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FERTILIZER RESPONSE IN SOYBEANS

Soybeans remove significant amounts of nutrients per bushel of grain harvested. Nutrient uptake in soybeans early in the season is relatively small. However as they grow and develop, the daily rate of nutrient uptake increases. Soybeans need an adequate nutrient supply at each developmental stage for optimum growth. High-yielding soybeans remove substantial nutrients from the soil. This should be taken into account in an overall nutrient management plan. A 40-bushel-per-acre soybean crop removes approximately 30 pounds of phosphorus and 50 pounds of potassium with the grain. The stover has an additional 10 pounds of phosphorus and 40 pounds of potassium which is either returned to the soil or utilized as feed. Nitrogen is supplied to soybeans mainly by nitrogen fixation, and fertilizer nitrogen application is not recommended if the plants are well nodulated. Soybeans are high in protein which contains lots of nitrogen. The beans remove 130 pounds of nitrogen per acre, and 44 pounds with the stover. Soybeans use all the nitrogen they can fix plus nitrogen from the pool of available nitrogen in the soil. Nitrogen fertilizer application to soybean seldom results in any yield benefit, and efforts should focus on proper inoculation.

Phosphorus applications should be based on a soil test. Phosphorus fertilization is generally very positive in soils testing very low or low (less than 15 ppm Bray p1) for phosphorus. Broadcast applications are generally used, but banding fertilizer at planting is an efficient application method for soybeans. Soybean seeds are easily injured by fertilizer; therefore, no direct seed contact with fertilizer is advised.

Soybean seeds are relatively high in potassium and removal of potassium by soybeans is greater than for other crops on a per-bushel basis when only the grain is removed. As with phosphorus, a soil test is the best index of potassium needs. Soils testing very low or low should be fertilized with potassium, either as a banded starter at planting or broadcast and incorporated. We have very few soils with test levels that require potassium fertilization.

Sulfur is mobile in the soil (leaching is common), but fairly immobile in the plant. High soil test variability along with significant uptake by crops generates the need for proper sulfur management, especially in sandier soils and fields with several different soil types. Deficiency symptoms in soybeans are pale-green to yellow leaf color without prominent veins or necrosis in the youngest leaves. Recent Kansas studies suggest a low probability of soybean response to sulfur application. Iron deficiency symptoms appear in irregularly shaped spots randomly distributed across a field, primarily in fields with a previous history of iron deficiency. Different annual weather patterns can make iron chlorosis more or less prevalent. Iron chlorosis also differs under different soil conditions. In general, high soil pH and high carbonates (free lime) can increase the incidence of iron deficiency.

Zinc, manganese, and boron are other nutrients that can be limiting in soybean. The need for zinc should be determined by soil tests. Zinc fertilizer can be either banded at or broadcast preplant with little difference in response when applied at an adequate rate. Both organic and inorganic zinc sources (chelates and non-chelates) can be used, but chelates are considered more effective than the inorganic sources. Manure applications also are effective at eliminating micronutrient deficiency problems, including iron.

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