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[C3.3-4] Soil Management Strategy for Enhancing Crop Yields

Application of Liquid Calcium Carbonate Micron Particles on the Furrow as Affecting the Soil Phosphorus Availability and Common Bean Yield

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The common bean (Phaseolus vulgaris L.) crop has great economic importance to Brazil because the cultivated area during the 2012/2013 harvest was 3.16 million ha-1, which yielded 3.32 million Mg ha-1. Tropical soils such as the Brazilian Cerrado or the African Savannas are naturally acidic because leaching of basic ions from high rainfall, which result in reduced soil fertility. In these areas satisfactory cash crop grain yields are dependent of performing proper liming and soil fertilization. Soil acidity is one of the main limiting factors of crop yields in many parts of the world. Lime application is a cheap and effective way to increase soil pH. However, the reactions that raise soil pH after lime application occur slowly. Because of this, lime application close to the crop sowing day may not raise the soil pH and provide increases in some nutrients availability. While the conventional liming has a particle size of 50% < 0.3 mm and 50% > 0.3 mm the micron particle has a size between from 0.0001 to 0.0002 mm. Another difference is because the micron particle normally is applied in a solution with water, which probably makes the reaction with the soil faster. In this sense it is likely that the liquid liming application will provide faster soil reaction in the soil furrow. However, from the best of our knowledge there are no virtual researches about this topic. The aim of this study was to evaluate the effect of the liquid application of calcium carbonate micron particles in the sowing furrow on the pH, the concentrations of Al, P, K, and Ca, and the base saturation in the soil and on the yield components, grain yield, concentration, and grain content of common bean.
The trial was conducted for two years (2010 and 2011) at the Guaribas Farm, located in the city of Unai, MG, Brazil. The experimental area was grown for four years in the NTS, with corn cultivated in summer and common beans in the winter season. The soil was a sandy clay loam (kaolinitic, thermic Typic Haplorthox) with 500 g kg-1 clay, 300 g kg-1 silt, and 200 g kg-1 sand. The experimental design was a randomized block design with four replications in both years. The treatments consisted of six doses of calcium carbonate (0, 1050, 2100, 4200, 8400, and 12 600 g ha-1) applied in the sowing furrow (0.03 m deep together with the common bean seed). The plots were 40 m2 (10.0 m x 4.0 m). The used area of each plot was the two central rows, disregarding the 0.50 m on each side. A 4.5-cm-diameter galvanized-steel auger was used for sampling at depths of 0 to 0.10 and 0.10 to 0.20 m at 15 and 30 days after calcium carbonate application. For each layer, eight subsamples were collected from under the common bean plant rows and in the middle of the inter-rows (0.25 m from the plant row) of each plot. For each location (in-row and between rows), the eight subsamples were combined into a composite sample. The composite samples were air dried and sieved (2 mm mesh) and later analyzed to determine the pH (CaCl2 0.01 mol L-1), P, Al, Ca, and exchangeable K, as well as the calculated base saturation (V%) and aluminum saturation (%). It was also evaluated the yield components, grain yield, concentration and content of P in common bean grains
Our results indicate that the calcium carbonate increased the pH (from 4.8 to 5.3 at 0-0.10 m deep layer) and the P concentration in the soil (from 70 to 80 mg dm-3 at 0-0.10 m deep layer) until 30 d after application. The concentration of Ca, K and the base saturation of the soil were not affected by the addition of calcium carbonate. The concentration (from 4 to 4.3 g kg-1) and content (from 1,500 to 1,870 g ha-1) of P in the grain and grain yield (from 3,500 to 4,100 kg ha-1) of the common beans increased with increasing concentration of calcium carbonate. The use of calcium carbonate micron particles in the sowing furrow is a new and effective practice that increases crop yield in no-tillage systems.

Keywords：*Phaseolus vulgaris, liming, fertilization, Cerrado Region*