

Seasonal P Demonstration/Research Project – 2001

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Participating Consultants: Richard Wildman (Agricultural Consulting Services Inc.), David DeGolyer (Western New York Crop Management).

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Introduction

Cornell University annually publishes the "Cornell Guide for Integrated field Crop Management". Included in this guide are recommendations for nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and micronutrients for a large number of field crops in New York. The recommendations are based on decades of field research in NY showing soil nutrients extracted with sodium acetate buffered at pH

4.8 (Morgan solution) are correlated well with crop yield for the vast array of NY soil types.

Most of the private soil-testing laboratories that serve NY producers use the Mehlich-III extraction, an unbuffered solution of acetate, ammonium nitrate, ammonium fluoride, and ethylenediaminetetraacetic acid (EDTA). K, Ca, Mg and Na are extracted by the ammonium nitrate and nitric acid. Phosphorus is extracted by reaction with the acetic acid and fluoride and the micronutrients are extracted by the interactions of ammonium and EDTA.

For the wide variation in New York soils, the Mehlich-III solution extracts 5 to 20 times as much P as the Morgan solution depending on the amount of Mehlich-III extractable Al in the soil. The Bray-1 solution extracts about 80-85% of the amount of P extracted by the Mehlich-III solution. Due to the larger amount of P extracted with the Mehlich-III solution, one would expect Mehlich-III P levels to be less influenced by environmental changes (i.e. moisture, temperature etc.). This may have implications for assessment of environmental (runoff) risk of phosphorus as well as the accuracy of agronomic P recommendations.

Objectives

In spring of 2001, a study was initiated to answer the following questions:

- What is the seasonal variability of soil test P values using the Morgan, Mehlich-III and Bray-1 extraction solutions?
- How does depth of sampling affect these variations?
- Do calcareous and acidic soils differ in their response to climatic changes?

Approach

Field crops extension educators, consultants, research and teaching institutes and commercial laboratories were asked to collaborate in this project. Seven extension agents, two consultant firms and three research/teaching institute managers selected a total of 44 sites throughout NY. Sites were selected based on soil classification (calcareous soils and/or soils with a native low pH) and soil test P level. Soil test levels were divided into six classes:

- < 8 lbs P/acre (low to medium);
- 9-19 lbs P/acre (high);
- 20-39 lbs P/acre (high);
- 40-80 lbs P/acre (excessive);
- 81-150 lbs P/acre (excessive);
- >151 lbs P/acre (excessive).

Soil types represented in this project are: Fremont (1), Willowemoc (2), Tunkhannock (2), Barbour (2), Volusia (2), Howard (6), Langford (2), Madrid (1), Arkport (1), Knickerbocker (2), Phelps (2), Lima (5), Amenia (2), Conesus (1), Lansing (1), Ontario (2), Dunkirk (1), Nellis (1), Galway (1), Teel (1), Honeoye (3), Wallkill (1), Hogansburg (1), Cosad (1). In between brackets is the number of sites within a specific soil type.

The 44 sites were first sampled between May 17 and 25, 2001. Samples were passed through a 2 mm sieve after arrival at Cornell's Nutrient Analysis Laboratory and dried overnight at 55°C. At Cornell University, samples were analyzed for pH, organic matter, Morgan extractable P, K, Ca, Mg, Fe, Al, Mn, Zn, and nitrate (see Figure 2). Subsamples were sent to Brookside Laboratories Inc. for pH, Bray-1 P, and Mehlich-III extractable P, K, Ca, Mg, Na, S, Fe, Mn, Cu, Zn, B and Al. Spectrum Analytic Inc. analyzed the samples for pH, organic matter, and Mehlich-III extractable P, K, Ca, Mg, Mn, Zn and Al. Thus, although the main focus of this study is soil phosphorus, the data collected will also address seasonal variability of soil pH and Mehlich-III extractable K, Ca, Mg, Na, S, Fe, Mn, Cu, Zn, B and Al. Sites were re-sampled between June 18 and 25 and between July 18 and 25. Future sampling is planned for the months of October and November, 2001 and April, 2002. Five corn plants will be harvested at each site in August/September of 2001 to determine whole plant nutrient concentrations and removal as a function of soil test nutrient level. This will aid in the development of a database on P removal rates for corn silage.

Each sampling location consists of a strip 10 feet in length between two corn rows. Samples are taken over two depths: 0-2 inches and 0-8 inches (Figure 1). Soil temperatures at 1 and 4 inches depth are recorded at the time of sampling and gravimetric moisture contents are determined upon arrival in the laboratory.



Figure 1: Soil samples were taken over 0-2 and 0-8 inches depth.



Figure 2: Soil samples are analyzed for pH, organic matter, nitrate and Morgan extractable P, K, Ca, Mg, Fe, Al, Mn, and Zn in the Cornell University Nutrient Analysis Laboratory. Brookside Laboratories Inc. and Spectrum Analytic Inc. analyze the samples for pH, Mehlich-III extractable nutrients and Bray-1 P.

Preliminary Results

Of the 44 sites, 21 were on calcareous soils while 23 were acidic in nature. Soil test P levels ranged from 2 to 502 lbs P/acre (Morgan extraction). Table 1 gives an overview of the soil test P levels obtained in the May 2001 sampling.

Table 1: Soil test P levels of the 44 sites in this study taken over 0-8 inches in May 2001.

Soil test P range (lbs P/acre, Morgan)	Calcareous	Acidic
<8	4	4
9-19	5	2
20-39	3	5
40-80	2	6
81-150	4	2
>150	3	4
Total	21	23

No seasonal variability in pH was seen (Figure 2) between the sampling in May and in June. However, the June samples showed a 9% increase in Morgan extractable P (Figure 3). Mehlich-III and Bray-1 P analyses are being conducted and we will continue to take samples in the months of July, October and November, 2001 and in April 2002.

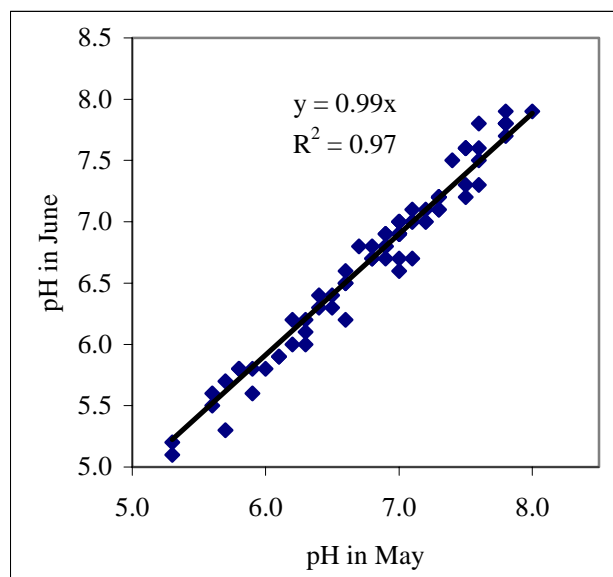


Figure 2: pH in May and June, 2001.

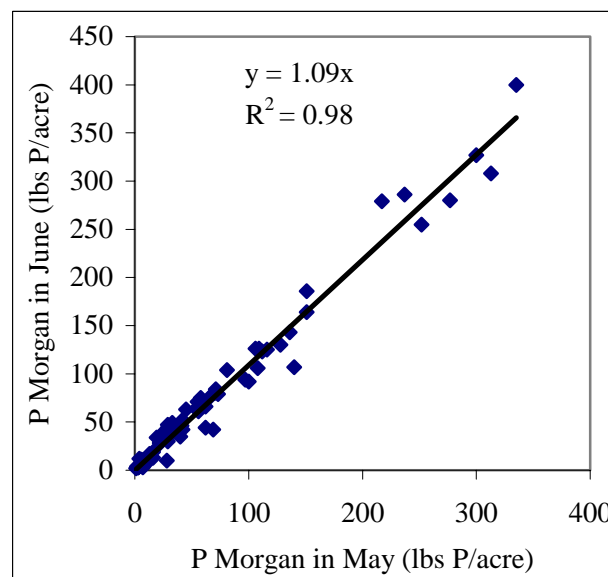


Figure 3: Extractable P (Morgan) in May and June, 2001.

For Further Information

Information on this project can be obtained from Quirine Ketterings (qmk2@cornell.edu or 607 255 3061) or Tim Byron (tmb29@cornell.edu or 607 255 9875). You can also write to: Quirine Ketterings, Nutrient Management Spear Program, Department of Crop and Soil Sciences, Cornell University, 817 Bradfield Hall, Ithaca NY 14853. Updates on the project will regularly be made available through the website of the Nutrient Management Spear Program (see below).

Nutrient Management Spear Program: <http://www.css.cornell.edu/nutmgmt/index.html>

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