The Effect of Long-Time Fertility Treatments on the Nitrogen and Carbon Content of A Prairie Soil

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Abstract

Nitrogen and carbon studies of the surface 7 inches of a prairie soil, Geary silt loam, were initiated in 1911 on the soil fertility plots at the Kansas Agricultural Experiment Station, Manhattan, Kans. This paper reports the results of the 1946 analyses on these plots and correlates the trends in nitrogen and carbon changes over the entire period of the experiment with fertilizer applications, crop rotations, yield of dry matter, and carbon: nitrogen ratios. This study has led to the following conclusions:

1. There has been a continual over-all loss of nitrogen and carbon over the entire 30-year cropping period studied regardless of cropping system or fertilizer treatment.

2. Plots with the highest nitrogen content at the beginning of the experiment have suffered the greatest losses.

3. Fertilizer treatment had relatively little influence on the nitrogen trends in the soil or on carbon: nitrogen ratios.

4. The rates of nitrogen losses were essentially the same on a 16-year rotation with 4 years alfalfa, corn, wheat, wheat rotated for 12 years and on a 3-year rotation of corn, soybeans, wheat for the entire period, but continuous wheat has nearly reached an equilibrium.

5. The loss of carbon has been the greatest on the 3-year rotation and continuous wheat as compared with the 16-year rotation.

6. The average carbon: nitrogen ratio on plots to which no fertilizer has been applied remained unchanged throughout the 30-year experiment. The carbon: nitrogen ratio of the 16-year rotation has widened slightly over the entire period, but the carbon: nitrogen ratios for continuous wheat and for the 3-year rotation has remained essentially the same.

7. The total yield of dry matter was highest for the rotation containing alfalfa and for complete fertilizer treatments, but had relatively little influence on carbon: nitrogen ratios.

8. As indicated by the results of this experiment, cropping systems and fertilizer treatments studied on this soil have had only slight influence on the trend of carbon and nitrogen but may have some influence on the speed with which an equilibrium is reached and also the ultimate level. Erosion plays a more important part on this soil type than crop removal in influencing nitrogen and carbon losses.