

THE ROLE OF VETIVER GRASS IN EROSION CONTROL AND SLOPE STABILIZATION ALONG THE HIGHWAYS OF THAILAND

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Abstract

At His Majesty the King of Thailand's initiative, in 1993 the Department of Highways instructed its highway construction and maintenance units to plant vetiver grass on the slope areas of 113 highways for soil erosion prevention. Over 6.5 million tillers have been planted, either in rows or in clump patterns in slopy areas, depending on the seriousness and the tendency of erosion. On road slopes where erosion is not severe, tiller planting is done in rows 1 to 2 m apart and in clumps with not more than 10-15 cm spacing. On slopes where erosion is severe, tiller planting is done in rows spaced not more than 50 cm and in clump spaced not more than 5-8 cm.

The applications of vetiver grass for highways are on the back slope, side slope, bridge approaches, shoulder slope and other slope protection works. The results showed that vetiver hedges were successful in controlling erosion and stabilizing slopes, although they may take at least one year to become fully effective. Planting on fill slopes grew usually better than cut slopes. Polythene-bagged tillers kept in the nursery are recommended and the suitable period for planting is the beginning of the rainy season. Fertilizer should be applied at the bottom of the planting holes.

Introduction

The Department of Highways is aware of the importance of soil and water conservation, not only in highway construction projects, but also in existing highway erosion-control projects. The department is a member of the Committee for the Development, Promotion and Utilization of Vetiver at His Majesty's initiative. In 1993, it instructed its maintenance and construction units to make use of the vetiver grass on highway slopes for erosion control in no less than 113 highways. Since then, more than 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 it is also efficient and reduces environmental impact due to its natural application.

Vetiver grass can reduce or control soil erosion on the slopes if planted in rows across the slope. Row spacing should be 1 m and clump spacing 10-15 cm. Soil erosion protection occurs both in surface and sub-surface soils. When the vetiver clumps grow close laterally, they act as a living wall which stands against and slows down runoff, and the eroded soil is deposited behind the vegetative barrier. The vetiver grass tillers grow up through it and go on building natural terraces, and they adjust themselves to rise above these natural terraces, which still act as living walls as long as the vetiver is alive. Under the vetiver hedgerows where the soil condition is good, the root system penetrates as deep as about 3 m and expands to about 0.5 m (National Research Council 1993; Grimshaw and Helfer 1995). The root system acts as an underground curtain that tightens the soil particles like reinforced earth to protect from erosion.

Target Areas for Vetiver Grass Planting

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

The methods of vetiver grass planting on highway slopes can be classified into two categories depending on the seriousness of the erosion. On slopes where erosion is not severe, tiller planting should be in

rows 1 to 2 m apart and in clumps not more than 10-15 cm apart. On slopes where erosion is severe, sprig planting should be in rows spaced not more than 50 cm and in clumps spaced not more than 5-8 cm.

Design of Vetiver Grass Planting Applied to Highway Slopes

Application of the vetiver grass technology in highway erosion control can be done in many ways. The Department of Highways (1994) has designed a Standard Drawing [SP-204 1994 and SP-206 (Revision) 1999, "Vetiver grass planting for highway slope protection"]. The purpose of the design is to direct and help the maintenance and construction units to use vetiver grass planting for erosion control correctly throughout the country. The main designs are as follows:

- Vetiver planting for cut slope (back slope) and fill slope (side slope) protection
- Vetiver planting for bridge slope protection
- Vetiver planting for highway ditch-lining protection
- Vetiver planting on shoulder slope

Vetiver planting, together with other slope protection, works to provide more efficiency and stability, such as planting on the back of gabion walls, masonry walls, and in concrete square grids for slope protection. For slope protection, clump spacing is 5-15 cm and row spacing 50-200 cm, depending on the gravity of the erosion. For serious cases, narrow spacing should be applied.

The main reason for narrow spacing for highway slope protection is that highway slopes are steeper than natural or farming slopes. Fast runoff can easily wash off the soil and the sheet erosion occurs rapidly. Finally, rills or gullies develop that affect the slope stability. The narrow spacing of vetiver hedgerows can overcome such a problem, particularly if vetiver is planted during the rainy season.

The design notes provide more details about the construction methods. For example, how to select proper vetiver grass ecotypes, how to prepare the slope, method of planting, duration of planting, fertilizer application, etc. The notes also outline the maintenance practices for vetiver grass hedgerows.

Polythene-bagged tillers kept in the nursery are recommended for planting in the field. The most suitable period for planting is at the beginning of the rainy season.

Conclusion

The department has applied the design for erosion control of highways to many projects, not only construction projects but also maintenance projects. Success has been achieved, especially on the maintenance projects for side-slope erosion control, or side-slope rehabilitation projects due to side-slope failure. Vetiver grass planting on highway side slopes can be efficiently applied and will be mostly successful, unlike the design applications on back slopes which encounter difficulties in vetiver grass planting and unsuitability of the soil or of the slope condition. As a consequence, the results for some projects were not satisfactory.

The application of vetiver to highway ditches to protect from damage of the concrete or mortar-ditch lining due to runoff from back slopes or to reduce the flow along highway earth ditches (called ditch check) has been quite successful.

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

References

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