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Earthworms the first turfgrass cultivators

My interest in earthworms was stirred in a Plant Ecology class by Dr. J. Weaver at the University of Nebraska. Dr. Weaver, of Weaver and Clements fame, was a founder of Plant Ecology.

While planning a five-day course in turf at Rutgers approximately 40 years ago, I asked a graduate student, Dave Moote (later golf course superintendent in Canada, now at Island Country Club

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Thinning the turf cover

Reducing Thatch and Increasing the Percentage of Young Tillers

Thinning, which is sometimes called thatching, is not a new practice. Fifty or sixty years ago, turfgrowers would thin with sharpened steel rakes to reduce thatch accumulation. Sometimes the purpose has been to reduce prostrate stem growth. The trick was to leave enough live growth buds to generate new turf cover in a reasonable length of time. This has been done most often on bentgrass and bermudagrass. Theoretically, the latter is better adapted to survival of thinning because of its (1) vigor, (2) rhizomes, and (3) tolerance of heat. In earlier years, some bermudagrass growers would re-dig the senescing thatchy stand to destroy thatch and to develop a new stand of vegetative growth. Often, seed has been used to help regenerate cover with bentgrass.

The thinning practice surged approximately forty years ago with machines like the Verticutt (flailing vertical knives) and the Aerothatch (a power driven reel of knives that cut gooves). These machines made it possible to power flail-out significant quantities of the thatch layer. Of course, thinning raised the following concerns:

(1) Will opening the cover cause loss of stand from sunburn of exposed plant parts in the green layer?

(2) Will it increase weeds?

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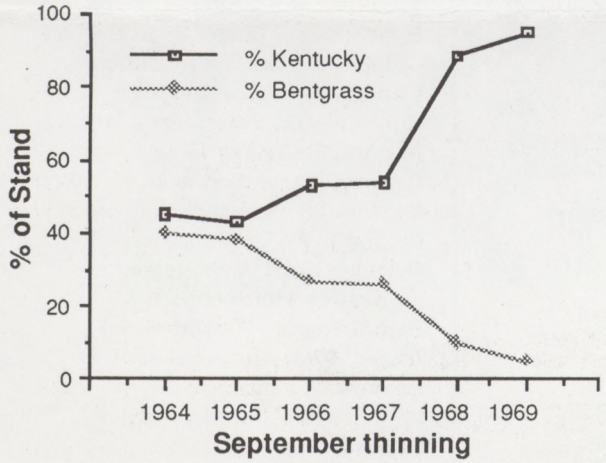

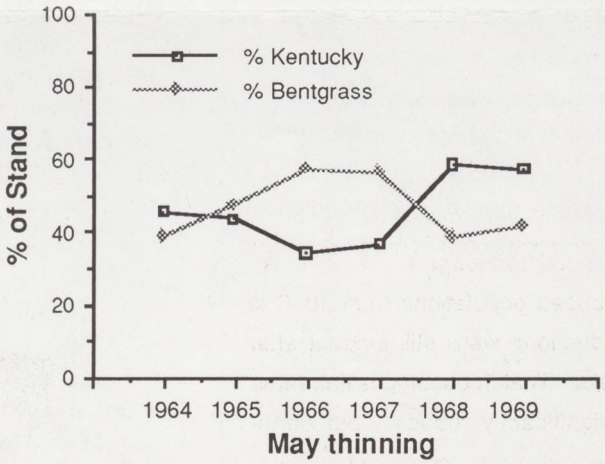

Figure 1, to the left, shows September thinning with vertical mower on mixed turf of Kentucky bluegrass and bentgrasses. Figure 2, to the right, shows May thinning. Treatments were conducted from 1964-69 at the New Jersey Agricultural Experiment Station of Rutgers University. Species content was determined with a point quadrant and leaf identification on replicated plots.

OPINIONS AND COMMENTS

Soil Core Removal and Sinking Greens

Leaving the soil from coring greens has two schools of thought — those "who leave them" and those "who take them off" with conviction. To examine this diversity of procedure, we can start with the reasons for cultivating and topdressing. Thatch control, keeping the surface open and stimulating new shoots are primary benefits.

For discussion on leaving soil cores, we are especially interested in the reasons for topdressing as follows: truing the surface, reducing dry spot problems, thatch control and increasing the depth of root zone. All of these can be good reasons for leaving soil from coring. Additional reasons are reduced chance of diverse layers in the soil profile and retaining soil-like materials. Most greens will benefit from soil cores — as they supplement prepared topdressing for thatch control. Paul Weiss Sr., a respected golf course superintendent from Pennsylvania, said, "Soil cores are the poor club's topdressing."

Reasons for removal

(1) To minimize spreading of weed seed from below the germinating layer onto the surface of greens that have been free of weeds for several years.

(2) To minimize messiness that detracts from putting green appeal for the golfer.

(3) To permit quicker dilution of a topsoil used in construction that is too

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in Naples, Florida), what topic he would like. We decided on the topic of earthworms in turf. His presentation in the 1950's was abstracted in the Rutgers Proceedings for that year. His comments that earthworms are worthy of tolerating in some types of turf for their cultivating action "ruffled some feathers." This was the era of post-World War II turf when slicers, hole-cutters and deep-tine cultivators had their greatest development. I received a very severe reprimand by two of the nation's turfgrass agronomists, asking if I had not heard of the "aerifiers."

Of course, both the interest in earthworms and cultivating machines has continued. The New Jersey Turfgrass Association **Greenworld** published a second article on earthworms in June, 1986. This article mentioned the value of earthworms for opening the soil and reducing thatch.

The 1986 article detailed various conditions that favored earthworm action and some of the ways earthworms benefit turf. They commonly create channels of 9- or 10-inches into the soil. They will go appreciably deeper with drying of the soil or with extreme temperatures. With larger populations, 25 to 30 channels per square foot have been counted. They do give some grinding of soil particles, but most importantly for turf, they pull plant parts into the opening and mix them with the soil. Their digestive tract has enzymes and microflora that help digest organic matter. As many as 200-400 earthworms have been counted in the profile of a square yard of soil. Earlier studies in Europe, New Zealand and Australia showed an active earthworm population can deposit an inch of soil on the surface in a three- to eight-year period. The earthworm aids soil permeability, plant nutrient availability and thatch control. Their work has shown significant increases in plant growth in crop plants and turf.

When it is desired to encourage earthworms, do not overlook liming. They thrive in well-limed soils as compared with acid soils. When on this subject, remember that with a few exceptions, most of the nitrogen carriers increase acidity. Thus, with higher rates of nitrogen, more lime is needed to maintain a well-limed soil.

The objections to earthworms are largely from the casts that interfere with putting surfaces (this is especially

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OPINIONS AND COMMENTS

Soil Core Removal

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high in clay and silt. Similarly, removing cores speeds dilution from a layer of improper topdressing material.

The latter two situations are problematic. First, a cursory judgement that greens have an incorrect soil texture can be wrong. High sand greens can be hard. Tests and expertise are needed to be sure what a faulty greens soil needs. Also, there is a chance that purchased or course-prepared topdressing may be worse than the soil in the greens.

A sometimes overlooked factor in core removal is that small dusting-type applications of topdressing with core removal may give a net loss of root zone depth. This is a serious shortcoming for those greens that need more depth of better soil. Topdressing to improve the soil base is needed on many greens. Often, this is the only chance for correcting the soil by courses that find it difficult to take a green out of play for rebuilding. You will find it interesting to determine the gain or loss in depth from the removal of soil cores and/or topdressing.

Removing soil cores is not a clear "yes-or-no" situation. I believe strongly that leaving them is the right answer, on most occasions. If the cores are high in silt or clay, remove them. Topdressing is a good antidote for thatch control, but most greens need more for control of this problem. More depth of good soil on greens is an important role for cores. For those who say removal of cores is easier, reconsider matting soil off the cores with the right weather. I did a lot of this with student help on the half-acre plus green at the Dudley Road site. •REE

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true for the "oriental" earthworms), and the muddiness that can occur on the turf. Some claim they expose buried weed seed, but this seldom appears as a problem.

In 1990, Drs. Potter and Powell, Kentucky scientists, published an article on the action of earthworms in turf. Their work concentrated on organic residue* in the soil and the action of the worm on the physical condition of Kentucky bluegrass turf. Thatch pieces were placed in nylon mesh bags with opening sizes that give varied admission to earthworms. These were placed just below the soil surface for 23 months. At the close, plots (thatch pads) exposed to earthworms, had 80% mineral soil by weight compared with 35% mineral soil where the worms were not present. With regard to pesticides, Dr. Potter wrote, "The Fungicide benomyl (Benlate) and the insecticides diazinon, carbaryl (Sevin), ethoprop (Mocap) and bendiocarb (Turcam) all dramatically reduced the earthworm populations. The last three materials reduced populations by an average of 76-99% across two tests. All of the treatments significantly reduced the rate of breakdown of the buried thatch. Less severe but significant earthworm mortality was caused by isofenphos (Oftenol), trichlorfon (Proxol or Dylox), chlorpyrifos (Dursban) and isazophos (Triumph).

In long-term tests, Diazinon, Benlate, Sevin, Mocap and Turcam were evaluated in larger plots for a longer period of time. The 13 x 13 plots were treated once at labeled rates in May and earthworm samples were taken at 1, 3, 5, 20 and 47 weeks. The last four insecticides had severe impact

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* POTTER, D.A. 1991. Earthworms, Thatch and Pesticide. Green Section Record. Vol. 29:6-18.

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One of the greatest obstacles to success is man's ability to put first things first.

--Charles Roth

Grow angry slowly -- there is plenty of time. --Ralph Waldo Emerson

God only asks for 10% of my income, what right does the government have to ask for 50% or more?

Thinning the turf cover

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(3) Will it cause shifts in species content?

The practice of thinning has grown and the development of more efficient machines has continued for 50-60 years. There are a great number of flail-type machines in use for thinning. There is a good assortment of machines that give both thinning and groove-slicing. These differ from vertical mowers and flails which are not designed to disturb the soil.

Theory, Use and Results From Thinning (Dethatching)

The theoretical benefits of thinning go beyond thatch reduction. Thinning makes room for new tillers, which is possibly as important as reducing the thatch layer. Thinning reduces loose stolons and fluffy senescent turf. Most overlooked is its use for discouraging one species over another. Figures 1 and 2 on the front page give some of my research, which showed thinning turf can reduce bentgrass and increase Kentucky bluegrass. Annual thinning in September-October over five years enabled Kentucky bluegrass to become highly dominant over bentgrass. In contrast, May thinning suppressed Kentucky bluegrass and enabled bentgrass to become a major component of the turf.

This test was preceded by several defoliation observations on thinning of turf showing the following results of interest and potential for research.

(1) Thinning of a New Jersey lawn of Merion Kentucky bluegrass that was losing vigor (apparently from thatch and related problems) was thinned severely (50% removal of green aspect) in October with the thought this would not harm the lawn and still permit recovery by spring. The result was serious winterkill.

(2) An observation on a Kentucky bluegrass lawn that received April thinning at the Wooster Ohio Experiment Station gave better regrowth in spring and summer as compared with the untreated checks.

(3) May thinning gave increases in crabgrass on some of my tests.

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The passion for equality produces uniformity which produces mediocrity.

--Alexis Detocqueville

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that reduced populations from 40-77% and reductions were still evident after 20 weeks. Thatch decomposition rates were significantly reduced, but earthworm populations recovered to near normal in 11 months.

Summary comments

Dr. Potter's work shows the earthworm accomplished much of its effect by mixing soil with thatch and digesting plant residue. This method of biological control is nature's way. What reason do we have for not using it, except when casts are a problem?

Thatch problems are often inadequately controlled with moderate cultivation and topdressing. Let the earthworms help with thatch control and opening the soil. I am not proposing elimination of turf cultivation. This can be helpful in seasons when earthworms are inactive. Use both techniques as needed and feasible.

Earthworms have the nice advantage of a neat channel to a greater depth than most machines. Their channels have been noted to stay open for considerable time in loam or clay soils. When the older worms die, the larger populations contribute significant amounts of slow release nitrogen and other nutrients.

There are different species and strains of earthworm that occur naturally. Earthworms are worthy of our liming very acid soils to increase their numbers as desired. Next, we hope manufacturers will tell us when their pesticides affect earthworms. If a pesticide that is severe on earthworms must be used, hopefully it will not be needed two or three consecutive years.

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