TURFGRASS TRENDS

EFFLUENT IRRIGATION

Problems Surface with Effluent Use on Turf in the Southeast

By Thomas Rufty, Danesha Seth-Carley and Lane Tredway

Population increases in the southeastern United States are creating new challenges for turfgrass managers. An important one is the expanded use of sewage effluent as a water source.

Unknown to most people, the main driver for increased effluent use is the need to disperse sewage effluent. Concerns about water quality have led to policy decisions within the Environmental Protection Agency and state regulatory agencies to restrict direct discharge of sewage effluent into surface waters. Increases in sewage effluent must be applied to the landscape. This is true whether effluent is generated by expansion of municipal waste treatment plants or by construction of local waste treatment facilities that serve individual communities. The expected protection of water quality will result from uptake or filtering of pollutants by the vegetation and dilution of escaped pollutants in the large body of groundwater.

Turfgrass systems are the ideal effluent dispersal sites. Effluent contains high concentrations of pollutants such as nitrogen and phosphorus. Turfgrasses can efficiently take up these plant nutrients and act as a natural filter for the environment. Also, golf courses, athletic fields, parklands and home lawns are where large acreages can be found and irrigation systems are often in place. From the turfgrass industry side, effluent can be an important water source for irrigation. Effluent has been used for many years to irrigate recreational turfgrass areas in the southwestern United States, California and Florida (cf. Harivandi 2004).

Even though sewage effluent applications to turfgrasses seem an ideal fit, a number of problems have been cropping up in the southeastern transition zone, which includes North Carolina and much of South Carolina. This zone is where warm- and cool-season grasses are at the limits of their adaptation and have seasonal growth patterns. The region is also experiencing very rapid population growth and, as a consequence, generation of sewage effluent is rapidly increasing.

The problems can be traced to the climate in the transition zone. Warm-season bermudagrass is most often the grass type growing on the large acreages at golf courses and recreational sites used for effluent dispersal. Water use by the bermudagrass system and potential evapotranspiration (pET) coincides with high temperatures and high bermudagrass growth rates in the summer. The problem is that summer is also the time of year when rainfall is greatest.

From the bermudagrass growth, pET and rainfall profiles, one can quickly see

Continued on page 48

IN THIS ISSUE

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Turfgrass systems are the ideal effluent dispersal sites. Effluent contains high concentrations of nitrogen and phosphorus.

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Continued from page 47

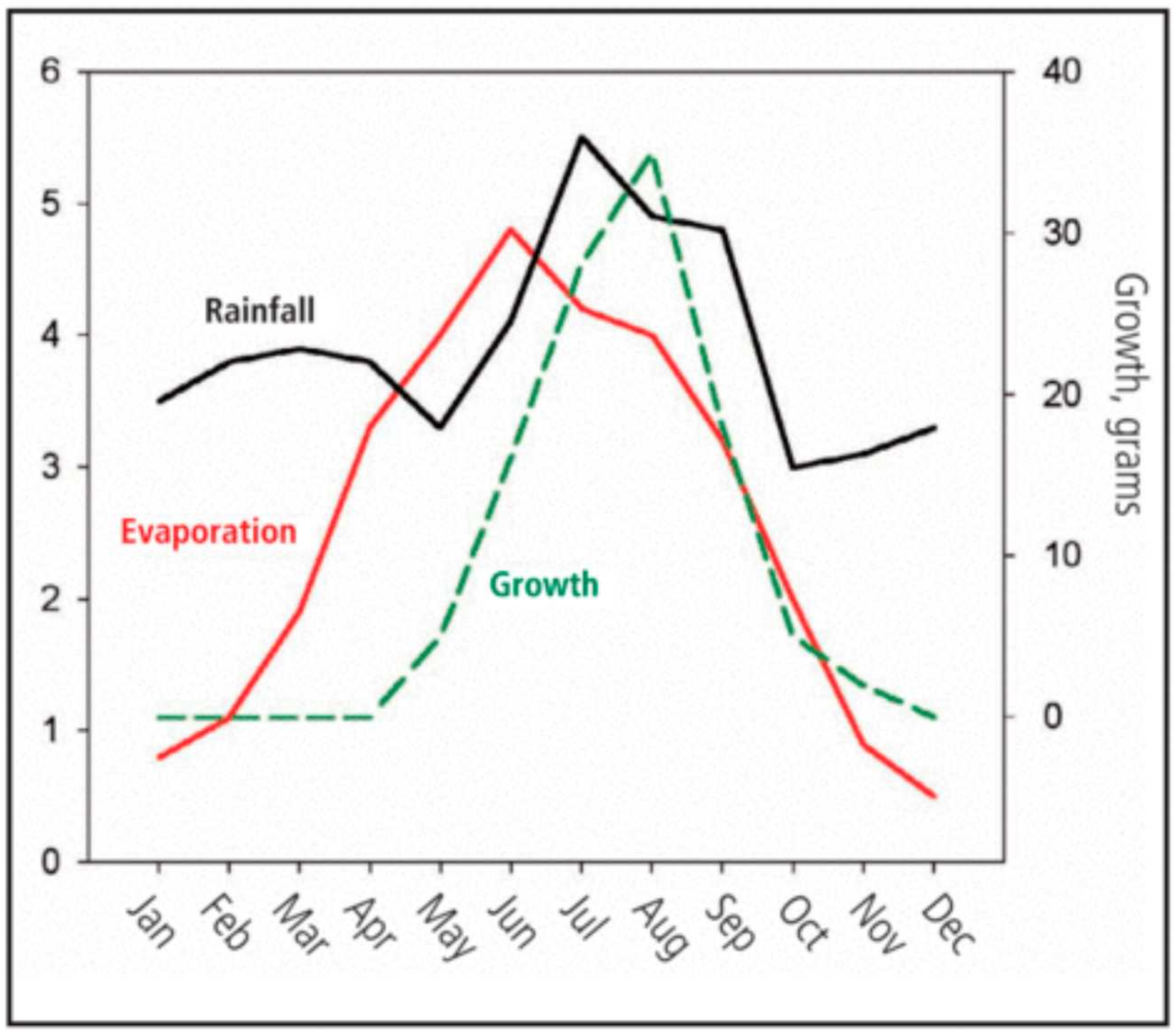
the complexity involved with effluent dispersal. Because pET never greatly exceeds rainfall, effluent dispersal is primarily limited to time windows between rain events in summer months. The seasonal dispersal then has a domino effect, necessitating substantial storage capacity for effluent during winter months. And if there is a particularly rainy year with unusually high rainfall in summer, then the storage capacity must be adequate to accumulate effluent from one year to the next.

So, one might ask, who cares about pET and water use by bermudagrass? Why not view a golf course like a backyard drainage field? Apply effluent year round and let it go downward through the soil. Even if pollutants are not filtered, they will be diluted in groundwater as intended. Well, as it turns out, water infiltration on golf courses also can be a problem.

Fine-textured, clay soils are pervasive in the transition zone (Buol et al. 2003). They become compacted during construction, and contours often involve cuts deep into the subsoil or "B horizon." In either case, soils have very low hydraulic conductivities. Even with sandy soils in the region, soil compaction often occurs as a result of heavy equipment traffic (Naderman 1990). Much research has examined compaction in agricultural soils in the area (Gent et al. 1984). It is known that a penetration resistance of 20 to 30 kilograms per square centimeter (kg/cm^2) restricts downward root growth and creates a perched water table. Under bermudagrass fairways, we have found a layer of resistance up to 50 to 70 kg/cm^2. With the very low rates of water infiltration, only small amounts of effluent can be added at any one time and fairways stay wet, and playability declines noticeably with repeated applications.

The limited capacity for effluent dispersal on golf courses often leads to strained relations between superintendents and developers. To obtain permits for a planned community, developers now must demonstrate to regulators how the resulting effluent will be dispersed. In new golf course communities located in fast-growing metropolitan areas, sewage is processed in community or "package" treatment plants and dispersed on the golf courses. The environmental impacts are controlled on site. However, to ensure the maximum numbers of lots are approved, it is not unusual for developers to obtain effluent dispersal permits committing to unrealistic dispersal amounts.

Superintendents generally like access to effluent water because it provides a safety cushion during droughts. But they want the amount of effluent required for irrigation, nothing more and nothing less. We have examined transition zone rainfall over the past 50 years in detail, and estimate that about 20 to 25 million gallons of effluent can



Profiles of rainfall, evaporation and bermudagrass growth in central North Carolina. Estimates for rainfall and evaporation are from 60-year climate data obtained from the Southeastern Regional Climate Center in Chapel Hill, N.C. Note that maximum rainfall and evaporation occur in late spring and summer, limiting net potential evapotranspiration and making effluent dispersal difficult.

be dispersed on an 18-hole golf course with 80 acres of bermudagrass in a normal rainfall year. Nonetheless, effluent permits have been issued that commit to dispersal of as much as 100 to 150 million gallons a year.

There is nothing subtle here. The requirement for effluent dispersal on the landscape and unrealistic permit levels are putting superintendents in a bind they cannot resolve. Developers are often their bosses, so the superintendents have to work with the situation as best they can. Unfortunately, the excess water problem worsens with time as communities build out. Over-extended state regulators are not ordinarily the solution to the problem, because they often view golf courses as waste disposal sites. Wet fairways are not an issue for them.

The appropriate solution to the effluent problem is setting aside larger acreages for landscape dispersal. Enough additional land must be available for dispersal even in wet years with high rainfall. Non golf course land would be expected to have higher infiltration and thus greater water loading capacities per acre. Of course, there are problems even with this obvious solution. High land prices accompany high population growth, so extra land set-asides or purchases can hamper potential profits. Regardless of whether extra land is available, the bottom line is that golf courses should not be locked in to accepting any minimum amount. They would use only the amount of effluent they need for normal irrigation purposes.

Unfortunately, there are problems with effluent dispersal on golf courses in the transition zone in addition to excess water applications. Two of the main ones are degradation of bentgrass quality on putting greens and difficulties with irrigation system operations. We will explore those issues in an upcoming article in Turfgrass Trends.

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