PFP7 Flame Photometer Protocol: P05-001A

The Determination of Available Potassium in soils

Introduction

Soil is a complex mixture of mineral particles, organic matter, water and air. The mineral particles come from the breakdown of rocks. As rocks break down into the particles of sand, silt and clay that make up soil, potassium and other elements are released and may become available to plants. It is important to assess the quantity of potassium in the soil solution and the readily available pool to ascertain whether or not to apply potassium fertilizer.

Potassium is extracted from air-dried soil samples by shaking with 0.5M ammonium acetate/acetic acid solution for 30 minutes. This effectively displaces the potentially available K^+ ions. The potassium content of the filtered extract is then determined using a Jenway PFP7 Flame Photometer.

Materials required

Ammonium Acetate/Acetic Acid

- Aqueous solution: 0.5M with respect to both reagents (38.55g ammonium acetate and 29ml of glacial acetic acid, diluted to 1 litre with deionised water).

Standard Potassium Solution: 2000ppm

- Accurately weigh 1.907g of potassium chloride previously dried for 2 hours at 105°C.
- Dissolve in about 50ml of the ammonium acetate/acetic acid solution.
- Transfer to a 500ml volumetric flask and dilute to 500ml with the ammonium acetate/acetic acid solution.

Other equipment

Balance
100ml polyethylene bottles
Measuring cylinder
Shaker
Funnel
Whatman No. 2 filter paper

Method

1. Pass the sample of air-dried soil through a 2mm sieve. Using a scoop, measure out 10ml of the sieved soil without tapping to avoid compacting. Transfer to a 100ml polyethylene bottle, together with 50ml of the ammonium acetate/acetic acid solution.

2. Stopper the bottle, transfer to a shaker and shake for 30 minutes (275 strokes per min, 25mm travel).

3. Remove from the shaker, allow to stand for several minutes and then decant the supernatant liquid through a dry Whatman No. 2 filter paper.

4. Prepare potassium standard solutions to cover the range 0 to 100 ppm potassium (see below).

5. Set the Flame Photometer at 100 using the 100ppm potassium solution.

6. Successively aspirate the 20, 40, 60 and 80 ppm potassium standard solutions and prepare a calibration graph.

7. Determine the potassium content of the soil extract by aspirating the solution, diluting as necessary in ammonium acetate/acetic acid solution. Calculate the concentration by reference to the calibration graph, taking into account any dilution factors.

Preparation of potassium standard dilutions

1. Transfer 25ml of the 2000ppm potassium standard solution to a 100ml volumetric flask and dilute to 100ml with the ammonium acetate/acetic acid solution. This solution contains 500ppm potassium.

2. Transfer 10ml, 20ml, 30ml, 40ml and 50ml aliquots of the 500 ppm potassium solution to 250ml volumetric flasks. Dilute to 250ml with the ammonium acetate/acetic acid solution and mix well. These solutions contain 20, 40, 60, 80 and 100 ppm potassium respectively.

Results

Normally the results are reported as ppm potassium in the extract. These can be classified in a descriptive scale (1) as shown in the table below.

Index	mg/l (ppm)	Status
0	0-60	Very low
1	61-120	Low
2-	121-180	Moderate
2+	181-240	Moderate
3	241-400	High
4	401-600	Very high
5	601-900	Very high
6	901-1500	Very high
7	1501-2400	Very high
8	2401-3600	Very high

References

(1) Rural Development Service Technical Advice Note 31; Defra, November 2005.