

## List of Vetiver Researches

### Field Trials/Applications

- (1) Study on Vetiver Variety, Availability and Uses of Vetiver in Bangladesh  
Main Purpose: To find the vetiver sources and acceptance by local people  
Duration: 2007-2009
- (2) Pond Slope Protection in the *Barind* Tract Zone  
Main Purpose: Control of wind-induced and rain-cut erosion of pond bank  
Period: June 2010-December 2010  
Funding Agency: BUET
- (3) Use of Vegetation and Geo-jute for Road Slope Protection  
Main Purpose: Protection of road slope from erosion  
Period: November 2011-November 2013  
Funding Agency: BUET & JDPC  
Collaboration with Roads and Highways Department (RHD)
- (4) Investigation of Climate Resilient Slope Protection in Coastal Areas of Bangladesh  
Main Purpose: Investigation of the effectiveness of vetiver in protecting embankments in 12 coastal districts of Bangladesh under the project CCRIP  
Period: July 2014-June 2017  
Funding Agency: IFAD-UN  
Collaboration with Local Government Engineering Department (LGED)
- (5) Protection of Dykes in Saline Zones  
Main Purpose: To investigate the effectiveness of vetiver to protect shrimp pond dykes in moderate to high saline zone in four locations  
Period: May 2013-June 2014  
Funding Agency: BUET  
Collaboration with WAB-Trading International (Asia) Limited
- (6) Bridge Approach Road Slope Protection in Haor Region  
Main Purpose: Protection of bridge approach from rain-cut erosion and flood  
Period: May 2016-June 2017  
Funding Agency: Roads and Highways Department (RHD)
- (7) Eco-slope Protection and Intervention at North-West Flood Prone Region  
Main Purpose: Protection of char land and village from the flood of nearby river  
Period: November 2016-July 2017  
Funding Agency: UNDP  
In collaboration with ESDO (Local NGO)
- (8) Performance of Village Protection, Model Village, Upazila/Union Road Slope Protection  
Main Purpose: Investigation of effectiveness of vetiver grass in protecting submersible road, Village Island, killa from wave action in 28 Upazilas of Haor under the project HILIP  
Period: June 2018-April 2020  
Funding Agency: IFAD-UN  
Implementing Agency: Local Government Engineering Department (LGED)
- (9) Establishment of Vetiver Demonstration Centre in Chattogram  
(Inaugurated by Her Royal Highness Princess Maha Chakri Srinthorn)  
Main Purpose: To demonstrate vetiver uses and train people regarding vetiver application  
Period: May 2018-ongoing  
Funding Agency: Govt. of Bangladesh and Thailand

- (10) Effectiveness of Vetiver for Landslide Prevention in Hilly Areas  
Main Purpose: To investigate the effectiveness of vetiver in erosion control of hill slopes and landslide prevention  
Period: June 2019-ongoing  
Funding Agency: BUET and Chattogram City Corporation
- (11) Protection of Flood Embankment and Teesta River Bank  
Main Purpose: Protection of flood embankment and river bank of Teesta using vetiver  
Period: June 2019-ongoing  
Collaboration with BAPA, BPI, Teesta Nadi Rakkah Committee and local community people
- (12) Bioengineering for Erosion Reduction/Landslide Protection in Refugee Camps of Cox's Bazar  
Main Purpose: Protection of hills of the camps from rain-cut erosion and landslide.  
Period: 2017-ongoing  
Funding Agency: International Organisation for Migration (IOM) and other NGOs
- (13) Protection of Rural Roads and Training of LCS on Vetiver Application  
Main Purpose: Protection of rural roads and training of Labour Contracting Society (LSC) under the project 'Promote Resilience of Vulnerable through Access to Infrastructure, Improved Skills and Information (PROVATi<sup>3</sup>) in 25 underdeveloped Upzilas (e.g. low-lying and char land) of 6 northern districts. On the success of HILIP and CCRIP, IFAD has taken the project  
Funding Agency: IFAD-UN  
Implementing Agency: Local Government Engineering Department (LGED)
- (14) Canal Bank Protection of Active Pharmaceutical Ingredients (API) Industrial Estate  
Main Purpose: Canal bank protection  
Period: August 2019-ongoing  
Founding Agency: API
- (15) Protection of National Highway of Roads and Highways Department (RHD)  
Main Purpose: Protection of road slope using vetiver and demonstrate the vetiver potential in slope protection in the Cumilla zone  
Period: November 2019-ongoing  
Implementing Agency: Roads and Highways Department (RHD)
- (16) Padma Bridge Rail Link Project  
Main Purpose: Protection of rail embankment in different locations along the 174 km long under construction rail embankment  
Period: Proposed  
Implementing Agency: Bangladesh Railway (BR)

### **Proposed Research Projects**

- (1) Training on Vetiver Based Bioengineered Method and Vetiver Use for Manufacturing Handicrafts for Engineers & LCS
- (2) Prospects of Bioengineering for Environmental-friendly Char-Land Development and Land Reclamation (Bangladesh Water Development Board, BWDB)

### **Model/Simulation Study at BUET**

- (1) Road Slope Protection in Different Soil Conditions  
Main Objective: To study the growth of vetiver in different soils  
Period: June 2015-December 2017  
Funding Agency: IFAD-UN
- (2) Growth of Vetiver in Sandy Soil  
Main Objective: To investigate the growth of vetiver in sandy as the roads, flood embankments, etc. are mainly constructed with sandy soil in Bangladesh

Period: August 2016-November 2016

Funding Agency: BUET

- (3) Submergence Tolerance of Vetiver Grass  
Main Objective: To study the submergence tolerance of vetiver under flood water and fluctuating water level.  
Period: November 2018-ongoing
- (4) Erosion Reduction, Landslide Prevention and Water-logging Reduction  
Main Objective: To determine the erosion reduction, landslide prevention and water-logging reduction in the nearby area by vetiver plantation on the hill slopes  
Period: August 2017-March 2018)  
Funding Agency: BUET
- (5) Measures for Landslide Prevention in Hill Tracts  
Main Objective: Landslide prevention using vetiver grass in Chattogram hill tracts  
Period: August 2017-March 2018  
Funding Agency: BUET
- (6) Protection of Embankment/Slopes from Wave Action  
Main Objective: To examine the wave tolerance of vetiver protected slope  
Period: August 2019-ongoing  
Funding Agency: BUET and IFAD-UN
- (7) Infiltration Characteristics of Vetiver Planted Sub-soil  
Main Objective: To study the infiltration phenomenon of vetiver planted clayey and sandy sub-soil  
Period: June 2018-January 2019  
Funding Agency: BUET
- (8) Numerical Simulation of Shear Strength of Rooted Soil  
Main Objective: To simulate the stress-strain behavior of vetiver rooted soil (intact sample) using commercial software GeoStudio  
Period: January 2018-January 2019  
Funding Agency: BUET
- (9) Erosion Control and Slope Stabilization of Embankments Using Vetiver System  
Main Objective: To investigate the erosion of vetiver protected slope by applying artificial rainfall  
Period: 2011-2013  
Funding Agency: BUET
- (10) Determination of Roughness coefficient of Vetiver Grass  
Main Objective: To determine the roughness coefficient of vetiver grass for estimating flow velocity through vegetated bed  
Period: ongoing  
Funding Agency: BUET
- (11) Stability and Bearing Capacity of Vetiver Reinforced Ground by Subloading  $t_{ij}$  Model  
Main Objective: To study the slope stability and bearing capacity of vetiver reinforced ground using FEM Subloading  $t_{ij}$  Model  
Period: 2012-2013  
Funding Agency: BUET
- (12) Simulation of Behavior of Vetiver Rooted Soil using PLAXIS 2D/3D  
Main Objective: To study the slope stability of vetiver reinforced ground using Palxis2D/3D  
Period: 2018-2019  
Funding Agency: BUET

## **Experimental Investigation at BUET**

- (1) Growth study of vetiver grass in different soils and geographic locations
- (2) Effect of soil textures, soil nutrients (N, K, P, S, B), soil pH and organic matters on vetiver growth
- (3) Investigation of vetiver root morphology
- (4) Tensile strength of vetiver grass root
- (5) Effect of soil particle size, root length, root content, root arrangement, moisture content on the shear strength parameters and deformation behavior of rooted soil (Unconfined Compression Test, Direct Shear Test, Triaxial Test on both intact and reconstituted samples)
- (6) Determination of additional shear strength that is contribution of vetiver root in rooted soil matrix
- (7) Development of a simple device to determine the in-situ shear strength of rooted soil
- (8) In-situ shear strength of vetiver rooted soil
- (9) Development of mathematical model for quantifying the effect of root-reinforcement on the shear strength of soil
- (10) Strength-deformation characteristics of reconstituted rooted sandy soil
- (11) Chelate assisted phytoremediation of heavy metals using vetiver grass
- (12) Cleaning of contaminated land using vetiver grass

## **Workshop/Seminar/Conference (Total: 44)**

- (1) Asian Development Bank, ADB (One Seminar, Sept. 2018)
- (2) Bangladesh Poribesh Andolon, BAPA (an organization which works for protecting environment in Bangladesh (One Seminar, April 2019)
- (3) Bangladesh Water Development Board, BWDB (Two Presentations, Nov. 2017 & Feb. 2018)
- (4) Chattogram City Corporation and The Institution of Engineers of Bangladesh (One Seminar, Feb. 2017)
- (5) International Organisation for Migration, IOM for Refugee Camp Protection (One Seminar, March 2019)
- (6) Local Government Engineering Department, LGED (Conducted 13 Workshops and 4 ToTs during 2014-2019)
- (7) Roads and Highways Department, RHD (Two Seminar, Aug. 2015 & Sept. 2019)
- (8) Save the Children for the Site Development of Refugee Camps (One Seminar, Jan. 2018)
- (9) Universities (Made invited presentations at 10 different universities of Bangladesh, during 2011-2019)
- (10) ICCEE 2018, Malaysia (Oct. 2018)
- (11) Workshop on Application of Bio-Engineering Techniques in Mitigation River Bank Erosion in ASDMA, India (Nov. 2016)
- (12) Conference on Development and Democracy in Bangladesh: Problems and Prospects, UC Berkeley, USA (Nov. 2015)
- (13) ICV6, Vietnam (May 2015)
- (14) The 2014 World Congress, ACEM'14, South Korea (Aug. 2014)
- (15) 3<sup>rd</sup> Int. Conf. of GEOMATE 2013, Japan (Nov. 2013)
- (16) BGC 2010, Dhaka, Bangladesh (Nov. 2010)
- (17) RAE 2010, USA (Nov. 2010)

*Besides, electronic & print media, TV and magazines frequently cover my vetiver research.*

### **Postgraduate and Undergraduate Theses**

Ten postgraduate students obtained their M.Sc. in Civil Engineering by conducting research on vetiver during the period 2009-2019 under my supervision. At present, seven students are conducting their thesis on vetiver research under my supervision.

### **Publications**

Published more than 25 research reports, papers in journal, conference and seminars. Some of the publications are available at ResearchGate.