Technology Section

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A SIMPLE POROUS CERAMIC CUP SOIL WATER SAMPLER

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A simple soil water sampler fabricated from porous ceramic cup was tested in soil columns under laboratory conditions. This device proved useful for collecting water samples from saturated soil. A water sample was forced out of the cup with a hand operated squeeze bulb. The porous cup showed no measurable adsorption of Cl^-. The device described here could be used in monitoring changes in soil water composition during leaching and reclamation of saline soils without disturbing the soil after installing it in the field.

Key words: Porous ceramic cup, Water sampler, Leaching, Reclamation.

INTRODUCTION

Comprehensive soil water analysis is diagnostically useful for predicting the availability of biochemically consequential chemicals to plants or ground and surface waters, especially when the solution composition is expressed in terms of single ion activities [1,2]. Collection of proper soil water samples is a prerequisite for obtaining this information. A number of methods have been used for this purpose e.g. displacement, compaction, centrifugation, molecular adsorption, suction and pressure membrane extraction for taking soil water samples under laboratory conditions [3]. One of the more promising ways to extract samples of soil water from undisturbed field soil is with porous ceramic cups, first described by Briggs and McCall [4]. This was the first suction method useful for extracting soil water samples under laboratory and field conditions.

The field application of the suction principle has been made by several workers [5-10]. They all used a vacuum system to extract soil water from soils. While working in submerged soils or during reclamation of salinity by leaching under flooding and ponded condition a simple device for obtaining soil water samples is needed for routine daily sampling for following changes in soil profile.

This communication describes a simple porous ceramic cup sampler for soil water sampling from saturated or submerged soils during leaching of saline soils under field and laboratory conditions. The results of laboratory tests in soil columns are reported.

MATERIALS AND METHODS

Porous ceramic cup assembly. The porous ceramic cup assemblies were made as shown in Fig. 1. The porous ceramic cups were specially tooled by the Soil Moisture Equipment Company, Santa Barbra, California, USA. They were so constructed so as to have an outer dia. of 4.8 cm, inner dia. of 4.5 cm and a length of 6.3 cm. An extension of plastic pipe which had been tooled on a lathe to the proper size was connected to the ceramic cup with plastic cement. This connection resulted in a smooth outer seam between the two units, and a water and air-tight connection. The open end of the plastic pipe was fitted with a two-hole rubber stopper into which two lengths of glass tubing had been inserted, one ending just at the lower surface of the stopper and the other leading to the bottom of the cup. A thick walled rubber tubing of required length was then connected separately to both leads. One

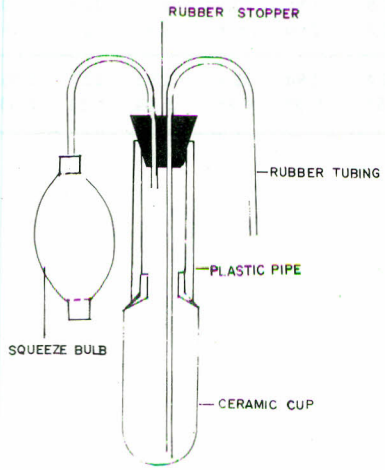

Fig. 1. Porous ceramic cup water sampler.

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complete assembly, consisting of ceramic cup and rubber tubing, was installed at each sampling point and one bulb was transferable from assembly to assembly.

With this assembly it was possible to collect soil water samples by applying air pressure with a squeeze bulb through the shorter lead and forcing water through the outlet. This device is useful only when the soil is saturated.

Testing of porous ceramic cup assembly under laboratory condition. Dry Chicot sandy loam soil sieved through a 2 mm sieve was packed in four steel cylinders 30 cm I.D. and 90 cm long. The cylinders were provided with a drain hole at the bottom. Porous ceramic cup assemblies were placed at 30 cm depth from the surface of the column. For obtaining uniform bulk density of soil in the column a weighed quantity of soil was packed in a measured depth. These columns were leached with $CaCl_2$ solution containing 2 me Cl^-/1. Constant water heads of 5 cm was maintained in the columns. When the water started draining out from the drain holes, the water samples were collected from the porous cups at 24 hr. intervals and analyzed for Cl^- by titrating against standard $AgNO_3$ using K_2CrO_4 indicator.

RESULTS AND DISCUSSION

The volume of water samples and Cl^- concentration at each sampling from the columns is reported in Table 1. The volume of water and concentration of all the samples in the four columns were fairly reliable and consistent. Moreover, the concentration of Cl^- in samples did not differ much from that of the solution used for leaching. This showed negligible adsorption of Cl^- in the wall of the cup. Similarly porous ceramic cups showed no measurable adsorptive capacity for NO_3^- [6].

Table 1. Volume and chloride concentration of water samples collected with porous ceramic cups from soil columns.

	Column 1		Column 2		Column 3		Column 4	
Sample No.	Volume ml	Cl^- me/1	Volume ml	Cl^- me/1	Volume ml	Cl^- me/1	Volume ml	Cl^- me/1
1.	22.0	1.95	22.5	1.90	21.8	2.0	23.0	1.95
2.	23.0	2.00	21.9	1.95	22.5	1.95	21.8	1.90
3.	21.5	1.90	23.0	2.00	23.00	1.90	22.0	2.00
4.	22.8	1.85	22.5	2.00	21.8	2.00	22.5	1.95
5.	22.5	2.00	23.00	1.95	22.5	1.95	23.0	2.00
Average	22.4	1.94	22.6	1.96	22.3	1.96	22.5	1.96
S.D.	±.67	±.09	±.45	±.04	±.51	±.03	±.55	±.05

The porous ceramic cup assembly described here is useful for collecting soil water samples for monitoring changes in the ionic composition of soil water of saturated soils. It allows collection of water samples without disturbing soil over a period of time and without using a vacuum system. Therefore, this device would be useful in many situations such as leaching, reclamation, ground water recharge, waste water disposal and whenever that the composition of the soil solution is of interest. This device would assist in data collection with respect to leaching similar to that obtained by lysimeter studies but with equipment that is easily installed in existing field plots.

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