SOIL CONDITIONS IN RELATION TO THE RESPONSE FROM GREEN MANURE APPLICATIONS

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It is generally assumed that cultivated soils in humid regions are commonly deficient in nitrogen and that the maintenance of crop production on these soils depends to a very great extent upon the use of cropping systems in which legumes are grown and/or liberal applications of various nitrogenous fertilizers are applied. In regions which are distinctly semi-arid in character and legume crops cannot be produced successfully, the problem of maintaining the nitrogen content of soil has not been solved; however, many investigators continue to hope that nonsymbiotic fixation of nitrogen will be adequate to meet the normal requirement of crops which can be grown under the climatic conditions which prevail. Between the semiarid region of the Great Plains where legume crops do not make a satisfactory growth under average conditions and the humid area in the west-central portion of the Mississippi Valley where a nitrogen deficiency in the soil frequently limits crop production, a zone of varying width occurs where the average climatic level for crop production is low with a marked seasonal variation in plant development. In this area the use of accepted soil-building methods which are commonly employed under a more favorable environment for plant growth may require some modifications.

During the transitional period from virgin land to a point where all soils are deficient in nitrogen, the use of legume cropping systems for soil improvement cannot be recommended as a general practice on every farm, since economical increases in crop yield are not always secured following the growth of a legume crop when a part or all of the crop residue is returned to the soil. Some important facts concerning organic matter and nitrogen changes in soil have been discovered by research in different areas, but their application is not always clear. Chemical analyses of cultivated land indicate that the organic matter and nitrogen content of a soil is decreased as a result of tillage and the production of soil-depleting crops. Soil biologists have studied the rate of nitrate accumulation in the field and in the laboratory, and when the nitrate is not removed by growing crops it will accumulate in the soil. This builds up a nitrate content which is released for plant use as a result of biological activity.

In view of all the investigations which have been conducted concerning changes in the nitrogen content of soil, one would naturally expect to find many comparisons in the literature which would indicate the probable response that might be expected when cropping systems designed to increase the nitrogen content of soil were used on land of varying productivity. Although the physical character of some soils may have a more important effect on plant development than the chemical constituents which are present in them, no measuring stick has been found which could be used to indicate when the potential or actual nitrogen content of soils having similar characteristics has declined below a point where a deficiency of one or more soil nutrients rather than a climatic condition is the limiting factor in production. Within limited areas, such a measuring stick would have some merit if a sufficient number of experiments on different soil types could be done to attempt to replace this loss in soil organic matter and therefore maintain crop yields. Russel (5) suggested that nitrogen losses in Nebraska soils will cease after 25 to 30% of the nitrogen originally present in the soil has disappeared as a result of tillage operations, and Duley and Morton (6) found that no appreciable increase in yield of corn and wheat occurred when peas were grown in a 3-year rotation and the crop residue was returned to the soil. This soil contained, after 25 to 30% of the nitrogen originally present in the soil has disappeared as a result of tillage operations, and Duley and Morton (6) found that no appreciable increase in yield of corn and wheat occurred when peas were grown in a 3-year rotation and the crop residue was returned to the soil. This soil contained,