Decline of native fishery on Lake Victoria, compels lakeside communities to engage in farming on fragile landscapes and on soils prone to erosion. Excess soil nutrients especially phosphorous attached to soil particles are washed down to the lake by runoff causing eutrophication, a process that triggers the growth and spread of Water Hyacinth Weed (Eichhornia crassipes) on the lake's surface. This paper seeks to impart skills among farmers in application of Vetiver Grass Technology for control of runoff in their crop fields and sediment control at selected sites..

ESTABLISHMENT OF VETIVER GRASS NURSERY AND HEDGEROWS FOR CONTROL OF EUTROPHICATION IN LAKE VICTORIA

A paper preseted during the training workshop of farmers at UMEA Kikondo Primary School on 4thMay 2019.

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INTRODUCTION:

Soil erosion starts as sheet erosion. As the sheet of water moves down the slope gaining speed, it breaks up into individual streams or rills. If uncontrolled, the rills combine to form streams and cut out gullies. As the gullies are cut, their depth increases the slope and speed of the runoff, and these gullies go from the bottom to top of the slope. Once they can go on further, they get deeper and create side gullies, until the dendritic partner of erosion has developed.

On arable land, sheet erosion is the major problem, and the one least recognized. The present means of control is more oriented toward the secondary and tertiary stages of erosion: Reeling and gullying. The silt load carried by sheet erosion is merely diverted to drainage. If rills or gullies are obvious in an area, conservationists get concerned, but little attention seem to be paid to irredeemable loss of top soil and nutrients. Every land has a slope irrespective of how flat it appears and it should be protected against sheet erosion.

CRITERIA FOR A VEGITATIVE SOIL CONSERVATION PLANT:

For the plant to be useful in soil conservation it must have the following characteristics:

- It must be capable of forming a dense permanent hedge, resistant to the harmful effect of overgrazing and fire.
- It must be perennial and permanent, capable of surviving as dense hedge for centuries. It must not compete with the crop plants it is protecting.
- Its crown must be below the surface, to protect it from fire and over gazing.
- It must be sterile, also producing no stolons or rhizomes so it will not become a weed.
- It should repel rodents, snakes, and so on. The sharp leaves and aromatic roots of Vetiver keep free of vermin and other pests; and relatively unpalatable to livestock.
- It must be both a xerophyte and hydrophyte if it is to survive the forces of nature. Vetiver grass, once established, is not affected by draughts or floods.
- It must have a deep penetrating root system, capable of withstanding tunneling and cracking characteristics of soils. Roots must penetrate to at least 3 meters.
- It must not compete with the crop plants it is protecting.
- It must be cheap and easy to establish as a hedge and easily maintained by the farmer. It must be easily removed if the farmer no longer wants it.

- ❖ It must be totally free of pests and diseases, and must not be an intermediate host for pests or diseases of any other plants.
- ❖ It must be capable of growing in all soil types, regardless of nutrients status, pH, or salinity. This includes sands, shale, gravels, and even aluminum toxic soils.
- ❖ It must be capable of growing in a wide range of climates-from 200mm of rainfall to 6000mm-from temperatures of -9 degrees to more than 50 degrees C.

These characteristics describe ***vetiveria zizanioides.*** It is a remarkable plant and no other is known to share its hardiness or diversity.

Nursery Establishment:

- **Step 1:** Book for planting material usually from a Vetiver Nursery. If Vetiver is unknown in your area, check with the nearby Botanic gardens look for ***Vetiveria Zizanioides.***
- **Step 2:** Prepare nursery site in a well-drained place with fertile soils add farm manure if available.
- **Step 3:** Obtain the planting material, keep for 7-10 days, well watered in a shed.
- **Step 4:** Prepare the slips in a shed, cut the tops off about 15-20cm above the base and 10cm bellow the base, put the prepared slips in a basin of water or any other container of water.
- **Step 5:** Water the beds thoroughly before planting. Use a pointed stick with a diameter of 5cm to make a hole in the soil and plant two slips in each hole. Using your hand firm the soil around the slips. Plant in double or triple lines across the stream bed at a distance of 40cm from each hole. This wide spacing gives each plant ample room to tiller or produce more planting material.
- **Step 6:** Nursery plants should be cut back to about 30-50cm to encourage tillering.

Where ants are a problem to the young slips, home prepared biological means of protecting your nursery are recommended. They include using a solution of ginger and vinegar to spray the affected plants and a solution of liquid detergent can also be applied to kill the ants. Also realizing free range local chicken in the nursery is effective as they prey on the Ants until they reduce them to harmless levels.

The best nurseries seem to be in loamy soils where drainage is good. In the first two months, when the plants are getting established, weed the beds to keep the weeds under control. After 6 months, there should be between 80 and 100 tillers per plant, which can be used as planting material. Thoroughly soak the plants to make it easier to lift them out of the ground. Once sufficient roots are exposed, they can be cut 20cm below the surface and pulled out. The clumps are then transported to the field. When harvesting, leave three to four tillers in the ground from each clump to renew the planting material.

Slips handling:

Before transporting the slips from the nursery to the field, cut the tops off about 15-20cm above the base and 10cm bellow the base. This will improve the slips chances of survival after planting by reducing the transpiration level and thereby preventing them from drying out.

Planting the slips in the crop field:

Using a pointed stick make a hole on the line that was pegged out to mark the contour. Push the slip into the hole, taking care not to bend the roots upward. Then firm the slip in the soil. Ten to fifteen centimeters from the slip, along the same contour line, plant the next slip and so on.

Only a single row of slips need be planted. If planted correctly, the slips can withstand up to one month of dry weather.

Some slips may die, however, and leave gaps in the hedge line. These gaps should be filled by planting new slips.

The surface distance between Vegetative barriers is obtained by multiplying the Vertical Interval by the surface run. E.g. A slope of 70% has surface run of 1.7m with a vertical interval of 2m.

Therefore the distance between hedges =2 x 1.7 = 3.4m

However farmers are encouraged to use observational skills to establish hedges where the runoff gains velocity, beginning with the uppermost part of the slope.

Maintenance:

Maintaining the hedge is simple and cheap. When the hedge has been established and there are no gaps, it should be trimmed every year. This encourages the plant to tiller and thicken up the hedge. When you trim the hedge some leaves dry, these can be removed and used as mulch.

With mature, established hedges, there is no need to fertilize as they filter nutrients in the field and seem to be capable of maintaining a high standard of vigor regardless of soil type. The same applies to water requirements; all the runoff water accumulates behind the hedge waiting to filter through, meaning that there is more water at the base of the hedge than the average amount rain in the area, which is why the hedge is so drought resistant.

Other important uses for Vetiver grass:

Irrigation: Vetiver grass has now been successfully used to prevent the erosion of canal banks.

It can be planted along the top of the bank to protect the edges or along the waterline, especially on curves of unlined canals.

Dams: Vetiver grass hedges around the perimeter of a dam will prevent silt from washing into the dam, and give the dam a much longer life.

Orchards and tree crops on steep slopes: Orchards have shown remarkable response to being planted behind a Vetiver hedge on very steep slopes.

Plant Protection: Vetver grass in India and Zimbawe is used to keep rhizomatous weeds out of field.

Handicrafts: Vetiver grass eaves make good baskets and mats.

Mulch: The dry material of Vetiver grass is long lasting mulch.

Boundary demarcation: The grass can be used to mark the boundary of your land.

Sewage Treatment: Vetiver grass is effective in reducing nitrogen from domestic sewage.

The advantages of vegetative hedges:

Vegetative hedges have many advantages because they filter the soil and retain it, they build up natural terraces. If all cultivation and planting is parallel to the hedge and the hedge is placed at the correct vertical interval indicated by the point where riling commences, far more land on steep slopes can be safely brought under cultivation.

In many countries, land scarcity and population pressure effect the slope that is considered acceptable slope for cultivation in parts of central Africa is 12%, in the Philippines, 25% and in Israel, 35%. These limitations of slope are directly tied in to the structured system of soil conservation. The steeper the slope, the more complicated the engineering, consequently the more difficult it is to build. Further, the structures have to occupy more land as the slope increases. Because of population pressure, however, cultivators take little notice of these slope limitations and most governments are either unable or reluctant to enforce them. The result is that government soil conservation measures stop at their slope limits, but cultivation does not, and erosion continues uncontrolled. If these areas were compulsorily planted by farmers with Vetiver grass barriers, erosion would be controlled. Providing the cultivators follow the contour guideline, slope is not a constraint. This means that food crops can be grown safely on 50% slopes-in the Fiji islands, sugarcane is grown on 100% slopes (45 degrees) without any erosion

problems. In fact, over the 30 years the hedges have been in effect, they have built up almost level terraces 4 meters behind the hedges.

There is now no question about the merits of using vegetative hedges despite the slope-and on flat land as well. In rain fed areas all land must be protected, right down to the river's edge. It is imperative to understand though that the land users will only voluntarily adopt conservation practices when these practices are perceived as being in their own best interests. Is conservation in the best interest of the land user?

Once the Vetiver hedges have been established, the extension worker can show the farmer how the hedge is filtering out soil from the runoff and building up a terrace. Until the farmers actually see this, they have no concept of what they were losing to sheet erosion.