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Potential Applications of Open Weave Jute Geotextile (Soil Saver) in Meeting Geotechnical Difficulties

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Abstract

Geotextiles made of natural fibres like jute have been found to be effective in improving geotechnical characteristics of soil and are being extensively used for various technical end-uses viz. rural road construction, protection of river banks, stabilization of embankments, erosion control, management of slopes, consolidation of soft soils etc. Out of the several natural agents causing extensive damages to roads, landslides can claim to be a major destroyer. Open weave Jute Geotextile (JGT), popularly known as soil savers, if properly designed can fulfil the said criteria besides facilitating growth of vegetation. This article delineates testing and analysis of the prime property parameters of some open weave JGT samples of different fabric weight categories, manufactured in the jute mills, followed by their comparative analysis based on which they have been selected to fulfil the end-use requirement. This was followed by determination of the tolerance limit of the property parameters of the selected open weave JGT samples by statistical interpretation for formulation of the specification before the actual field trial.

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Keywords: Jute; natural fibres; geotextiles; jute geotextiles; soil savers; fabric weight.

1. Introduction

The phenomenon of landslips and hill slope management has been under intensive study by geologists and geotechnical engineers [1]. Their thorough research reveals that landslides occur in different forms considering the nature of mass movements like that of earth, rocks and debris alongwith type of materials moved [2]. Case studies carried out at different hill slopes across the world show that severe and uncontrolled surficial erosion is the major triggering factor behind landslips [3]. Precipitation is the principal agent of such surficial erosion of hill slopes [4]. Kinetic energy of rain drops dissociates the top soil. The extent of such erosion depends on the intensity of precipitation, erodibility of soil covering the hill slope, the hill slope that influences the velocity of surface run-off

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and migration of detached soil particles. Deforestation is considered as the major contributing factor to erosion [5]. The detached soil particles and debris are carried by the run-off and get deposited at the slope-bottom foothill choking the natural drainage. The present global trend to combat soil erosion in all types of soil is to go in for bio-engineering measures which are essentially nature's involvement in controlling landslips. Open weave JGT manufactured from jute rove and having a three-dimensional structure, when laid on the slope surface initially gives protection against soil disintegration due to rain splash as a partial soil cover [6].

Open weave JGT has got triple advantages. Firstly, its weft yarns pose successive hurdles on the path of the sheet flow and will thus reduce the flow velocity at every crossing on its way down the slope. Secondly, the pores of the fabric will help better water absorption due to temporary stagnation of water within the pore spaces. Lastly, growth of vegetation will be more lucid if there are openings in the fabric. Keeping in mind about reduction of the velocity of the run-off at an optimum level and the extent to which jute yarn bundles in open weave JGT can withstand a certain velocity of surface run-off considering its extensibility and tensile strength for a specified opening as per the end-use requirements, design methodology of the open weave JGT has been framed and subsequently asked the various Jute Mills to manufacture the fabric samples. The open weave JGT samples, produced and supplied by the different Jute Mills, have been tested and analysed by the Geotextile Laboratory, Department of Jute and Fibre Technology, University of Calcutta. The comparative analysis of the results of different tests carried out with the produced JGT samples has been performed based on which three different open weave JGT soil savers of different area densities measured have been optimized and selected. This was followed by determination of the tolerance limit of the prime property parameters of the optimized and selected open weave JGT samples by statistical interpretation for formulation of the specification before the actual field trial in the field of hill slope management.

Nomenclature

JGT	jute geotextile
GSM	gram per square meters
AWRP	Average Weighted Ranking Procedure

1.2 Results and Conclusions

As per the plan of the work, nine numbers of open weave JGT samples having three fabric weight ranges, viz., 450 -550 gsm, 550 – 650 gsm and 650 – 750 gsm have been produced from a commercial Jute Mill. The test results are shown in tables 1 (a to c) respectively.

Table 1(a). Physical, mechanical and porometry properties of the open weave JGT samples within the gsm range 450-550.

Parameters → / Sample No. ↓	Physical Property				Mechanical and Porometry Properties		
	Width (cm)	Converted Mass @ 20% moisture regain	Ends /dm × Picks/dm	Thickness (mm)	Tensile Strength (kN/m), [Warp × Weft]	Elongation (%) [Warp × Weft]	Open Area (%)
01.	122.0	467.00	7.0 × 5.0	3.81	7.00 × 4.66	10.0 × 8.0	51.11
02.	122.0	482.22	7.0 × 5.0	4.62	6.34 × 5.74	11.0 ×12.0	55.87
03.	122.0	536.00	7.0 × 5.0	4.96	4.85 × 5.55	16.0 × 16.0	51.10

Table 1(b). Physical, mechanical and porometry properties of the open weave JGT samples within the gsm range 550-650.

Parameters → / Sample No. ↓	Physical Property				Mechanical and Porometry Properties		
	Width (cm)	Converted Mass @ 20% moisture regain(M.R.)	Ends /dm × Picks /dm	Thickness (mm)	Tensile Strength (kN/m), [Warp × Weft]	Elongation (%) [Warp × Weft]	Open Area (%)