LTRC
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TECHNICAL SUMMARY

SUGAR CANE FIBER GEOTEXTILES: PRODUCTION, EVALUATION, AND FIELD STUDY

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INTRODUCTION

Fibers from sugar cane rind formed into a nonwoven mat were investigated as a biodegradable geotextile for soil erosion control to provide a competitive natural fiber product from essentially agricultural waste.

OBJECTIVES AND SCOPE

- Develop a process for production of sugar cane fiber mats based on fiber length and lignin removal
- Compare performance properties of mats with other natural fiber geotextiles in a laboratory setting
- Determine product performance of grass propagation and slope protection in a natural environment in a full scale field study

The sugar cane fiber geotextile, which both promotes rapid growth of a grass cover and resists high water runoff flow, can be an asset to the transportation and geotextile industries.

APPROACH

An extraction process using sodium hydroxide, mechanical action, and steam explosion yielded fiber bundles appropriate for nonwoven mat formation. A commercial wood fiber geotextile served as a benchmark for evaluations because it was assumed that the wood mat possessed minimum product specification requirements to control erosion. Laboratory results comparing sugar cane fiber and other natural fiber geotextiles indicated wood mats were more dense than the other geotextiles. Sugar cane mats were found to have a high biodegradability rate and were intermediate in thickness with lower strength, light transmission, water penetration, and better flame resistance in comparison to the other products.

Based upon satisfactory laboratory results, a field test was conducted in cooperation with LTRC and the Louisiana Department of Transportation and Development. The test site originally had shallow erosion problems, and a total of approximately 400 square yards of sugar cane fiber mats and geotextiles of coconut, straw, and wood were tested.

A measurement technique developed by scientists in the LSU Agricultural Center was used to determine vegetation coverage. Grass growth measurements were initiated four weeks after product installation and conducted weekly through the growing season. Each test section of mats was measured five different times to obtain an average.

CONCLUSIONS AND RECOMMENDATIONS

The products were evaluated for effectiveness in retaining sediment of the slope and promoting vegetative cover in one growing season. Field test results indicate that sugar cane mats allowed grass from planted seed to germinate, maintained integrity during heavy rains, and exceeded the rating established in LTRC's criteria for controlling erosion.

The sugar cane fiber geotextiles performed as well as the commercial products and exhibited grass propagation and slope protection equivalent to other products. Sugar cane fiber mats were superior in conformation to the slope even after heavy rains. Because of the long fiber entanglements, short fiber matting, and the retained lignin acting as an adhesive, the sugar cane mats did not need stitching to maintain their shape and bulk properties. These attributes will minimize production costs. The stitching in the commercial mats allowed undercutting and small channel formation, did not biodegrade, and interfered with mowing.

A possible reason for sugar cane fiber and coconut geotextiles having lower germination measurements than the straw and wood is mat opacity. Low sunlight exposure affects Bermuda grass growth even to the extent that growth is stunted by the grass's own shadow if allowed to grow too long. Although the sugar cane mats were visually similar to the other products, weight and thickness (which affect opacity) can be altered by the amount of fiber used per square foot of mat.

Preliminary economic analysis indicates that the production cost of sugar cane mats is approximately 24 cents per square meter compared to a retail cost of approximately 60 cents per square meter for the most economical of the products examined in the full scale field test. Based on those cost figures, the sugar cane mats provide the potential for a substantial savings in cost in addition to providing a market for a waste product.

Extensions to this research include:

- The development of a continuous process for mat formation
- The investigation of a spray-on application using a hydromulcher for mat application and the use of bagasse fibers
- A questionnaire sent to the 50 state DOTs to gain information regarding current application techniques, product selection, and geographical concerns. Responses will be used to develop estimates of geotextile market size, forecasted market growth, competing product analysis, and a feasibility plan for the sugar cane fiber geotextile.

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