UNHARVESTED OR HAILED-OUT SOYBEAN FIELDS – NUTRIENT SUPPLY TO CORN?

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Flooded fields and wet soil conditions in the fall 2018 meant some soybean fields were not, or are not going to be harvested. Also, some fields occasionally experience significant shattering or a hailstorm in the fall where soybean seed is knocked from the plants and thus not harvested. Although the grain is not harvested, nitrogen (N), phosphorus (P), and potassium (K) nutrients returned to the soil in the soybean grain can be accounted for when planning nutrient applications for the next crop. Other nutrients will also be returned, but most not a fertilization need in most Iowa soils. An estimate of soybean bushels per acre lost is needed to approximate nutrient return to the soil.

For P and K, the calculation is straightforward. Either multiply the estimated yield lost times the bushel equivalent content for P_2O_5 and K_2O (for soybean, 0.72 lb P_2O_5/bu and 1.20 lb K_2O/bu at 13.0% grain moisture content), or if the loss was significant or the crop not harvested, simply assume fertilizer or manure P and K applied before planting were never removed from the soil. With both approaches, P and K returned to the soil in soybean grain will be available for future crop use. Because the soybean residue was not affected, there would be no difference from a normal harvest.

It is expected that the usual "soybean rotation N effect" for the soybean–corn crop rotation will not change. That is, the MRTN rate provided by the Corn Nitrogen Rate Calculator (http://cnrc.agron.iastate.edu/) for corn following soybean will be an appropriate initial starting point for an application rate. However, an estimate is needed of the additional N that will be supplied by the soybean seed, which will be a deduction from the MRTN rate. At harvest, 63% of aboveground soybean plant N is contained in the soybean seed. The soybean seed N content (protein) varies, but 3.1 lb N/bu is a reasonable value. For example, a soybean seed yield of 60 bu/acre would contain approximately 186 lb N/acre.

In essence, think of the soybean grain lost to the soil as fertilization with an organic N form. Therefore, an estimate is also needed in regard to conversion of the seed N to crop-available inorganic N (ammonium and nitrate). Not all of the seed N will be available the first year. Although it is not known exactly what the availability will be, a study of corn N response in fields with hailed-out soybean seed provides some guidance. In a study in 2002-2003 where soybean seed was hailed out at harvest time in the fall 2002 (estimated 35-45 bu/acre soybean grain yield on the ground), the next-year corn crop had an economic optimum N rate at 50 lb N/acre compared to 120 lb N/acre where the soybean crop had been harvested (corn yield approximately 220 bu/acre). That fertilizer N application requirement indicates a first-year N availability of approximately (at least) 60%. The Late-Spring Soil Nitrate Test (LSNT) test values were higher where the soybean seed was hailed out, but not up to the critical test level. These study results show that N will become crop-available from soybean seed. Soil sampling in corn for the LSNT, or crop N stress sensing, can help confirm the corn N fertilization need. The LSNT results may be lower than expected due to seed N mineralization later in the season after sampling. Creating an "N-rich" or "non-limiting" N reference strip or multiple non-limiting small areas can provide a comparison N response.

In high yield-loss situations, it is possible that the rotation and soybean seed could supply all or nearly all of a corn crop N need. In those instances, a suggested management practice would be to still apply a small amount of N (15-30 lb N/acre as starter or weed-and-feed) before or at planting to offset any early-season delay in N availability or lower than expected N supply from the soybean seed.

If the soybean seed germinated in the fall, it is unlikely there would be an impact on mineralization of N from the seed, but if there is any impact, it would increase the decomposition of the organic seed materials and enhance N release. It is unlikely that N will volatilize from the decomposing soybean seed, nor would tillage be needed to speed decomposition for seed on the ground (but could for grain on standing plants). Given erosion concerns related to tilling soybean stubble, it would be better to leave the fields alone until planting time in tilled systems. No-till systems will be more variable in N supply, and seed on standing plants will decompose differently (likely more slowly) than those on or in the soil.