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Phosphorus and Potassium in Silage Harvest of Drought-Damaged Corn

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Phosphorus and Potassium in Silage Harvest of Drought-Damaged Corn

Abstract
Dry conditions in some areas of Iowa this summer are resulting in quite variable corn growth and production potential. Some livestock producers are considering harvest of corn damaged by drought conditions for silage. Corn silage harvest results in more phosphorus (P) and potassium (K) removal than grain alone because almost the entire plant is harvested. The increased amount removed with silage differs for P and K because the relative amount of P and K is different in corn vegetative parts than in grain. For P there can be approximately four times more P per ton of dry matter in grain than vegetative parts, but for K the opposite occurs, with almost three times more K per ton of dry matter than in the vegetative parts.

Disciplines
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Extension and Outreach

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Phosphorus and Potassium in Silage Harvest of Drought-Damaged Corn

July 21, 2017

Dry conditions in some areas of Iowa this summer are resulting in quite variable corn growth and production potential. Some livestock producers are considering harvest of corn damaged by drought conditions for silage. Corn silage harvest results in more phosphorus (P) and potassium (K) removal than grain alone because almost the entire plant is harvested. The increased amount removed with silage differs for P and K because the relative amount of P and K is different in corn vegetative parts than in grain. For P there can be approximately four times more P per ton of dry matter in grain than vegetative parts, but for K the opposite occurs, with almost three times more K per ton of dry matter than in the vegetative parts.

The easiest approach for estimating P and K removal with silage harvest is to use existing estimates of the average corn silage removal amounts per unit of yield. The ISU Extension and Outreach publication PM 1688 (A general guide for crop nutrient and limestone recommendations in Iowa), reports values of 3.5 lb P_2O_5/ton and 9.0 lb K_2O/ton (65 percent moisture based). On a dry matter basis, the values are 10 lb P_2O_5/ton and 26 lb K_2O/ton. The total nutrient removal amount per acre will vary according to the amount of silage harvested. These average concentration values could be correct with drought-damaged corn if the plant vegetation and grain are roughly affected in equal proportion.

However, drought conditions complicate estimates of P and K removal with silage harvested early because of largely unpredictable effects on dry matter production and nutrient uptake and accumulation. Depending on moisture availability during the season, there could be relatively more or less dry matter production than nutrient uptake, which would result in lower or higher concentration values, respectively. Data is very limited, however. Results from research in Kansas showed the nitrogen (N), P, and sulfur (S)

concentrations were about the same for normal or drought-stressed corn, but the K concentration increased by about 50 percent.

An additional consideration is the growth stage of the corn when it is harvested. If the corn has not matured normally and is harvested early or dies due to lack of moisture and high temperatures, it may only be at an R1 (silking), R2 (blister), R3 (milk) or R4 (dough) growth stage at the time of silage harvest. In those cases, the full-time period for nutrient uptake has not occurred and, in addition, the dry conditions could further reduce uptake. For each of those stages, and assuming little to no grain production, then the percent of normal full vegetative P and K uptake are for P: R1 50, R2 55, R3 55, R4 55 percent; and for K R1 75, R2 85, R3 85, R4 85 percent (adapted from ISU Extension and Outreach publication PMR 1009, Corn Growth and Development). Therefore, depending on the severity and timing of the dry conditions, the effects on P or K accumulation in the plant could differ greatly. Vegetative P and K concentration normally decrease as grain fill occurs due to translocation to grain, but that will be limited or non-existent in situations with little to no grain. One could multiply the percentage of normal full uptake for the appropriate harvest growth stage by the normal P and K removal values for silage to estimate P_2O_5 and K_2O amount per ton silage when there is little or no grain. For example, if silage is harvested at a R3 growth stage, then an estimated amount per ton silage (dry matter based) would be 10 x 0.55 = 5.5 lb P_2O_5/ton and 26 x 0.85 = 22 lb K_2O/ton.

Because of the great deal of uncertainty, a more accurate estimate of P and K removal can be obtained by collecting and sending silage samples to a laboratory for analysis. The Iowa State University Soil and Plant Analysis Laboratory and private laboratories are equipped to analyze plant tissue for P, K and other nutrients. You need to be sure the sample is representative by making a composite sample from material taken from different silage loads.

No matter the method used to estimate silage P and K concentration, the amount of silage harvested per acre has the greatest impact on nutrient removal. Therefore, it is important to have a good estimate of silage harvested and moisture content. For P and K, even if estimates of removal with silage harvest are off somewhat, soil sampling and testing in the fall can help with longer-term management in drought-affected fields. In extreme cases where no or very limited crop is harvested, then P and K will recycle from plants and be available for the next crop.

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Crops:

Corn Biomass and Forage

Tags: corn silage drought damaged corn phosphorus potassium drought

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