Analysis of Soils on the Caribbean Island of Dominica

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Abstract

Soils literally provide food on the table for the people of Dominica. Our study emphasized exploring the characteristics of soils from various parts of the island as well as those in the field station. Our results were for the most part as expected; soils from the station were of better agricultural usage and less weathered than those found on the heights of Morne Trois Pitons. Moisture varied to a great degree and was lower at high elevations. Further research is needed to fully understand the soils of Dominica, but our research has assisted in establishing the groundwork for the basic knowledge of the soils found on the island.

Introduction

Soils are a very important resource of every nation. If neglected, entire economies can fail and erosion and dust storms can lay waste to the land. Dominica is very susceptible to landslides, making the study of soils very useful. Our aim in this study was to examine the nutrient properties of soils ranging greatly in elevation from 1200ft to 3200ft. Differences in rainfall, slope, and other factors were expected to play a big role in the soils found in the field station compared, for example, to Boeri Lake. Through a series of tests we were able to discover some important properties such as Nitrogen, Phosphorus, and Potassium and relate them to quality in terms of agricultural usage.

Material and Methods

Nine soil samples were collected across the various trails. Samples one and two were collected along the Middleham Falls Trail, three and four were collected along the Mt. Joy Trail, five and six were collected from the Boeri Lake Trail, and samples seven, eight, and nine were collected from the gardens surrounding Springfield Station. Each sample was collected using an Oakfield model, 19” tube auger made by Forestry Suppliers. Once collected, each sample was placed in a Ziploc bag and numbered. A soil moisture reading from each retrieval spot was obtained after collection and recorded.

Due to the lab oven being out of service, the soil was dried naturally by the sun. Each sample was set out in an aluminum pan on a table exposed to sunlight, and after a few hours the samples were all completely dried. Once dry, each sample was crushed into the smallest aggregates possible and then sifted to remove any pieces of grass or rocks still mixed in the sample. The crushed samples were placed each placed in a plastic cup until further needed, so as

to not acquire moisture again. The next step was to test soil pH, as well as the nutrient levels of Nitrogen, Phosphorous, and Potassium in each soil observed. Each test was done using the Mosser Lee, Soil Testing Kit, containing four clear vials and 60 indicator tablets, as shown in Figures 1 and 2, and requiring extra plastic cups, a squirt bottle for rinsing, a disposal container for getting rid of used soil and water, and a measuring spoon.

Fig. 1- Indicator tablets used to show pH and nutrient levels.

Fig. 2- The four, unbreakable test tubes used for each test.

To test the soil pH, the pH vial was filled to the top line with water and a capful of soil was mixed in for each individual soil. A pH tablet was then dropped in and the mixture shaken to provide a color indicating the pH content of each sample. A similar procedure was used for each nutrient test as well. Before doing the nutrient tests, a mixture had to be made for each sample consisting of two tablespoons of water, a teaspoon of the soil, and two tablets of Floc Ex TesTabs. The liquid from the mixture was then used for the following nutrient tests to determine if nutrient levels were low, medium, or high by use of color charts made for each individual test.

The Nitrogen (N) test was comprised of filling the N vial to the lower line with the Floc Ex liquid and then mixing that solution with an N tablet until the tablet was fully dissolved or the indicator color clear. The Phosphorous (P) test consisted of filling the P vial to the quarter line

with the Floc Ex liquid, adding water till the solution reached the top line, and adding a P tablet. It was then mixed until the tablet fully dissolved or the solution was made clear. The last test was done in a similar fashion, filling each Potassium (K) vial all the way to the top line with the Floc Ex liquid and mixing with a K tablet until everything was dissolved or the solution clear. All of these results were recorded and placed in an excel document for analysis.

Results

In gathering soil profiles, there was little difference in soil coloration and horizons between many of the collected profiles. However, there was an obvious change in profile coloration in comparing soils from higher elevations verses those found in the Springfield gardens. As shown in Figures 3 and 4, the garden soils had a visibly higher organic matter content with drastically darker coloring.

Fig. 3- Soil profile collected from Boeri Lake.

Fig. 4- Soil profile collected from Springfield garden.

As expected, the soils surrounding Springfield Station were of better quality in reference to growing crops. Our soil testing kit showed the pH levels varied from anywhere from 5.8 to

6.8. In Figure 5, the pH values for each location are represented and show the slight variation among the soils.

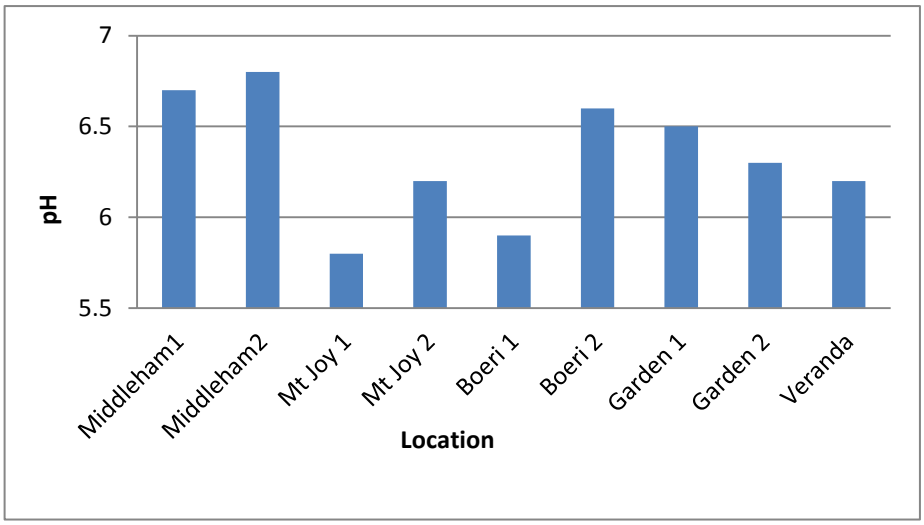

Fig. 5- pH levels of each soil sample

Soil moisture was also collected at each sample site. As the numbers showed, there was a definite higher moisture percentage in the garden soils acquired. Figure 6 provides a visual breakdown of these soil moisture percentages we tested.

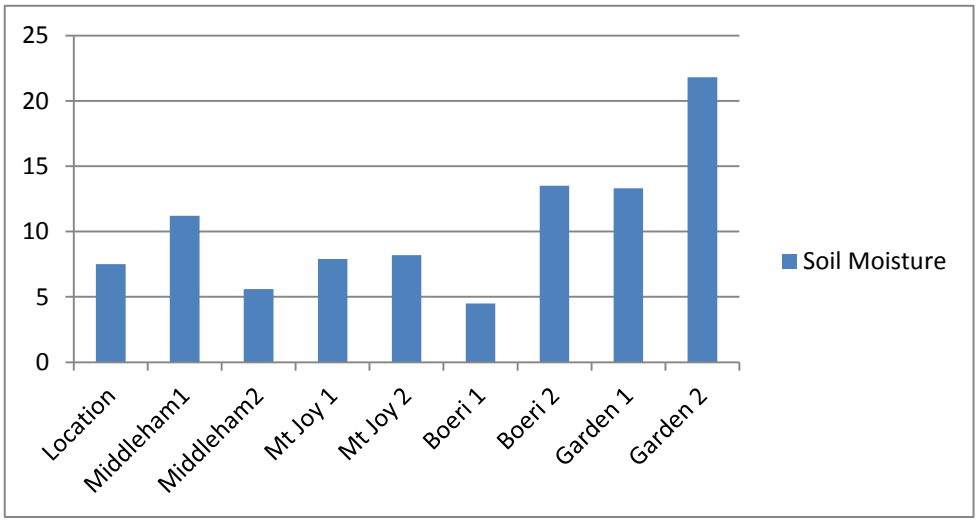

Fig. 6- Soil Moisture levels of each soil sample

The remainder of our research consisted of testing soil nutrient levels at each sample site. For Nitrogen (N), Phosphorous (P), and Potassium (K) levels, values of low, medium, and high were obtained. Consistently, all soil samples were low in Nitrogen. The second Mt. Joy sample had the lowest nutrient levels overall, whereas the second Middleham Trial sample and the veranda butterfly garden had similar, higher nutrient levels. In particular, the garden soils were lacking in Nitrogen and Phosphorous, which is much more crucial in an agricultural setting verses along the other trails.

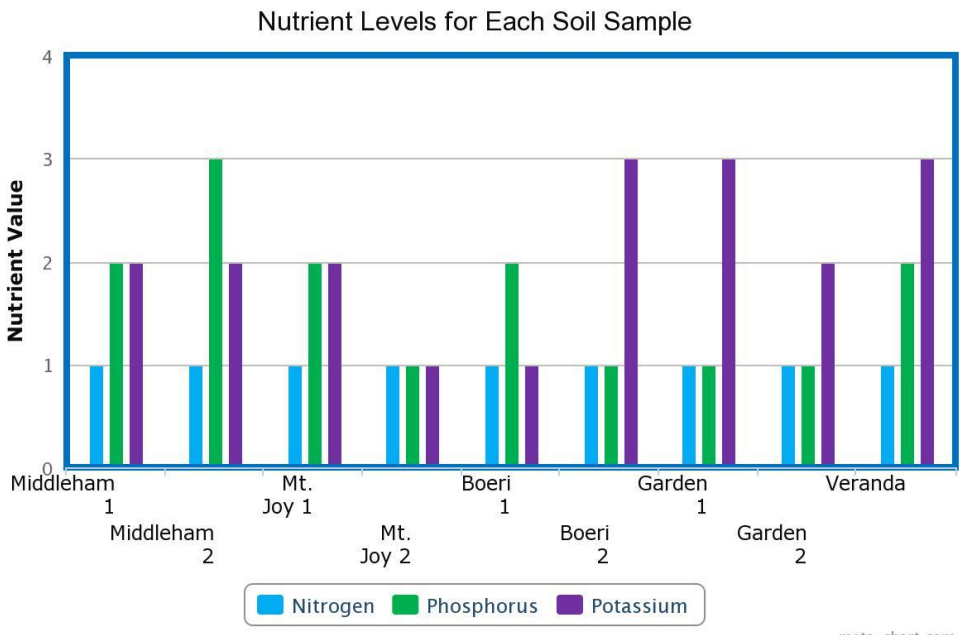

Fig. 7- Nutrient levels of all soil samples

Discussion

The high slopes of the Boeri Lake as well as Mount Joy are expected to contribute heavily to the high amounts of clay found in the A and B horizons we sampled; erosion undoubtedly washed away the silt and sand long ago. We made sure to sample from the highest terraces when taking the field station soils to account for the deep tillage of the soil profiles in the lower garden. Unexpectedly, the highest altitude samples had the least moisture. Perhaps this

was due to the high clay content interfering with the moisture meter or a lack of permeability of the soil due to weathering. In addition, the consistently low Nitrogen levels for all samples provided data indicating Dominican soils are low in Nitrogen in general; but further research can be done in determining the accuracy of these readings by using soil nutrient meters that can produce exact numbers of nutrient content.

Overall, the gardens were found to be the best soils overall to grow crops. When sampling, we noticed pungent compost piles nearby which may explain why they performed so much better in our testing. This also explains the darker profiles we collected from the gardens; having compost added to the soils provides better nutrient uptake, water retention, and health of the soil in general. Also, according to Hefty (2012) the optimum pH of agricultural soils lies somewhere be 6.3 and 7.3. Based on the acquired data, the garden pH was in best range possible, and if anything, minimal amounts of lime could be added to bring the pH up just slightly. Other than that, the garden soils only lacked Nitrogen and Phosphorous.

We recommend to Springfield gardeners that moderate amounts of Nitrogen and Phosphorous be added to the soils. This can be done by adding portions of humic matter to the soils in order to initiate better retention of nutrients, better stability of the soil and further moisture retention as well. In the future, continued research can be done in order to find a greater correlation between soil nutrient uptake and elevation of agricultural fields.

Acknowledgements

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