

Hydromulches vs. Erosion-Control Blankets in Hillsides

By Dr. Gilberto E. Urroz

The need to protect hillsides against rainfall erosion, whether in agricultural applications or in highway construction, has contributed to the development of a large number of erosion-control materials. There is a need to test and compare the performance of new and existing erosion-control methods. In this article I present results from a series of tests performed under simulated rain and sunlight to determine the effectiveness of a variety of hydromulches and erosion-control blankets in terms of erosion protection and plant growth enhancement.

Hydromulches, mixed with water and seed, are sprayed under pressure directly on the soil surface, while erosion-control blankets are rolled and stapled to the soil after seed is applied directly onto the soil surface. A hydro- or an erosion-control blanket protects the soil against erosion by damping the raindrops that dislodge soil particles and may help enhance plant growth by retaining moisture. Hydromulches are sometimes combined with a tackifier or soil binder that acts as a chemical binding between the mulch particles to create a continuous and resistant cover. In the tests reported here hydromulches with and without tackifiers were utilized. Hydromulches are usually composed of wood fiber, recycled paper or other vegetable fibers. Erosion-control blankets, on the other hand, are made from synthetic or natural fibers held together by one or several layers of nettings. Among the natural fibers used in erosion-control blankets we can count excelsior material, straw, coconut fiber and jute fiber. Erosion-control blankets



Erosion-control fabrics, when properly used, can offer superior erosion control on slopes subjected to heavy rainfall. File photo.

for low-rain intensities or low-flow velocities can even be made of paper layers.

The Utah Water Research Laboratory (UWRL) performed a series of tests on ten hydromulch applications and eight erosion-control blankets aimed at comparing their performance in terms of erosion protection, water retention and plant growth enhancement. This test series was financed by the Mountain-Plains Consortium, a University Transportation Centers Program for Transportation Research,

Public Service and Education. The results from the study were to benefit the State Department of Transportation in the selection of erosion-control materials for its highway construction applications. The tests, however, were limited to a single set of test conditions. The results are of limited application. The test conditions (a slope of 2.5:1 and a rainfall intensity of five inches/hour for 30 minutes) turned out to be too extreme for most hydromulches, and underline the need to establish test standards for the two groups of ero-

Table 1. List of products tested

| Hydromulches | | Erosion-Control Blankets | |
|--------------|--------------------|--------------------------|--------------------------------|
| Code | | Brand | Code |
| M1 | Climatizer Mulch | B1 | High-velocity Curlex |
| M2 | Cellumulch | B2 | Conwed Futerra |
| M3 | Verdyol Mulch | B3 | North-American Green S-150 BN |
| M4 | Nature's Own Mulch | B4 | North-American Green SC-150 BN |
| M5 | Silva Fiber Mulch | B5 | Anti-Wash GeoJute |
| M6 | Conwed Mulch | B6 | Dekowe 400 Coir |
| M7 | Re-Fiber Mulch | B7 | Bonterra S-1 |
| M8 | Re-Fiber Mix Mulch | B8 | Bonterra S-2 |
| M9 | Grass Fiber Mulch | | |
| M10 | Conwed 2000 Mulch | | |

Table 2. Results for erosion, water runoff and plant characteristics.

| Material Code(*) | Soil | Water | Plant | Plant Dry | Percentage of seed | | |
|------------------|----------------------|----------------------|-------------|----------------|--------------------|-------|--------|
| | Erosion Rate (lb/hr) | Runoff Rate (gal/hr) | Height (in) | Weight (lb/Ac) | lost | germ. | non-g. |
| M1 | 92.68 | 115.60 | 3.44 | 10.44 | 71.01 | 14.95 | 14.04 |
| M2 | 90.77 | 102.47 | 4.36 | 19.73 | 71.01 | 20.00 | 8.99 |
| M3 | 78.15 | 71.87 | 4.92 | 24.01 | 65.76 | 22.42 | 11.82 |
| M4 | 84.88 | 107.73 | 4.88 | 33.89 | 66.67 | 26.06 | 7.27 |
| M5 | 87.66 | 70.40 | 5.22 | 51.80 | 44.65 | 40.61 | 14.74 |
| M6 | 86.67 | 69.60 | 5.33 | 54.92 | 42.02 | 43.84 | 14.14 |
| M7 | 85.56 | 101.60 | 4.63 | 27.18 | 58.08 | 24.65 | 17.27 |
| M8 | 80.99 | 112.87 | 4.56 | 26.29 | 64.85 | 24.44 | 10.71 |
| M9 | 91.47 | 136.60 | 5.09 | 23.17 | 63.94 | 18.69 | 17.37 |
| M10 | 56.22 | 22.07 | 5.30 | 39.51 | 49.29 | 33.44 | 17.27 |
| B1 | 9.78 | 0.939 | 6.51 | 92.82 | 13.43 | 73.52 | 13.05 |
| B2 | 17.12 | 0.045 | 6.58 | 107.66 | 12.02 | 84.51 | 3.47 |
| B3 | 2.25 | 0.013 | 6.56 | 131.52 | 11.92 | 68.59 | 19.49 |
| B4 | 1.14 | 0.008 | 6.44 | 120.39 | 16.87 | 55.66 | 27.47 |
| B5 | 47.74 | 11.07 | 5.76 | 90.09 | 22.93 | 55.15 | 21.92 |
| B6 | 76.08 | 21.73 | 6.01 | 116.60 | 25.56 | 50.50 | 23.94 |
| B7 | 18.52 | 2.60 | 6.00 | 98.10 | 9.05 | 70.76 | 20.19 |
| B8 | 6.72 | 0.170 | 5.94 | 80.06 | 8.86 | 68.57 | 22.50 |

(*) M for hydromulches; B for erosion-control blankets.

sioncontrol materials under study.

The tests were performed in the UWRL's Rainfall Simulator Facility. This laboratory facility consists of a 20feet by 20-feet rainfall simulator that produces rainfall intensities from one inch/hr. up to 31 inch/hr., a tilting flume where soil one-foot deep can be tilted up to 45 degrees to simulate hill-sides and a sunlight simulator used for plant growth studies. A wind generator is also available that produces wind velocities of up to 60 mph over the erosion basin. The wind generator is useful when testing straw mulches, which was not the case of this test program. Raindrops produced by the rainfall simulator have diameters of approximately 0.16 inch, and their velocities of impact represent the energy of typical high-intensity storms. The spatial distribution of rainfall is essentially uniform and the control of application rates is within the accuracy requirements of most experiments. The simulator has been extensively tested and used in research

since its construction in 1973. The original Plexiglas™ modules were replaced with aluminum panels in 1992.

Materials tested were applied onto sandy-loam soil plots, 19.5 feet long and two feet wide, contained in the tilting flume. Plot preparation included removal of soil up to the maximum depth of erosion, replacement of soil in each plot, spading, tilling, leveling and compacting of the soil, and, finally, raking of the soil surface to roughen it. During each test, runoff from each plot was collected in large plastic tubs, then dried and weighed for determining the amount of soil and water runoff leaving the plot. After every rainfall event, the sunlight simulator was positioned over the test plots providing enough illumination to facilitate plant growth 24 hours a day for six consecutive days. After this, plant samples were taken from each plot and a count of nongerminating seeds was performed in order to compare germination rates and plant characteristics.

The hydromulches tested were applied at a rate of 2,000 lbs./acre. Barley seed was applied at a rate of 200 lbs./acre. The mulch and seed were mixed together in a water slurry in a laboratory-sized hydromulcher and then applied to the plots while the test bed was in a horizontal position. The plots were allowed to dry overnight before the rain was applied. Erosion control blankets were secured by rows of six-inch-long steel staples driven through the soil at both edges and at the centerline of each plot. For tests on erosion-control blankets, seed was applied by hand before laying the blanket on each plot at the same rate as in mulch applications.

Results obtained from each test included water-runoff rate, soil-erosion rate, average plant height, dry weight of plants and percentages of lost and germinating seed. Hydromulches, in general, allowed more soil loss and water than erosion-control blankets. It may be the case, however, that for flatter hill-

sides and lower rainfall intensities the performance of hydromulches and erosion-control blankets is comparable. Additional testing is necessary to determine the appropriate range of slopes and rainfall intensities for the controlled testing of hydromulches and erosion-control blankets.

Only one of the hydromulches tested contained a tackifier. The addition of a tackifier may, in most cases, improve the erosion-control performance of a hydromulch, particularly under the extreme test conditions used in this program, as the tackifier produces a more continuous and stronger cover.

Vegetation characteristics are related to the amount of soil and water retained by a given erosion-control material. In general, the vegetation in erosion control blanket plots performed better, in terms of plant characteristics and germination rates, than the plants in hydromulch plots. The average plant height was about the same for all blankets, about six inches; however, there were differences in terms of the dry weight of plants for those materials. Such differences can be attributed to the different seed germination rates as well as to the amount of water retained by each material. (Plant weight may

also be influenced by the chemical composition of the erosion-control cover, although such parameters were not under scrutiny in these tests.) For hydromulches, both plant height and dry weight of plants showed more variation than for erosion-control blankets. Such variation is related to the amount of water and soil retained, which, in turn, affects the germination rates. The results from this test program suggest that, as expected, the more soil and water retained by a plot, the better the germination rates and the taller the plants, which translated into higher plant weight.

Erosion-control blankets had the best germination rates (50 percent or more). The rates of seed lost were estimated from the count of plants and of seeds left in the samples collected from each plot. Hydromulches, which allowed the largest amount of runoff, also allowed the largest percentage of seed losses. This result is not surprising, as the seed was laid on top of the soil or of the hydromulch cover and was easily carried off the plots by the flowing water.

The present tests on hydromulches and erosion-control blankets under controlled slope and rainfall conditions were of an exploratory nature

and their results should not be taken as the definitive criteria in the selection of erosion control systems. Only a single set of soil type, soil slope, rainfall intensity and duration was used, therefore placing hydromulches at a disadvantage with respect to erosion-control blankets as the soil slope (2.5:1) and the rainfall intensity (five inches/hr.) were high. The results of these tests point out the need for a sustained program of testing on hydromulches, blankets and other erosion-control systems under a varied set of conditions to determine not only their performance, but also the range of conditions (soil types, slopes and rainfall intensities and durations) for which each system is appropriate.*

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