North American Soil Test Summary

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Abstract. With the assistance and cooperation of numerous private and public soil testing laboratories, the International Plant Nutrition Institute (IPNI) periodically summarizes soil test levels in North America (NA). Soil tests indicate the relative capacity of soil to provide nutrients to plants.

Therefore, this summary can be viewed as an indicator of the nutrient supplying capacity or fertility of soils in NA. This is the eleventh summary completed by IPNI or its predecessor, the Potash & Phosphate Institute (PPI), with the first summary dating back to the late 1960s (Nelson, 1980). The summary offers a snapshot view of soil test levels in 2015, but also provides a comparison to the previous three summaries which were completed in 2001, 2005, and 2010 (Potash & Phosphate Institute, 2001; 2005). Since the 2015 summary is the fourth summary in which laboratories were asked to contribute complete frequency distributions of soil test results, temporal trends in soil test level distributions can be viewed for states and provinces.

The increase in samples in this year's summary reflects the growing influence of precision agriculture in production systems. While we cannot say that the increase in samples relates directly to precision

sampling schemes, the trend for more data to support precision activities supports the increase in samples submitted.

Important to appropriate use of this report is recognition that nutrient management should occur on a site-specific basis where management objectives and the needs of individual fields and, in many cases areas within fields, are recognized. Therefore, a general soil test summary like this one cannot reflect the specific needs of individual farms. Its value lies in calling attention to broad nutrient needs, trends, and challenges, and in motivating educational and action programs that are in turn relevant to growers and their advisers.

Keywords. *Soil Test Summary, North America, Soil, Fertilizer, Nutrients*

Introduction

With the assistance and cooperation of numerous private and public soil testing laboratories, the International Plant Nutrition Institute (IPNI) periodically summarizes soil test levels in North America (NA). Soil tests indicate the relative capacity of soil to provide nutrients to plants. Therefore, this summary can be viewed as an indicator of the nutrient supplying capacity or fertility of soils in NA. This is the eleventh summary completed by IPNI or its predecessor, the Potash & Phosphate Institute (PPI), with the first summary dating back to the late 1960s (Nelson, 1980). The summary offers a snapshot view of soil test levels in 2015, but also provides a comparison to the previous three summaries which were completed in 2001, 2005, 2010 (Potash & Phosphate Institute, 2001; 2005). Since the 2015 summary is the forth summary in which laboratories were asked to contribute complete frequency distributions of soil test results, temporal trends in soil test level distributions can be viewed for states and provinces.

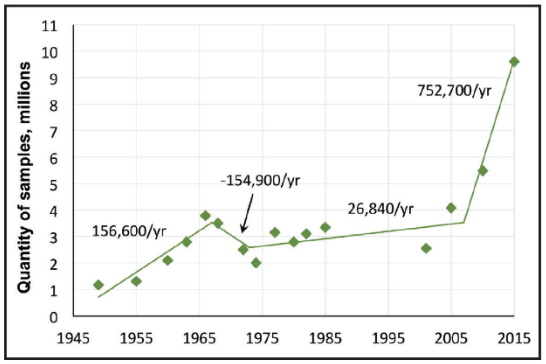

Figure 1. Soil sample volume in the U.S., 1949-2015.

This soil test summary includes the following tests and numbers of soil samples:

- P tests on 7.5 million samples
- K tests on 7.3 million samples
- pH tests on 7.2 million samples
- Mg tests on 5.9 million samples
- S tests on 4.9 million samples
- Zn tests on 4.4 million samples
- Cl^- tests on 0.4 million samples

The samples were collected in the fall of 2014 or spring of 2015 and therefore reflect fertility status for the 2015 crop year. The sample volumes above continue the increases observed since the 2005 summary that likely reflect increased soil sampling in North America.

Methods

Many soil test procedures are used for P and K determination in North America, although just a few are dominant. In order for data to be pooled among laboratories using different procedures, ranges of agronomic equivalency for each test were defined. These ranges were either taken from the literature or estimated by soil fertility specialists in consultation with IPNI NA or Nutrient Program Directors. In the summary, all soil test data are reported in terms of well-known soil test procedures. Procedures used for reporting purposes are Bray and Kurtz P1, ammonium acetate extractable K and Mg, 1:1 soil:water pH, calcium phosphate extractable S, DTPA extractable Zn, and water extractable Cl-. Although an attempt was made to define calibration equivalency for each of the soil test categories among the various testing procedures, it is likely that error was introduced in this process.

A challenge in pooling data from many laboratories over a period of years is to accurately account for changes in extractants, how the extractants are employed in a specific procedure, how the elements are detected in the extracted solution, and finally, how the results are reported to clients. Changes in or miscommunication about any of these steps can result in serious errors

in the summary process. The IPNI staff and cooperating laboratories often communicated several times to ensure the accuracy of these factors. The software capability for conducting database queries differs markedly from laboratory to laboratory. Some laboratories were not able to provide queries for the soil test ranges specified in the protocol. In such cases, data interpolation routines were created by IPNI staff and used to translate between the two systems. Some IPNI Directors used their own methodology; however, during the 2015 summary, a standard methodology was developed for those Directors not using their own method.

Summary

The 2015 Soil Test Summary is the biggest summary to date. Over 7 million soil samples were submitted by private and public laboratories. Many different charts and maps were created for analysis for the soil samples: distribution charts, average change charts, median charts, median maps, percent blow maps, change in percent blow maps, and state critical levels. Results of the soil tests are can be viewed, in detail, on the new Soil Test Summary website at: www.soiltest.ipni.net. On the website the user can look at any combination of region (State, Providence, custom region), year (2001, 2005, 2010, 2015), element (P, K, pH, Mg, S, Zn, Cl^-) and view the results. Examples of some of the charts and maps that can be produced are below:

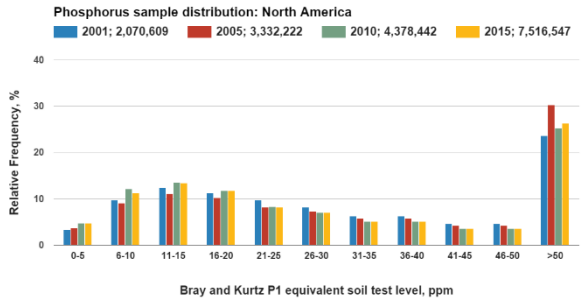

Figure 2. Relative frequency distribution of Bray and Kurtz P1 equivalent soil test levels for North America from 2001-2015.

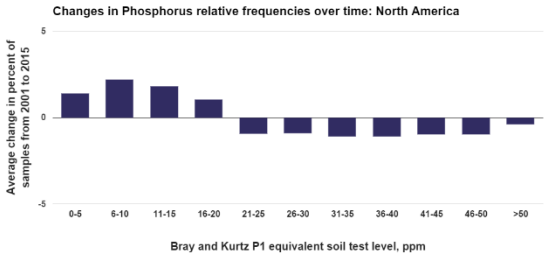

Figure 3. Average change in Bray and Kurtz P1 equivalent soil test levels for North America from 2001-2015.

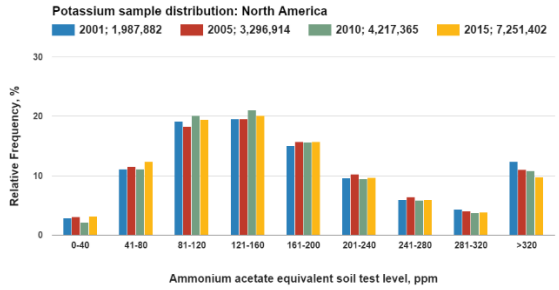

Figure 4. Relative frequency distribution of ammonium acetate equivalent K soil test levels for North America from 2001-2015.

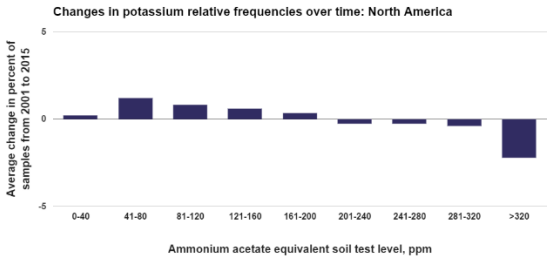

Figure 5. Average change in ammonium acetate equivalent K soil test levels for North America from 2001-2015.

References

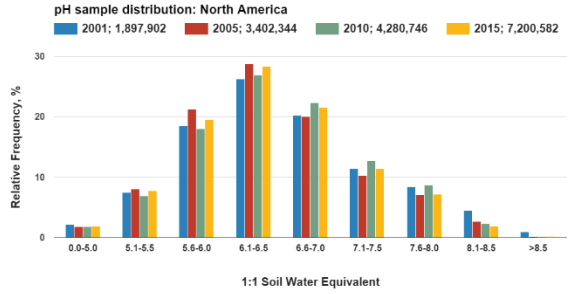

Figure 6. Relative frequency distribution of pH soil test levels for North America from 2001-2015.

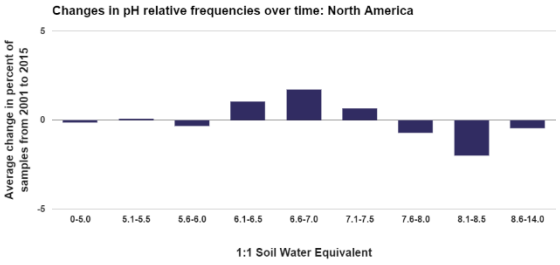

Figure 7. Average change in pH soil test levels for North America from 2001-2015.

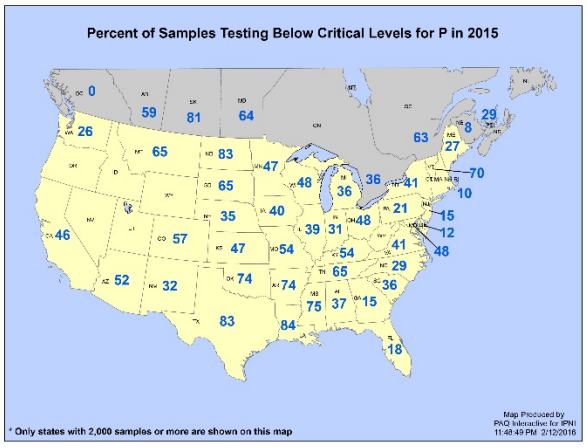

Figure 8. Percent of samples testing below critical levels for P for major crops in 2015.

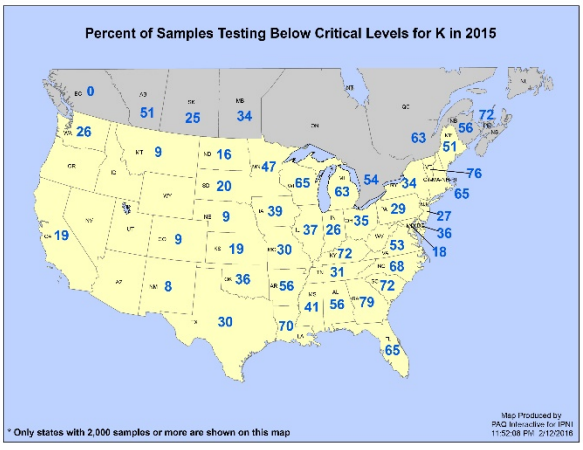

Figure 9. Percent of samples testing below critical levels for K for major crops in 2015.

Nelson, W.L. 1980. Soil test summaries and their interpretation. Better corps with Plant Food. 63(4): 6-10.