Drip Irrigation and Weed Control.

John T Law Jr., Ph.D., ValleyCrest Companies

This discussion is about weed control on commercial landscapes, or what is called the *built environment*. The term built environment refers to landscapes that are built to provide a setting for people to live, work, shop, move around and other activities. The built environment includes infrastructure like electricity, water for irrigation and drainage structures. The soil in the built environment is extensively modified by compaction to provide support for structures and the infrastructure. Compacted soil in the built environment has a high bulk density which means very few pores large enough for water to move. Consequently, the landscape soil has a low water infiltration rate and water percolation rate. The water infiltration rate is typically much slower than water is applied by irrigation systems. Water tends to run off. Amending the soil to improve structure typically results in only a short lived improvement. Organic amendment added to soil during landscape installation breaks down quickly and is usually gone in a few months or less. Once installed, a commercial landscape cannot be tilled or amended as is done with agriculture and garden soil. Consequently, irrigation water tends to run along the soil surface to lower areas. Water collecting in lower areas, combined with generally uneven irrigation provides good moisture for weed growth. If the water constantly displaces air in the soil, roots of ornamentals cannot grow well, making the ornamentals less competitive to the weeds. Weeds basically only need light and water, so managing irrigation and soil moisture is important. Of course, there are other weed control challenges in the "built environment.

The recent GMO - cancer - glyphosate narrative has resulted in some clients not allowing glyphosate use. Clients often propose "alternative" burn back or contact herbicides, but they have been poor performers. It is important to recognize that there is a huge gap in scientist vs. citizen beliefs about the hazards of herbicides and other chemicals. Social science research says this gap cannot be closed by education or facts. Some clients insist on natural organic fertilizer. Natural organic fertilizer contains significant amount of phosphorous (P), which is basically a "starter" fertilizer for weed seeds. Landscape ornamentals typically do not need P. Besides favoring weeds, natural organics have a high carbon footprint compared to polymer coated urea, and if the P goes off site it can be a pollutant.

Drip irrigation is typically an agency or municipal requirement for new landscape installations. It is not unusual to see claims that drip is 95% efficient to support these mandates. That is impossible on landscapes, and probably anywhere. Even to give landscape water use design numbers is misleading. Irrigation output calculations can be difficult for drip systems and the numbers typically have a lot of false precision. Nevertheless, drip or other low pressure irrigation is the way to irrigate narrow bed areas. Also, recycled water is best delivered by drip to minimize exposure to air born from the recycled water. However, stream rotors are usually just as efficient as drip, in spite of the frequently misleading numbers. The main limitation is stream rotors work best in beds wider than 15 feet, and 20 feet is better. Designing a landscape with perhaps fewer, but larger planting areas has other benefits. Trees grow better and stormwater can be managed

better in bigger beds. However, what is usually important for landscape design is flow and site lines. This often leads to narrow and/or small ornamental beds along the flow.

Overhead sprays can be used on narrower beds, and are useful for watering preemergent herbicide, keeping down dust, and wetting mulch. However, spray heads are not as efficient as drip. Some consideration should be given to having both drip and spray irrigation. The drip can be used most of the time and the spray heads used when overhead water is needed such as a preemergent application to prevent annual weeds. Overhead irrigation is a consideration for perennial weeds as well.

An important part of establishing a landscape is the initial control of existing perennial weeds such as Bermudagrass, Kikuyugrass, Oxalis, bindweed, nutsedge etc. The best way to do this is "grow and kill". The landscape site is irrigated to stimulate growth of dormant rhizomes, as well as weed seeds. It is much more difficult to soak the soil with drip irrigation than with overhead irrigation. The stimulated weed growth and active underground growth are then killed by glyphosate or other systemic herbicides. The stimulated weeds can also be killed by smothering them, but that typically takes too long for typical construction schedules, and may result in underground portions going dormant rather than dying. Tilling is usually not practical unless done before site development begins. The advantage of glyphosate is that it can be applied to planned landscape areas after all the infrastructure has been installed.

Weeds can easily grow back into a new landscape, especially when plants are not established. Plants that have not established a root system have to be irrigated more often, favoring weeds. And the plants don't grow significantly to shade the soil, which also favors weeds. So, the quicker the landscape plants establish the easier it will be to control weeds. Keeping root balls moist on new plants is always a challenge, especially for container grown plants. Water needs to be applied directly over the root ball until roots grow into the surrounding soil. Overhead irrigation provides water somewhat better than typical inline drip installations. However, using emitters on flexible PVC pipe is the best. The flexible PVC pipe can be moved from the rootball to beside the root ball, and then farther out as the tree or shrub grows. There is a limit to how much area the drip system can be expanded to cover. So if the goal is complete plant cover of well-established woody plants then overhead rotors will get you there faster. Overhead irrigation also has another advantage.

Roots and water often find the same cracks and pores, but drip placement might not be where these cracks and pores are. Overhead irrigation is more likely to flow into these "voids". So overhead rotors can achieve the much desired goal of "targeted delivery" of the water where it is needed. The roots essentially target themselves for water via interacting with soil voids that water can flow into and drain out of. This is why modern installation specs call for fracturing soil (http://www.urbantree.org/details_specs.shtml). Fracturing follows natural weaknesses in the compacted soil so the cracks tend to be longer and more connected than just tilling, rototilling or mixing. If the goal is *not* complete cover, then weeds will be much more likely, since weeds basically just need light and water. As discussed earlier there are usually parts of a landscape that stay wet a significant amount of time. Water is applied unevenly on most ornamental beds, and a lot of turf. So to keep the driest areas from drying out, some of the wettest areas stay wet. A 3X

difference in water application would not be unusual. And, remember that the soil is compacted, so water does not readily soak in, and tends to run. Most roots are near the soil surface where they can get air. It takes at least several years and usually longer for roots to grow down into the soil with the result that the plants can be irrigated less often. Again, fracturing the soil will speed this deeper root growth by creating cracks for roots to grow into. Mulching with chips from pruning operations also helps roots grow. Mulch of course shades the soil to inhibit weeds, but as the mulch breaks down it helps achieve less frequent irrigation which keeps weed seeds from successfully germinating. When mulch decays it creates a spongy layer on top of the soil, basically an O horizon. This layer can detain the irrigation water, giving it more time to soak in. The decaying mulch also creates an ecosystem of invertebrates, some of which burrow in to the soil creating pores for water infiltration. Mulch decay depends on moisture and the decay process will be much slower with drip under mulch than with overhead irrigation. There are also other considerations of drip vs. overhead irrigation.

More and more irrigation water contains a significant amount of salts. Recycled water contains more salt than potable water. This salt will accumulate unless it is leached below the root zone. Leaching is much more efficient with overhead irrigation than with drip irrigation. Salts, as well as biological activity from the nutrients in recycled water typically cause more clogging problems for drip irrigation than for overhead rotors. Monitoring and maintenance of drip systems is more demanding because the system is usually buried or under mulch. Leaks can be hard to find.

Weeds are the best adapted plant in the landscape and they are much more of a problem when soil stays moist. When designing a landscape consider weed control. One of these consideration is drip vs overhead rotors on areas wider than 15 feet. Drip is sometime mandated even where it will not make any more efficient use of water than rotors and can make weed control more difficult.