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SOYBEANS AND N FERTILIZER - DO THEY GO TOGETHER?

Soybean is a nutrient dense, high protein seed. Consequently, nutrient requirements of a good soybean crop are rather high. Although numbers can vary, IPNI recently assembled values that indicate that on average one bushel of soybeans contains 3.25 lb N, 0.73 lb P₂O₅, and 1.18 lb K₂O.

A question that sometimes arises is “do soybeans benefit from N fertilization, and if so under what conditions?” To begin to answer this question it is instructive to first consider sources of N for soybean uptake.

Soybeans get their N from three sources: 1) N₂ fixation by Bradyrhizobium, 2) nitrate and ammonium in the soil, and 3) fertilizer N. An evaluation of technical studies done by scientists at the University of Nebraska showed that on average, 50 to 60% of the N in soybeans comes from N₂ fixation. Normally, the remainder comes from the N in the soil. The maximum amount of N₂ that can be fixed was considered by the authors of the review to be 300 lb N/A. When excessive fertilizer N is applied it can substantially reduce N₂ fixation, making N fertilization of soybeans an even more delicate consideration. Typically, seasonal N demand peaks just after growth stage R3 (beginning pod).

Soybeans can be responsive to N fertilizer under certain conditions, whether in high or low yield environments. High yielding environments may have a greater chance of responding to fertilizer N, but at lower yields, there are still several situations the review authors listed where responses to N were more likely. These included poor establishment of the nodule system, extremely low soil N supplies at planting, plant water stress, soil pH problems, low soil temperature, or an absence of native Bradyrhizobium resulting from a cropping history with infrequent or no legumes.

Specific examples of some of these conditions have been reported on in *Better Crops Magazine* >www.ipni.net/bettercrops<.

Lamond and Wesley (2001) evaluated N treatments at four irrigated soybean sites over two years. Nitrogen fertilizer was applied at the R3 growth stage at 0, 20, and 40 lb N/A. Sources were UAN, urea, urea+NBPT and ammonium nitrate. All sites were in corn-soybean rotation and had high P and K levels. Nitrogen fertilizer increased yield in six of the eight site years. Sources of N fertilizer performed similarly, except the highest UAN rate where yield was reduced due to leaf burn. Yield in the control treatment averaged 55 bu/A and ranged from 72 to 35 bu/A. Yields with N fertilizer averaged about 62 bu/A—11% (7 bu) over the control average. There was no advantage to applying over 20 lb N/A. The authors ultimately stated that “Results suggest that soybeans with high yield potential (greater than 55 bu/A) may not be able to supply enough N during peak demand via atmospheric N (N₂) fixation.”

Mengel et al. (2012) reported soybean yield response to N under much different conditions. In 2009 and 2010 fields were planted into “virgin” ground with no history of soybean production. Both sites were rainfed, thus average yield potential was considerably lower than expected under irrigated conditions. Observations indicated that plants were poorly nodulated, even though seed was commercially inoculated. Nitrogen was applied to each field during the growing season (R1 to R2) in 30 lb increments up to 150 lb N/A. The two site years of this study showed that N fertilization increased yields where nodulation was less than ideal. Applying just 30 lb N/A on average increased yield from 23 bu to 30 bu/A.

Nitrogen fertilization of soybeans requires careful evaluation of conditions, and even then carries some financial risk. Nevertheless, it can sometimes be beneficial and should be considered where appropriate. Review of publications, and consultation with CCAs and extension specialists can help in determining whether N and soybeans go together in your field.

– WMS –

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Abbreviations: N = nitrogen; P = phosphorus; K = potassium.