Nitrogen is the limiting nutrient in the production of corn on many of the light-colored soils of the Midwest. Investigations during the past 5 years at the Purdue University Experiment Station (4) have shown that plowed-under ammonium or ammonium-forming fertilizers are effective in supplying the needed nitrogen. One phase of these investigations was concerned with the effect which the applied nitrogen had on the composition of the grain and stover. The composition gives information on the physiology of the plant, and, in conjunction with the yield, gives the recovery of the applied nitrogen. Recovery data gives information on the efficiency of the method of application.

Few data exist on the immediate recovery of nitrogenous fertilizers applied to corn in field experiments. Studies in nitrogen economy which have been reported may be classified into three groups, viz., (a) long-time fertility plots, (b) lysimeter tank and cylinder experiments, and (c) greenhouse experiments. The results from the long-time fertility experiments are generally subject to the greatest errors. The results from the cylinder and greenhouse experiments of New Jersey (3) and other states have indicated an approximate maximum of 60% recovery of the applied nitrogen in the aerial parts of the plant.

Most investigators in field studies with crops other than corn have obtained about 40 to 50% recovery of the applied nitrogen.

EXPERIMENTAL

The experiments reported were conducted in cooperation with farmers who prepared the land and planted and cultivated the corn. The soil was a typical Vigo silt loam, which is the mature, imperfectly drained member (Group IV) of the Illinoisan catena. The surface soil is very acid (pH 5.9) and low in organic matter, containing 1,600 pounds of nitrogen per acre, plow layer.

Three rates, 0, 200, and 400 pounds per acre, of ammonium sulfate were broadcast in spring and plowed under. The three rates were laid out in replicate blocks which were arranged in a 3x3 Latin square. These blocks were systematically crossed by four-row treatments applied at planting, no fertilizer, 0-12-12, 3-12-12, and 3-12-12 plus a side-dressing of 100 pounds per acre of ammonium sulfate applied during the week preceding the appearance of the first tassels. Row fertilizers applied at planting time were used at the rate of 600 pounds per acre. They were applied in continuous bands on both sides of the corn row at a depth of 2 to 3 inches and 3 inches laterally from the seed which was drilled. Indiana Hybrid 613 (66xTr, Wf9xHy) was planted on all plots.

In 1940, the plowed-under treatments were increased to five by adding an 800-pound rate with and without hydrated lime. The lime was added in an amount to neutralize the acidity induced by the extra 400 pounds of ammonium sulfate. These five blocks were arranged in a 5x5 Latin square and gave five replications.

The 800-pound plow-under treatments were increased to 600- and 800-pound in 1941. Hydrated lime was applied at the rate of 670 pounds per acre to neutralize the acidity induced by the latter rate. The plot arrangement was the same as that used in 1940.

Grain yields were obtained by harvesting all plots. Stover yields were obtained by harvesting three replicates. Samples for chemical analysis were obtained from three replicates.

Nitrogen determinations were made according to the Kjeldahl method. No differentiation was made between nitrogen in the ammonium-ion form and nitrogen in nitrate form. Determinations were made for nitrate nitrogen because the tissue tests indicated no nitrates present in the mature plants.

The nitrogen in the cobs was not included on recovery because the nitrogen in the cob comprised 2 to 3% of the recovered nitrogen.

Rainfall during the 1939 season was well distributed, except for a late fall drought. The 1940 and 1941 seasons were characterized by midsummer droughts. In 1940, only 0.39 inch of rain fell between July 16 and August 27, and in 1941, only 1.37 inches and 0.61 inch fell in July and August, respectively. These preceding and following these dry periods greatly affected the growth of the plants.

RESULTS AND DISCUSSION

EFFECT OF APPLYING 18 POUNDS OF NITROGEN IN THE CORN ROW AT PLANTING

In all cases, nitrogen applied in the row with phosphate and potash caused an early growth response which began to appear after the appearance of the third and fourth leaves. The stover yields doubled in the favorable corn year of 1940. The 18-pounds of nitrogen increased 530 and 280 pounds per acre over the unsupplemented row nitrogen.

The plowing under of ammonium sulfate did not obliterate the early row nitrogen response nor did it sufficiently long to prevent, in most cases, the early nitrogen-in-row corn from catching up, as shown in the unfavorable 1940 and 1941 seasons with unsupplemented row nitrogen.

The plowing under of ammonium sulfate applied in the row did not increase significantly the recovery of the nitrogen in the cobs. The nitrogen in the cobs made up only 0.39 inch of rain fall in the first week following the appearance of the first tassels. This drought had little effect on the corn yields. The growing season of 1940 and 1941 were characterized by midsummer droughts. In 1940, only 0.39 inch of rain fell between July 16 and August 27, and in 1941, only 1.37 inches and 0.61 inch fell in July and August, respectively. These preceding and following these dry periods markedly affected the growth of the plants.

The nitrogen in the cobs was not included on recovery because the nitrogen in the cob comprised 2 to 3% of the recovered nitrogen.