Lime and Fertilizer Requirements as Related to Turf Establishment Along the Roadside

R. J. CURRY, L. E. FOOTE[1], O. N. ANDREWS, Jr., and J. A. JACKOBS
University of Illinois

•THE ESTABLISHMENT of grasses and legumes on highway rights-of-way is the most economical means of controlling erosion and providing pleasant scenery for motorists. Present practices in the establishment of grasses and legumes on Illinois rights-of-way include the use of "blanket" lime and fertilizer applications. Because the climate and soils of Illinois vary widely, considerable doubt has been expressed concerning the agronomic and economic feasibility of a standard lime and fertilizer recommendation for all highway roadside soils. It is well established agriculturally that soil testing provides the best information available when considering a fertility program for crops. Most of the plant species used for highway roadsides are utilized in various agricultural practices, especially where a grassland agriculture is prevalent. A study was conducted to evaluate the lime and fertility status of roadside soils, and the inadequacies of a blanket application of lime and fertilizer in providing the essential plant nutrients for optimum establishment of desirable grass and legume species.

PROCEDURE

One hundred thirty soil samples were taken at 80 sites on highway roadsides in Illinois. These samples were obtained from "raw" cuts on new highway construction or well-established roadsides where the fertility status of the soil had not been altered in recent years. The soil samples were taken with a bulb-digger. Cores of soil obtained by use of the digger were $2\frac{1}{2}$ in. in diameter and 8 in. long. The samples were taken from the soil surface to an 8-in. depth. On five different slopes samples were taken at the top, center, and bottom of the cut to determine the fertilizer and lime requirements within a highway cut.

The University of Illinois Soil Testing Laboratory analyzed all of the soil samples for total and available phosphorus, available potassium, and pH. The percent unavailable phosphorus was determined by subtracting the available phosphorus from the total phosphorus, dividing by the total phosphorus, and multiplying by 100.

RESULTS AND DISCUSSION

The percent unavailable phosphorus increased as the pH increased (Fig. 1). At a pH of 4.1 only 25 percent of the phosphorus was unavailable for plant use as compared to approximately 75 percent unavailable phosphorus at a pH of 8.1. This implies that in soils with a high pH, phosphorus becomes unavailable to the plant.

It is well accepted that grasses make optimum growth at pH 6.0. Using pH 6.0 as a basis for determining the soil requirement for lime, soil tests indicated that on 73.5 percent of the sites where samples were taken, lime would not be required (Fig. 2). Of the remaining 26.5 percent of the samples, 81 percent would require more than 2 tons of lime for an optimum soil pH of 6.0 (Fig. 3).

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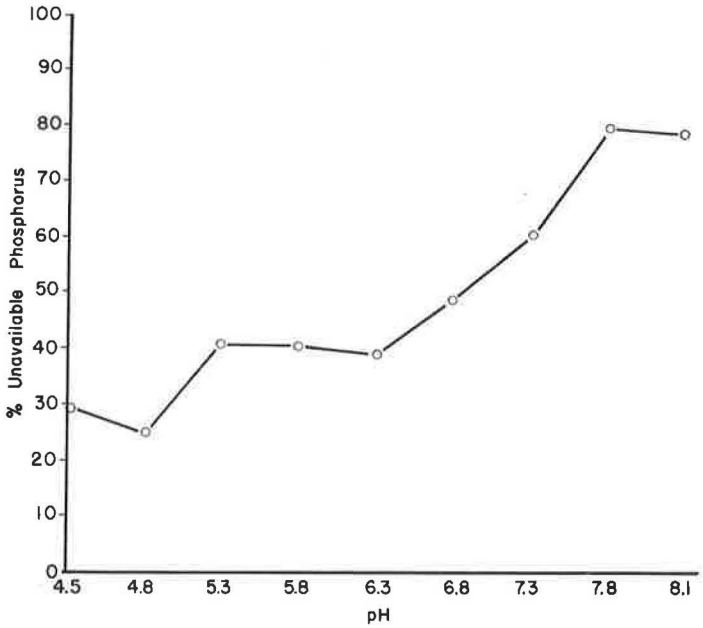

Figure 1. Availability of phosphorus at increasing pH levels.

At present on Illinois roadsides the State Standard Specifications provide: "Art. 110.3(c) (2) The agricultural ground limestone shall be applied at the rate of from 2 to 4 tons per acre, the exact rate to be specified by the Engineer." As indicated by these results, this practice does not provide the most efficient use of lime in correcting soil pH's. Although on some of the soils the added lime magnifies the problem of phosphorus availability to the plant, other sites are not receiving enough lime to raise the pH to a desired level for grass and legume establishment.

On the slopes that were differentially sampled, the samples taken at the top

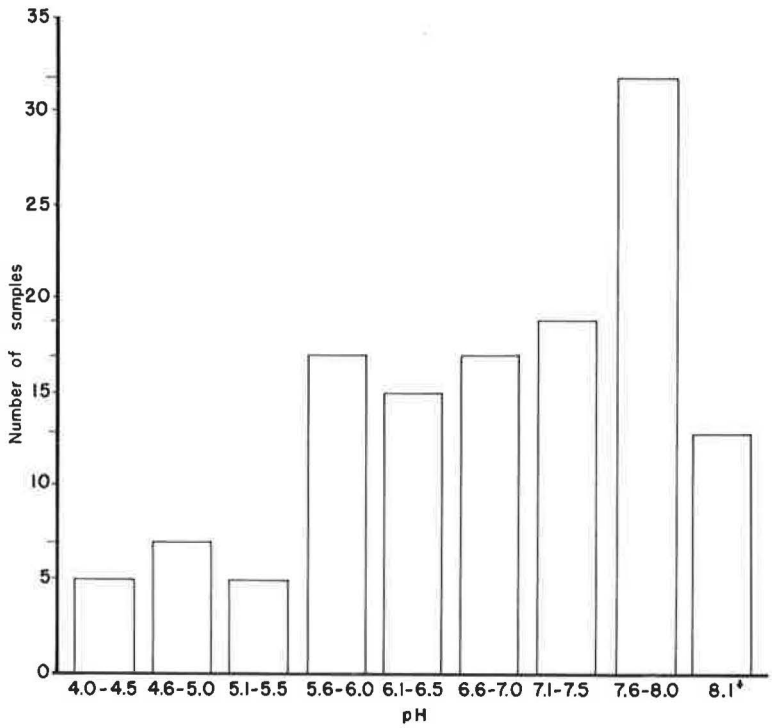

Figure 2. Frequency of occurrence at various pH levels.

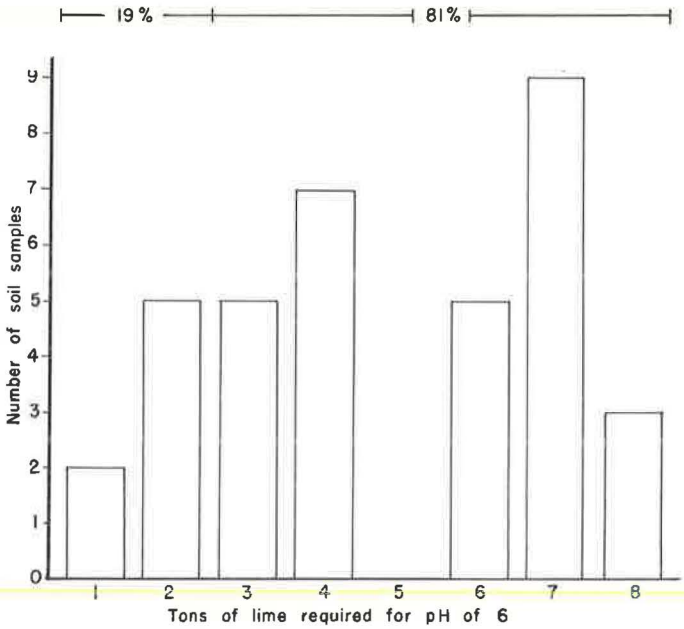

Figure 3. Distribution of lime requirements.

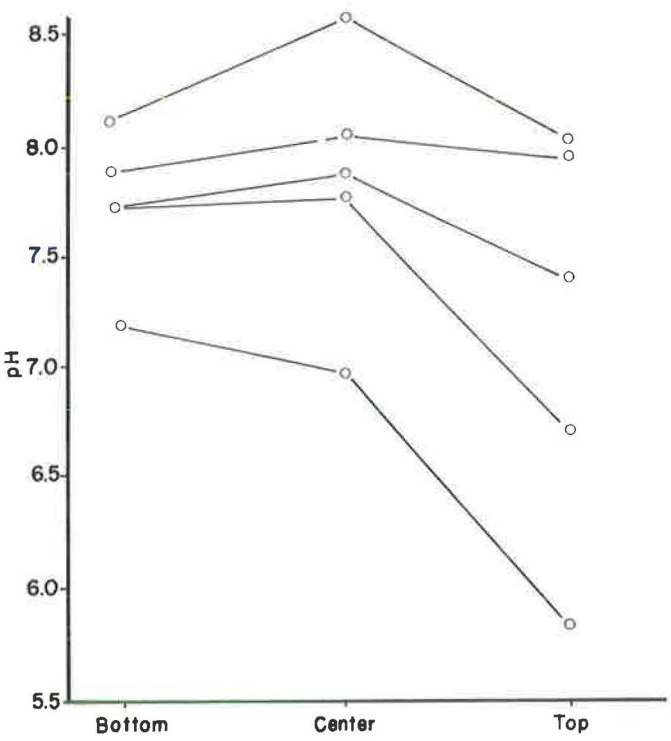

Figure 4. Soil pH as related to position on slopes.

of the slope had a lower pH than the samples at the center and bottom of the slope (Fig. 4). According to these data there may be considerable variability in soil pH within a specific slope or highway cut. The problem involved in such cases is in applying the proper amount of lime to correct soil pH over the entire slope. No uniform recommendation will be acceptable in all cases with respect to lime because too much lime may be of more harm in establishing grasses than too little lime. In such instances lime should be applied so that most of the surface expected to be covered in turf will be at a satisfactory pH. It is well known agronomically that most grasses will establish and develop at a pH as low as 5.5.

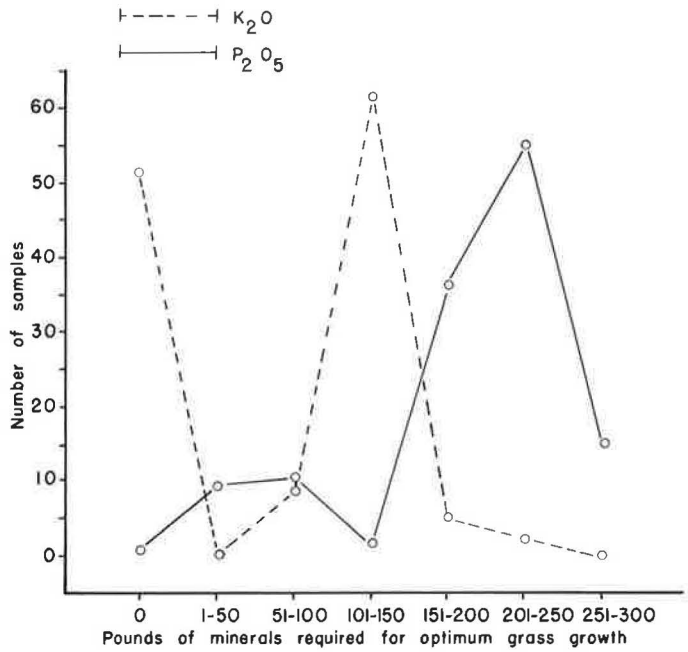

Figure 5. Frequency of soil samples requiring phosphorus and potassium.

In respect to phosphorus and potassium, adequate quantities of these minerals should be available in the soil for plant use. There is no reason to suspect that present practices in Illinois do not provide adequate phosphorus; however, the liming practices may limit the availability of this phosphorus.

From the soil samples it appeared that there was a greater requirement for phosphorus than potassium (Fig. 5). There were no identifiable trends in this study with respect to potassium. The usual soil tests do not include nitrogen analysis, but 80 lb of nitrogen on a per-acre basis is sufficient nitrogen for grass establishment.

SUMMARY

The value of a soil testing program in determining the fertility needs along new highway cuts is expressed by an agronomic comparison with the present blanket application method. The soil test data show that most of the sites do not need lime, but the majority do require phosphorus and nitrogen. The application of lime to those sites that are high in lime may cause a tie-up of essential nutrients such as phosphorus, and also increase labor requirements and costs. As a practical solution to such a fertility problem, soil tests taken prior to seeding could be utilized by everyone concerned in the establishment of grasses on the right-of-way to develop an adequate fertility program for grass establishment. Inasmuch as this research effort indicates that overliming has occurred on many roadsides, a pH test using pH 5.5 as a minimum pH could be used to determine the lime requirement.

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