Nitrogen Uptake by Wheat in Relation to Nitrogen Content of Soil

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Considerable interest has been shown in the quality of organic matter and the availability of its nitrogen under different cropping systems. A review of early literature is given by Waksman (8). His work and that of others such as Fraps (2), Gainey (4), and Gowda (5) have shown a definite correlation between nitrifying capacity of soils and productivity although there are many exceptions. Fraps and Sterges (3) list several factors affecting the nitrifying capacity of soils.

Allison and Sterling (1) conducted nitrification studies on Cheyenne fine sandy loam soil from selected rotation plots of varying total nitrogen content at Mandan, N. D. Their results showed that nitrate formation from soil organic matter was directly correlated with total soil nitrogen at all incubation periods on both limed and unlimed soils. The addition of lime was most effective in increasing nitrification on the low nitrogen soils and resulted in nitrates formed being nearly proportional to total soil nitrogen. They concluded that in a given soil type and under like climatic conditions, thoroughly humified soil organic matter is fairly uniform in quality regardless of past agronomic treatment. Rendig (6) found that the proportions of the various forms of organic nitrogen in a virgin prairie soil and a virgin forest soil were remarkably similar, the greatest difference being the higher content of nonbasic amino nitrogen in the latter. A cultivated cultivated forest soil, was lower in content of nonbasic and amide nitrogen but higher in percentage of basic nitrogen.

The purpose of the present study was to determine the relationship between total soil nitrogen and nitrogen availability under field conditions on soils of the same type.

SOIL AND METHODS

This study was conducted in 1948 at Mandan, North Dakota on Cheyenne fine sandy loam soil. Wheat plots of varying total nitrogen content were selected from rotations which had been in effect since 1914. Most of the soils studied were the same as those investigated by Allison and Sterling (1). Crop yield, pH, and nitrogen content of the soil are given in Table 1.

Composite samples were collected in 1943 from nine locations in the rotation plots and used to determine nitrogen for 0- to 6-, 6- to 12-, and 12- to 24-inch depths. In using these data for the present study, the assumption was made that there had been very little change in the nitrogen content of the soil between 1943 and 1948. Nitrogen removal by wheat was determined from three subplots established in a strip along one side of each rotation plot. Square yard samples were clipped close to the ground at four stages of growth: tillering, jointing, heading, and dough. Oven-dry yields were determined from each sample and the plant material was analyzed.

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