Effect of Decomposition of Added Oat Straw and Alfalfa Meal on Solubility of Soil Copper in Ammonium Acetate

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In another paper (2), it was shown that when oat straw and alfalfa meal were added to Merrimac sandy loam, the ammonium acetate soluble copper increased over that in unamended soil as a result of the presence of unknown soluble components in the crop residues. Thus, when 4.35 grams of oat straw and 0.6 gram of alfalfa meal were added to 374 grams of Merrimac sandy loam (20.4% moisture), leachable copper was found to be 22.0 $\gamma$ Cu per 10.0 grams dry weight soil. When no organic matter was added, the same soil yielded 8.4 $\gamma$ Cu when leached with neutral N ammonium acetate. On a 10.0-gram dry weight basis, the total copper added in the oat straw and alfalfa meal was only 1.72 $\gamma$. The present paper reports the effect of decomposition of the plant residues on the solubility of soil copper.

EXPERIMENTAL PROCEDURE

The Merrimac sandy loam used in these experiments was described in the previous report (2). Oat straw, chopped and sieved through a 2-mm screen, and finely ground alfalfa meal were added to the soils at the rate of 200 pounds nitrogen per acre and at a carbon-nitrogen ratio of 30:1. This application amounted to 4.35 grams of oat straw and 0.6 gram of alfalfa meal added to 374 grams of soil containing 20.4% moisture. The plant material was thoroughly mixed into the soil and the mixture placed in a round, wide-mouthed quart jar with a screw cap. Duplicate jars were prepared in this way, single samples being taken from each jar. A third jar containing unamended soil was included in each experiment.

By keeping the screw cap not quite tightly closed and incubating the jars on their sides, gas exchange was permitted since the CO$_2$, being heavier than air, would flow down and out to be replaced by air through the upper portion of the lid. This simple procedure not only permitted gas exchange but also kept water losses low. During 14 days at 29° C, the moisture decreased 2.7%. At 37° C the decrease was 2.4% and at 45° C the loss was 2.5%.

At the stated intervals, the jars were removed from the incubators and the soil thoroughly mixed by rotating in an eccentric fashion so that the soil particles rolled freely over each other. Thirty rotations were found to perform mixture. One sample (40.0 grams wet weight) was taken from each jar at each sampling period and leached with 250 ml of neutral N ammonium acetate. The leachate was evaporated to dryness and predigested with 5 ml concentrated nitric acid. The digestion of the organic material was completed with 5 ml nitric acid plus 5 ml 60% perchloric acid. The salts, after being evaporated to dryness with 5 ml hydrochloric acid, were dissolved in dilute, boiling nitric acid, and made to volume. Copper determinations were run by the method of Drabkin (1) as described in the earlier paper. All reagents, except concentrated nitric and perchloric acids, were either distilled from pyrex glassware or were purified by dithizone extraction where needed (3). Blanks on all reagents but were not large enough to necessitate correction. The leached soil samples were washed into tared beakers and dried at 110° C for dry weight determinations.

RESULTS

The accuracy of determinations of the soil copper here reported may be calculated from...