RELIABILITY OF LIME REQUIREMENT CALCULATIONS BASED ON THE RAPID COPPER
METHOD FOR EXCHANGE CAPACITY

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DETERMINING the degree of soil acidity and recommending the lime required to adjust soils to pH values within the reaction range recommended for the various crops are important services being rendered by various agricultural agencies. Certain soil characteristics in addition to reaction should be known in order to make reliable liming recommendations. This paper reports a study of the relationship of the lime requirement of soils to their exchange capacity. In the Coastal Plain region the organic matter content usually accounts for more of the variation in exchange capacity than the inorganic clay content.

The relationship of exchange capacity to percentage base saturation has been studied by various workers. Morgan (9) and Pech (10) reported a general relationship between base saturation and pH. Sieling (13) reported a relationship but gave no quantitative value between exchange capacity and lime requirement. Mehlich (8) showed some extreme variation in per cent base saturation at a definite pH with various clays. Pierre and Scarseth (11) reported a relationship but an imperfect relationship of base saturation on exchange capacity to pH. The general conclusion that can be drawn from these reports indicates that soil properties other than exchange capacity and pH also influence lime requirement.

The simple and rapid determination of base exchange capacity of soils by means of the copper acetate method devised by Sieling (12) was studied. The method is based on the assumption that a predominant quantity of the exchangeable cations are replaced by copper. Sieling found very close correlation between copper acetate and ammonium acetate base exchange capacity values. Jamison (6) found by the ammonium acetate method.

Sieling's (12) method measures the absorption by a 5-gram sample of soil from a dilute solution of copper acetate-acetic acid by colorimetrically estimating the amount of copper remaining in the solution after 2 minutes. Five mls of the clear filtrate obtained from the soil is treated with 2.5 mls of 1-3 ammonium hydroxide and gives the solution a deep blue color after the formation of a cupra-ammonia complex, which is again filtered to remove precipitated hydroxides. Some modifications of the method were used.

In order to study the relationship of exchange capacity to lime requirement in eastern Virginia, soil samples were collected during March from 46 fields. The samples were air-dried and then a series of five 200-gram portions were used for the determination of their liming curves. Varying amounts of 200-mesh dolomitic limestone (43% MgCO₃ and 54% CaCO₃) were mixed thoroughly to the portion of soil with 48 hours before determining the exchange capacity by the copper acetate method. For this determination the soil was shaken intermittantly for 6 hours, left in the solution overnight, reshaken, and filtered the following day. Twenty grams of soil were also leached with 400 mls of solution for the determination of the exchange capacity by the copper acetate method (11).

In addition to the study of lime requirement and exchange capacity relationships, four soils of the Woodstock, Sassafras, Elkton, and Bayboro series were collected and determined the influence of the period of air-drying on the exchange capacity of the soils. The fresh soils were corrected to the weight of those that had been air-dried 1 week.

Experimental Procedure