

One of the simplest ways of providing for proper growth of turf is, of course, to provide the grass plants with sufficient nutrient elements by adequate fertilization. In Table 4 are shown the effects of different fertilization of a Kentucky bluegrass sod on the accumulation of organic matter which is so important in the aggregation of soils, and the loosening effect of stimulated root activity in the first two inches of surface soil as reflected by an increase in non-capillary porosity.

Specialized implements such as the Aerifier, Terferator, and others are now being used for puncturing compacted surface layers in turf soils. These

machines, in removing plugs of soil from turf areas, actually create a system of large or non-capillary pores by which moisture, fertilizer and seed can be taken into the soil. They also provide a breathing system through which air can escape during rainfall or irrigation and through which fresh air can enter the soil later. The rapid intake and movement of water and air are recognized generally as prime necessities in compacted soils. The widespread use of these mechanical devices in opening up or in aerating compacted surface layers would indicate that results are being obtained in terms of better turf.

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## OBSERVATION OF NEMATODES IN YELLOW TUFT OF BENTGRASS

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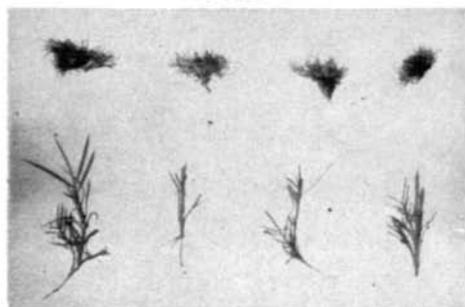
Yellow tuft in bentgrass occurs as small circles in the turf  $\frac{1}{4}$  to 1 inch in diameter. A close examination discloses that the tufts are formed by many small shoots arising from a node on the stolons of bentgrass. The majority of these shoots will contain a number of fine leaves, many of which are yellow and some of which may be dead. The yellow color may persist indefinitely or may be present only a few months until the advent of more favorable growing conditions, after which the normal green color reappears. This condition is apparent mostly in the fall or early spring but may persist through-

out the year. Although this disease may occur on other grasses, it is most common on bentgrass turf. Similar conditions have been reported on Bermuda grass in Florida and in South Africa. Fig. 1 shows a comparison of tufted shoots with normal shoots of bentgrass.

### Historical

Yellow tuft was first described by R. A. Oakley<sup>1</sup> in 1924. In this account he stated: "A close examination shows the small tufts or rosettes which cause the mottling or spotting to be made up of young grass plants produced on the stems of the older plants. Botanically the tufts or rosettes are proliferations from the older turf. So far as can be ascertained, they are not due to any fungus disease or to any insect or nematode". This investigator tried to alleviate the condition by applications of ammonium sulfate, ammonium phosphate, and iron salts but did not obtain any noticeable results.

FIGURE 1



Comparison of tufted shoots in upper row with normal shoots in lower

<sup>1</sup> Oakley, R. A. MOTTLED CONDITION OF BENT TURF. Bulletin of the Green Section of the U. S. Golf Association, Vol. IV, No. 11, p. 259, Nov. 1924.

Monteith and Dahl<sup>2</sup> published on various turf diseases in 1932 and in relation to the cause of yellow tuft made the following statement: "Although various explanations have been made as to the cause of yellow tufts, the real cause remains unknown. A similar tufted growth occurs on many trees and shrubs, where it has been traced to injuries resulting from some mechanical factor or from the invasion of parasitic organisms, particularly bacteria".

#### Economic Importance

The presence of yellow tufts does not greatly harm the quality of a putting surface but may, under severe conditions, cause enough unevenness of the surface to deflect a putt. The unsightliness of the putting greens, however, is the chief difficulty caused.

This condition, although generally unnoticed, is common throughout the Mid-

<sup>2</sup> Monteith, J. and A. S. Dahl. TURF DISEASES AND THEIR CONTROL. The Bulletin of the U. S. Golf Association Green Section. Vol. 12, No. 14, August 1932.

#### COMING EVENTS

- June 12: Turf Field Day. Central Plains Turf Foundation and Kansas State College at Manhattan, Kansas. Ray A. Keen.
- August 20: Golf Association of Philadelphia and Philadelphia Association of Golf Course Superintendents at Plymouth Country Club. Mrs. Ralph I. Raynor, 629 Chestnut Street, Room 303, Philadelphia 6, Pa.
- August 22-23: Twentieth Annual Greenkeepers' Field Days. University of Rhode Island at Kingston, R. I. J. A. DeFrance.
- August 27-31: American Society of Agronomy Annual Meetings, Pennsylvania State College, State College, Pa. L. G. Monthey, Madison, Wis.
- September 5-7: Turf Field Days. The Pennsylvania State College and Turf Advisory Committee, State College, Pa. H. B. Musser.
- September 17-18: Turf Field Days. Purdue University and Midwest Regional Turf Foundation. West Lafayette, Indiana. W. H. Daniel.
- October 7-9: National Turf Field Days. Beltsville Turf Gardens, Plant Industry Station, Beltsville, Md., USGA Green Section and U. S. Department

FIGURE 2



Photomicrograph of a nematode of the species *Eucephalobus Oxyuroides* in leaf tissue of bentgrass.

dle Atlantic States, where it seems to have increased in severity during the past two years. Last year, particularly, putting surfaces were damaged on several golf greens around the Washington area. In one case a green planted from stolons in December had yellow tuft the following summer.

#### Results of Examinations

Numerous examinations of yellow tufts from various locations have re-

of Agriculture cooperating. Fred V. Grau.

October 24-26: Turf Conference. Central Plains Turf Foundation and Kansas State College at Manhattan, Kansas. L. E. Lambert and Ray A. Keen.

(Note: The Advisory Committee for the Northern California Turf Conference is considering changing the spring dates to fall dates. Early November is being considered. It is hoped that turf conference groups in the Western half of the United States can integrate dates through the Green Section for efficiency and economy of travel.)

1952

January 8-9: Turf Conference. Mid-Atlantic Association of Golf Course Superintendents. Lord Baltimore Hotel, Baltimore, Md. E. N. Cory, University of Maryland.

February 3-8: 23rd Annual Turf Conference and Show of Golf Course Superintendents Association of America. Neil House, Columbus, Ohio.

February 18-21: Turf Conference. The Pennsylvania State College, State College, Pa. H. B. Musser.

March 3-6: Turf Conference. Midwest Regional Turf Foundation and Purdue University, West Lafayette, Ind. W. H. Daniel.

vealed the presence of several nematodes among which two forms, *Eucephalobus oxyuroides* and *Panagro laimus rigidus*, appear in relatively large numbers. Other nematode forms observed in tufts, but never as numerous as the two mentioned, are *Tylenchus*, *Aphelenchoides*, *Doryloimus*, *Monhystera*, *Ditylenchus* and *Plectus*. When healthy shoots were examined, however, in some cases a few specimens of *Eucephalobus oxyuroides* and *Panagrolaimus rigidus* were also found, but never in as large numbers as found in diseased tufts.

Throughout the examinations of affected shoots, these nematodes were usually found either well within healthy tissues of the leaf sheaths (Fig. 2 and 3) or between the leaf sheaths and the stem, apparently feeding on the contents of the cells. Observations of the intestinal contents of several of these nematodes revealed the presence of green chloroplasts indicating that these forms had been feeding on healthy cells where chloroplasts are usually found.

#### Conclusions

Whereas *P. rigidus* and *E. oxyuroides* had been regarded as free-living soil forms normally feeding on decaying plant material, the possibility that they may be plant parasitic is now worthy of consideration. It is conceivable that the formation of the number of fine leaves which make up a diseased tuft may be stimulated by the feeding of nematodes on the meristematic tissues of the plant, or that the effects of their presence in sufficient numbers within shoots may manifest the symptoms of yellow tuft. It is equally as strong a possibility, however, that yellow tuft is made up of a group of concurrent symptoms to which the deleterious effects of these nematodes may add.

#### Movie Being Revised

The U. S. Department of Agriculture's 16mm kodachrome short entitled, "Lawns that Live," designed for television showings, was considered by the movie experts unsuitable for motion picture use. Therefore this film is in the process of revision and no copies are available for sale

## TURF RESEARCH REVIEW

The second edition of **TURF RESEARCH REVIEW**, a directory covering turf activities in the United States for the calendar year 1950, is now ready for distribution at the Green Section office. A limited number of copies are for sale at \$1.25 a copy, postage free, first come, first served.

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**TURF RESEARCH REVIEW** in effect is an annual supplement to the USGA's new book, **TURF MANAGEMENT**, by H. B. Musser, published by McGraw-Hill Book Co. at \$6 a copy. It is available from bookstores, from McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y., or from the United States Golf Association, 40 East 38th Street, New York 16, N. Y.