

## SHORT COMMUNICATION

### **Analytical technique of the Pw method, used for the assessment of the phosphate status of arable soils in the Netherlands**

#### *Summary*

The paper deals with the analytical technique of a new method for the assessment of the phosphate status of soils, characterized by aqueous extraction at a wide water : soil ratio *viz* 60 : 1 (volume/volume) the soil being moistened 22 hours preceding the extraction.

#### *Introduction*

A new technique involving aqueous extraction of soil phosphate has been developed by the author and Van der Paauw<sup>2,3</sup> in co-operation, assisted by J. Ris.

In the paper<sup>2</sup> of Van der Paauw (also appearing in this issue) the importance of the Pw method for the assessment of the phosphate status of arable soils has been shown. The method has proved to be essentially non-soil-type specific.

A study on some aspects of the behaviour of phosphate in soil-water systems has already been given in a former paper<sup>5</sup>. More detailed information concerning the development and motivation of the analytical technique of the method will be given in a future paper<sup>6</sup>.

#### *Preparing the soil sample*

Dry sample at 30°-40°C. Remove coarse particles (plant residues and grit), grind and pass through a 2-mm sieve.

#### *Drawing of working sample*

Fill the scoop (Fig. 1) amply and pack down the contents by standardized tapping or vibrating. Level off with spatula. Transfer contents (1.20 ml) to flask of about 125 ml.

#### *Moistening*

Moisten the 1.20 ml sample with 2 ml demineralized water. Shake a few times by hand. Stand for 22 h at 20°C.

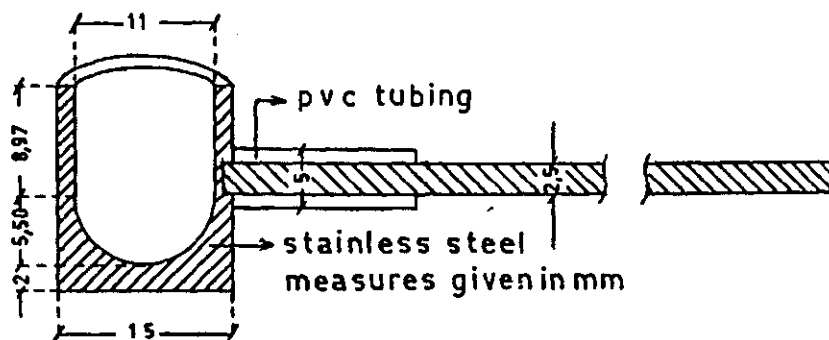


Fig. 1. Technical drawing of the scoop used for acute measuring the working sample.

#### *Adding water and shaking*

Add 70 ml demineralized water of 20°C, shake vigorously for 1 h at same temperature (160–170 strokes per min. with bottle upright, or 30 rpm if turning bottle end over end). Thus the water/soil ratio has become 60:1, both on volume basis.

#### *Filtering*

Start filtering after an approximately fixed time. The filter must be fine and should neither release nor adsorb phosphate. To avoid turbidity

1. use two filter discs folded together
2. wax margin of filter discs with paraffin wax to prevent the suspension from creeping over the edge
3. discard the first millilitres of filtrate (which are often turbid).

If, exceptionally, the whole filtrate is turbid, add some 1.5 g NaCl crystals to 50 ml of filtrate, and filter again over clean paper (the NaCl concentration of about 0.5 N does not influence the estimation of phosphate).

#### *Reagents*

For Murphy and Riley's colorimetric method<sup>1</sup> of estimating phosphate the following reagents are needed (all phosphate-free):

1. Sulphuric acid 5 N
2. Molybdate solution: 4%  $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4 \text{H}_2\text{O}$  stored in the dark or in a brown bottle
3. Ascorbic acid solution 1.75% (cannot be kept longer than a day)
4. Potassium antimonyl tartrate solution obtained by dissolving 0.275 g  $\text{KSbOC}_4\text{H}_4\text{O}_6 \cdot \frac{1}{2} \text{H}_2\text{O}$  in demineralized water and diluting to 100 ml (cannot be kept for more than a few weeks).

Mix 160 ml of 1, 50 ml of 2, 100 ml of 3 and 16 ml of 4. Make up to one litre, mix, and after 20 min. filter to eliminate a blue colloidal precipitate which may form.

The mixture can be kept only a day.

### Standard solutions

Dissolve 1.9167 g  $\text{KH}_2\text{PO}_4$  (prepared according to Sørensen) in demineralized water and dilute to 1 litre (1 ml contains 1 mg  $\text{P}_2\text{O}_5$ ). Prepare dilutions of this solution containing 10, 20, 40, 60 and 80  $\mu\text{g P}_2\text{O}_5$  per 20 ml. Store all solutions in the dark.

### Colorimetric analysis

Transfer 20 ml of the reagent mixture to bottles of about 100 ml.

1. Standards. Add 20 ml of the standard solutions. Include a blank (20 ml water).
2. Filtrate. Add 20 ml of the filtrate.

Mix well, wait 20 min and measure the absorbance of the solutions using a 1-cm cuvet:

- a. in a spectrophotometer at a wavelength of 882 nm or, if interference of Sn can be expected, at 720 nm (see under Interferences), or
- b. in a colorimeter with a red-glass filter or an interference filter with maximum transmission at about 850 nm (*i.e.* the highest obtainable) or at 720 nm if Sn interferes.

The absorbance of the blue solution remains constant for at least 12 h.

Beer's law is followed up to 80  $\mu\text{g P}_2\text{O}_5$  per 40 ml final volume. From the readings of the standards, calculate the absorbance per  $\mu\text{g P}_2\text{O}_5$  (= a).

Indicating: absorbance of the filtrate determination =  $A_F$   
absorbance of the blank determination =  $A_0$

and considering that 60 ml of the filtrate contains the phosphate dissolved from 1 ml soil, while the determination relates to 20 ml of the filtrate, the Pw-value is calculated as follows:

$$\text{Pw value} = \frac{A_F - A_0}{a} \times \frac{60}{20} \mu\text{g P}_2\text{O}_5/\text{ml soil or mg P}_2\text{O}_5/\text{litre soil.}$$

### Interferences

The reader may be referred to Van Schouwenburg and Walinga<sup>4</sup>.  $\text{As}^{5+}$  interferes and has to be reduced to non-interfering  $\text{As}^{3+}$ .  $\text{Sn}^{4+}$  interferes when light absorption is measured at 882 nm. No interference has been observed when measuring at 720 nm. However, the sensitivity is considerably lower than at 882 nm.

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### References

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- 6 Sissingh, H. A. and Paauw, F. van der, Plant and Soil (*in preparation*).