Long-time Effect of Applying Barnyard Manure at Varied Rates on Crop Yield and Some Chemical Constituents of the Soil

B. L. Brage, M. J. Thompson, and A. C. Caldwell

Over 100 years have passed since the first long-time fertility experiments at Rothamsted were begun. Many similar investigations have been in effect in the United States, but all have been of shorter duration. Rate of manuring plots have been in operation for 30 years at the Northeast Experiment Station, Duluth, Minn. It is the purpose of this paper to present the yields of different crops as they have been affected by different rates of manuring and also to present the effect of manure on various soil constituents.

REVIEW OF LITERATURE

It is recognized that raising the nitrogen, carbon, and organic matter level of soils is difficult, especially under subhumid to humid conditions. Smith (18) found that it was impossible to maintain the nitrogen supply of the Sanborn field in Missouri at its virgin content when extensive cultivation was practiced, even though large additions of nitrogen were made in the form of manure and commercial fertilizers. Research workers in Ohio concluded that 16 tons of manure in a 5-year rotation maintained organic matter, but not nitrogen (1). Harris and Gourley (6) found a gain of only 6 tons of organic matter in a soil to which 328 tons of manure had been added in 21 years. Crane (4) also found that organic matter was difficult to maintain. After 20 years of work on the Morrow plots to which 76 tons of manure had been added, there was a 4-ton loss of organic matter.

Metzger (10) arrived at the conclusion that manure failed to produce significant increases in nitrogen.

Royer et al. (16) reviewed the data on long-term plots at Purdue and found that there was considerable removal of phosphate on the manured plots than on the unmanured plots due to the stimulating effect of manure on crop growth.

Any practice which increases the organic matter of the soil should simultaneously increase the exchangeable calcium and magnesium from manure application. Merkle (8, 9) and Prince et al. (15) found that an increase was obtained from continued application of manure. Merkle concluded that there was no significant difference in exchangeability between manured and check plots. Metzger (10), and Schollenberger and Dreibelbis (17) found increases in exchangeable magnesium from manure application. (15) and Schollenberger and Dreibelbis (17) found increases in exchangeable calcium, but Merkle (8) and Merkle et al. found no significant difference in exchangeable potassium according to Schollenberger and Smith (19), and Metzger (11). Merkle (8) concluded that manure makes a soil more acid, but Schollenberger et al. (17) found differently.

Hall and Russell (5), in studying the effects of manure on crop yields, concluded that barley responded more to manure than wheat did. Smith (18) found that crop rotations were as effective in maintaining yields of corn, oats, and wheat as heavy applications of manure on these crops grew.

MATERIALS AND METHODS

Field Layout of Plots

The cropping system consisted of a 4-year rotation of crops: 1 year of grain, 2 years of hay crop, 1 year of potatoes, rutabagas, and sunflowers. The hay crop was a mixture of yellow sweet clover, alsike, alfalfa,