



Utilizing Compost as an Alternative Method to Standard Seedings: Summary

The Texas Highway System

According to the Federal Highway Administration (FHWA), the state of Texas has 79,260 miles of agency-owned public roads. North Carolina, with 78,266 miles of roads and highways, is the only other state that maintains a comparable public highway network. In fact, the Texas highway system contains more miles of public roads than the combined total of agency-owned roads in the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont.

Practical highway right-of-way design for all the roads includes consideration of the cross-sectional slope, the longitudinal slope, and the type of grass or other vegetation. Cross-sectional slopes must not allow overland flow to erode the face of the ditch, longitudinal slopes must prevent open channel flow from exceeding the permissible velocity of the channel, and the vegetation selected must provide protection for the channel while allowing storm water flow to pass with a minimum of disturbance.

Maintenance and upkeep of the unpaved buffer or right-of-way ditch is a key element in an overall strategy designed to protect the integrity of the roadway and related structures. The unpaved right-of-way buffer allows storm water to infiltrate into the soil and serves as an open drainage channel for storm water runoff. When vegetation is used as a protective cover, the time between site preparation and the achievement of an adequate ground cover is critical. If heavy precipitation events or high winds occur before the ground cover is well established, then serious erosion damage can result.

What We Did...

Our research plan examined the effectiveness of using compost to establish roadside vegetation. It included the following tasks:

(a) Review of other state DOTs' compost use

Literature collected from state departments of transportation in Connecticut, Florida, Idaho, New Hampshire, Oregon, Texas, Virginia, and Washington verifies the effectiveness of compost in

erosion mitigation and vegetation establishment on highway rights-of-way. In the cited case studies, Oregon and Washington applied compost exclusively as a surface mulch; Connecticut, Florida, Idaho, New Hampshire, and Virginia used only incorporation; Texas was the only state to use both incorporation and surface application. Various types of compost were used under different conditions during the case studies, so few direct comparisons can be made.

b) Field Study at Three Locations

Figure 1 shows the geographical location of the Lubbock, Karnes, and Falls county field test sites and locations from which compost was generated. Field test sites were approximately 700 feet in length and were located on rural farm road rights-of-way. The field test sites were situated between the clear zone adjacent to the roadway and the right-of-way boundary, and ran parallel to the roadway surface.



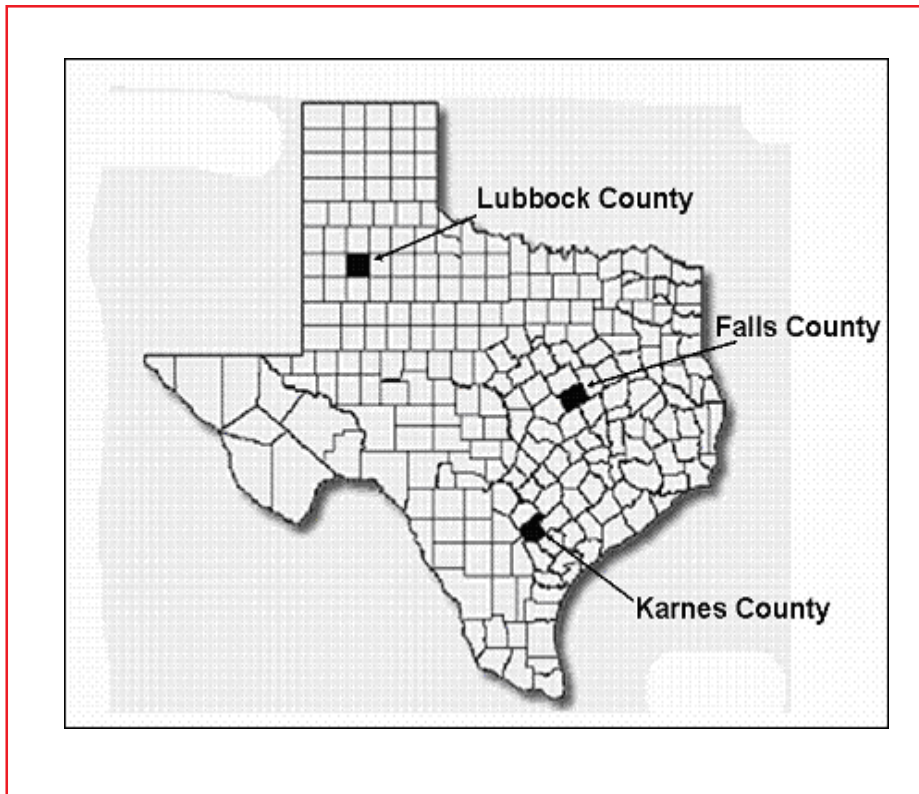


Figure 1: Three sites selected in Texas for field experiments

(c) Experimental Design

Personnel from TxDOT and TTU cooperated in the selection of field test sites in Lubbock, Falls, and Karnes Counties. Each test site consisted of three blocks (the replicates) located within each of the field sites. Each block was 10 ft. wide and 200 ft. long consisting of two 100-foot sections. A buffer strip separated each block and each main plot. Each sub-plot was 10 ft. by 10 ft. and the randomized treatment for each sub-plot is given in Table 1. Five of the treatments represent standard seeding methods practiced by TxDOT, and five treatments contain various compost seeding methods. Due to the number of factor combinations requiring evaluation, the Split-Plot Design (Little and Hills, 1972) was selected. Figure 2

shows the plot from Falls County immediately following installation.

(d) Data Analysis

The final task in this project involved an analysis of the collected data from the three field test sites. These data were analyzed for the effects of treatment on soil temperature, soil moisture, grass establishment, and soil chemical properties.

What We Found...

The primary purpose of the research underlying this report consisted of an investigation designed to determine if the establishment of vegetation on highway rights-of-way could be improved by the

application of compost as mulch compared to various traditional methods of protection. A review of scientific literature and field trials in three diverse geographical regions of the state of Texas defined the research component of the experiment. Physical evidence, visual observations, and laboratory analyses were combined with descriptive and inferential statistical methods to form the investigative component. The body of evidence collected supports the following conclusions:

1. One-half-inch of supplemental irrigation per month provided no beneficial effects on the establishment of roadside vegetation in the Blackland Prairies, on the South Texas Plains, or on the Southern High Plains regions of the state of Texas during a dry year.
2. Soil moisture was most effectively conserved by application of straw mulch held in place by jute netting, by the compost manufactured topsoil, or by the application of a 4.0-inch layer of compost mulch.
3. Soil temperature is reduced by application of straw mulch held in place by jute netting or by the application of a 2.0-inch to 4.0-inch layer of compost mulch.
4. The emergence and establishment of perennial grasses is retarded or even prevented by the application of compost mulch in excess of 1.0-inch depth.
5. A 4.0-inch layer of mature compost mulch prevents most annual and invading plants from reestablishing subsequent to tillage of the soil.



Figure 2. Example of the Falls County test site immediately following installation.

The Researchers Recommend...

Recommendation #1 — Even though the supplemental irrigation showed no beneficial effect on plant emergence and establishment, the fact that these tests were conducted during a dry year precludes the conclusion that no benefits can be achieved. When quick establishment of a ground cover is required, irrigation should be supplied every two to three days for the first three weeks of establishment to provide sufficient water to not allow the young plants to burn. The quantity of water supplied must be determined according to the capacity of the soil to hold water and the crop water consumptive use, each of which varies with the time of year. It is best to follow the guidelines provided in Borrelli, et al. (1998) titled Mean Crop Consumptive Use and Free

Water Evaporation for Texas. In addition, the 4-inch depth of compost applied as mulch may aid in retaining soil moisture, but compost depths greater than 2 inches may retard or even prevent seed emergence and establishment, unless the seed is planted on top of the compost. This effect on soil moisture also carries over to soil temperature. As the compost depth increased, the soil temperature decreased, and this too can reduce seed emergence. The difference in soil temperature caused by the compost mulch diminished to no differences as the season progressed, which is expected since it is following the natural soil heating as the ambient temperature and day length increased.

Recommendation #2 — Another factor that must be considered when applying compost, either as mulch or incorporated into the soil, is the quantity of nutrients being applied. Since the

quantity of nutrients varies greatly depending on the various compost sources, it is recommended that a complete nutrient analysis of the compost be made and the quantity of compost applied be limited to the annual crop needs for the various nutrients. A 1-inch layer of compost from the three sources used in these tests contributed from 500 lb/ac of total nitrogen for the dairy waste compost to 1,000 lb/ac for the cotton burr compost. This may mean that some nutrients will have to be supplemented in order to provide the complete crop nutrient needs. Although not all of the nitrogen is available during the first year, the application of available nitrogen, as well as the other constituents, needs to be considered when applying compost to any vegetated roadside right-of-way.

Recommendation #3 — Finally, when considering the use of compost to establish roadside vegetation, thought should be given to using a combination approach. It is recommended that a combination approach incorporating the compost in the soil combined with the straw mulch cover for retention of moisture and control of erosion be used as one of the alternatives. This alternative could provide the benefits of a quicker release of the nutrients for the plants to consume with the added benefit of retaining soil moisture and protection of the broadcasted seed.



For More Details...

The research is documented in the following reports:

Report No. - 0-4571-1, Using Compost as an Alternative Method to Standard Seedings

Research Supervisor: Clifford B. Fedler, (806) 742-2801, clifford.fedler@coe.ttu.edu

Project Director: Ben Bowers, (512) 416-3091

To obtain copies of the reports, contact the Center for Transportation Research Library at (512) 232-3126.

TXDOT IMPLEMENTATION STATUS

December 2003...

The research evaluated utilizing compost as an alternative method to standard seedlings. The research resulted in improved knowledge and guidance in the use of compost in TxDOT projects. The guidance will be used by TxDOT vegetative management specialists to enhance and promote the use of compost in TxDOT ROW.

For more information, contact; Bill Knowles, P.E., RTI Research Engineer, at (512) 465-7403 or email: wknowle@dot.state.tx.us.

Your Involvement Is Welcome...

Disclaimer

This research was performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. The content of this report reflects the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not for product endorsement.

The University of Texas at Austin
Center for Transportation Research Library
3208 Red River #115
Austin, TX 78705-2650