Research Note

ROOT GROWTH NEAR VERTICAL ROOT BARRIERS

By E. Thomas Smiley

Roots from trees near sidewalks are known to grow under and take advantage of cracks in pavement, resulting in additional cracking or lifting of the pavement (D'Amato et al. 2002). The cost of the damage is in excess of $100 million per year in the United States (McPherson and Peper 1995; McPherson 2000). Vertical root barriers are one treatment that has been found to redirect root growth to lower levels of the soil, thus reducing damage to the sidewalk (Wagar 1985; Barker and Peper 1995; Gilman 1996; Costello et al. 1997). Since vertical barriers are known to divert or reduce root growth, numerous products are now available. This study was developed to examine root growth patterns near a variety of vertical root barriers.

MATERIALS AND METHODS

Two rows of 15 willow oak (*Quercus phellos*) each, 4 cm (1.5 in.) caliper, were planted on 3 m (10 ft) spacing at the Bartlett Tree Research Lab in Charlotte, North Carolina, U.S., on November 8, 2000. Soil was a Cecile clay loam. Parallel trenches 45 cm (18 in.) deep were dug on opposite sides of each row of trees, at a distance of 60 cm (2 ft) from the centerline of the tree trunks, for installation of root barriers. A 3 m (10 ft) long and 45 cm (18 in.) deep section of root barrier was inserted into each trench, centered on the tree. Each treatment was replicated ten times in a randomized block design. Trees were irrigated and fertilized with granular Boost (24-7-7) at the rate of 2.4 kg N/100 m^2 (6 lb N/1,000 ft^2) at the time of planting. Irrigation was applied as needed after planting.

Treatments were installed on December 19, 2000, as follows:

1. DeepRoot Tree Root Barrier, UB18-2 Universal Barrier (Deep Root Partners, San Francisco, CA). Panels are a copolymer polypropylene 2 mm (0.08 in.) thick and are 45 cm (18 in.) high by 61 cm (24 in.) wide.
2. DeepRoot Tree Root Barrier with Spin Out®, UB18-2 Universal Barrier coated with Spin Out® (Griffin LLC, Valdosta, GA), a copper hydroxide resin coating (6 g $Cu[OH]_2/m^2$).
3. Typar® Geotextile 3801, a heavyweight (272 g/m^2 [8 oz/yd^2]), nonwoven polypropylene geotextile fabric (Reemay Inc., Old Hickory, TN).
4. Biobarrier®, a medium weight (130 g/m^2 [4 oz/yd^2]), nonwoven polypropylene geotextile fabric with attached nodules containing the herbicide trifluralin (17.5% a.i.) (Reemay Inc., Old Hickory, TN).
5. Tex-R® Barrier, a heavyweight (415 g/m^2 [12.5 oz/yd^2]), needle-punched, nonwoven polypropylene/polyester coated with Spin Out® (6 g $Cu[OH]_2/m^{2)}$ (Texel, St. Elzear, Beauce Nord, QC).
6. No barrier—control treatment.

On February 26, 2002, five trees in each treatment (one block) were excavated to reveal the root system using methods similar to Gilman (1996). Excavations were made with a track hoe, by digging the area between 90 cm (36 in.) and 215 cm (84 in.) from the tree trunk (Figure 1). An additional 15 cm (6 in.) of soil was sliced off the side of the trench with a square tipped shovel to cleanly cut roots in that plane. Soil was then removed using an Air Spade (Concept Engineering Group, Pittsburgh, PA). Root growth was quantified adjacent to the outside of the barrier or at the barrier line for the controls. The barriers were then removed and soil was removed using an Air Spade. Roots present in the original 10 cm (4 in.) wide trench inside the barrier were pruned, dried, and weighed. Maximum root spread and number of roots on the inside of the barrier, adjacent to and parallel to the barrier, and at the edge of the original trench were measured for each treatment. The remaining trees will be excavated in the future and evaluated in a similar manner.

Data were analyzed using SPSS (SPSS Inc., Chicago, IL) ANOVA to compare differences among treatments. Student-Newman-Keuls procedure was used for separation of means at the P = 0.05 confidence level.

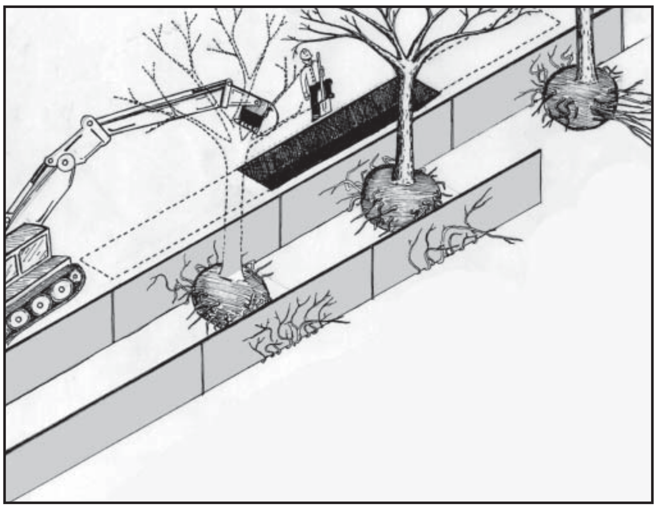

Figure 1. Graphic representation of root excavation process.

RESULTS

No roots penetrated any of the barrier treatments. None of the roots examined were greater than 1.25 cm (0.5 in.) diameter. At the vertical plane 15 cm (6 in.) outside the barrier, some roots were found to have grown beneath the barrier and in an upward direction. At this plane, between the soil surface and a depth of 30 cm (12 in.), there were significantly more roots from the control trees than from any other treatment (Figure 2). At a depth of 30 to 45 cm (12 to 18 in.) there were significantly more roots in the control treatment than any other treatment except the DeepRoot Barrier. Below 45 cm (18 in.) there were no significant differences in the number of roots.

When counted at the plane of the root barrier, there were again more roots in the control than any other treatment from the soil surface to a depth of 45 cm (18 in.) (Figure 3). Inside the root barrier there were no significant differences in root dry weight; however, there were more roots counted in the control treatment. The distance of root spread parallel to the barrier was not significant for any treatment. It is interesting to note however, that the two treatments with the greatest spread were both copper treatments.

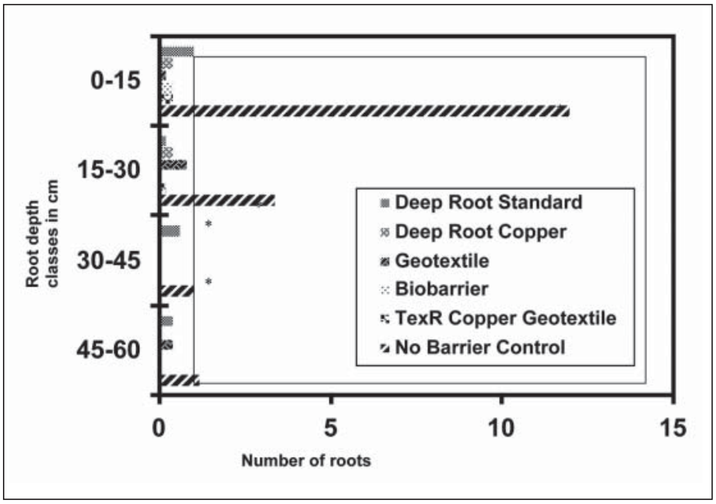

Figure 2. Root count 15 cm (6 in.) outside of root barrier line. Asterisk (*) indicates a significant difference among treatments (*P* = 0.05).

DISCUSSION

All five root barriers significantly changed the growth patterns of the tree roots that encountered the barrier. Root growth in the area where a sidewalk would be located was greatly reduced compared to the control trees. Instead of growing horizontally outward, roots on the treated trees were directed below the barrier. This additional distance of growth resulted in fewer root growing beyond the barrier as compared to the unimpeded control group roots.

The DeepRoot Universal Barrier appeared to be the best at redirecting growth below the barrier, while the chemically treated barriers, especially Biobarrier, were better at suppressing root growth. While not statistically significant, it is interesting to note that the copper treatments may have redirected growth from toward the barrier to parallel to the barrier.

Far fewer willow oaks roots were found in this trial after two growing seasons than were reported by Gilman (1996) after three growing seasons with live oak (*Q. virginiana* P. Mill.) and sycamore (*Platanus occidentalis* L.). None of the roots were larger than 1 cm (0.4 in.) diameter. Therefore, it is too early to speculate on the final disposition of the roots that grow under the barriers. Our second block should be harvested in the future and will provide longer-term data.

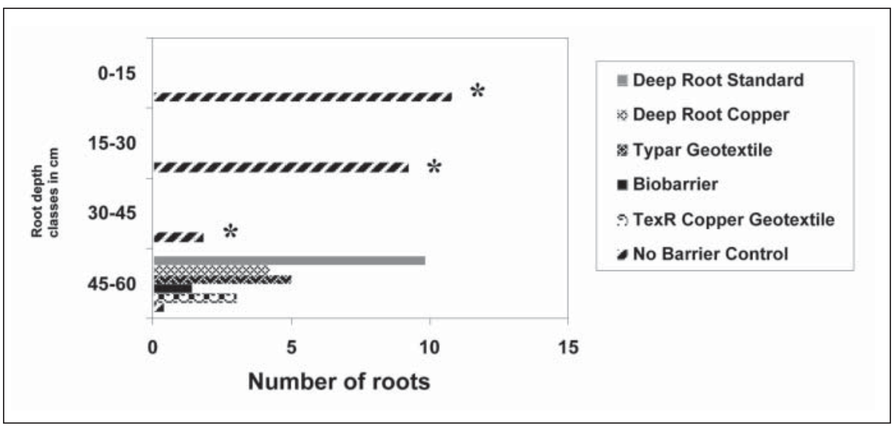

Figure 3. Root count adjacent to the outside surface of root barrier or at the root barrier line. Asterisk (*) indicates significant difference among treatments (*P* = 0.05).

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