

ECTC Test Protocol

Proposed ASTM Test Method

Approved - June 2004

Designation: ECTC Test Method 4

Standard Index Test Method for DETERMINATION OF ROLLED EROSION CONTROL PRODUCT (RECP) ABILITY TO ENCOURAGE SEED GERMINATION AND PLANT GROWTH UNDER BENCH-SCALE CONDITIONS

1. Scope

1.1 This index test method establishes guidelines, requirements, and procedures for evaluating the effect of Rolled Erosion Control Products (RECPs) on seed germination and vegetation enhancement.

1.2 This test will examine the effects of RECPs on seed germination in a controlled environment.

1.3 This index test is not intended to replace full-scale simulation or field testing in acquisition of performance values that are required in the design of erosion control measures utilizing RECPs.

1.4 This index test method provides indication of RECP and bare soil performance under controlled and documented conditions.

1.5 The values stated in SI units are to be regarded as standard. The inch-pound values given in parentheses are provided for information purposes only.

1.6 This index test method does not purport to address all the safety problems, if any, associated with its use and may involve use of hazardous materials, equipment, and operations. It is the responsibility of the user to establish and adopt appropriate safety and health practices. Also, the user must comply with prevalent regulatory codes, such as OSHA (Occupational Health and Safety Administration) guidelines, while using the test method.

2. Referenced Documents

2.1 ASTM Standards

D 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 698 Test method for laboratory compaction characteristics of soil using standard effort

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction⁵

D 4354 Practice for Sampling of Geosynthetics for Testing

D 5268 Specification for Topsoil Used for Landscaping Purposes

D 6475 Test Method for Measuring Mass per Unit Area of Erosion Control Blankets

D 6566 Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats

3. Terminology

3.1 For definitions of terms used in this practice, see Terminology D 653.

4. Summary of the Test Method

4.1 Containers containing soil are sown with seeds and then covered with an RECP. Additional containers of soil are sown with seed and left uncovered as "controls". The light and temperature are maintained and, along with humidity, documented. The amount of germination and growth is measured periodically throughout the test, and the weight of vegetation is calculated at the conclusion of the test.

4.2 Each RECP under consideration as well as control containers of uncovered soil undergo testing in a simulated climate.

5.0 Significance and Use

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5.1 This test method evaluates the effect of an RECP on seed germination and initial plant growth in a controlled environment.

5.2 The results of this test can be used to compare RECPs and other erosion control materials to determine which are the most effective at encouraging the growth of vegetation.

6.0 Apparatus

6.1 Germination containers: Plastic pots nominally 20 ± 1 cm (8 ± 0.4 in) inside diameter made from plastic pipe section cylinders and having a height of 10 ± 1 cm (4 ± 0.4 in). The pots include a perforated bottom to allow drainage.

6.2 Light and Temperature -controlled chamber: Chamber capable of maintaining a constant temperature of 27 ± 2 °C and $45 \pm 5\%$ RH and having a light source as outlined in Annex A1.0.

6.3 Photometer: Instrument capable of measuring and recording the illumination provided by a fluorescent light source, including both the visible and ultraviolet (UV) spectrum.

6.4 Thermometer: Instrument capable of measuring and recording temperature.

6.5 Hygrometer: Instrument capable of measuring and recording relative humidity.

7.0 Test Organisms

7.1 The test should be conducted on one seed mix of tall fescue (PLS = $80\% \pm 5\%$)

NOTE: The test organism listed in this test procedure has been successful for product comparison purposes. However, this test may be used with alternative test organisms based on user needs. If test organisms different from those listed in this procedure are used, agreement should be established between the testing laboratory and the user of the test.

8.0 Sampling

8.1 Perform RECP material sampling in accordance with ASTM D 4354.

8.2 The laboratory RECP sample should be 1 m^2 (3.28 ft^2).

8.3 Cut six specimens from each RECP laboratory sample. The specimen should completely cover the soil in the germination pots.

9.0 Procedure

9.1 Preparation of germination containers

9.1.1 Prepare three pots for each RECP to be tested and three control pots.

9.1.2 Place the soil growing medium in each pot. The growing medium shall be topsoil conforming to ASTM D 5268 with an in-place moisture content and unit weight determined as follows:

9.1.2.1 Condition and place the topsoil in each pot at a moist unit weight of 85 ± 5 pcf and 35 – 40% moisture content (approx. 60% saturation).

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9.1.3 Randomly select three 5 cm x 5 cm (2 in x 2 in) squares from each pot. Outline and/or mark the selected squares in each pot. Data will be periodically collected from within these squares. Alternatively, the entire pot can be used for data collection.

9.1.4 Sow each pot with 0.50 seeds per cm² (500 seeds per ft²) - 176 seeds per pot & 13 seeds per selected square. The seeds are distributed as uniformly as possible throughout each pot.

9.1.5 Press the seeds firmly against the soil surface and apply a thin veneer of cover soil, no more than 3 mm (0.1 inches) thick, over the seeds. Compress both the seed and the topsoil using a 50 lb circular weight having a nominal diameter equivalent to the pot inside diameter.

9.1.6 Add sufficient water to bring the placed and compacted topsoil to approximately 100% saturation (stop as soon as free water is apparent on the surface).

9.1.7 Each RECP specimen shall be weighed and measured to determine its mass per unit area in accordance with ASTM D 6475 / 6566. Cover each of three pots with an RECP specimen. Three pots will be left uncovered to be controls. For RECP-covered pots, place the RECP over the pot and hold firmly in place around the perimeter of the pot. The RECP can be secured over the pot using a rubber band to prevent the growing plants from pushing the RECP up.

9.1.8 Check and record temperature, relative humidity, and light in each climate control chamber and make any necessary adjustments.

9.2 Test Operation, Maintenance and Data Collection

9.2.1 Place the pots in the controlled environmental chamber conditioned at 27 ±2 °C and 45 ± 5% RH. The test will proceed for 21 days.

9.2.2 The number of germinated seeds and the length of the plants within each designated square are recorded on days 7, 14, and 21. The plants are measured by measuring the distance from the table top to the end of the plant growth. Measure the height of the soil from the table top. Subtract the height of the soil from the height of the plant growth to get your plant length.

9.2.3 At the 7 and 14 day measurement periods, apply an additional quantity of water to each test pot equal to 12.5 mm (0.5 in) over the area of the pot (410 ml for an 8-in diameter pot).

9.2.4 At the conclusion of the 21 days, each pot is harvested by pulling with roots out of the soil within each designated 5 cm (2 inch) square measurement zone.

9.2.5 Dry the harvested grass clippings in an oven at 100 °C (212 °F) for 24 hours.

9.2.6 Make mass determinations for each pot.

NOTE: The test environment used in this test procedure has been successful for product comparison purposes. However, this test may be used with alternative test environments based on user needs. If test environments different from those listed in this procedure are used, agreement should be established between the testing laboratory and the user of the test.

10.0 Calculations

10.1 Find the total for each pot or the mean in the pre-identified squares in each pot of the number of germinated seeds and the average height of the plants for each measuring period. Similarly, determine the biomass after 21 days. The data for each pot should be normalized to the sample roll average based on the specimen-specific mass per unit area for the pot.

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10.2 Average the data from 10.1 for each set of three identically prepared pots to obtain two numbers per day of data collection for each configuration.

11. Report

11.1 The report shall at a minimum include the following:

11.1.1 General information, including test facility location, date and time.

11.1.2 Climate and soil pot (including soil weight and water weight added) details recorded before and during the test.

11.1.3 Description of each RECP under consideration

11.1.4 Soil description

11.1.5 Test seed description

11.1.6 Raw data

11.1.7 A table containing the biomass (will only have data for the last day), seed germination, and plant height averages for each RECP and the control for day of data collection

11.1.8 Any qualitative observations or conclusions about the performance of the RECPs

12. Precision, Bias and Reproducibility:

12.1 Precision:

The precision of the test is being determined.

12.2 Bias:

The bias of the test, if any, is being determined.

12.3 Reproducibility:

The reproducibility of the test is being determined.

13. Keywords

13.1 Erosion control, rolled erosion control product, RECP, germination.

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ANNEX

Mandatory Information

A1.0 Standard Climates

A1.1 Light Req'ts: The source of light will be from "warm white" fluorescent lights producing 900 ± 100 ft-candles at the soil/canopy surface. Typical warm white characteristics for a 48-in long lamp include: Light output = 3300 lumens; Color Temperature = 3000K; Color Rendering = 85.

Photoperiod should be at least 14 hours of light per day.

Illumination should be monitored weekly with a recording photometer. Adjustments to artificial lighting may be necessary.

Temperature & Humidity: Record air temperature and humidity at least daily. Air temperature and relative humidity should be continuously monitored.

Test Condition	Temperature	Humidity
Controlled	$27^{\circ} \text{C} \pm 2^{\circ}$ (approx 81°F)	$45\% \pm 5\% \text{RH}$

A2.0 Standard Soils

A2.1 Unless otherwise requested, use ASTM topsoil. ASTM topsoil shall comply with ASTM D 5268 specifications.

A3.0 Seed Calibration

A3.1 Seed for the germination test shall be stored in a refrigerator.

A3.2 The seed used in the test shall be subjected to a calibration test simultaneously with the running of the test. The calibration test shall involve the selection of 20 seeds from the same source as those used in the germination test. The 20 seeds are placed on a saturated paper towel, sealed within a plastic transparent container and exposed to the same temperature/lighting regimen as the germination samples. At 7, 14, and 21 days the number of seeds to germinate in each plot shall be noted. At the end of 21 days the percentage of seeds germinated shall be used to interpret the results of the germination test relative to previous tests. Three calibration replicates shall be used and averaged. If the seed germination rate from the calibration tests drops below 80%, new seed should be obtained.