

# Use of Transparent Polyethylene Rhizo-bags to Study Growth of Peach Roots

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Additional index words. *Prunus persica*, root length, rooted cuttings

Nondestructive studies of plant root systems are limited to hydroponic and glass-wall-type growing systems, which are expensive and limit the ways to observe and measure root structures. The following system was adapted from agronomic studies as a convenient, cost-efficient, and sensitive method of monitoring root growth of horticultural crops.

Rooted semihardwood cuttings of peach (*Prunus persica* L. Batsch. cv. Redhaven) were rooted and naturally defoliated (Couvillon and Ercz, 1980). After dormancy, plants were placed in a greenhouse where temperatures were maintained at 30C day/16C night.

To monitor root growth over time without disturbing the plants, a method developed by Bohm (1972) and used by C.B. Elkins (personal communication) was modified. Transparent polyethylene rhizo-bags (PER) were constructed of 6-mm-thick polyethylene "bag-making" tubing material (McMaster-Carr Supply Co., Chicago). The PER were 16.2 cm in diameter, 115 cm long, and sealed at the bottom by folding over and stapling one end of the tubing (Fig. 1). The PER were filled with 23 liters of washed #2 quartz sand with a particle size distribution, by weight, of (%/mm) 0.08/2.36, 0.11/2.00, 2.38/1.00, 2.34/0.85, 12.3/0.60, 26.4/0.43, and 56.41/less than 0.43. Twenty-four 4.0-mm holes were cut into the bottom 20 cm of each PER to allow for water drainage without sand leakage. The PER were leaned at

an 87° angle from the horizontal. Black plastic was wrapped around the PER to prevent algal growth and possible root dysfunction caused by light. Plants were watered every other day. Twice a week, watering was supplemented with a modified Hoagland's solution (Jones, 1973; Maynard and Barker, 1970).

After 1 week, root growth was monitored every third night for 4 weeks. At dusk, the black plastic was removed, and the PER were turned so that the backs, where =25% of the total root growth was visible, were facing forward. Acetate sheets, 50 cm long and 20 cm wide, were aligned on the sides of the PER and taped into place. To enhance visibility, roots were illuminated with a Blak-Ray ultraviolet lamp (UVP, Inc., San Gabriel, Calif.), causing actively growing roots to fluoresce (Miltner, 1987). Narrow-tipped, permanent markers (Staedtler Lumocolor) were used to trace the roots onto the acetate sheets. After the root growth was traced, the PER were turned back into position and re-wrapped with the black plastic. To determine root length, the acetate tracings were re-traced with a calibrated Model M Linear Probe (Lasico, Los Angeles). The total number of active root tips were also counted at each tracing period. At the end of the 5-week study, plants were removed from the PER and the roots collected by sifting the sand through a screen with 1-mm openings. Roots were dried at 65C for 48 hr and weighed.

The PER provided an economical system for studying root growth in peach plants. The

material cost of each PER was ~75c. The washed quartz sand was well-aerated and roots extended down ~75 cm. In contrast to hydroponic culture, sand ensured accurate measurement of changes in root length over time, permitting calculation of rates of root growth. Root morphology and branching patterns were also easily observed. Sand also allowed for faster and more complete root harvesting at the conclusion of the study, since it did not adhere to roots during cleaning.

Ultraviolet light has been used for identification of active roots in studies of agronomic crops growing in glass-wall systems (Dyer and Brown, 1983). Not all types of plant roots fluoresce, although peach roots do. This fluorescence improved the accuracy and ease of tracing the roots onto acetate sheets. The acetate sheets also provided a permanent record of root growth.

Though originally established for use in agronomic crops, PER provide a cost-efficient and sensitive method of observing root growth in horticultural crops. PER proved superior to hydroponic solutions when observing root morphology, since PER contain a stable medium that allows a sensitive observation of root initiation, elongation, branching, and senescence. In addition, PER are less expensive and more space-efficient than other glass-wall systems such as root boxes, acrylic tubes, rhizotrons, and mini-rhizotrons.

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Received for publication 13 Jan. 1989. Mention of trade names in this publication does not imply endorsement of the product nor criticism of similar ones not mentioned. This paper was submitted as partial fulfillment of requirements for the MS degree by D.J.F.M. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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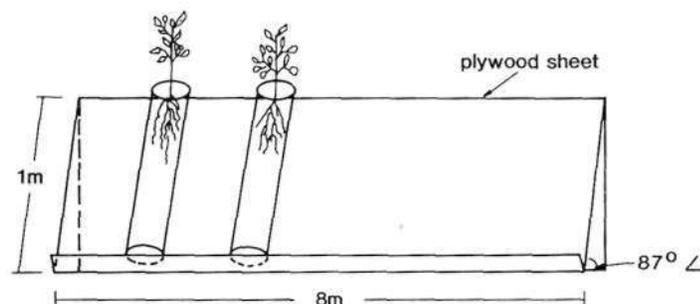


Fig. 1. Support for the polyethylene rhizo-bags (PER) is a reinforced, 8-m-long, 1-m-high plywood board leaned at an 87° angle from the horizontal plane.