

Geo Jute Provides Long Lasting Erosion Control

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ABSTRACT : To maintain a balanced ecosystem in various civil engineering construction projects, geojute is now being increasingly used for stabilization of top soil against erosion from rain and wind and to establish vegetation. It is a thick woven fabric having different unit weight and mesh sizes. Being a bulky and flexible material, jute drapes easily following the contours of the slopes and can maintain close contact with the soil. Jute mesh creates millions of microclimate that are conducive to germination of seeds and can provide safe anchor to seeds and saplings. Using geojute, establishment of vegetation and consequently a panoramic view can be achieved either by spreading seeds or fixing the grass blocks during laying the geojute and appropriate follow-up maintenance.

In this paper experience of protecting Great Dhaka City from devastating floods through natural embankments, where geojute was used, is described and success and technoeconomic aspect as well as maintaining eco-balance is highlighted.

1 INTRODUCTION

Thick yarns of Jute woven mesh, when laid over erodible soil, provide thousands of tiny checked dams per square metre to impede the flow of water, thereby helping to keep the soil from washing away. When combined with a grass seeding procedure, the jute material provides enough stability for the erodible soil allowing germination and a successful growth of vegetation. Without jute, areas susceptible to erosion could not be stabilized, and surface water would flow uncontrollably, carrying away soil and seeds.

In today's world of synthetic materials and new manufacturing processes, jute - a natural fibre - rates as one of the most dependable and proven erosion control products available. From roadside revegetation to the relatively new field of soil bioengineering, jute has effectively and consistently controlled erosion under a wide range of environmental conditions. Made from jute natural fibre, the mesh known as geojute is ecologically harmonious and decomposes once the protective vegetation has become established. Geojute contains no toxins, plastics or pollutants.

2 APPLICATION

The thick jute yarn (upto 0.25in diameter) is woven into an open mesh (each mesh opening measures approximately 5/8in x 7/8in) which creates small, but highly effective sediment traps. Each mesh square acts as a tiny dam to hold soil in place and creates a stable growing medium for seeds and other plant material. If soil can be prevented from moving, a permanent vegetative cover will grow much faster. The jute yarn also reduces the impact of rain drops and splash which dislodge unprotected soil particles leading to erosion.

Manufactured in rolls which measures 4ft wide and approximately 225ft' long (other roll lengths are available), jute can be laid quickly with untrained labour and requires no special tools or equipment. Jute is anchored to the soil with metal staples or wooden stakes and can be easily cut to accommodate any special areas, plant material or obstacles.

2.1 Stabilizes soil on slopes

Since jute mesh is flexible, it drapes easily over surface contours, yet it is heavy enough to maintain close contact with the soil. Vegetation grows through jute and will not push it up and off of the soil surface. Jute stabilizes

surface soil on slopes with thousands of tiny checked dams per square metre. This unique feature keeps seeds and other plant material in place on steep terrain, which is a very critical requirement for successful seed germination and establishing vegetation.

Depending on climatic conditions, jute may remain effective on slopes for upto 3 years. For harsh sites, this is a significant advantage considering it may require years to achieve successful revegetation under adverse conditions.

3 EROSION CONTROL

Since it clings so well to the soil, jute is an excellent choice for erosion control in shallow drainage where gradients are gentle and flows are light. The 4ft width of the material facilitates easy and fast installation. Made of flexible yarns jute is easily manageable for checked slots, anchor trenches and overlapping. The heavy yarn also serves to provide a rough surface, which during water flow, helps to trap sediment, prevents erosion and stabilizes seed so that natural vegetation can become the ultimate erosion control material.

4 ENGINEERING PROPERTIES

The ability of jute to absorb water is a unique feature which contributes to its erosion control capabilities. Ingold (1990) describes the importance of water absorbency in reducing rain drop impact. An important ramification of this quality is the increase in jute's already high degree of drapeability. Ingold states that jute is approximately 8 times more flexible than the most flexible synthetic mats. Once jute absorbs water to capacity, its flexibility is increased approximately 25%, thereby improving its drapeability, i.e. its ability to maintain intimate soil contact.

4.1 Soil loss due to erosion

Soil loss in a particular site can be measured quantitatively. Comparing the amount of soil removed from a vegetated soil to that of bare soil is one way to compare the effectiveness of various erosion control treatment. This ratio, as used in the universal Soil Loss Equation, is known as the C (Crop) Factor. Goeojute showed a C Factor of 0.004 (the smaller the number, the better the performance) for a 3:1 slope and 0.005 for a 1.5:1 slope.

This means that jute retained 99.6% (3:1 slope) and 99.5% (1.5:1 Slope) of the sediment expected to be lost from bare ground. In Table-I engineering properties of geojute are shown.

Table 1. Indicative range of engineering properties of geojute

Test	Test Method	Direction	Range of Values	
			From	To
Strip tensile strength (r) (k/m)	ASTM D1682-64	Warp Weft	20 25	40 55
Tensile elongation (ε) (%)	ASTM D1682-64	Warp Weft	20 18	30 21
Indicative Resistance to Dynamic Installation Stress (A) (kN/m) [A = r. ε]	According to Swiss (SVG) method		3.6	8.4
Grab Strength (N)	ASTM D4532	Warp Weft	730 780	1780 2350
Trapezoidal Tear Strength (N)	ASTM D4533	Warp Weft	350 500	600 875
Pore Size Opening O ₉₀ (Maximum Nominal Size) (mm)	Draft Dutch Standard (Dry Sieving)		0.15	0.30
Water Flow (l/m ² /sec)	Draft Dutch Standard		5	30

5 DHAKA EXPERIENCE

After devastating flood in 1988, Bangladesh government decided to protect Dhaka city from such serious floods in the future. As such a flood protection embankment about 24 km long has been constructed around the city. The construction started in 1989 and ended in 1991.

5.1 Results

Geojute was used to protect the soil from erosion due to flood and lengthy monsoon season. On spreading geojute on the city protection embankment, grass blocks were fixed up in some places and grass seeds were sown in some other places. The open mesh structure which allowed plants to grow and light to enter between strands, has resulted in preventing soil erosion through revegetation and now a green panoramic scene (Fig 1) exists through out the entire area, particularly where proper maintenance was made. Fig 2 shows a place where slopes have eroded in the absence of erosion control measures. Fig 3 shows an embankment area where geojute was used with grass blocks, and maintained where necessary. Fig 4 illustrates a patch where the maintenance was inadequate.

5.2 Economical & aesthetic

Jute mesh makes economic sense. Jute is competitively priced and often less expensive than many similar erosion control products. With excellent conformity to surface features, jute mesh blended naturally with surrounding environment. Since vegetation grew easily through jute, plants did not push the material away from the ground surface.



Fig 1. Embankment where Geojute was laid and grass blocks were fixed and maintained, showing controlled erosional vegetation

6 CONCLUSION

Geojute can absorb 5-8 times more water (by weight) depending on the quality of fibre used, percentage of oil in processing applied and on twist. This helps in creating long lasting microclimate (in the tropical and desert areas) conducive to the germination of seedlings used and protects and shades young vegetation.

For secured top soil erosion control vegetation growth is necessary for which any suitable creeping and turfing grass seedlings can be spread techno-economically. This lush green vegetation creates a soothing and a panoramic view. Geojute, due to its drapeability, lays firmly on the contours of the soil, thereby protecting the top soil from erosion due to rain and wind. It biodegrades after sometime, gets absorbed in as nutrients to the soil and is eco-friendly.

REFERENCES

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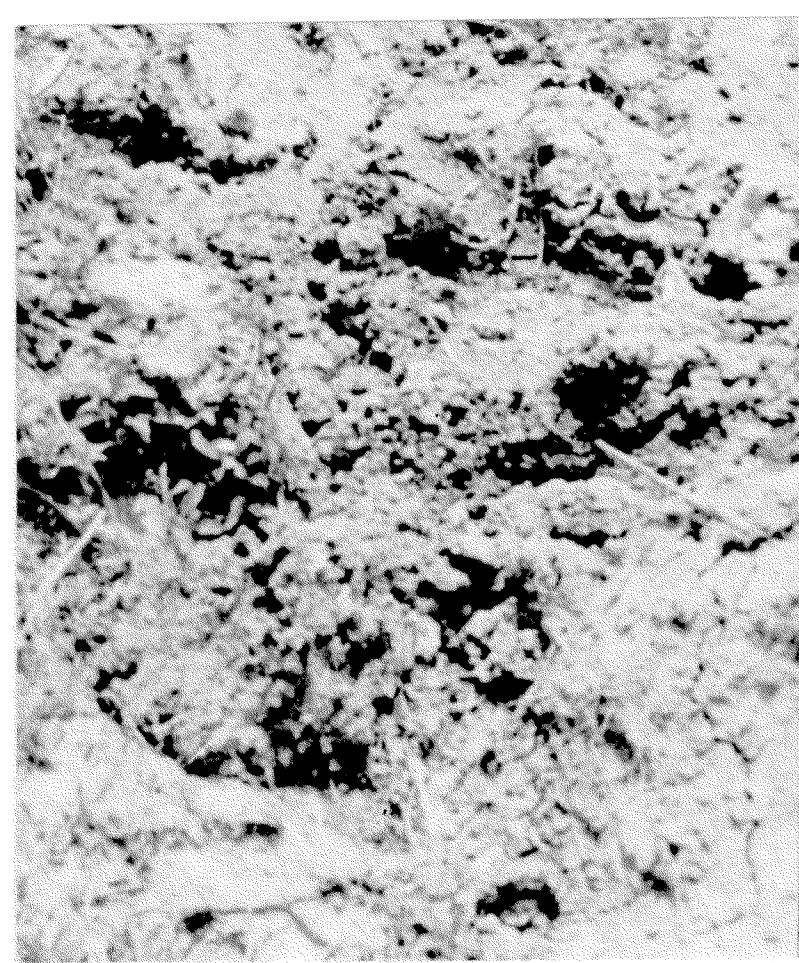


Fig 2. Slope erosion in the absence of geojute protection



Fig 3. Geojute protected and maintained slope



Fig 4. Embankment slope treated with geojute but with inadequate maintenance showing some distress to grass