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FERTILIZING SOYBEANS

At the Crop Clinic in Lincoln I was interested in Professor Patricio Grassini's work with the question of is soybean yield limited by nitrogen? 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. Soybeans tend to use residual nitrogen in the soil first and then rhizobium bacteria infect the roots and supply nitrogen to the plant. Did you know a well-managed irrigated soybean crop that yields 80 bushels per acre requires about 384 pounds of nitrogen per acre? Soybeans are a high protein crop which requires a lot of nitrogen.

The research revealed no yield response with added nitrogen fertilizer to soybeans in the lower yielding plots (40 bushel yield) but a 13 bushel response in the 90 bushel yield plots. The trouble is the researchers had to use nitrogen rates that are far from being economically profitable and environmentally sound for the 13 bushel response (the high nitrogen rate replicated plots were 300 to 780 pounds of nitrogen per acre). As our soybean yields continue to increase over time, new research will need to be directed at agronomic practices that can break the trade-off between nitrogen fertilizer addition and nitrogen fixation and how to increase nitrogen fixation. Farmers efforts should continue to focus on proper nodulation of the plants.

A 40-bushel-per-acre dryland 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.

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 are rare in our area. 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. It is becoming increasingly competitive to find manure sources because of the positive effect on yield beyond commercial fertilizer.

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