Vetiver and its system for community development in Ethiopia

Introduction

Vetiver grass was first introduced to the country by Indian experts in 1970 as a means of protecting coffee plantation from the invasion of crotch grass. It has been used for this purpose in different state coffee plantation areas, which are located in the south western part of Ethiopia. In this area the grass was also used for stabilization of road sides.

In 1991 the grass was reintroduced by World Bank to representatives of government and non government organizations involved in agricultural development activities as Vegetative hedge for soil and water conservation. Since then its use for soil and water conservation was started by few organizations and recently happened to grow considerably by Ethiopian government organizations and NGOs. The use of it by different organization contributed much in scaling up its uses to a different agro climatic , socioeconomic and cultural situations as the organization operational areas are differs in geographical distribution. The application of the grass in different agro climatic conditions and using it by various organizations also promoted the diversification of vetiver grass use, it is not any more used only for soil and water conservation purpose.

Presently vetiver are used for soil and water conservation in different land use types, road side stabilization, animal forage, ornamental plant, water quality treatment, soil and water pollution mitigation measures and cosmetics production. Its area of distribution includes the regions like southern nations, Oromya, Amhara, Tigray and Benshangul which comprise more than 85 % of the country.

Why is Vetiver for Soil and water conservation?

The Ethiopian government and NGOs have for the past thirty years made great efforts in tackling the problem of soil loss with the use of physical structures, such as stone bunds, soil bunds, and fanya juu on farmland, and hillside terraces on degraded land. Despite the fact that this form of conservation has not proved popular with farmers, experts have persisted in the deployment of physical structures. Farmers often agree in the building of these structures so as to get the benefit of FfW (Food for Work) or CfW (Cash for Work).

Reasons for the resistance by farmers to the erection of physical soil conservation structures include the following:

- A considerable amount of arable land is “consumed” by these structures, resulting in a yield reduction of 10 – 20% according to farmers’ estimate.
- Physical structures harbour rodents that result in yield losses estimated at 25% of the standing crop.
- Labour and maintenance requirements are high, often to the burden of their normal agricultural activities.

- Physical structures hinder ploughing operations.

Taking these reasons into consideration, Different Organizations decided to employ vetiver hedge technology as an alternative to physical structures on farmland for the purpose of soil and water conservation.

Vetiver as soil and water conservation measures were used in farmlands, gullies, Grazing Lands, and hillsides in a different forms. The plantation technique for soil and water conservation purposes varies depends up on the land use types and agro climatic conditions. In the less rainfall areas polytheened vetiver seedlings, with tillers more than four which are planted at spacing lower than 8cm have been found to establish tick hedge with in a year time. While bare rooted vetiver slips mostly with four tillers, planted at a spacing of 10 cm had found to establish effective hedge with in a year time. The techniques of plantation could also vary depending up on the land use types and slope. In gully side wall and very bare hill side which are at slope more than 40%, effective hedges established through the application of instant hedge developed in the nursery.
The length of hedges planted per a hectare of land various depending up on the land use types and the slope. Effective conservation effect by vetiver hedges were recorded in Gullies sidewalls with higher hedge length while similar effects attained with quite lesser hedge lengths in a farmlands at equal slope and slope lengths.

Vetiver Effectiveness in Soil and Water Conservation

The study made on the effectiveness of soil and moisture retention capacity of the vetiver hedge prevails that it is highly determined based up on the plantation techniques used, the maintenance effort made, agro climatic conditions, the management measures deployed in the very first year of plantation, and the plantation time. These factors affect the performances of vetiver hedge in conserving soil and moisture by slowing down the tillering effect of the plant and reducing the survival rate which creates gaps between slips planted to form the hedge. When a gap between vetiver slips considerably reduces the effectiveness of the vetiver hedge in soil and conservation if not aggravated the erosion rate. The experience in Gojam, some part of Illubabor and southern nation prevails that vetiver hedges established with a lot of gap contributes much for rill formation and aggravating erosion.

The hedges which were established in the proper consideration of the aforementioned factors however found to have effective and higher retention capacity of the soil and moisture irrespective of the difference in agro climatic zone and land use types. The soil retention capacity of vetiver hedge in high rain fall areas ranges from 10 - 20 ton in the farm lands, 5-7tone in Gullies. 6.5-15 ton in hill side areas. In low rainfall areas the trend between different land use types remain the same the amount conserved is considerably less which are 7-12 tone in the farm land, 3-7tone in the gully and 5- 12 in the hill side. The

differences between different agro climatic zones are mainly as a result of variation in the run of amount. While the variation between lands use types attributes to the characteristics variation which in turn affect the effectiveness the hedge formation. The results refer to the watershed where various slope class, soil type and land management styles were considered during data collection to address all variability.

In anther specific studies in south Gonder on moisture retention capacity of the vetiver grass depicted that the plots planted with vetiver grass, conventional practices and the control plot (Not treated) has shown difference performance regarding soil moisture retention in the three depth ranges. Not doubt the control

consequently more pronounced soil moisture retention at depth 70 cm and more. The same study conducted at the watershed level by developing at the rainfall and runoff relationship pattern showed reduction of the peak flows as a result of the vetiver hedges established in the watershed by respecting the watershed logic. It has also shown that the vetiver hedge enhance the base flow during the transition and dry flow periods.

Further observation prevailed that vetiver hedge slope reduction effect is not limited as the physical structures. Its effect continuous as it grows continuously up to the point where by there soil particle detachment is avoided from up stream of the hedge. In addition as different from the physical structures it maintains the natural drainage system while the physical structures are affecting it by concentrating runoff to specific outlet only. The vetiver comparative advantage is also it takes a smaller area of production as compared the physical structures. The area taken by vetiver hedge is lesser by 70% as compared to the other physical structures.

The yield of a crop growing closer to the hedge was also found to perform very well, perhaps as result of fertile soil accumulation and/or moisture retained in the soil around the hedge.

In general the so far experience had showed that vetiver hedge is the only biological material performing well for soil and water conservation in the farm land by complimenting all the other criteria needs to be fulfilled by the biological measures. Nevertheless in gullies and hillside areas there are a number of

grasses such as bana grass and green gold by far better than vetiver grass in conserving soil and moisture. Actually these grasses have there own peculiarity. The bana grass fits also to the very dry area while green gold is only in the wet area.

The cost comparison to the most common physical structures clearly describes that vetiver hedge establishment in the farm land is cheaper by 50%-70%. When the comparison includes the maintenance cost required for both measures the vetiver hedge establishment become cheaper by more than 85%. Furthermore the area could be covered in short period of time with the available labour in the watershed is higher by 500% provided there is no limitation of planting material. According to the so far experience the required planting material production was not limited as a result of an availability of labour as far as the financial resource and production area is available. When its requirement could reach to a stage that can't be sufficed by the production area tissue culture concept can come in. Nevertheless the so far experience didn't pushed as in to such an issue.

Types of measures	**Establishment Cost (Birr)**		**Maintenance Cost (Birr)**				**Remarks**
			Year 2		**Year 3**		
	CfW	**FfW**	**CfW**	**FfW**	**CfW**	**FfW**	
Fanya Juu*	**1,200**	**1,896**	**240**	**381**	**360**	**569**	**Continuous**
Soil Bund*	**900**	**1,422**	**180**	**284**	**270**	**427**	**Continuous**
Stone Bund*	**2,940**	**4,645**	**294**	**465**	**441**	**697**	**Continuous Incl. Costs for stone collection**
Vetiver Hedge (bare rooted)**	**360**	**524**	**144**	**210**	**36**	**53**	**Incl. Plant Material**
Vetiver Hedge (containerized plants)**	**916**	**1,447**	**50**	**79**	**0**	**0**	**Incl. Plant Material**

Other area of Vetiver grass application In Ethiopia

Vetiver grass for road side stabilization was demonstrated by non government organizations which were involved in rural development activities following the progressively growing road construction in Ethiopia. Companies which were involved in road construction were supplied with vetiver grass planting materials and training was provided on the appropriate techniques of vetiver plantation for road side stabilization. The effect of vetiver in road stabilization also proved to be very much effective.

In orchards vetiver hedge planted around the fruit tree in a form of micro basin to harvest water around the tree and retain water as in situ reservoir. Quite a

significant difference in performance was observed between the trees planted around with vetiver compared to the one with out it. These differences were highly magnified in less rainfall areas.

In the hand dug well considerable water yield improvement were recorded after the treatments of upstream areas with vetiver hedges. It was not only the water yield but also the quality of water of specially the rainy season was outstandingly improved.

Vetiver was also used as an ornamental plant around institutional and private compounds.

During vetiver grass exhibition which were conducted in 2003 a private investor informed us that he started to produce cosmetics from vetiver grass roots. The progress he made was not followed up

Vetiver adaptability

Vetivers in Ethiopia were tested in areas, which are characterized by a wide range of environmental conditions. In altitude ranges of 1200- 3200masl, rainfall ranges of 500- 2200mmper annum, and wide ranges of soil type. Regardless of differences in rainfall, altitude, soil type, and other microclimatic conditions, vetiver has performed well. Despite differences in tillering capacity, growth height, and leaf colour its performance was satisfactory. But, it was observed that growth and tillering rates are lower at high altitude ranges, and that establishment in termite and mole-infested areas may prove to be problematic.

Propagation techniques

Different organization experimented with propagation techniques such as bare-root splits, raised-bed methods, propagation in various sized polythene tubes, and instant hedge methods. Root treatments, including the soaking or dipping of roots in manure, were also tested.

The most efficient and cost effective methods for high rainfall and low rainfall areas are different. In the high rainfall areas bare rooted propagation supported with furrow irrigation in the dry season are found to be effective. Seedlings produced with this system, when planted in the field in high rain fall areas, the survival rate and tillering capacity is high enough to form a hedge with in a year time. In this area when the amount required is low it is possible to propagate it in the field with out supplementary irrigation in the dry season

Nevertheless in low rainfall areas the most efficient and cost effective proved the two-stage production process - multiplication within nurseries in black big polytheen tube, and multiplication for final planting out in the field using white smaller polytheen tube.

This system helps very importantly when a lot of planting material production is required in a very short period of time. The details of the production system are as follow:

I. Multiplication procedures for low rainfall and high altitude areas within nurseries

- Black polythene tubes with a leaf-lay size of 16 cm and 22 cm in length are filled with a mix of soil, sand and compost at the ratio of 3:2:1.
- Two vetiver tillers are planted in each tube.
- Plants are irrigated twice daily for the first two weeks, and thereafter once daily.
- Fertilizer is applied at the rate of 10 grams of DAP in the first week and 10 grams of urea once a month thereafter.
- Trimming of leaves occurs once a month.

This strategy results in the development of eight or more tillers per polytheen tube within three months. At this stage the whole process is repeated. The tillering rate declines rapidly if replanting is not undertaken. With care, the polytheen tubes can be re-used three times over.

This system allows for the production of at least 64 tillers from each original tiller, which is far higher than the rate of production from any other method that was tested.

II. Production for field planting

Field planting starts beginning of the rainy season. Production for field planting starts two months before this time.

- Transparent polytubes of 10 cm leaf-lay size, and 16 cm in length, are filled with a mix of soil, sand and compost at the ratio of 3:2:1.
- Two tillers from the black polytubes are transplanted into the transparent polytube bag.
- In this instance DAP and urea fertilizers are applied after a week and at the end of the month respectively.
- No trimming is required.

After one and half month the tillers develop a good root system, new shoots, and a third tiller, all of which enable them to withstand harsh field conditions.

The smaller transparent polytheen tubes are utilized for field planting in order to reduce the costs of production, and to minimize the soil mass that has to be transported to the field. The cost of production (three tillers) using this system in addition of the cost of multiplication per seedling is seventeen Ethiopian cents.

The cost of production which is recommended for high rainfall and mid and low altitude areas is ten Ethiopian cents.

Note: This propagation technique can be only recommended for high altitude areas. Low altitude areas with sufficient and reliable rainfall are better served with bare rooted plantings.

Vetiver effect on community development

Vetiver has been planted alongside existing physical structures such as stone bunds, and also on untreated farmland, along the contour. In both instances, farmers were pleased with the performance of the vetiver, reasoning that it conserves soil and water, and provides practically immediate benefit by way of forage, thatching and mattress-stuffing material, green leaves for use in traditional coffee ceremonies, etc. Farmers also appreciate the low labour requirements for hedge establishment, as well as the minimal maintenance needed in comparison to physical structures.

Farmers remove physical structures on their land after the vetiver hedges are sufficiently established, stating that these structures are obsolete due to the fact that the vetiver hedges efficiently trap soil and conserve moisture without occupying more land than it is necessary, and that rodents thereby have no tendency to multiply after their breeding places (stone bunds) have been removed. To enlarge on this last point, farmers insist that vetiver has a dramatic effect in reducing rodent numbers. This effect has been reported specially in the northern parts of the country where the infestation of rodents in the farmland areas are high.

In south western parts of the country vetiver grass are layered with a grain in a grain bean to protect the grain from the attack of weevils. Similarly the use of vetiver grass as a bedding material in the house to protects the people from the attacks of bed bugs and flies are widely adopted. Thus it would be advisable to make further research on the possible insecticide effects of vetiver grass in references to the Ethiopian local condition.

Furthermore farmer's generated income by selling the grass trimmed from the already established hedges. The market for the trimmed grass is also growing as its use for thatching of seedling bed and roofs, and using it for coffee ceremony purpose in the town, compost making and as a bio insecticide happened to grow well in rural and urban areas. Selling of the vetiver clumps for further multiplication in the nurseries and/or direct distribution for plantation in the farm land is also happening. The major consumers of these services are private and non government organizations. The exchange of vetiver clumps with in farmers in kind is also very common for plantation in the farmland for soil and water conservation purpose. Agricultural experts have confirmed that farmers are

placing a high priority on vetiver in the field of soil and water conservation. Many farmers from areas other than project intervention areas have also proceeded to treat their own farmland with vetiver obtained from within intervention areas.

The only thing that can be pointed as a handy crafts of Vetiver grass is tread made for tethering livestock and packing materials for transportation. There is a need to make effort in developing the handy crafts of vetiver grass

Dissemination strategies of vetiver Grass in the country

The dissemination strategies applied in Ethiopia for vetiver promotion various in references to the target area. The farming communities were introduced about vetiver grass effect in soil and water conservation by demonstrating it through innovative farmers. Innovative farmers were assisted in planting material provision and technical backstopping. Then after farmers to farmers experience exchange visit organised by different organization played a prominent role in getting vetiver disseminated at the farming community level. During farmers to farmers exchange visit the visitor group raises all the concern related to the technology to the farmers who used vetiver in advance. This system allows the free discussion between farmers, so that they understand at their own perspective. The expert's involvement in this discussion was limited to minimum to not affect farmers' confidence.
Further more the traditional information exchange methods existing in the community had also played a significant role in popularising the vetiver technology at the community level.
These systems in most of the cases were supported with vetiver training program to consolidate the information gained during farmers to farmers experience exchange visit and traditional information exchanging mechanisms.

The organizations involved in agricultural and community development activities were informed about the vetiver technologies through workshops training and field visiting. The vetiver technologies were also presented to a number of bazaars and events conducted in the country and pamphlets about it distributed to organizations and individuals.

A number of international and local NGO's, and bilateral and multilateral organizations have visited and observed vetiver in the different projects found in different regions, and all have indicated a strong interest to include vetiver hedge technology in their programs. The majority of them have been supplied with planting material and appropriate information, and information on their experience on their relative success rates re-circulated.

As a result of this effort the vetiver technology as a soil and water conservation activities are already formulated in the extension packages in some regions.

In relation to the Ethiopian Government, the Deputy Prime Minister, the Information Minister, and the President and Vice President of the Amhara region paid a visit to the project, after which a delegation was sent to evaluate the program's activities in relation to vetiver and other innovations. This visit resulted in the inclusion of vetiver hedge technology into the national agricultural extension package.
In April 2003, the Ethiopian Prime Minister also paid a visit to a vetiver grass treated watersheds to see its effect in relation to water harvesting.

A delegation of ministers from Ethiopia, Sudan and Egypt were also in watersheds which are in Nile basin and were treated with vetiver to see its effect in reducing erosion and runoff.

Challenges

Though vetiver is outstanding in its performances for soil and water conservation in the farmland its application at larger extent was hindered by the following factors:

- FFW or CFW activities which are common in food insecure areas were the major factors contributing much in hindering the scaling up effect of vetiver hedge for soil and water conservation activities. The physical structures construction absorbs a lot of labour and address a considerable amount of beneficiaries by accomplishing small amount achievements. Thus preferred to do it by the experts as well as the farmers.
- Free grazing is very much common almost all over Ethiopia, early stage grazing of vetiver effectively threaten the survival and hedge formation rate of the vetiver grass. This effect discouraged a number of organizations from the promotion of vetiver grass.
- Improper technicality application in vetiver technology promotion lead to undesirable effects such as rill formation in the farmland and reached to a conclusion that it is not effective
- Lack of proper networking hindered the proper flow of information among the users of the technologies.
- The participation of researchers and policy makers in the promotion of the technologies were minimal.