



Standard Test Methods for Organic Matter Content of Putting Green and Sports Turf Root Zone Mixes¹

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1. Scope

1.1 These test methods cover the determination of the percent organic matter of a putting green root zone mixture using a loss on ignition method or the Walkley Black method. These test methods are useful for quantifying the organic matter content of volume ratio mixed root zone mixes. Test Method D 2974 is recommended for peat and other organic soils.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use, nor the disposal of hazardous waste that may be generated. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific precautionary statement, see 8.2.6.

2. Referenced Documents

2.1 ASTM Standards:

D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils²

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods³

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method³

3. Summary of Test Methods

3.1 *Method A*—Organic matter content is determined by loss on ignition.

3.2 *Method B*⁴—Organic matter content is determined by the Walkley-Black method; a dichromate oxidation procedure whereby the color intensity of the reaction product is determined colorimetrically.

¹ These test methods are under the jurisdiction of ASTM Committee F-8 on Sports Equipment and Facilities and are the direct responsibility of Subcommittee F08.52 on Playing Surfaces and Facilities.

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² *Annual Book of ASTM Standards*, Vol 04.08.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Procedure was based on procedure published in “Methods of Soil Analysis, Part 2: Chemical and Microbiological Properties,” American Society of Agronomy Monograph No. 9, 2nd Ed.

4. Apparatus—Method A

4.1 *Oven*, capable of maintaining a constant temperature of 105°C.

4.2 *Muffle furnace*, capable of producing constant temperatures of 360°C.

4.3 *Evaporating dish or crucible*, made of high silica or porcelain of not less than 10-mL capacity.

4.4 *Desiccator*,

4.5 *Aluminum foil*, heavy duty, and

4.6 *Balance*, sensitive to 0.001 g.

5. Apparatus—Method B

5.1 *Soil grinder*,

5.2 *Balance*, sensitive to 0.01 g.

5.3 *Sulfuric acid*, concentrated (not less than 96 %),

5.4 *Potassium dichromate*, 1 N, made by dissolving 49.04 reagent-grade potassium dichromate in water, and diluting to a volume of 1 L,

5.5 *Spectrophotometer or colorimeter*, set at or adjustable to 610-nm wavelength.

5.6 *Standard*, 10 000 mg/L as CO₂,

5.7 *Pipets*, assorted, capable of measuring volumes of 0.1 to 10 ml,

5.8 *Glassware*, assorted, to include 250-ml Erlenmeyer flasks and funnels (75-mm ID), and

5.9 *Oven*, capable of maintaining a constant temperature of 105°C.

6. Procedure—Method A

6.1 Scoop 5 to 10 g of oven-dried (105°C) soil into tared crucibles.

6.2 Weigh and record weight to the nearest 0.001 g.

6.3 Place the sample into a muffle furnace heated to 360°C. Leave the sample in the furnace for 2 h.

6.4 Cool to 150°C, or cover with a piece of foil and cool in a desiccator.

6.5 Weigh in a draft-free environment to the nearest 0.001 g.

7. Calculation of Percent Organic Matter, Method A

7.1 Calculate percent organic matter as follows:

$$LOI, \% = [(weight\ at\ 105^{\circ}C - weight\ at\ 360^{\circ}C) / weight\ at\ 105^{\circ}C] \times 100 \quad (1)$$

8. Procedure—Method B

8.1 Preparing a Standard Curve:

8.1.1 Set up five 250-ml Erlenmeyer flasks.

8.1.2 Use a pipet to pipet the volumes of standard solution into the flasks, as listed below.

mL of 10 000 mg/L CO ₂	% Organic matter
0	0
0.20	0.9
0.50	2.2
1.00	4.4
1.20	5.3

8.1.3 Pipet 10 mL of potassium dichromate into each flask.

8.1.4 In a well ventilated area, pipet or dispense 20 mL of sulfuric acid into each flask.

8.1.5 Cover the flask and allow the reaction to progress for 10 min.

8.1.6 Add 100 mL of distilled or deionized water to each flask and swirl briskly.

8.1.7 Read the absorbance for each standard at 610 nm and plot a standard curve.

8.2 Procedures:

8.2.1 Obtain a representative, oven-dried root zone sample.

8.2.2 Grind a small quantity of sample until 100 % passes a 140-sieve (0.1 mm).

8.2.3 Weigh out exactly 1 g of sample (to the nearest 0.01 g), and place in a 250-mL Erlenmeyer flask.

8.2.4 Add 10 ml potassium dichromate.

8.2.5 Make up a blank sample by adding potassium dichromate into an empty flask.

8.2.6 Carefully add 20 mL of sulfuric acid to both flasks.

Caution: Be careful of the fumes and the heat generated by the reaction. Allow to sit for 10 min.

8.2.7 Add 100 mL of distilled or deionized water to the flasks.

8.2.8 Set up a funnel with No. 2 or similar filter paper. Pour enough of the solution through the funnel to collect about 10 mL.

8.2.9 Read the absorbance of the sample at 610 nm. Refer to the standard curve to obtain percent organic matter.

9. Report

9.1 Report the following information:

9.1.1 Sample identification,

9.1.2 Sample condition when received,

9.1.3 Percentage organic matter to nearest 0.01%, and

9.1.4 Method used: A (Loss on Ignition) or B (Walkley-Black).

10. Precision and Bias

10.1 *Interlaboratory Test Program*—An interlaboratory study was conducted in accordance with procedures of Practice E 691. Three randomly selected test specimens for each of six root zone mixes were sent to nine laboratories for organic matter content determinations using Method A, Loss on Ignition. The mixes were representative of sandy root zone mixes used on turf grass areas and were mixtures of either (1) sand and peat, (2) sand and soil, or (3) sand, soil, and peat.

10.2 *Test Result*—The following precision information for organic matter content is in the unit of percentage and the repeatability and reproducibility limits, as a percentage of the organic matter content, is for the comparison of two test results, each of which is the average of three test determinations.

10.3 *Precision*⁵:

10.3.1 *Organic Matter by Method A (Loss on Ignition)—Test Range from 0.82 to 2.87 % Organic Matter:*

95 % repeatability limit (within laboratory)	30 % (25 to 35 %) of test result
95 % reproducibility limit (between laboratories)	39 % (29 to 54 %) of test result

The preceding values for limits are the average (and range) for the six mixes. The terms *repeatability limit* and *reproducibility limit* are used in accordance with Practice E 177.

10.4 *Bias*—The bias for these measurements is undetermined because there is no reference value for the materials (mixes) used.

11. Keywords

11.1 organic matter; putting greens; soils; sports fields

⁵ Supporting data are available through ASTM Headquarters. Request RR: F08-1005.

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