take Home Message

These results may not be totally applicable to Midsouth soils and the Midsouth soybean production environment. However, they do paint a consistent picture of soybean response, or rather lack of response, to micronutrient fertilization when soil levels of these nutrients are determined to be adequate according to accepted soil tests.

With increasing yields from irrigated soybean in the Midsouth, producers likely should become more aware of micronutrient levels in their soils, and be vigilant for micronutrient deficiency symptoms.

- Click here for a White Paper on this website that provides detailed discussion about nutrient management for soybean production.
- Click here for a White Paper on this website that provides a detailed discussion about tissue testing and how it can be used in conjunction with soil test results to determine proper fertilization for high soybean yields.
- Click here for an article from Pioneer titled "Micronutrients for Crop Production" that provides details about availability of micronutrients by soil pH level, their estimated uptake by high-yielding soybeans, and a narrative description of general micronutrient deficiency symptoms.
- Click here for MSU Extension Information Sheet 1038 by Dr. Larry Oldham titled "Micronutrients in Crop Production". This publication provides a concise summary of micronutrient function in plants, their deficiency symptoms, and conditions that may promote their deficiencies in crop plants.

Composed by Larry G. Heatherly, Updated Dec. 2024,
larryheatherly@bellsouth.net