An appraisal of the electrical resistance method for assessing root surface area*

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Introduction

One root resistance method, termed the earth impedance method, is run at a single low frequency, and the absorbing root surface area is assessed accordingly. However, some recent studies suggest that the electrical current would not pass through the roots but at the root collar. The aim was to measure electrical resistance of roots in relation to their morphology and to assess the effect of the stem on electrical current pathways.

Materials and methods

Hydroponically raised willow cuttings (Salix schwerinii) were set in a constant electrical field (effective voltage of 0.1 V, sine-AC, 128Hz) in a hydroponic solution in three experimental set-ups (Fig.1). The electrical resistance of three components in the measurement system was measured. Roots were scanned (Epson Expression 1640XL) to assess the root surface area using image analysis (WinRhizo).

Conclusion

The resistance decreased in relation to the contact area of stem with the solution. However, the resistance depended strongly on the contact area of the stem with the solution, thus causing bias in the evolution of root surface area.

Results

The resistance and root surface area was significantly correlated when whole root systems of different plants were immersed in the solution (Fig. 2). Contact of the stem with the solution had a significant effect on the resistance. No difference was observed when the stem was in contact with the solution with or without the root (Fig. 3). A significant relation was found between cross-sectional area of the stem and the resistance of the stem as with or without the root immersed in the solution (Fig. 4).

References


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