The Role of Vetiver Grass in Erosion Control and Slope Stabilization Along the Highways of Thailand

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Abstract

Planning on the development and promotion of the utilization of the vetiver grass under His Majesty's Initiative Project of the Department of Highways has commenced since 1993 when the policy has been given to its Highway Construction and Maintenance Units that vetiver grass should be planted slope areas of 113 highways as a soil erosion prevention. Over 6.5 million tillers have been planted, either in row and in clump pattern on slope areas, depending on the seriousness and the tendency of erosion. Two patterns used are : (i) On roadway slopes where the tendency of erosion is not severe, tiller planting shall be in row at spacing of 1 – 2 m and in clump at spacing of not more than 10 – 15 cm, (ii) On roadway slopes where the tendency of erosion is severe, tiller planting shall be in row at spacing of not more than 50 cm and in clump at spacing of not more than 5 – 8 cm.

The applications of vetiver grassing for highway benefit are on back slope, side slope, bridge approaches, shoulders slope and other slope protection works. The results showed that vetiver hedges gave significantly in erosion control and stabilizing slopes, although they may take at least one year to become fully effective. Planting on fill – slopes was usually better growth than cut – slopes.

Polybagged tillers kept in the nursery is recommended and the suitable period for planting is the beginning of the rainy season. The bottom of the planting holes should be applied with fertilizers.

Keywords : Erosion control, slope stabilization, roadway slope, back slope, side slope, bridge approach, shoulder slope, polybagged tillers, vetiver hedgerows.

Introduction

Department of highways (DOH) has paid concentrated interest on the important roll of soil and water conservation to reduce the environment impact, not only in highway construction projects, but also in the existing highway erosion control projects. DOH is one of the members of the Committee for the Development and Promotion and Utilization of the Vetiver under His Majesty's Initiative, Since 1993, DOH launched the policy for its Maintenance and Construction Units to make use of the vetiver grass on highway slopes for erosion control not less than 113 highways. In this regard, over 6.5 million tillers have been planted. The application of vetiver grass for erosion control on highway slopes is not only simple employing low cost technologies, but also gives more efficiency, and reduce the environmental impact due to its natural application.

Vetiver grass can reduce or controlling soil erosion on the slope if planted in rows across the slope, the row spacing shall be 1 m, and clump spacing should be 10 – 15 cm. The process of soil erosion protection occurs both in surface and sub-surface soil. This phenomena happened in such a way that when the vetiver clumps grow closed laterally, they act like living wall which stand against and slow down run off, and the eroded soil is deposited behind the vegetative barrier. The vetiver grass tillers grow up through it and goes on building up natural terraces, and adjust themselves to rise above this natural terraces which still act like the living wall as

long as the vetiver are alive. Under the vetiver hedgerows where as the soil condition are good, their root system penetrating deeply to about 3 m and radially expands at about 0.5 m (National Research Council, 1993; Grimshaw, 1995; Chomchalow, 1998) The root system acts as the under ground curtain which tighten the soil particles like reinforced earth to protect erosion.

The Target Area for Vetiver Grassing

On the highway cut slopes (back slope) and high embankment slopes (side slope) which are on the mountainous areas, there is a strong tendency for erosion, particularly in the northern, southern, and north-eastern parts where soils are sandy or silty deriving from granite or sandstone. All these areas are the target areas for vetiver grass planting of DOH for erosion control and soil conservation.

Typical Method of vetiver grass planting on highway slopes can be classified into two categories depending on the condition or the seriousness of the erosion on the highway slopes they are :

- On highway slopes where erosion is not severe, tillers planting should be in row at spacing of 1 – 2 m and in clump at spacing of not more than 10 – 15 cm.

- On highway slopes where erosion is severe, sprig planting should be in row at spacing of not more than 50 cm and in clump at spacing of not more than 5 – 8 cm.

Design of Vetiver Grassing Planting Applied for Highway Slopes

Application of the vetiver grass technology in highway erosion control can be accomplished in many approaches. DOH has designed the Standard Drawing [SP – 204, 1994; and SP – 206 (Revision) 1999 “The vetiver grass planting for

highway slopes protection"]. The purposes of the design is to direct and help the Maintenance and Construction Units to utilized the vetiver grass planing for erosion control correctly or perfectly throughout the country. The main designs are as follows

- Vetiver planting on cut slope (Back slope) and on fill slope (Side slope) protection
- Vetiver planting for bridges slope protection
- Vetiver planting for highway ditch lining protection.
- Vetiver planting on shoulder slope
- Vetiver planting together with the other slope-protection works to provide more efficiency and stability, such as planting on the back of gabion wall, masonry wall, and also in concrete square grid slope-protection system (see detail designs in Figs 1 – 4) .

Conclusions

In the design shown, the typical method of vetiver grass planting, generally for the slope protection, clumps spacing vetiver from 5 – 15 cm, and row spacing should be 50 – 200 cm, depending on the condition of the erosion. For the serious case, the narrow spacing should be applied.

The main reason of narrow spacing for the highway slope protection is because the highway slopes are more steeper than the other natural slope or farming slope, In such a condition, the faster runoff that can easily wash off the soil, the sheet erosion occurs rapidly and finally, rill or gully develop that affect the highway slope stability. The narrow spacing can overcomes such problems., particularly during the beginning of grassing while the rainy season .

The design notes provide more details about the construction methods. For example, how to select the proper vetiver grass, how to prepare the slope, method of planting, duration of planting, fertilizing etc. and finally gives also the maintenance practice for the vetiver grass hedgerows.

Polybagged tillers kept in the nursery is recommended for planting in the field, and the suitable period for planting is the beginning of the rainy season.

DOH has applied design for the erosion control of highways in many projects, not only in construction projects, but also in maintenance projects. Success has been achieved, especially on the maintenance projects for side slope erosion control, or side slope rehabilitation projects due to the side slope failure. Vetiver grassing on the highways side slope can efficiency applied and mostly successful, unlike the design applications on back slope which encounter the difficulty of grassing, unsuitability of the soil or the slope condition and the result come out for some projects were not perfectly successful.

The application for highway ditch, to protect the damages of concrete or mortar ditch lining due to the runoff from back slope, or to reduce the flow along highway earth ditch which call ditch check are perfectly successful.

The application of the combination with the other slope protection works for example on the back of gabion wall, masonry wall etc. has been made in a pilot project for shore protection along the sea road in southern part of Thailand, the preliminary result of which is very encouraging.

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Figure 2 Planting of the vetiver on embankment slope (Highway No.1284: Kun Klang – Kun Wang, Chiang Mai Highway District 1)

Figure 3 Vetiver hedges planted on cutslope (Back slope) to prevent soil erosion.

Figure 4 Embankment slope (Side slope) stabilized with vetiver

A) Highway No.4151 Jt.Phatthalung Highway District JRT. No.403, Trang Highway District.

B) Highway No.1096 Mae Rim – Samoeng : Chiang Mai Highway District2)