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Sampling schemes for estimating root density distribution in cropped fields

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Summary

In discussions on root research methods, so far the choice of sampling schemes seems to have been a neglected topic. In this paper sampling schemes are discussed for various situations. It is shown that the schemes used traditionally for row crops such as cereals may give a bias of about 30 % in total root dry weight. More reliable sampling schemes are presented, as well as possibilities for correction of data from traditional sampling.

Available data on variation in root mass per auger sample are summarized to calculate the number of replicate samples required to detect differences (of given magnitude) between two means. The coefficient of variation of root weight per auger sample seems to be fairly constant at around 40 % in grassland, with slightly higher values for deeper layers of soil.

A method is described by which slices of a root system, obtained by the pinboard method, can be used to estimate the total size of the root system of a single plant. As an example results are discussed for a potato experiment.

A related technique is presented for calculations on profile wall observations.

Introduction

Root systems of plants can be described in two systems of reference, viz the soil or the plant, with root length, surface area, volume or weight as the root parameter depending on specific research questions. Root length per unit volume of soil can for example be used for theoretical estimates of the part of the potentially available resources (water and nutrients) which can actually be taken up by the root system at the required rate (van Noordwijk, 1983); input of root dry matter per unit volume of soil is important in the description of soil life. The total size of the root system per plant is important, as this integrates all possibilities for uptake of a root system, or reflects dry-matter distribution over shoots or roots (Brouwer, 1984). In tube or container experiments the complete root system of a single plant can be washed out