Corn Cobs, Other Factors Can Affect Soil Quality

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The discussion about using corn residues as an alternative energy source often hinges on the issue of soil quality. We all know that the soil benefits from residue return, but we all suspect (hope) that there might be some level of residue that might be removed without harm to the soil. Research on this question is ongoing, both in Kentucky and other states. Alternatively, the "better safe than sorry" folks have suggested that growers remove, in addition to corn grain, the cobs. All other stover would be returned to the land. A number of harvest strategies for doing this have been proposed, and several of these harvest engineering schemes are under active development. As of yet, however, there is no data on the merits of this practice, relative to any other residue removal practice. However, we can ask the following question: What proportion of corn residue is made up of cobs, and what is the nutrient value of my cobs, left in the field?

To help answer this question, grain, cobs and stover were harvested, separately, in the fall of 2008 from an on-going no-till corn-nitrogen (N) rate experiment on the research farm at Lexington. All three components were analyzed for their N, phosphorus (P) and potassium (K) concentrations. The season was initially cool and wet, but later turned hot and dry, substantially lowering grain yields.

The impact of the dry season is evident in Table 1, where 90 lb N/acre was enough to maximize yield at just over 100 bu/acre. This N rate also maximized dry matter production as grain, cob and stover (5000, 1000 and 5600 lb dry matter/acre, respectively). Grain was about 38 percent of total dry matter at 0 lb N/acre and 43 percent with N fertilization. Cobs were 16 to 17 percent of ear (grain plus cob) dry matter, regardless of N rate. However, as a proportion of all residue dry matter, cobs rose from 12 percent to 15 percent with N fertilization.

Grain N and P concentrations were higher, and K concentrations lower, than those found in the two residue fractions (Table 1). Assuming all crop dry matter would be removed, the grain contained most of the N and P, especially when N fertilized. The stover contained large amounts of N and P, and most of the K. Cob K concentrations were about as high as those found in the stover, but otherwise were generally the lowest of all three fractions. Because the weight of cobs is low, and cob nutrient levels are generally low, the fraction of crop nutrients removed with cob harvest never exceeded 10 percent.

These results are from one year of work, at one location. Nonetheless, this data supports previous observations. Cobs tend to be nutrient poor, especially for N and P. Cob removal leaves substantial amounts of corn stover (stalk and leaf) residues remaining on the land to sustain soil quality. Cob removal will not quickly deplete the soil of nutrients that would have been used by subsequent crops. The economic impact of the nutrient loss depends on the yield, the efficiency of cob recovery, cob nutrient concentrations, and the anticipated replacement prices for those nutrients.

Table 1. Grain yield and grain, cob and stover dry matter, nutrient concentrations and nutrient removal at three rates of fertilizer N for no-till corn in 2008. Δ

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Table 1. Grain yield and grain, cob and stover dry matter, nutrient concentrations and nutrient removal at three rates of fertilizer N for no-till corn in 2008.

N Rate	yield	dry matter produced	nutrient concentrations			nutrient removal			nutrient removal		
			N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
lb N/A	bu/A	lb/A	lb/ton dry matter			lb/A			fraction of total (%)		
			grain								
0	58	2740	18.7	13.0	7.8	25.6	17.8	10.7	61.8	40.0	12.3
90	104	4910	23.4	12.9	7.5	57.1	31.7	18.4	67.7	62.0	15.0
180	108	5100	27.8	11.8	7.0	70.2	30.4	18.0	62.8	58.9	15.7
			cobs								
0		534	10.6	4.7	24.1	2.8	1.2	6.3	6.7	2.8	7.3
90		976	10.2	4.5	20.5	5.0	2.2	10.0	6.0	4.4	8.2
180		1010	9.0	4.1	14.9	4.6	2.0	7.5	4.1	3.9	6.5
			stover								
0		3990	5.7	11.3	31.0	13.0	25.5	69.6	31.5	57.2	80.3
90		5580	6.6	5.2	29.2	22.2	17.2	93.9	26.3	33.7	76.8
180		5610	11.0	5.6	27.6	37.0	19.2	89.0	33.1	37.2	77.8