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Available Potassium

1. Application

This procedure covers the extraction and analysis of plant available potassium (K) in soil.

2. Summary of Methods

Plant available K is extracted with the Bray P1 reagent, 0.03 N NH_4F, 0.025 N HCl. It is not the same procedure, but it is the same extracting solution. The NH_4^+ and H^+ ions displace exchangeable K from cation exchange sites in the soil. Water soluble K is also extracted. This procedure extracts approximately 90 % as much K as the 1 N NH_4Oac procedure.

Extracted K is analyzed using an atomic absorption spectrophotometer, ICP-OES or a flame photometer. Phosphorus is extracted simultaneously with K and analyzed separately.

3. Safety

Each chemical compound should be treated as a potential health hazard. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material handling data sheets should be made available to all personnel involved in the chemical analysis.

4. Interferences

Potassium is partially ionized in the air acetylene flame of AA. To suppress ionization, cesium nitrate or chloride solution can be added to give a final concentration of 1000 ppm in all solutions including the standards and blank. The purest available cesium compound must be used to avoid potassium contamination.

5. Apparatus and Materials

5.1 Soil scoop calibrated to hold 1.5 g of light-colored silt loam soil.
5.2 Erlenmeyer flasks (50 ml).
5.3 Constant suction pipette apparatus (15 ml).
5.4 Time-controlled oscillating shaker (Eberbach) set at 160 excursions per minute.
5.5 Filter paper (9 cm Whatman No. 2 or equivalent).

5.6 Funnel tubes (15 ml)
5.7 Disposable plastic test tubes (13x100).

6. Reagents.

6.1 Stock P-A solution (1.25 N HCl, 1.5 N NH_4F): Add 54 ml of 48% HF to 700 ml of deionized water. Neutralize to pH 7.0 with NH_4OH (This makes 2 N HF). Add 108 ml of concentrated HCl (11.6 N) and dilute to 1 liter.
6.2 Dilute P-A solution (0.025 N HCl, 0.03 N NH_4F): Dilute 20 ml of stock P-A solution to 1 liter with deionized water.
6.3 Standard K stock solution: 10,000 ppm K
6.4 15 ppm K bulk standard solution (1.5 ml 10,000 ppm K stock solution diluted to 1 L with dilute P-A solution.)
6.5 Optional: 10,000 ppm cesium chloride solution (12.67g cesium chloride [ultra configuration grade] in 1 liter of 1% HNO_3).

Note: To suppress ionization of K, cesium chloride solution is added to all samples, blanks and standards to give a final concentration of 1000 ppm.

7. Methods

7.1 Place a 1.5-g scoop of soil into a 50-ml Erlenmeyer flask.
7.2 Add 15 ml of dilute P-A solution with the constant suction pipetting apparatus.
7.3 Shake the suspension on an oscillating shaker for 5 min.
7.4 Filter through filter paper into a 15-ml funnel tube.
7.5 Determine K in the clear filtrate using an atomic absorption spectrophotometer, ICP-OES or a flame photometer.

8. Calculations

Any necessary weight to volume dilutions are performed by computer during analysis, (in this case ppm in soil x 10).

9. Quality Control

9.1 Laboratory Reagent Blank (LRB) - At least one LRB is analyzed with each batch of samples to assess contamination from the laboratory environment. Contamination from the laboratory or reagents is suspected if LRB values exceed the detection limit of the method. Corrective action must be taken before proceeding.
9.2 Standard soil - One or more standard soils of known extractable K content is analyzed with each batch of samples to check instrument calibration and procedural accuracy.

10. Reporting

Results are reported as available ppm K in soil.

11. References

11.1 Bray, R.H., and L.T. Kurtz. 1945. Determination of total, organic, and available forms of phosphorus in soil. Soil Sci. 59:39-45.

11.2 Munter, R.C. 1988. Laboratory factors affecting the extractability of nutrients. pp. 8-10. *In* W.C. Dahnke (ed.), Recommended Chemical Soil Test Procedures for the North Central Region. NCR Publ. 221 (revised). ND Agr. Exp. Sta., Fargo, ND.