Probe Beneath The Surface

By **AUSTIN J. MILLER, President**
A. J. Miller, Inc., Royal Oak, Mich.

Overwatering is one of the biggest problems superintendents experience with automatic irrigation systems on golf courses today.

AFTER spending the day on the course, the golf course superintendent returns to his office, twists a few dials, sets several switches and leaves for the night knowing that his irrigation system will operate on schedule and without anyone in attendance.

This is a very common occurrence in the midwest and confidence in the automatic system is no longer difficult to establish.

This doesn't mean that problems are non-existent. What I would like to suggest is that we haven't recognized and addressed ourselves to the real problems. The superintendent with the new fully automatic system finds it is quite easy to get himself in deep trouble by *overwatering*.

This past season parts of the midwest and east were plagued by heavy rains. Many courses in these areas are built on relatively heavy soils. Overwatering in previous years left them with full soil reservoirs and no place for the water to go. The superintendent on a sandy course was more fortunate. His overwatering was less obvious. Overwatering, however, wastes water and leaches out nutrients, possibly into the ground water table and should be avoided.

This is the theme I'd like to develop. But first, let's go over the tools we have to work with.

In the humid areas of the country, the irrigation system must provide all the water turfgrass needs during the infrequent drought conditions and the supplemental water the turf needs during the frequent erratic rainfall periods. The drainage system, of course, services the course during periods of heavy rainfall.

Designing the irrigation system for drought conditions requires a good, even pattern of water distribution. Relative timing between the various areas is important but not critical. If a close watch is kept on the turf and an area shows signs of moisture stress, the interval of time can be increased for that night and the water deficiency made up. Economics (systems seldom have excess capacity) and the high and steady evapotranspiration rate during drought conditions keep superintendents from overwatering during these times. Evapotranspiration is the loss of water from the soil by evaporation and by transpiration from the plants growing in the soil.

Designing for humid conditions present a different set of problems. Generally, the grass has a low drought tolerance. The evapotranspiration rate varies to a greater degree and the amount and frequency of rainfall cannot be predicted accurately. The designer must now provide the operator with an extremely even pattern of distribution because excess water will not readily be lost by evapotranspiration. He must also provide for automatic shut down of the irrigation system due to rain and/or high soil moisture measurement.

A system designed for humid areas must also have flexible programming for a wide variety of areas. Rainfall over a course is generally uniform, but the water requirement varies according to changes in soil type, slope, etc.

The above discussion deals with the irrigation requirement of the grass plant for it's day to day water needs. A short range, but extremely important problem. is satisfying the plant's need for water when the evapotranspiration rate exceeds the uptake ability of the roots to supply water. A very short cycle of the sprinklers, 2-5 minutes, will raise the relative humidty in the micro-climate area and reduce the temperature of the plant and it's evapotranspiration rate. This is called syringing. It is valuable as a dew and frost removal tool.

Central programmers to provide steady irrigation during a drought, flexible irrigation during periods of rainfall, syringe cycles for influencing the micro climate and emergency shut down during rainfall or high soil moisture are being installed today and can be relied upon by the turf area superintendent.

So, doesn't that solve the problem?

Not really, because the superintendent has to set the amount and frequency of the irrigation and syringe cycles and he does not now have measured input of the required information. His decisions are based too much on experience and too little on fact. The result all too often is overwatering.

Then, how much water is needed by turfgrass? This is determined by solar radiation, wind, grass species, length of day, cultural practices and other inputs. Over the long period of time we usually return to the soil the water lost by evapotranspiration. The frequency with which we make these additions and the amount of water added will depend on the water holding capacity

(continued on page 38)

PROBE BENEATH THE SURFACE

(from page 20)

of the soil reservior and the upper and lower limits we set on this reservoir. This is usually expressed as percent of field capacity.

The turf superintendent should determine the watering holding capacity of his various soil types by use or a tensiometer, irrometer or similar moisture sensing device. Install the tensiometer in a representative area at the bottom of root depth. After calibrating the tensiometer, let the soil in that area dry to the 50-60% field capacity point. Add a predetermined amount of water with a sprinkler, about one-third inch, and determine what the increase is in percent of field capacity.

Water applied can be measured in a pan set adjacent to the tensiometer. Compute the amount of water required to manage your irrigation between field capacity limits. A second tensiometer at the 12-inch or 18-inch depth is valuable to prevent overloading the lower soil profile with water.

If the tensiometer reading at these lower levels shows an increase in moisture, percolating is occurring past the root zone. This is water going to waste and is filling up your water reservoir leaving little capacity for the coming rains.

If the increase in soil moisture at lower levels is due to rainfall, then care must be exerted not to over irrigate and add more water to an already filling reservoir.

Another method of controlling irrigation is the water balance method. Here a balance sheet of credits and debits of water is kept. Rainfall and irrigation are the credits. The debits depend on the evapotranspiration of the turf plant. This is difficult to measure on the golf course but a lot of good approximation can be made by checking the evaporation from a free water surface. Research on grass type will show its' evapotranspiration rate to be some percent of the evaporation from a standard pan. Making a standard pan is not difficult and recording the evaporation can be done once a day or just before timing the next irrigation.

Many of the national weather service stations measure evaporation and will be glad to show you their equipment. With this method water lost from the soil reservior by evapotranspiration can be determined. And rainfall can be measured. The difference is made up by irrigation — hence the balance method. *A note of caution — the rainfall in excess of that necessary to bring the soil to 100% field capacity usually percolates to a lower profile and is lost and not available to the plant. Even in the water balance method, it's well to have a few tensiometers installed around the course so you can monitor your soil-water relationship.*

In addition to the tensiometer method of measuring soil moisture, you can use electrical conductivity of the soil as an indication of available water. This is usually done by measuring with metal probes. The varying level of salts in the soil may require recalibrating at various intervals.

There is a limited variety of equipment on the market. Development of accurate, permanently installed equipment is one of the great needs of our industry.

As a professional turf man you need to "look" under the surface and plan better management of the water in your soil reservoir. □