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# 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 crown-vetch, 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.



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**"PROGRESS FROM THE GROUND UP"**

# GROWTH IN LAND RECLAMATION TO TAKE SIGNIFICANT JUMP

Land reclamation/erosion control could be the BIG Green Industry market of the future. Environmental legislation, especially recent surface mining requirements, are expected to increase dollar volume by nearly 30 percent this year. That is more in one year than experienced in the last five years according to survey respondents in the field. The growth is expected primarily in the area of coal and non-highway public works projects.

WEEDS TREES & TURF polled 1,200 erosion control specialists in the International Erosion Control Association and the Associated Landscape Contractors of America. Ten percent participated in the survey. Respondents included landscape contractors and architects, foresters, engineers, highway maintenance officials, utility personnel, and others.

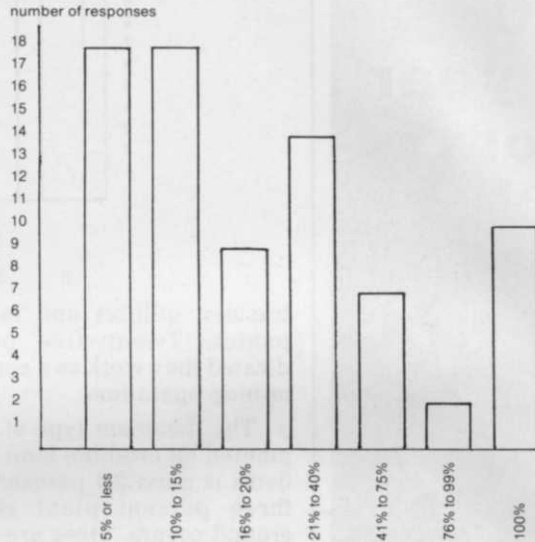
Respondents indicated their primary types of revegetation work at the moment are highway rights-of-way, parks, residential construction sites, industrial construction sites, and utility work sites. Mining site revegetation is performed by only 27 percent of those responding. Reforestation represents only nine percent of the type of revegetation work performed.

The average percentage of gross revenue derived from erosion control was 31 percent with a median response of 20 percent. Ten percent indicated that erosion control makes up 100 percent of gross revenue.

The average volume of erosion control work done in 1977 was \$295,529 with a median of \$75,000. We asked also for volume in 1973 and predicted volume for 1978 to get a picture of market growth. The average volume for erosion control in 1973 was \$277,380 with a median of \$50,000. The predicted average volume for 1978 was \$381,934 with a median of \$150,000.

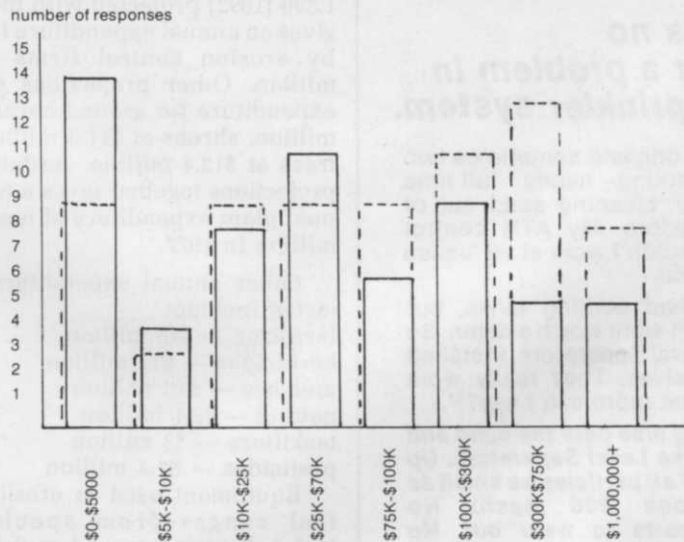
It is evident that a much greater jump in erosion control business is expected this year than has been experienced in the past five years. Projecting the average to 1,200, the base for this survey, the market increased from \$333 million in 1973 to \$355 million in 1977, an increase of \$22 million in five years. In 1978, the market is expected to reach \$458

**Percentage of Gross Revenue** Derived from Revegetation, Erosion Control, or Land Reclamation



**Distribution of Dollar Volume** in Revegetation: 1973-1977.

Distribution of the Dollar Volume of Revegetation Work done in 1973 \_\_\_\_\_  
 Distribution of the Dollar Volume of Revegetation Work done in 1977 - - - - -



million, a jump of \$104 million in one year! Furthermore, when asked about the next five years, respondents predicted an average increase in volume of 117 percent, which would place the market at \$760 million in 1982. We repeat, these market figures are projected from the average volume of erosion control work done by 1,200 firms. Growth in the number of firms, which is very likely in a healthy market, may increase these figures significantly.

Surface mine revegetation alone will grow at a fantastic pace with the help of funds received from taxes on mined coal and distributed to states for reclamation projects. An estimated \$70 million will be spent this way in 1978. Forty percent expect to benefit from mining legislation.

Two thirds of the respondents said they serve as a revegetation consultant to some degree. They consult primarily for public agencies, general contractors, landscape con-

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Julian Serno, Golf Superintendent  
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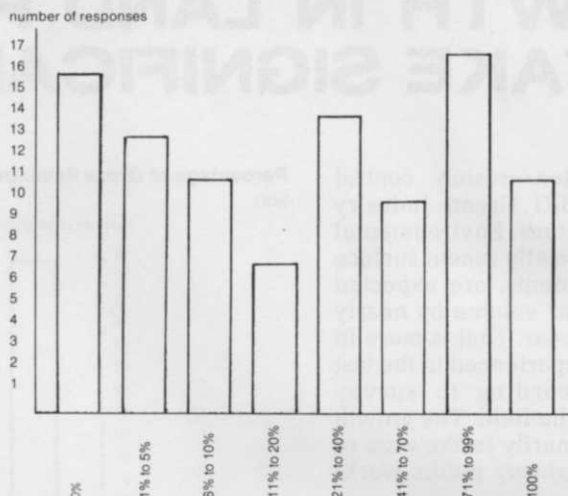
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**Percentage of revegetation Work That is Hydraulic Seeding**



tractors, utilities and mining companies. Twenty-five percent indicated they work as a consultant for mining operations.

The dominant type of vegetation planted on erodible land by respondents is grass (91 percent). Seventy-three percent plant shrubs and ground covers. Trees are planted by 71 percent.

The erosion control firms in this survey spend an average of \$24,834 per year on seed. Using 91 percent of 1,200 (1092) projected with the mean gives an annual expenditure for seed by erosion control firms of \$27 million. Other projections put the expenditure for ground covers at \$5 million, shrubs at \$11.6 million, and trees at \$12.4 million. Adding these projections together gives a total annual plant expenditure of nearly \$44 million in 1977.

Other annual expenditures projected include:  
fertilizer — \$18 million  
herbicides — \$12 million  
mulches — \$13 million  
netting — \$2.1 million  
tackifiers — \$2 million  
pesticides — \$1.4 million

Equipment used in erosion control ranges from specialized hydraulic seeders and mulchers to farm equipment such as seed drills and manure spreaders. The survey was limited to the most common types of equipment.

The following numbers of equipment are projected for 1,200 erosion control firms:

- tractors — 5,000
- dump trucks — 4,200
- tank trucks — 2,250
- hydraulic seeders and mulchers — 1,200
- fork lift vehicles — 1,050
- large earth movers — 604

More than 80 percent of the respondents do hydraulic seeding. Ten percent indicated their business is entirely hydraulic seeding work. The average involvement in hydraulic seeding was 38 percent.

Twenty-one percent do some form of aerial seeding. It makes up an average of 23 percent of the business for these firms.

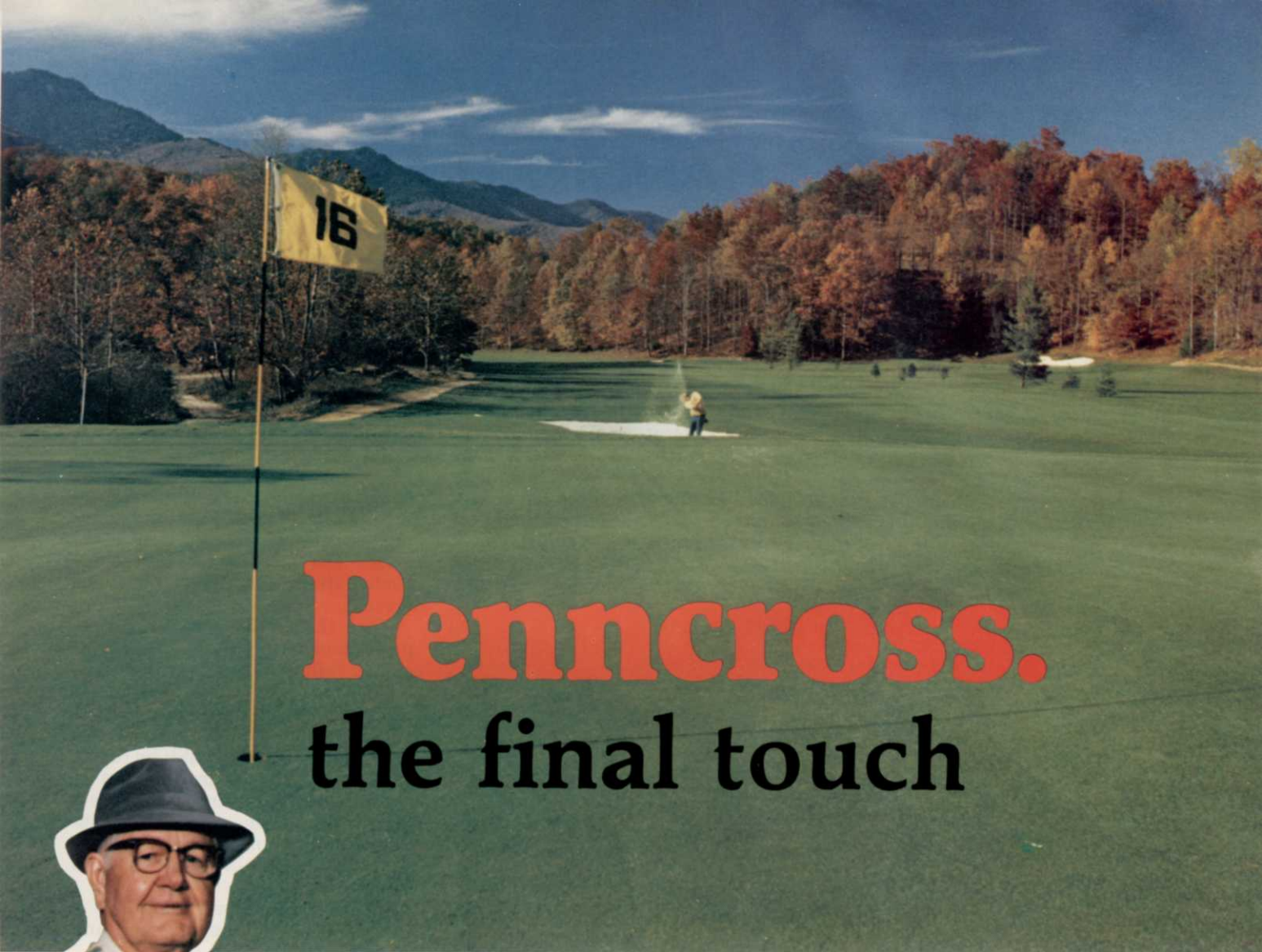
Finally, we asked if the respondents were familiar with the Surface Mining Control and Reclamation Act of 1977. About half (49 percent) knew of the Act.

A considerably greater amount of research on the reclamation/erosion control market is needed. We hope to have scratched the surface. Since it appears the volume of business in this area is about to jump significantly, research is needed to help manufacturers meet chemical, equipment and supply needs.

Once again, we'd like to stress the projections in this survey are based upon 1,200 names of firms known to be actively involved in erosion control and reclamation in some form. The associations, sources for the survey respondents, probably represent less than the entire market. We encourage anyone considering erosion control or reclamation work to contact regional and national associations to help the market organize for the most efficient growth based on the latest technology and data.

Regional associations can be contacted through state departments of natural resources. At the moment, the International Erosion Control Association, P.O. Box 807, Freedom, Ca. 95019, appears to have the largest membership in the field. The Associated Landscape Contractors of America, 1750 Old Meadow Rd., McClean, Va. 22101, is also active in reclamation technology.





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BYRON NELSON

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# PEABODY COAL COMPANY: ABIDING BY CHANGING LAWS

The technology of reclaiming surface-mined land has changed greatly in the last 15 years, primarily because laws have mandated what the technology will be and the laws have changed. In 1977, Congress passed the Surface Mining Control and Reclamation Act and the Office of Surface Mining, Reclamation, and Enforcement was created within the U.S. Department of the Interior. Although final regulations are not complete, anticipation of what they will be has created a surge of interest in reclamation of surface-mined land.

One company that has done an admirable job of adjusting to both state and Federal laws is Peabody Coal Co. of St. Louis, Mo. WEEDS TREES & TURF visited Peabody's Broken Aro mine in east central Ohio for a look at the changes of the past 15 years and the reaction to upcoming Federal requirements.

Reclamation supervisor Earl Murphy, a forester by training who joined Peabody from the Ohio Park Service in 1973, described the latest revegetation work performed at Broken Aro, one of two surface

mines owned by Peabody in Ohio.

The difference between revegetation work performed during three separate periods was striking. Reclamation performed prior to 1965 consisted of many small tree-covered hills, many bodies of water and visible high walls. The dense vegetation and craggy terrain offered protection for wildlife inside.

The next method of reclamation, from 1965 to 1972, consisted of striking the tops of spoil piles and planting trees, 900 per acre, and some grass. The most common tree for reclamation has been the black locust.

The third type of reclamation, performed after 1972, consists of gentle rolling hills of grasses and legumes with networks of drainage ditches leading to silt basins. The company that Peabody leases the land from has asked that it be reconstructed to serve as grazing land.

The three-year permit which Peabody has from the state allows mining of approximately 300 acres per year. The mining procedure goes as follows:

- silt basins are constructed
- top foot of soil is removed and stockpiled



**Workers** for the Ohio Mining and Reclamation Association prepare to mulch newly seeded area nearby (top). A silt basin (below) is a vital part of mine reclamation and is usually the first step of the reclamation process. Reclaimed soils can absorb limited quantities of rainfall. Therefore, increased runoff must be handled through special ditches and silt basins.

