

Calcium & Magnesium. Controversy?

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The interest in the calcium (Ca) and magnesium (Mg) content of soils is due to a theory advanced in the mid-1940s called the basic cation saturation ratio (BCSR) concept. This theory suggested the cation exchange capacity (CEC) of the soil should be occupied by 65% Ca, 10% Mg, 5% K, and 20% H. Late in the 1950s, the ideal BSCR was modified to 65-85% Ca, 6-12% Mg, and 2-5% K. The original concept was based on filling the soil CEC with an inexpensive cation and minimizing the luxury consumption of potassium (K). Early research showed that percent base saturation of a particular cation on the CEC and its interaction with other adsorbed cations influenced cation availability lending some promise to the BSCR theory. *However, many later experiments showed that wide differences in soil Ca:Mg ratio support equal amounts of crop growth, i.e. BSCR has little effect on crop production.* Unfortunately, few of the studies evaluating BSCR were conducted in the field and little research has been done recently.

Interest in the BSCR theory concept continues today in part due to research showing extremely high %Mg (74-98% of the CEC) may have detrimental properties on water infiltration and runoff and soil erosion. *Since %Mg rarely exceeds 30% in Indiana soils, however, it is unlikely that the level of Mg has any practical effect on infiltration, runoff, or erosion.* The Mg content of Indiana soils does not and will not exceed 30% for several reasons. First, all limestone available in Indiana contains more Ca than Mg. Second, corn and soybean remove far more Mg than Ca. Third, Mg is held less tightly than Ca to the CEC and is therefore more likely to leach. Thus, the application of limestone should be based on traditional factors; such as fineness of grind, relative neutralizing value, and cost, not Ca and Mg content. The exception is on sandy soils low in Mg, where Mg deficiency may occur. Dolomitic limestone (containing Mg) should be used in this situation because it is the least expensive source of Mg. Dolomitic limestone is generally less expensive than calcitic limestone (low to nil Mg content).

Application of gypsum (CaSO_4) may increase water infiltration and reduce crusting of some Indiana and Midwest soils. *This effect of gypsum on soil properties is independent of the Ca:Mg content of the soils.* Unfortunately there has been little research to identify soils where improvement in physical properties is likely or to evaluate the yield and profit benefit of gypsum applications. Although still rare, sulfur (S) deficiency is increasingly noted in the Midwest. Gypsum application can correct S deficiency, however, there are more effective and less expensive fertilizer materials that can be used to provide S.