

The Relation of pH to Available Phosphate and Potash in Purdue Soil Tests, 1961¹

RUSSELL K. STIVERS, Purdue University

Soil test summaries reported by Barber and Bronson (1) and by Jones, Mederski, and Musgrave (2) failed to show any relationship between soil pH and available phosphate in older Indiana and Ohio data. Neither did these summaries show the relationship between soil pH values and soil tests for potash. As a result of this information and because of secondary objectives, the relations between soil pH and available phosphate and available potash in the 1961 Purdue soil tests were the major objective of this investigation.

Another objective of this investigation was to compare soil pH, available phosphate, and available potash tests in the 1961 data, with the summary of 65,483 samples analyzed in the 1952-1954 data reported by Barber and Bronson. (1) Another secondary objective was to find where in the distribution of phosphate tests tabulated in relation to soil pH, that tests were unusually high where rock phosphate might have influenced the results.

Methods and Procedures

This investigation consisted of summarizing data from about half of the total of 50,551 soil samples tested during 1961 at the Purdue Soil Testing Laboratory. For the phosphate versus pH study there were 8 classes of phosphate on the horizontal axis and 7 pH classes on the vertical axis. All combinations of pH and phosphate classes resulted in 56 separate categories. Likewise, in the potash versus pH study there were 8 potash classes and 7 pH classes resulting again in 56 separate categories. A total of 22,280 samples was summarized in each of the two studies. All samples were not the same in the two studies because two different people working at different times made the summaries.

Statistical analyses consisted of averages and calculation of percentages.

Results and Discussion

The distribution of soil pH values for the 1952-1954 data as reported by Barber and Bronson (1) is compared in Table 1 with that for 1961. There were 23.9 percent of the 1952-1954 soil samples that tested above pH 6.5. In the 1961 data there were 38.78 percent of the samples in the phosphate versus pH study and 38.19 percent in the potash versus pH study that tested above pH 6.5. Values in the phosphate study were not significantly different at 95 to 5 odds from those in the potash study. Since soils above pH 6.5 were not considered as needing lime these data indicate that fewer of the samples tested in 1961 needed lime than those tested in 1952-1954. Possible explana-

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TABLE 1. Distribution of soil pH values in three different studies, Purdue Soil Testing Laboratory.

| Soil pH | 1952-1954 Percent | 1961 Phos- phate Study Percent | 1961 Potash Study Percent |
|---------------|----------------------|--------------------------------------|---------------------------------|
| Less than 5.1 | 1.9 | 1.06 | 1.08 |
| 5.1—6.5 | 74.4 | 60.13 | 60.73 |
| More than 6.5 | 23.9 | 38.78 | 38.19 |

tions for this difference may be that farmers testing in 1961 were liming their soils to a higher pH than those testing in 1952-1954, the samples tested in 1961 were from a different population of soils or fields than those tested in 1952-1954, or the farmers who tested in 1952-1954 had applied lime resulting in a higher pH in 1961.

A comparison of phosphate soil tests for 1952-1954 with those of 1961 is shown in Table 2. The very high class contained slightly the

TABLE 2. Distribution of phosphate soil tests, 1952-1954 and 1961, Purdue Soil Testing Laboratory.

| Phosphate Classes, Lbs. per A. | 1952-1954 Percent | 1961 Percent |
|-----------------------------------|----------------------|-----------------|
| 0—40 (Very Low) | 16.9 | 15.7 |
| 41—100 (Low) | 22.7 | 23.3 |
| 101—180 (Medium) | 21.2 | 19.2 |
| 181—300 (High) | 16.4 | 17.6 |
| 300+ (Very High) | 23.0 | 24.2 |

largest percentage of all samples in both periods. There were no indications of important differences between the data for the two periods.

The comparison of potash tests for 1952-1954 with those of 1961 is given in Table 3. There were real differences between the medium

TABLE 3. Distribution of potash soil tests, 1952-1954 and 1961, Purdue Soil Testing Laboratory.

| Potash Classes, Lbs. per A. | 1952-1954 Percent | 1961 Percent |
|--------------------------------|----------------------|-----------------|
| 0—100 (Very Low) | 15.7 | 12.5 |
| 101—180 (Low) | 58.2 | 56.0 |
| 181—250 (Medium) | 5.8 | 19.6 |
| 251—375 (High) | 17.0 | 8.8 |
| 376+ (Very High) | 3.7 | 3.2 |

and high classes. The percent in the medium class for the 1961 data was 19.6 as compared to 5.8 percent in the 1952-1954 data. In the high class a reverse relationship was found with 8.8 percent in 1961 compared with 17.0 percent in 1952-1954. One possible explanation for this difference may be that farmers were cropping heavier in 1961 than in 1952-1954, and as a result, they were taking out more potash in 1961 compared with the previous period. Another possible explanation may be as stated previously, that a different population of soils was being sampled in 1961 as compared to those sampled in 1952-1954.

The relation of soil pH to available phosphate in the 1961 data is shown in Table 4. The largest single value, 8.20 percent, was in the low phosphate class within the pH range of 6.1-6.5 inclusive. The largest pH class was 6.1-6.5 inclusive with 35.39 percent of the total. In the very low, low, medium, and high phosphate classes, the great majority of samples fell in the pH range 5.1 to 7.5 inclusive. If one considers any value with 1.0 percent or more as being important in the very high phosphate classes, the important values were from pH 5.6 to 7.5 inclusive at the low end and from 6.6 to 7.0 inclusive at the high end or in the 901+ class. The values became less from low to high in the very high phosphate classes, so that in the 701-900 phosphate class there were no values as great as 1.0 percent. In the 901+ phosphate class at pH 6.6-7.0 inclusive there was one important value, 1.27 percent. One might suspect that rock phosphate applications to the soil had influenced the tests included in the 1.27 percent value. Regardless of the reason for this small island of high tests, there was evidence of buildup or an increase in the values in the 901+ phosphate class.

The relation between soil pH and available potash is given in Table 5. This distribution was similar to that for phosphate except for certain major differences. These differences were primarily in the very high potash classes. There were no single values with more than 1.0 percent in the very high potash classes. There was no definite indication of a large decline in percentages from the low to the high values among the very high potash classes. The values in the 976+ class of very high potash were, in the main, smaller than other very high potash classes. This indicates that there was no buildup of soil potash like there was for phosphate.

Summary

Soil pH, phosphate, and potash data from 22,280 soil samples tested in the Purdue Soil Testing Laboratory in 1961 were summarized and compared with a summary of 1952-1954 data from the same laboratory. Samples testing above pH 6.5 increased from 23.9 percent in the 1952-1954 period to approximately 38.5 percent in the 1961 period. A comparison of the phosphate tests from the same two periods showed no real differences. However, the potash tests were different. The percent of samples in the medium potash class in the 1961 summary was 19.6 as compared to 5.8 percent in the 1952-1954 data. There was a reduction in the high potash class in the 1961

TABLE 5. Relation of soil pH to available potash in 22,280 soil samples, 1961, Purdue University Soil Testing Laboratory.

| | | Classes of Available Potash (K ₂ O) in Lbs. Per A. | | | | | | | |
|--------------------|----------|---|-------|------|--------------------|---------|---------|-------|--------|
| Classes of Soil pH | Very Low | Low | Med | High | Percent of Samples | | | Total | |
| | | | | | 376-575 | 576-775 | 776-975 | | |
| 7.6+ | 0.17 | 0.67 | 0.26 | 0.19 | 0.01 | 0.04 | 0.04 | 0.07 | 1.45 |
| 7.1-7.5 | 1.18 | 4.73 | 1.41 | 0.78 | 0.11 | 0.22 | 0.13 | 0.10 | 8.66 |
| 6.6-7.0 | 3.34 | 15.67 | 5.49 | 2.59 | 0.25 | 0.38 | 0.19 | 0.16 | 28.07 |
| 6.1-6.5 | 4.20 | 21.00 | 7.60 | 3.19 | 0.26 | 0.33 | 0.17 | 0.13 | 36.88 |
| 5.6-6.0 | 2.33 | 9.74 | 3.41 | 1.45 | 0.11 | 0.13 | 0.04 | 0.04 | 17.25 |
| 5.1-5.5 | 1.04 | 3.67 | 1.23 | 0.51 | 0.07 | 0.08 | 0.02 | 0.00 | 6.62 |
| Less Than 5.1 | 0.24 | 0.56 | 0.15 | 0.06 | 0.02 | 0.04 | 0.01 | 0.00 | 1.08 |
| Total | 12.50 | 56.04 | 19.55 | 8.77 | 0.83 | 1.22 | 0.60 | 0.50 | 100.01 |

summary compared with the earlier period. Possible explanations for these differences were given.

In the phosphate versus pH and in the potash versus pH studies of the 1961 data the highest percentages of samples were in the low and medium classes at soil pH's of 6.1 to 7.0 inclusive. A breakdown of the very high phosphate data showed that there was no well defined place at which numbers of samples rapidly declined. There seemed to be a slight increase or buildup at the top or 901+ class in very high phosphate. However, in the potash versus pH study there was a well defined place at which numbers of samples rapidly declined. This was between the high and the very high classes. There was no increase in percent of samples at the top of the very high potash classes.

Literature Cited

1. BARBER, STANLEY A. and ROY D. BRONSON. 1958. Soil fertility maps of Indiana. Purdue University Bulletin 664: 1-12.
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