DETERMINATION OF EXCHANGEABLE MAGNESIUM IN SOILS BY TITAN YELLOW WITH REFERENCE TO MAGNESIUM DEFICIENCY IN CITRUS

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RECENT studies (1, 2, 4, 9) have shown that a certain type of leaf chlorosis in citrus in Florida (3), locally referred to as “bronzing”, is due to a magnesium deficiency and that this condition may be corrected by the application of water-soluble magnesium salts or dolomite to the soil. While the application of magnesium sulfate to the soil early in the spring will usually control bronzing during the succeeding fall, the response to dolomite is not generally noted until the next season. These observations would indicate that the magnesium in the exchange complex is more readily available than that in the dolomite which must undergo certain reactions with the soil and the fertilizer materials applied, in order to become sufficiently available to meet the requirements of citrus on the light sandy soils of Florida.

Experiments now in progress at the Citrus Experiment Station have shown that even heavy applications of magnesium sulfate do not appreciably increase the exchangeable-magnesium content of light sandy soils below pH 5.0 without the correction of the soil acidity. Hence, magnesium sulfate is generally recommended in conjunction with some form of basic material, preferably dolomite, to provide an immediate supply of available magnesium and to build up the exchangeable magnesium content of the soil. Since the decomposition of dolomite in the soil may be expected to vary with the soil reaction, the exchange capacity, the depth of incorporation, moisture conditions, fertilizer practice, and other factors, it was thought desirable to develop a rapid laboratory method by which the amount of exchangeable and water-soluble magnesium could be determined accurately in the presence of undecomposed dolomite and which could be used in predicting the need for magnesium fertilization early in the season in order to prevent the appearance of the usual symptoms of magnesium deficiency in the fall. The purpose of this investigation was, therefore, to develop a rapid method for the determination of exchangeable magnesium in soils and to correlate the occurrence of the symptoms of magnesium deficiency in citrus with the exchangeable-magnesium content of the soils as determined by the proposed method.

SOLUBILITY OF DOLOMITE IN DIFFERENT EXTRACTING SOLUTIONS

It should be obvious that if the method is to be used as a measure of the immediate supply of the available magnesium in soils containing free dolomite, the extracting solution employed must not extract only the exchangeable and the water-soluble magnesium. Accordingly, a study was made of the solubility of dolomite in several different types of extracting solutions that are commonly employed in base-exchange work. The following extracting solutions were studied: 1 N ammonium acetate, pH 7.0; 1 N sodium acetate, pH 7.0; 1 N sodium chloride, and sodium acetate, pH 4.8; the “Universal” extracting solution prepared according to Morgan (6).

Dolomite was added to each of the above extracting solutions in amounts equivalent to 1,000, 2,000, and 4,000 pounds per acre under actual conditions of the test to be described later, and the amounts of magnesium determined in the filtered extracts by means of Titan yellow. The same amounts of dolomite were also added to Norfolk fine sand at different pH values and then extracted with each of the above extracting solutions. These samples of Norfolk fine sand, very low in exchangeable magnesium and having an exchange capacity of 2.5 M.E. per 100 grams, were taken from plots which had received different amounts of high calcium limestone.

The amounts of magnesium brought into solution by the different extracting solutions both in the presence and the absence of the soil are expressed in pounds per acre and are shown in Table 1.