The Effect of Green Manure Crops of Varying Carbon-Nitrogen Ratios upon Nitrogen Availability and Soil Organic Matter Content

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The desirability of maintaining or increasing soil organic matter is well recognized, but the addition of the necessary plant materials to accomplish this aim may produce a marked decrease in nitrogen availability. Such a decrease almost invariably occurs when mature carbonaceous materials are added. Young succulent materials may produce no such depression, but the recovery from a unit of nitrogen added in these materials is commonly lower than from a similar quantity of nitrogen added as commercial fertilizer. The nitrogen that is tied up in the added green crops is slowly released later. Successive additions of green crops, or of mixtures of carbonaceous materials with fertilizer nitrogen, should therefore produce larger and larger yields as the inactivated nitrogen from the earlier additions is released. This might not, of course, occur if the nitrogen loss were large.

The studies here reported were planned to furnish information on the points mentioned. More specifically, the objectives were (a) to determine the efficiency of utilization of commercial nitrogen applied with and without green manure crops of various ages, (b) to study the rate of release to successive crops of nitrogen from green manure crops of varying carbon-nitrogen ratios, (c) to obtain quantitative data on the extent to which the added organic materials and fertilizer nitrogen affect the soil organic matter content, and (d) to determine if gaseous losses of nitrogen are appreciable.

The present final report supplements the preliminary results already reported (6).³

EXPERIMENTAL PLAN AND METHODS

This comparatively long-time greenhouse experiment involved the growing of five successive crops, followed by a fallow period of 8 months, and then a final unfertilized crop and a second fallow period of 12 months. The soil was analyzed initially and at the end of the first fallow period for total carbon and nitrogen, and all crops were analyzed for total nitrogen.

The first indicator crop was planted on July 19, 1943, and the first fallow period began on October 27, 1944. The final unfertilized crop was planted on June 21, 1945, and harvested on Aug. 13, 1945. The second fallow period, which began at this time, ended on August 15, 1946.

The experiment was conducted in 2-gallon glazed pots containing 20 pounds of Evesboro loamy sand. It was limed to pH 6.0 and maintained at approximately this reaction for the duration of the experiment. Adequate phosphorus and potassium, usually 1,500 pounds of a 0–15–6 mixture, were applied to each crop. Magnesium and the necessary minor elements were also added. Commercial nitrogen at varying rates, shown in the tables, was supplied to each crop as urea.

¹Contribution from the Division of Soil Management and Irrigation, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agriculture, Beltsville, Md. Received for publication November 17, 1947.
²Associate Chemist, Senior Chemist, and Associate Chemist, respectively.
³Figures in parenthesis refer to "Literature Cited", p. 248.