AHTD TRC TRANSPORTATION RESEARCH COMMITTEE

TRC0205

# Seeding and Erosion Control of Embankments

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Final Report

2005

TRC-0205

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December 1, 2005

FINAL REPORT

# Booneville Plant Materials Center

USDA-NRCS
Arkansas
Final Report
Dec. 1, 2005
Project No. TRC-0205

**Title: Seeding and Erosion Control of Embankments**

**History:** The project began May 1, 2001. The objectives of this project will be implemented by phases, as directed by the subcommittee. The project will be evaluated after completion of each phase by the subcommittee. Quarterly reports and annual reports will be prepared and submitted to the subcommittee. The final report will be published within twelve months of the end of this contract.

**Responsibility:** The Natural Resources Conservation Services' (NRCS) Booneville Plant Materials Center (PMC) is conducting the research. The NRCS is an agency of the United States Department of Agriculture. James R. King, Manager of the PMC is the principle investigator.

**Site 1 I-540 Mountainburg**

The first research site was established on a west exposure slope of the northbound lane of I-540, one mile north of the Mountainburg exchange. This research site was designed to identify the most effective and economical mulch material(s) for slope protection post seeding. Site characterization was done 3 months in advance. Soil amendments were applied according to soil test results, provided by the U of A soils lab. 'Blackwell' switchgrass was chosen for the test, based on its drought tolerance. A slope 3:1 slope eighty feet in length (up slope) and 600 feet long was chosen for the test. A concrete bottom ditch existed at the foot of the slope. Four mulch materials were chosen for the test; grass hay; wheat straw; envirogard plus; and jute matting.

A clean firm seedbed was prepared on the slope, using conventional equipment. The seed was drilled using a Marliss grain drill, followed by a water filled roller. A random block plot design was used with treatments being replicated 3 times to eliminate variability among treatments. Grass hay mulch was applied at a rate of 1.5 tons/acre, as was the wheat straw mulch (both applied with conventional equipment). Envirogard plus was applied at a rate of 3/8 inch soil cover, using non conventional equipment. The jute mat was applied by manual labor.
Treatments were evaluated for germination percentage, soil loss amounts and mulch persistence. Germination was best with jute mat, and grass hay mulch followed by wheat straw mulch and envirogard plus. Soil loss was determined by measuring sedimentation at the foot of

the slope at each treatment/replication. Each material allowed no significant erosion. The order of mulch persistence is as follows: Envirogard plus, 1 year; jute mat, 1 year 3 months; grass hay and wheat straw mulch, 8 months. The persistence of the mulch is significant initially for soil protection until vegetative cover is established, then moisture retention for plant growth. All treatments at this site have been successful protecting the soil and supporting the vegetative cover. The same treatments need to be tested on steeper slopes. At some point the steepness of the slope will separate the success of the mulches. On a 3:1 slope they are all successful. It now comes down to economics of the treatments. The following table captures the turn key cost per acre for each treatment.

| | | | | | |
|---|---|---|---|---|---|
| **Seedbed Prep.** | **$40.00** | **ac** | **1ac** | **$40.00** | |
| **Wildflowers** | **45.00** | **lb** | **5lb/ac** | **225.00** | |
| **Seed** | **10.00** | **lb** | **7lb/ac** | **70.00** | |
| **Seeding** | **10.00** | **ac** | **1ac** | **10.00** | |
| **Rolling** | **10.00** | **ac** | **1ac** | **10.00** | |
| **Sub-Total** | | | | **355.00** | |
| **Mulches** | | | | | |
| **Hay (1.5 ton/ac)** | **60.00** | **bale** | **3 bales** | **180.00** | **535.00** |
| **Straw (1.5 ton/ac)** | **60.00** | **bale** | **3 bales** | **180.00** | **535.00** |
| **Jute (49 rolls/ac)[1]** | **124.00** | **roll** | **49 rolls** | **6075.00** | **6430.00** |
| **Envirogard + (515 bags/ac)[2]** | **5.08** | **bag** | **515 bags** | **2616.00** | **2971.00** |

**[1]Jute costs/roll- $70.00 + $15.00- freight + $29.00- inst**
**[2]Envirogard Plus cost/bag- $4.00 + $0.68- shipping & I**
**$0.40-pplication**


**Site 2 I-540 Livestock Auction Access Road**

The second research site was established March 22 -27 2003 on an east facing slope along the access road to a livestock auction facility, one half mile south of the Mountainburg exchange. This slope is 2.6 acres in size. The slope is inconsistent, with areas of 3:1, 2.5: 1, and 4:1. The area is a "cut" with exposed bedrock. This area was creating a downstream silt problem due to the lack of soil stabilization. The Dept. had seeded this area at least two times with very little success. David Becker brought in a Dept. dozer and reshaped the slope, prior to PMC research establishment. Center staff prepared a seedbed on the slope using a tractor mounted tiller.

Alamo' switchgrass, 'Kaw' big bluestem, Cheyenne' indiangrass, and 'Prairie Gold' maximillian perennial sunflower were broadcast. The entire site was rolled, and mulched. The mulch used (2 tons per ac) was round baled (5'X 6') Alamo switchgrass hay. Soil samples were taken and were processed by the U of A Soils Lab in Fayetteville. Fertilizer was applied in June based on soil test analysis.
The PMC staff collected erosion/sedimentation data from this site 4 times each year for three years. The germination at this site was excellent with 90% cover in the first three months. Soil erosion was insignificant with only a trace of sediment reported. Following evaluations monitored sediment and stand persistence. The last evaluation was in June 2005. The slope is 90 percent covered, with the only areas with none to poor vegetation found on exposed bedrock near the top of the slope.

**Site 3 Batesville area**

Site three has been established in the first and second weeks of May. This research will involves testing vegetative terraces on slopes too steep for conventional equipment. This plan was developed and initiated in Feb. 2003. One thousand six hundred native grass plants have been hand established on a steep slope just south of Batesville. The site was selected by AHTD. PMC staff designed the vegetative terraces with 24 inches between terraces and 12 inches between plants within each terrace. A rock drill was used to penetrate the soil/rock slope for planting. Once the transplants were in place the entire area was over seeded with switchgrass, indiangrass, bigbluestem, and littlebluestem, and fertilized (200 lb/acre of 17-17-17 complete). The species include switchgrass, indiangrass, big bluestem, littlebluestem, and eastern gamagrass. Two weeks following establishment the slope failed. The plants survived the slump, but were destroyed during slope repairs.

**Conclusions**

Site characterization is one of the most important steps of vegetating disturbed areas of highway construction. Soil sampling and testing for needed amendments cannot be over stressed. Fertility and pH of the materials to be vegetated are critical to the success of the plantings. Every site will be somewhat different and must be treated as such, even subtle changes within the same construction site may prove to be problems if not identified and treated correctly. Site characterization should be done as far in advance of the actual planting as possible. This is necessary mainly for pH adjustments. To raise the pH, ground limestone takes approx. 4-6 months to begin to bind acid in the soil.

The PMC conducted research for the Bureau of Mines in the mid 80s' that studied methods of vegetating reclaimed mined land in Western Ark and Eastern Ok. As with highway construction,

it was usually unpredictable when a site would be ready for vegetation operations. We found that in the event of a job being completed when nothing could be planted, (middle of summer or winter) a temporary mulch was very effective in protecting the site until a good planting date. We found that about a ton to a ton and a half of grass hay mulch was adequate. As a good planting date approached, the temp. mulch was incorporated into the soil, a seedbed prepared and selected species planted as normal. This temp. mulch strategy eliminates the need for irrigation and/or replanting the site. Grass hay and wheat/oat straw mulch are very effective for erosion control on slopes up to 3:1 steep, and are the most economical. Research is needed to identify slope steepness at which they fail. At this fail point, the jute mat and envirogard plus should still protect the slope.