

## Implications of tissue sampling program in Shenandoah Valley corn fields

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In summer of 2013, we tissue sampled over one hundred corn fields in Rockingham and Augusta Counties at around the V6 growth stage, and prior to sidedressing. Thanks to Virginia State Dairyman's Association for funding this work, and to Scarlett Reel, now with VA DCR for taking many of these samples (also thanks to Matt Booher for his thoughtful edits)!

Tissue sampling is useful for identifying micro-nutrient deficiencies, which in soil are present at such low levels, that soil sampling is not very useful. Additionally, tissue testing for sulfur and nitrogen can also pay, since both are soil-mobile *macronutrients* whose presence can fluctuate in soils. Samples were sent to A&L Eastern Lab in Richmond, VA. Of the nutrients sampled, the following nutrients important to corn were found to be less than sufficient in one or more samples: magnesium, zinc, nitrogen, potassium, and boron.

Of these nutrients, magnesium (Mg) was most often found to be deficient (Table 1). As shown in Table 1, of 119 samples collected at V6, 54 (45%) were deficient in Mg. We re-sampled a handful of fields later in the season to see if nutrient accumulations would change. Fifty percent of these fields continued to show Mg deficiency late into the season, while the rest either stayed sufficient or became deficient.

Table 1 - Summary of Tissue Samples taken on Shenandoah Valley Corn Fields in 2013									
Nutrient	N	S	P	K	Mg	Ca	B	Zn	Mn
Normal level	---PERCENT---						--- PPM ---		
	3	0.15	0.25	2	0.2	0.25	3	20	30
# of fields deficient at sidedress time (119 TOTAL SAMPLED)	4	0	1	2	54	0	15	3	5
# of fields sampled twice with early season deficiency (25 TOTAL SAMPLED EARLY AND LATE)	2				16		5	1	
# of fields deficient at tassel	0				8		0	0	

Adjusting Mg deficiency can be accomplished when liming is needed by choosing high mag (dolomitic) lime rather than calcitic lime. Soil acidity should be checked through a routine soil test prior to applying lime. If lime is not needed another Mg source should be found--most fertilizer dealers should be able to offer some sort of inorganic Mg fertilizer. Sul-po-mag for example supplies Mg, sulfur, and potash and straight Mg fertilizer is also readily available.

Zinc is needed in very small amounts, but is still an important nutrient. Mineralization that occurs as organic matter (crop residue or manure) breaks down is an important

source of zinc and other micronutrients. Because this is a bacterially driven process, it may not be released fast enough to meet crop needs under cold soil conditions. In this case a starter fertilizer including zinc may help to prevent zinc deficiency in crops.

Nitrogen (N) and potassium (K) are needed in large amounts, and should be monitored using routine soil tests for potassium, and the pre-sidedress soil nitrate test (PSNT) for N. Since N can be mobile in the soil, the PSNT is useful immediately before sidedressing, to determine N need, just before crop uptake increases exponentially.

Potassium (K) is another nutrient needed in relatively large amounts. Manure supplies some K and there are plenty of K fertilizer products available. Since the environmental loss of potassium is highly unlikely in most Valley soils, it can be applied anytime and is easily met with manure and/or a number of commonly available inorganic fertilizers.

Boron (B) is needed in very small amounts and response to B fertilization in corn is inconsistent as deficiency is rare. B is important in pollination and when truly deficient, plants can have barren stalks or twisted and small ears. If these symptoms are verified as caused by B deficiency, yield reduction has already occurred. Crops such as alfalfa use much more B and soil supply and uptake should be closely monitored. None of the previously reported deficiencies in our study showed deficiency when resampled late in the season. In fact, the concentration increased an average of 7x.

In general, samples revealed that micronutrients were sufficient. Since most of the fields tested have a history of manure use, this is not surprising. Manure, while not always balanced in its macronutrient content, usually contains adequate amounts to meet crop demand. Micronutrients in manure are present as both an immediately available fraction, and as an organically-bound fraction that is released slowly over time. Symptoms consistent with nutrient deficiencies can often be seen in corn fields, but do not necessarily indicate inadequate soil nutrients. Essentially, anything that restricts crop nutrient uptake can result in nutrient deficiency (e.g. drought, cold, root damage). Tissue testing complements soil tests and other information about a field to give us the whole picture about nutrient level and how well they are being used. Maybe the old saying, "don't guess, soil test", should become, "don't guess, soil and tissue test"! Or as one of my esteemed colleagues would say, "When it comes to nutrient uptake don't make assumptions, tissue test your corn and pumpkins."