Plant and Soil 113, 53–57 (1989)

PLSO 7588

Loss of dry matter and cell contents from fibrous roots of sugar beet due to sampling, storage and washing*

W. GRZEBISZ,[1] J. FLORIS and M. VAN NOORDWIJK
Institute for Soil Fertility, P.O. Box 30003, Haren (Gr.), the Netherlands. [1]Present address: Akademia Rolnicza Poznan', Katedra Uprawy Roli i Roslin', Ul. Mazowiecka 45/46, PL-60-626 Poznan, Poland

Received 13 November 1987. Revised July 1988

Key words: carbon balance, methods, N content, root biomass, shoot/root ratio

Abstract

To obtain correction factors for estimating root dry weight from washed samples and to test the efficiency of various procedures for storing root samples, dry matter losses were determined by simulating root washing methods with roots obtained from a nutrient culture. For sugar beet dry matter losses were higher than values previously found for wheat and ryegrass: about 30% for the procedure normally used and about 40% for samples pretreated with sodium pyrophosphate. The largest share of water-soluble sugars was lost from root samples within one day of storing roots. The N content of roots expressed on the basis of remaining dry matter rose first during handling of the root samples and decreased in samples stored for a longer period. In most cases no cell wall material (cellulose and lignin) is lost from the root samples; expressed on the basis of remaining dry weight the contents consequently rose.

Introduction

For the calculation of shoot/root ratios of plants and of the carbon balance of agro-ecosystems (Brussaard *et al.*, 1988) reliable estimates of root dry weight in the field are required. Bias due to the loss of rootlets during washing of root samples is often recognized as a problem; by using fine-meshed sieves such losses can be kept to a minimum (Schuurman and Goedewaagen, 1971). Without loss of rootlets, a considerable loss of root dry weight is still possible due to loss of part of the cortical and epidermal cells, including root hairs, root caps and associated mucilage and/or by loss of cell contents from all remaining root cells. Dry matter losses due to standard techniques for manipulation of root samples at our laboratory have been investigated for wheat (Van Noordwijk and Floris, 1979), ryegrass (Floris and De Jager, 1981), cucumber and tomato. As the diameter of ryegrass roots did not change during simulated washing and storage methods (Floris and De Jager, 1981), loss of cortex and epidermis probably is not a major factor responsible for loss of dry matter. In this article losses from fibrous roots of sugar beet and the possible nature of these losses will be discussed.

* Communication no. 2 of the Dutch Programme on Soil Ecology of Arable Farming Systems

Methods

Sugar beet, cv Regina, were sown in paper pots (diameter 2 cm, height 13 cm, filled with a sandy soil); after six weeks the young plants were transferred first to 1-l and later to 10-l pots filled with an aerated nutrient solution, containing the following concentrations of ions (m*M*/l): 10 NO_3, 1.2 H_2PO_4, 2.4 SO_4, 4.5 K, 3.5 Ca, 2.4 Mg and Fe, Mn, Zn, B, Cu and Mo as trace elements; the solution was replaced twice weekly. Growth of the plants was satisfactory (Table 1) and a normal taproot was formed; after 100 days the fibrous roots turned brown and started to disintegrate, so the experiment was terminated. At 39, 81 and 102 days after