

How Soil Conditions and Worms Affect Greens

By B. R. LEACH

GREENKEEPERS, as a class, have no use for grubs, weeds and brown-patch but there are still a few members of the profession who have a more or less morbidly sympathetic attitude toward the lowly earthworm. Their attitude is based on the supposition that earthworms improve the soil and cause fine turf to grow finer. The argument for earthworms in fine turf is typically presented in the following from one pen: "Consider for a moment the important work that earthworms perform in the soil. They are constantly burrowing through the soil in all directions, thus keeping the soil light and aerated so that the vegetation secures nourishment and grows easily. This lightening of the soil by the worms also causes better drainage."

All of which is interesting but incorrect as one knows who has studied the life-history and habits of earthworms. I always envy the non-professional writer or speaker on turf maintenance. Inasmuch as he has nothing to lose, he can say what he pleases without any fear of a comeback.

Greenkeeper's Plight

Greenkeeping is suffering from the machinations of men who think they know something about turf and insist on writing about what they think they know. This vast output of literary effort is mainly characterized by a deplorable ignorance of technical and scientific fundamentals and gives the studious greenkeeper a bad case of mental indigestion. The poor devil hardly knows who and what to believe, with the result that he doesn't believe anything or anybody.

Inasmuch as earthworms have been repeatedly observed and studied by such famous biologists as Charles Darwin (a complete account of their habits can be found in one of his books, or for that matter in the encyclopedias), there can be no good reason for any lack of sound information with regard to these pests. However, suppose we consider the earthworm from various angles in its relation to fine turf.

Inasmuch as earthworms are animals,

they are chiefly concerned with the attainment of three desires—sufficient food, suitable shelter, and the perpetuation of their kind by reproduction. As regards the latter phase of their existence, it is enough to say that they lay eggs in capsules, 3 to 6 in each capsule, the latter the size of a small pea seed. These eggs hatch and the young are fully grown in 4 to 5 months.

Earthworms are omnivorous, meaning that they eat almost anything, including each other. In golf greens they feed on the partly-decayed blades of grass which fall in the path of the mower, humus matter in the soil, the eggs and larvae of insects; but they apparently do not feed on living roots. They swallow large quantities of soil merely to assist them in excavating their burrows. This is shown by the fact that earthworms living in poor soils almost devoid of humus nevertheless ingest much soil.

If you examine turf early in the morning you may find little vertical tufts of dried grass blades sticking up, and if you look closely you will see that each of these tufts is projecting from the mouth of an earthworm burrow and that the portion of the tuft in the burrow is much chewed and macerated. In gathering this food, the earthworm comes up so that almost its entire length is out of the burrow but it remains firmly anchored to the burrow by means of its tail. Consequently each worm forages as far from the mouth of its burrow as it can reach. As soon as it has exhausted the food supply within a radius around the mouth of its burrow equal to the length of its body, it makes another burrow at a distance as far out as it can reach while still anchored to the old one by its tail.

The earthworm does its feeding and moving around on the surface generally after dark, keeping under cover during the day when birds and other enemies are around. In making its burrow, the earthworm goes almost straight down, pushing aside the soil particles or swallowing them. When complete, the burrow is a little wider than the thickness of the worm and a little deeper than the earthworm's length.

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To prevent the walls of the burrow from crumbling in, the earthworm plasters them with a sort of glue-like cement which it secretes for this purpose. Earthworms rarely go below plow-depth in the soil except during the winter or when the soil becomes very dry during the growing season.

Having constructed its burrow, the earthworm proceeds to live a quiet, uneventful life, hunting its food at night and coming up to void the contents of its lower intestine which are commonly found scattered on the surface of fine turf and are popularly known as worm casts.

Since earthworms burrow in the soil only to the extent of a narrow hole a few inches deep and not indiscriminately here, there and everywhere through the soil like maggots in a cheese, it is rather difficult to understand how they can be credited with aerating or lightening the soil. Furthermore this idea of aerating or lightening the soil by such means as earthworms or spike-toothed rollers is fundamentally wrong. The aeration and drainage of the upper soil layer in a golf green needs no such artificial stimulation, in fact such stimulation is harmful to say the least. Aeration of the upper 3 or 4 inches of a green is entirely a problem of soil texture, proper subsoil and surface drainage and treading with the correct soil mixture.

In spite of all that has been written on the subject of golf green construction and care from the soil standpoint, the average greenkeeper still seems to be laboring under a cloud of misunderstanding with the result that fully one-half the work he does and much of the money he spends are wasted. At the start, let me say that the handling of a golf green is entirely and irrevocably different from the handling of any other crop that grows in soil and yet this difference is very obvious if you stop and think for a minute.

The roots of closely-mowed fine turf grasses such as the bents are all within two or three inches of the surface. This means that the soil below this depth is of no importance whatever as far as it affects the grass or supplies food, always of course provided that this under soil is free from lime. Consequently you can forget the soil below the three-inch depth except for one factor and that is the factor of drainage. If your greens are naturally well-drained, well and good; otherwise, tile drains will be necessary not only for the green but for the surrounding ground. The

top three inches of a golf green will never be up-to-snuff if the soil below is saturated with standing water. Such greens are suffering from chronic constipation and you can't cure constipation by rubbing your scalp with hair tonic or bear's oil.

Consequently, when you spend all your money topdressing a water-logged green, you are operating at the wrong end and wasting your time and money. It seems platitudinous to harp on this question of drainage in this day and age, but there are plenty of wet greens in this country. So much for subsoil drainage.

As far as surface drainage is concerned, you would think that anyone with half a head would know enough to avoid dished-in greens where areas or pockets of varying size hold the surface water after a rain simply because there is not sufficient slope in at least one direction so that the excess water can run off. And yet there are not many courses where you don't find some dished-in spots. Such spots are bad, first because they get more water than they should and are therefore generally soggy, and second because this water from the surrounding higher portions of the green carries down soluble fertilizers, brown-

patch control chemicals, and the like in excess. As this water in the low spots evaporates, this excess chemical stays in the low spot and takes the punch out of the turf at that point.

Having provided for adequate subsoil and surface drainage, the latter by proper contouring, it remains only to get the upper three inches of soil in the proper physical condition and to keep it so. What is the proper physical soil condition? The ideal physical soil condition for fine turf is embodied in what might be termed a medium loam soil. Such a soil contains sufficient clay or silt so that the soil has a maximum water-retaining capacity, but not so much clay or silt that it is sticky. It contains sufficient sand so that the soil is open and reasonably porous and yet not so much that it dries out rapidly. Such a soil does not mold like putty if you squeeze it when wet, nor does it bake and crack when dry. You can make such a soil by mixing 20 per cent clay or clay-loam with 10 per cent organic matter such as well rotted manure and 70 per cent sand or loamy sand (all ingredients to be free of lime). The sand should be of a coarse nature and you can increase the organic matter 5 per cent

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As far as organic matter is concerned, well-rotted manure is necessary, but half of the organic matter in the above mixture can well consist of imported peat moss, a product which the greenkeeper will do well to get acquainted with. This material is not to be confused with peat out of our native bogs or the so-called humus or swamp muck which was quite the rage some years ago. Peat moss is naturally rotted sphagnum moss which is taken out of old lake beds in certain of the middle European countries. It is finely granulated and packed dry in 175 pound bales. In the first place this material is as acid as a California lemon or a 40-year-old spinster's tongue which, together with its tremendous water-holding capacity, makes it an ideal material for use in the soil of a golf green. I predict a big future for this material in the golf-maintenance world.

If your golf course is located on a medium loam soil or you can obtain such soil for topdressing, count yourself lucky. If your course is located on heavy clay or on a sandy soil, it will be necessary to alter your upper 2 or 3 inches of soil on the greens so as to approximate the medium from soil type. If you are planting a green on heavy clay, contour the green as you wish it to appear finally and then spread two inches of sand over the surface, add a light covering of organic matter and then work the surface to a depth of *three* inches, no more, so that you drag up about three-quarters of an inch of the clay and mix it with the sand and organic matter.

Better still, spread the two inches of sand over the green and then half an inch of clay on top, together with the organic matter and work the mixture to a uniform condition and plant the seeds or stolons. If you are building a green on sandy soil, spread half an inch of clay or clay loam on the surface together with the organic matter and work it in to a depth of three inches and plant the green. This system in either case will give a 20 per cent clay content in the upper three inches which is exactly what you want and *no more*. If you don't want the surface to be sticky in wet weather and to bake and crack in dry weather, 20 per cent clay is the limit in a golf green. A soil containing more than 20 per cent clay, say 30 per cent, is practically as sticky as one containing 90 per cent clay, although not many green-

keepers seem to be aware of this truth.

When it comes to topdress, use the mixture of 20 per cent clay loam, 10 or 15 per cent organic matter, and the balance coarse sand. Never forget that the topdressing you are applying today is the golf green of tomorrow and act accordingly. You can ruin a golf green in a season by top dressing with the wrong soil mixture and spend the next two seasons in getting it back into shape. When greens are built and topdressed in this way the aeration and drainage of the upper three-inches will take care of itself and I assure you that the earthworm will not be necessary. As a matter of fact, however, other things being equal you will have plenty of earthworms in such a green because when you provide these ideal soil conditions for the fine turf grasses you incidentally supply the very conditions most desired by earthworms. Hence they will flock to such greens and control measures will be necessary. In next month's article I shall have more to say about soil conditions as affecting the earthworm population, together with a discussion of methods of earthworm control in fine turf.

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