

Management For Better Roots

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ROOTS ARE OFTEN the forgotten part of the turfgrass plant. Green Committee members attending Green Section Turf Advisory visits are often surprised to see the short root systems on greens that are maintained under poor soil and management conditions. I am often amazed at how superintendents keep greens alive under those conditions; some do not. It is equally amazing how extensive the root system can be at a 1/8-inch height of cut under ideal soil and management conditions.

Ideal conditions for production and longevity of grass roots are not impossible to obtain. These conditions will vary some between warm- and cool-season grasses. The only warm-season grass species commonly used in putting greens is bermudagrass. All other grasses used on putting greens are cool-season grasses. These include creeping bentgrass, *Poa annua* and the grasses that are used for fall and winter overseeding of bermudagrass greens. Roots grow best and perform their functions of mineral and water absorption most satisfactorily when soil temperatures are optimal, when oxygen and moisture levels are adequate, when not adversely affected by herbicides, nematodes or disease, and when the leaves are green and healthy.

The temperature of the soil in which roots grow affects the vigor of the root metabolism. Cool-season grass roots grow most vigorously and are initiated when soil temperatures are within 15 degrees of 55° Fahrenheit, either above or below. Soil temperatures are usually slightly above weekly average low air temperatures. Bermudagrass roots respond similarly to temperature, but at a 15- to 20-degree higher optimum. Roots do not necessarily die above and below these ranges, but they do not perform as well. There is little one can

do to modify soil temperature. Activated charcoal and sewage sludge have been used at times for their dark color to warm soils. Spring aeration is often used in the North and South to warm the soil and thus stimulate earlier growth of creeping bentgrass and bermudagrass. Temporary cooling is obtained by light watering and syringing.

The oxygen level in the soil air determines in part the ability of the roots to absorb water and minerals. We can do something about the oxygen level in the soil air. Any management practice which encourages movement of air into

the soil will be helpful in increasing the oxygen in the soil air. These helpful practices are aeration (coring), spiking, using soil mixes which remain porous after compaction, and careful irrigation practices. Water forces air out of the soil, but as the water moves down through the soil profile, air replaces the water in the pores. Saturated soil conditions after a heavy rain or irrigation result in low levels of oxygen in the soil. High soil temperatures increase all biological activity, i.e., root and microbe metabolism. All biological activity uses oxygen. Soils saturated with water in the summertime will have less oxygen in them than soils saturated in winter. Wet wilt is a common summer phenomenon caused by such conditions.

The more porous surface and channel created by a sand topdressing program makes root growth possible in hard-packed gumbo soil.



BY CAREFUL AERATION of creeping bentgrass and/or *Poa annua* greens in midsummer, superintendents have often been able to save grass thought to be close to dying. Careful management involves completing the full operation of aeration and related practices in the early morning when temperatures are at their lowest and so the grass is best able to withstand these maintenance procedures. In other words, operate on the patient when he is in good condition, and he will respond better than he would if operated upon when weak.

An excess of available nitrogen can be devastating to grass roots. Research on cool-season grasses has shown that root growth ceases and the total amount of roots may become less when available nitrogen is much above one-quarter pound per 1,000 square feet at soil temperatures above 50° Fahrenheit. Nitrogen available to the plant comes from fertilizers and from decomposition of soil organic matter. Decomposition of organic matter is most rapid between soil temperatures of 70° and 90° and



(Left) Roots flourish in aeration holes.

(Below) Aeration is a messy but necessary part of good management.



when moisture is adequate in the soil for microbial activity. Cool-season grasses often survive best through the summer when they receive little or no nitrogen from fertilizers. Excessive nitrogen under summer conditions stimulates top growth and uses up all available stored carbohydrates. Slow-release fertilizers and fertigation systems allow the superintendent to supply nitrogen to the turf at rates which do not stimulate excessive growth. Dormant fall feeding of cool-season grasses accomplishes the same results, because soil temperatures are not warm enough to result in rapid foliage growth.

RROOTS NEED FOOD (carbohydrates) produced by the photosynthetic process in the green leaves above. Therefore, scalping, disease of the leaf tissue and any other cause of leaf damage results in starvation of the roots.

Soil nematodes and fungi may injure roots. Herbicides often have time and again been shown to adversely affect grass root initiation and growth. Superintendents are usually aware of most of the cause-and-effect relationships to root health. It is difficult, however, to convince golfers that they will have better greens and root growth if greens are aerated. If holes created by aeration are filled, settled and refilled

so that the putting surface remains relatively smooth, superintendents can eliminate much of the objection golfers have against aeration of greens. Anyone wishing to convince an upset golfer of the need to aerate old soil greens merely has to cut out a plug from the green and show him the strong, healthy root growth in aeration holes. Roots hardly penetrate the compacted soil surrounding the aeration hole. Survival of stressed grass over aerifier holes is a common occurrence after winter desiccation.

On severely compacted soils void of turf, weed growth often occurs only in aeration holes. The fear of weed invasion is often a legitimate reason for not spiking or aerating turf more frequently. Careful timing of these operations and combining them with a pre-emerge herbicide application is necessary where weeds are a special problem. Managers often lightly fertilize several days to a week before they aerate so that the holes will close more rapidly and thus reduce chances of weed seed germinating in aeration holes.

Poor soil conditions and too much nitrogen, water and traffic often cause short, stunted, weak root systems. If managers of fine turf do not have ideal soil mixes, careful control of nitrogen and water, along with spiking and aeration, are the tools they must employ to keep the roots healthy.

Important Message for USGA Member Clubs

Since 1953 the United States Golf Association has offered a Turf Advisory Service to assist Member Clubs with turfgrass problems.

Effective January 1, 1982, the fee for the Turf Advisory Service will be \$350.00 for one visit. The fee for two or more visits, **if payment is made prior to March 1**, is as follows:

- a. Two visits — \$500.
- b. Subsequent visits (three or more) — \$250. per visit

Although the fee has been increased because of the ever-increasing costs of operation, it is less than the price charged in 1977. The USGA Green Section Turf Advisory Service is a nonprofit effort. Green Section agronomists work to bring superintendents and green committeemen the latest in care and conditioning of golf course turfgrasses. We hope we can count on your continued support of the USGA through its Green Section and Turf Advisory Service.