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Potassium Analysis of Soils on the Campus of Savannah State College

by

Charles Pratt*

Potassium is quite unlike most macro-metallic elements required by plants, because it is not definitely known to be built into organic compounds essential for continued existence of the plant. It occurs in plants principally as soluble inorganic salts, which are taken up from the soil and translocated to growing parts of the plant. The fundamental role of potassium in plant metabolism is probably catalytic or regulatory.

Because most potassium compounds are soluble, areas of high rainfall are generally low in potassium. With the intensified lawn-grassing program beginning at Savannah State College, it became desirable to analyze the soil for the major plant nutrients in the various locations on the campus. Because of Savannah's high annual rainfall and the high leachability of potassium, the study was begun with this element first.

The method of study used was a colorimetric one involving various reagents to produce a colored solution whose intensity was directly proportional to the concentration of potassium. This type of analysis is based upon Beer's Law[1] which states that for a solution of a given material the amount of light absorbed is directly proportional to the concentration, all other factors being constant. Mathematically the law is written:

$$-\log\frac{I}{Io}=K^{\circ}_{\lambda}\,dC$$

Experimental

Soil samples were placed in prepared ½ pound bags of not more than an inch thickness for two or three days. Five-gram samples of the air-dried soil from each area were shaken with 10 ml. of sodium nitrate solution for 1 minute. The sodium nitrate solution was prepared by dissolving two hundred fifty grams of the salt and diluting to one liter. The solution containing the soil was filtered.

The filtrate was cooled by placing the tubes in a cold water bath. A solution of sodium cobaltinitrite was made by dissolving 50 grams of cobalt nitrate and 300 grams of sodium nitrite in distilled water, acidifying with 25 ml. of acetic acid, and diluting to one liter. This solution was cooled and left unstoppered for 24 hours, after which it was filtered into a brown bottle at a temperature between 16 and 23 degrees centigrade.

* The investigator is indebted to Idella Glover, a chemistry student, at Savannah State College, for her cooperation and assistance.

[1] Paul, M. A., *Physical Chemistry*, D. C. Heath and Company, Boston (1962), p. 379.

A solution of 95% ethyl alcohol was cooled in an ice bath. Two milliliters of this solution were measured into clean absorption tubes, 6 drops of the sodium cobaltinitrite solution were added and the mixture was shaken. This gave a yellow precipitate.

Two milliliters of the cooled soil extract were injected immediately into the center of the cobaltinitrite-alcohol mixture and allowed to stand ten minutes, after which the tubes were placed in the "Spectronic 20" spectrophotometer and the absorption read at a wavelength of 500 millimicrons. The photometer readings were converted to parts per-million (p.p.m.).

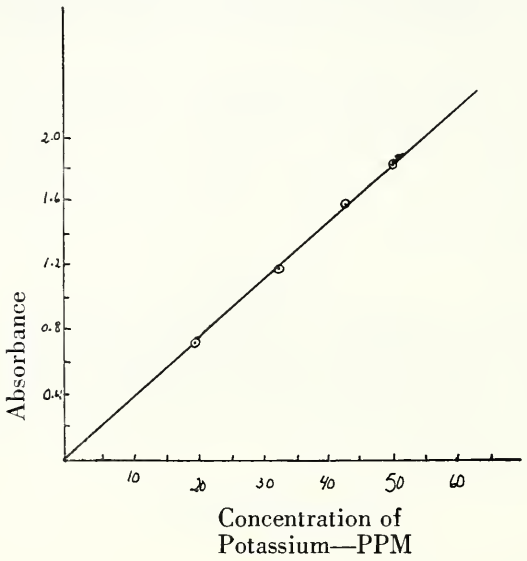

Figure 1. Standard Potassium Curve

Standard Potassium Curve: Solutions of the sodium cobaltinitrite-alcohol were prepared as described above. Two ml. of potassium chloride solution of varying but known concentrations were added to each of two samples of the cobaltinitrite alcohol solution. Also two ml. of distilled water were added to a solution of cobaltinitrite to serve as a blank. The standard curve is shown in figure 1. To convert to pounds per acre the photometer readings were multiplied by four.[2]

SUMMARY

Soils from various areas of the Savannah State College campus have been analyzed for potassium, by colorimetric methods, and found to be low in this element.

[2] Kitchen, H. B., *Diagnostic Techniques for Soils and Crops,* American Potash Institute, Washington, D. C. (1948), p. 62.