Subsurface Irrigation Offers an Efficient Alternative

By Justin D. Weeaks and Michael A. Maurer

The high plains of Texas has limited rainfall, typically receiving about 18 inches annually. This relatively arid area requires that increased supplemental irrigation be applied to turfgrass and residential landscapes.

Given the lack of natural rainfall, providing more efficient means of irrigating turfgrass is a subject that needs to be addressed, particularly in seeded bermudagrass cultivars.

Using bermudagrass seed can quickly add up to substantial savings in terms of seed cost compared to sod or sprig materials. Labor costs are also reduced as a result of less time in seeding golf courses or residential lawns. Using a subsurface drip irrigation system will also add to the savings by more efficient means of irrigation.

Management with SDI is different from conventional over-the-top irrigation systems.

Subsurface drip irrigation (SDI) users may get as much as a 50-percent reduction in water use compared to conventional irrigation systems while still achieving the same plant growth (Pearce, 1994). When using SDI, runoff is virtually eliminated because water is contained in the soil profile. Runoff is the leading cause of water abuse.

With an efficient method of delivering irrigation water, researchers anticipated that it would be possible to establish seeded bermudagrass using SDI.

A well-designed irrigation system will save time, money and most importantly water. SDI minimizes runoff and overspray by putting water at the site of action, the grass's root zone. By designing a looped grid system, efficiency can become as high as 90 percent to 100 percent (d Hulst, 2000).

Subsurface drip irrigation can save water and reduce runoff potential and help to produce a healthier and aesthetically pleasing turfgrass (Lamont, 1994). However, a golf course's management strategies must be changed when irrigating with SDI. Management with SDI is quite different from conventional over-the-top irrigation systems.

Figure 1. The wetting at each plot was sufficient to see visible wetting patterns on the surface.

Subsurface drip irrigation system

Finding the right subsurface drip irrigation products can be simply a matter of the purchaser going with a preferred brand name in most cases.

Typically, a subsurface drip system consists of polyethylene tubing, fittings, emitters, filters, pressure regulators, valves and gauges, and fertigation or chemical units to deliver liquid fertilizers or other chemicals (Lamont, 1994). The tubing is normally one-half inch in diameter and is equipped with emitters for irrigated areas and blank tubing for looping the system.

The filtration system in any irrigation system is critical and subsurface drip is no exception. When using well water or municipal water that is high in soluble salts, a screen or disc filter should be used. Many times a flush-out valve is also used (Lamont, 1994) to flush out sedimentation that may buildup.

Caution must be taken when selecting drip tape due to root penetration and intrusion of the turfgrass plant into the orifice or emitter. Studies have shown that 10 percent of emitters will be blocked within the first three years if the

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Figure 2. This plot showed turf establishment shortly after seeding at around two weeks.

Figure 3. This plot showed salinity accumulation at the surface at around 16 weeks.

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emitters are not protected by some form of chemical means. After four years 60 percent of emitters were blocked, and after five years 95 percent of emitters were blocked. Many emitters have trifluralin, a root-inhibiting chemical, impregnated in the emitter (Pearce, 1994).

Some systems have a filter attached at the valve that has a series of discs that when water passes through a small amount of the chemical is delivered throughout the entire system. Since the drip line is flexible, they are usually flexible enough to deal with changes in ground temperature (Stroud, 1987) and changes in contour and grade.

Another important aspect of the subsurface drip irrigation system is its grid design or layout. Typical spacing is at 12-, 18-, or 24-inch increments between drip lines (Maloney and Wright, 1993). Emitter spacing is available in 12-, 18-, and 24-inch increments.

Seeding bermudagrass using SDI

There has been no research to date that indicates whether seeded bermudagrass can be established by using subsurface drip irrigation. Two field experiments were conducted in 2001 and 2002 at Lubbock, Texas, to determine whether seeded bermudagrass could be established using SDI. The system used irrigation water from local city water.

Installation of the SDI system consisted of three SDI treatments of 12-, 18-, and 24- inch lateral spacing of drip lines. The control treatment consisted of 90-degree pop-up sprinklers. Treatments were replicated four times in a randomized block design.

Emitter spacing was equal to the distance between each later drip tube. Plot sizes were 10 feet. by 10 feet for the first year's study and 15 feet by 15 feet for the second year's study. Reestablishing the research was necessary because of research farm relocation.

Bermudagrass was seeded using a drop-type spreader at the rate of 1.5 pounds per 1,000 square feet. The seed was lightly raked in and irrigation followed. Wetting of each treatment was sufficient to see visible wetting patterns on the surface of the soil (Fig 1). Plots were maintained at a constant level of moisture until germination was noticed.

Weekly visual observations were taken to determine percentage of ground cover. Once a plot obtained 90-percent coverage, it was assumed to be complete coverage. Salinity of soil was also monitored monthly through soil samples and analyses of samples.

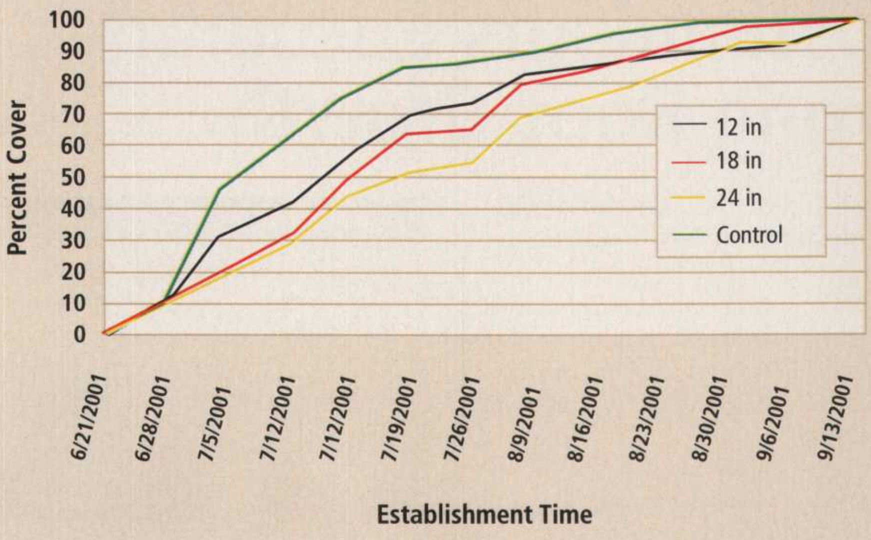
Successful establishment

The primary objective of establishing seeded bermudagrass using SDI was a success. Full (90-percent) turfgrass coverage was noted at weeks 10, 11 and 9 for the 12-, 18-, 24-inch control plots, respectively (Fig. 2). Salinity accumulated in the top 6 inches of the soil for all SDI treatments (Fig. 3).

Although salinity values were elevated in all SDI treatments, there were no deleterious effects on turfgrass quality. A second study was

TABLE 1

Seeded Bermudagrass Coverage



also conducted but that data has not yet been analyzed.

Conclusion

It is possible and practical to establish seeded bermudagrass using SDI. This Texas study obtained acceptable turfgrass coverage in as little as 10 weeks (Fig. 4). This is quite encouraging for superintendents.

This enables an inexpensive alternative to sodding or sprigging, not to mention reduction in labor costs.

Salinity accumulation is a concern that many turfgrass professionals should consider. This study showed there was an accumulation of salinity during the growing season but values returned to pre-study status.

The salinity accumulation during establishment and even a couple of months after establishment is possibly due to very low rainfall during establishment phase.

Even during this period of high salinity values there were no outward signs of turfgrass stress. Once the seeded area received about two inches of rainfall, salinity values decreased significantly. This is very useful in areas that receive little rainfall. More studies need to be conducted on long-term salinity accumulation of SDI tubing.

While we expect seeded cultivars of bermudagrass should establish well when using SDI, turfgrasses such as cool-season fescue and other bunch-type grass may not establish as easily.

This is probably because warm-season grasses have stolons, rhizomes or both to aid in spreading.

Figure 4. These plots showed full coverage in some treatments at around 10 weeks.

However, further studies should be made to confirm or contradict this determination.

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