Tree Root Growth Control Series:

Root Control Barriers

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Introduction

One of the easiest and most available materials used to control root growth are various types of two-dimensional barriers. There are a number of commercial products on the market, some using a herbicide. In a survey of community management programs, 50% of surveyed programs said barriers are considered at least partially effective (24). Listed by survey in order, after species selection and mechanical cutting, barriers represent a more tree-literate approach to root growth control. But as with most things biological and installed by humans, no barrier is completely effective as applied (43).

Many types of barriers have been shown to be effective, a sampling is given in Table 1. Table 1 does not represent an exhaustive list, but is provided to show the diversity of root growth control barriers. There are many "weeding" and mulch fabrics that are not effective for root growth control because they lack fiber-to-fiber strength to resist root elongation or radial expansion (28).

Table 1: Selected list of tree root growth control barriers found to be effective for various lengths of time.

Copper sulfate-soaked, synthetic, non-woven fabric (51)
Copper screen (55)
Cupric carbonate ($CuCO_3$) in latex paint (2)
Fiberglass and plastic panels
Fiber-welded synthetic fabric / mesh (28)
Galvanized metal screen
Ground-contact preserved plywood
*Heavy rigid plastics (4,5,34,35)
Infrastructure aprons and footings (34,35)
Metal roofing sheets
Multiple layers of thin plastic sheets
Nylon fabric / screen (55)
Permeable woven fabric sheets (28)
Rock impregnated tar paper / felt (28)
*Slow-release chemical barriers (34,35,55)
Thin layer asphalt / herbicide mix (43)
Woven and non-woven plastic sheets (28)

* = common commercial tree growth control products

From the sample of effective root barriers listed in Table 1, three barrier types are most common: traps (root engaging and constricting), deflectors (walls), and inhibitors (chemical constraints). Note that no barrier

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stops all roots under all conditions. Combined features of the barrier, the site, and barrier installation and maintenance are critical to effectiveness (55).

Traps

Screens, welded fiber sheets, and woven and non-woven fabrics can be considered root traps. The effectiveness of these traps depend upon the gap / hole size in the material. Holes in the materials should be large enough to engage and allow root tip growth into or through the material, with materials strong enough to strangle radial growth and girdle roots (28,50,55). Smaller holes are more effective than large in limiting root growth (55). Remembering root elongation mechanics, if you keep roots small, they will be able to generate far less force in elongation and radial growth. These permeable materials allow water movement in the vapor and liquid phase, and do not constrain gas exchange in the soil.

Good examples of these traps are screen and welded fabrics. Nylon fabric screens with 1/26 inch square openings were found to be effective in controlling root growth, as was copper screen with 1/16 inch square openings (55). The smaller holes were considered more effective (55). Weld-woven, synthetic, non-elastic fabrics with strength to girdle roots growing through openings between 0.05 inch and 0.02 inches in diameter were found to be effective (50).

Deflectors

Deflector barrier types include solid plastic, metal, and wood materials. Deflectors, when installed correctly, can be highly effective. These barriers attempt to change normal root orientation, to exclude root growth in an area, or to reposition roots in generating less damage. Because these barriers are solid, soil moisture contents and water drainage may be affected (55). In areas where frost heaving and freeze / thaw cycles are present, these deflectors may facilitate additional damage. If drainage is provided around the barrier, roots may take advantage of additional resource space and circumvent the barrier. Barrier thicknesses have been cited as effective from 0.15mm (15mils) sheets to thicker barriers. Thicker barriers are easier to install without damage and can handle more intensive site impacts over time (5)

Inhibitors

The last general type of root growth control barrier is an inhibitor. Inhibitor growth barriers use chemical control agents or toxins to constrain root growth. One inhibitor system comes from the nursery production trade. Cupric carbonate ($CuCO_3$) mixed in white acrylic paint at 100g/liter of paint and applied to a solid wall or sheet is effective in controlling roots. Higher rates of 500g/liter were damaging to the whole plant, not just the root tips (2). Other copper based products have been used as contact herbicides and barrier components. The duration of the root controlling effect is variable depending on soil moisture conditions.

One of the most visible and unique inhibitor barriers is the controlled release herbicide fabric. Depending upon soil temperatures, the root growth control effect can last across long periods of time. One of the most common commercial inhibitor barriers is a herbicide impregnated, slow release product developed originally by the United States government. The government created three different products using this technology: anti-root sewer pipe gaskets, geotextile fabric with herbicide impregnated nodule barrier, and an anti-root fouling plastic drip irrigation emitter (52). All are available in the marketplace.

The geotextile fabric root barrier has been successfully developed, marketed and used. This inhibitor barrier and its active ingredient will not systemically harm other vegetation, just root tips that come in close contact (52). The herbicide used in this inhibitor barrier is trifluralin (dinitroaniline family) which inhibits cell division in root tips by preventing chromosomal spindle formation. This herbicide is considered a preemergent since it inhibits root tip growth from seeds (52). Trifluralin is effective as a contact and a vapor phase herbicide within the soil. It does not accumulate into higher animal food chains because it is not taken-up into the tree (52). Trifluralin is not detectable beyond 10cm from the barrier into the soil, and so, is considered to have no environmental impact beyond the root control area (52). Figure 1 (52) shows herbicide release over time. Figure 2 (52) shows estimated effective life-spans for this type of inhibitor barrier in the soil.

Root Barrier Concerns

The advantages and disadvantages of root growth barriers of all kinds are summarized in Table 2. It is clear that the intensity of site usage and installation procedures of any barrier can damage its effectiveness.

Table 2. List of general advantages and disadvantages for root growth control barriers.

General Advantages —
— effective in trapping and constricting, deflecting, and/or inhibiting root growth (3, 28)
— tree circling barriers inhibit shallow rooting (4)
— roots pushed to deeper depths (24)
— initiated more smaller roots (24)
— smaller roots developed and delay on-set of infrastructure damage (53)
— can be used in combination with drainage / aeration treatments to control roots (53)
— when deeply seated into ground water or anaerobic soil layers will contain growth (53)
— must break surface of soil and any mulch layer to be completely effective (3,6,40)

General Disadvantages —
— roots commonly grow under and over barriers causing damage (28)
— many barriers are not installed deep enough (28)
— surface damage to the top of root barriers is common and leads to failure (28)
— thin plastics subject to easy damage along soil surface area (6, 53)
— buried thin plastics failed where punctured or torn during installation (53)
— all barriers fail when the top of the barrier is damaged by equipment or traffic (6, 53)
— circling barriers & barriers placed too close, make circling roots a concern (3, 53)
— roots can physically push through thin zones (less than 5cm) of herbicide or thin plastic (52)
— may disrupt water and gas movement (anaerobic conditions and freezing heave) (28)
— deep, tree circling barriers may compromise structural roots and tree stability (3)

A major concern in root growth control is barrier placement. If long term tree health and maximizing soil resource volume is critical, barriers should be installed along or around the infrastructure to be protected (3). Placement of barriers should fulfill the objectives of minimizing root-caused damage and maximizing the soil area open for colonization by the tree. Barriers placed along the side of a sidewalk, pavement, foundation or utility corridor is preferable to barriers placed near or around the tree base. If containerization of a tree is an objective of using barriers, additional soil resource and tree structural stability concerns should be considered.

A second major aspect of barrier placement is root shadow size on the far side of the barrier. The rooting shadow size, shape and extent are dependent upon soil aeration, soil compaction, and barrier installation procedures. Figure 3 represents a rooting shadow (a Gilman shadow) on the far side of a barrier. After passing beneath a barrier, depending upon soil characteristics, roots again reach the surface (23,24,29). The length of soil surface behind the barrier that remains root free is the rooting shadow.

In poorly drained soils, roots can grow back to the surface quickly (within 4 feet) (23,24). In well drained soils, roots rise more slowly after growing under the barrier (24,29). If the barrier is deep enough, and properly installed to minimize backfill pore spaces, roots will not be able to grow beneath the barrier at all. If the barrier installation trench provides additional pore space and root growth channels, some roots growing beneath the barrier with immediately grow to the surface after passing the barrier (23,24).

Literature Cited

Full citations in: Coder, K.D. 1998. Selected Literature: Root Control Methods. University of Georgia Cooperative Extension Service publication FOR98-13. Pp. 4

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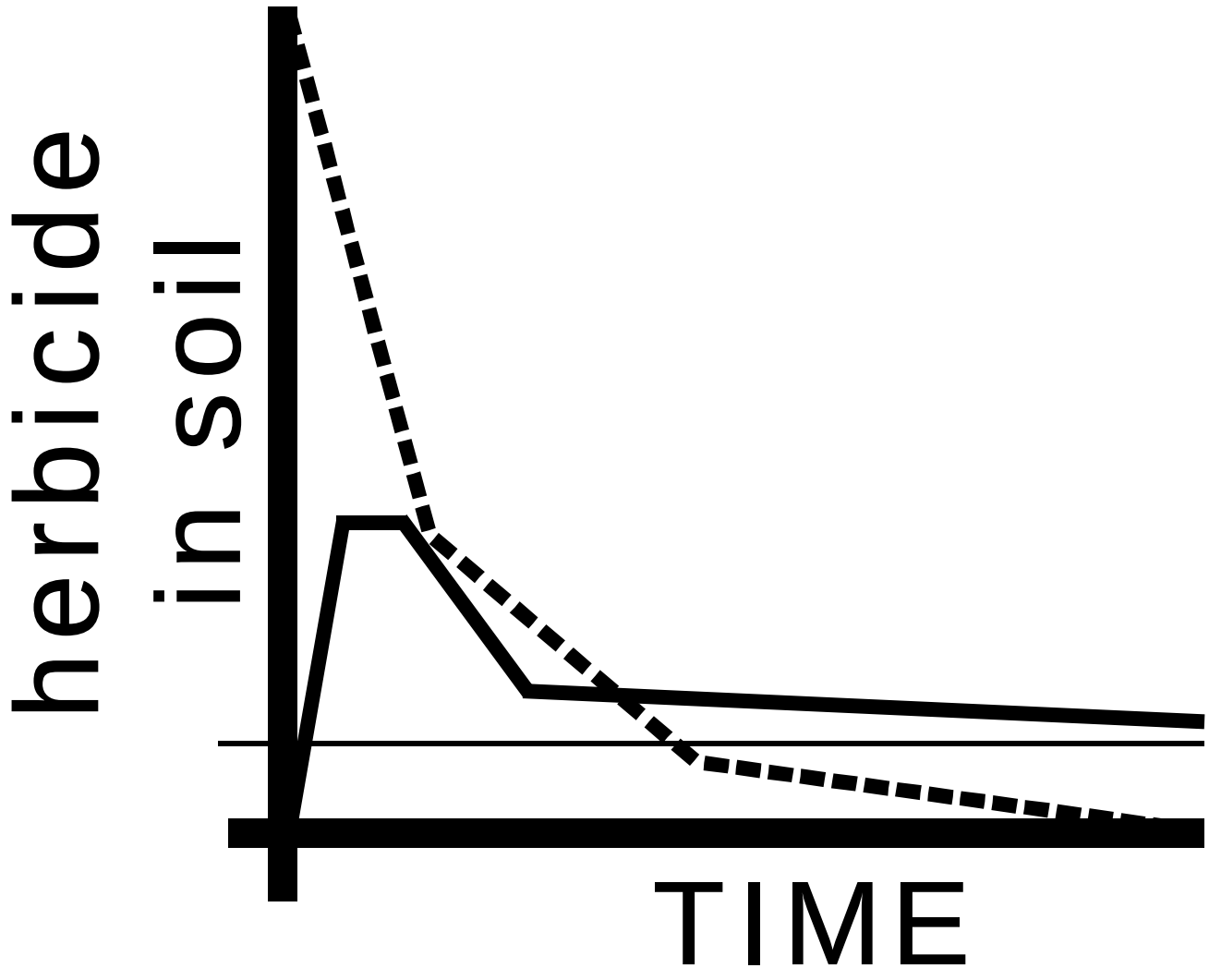

Figure 1: Herbicide release over time. (52)

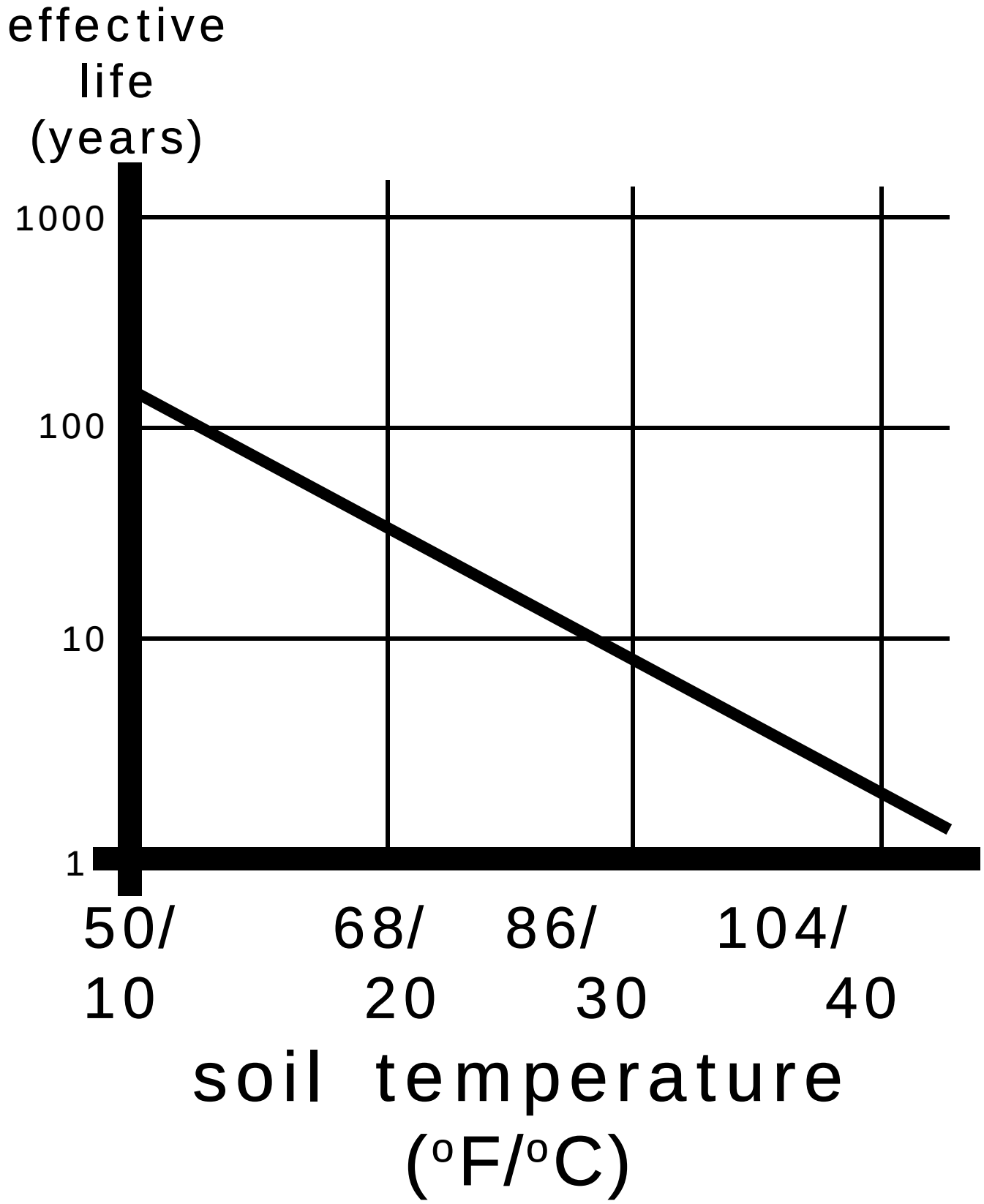

Figure 2: Effective soil life for example slow-release chemical barrier. (52)

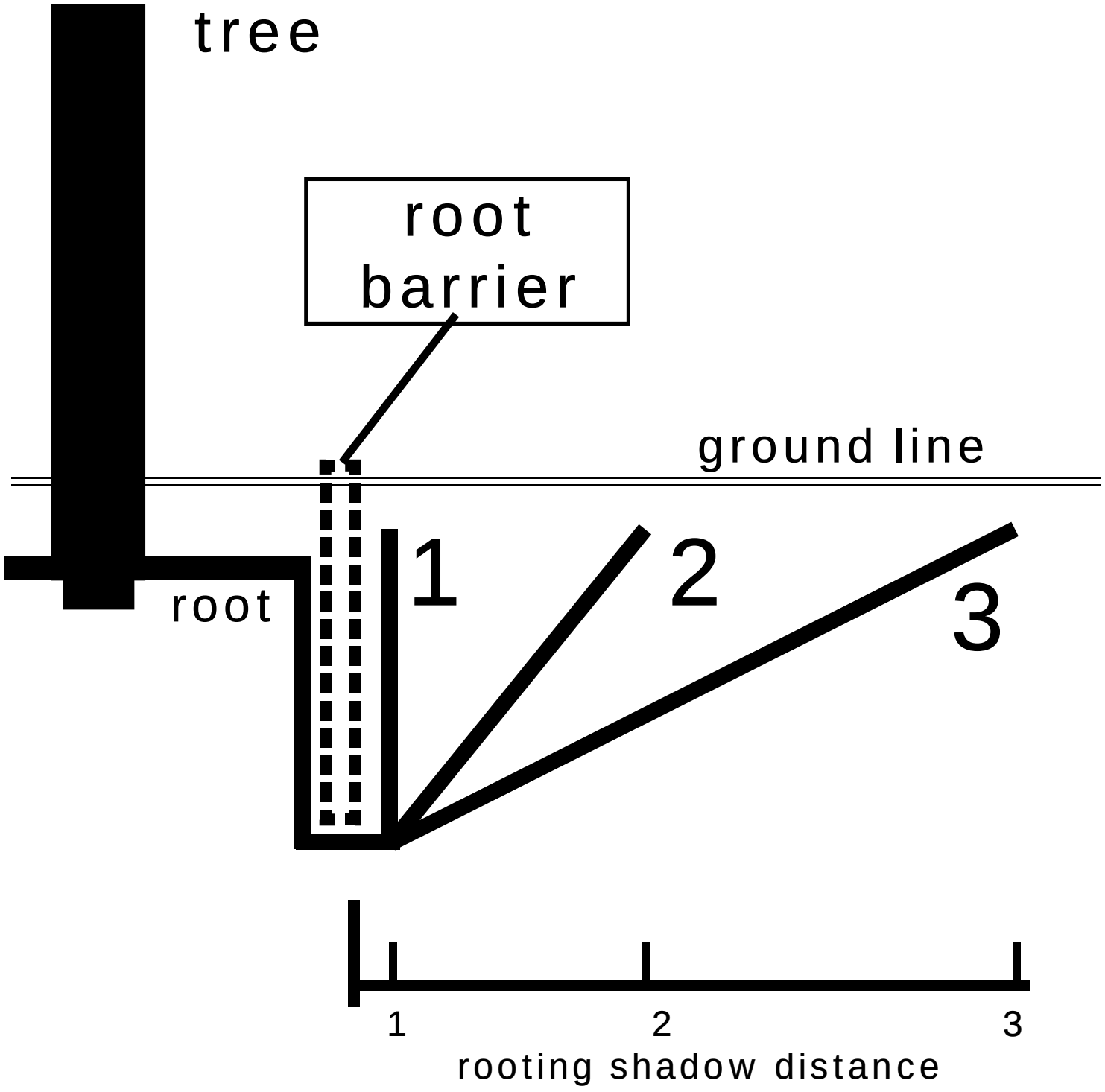

Figure 3: Rooting shadow beyond a barrier under three different conditions. #1 root escapes up installation trench. #2 poorly drained soils. #3 well-drained soils.