

## An inflatable minirhizotron system for root observations with improved soil/tube contact

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### Abstract

Commonly used minirhizotrons consisting of a transparent tube inserted into the soil seldom attain good contact between the tube and the soil, which leads to root growth occurring in a gap rather than in the soil. A new system is described involving an inflatable flexible rubber wall, made from a modified motorcycle tube. Pressure ensures a proper tube/soil contact so that the environmental circumstances for root growth along the tube more closely correspond to those in the undisturbed soil. Before the endoscope slide is introduced into the minirhizotron for taking pictures, the inflatable tube is removed, so that there is no – often opaque – wall between the endoscope and the roots. This improves the picture quality and facilitates the analysis of root images.

### Introduction

Minirhizotron systems are widely used as a method for determining root distribution and dynamics of root growth and decay in the soil (Brown and Upchurch, 1987; McMichael and Taylor, 1987; Van Noordwijk, 1987). Since the first reports on the method, using glass or acrylic plastic tubes inserted into the soil, several changes have been proposed and procedures for analysis of the root image data have been developed. However, one of the main problems of the minirhizotron system, i.e. how to obtain a good contact between soil and tube, has not yet been solved satisfactorily.

The reliability of the results obtained with a minirhizotron largely depends on whether or not root growth and decay observed along the minirhizotron wall corresponds to the actual root dynamics in undisturbed soil. In principle, the minirhizotron system should satisfy the following requirements:

- \* the tube wall material does not interfere with root growth or decay;
- \* a good soil/tube contact exists without compaction of the interfacial soil layer;
- \* soil temperature and soil water content should be the same in the bulk soil and the plane of observation;
- \* observing the roots should not affect root growth or decay;
- \* the visibility of the roots through the minirhizotron wall permits analysis of root images.

Several authors reported that poor soil/tube contact may be a major problem in minirhizotron measurements, as it not only results in aberrant root growth along the tube, but also in a reduced visibility of the roots growing in the gap between the minirhizotron wall and the soil. Upchurch and Ritchie (1983) showed that the existence of these gaps can lead to the formation of bunches of roots or to tracking of roots along the surface of the tube. In soils with dense layers impeding root penetration, a tunneling effect can