

**Multiplication and Distribution of Vetiver Grass
(*Vetiveria zizanioides*) for Soil and Water Conservation
Measures in the Highland of Bale Zone, Southeastern Ethiopia**

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Abstract: Land degradation is a major socio-economic and environmental concern in the Ethiopian highlands where this phenomenon has rendered vast areas of fertile land unproductive. To reverse this trend, the adoption of soil and water conservation (SWC) practices which are economically feasible, environmentally sound and replicable is paramount importance for sustainable production of Agricultural crops. The use of vetiver grass (*Vetiveria zizanioides*) has offered such prospects in a wide range of climatic environments. The four common ways to propagate Vetivers are: used Splitting mature tillers from vetiver clump or mother plants, that yields bare root slips for immediate planting or propagating in poly bags. The first program to popularize vetiver with small-scale farmers was started by a Sinana Agricultural Research Center soil fertility improvement, soil and soil and water conservation case team was after evaluated the adaptability and scaling up of vetiver grass then to popularize these technology Vetivers grass was multiplied on 40 m x 50 m = 2000 m² area and these material from the nurseries was distributed to local farmers free of charge and in order to farmers rise own nurseries. Vetiver grass is a potent versatile plant used for soil conservation, slope stabilization, improvement of water quality, pollution control, bioremediation and other environmental applications. Therefore We highly recommend planting vetiver grass not only in Bale, but also wide agro ecology. It is also recommended that if further studies are to be conducted in the future the use of Vetiver grass integration with physical soil and water conservation, its use for bioengineering and role of Vetiver grass in relation with Global warming and climate change mitigation.

Key words: Land Degradation • Vetiver Grass • Multiplication • Soil and Water Conservation

INTRODUCTION

Agriculture is the main source of livelihood for more than 80 % of the Ethiopian population [1]. However, the agricultural sector and hence the livelihood of farmers are under continuous threat from the effects of land degradation mainly caused by water-related soil erosion and soil nutrient depletion [2-4]. Land degradation is a major socio-economic and environmental concern in the Ethiopian highlands where then phenomenon has rendered vast areas of fertile land unproductive. To reverse this trend, the adoption of soil and water

conservation practices is crucial. To curb erosive land degradation requires soil conservation measures that are cheap, replicable and sustainable.

Farming on sloping area or highland frequently causes soil erosion problem which impacts land resource and the environment, reduces soil fertility and crop products and also shallows rivers. The control and solution to soil erosion problem were to increase production cost, wasted expenses for operation and maintaining, the farmers rarely accepted because to acquire expected products, farming technique adjustment were needed in the way that to increase input factor and

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there was risky for not being cost-effective, so, they did not recognize direct benefits of the mentioned conservation system. Vetiver grass is now being used world-wide as a low-cost, low-technology and effective means of soil and water conservation and land stabilization [5]. Vetiver grass hedges have the morphological and physiological characteristics that are ideal for the purposes of soil and water conservation.

In modern and traditional agriculture vetiver grass is used to trap sediments, control runoff, increase soil moisture recharge and stabilize soils during intense rainfall and floods. Vetiver grass plays a vital role in watershed protection at large scales - slowing down and spreading rain fall runoff, re charging ground water reserves, reducing siltation of drain age systems, lakes and ponds, reducing agro chemical loading into ground water and watercourses and for rehabilitation of misused land. Therefore utilization of Vetiver grass plays a great role for soil erosion control and rehabilitation of degraded land when integrated with physical soil and water conservation measure. Therefore the current study aimed at multiplying and distribution of vetiver grasses to the farmers for soil and water conservation measures their by minimize soil erosion and increase production and productivity of agricultural crops.

MATERIALS AND METHODS

Description of the Study Area: The experiment was conducted at Sinana Agricultural Research Center (SARC), which is located in Bale administrative zone of Oromia Regional State at about 460 km south east of Addis Ababa. The area has an altitude of 2400 m above sea level (a.s.l.). The geographic coordinates of SARC extend from 070 06' 12'' to 070 07' 29'' N and 400 12' 40'' to 400 13' 52'' E. The area has bimodal rainfall pattern with the first rainy season starting in March and taper off in July, while the second rains fall between August and December. The area receives rainfall of 346 to 861 mm during the first rainy season (March to July) and 353 to 894 mm during the main season (August to December). The mean annual maximum temperature is 21°C and the monthly values range between 19.4°C in October and 22.8°C in February. The mean annual minimum temperature is 9.5°C and the monthly values range between 7.7°C in December and 10.7°C in April. The coldest month is December whereas February is the hottest month. Topographically, the area consists of gently undulating plain. The distribution of Vetiver grass was conducted in different district in the highland of bale

zone depending on the level of land degradation and the slope on the land to reduce the level of land degradation through integration of biological and physical soil and water conservation measure.

Methods of Propagation: The four common ways to propagate vetiver are: used Splitting mature tillers from vetiver clump or mother plants, that yields bare root slips for immediate planting or propagating in poly bags. Three parts of the vetiver plant are used for propagation: Tillers or shoots, Crown (Corm), the hard part of the plant between the shoots and the roots and Culms. A culm is the stem or stalk of a grass. The following four-step method of propagating vetiver from cuttings: Prepare vetiver cuttings, Spray the cuttings with a 10% water hyacinth solution use plastic bags to cover the cuttings completely and leave it alone for 24 hours and dip in clay mud or manure slurry and plant in a good bed.

Splitting Mature Plants to Produce Bare Root Slips: Splitting tillers from a mother clump requires care, so that each slip includes at least two to three tillers (Shoots) and a part of the crown. After separation, the slips should be cut back to 20 cm length then the resulting bare root slips can be dipped in various treatments, including rooting hormones, manure slurry (Cow or horse tea), clay mud, or simple shallow water pools, until new roots appear. For faster growth the slips should be kept in wet and sunny conditions until planting out.

Planting in the Field and Management: While preparing the planting material the tillers are usually separated from the main clump and the tillers in which three tillers per pit were planted in 20cm space between rows. Once the plants start to grow vigorously, cut the leaf to about 50 cm. Cutting encourages "Tillering" and produces more planting material in a short period. Only a single row of tillers, three per pit, need to be planted. Some of the Management conducted for Vetiver grass after planted Weeding, Trans planting and Watering during dry season.

Vetiver Grass Multiplication in the Area: The first program to popularize vetiver with small-scale farmers was started by a Sinana Agricultural Research Center (SARC) Soil Fertility Improvement, Soil and Soil and Water Conservation Case Team, after evaluated the adaptability and scaling up of vetiver grass. Then to popularize these technology, Vetiver grass was multiplied on 40m x 50m = 2000m² area and these material from the nurseries was

distributed to local farmers on free of charge bases to enable farmers to rise it in his own nurseries. As the demand for vetiver increased dramatically, farmers and researchers tried to discover ways of propagating vetiver grass. It is difficult to produce viable vetiver seeds that can be propagated. We had to find ways to reproduce enough stock for planting to be given to all the farmers who had applied for vetiver grass. Various methods such as transplanting some of the original stock was used stem cutting and making longitudinal slits in the stems. However, the demand for vetiver is still high in different district of Bale zone. Based on this interest vetiver was distributed to help farmers raise their seedling in his own nursery to improve the available sources of vetiver and add the amount of materials they need.

Methods Used to Promote Vetiver Grass to End User

Trainings: A number of meetings and trainings were organized at local, district and zone levels to establish a strategy on how we could distribute and popularize vetiver grass. We made a small demonstration for the purpose of training the farmers and other groups interested in vetiver grass in the area. **Collaboration:** Our centre collaborates with other organizations and district agricultural office to network in the dissemination of information and materials to interested group in different districts of Bale zone.

Distribution and Use of Vetiver Grass for Soil and Water Conservation Measure:

Planting Vetiver grass tillers along the edge of water source, the grasses will rapidly multiply their shoots tightly to each other to become row of dense and abiding Vetiver clumps. Soil preparation and care taking are the same procedure as in multiplication field. When the grasses age 2-3 years, they can be cut off, the leaves are used for ground covering and in case of the areas are needed for utilization, both the culms and the roots can be ploughed up and over, they were decayed and become soil organic matters which aid in soil recondition suitable for growing plants and other economic crops. According [6] report it has been found that vetiver grass very suitable for fighting against desertification, soil moisture loss and enhances organic matter content of soil.

Vetiver grasses are planted across deep gully, when the grasses fully grow, the clumps stand closely adjacent to each other blocking the gully, when water strikes the grass fence, it will be dispersed and flow through the gully slowly. According [7] the use of vetiver grass for soil and water conservation method that is cheap, replicable and suitable. Planting Vetiver grass across deep gully begins at the head of the gully which should be placed with stones or sandbags lining against the gully to reduce the strength of the tide.

Table 1: The spacing between each row in various slopes depending on soil type and rainfall condition

Slope (%)	Spacing between rows
5-10	30 m
11-15	20 m
16-20	15 m
21-25	12 m
26-30	10 m
31-35	8 m
36-45	7 m
46-55	6 m

Table 2: Number of Vetiver root stacks and number of Kebele's to which vetiver root stock distributed to farmers at Goba and Sinana Districts during, 2012-2017 cropping seasons

Vetiver grass distribution in Goba district		Vetiver grass distribution in Sinana District	
Kebele's name	Number of Root stock	Kebele's name	Number of Root stock
Misira	500	Asanbarera	900
Aloshe	500	Selka bekeye	800
Ilasa	800	Hayiko	850
Wacho	600	Alage	8000
Bamo	550	Shewade	700
Total	2, 950	Total	11, 250



Fig. 1: Vetevir grass nursery site at sinana agricultural research center

Vetiver grass distribution were conducted for government agencies to multiply at FTC (Farmer Teaching Center), farmers and different stakeholder obtained Vetiver grass tillers and manual about planting and multiplication from sinana agricultural research center have their own plant nurseries in the area. According [8] who report that the utilization of vetiver for soil and water conservation is not difficult for farmers to apply on their own land similarly area were these technology disseminated as easily adopted by the farmer.

In general after promotion of vetiver grass was conducted its distribution also conducted as indicated (Table 2) for soil and water conservation and overcome the problem of soil erosion.

CONCLUSION

Vetiver is proving to be a really useful tool to help farmers who have been forced into precarious hill areas to control soil and water loss. Vetiver grass is a potent versatile plant used for soil conservation, slope stabilization, improvement of water quality, pollution control, bioremediation and other environmental applications. Although many grasses, trees, shrubs and mechanical techniques have been used to prevent soil erosion over the years, to date vetiver has stood the test of time. Therefore popularize this technology multiplication and distribution were conducted in the Highland of bale zone for the farmers and different stakeholder with the objectives of the farmers multiply the grass in their home garden (Rise its own nursery site) and used as grass strip and integration with physical soil and water conservation measure to reduction of soil erosion and land degradation which in turn increase agricultural productivity.

The over all of the study revealed that the use of vetiver grass for erosion control and further promoting this technology to wide agro ecology is very important and It can be recommend planting vetiver grass integration with physical soil and water, in sediment control and use as grass strip is very important not only in Bale highlands but also in wide agro ecological zones. Also further studies are recommended its use for bioengineering and role of Vetiver grass in relation to global warming and climate change mitigation.

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