MULCHES AND BINDING AGENTS TO ACHIEVE EROSION CONTROL

by R. E. Blaser, University Distinguished Professor of Agronomy
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Mulches and binding agents are used in two ways: 1) for temporary erosion and dust control during construction; and, 2) for simultaneously controlling erosion while seedlings become established. The best way to control erosion is with a plant cover.

For temporary erosion and dust control in construction projects with mulches, it is best to seed a temporary species such as annual ryegrass that will give a temporary vegetative cover. Such a temporary vegetative cover along with mulch is effective and persists longer than mulch-binder combinations.

The only practical way to control water and wind erosion is to establish a vegetative cover as quickly as possible. Success in achieving this depends on four steps.

1) Proper grading of slopes, cuts, and medians. The slopes should be as shallow as possible. Steep cuts should be stairstep graded. The surfaces, except for sandy soils, should be left in a rough, loosened condition for all slopes.

2) The appropriate lime and fertilizer mixture to stimulate desirable, persistent, long lasting species must be applied. It is usually necessary to apply high rates of phosphorus. Soil tests are very helpful in diagnosing the lime and fertilizer needs.

3) Appropriate varieties and seed mixtures are of paramount importance. The components in seed mixtures depend on the slope environment, the climatic region, the soil and rock characteristics, the subsequent mowing management or lack of mowing management, and the season of seeding.

For example, for steep cuts and fills, we design lime and fertilizer practices and seed mixtures to give a vegetative cover quickly from temporary species by using small amounts of annual ryegrass or cereals. Through a series of stages of changing vegetative covers, annual temporary grasses shift to persistent perennial grasses and, finally, persistent, hardy, perennial legumes such as crownvetch, flat pea, sweet pea, or sericea lespedeza dominate over the grasses. The legumes add variable beauty and are very persistent requiring no fertilization nor mowing management. We have legume stands on very infertile subsoil materials that have persisted on cuts and fills for over 20 years without additional attention.

Mulching is a final important factor that helps obtain vegetative cover quickly. Good mulches moderate the soil temperature and encourage water infiltration — these improve moisture content, germination, and seedling growth. Without mulches, the forceful contacts of raindrops with

Excellent germination and seedling growth (above) on a 1:1½ fill slope with a rough, loose surface mulched with 1,500 lbs./acre of woodfiber. A roughened 1:1½ fill slope (right) after applying 3,000 lbs./acre of straw and overseeded with a slurry of seed, fertilizer, and woodfiber at 700 lbs./acre.

soil breaks down the soil particles causing the pore spaces to become plugged with fine sandy and silty materials, thereby causing water runoff and erosion. Thus, with mulches, most of the water will filtrate into the soil to improve moisture for the seedlings.

We find that straw, hay, wood bark, wood chips, and wood fiber are the best kinds of mulches. Wood bark and wood chips are expensive to use because 35-50 cu. yds. are needed per acre, and these materials are usually not available in adequate amounts. Straw is generally a better mulch than wood fiber, but straw can also be a poor mulch if it bears a lot of cereal grains or weed seeds. Hay is comparable to straw mulch, but hay crops are usually contaminated with weeds and undesirable seeds.

I have noticed many seeding failures in highway corridors and in our experiments where we used hay or straw because the aggressive plants of cereal grains or weed seeds in the straw crowded the slow growing persistent perennial grasses and legumes. Later, when the annual cereal plants or weeds die, the soil erodes because desirable perennial grasses and legumes were shaded out.

Wood fiber applied at 1500 pounds per acre (8-12 percent dry matter) has given very satisfactory results during the favorable seeding seasons. Some paper fibers are 30 percent water and must be at higher rates to compensate for the water. Wood fiber and paper fiber are of similar value if applied at the same dry matter rates.

Because wood fiber has no contaminants, it is important to use a companion fast growing species such as annual ryegrass at 5-10 lbs. of seed per acre. During periods of stress, wood fiber at 1500 lbs./acre alone is inferior to straw applied at 3000-4000 pounds per acre. Straw cannot be used on steep 1:1 slopes — with heavy rains it usually flows down the slope, also it is difficult to hold in place. For steep slopes, wood fiber is the best material as it sticks to the soil and holds seed and fertilizer in place.

There is no one mulch best for all situations. The mulching should be tailored to the site. For example, for a lawn, it is very desirable to use wood fiber to avoid weed seed and cereal grain contamination. The best mulch treatment from the standpoint of prolonged control of erosion and ease of application is a combination of 3000 lbs. of straw overseeded with a slurry of fertilizer, seed, and wood fiber by the hydro method. We found that seeding the slurry mixture of mulch seed and fertilizer after applying the straw is as good as a three-step operation: 1) applying the seed and fertilizer; 2) applying the straw; and, 3) applying the wood fiber. Binding 3000 lbs. of straw with 700 lbs. of wood fiber has been a superb mulching combination. This is superior to any of the many binders or tacking agents. The wood fiber binds the straw together and at the same time to the soil; therefore, during late fall and winter seasons, when it is too cold for germination, the mulch lasts a long time and does not blow off. In experiments, a straw mulch with wood fiber as a binder has lasted during the entire winter season on steep 1:1½ slope sites. Asphalt, according to a few of our experiments, is the only chemical material that binds straw together satisfactorily; however, soil contact is poor, so removal by the wind is common.