color. On the contrary, the grass on the urea and potassium carbonate plot which received potash at the rate of 21.5 pounds to 1,000 square feet annually in addition to the 6-pound rate of nitrogen has been the poorest plot at this soil acidity level. It was 11.8 percent poorer than the check plot in density and 3.2 percent poorer in color.

The effect of potassium carbonate on the density and on the clover control may be associated with the fact that the applications of the potassium carbonate burn the bents. This burn, recurring every month, may not only have retarded the growth of the grass but have permitted the clover to come in.

## Summary and Conclusions

Data presented in this article show that in any discussion on the response of the creeping bents to fertilizers the question of the change in acidity which they produce in the soil must be considered.

The grass has been in best condition on those plots ranging in soil acidity from pH 4.5 to 6.0. On the most acid plots with a soil acidity of about pH 4.2 the grass has been decidedly poorer than on those with an acidity of above pH 6.0, although on the most acid plots there has been best control of clover.

Regardless of the final soil acidity, the bents have responded favorably to fertilizers carrying nitrogen alone at an annual rate of 6 pounds to 1,000 square feet, but the best response has been exhibited when the nitrogen carrier has maintained the soil acidity at about pH 5.5. Moreover, those plots which have not received nitrogen have invariably been among the poorest plots at the soil acidity level in which they occur. This is true even of the potassium phosphate plot, in spite of the fact that it received 6 pounds of phosphoric acid and 4 pounds of

potash annually, and has the favorable soil acidity of pH 5.5.

The greatest reduction in clover has been obtained on the most acid plots and the least on the slightly acid or alkaline plots.

When phosphoric acid was applied in addition to the 6 pounds of nitrogen in fertilizers which produced a moderate soil acidity, the improvement was somewhat greater than that resulting from the application of 6 pounds of nitrogen alone in the form of ammonium nitrate. When calcium was added as well as phosphoric acid and nitrogen the improvement was decidedly increased.

An excessive amount of phosphorus on the very acid ammonium phosphate plot has resulted in serious injury to the grass. As similar injurious effects are not evident on slightly acid plots which have received even more phosphorus the conclusion is drawn that the poor condition of the grass on the ammonium phosphate plots may have been due to the fact that phosphoric acid unites with the iron salts in the soil solution to form iron phosphate, which is practically insoluble in acid media. Thus the phosphoric acid may have been responsible for removing the iron from the soil solution, thereby making it unavailable to plants. An application of a solution of iron sulfate temporarily improved the grass.

Data are presented which demonstrate the fact that potash applied at the rate of 6 pounds or more to 1,000 square feet, has reduced somewhat the benefits derived from the addition of nitrogen and phosphoric acid. This apparently deleterious effect is more conspicuous in connection with the density than with the color of the turf. Also the presence of potash particularly in the moderately acid plots usually has been accompanied by a decided reduction in clover control.