The Effect of Various Amounts of Nitrogen, Phosphoric Acid, and Potash on the Yields of Silage Corn

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The question of what kind and amount of fertilizer will bring about the most economical returns from various crops is constantly being asked of agronomists wherever commercial fertilizer is used. The necessary information for a sound answer is often lacking. This is especially true when corn is the crop under inquiry. The attempt to find the most efficient kind and amount of fertilizer for corn has been the objective of many experiments. The results have differed a great deal depending upon the location of the experiments, soil type, weather conditions and other factors. The only practical solution seems to be continued studies under as many representative conditions as possible on which to base recommendations. These recommendations will change necessarily as new corn varieties are developed, new fertilizers become available, and new techniques of fertilizer usage and crop management are introduced. In the study reported here, information was obtained on the effect of various amounts of nitrogen, phosphoric acid, and potash applied in the fertilizer on two varieties of silage corn grown at the Rhode Island Experiment Station.

Considerable previous work on the problem of corn fertilization had been done at this station. As a result of many experiments, Hartwell and Damon (2) classified 21 different crops according to their estimated fertilizer needs. Corn was classed in a low-nitrogen, medium-phosphate, and low-potash requirement group. Subsequent studies (3, 4) have shown that this nitrogen classification was too low.

The ratio of silage to grain acreage is about 7 to 1. In this study the yields of green material are used as the measure of efficiency of various fertilizer applications. The results for a 3-year period, 1945–47, are included.

DESCRIPTION OF EXPERIMENT

The experiment on fertilizer grades for silage corn was located at the Rhode Island Experiment Station, Kingston. The soil is classified as Bridgehampton very fine sandy loam. The pH of the soil was approximately 5.7. For more than 40 years prior to this experiment, the plots had been in a 5-year crop rotation. For the greater part of this period the rotation consisted of corn, potatoes, rye, and 2 years of hay. No farm manure has been used on these plots for more than 50 years.

In all, 24 different fertilizer ratios or grades were included. The nitrogen applications ranged from 40 to 100 pounds per acre and were supplied as % nitrate of soda and % sulfate of ammonia. Phosphorus was supplied in superphosphate at rates of 60, 120, and 180 pounds of P\textsubscript{2}O\textsubscript{5} per acre. The potash was supplied in muriate of potash at rates of 60, 120, and 180 pounds of KG\textsubscript{2}O per acre. The fertilizer was applied in bands at planting time.

The crops were harvested for silage when they had reached the dent stage. Field weights of green material were taken for dry-matter determinations. There were only small differences in the percentages of dry matter between the two varieties in any one year. The results for the crops from the various fertilizer treatments for the general average was approximately 20% dry matter. The weights have been omitted in the tables and all calculations have been based on the green weights.

EXPERIMENTAL RESULTS

The yields obtained with the different fertilizer treatments are presented in Table 1. The low yields on treatments in 1945 with West Branch Sweepstakes corn are chiefly to reduced stands probably caused by fertilizer injury. A dry period in midsummer of that year had more noticeable effect on the West Branch Sweepstakes corn than on Ohio K-24.

RESPONSE TO NITROGEN, PHOSPHORUS, AND POTASH

The data from Table 1 have been assembled in Table 2 to show the influence on yield resulting from increments of N, P, and K regardless of the variable of the other ingredients.

The table shows there was no significant response in the yield of West Branch Sweepstakes in 1945 with increments of any of the three ingredients. Ohio K-24 showed a small response when the nitrogen increased from 40 to 60 pounds per acre beyond the 60-pound rate. The response to P and K was small and not significant.

In 1946 West Branch Sweepstakes showed a noticeable yield with increments of nitrogen up to 100 pounds per acre. Ohio K-24 showed a definite and consistent increase with increments of P and K, the response to K being more noticeable than that to P.

In 1947 West Branch Sweepstakes showed a small increase with nitrogen up to 80 pounds per acre, a considerable increase with increments of P, and no significant response with increments of K. Ohio K-24 showed a small increase in yield with increments of N and P and a noticeable increase with increments of K.

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