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## THE SCIENCE BEHIND THE NITROGEN CREDIT FOR SOYBEANS

**“Take a N credit for corn following soybean.”** This statement, or something like it, is common to most N recommendations for corn. The idea is that after a soybean crop, corn doesn’t need as much fertilizer N. The common perception is that because soybean is a legume, it adds to the overall N supply in the soil. Let’s take a closer look at what is going on with this credit.

**The credit itself amounts to a reduction in fertilizer N ranging somewhere between 20 and 60 lb N/A, depending on the recommendation system.** It can even be more in some cases. Some universities recommend a flat rate reduction, while others vary the credit based on soybean yield. Still others use a combination of the two. Common to all of them is that the credit is based on a comparison to a continuous corn system, which typically takes more N to grow a corn crop to the same yield level.

**So does corn following soybean use less N or should we really think of it as the continuous corn crop needing more N?** It all depends on which one is used as the basis of comparison. A continuous corn crop has more residue that is higher in C. Soil N can be immobilized for a time by soil microorganisms as they utilize the C in this residue, reducing the N available in the soil. Adding the additional 20 to 60 lb N/A makes up for the immobilized N and may also speed the organic matter mineralization process.

**Contrary to common perception, levels of nitrate in the soil are often lower after a soybean crop than they are after a corn crop.** Soybeans get their N either from the nitrate already present in the soil or from the N fixed by the bacteria present in the nodules. The more nitrate present in the soil, the less comes from the nodules. Consequently, soybeans actually deplete, rather than increase, soil nitrate levels.

**So where does the “extra” N come from following a soybean crop?** It is currently thought that exudates from soybean roots, as well as the roots themselves, increase a pool of organic N that is easily mineralizable. In the Midwest and Northern Corn Belt, this N becomes available early enough in the season that it reduces the fertilizer N needed, leading to the credit. However, in the warmer, more humid southeast U.S., this N can be mineralized too early in the season, resulting in no credit. In fact, many states in the southeast U.S. do not have a soybean credit.

**The soybean credit therefore appears to have more to do with the soybean root system than with the above-ground stem, leaf, and pod residue left after harvest.** Consequently, a late season disaster like hail damage wouldn’t be expected to reduce the N credit much if the crop was near maturity when it happened. In fact, it likely increases the credit since the high N soybean seed is left in the field and will quickly mineralize once contact with the soil occurs. The magnitude of this credit will be influenced by the duration of warm soil temperatures and the amount of precipitation received afterward in the fall and subsequently in the spring.

**The N credit is more than a number. Although it is a simple part of recommendations, it actually reflects a complex set of reactions in soils.** Having a better understanding of the science behind the credit can help advisers make adjustments under changing conditions.

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Abbreviations: N = nitrogen, C= carbon.