The Vetiver: From Nursery to the Protection of Infrastructures

S. Y. Mamadou

Agricultural Technician, plle N°5169 Pikine Icotaf, Pikine, Senegal

Abstract: At Cap Skirring (on the South West coast of Senegal) several hotels were losing much of their beaches areas and infrastructure (stairways, walkways and bungalow) to wind and water erosion as well as advances by waves and sea water. Hotel managers ignored the existence of a simple and effective technology such as the Vetiver System. They had previously spent large amounts on mechanical and vegetative methods of protection that had not proven satisfactry so far. Early in 2002 two hotels requested and obtained the service of a provider who introduced the Vetiver System to stabilize slopes, beaches, infrastructures and dunes. The results were quite satisfactory. Prior to this, research conducted in a private nursery by the author showed that rapid multiplication techniques allowed the nurseries to rapidly increase plant through a combination of spacing, pre-soaking and adding farmyard manure. These techniques were applied to the beach rehabiltion sites. At present six tourist complex have applied the vetiver system to combat soil, sand and sea-water caused erosion, and often in associated with the other local species as the *Casuarina équisétifolia* and the decorative plants. There resulting beautification and practical protection demonstrated that the vetiver grass (*Vetiveria zizanioides*) adapted well to Senegal and especially coastal zones. The original stock of vetiver grass, imported from South Africa is a close relative to the local vetiver (*V. nigritana)*, which grow in several regions of Senegal. The rapid acceptance, and application of vetiver by hotel owners in the southern part of Senegal resulted in many happy owners and a renewed respect for vegetative protection.

Key words : vetiver, erosion control, nursery, beach and dune infrastructure, multiplication

Email contact: S.Y. Mamadou <mamadusy@yahoo.fr>

1 INTRODUCTION

Vetiver is one of the earth's oldest plants, which has been used successfully to regenerate poor soils.

Continual research has expanded the virtues and potential of the plant. During the past several years, there has been significant research, and observations that have led to an increased use of the plant in Senegal.

The objectives of these efforts have been to show the applicability of vetiver technology to urban and rural population and businessmen population. It has many virtues (anti-erosion, fire resistant, and it has antiseptic properties), its roots can reach 3 meters deep, allowing the plant to fix firmly the soil and its stiff leafs stop eroding soil. Moreover, vetiver leaves can be used for mulch.

2 NURSERY MULTIPLICATION TECHNIQUES

2.1 Results of Research

We conducted over the course of a year research on the vetiver growth using different types of available manure, fertilizer, the most advantageous spacing between plants within a nursery setting and the effects of pre-soaking on survival rates and growth. Tables 1 shows test results using four types of

readily available animal manure and Tables 2, one type of mineral fertilizer, DAP (Di Ammonium Phosphate).

Table 1 Results from using different types of manure

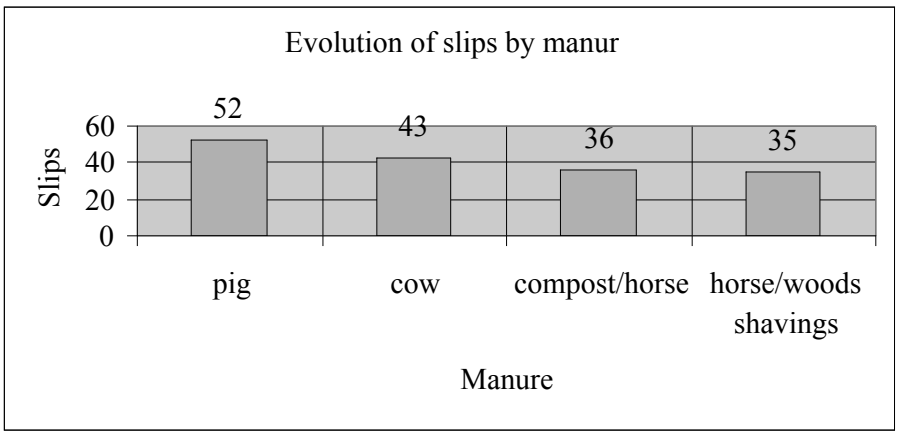
Index of slips by manure					
Planting dates	Slip number planted	DAP (kg)	Manure (kg)	Manure type	Average number of slips per clump in 160 days
10/08/2001	37	50	62.5	Pig	52
10/08/2001	37	50	62.5	Cow	43
10/08/2001	37	50	62.5	Compost/horse	36
10/08/2001	37	50	62.5	Horse/woods shavings	35
Total	148	200	250		

Table 2 Results from using different quantity of DAP fertilizer

Index of slips by fertilizer					
Planting dates	Planted area (m^2)	Number of clumps used	Compost used (kg)	DAP used (g)	Average number of slips per clump in 120 days
14/09/2001	14	150	200	400	35
14/09/2001	14	150	200	350	32
14/09/2001	14	150	200	300	32
Total	42	450	600	1050	

Clump sizes were counted and weighed 160 days after initial planting. We observed that pig manure was more efficient in accelerating multiplication. Each lot of vetiver plants were watered the same days; receiving the same quantities of fertilizers, of manure and water. The results were: 52 slips on overage for pig manure, 43 for cow dung, 36 for compost/horse and 35 for horse/wood shavings. From these results we were able to recommend pig manure and cow dung to private nurseries if then wanted to maximize the multiplication of vetiver (Fig.1).

Fig. 1 Results from using different types of manure



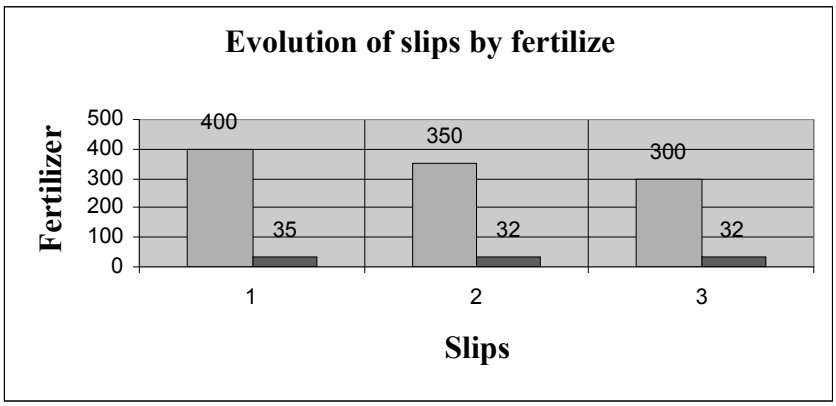
We also tested new slip growth using various doses of DAP and noted that beds received higher rate of fertilizer, from 350 to 400 g produced slightly (16%) more slips than the control plants (Fig.2).

2.1.1 The beneficial effect of Di ammonium phosphate

The production cost to tillers ratio shows that DAP usage is profitable when applied to vetiver. In fact, a 50 kg bag of DAP costs 9000 FCFA. Referring to Fig.2, there is 5 more slips on each clump that used 400 grams per square meter than when 300 g was applied. Therefore for 100 g extra of DAP put in

the soil, we have 5 more slips. The cost of 100 g DAP is 180FCFA (based on 50 kg bag of DAP costs 9000 FCFA).

Fig. 2 Results from using different quantities of fertilisers



Based on the average price of 100 FCFA per slips, we will make 500F CFA for the 5 extra slips. The difference between 500FCFA income and 180FCFA supplementary cost in DAP gives a net profit of 320 FCFA for each clump of about 35 slips, hence 48,640 FCFA for each bed of 152 clumps.

2.1.2 The impact of spacing on vetiver tiller growth

We also studied the impact of spacing on vetiver tiller growth; Table 3 below summarizes the findings.

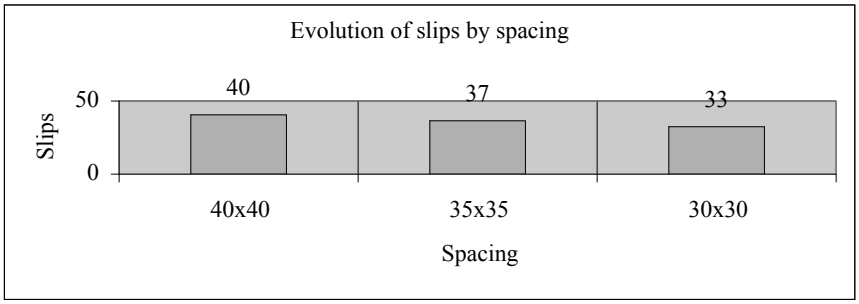
Table 3 Effect of different planting space on vetiver growth

Index of slips by spacing						
Planting dates	Plant density per 14m_	Dates of evaluation	Manure used (kg)	DAP used (g)	Spacing (cm)	Average number of slips per clump in 150 days
24/08/2001	87	24/01/2002	150	150	40 x 4.0	40
16/08/2001	93	16/01/2002	150	150	35 x 3.5	37
27/08/2001	148	27/01/2002	150	150	30 x 30	33
Total	328		450	450		

Fig. 3 shows that increased spacing between planted slips increases the number of new slips over a given period. We used 3 different beds using different spacings. We planted 40 slips at intervals of 40 cm x 40 cm, 37 slips at 35 cm x 35 cm and 33 slips at 30 cm x 30 cm. These plants were not out planted the same day but they received the same quantities of DAP, of manure and were evaluated 150 days after the date of planting. We note that the beds that had slips planted at 40 cm x 40 cm has 21 % more slips than the others planted with 30 cm x 30 cm spacing. Therefore, spacing between plants plays a role of paramount importance in the multiplication of the vetiver.

We also tested root formation and plant regrowth rates using a pre-soaking method and a control when slips were replanted directly after break-out from the source clumps.

Fig. 3 Results from using different spacing layout



2.1.3 The effect of manure soaking on vetiver tiller growth

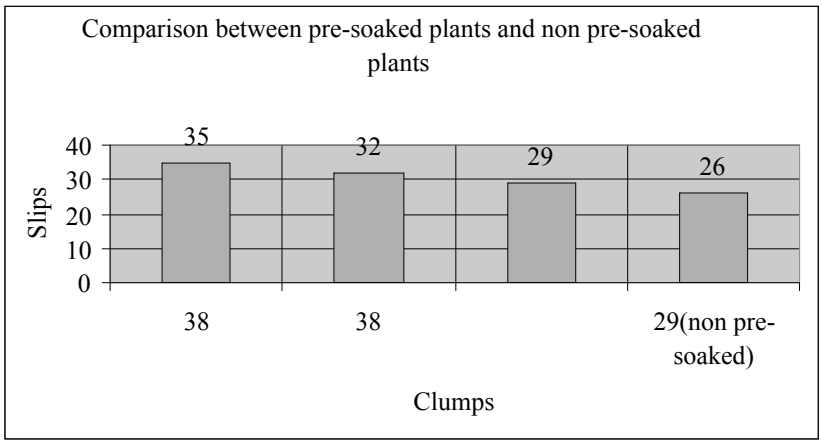
Pre-soaking in "cow-tea" consists of soaking vetiver plant in a mixture of water and cow dung for 3 to 5 days. The multiplication technique increases the survival rate of plants by more than 23% while facilitating their survival (Table 4).

Fig. 4 shows that pre-soaked plants have a higher survival rate; they are more apt to establish slips.

Table 4 Effect of manure soaking on vetiver tiller growth

Index of comparison between pre-soaked and unsoaked plants							
Planting dates	Number of planted slips	Quantity of DAP (g)	Quantity of compost (kg)	Number of pre-soaked plants	Number of plants planted directly	Number of survived plants	Average number of slips per clump in 120 days
21/09/2001	38	75	50	38		38	35
21/09/2001	38	75	50	38		38	32
21/09/2001	38	75	50	38			29
21/09/2001	38	75	50		38	29 (unsoaked)	26
Total	152	300	200	114		142	

Fig. 4 Effect of manure soaking on vetiver tiller growth



2.2 Pests Found

We have observed a few enemies of vetiver and their attack negatively impacted at least one large nursery. The main enemies found are:

- ***Termites***

They are gnawers living in societies composed of a male, a female with a large abdomen and numerous workers, which ensure food and soldiers for defence. They are found in hot and humid areas like the south of Senegal. The termites attack the vetiver as soon as it is planted or at the moment of the

penning of plants. They gnaw the leaves and necks and the damage is at times significant. We lost approximality 800 slips out 20,000 to termites over the course of 6 months (4%).

- ***Stem borers***

These omnivorous bugs eat their way up the stem. They are capable of destroying two months old plants, and are difficult to control, although we did not use any insecticide. They devoured 80 plants out of 180.

3 ESTABLISHING CONTOUR LINES FOR SLOP STABILIZATION: A NEW AND A TRADITIONAL METHOD USED IN SENEGAL

3.1 Laser Night Glasses – New Technology

For a large area (1.5 ha) precise contour lines were established using laser-equipped glasses. This devise was developed to establish accurate line on large sites.

The laser glasses is a sophisticated device that help to establish very accurate contour lines for hedge planting using. The method consists of the engineer wearing glasses with a laser beam mount on its front to mark out the starting points for the vetiver rows. The drawback is that the system can only be used in the dark, and it uses batteries. The laser glasses cost 125 EURO.

3.2 The "A"Frame – Traditional Technology

This device is used in most rural areas. While it is precise but it takes time when large areas are to be prepared for out-planting. It is conceived in shape of a triangle with a maximum spread of 1.5–2 m. It is a traditional surveyor tool and is used to establish contour lines for smaller surfaces.

4 THE METHODS USED

Several vetiver applications have been made by the author in the south of Senegal that has produced good demonstrations sites on slopes, beaches and dunes.

4.1 On the Slope

We establish contour lines using both laser night glasses and "A" frame in the following manners:

- The laser night glasses are used to mark out the starting points for the vetiver rows by standing at the far side of the slope and marking where the level laser beam hits the ground at the 1.5 m vertical spacing. This forms the starting point for the planting staff who use an air bubble level to plant the vetiver on the horizontal level during the day time at each 1.5 m vertical interspacing.
- After this step, we dug furrows from the top and then brought manure to the furrows, using 4 kg per linear meter; the manure is mixed with some earth and it is dampened to facilitate the marking of holes for planting. Because of the steepness of the slope we spaced plants 10 cm apart.
- Subsequently, we planted only tiller that had been pre-soaked. Between the hedges of vetiver we planted at alternative rows of colourful ornamental plants to colour the slopes (Photos 1&2).

Photo 1 New vetiver hedges (15.05.2002)

Photo 2 Fourteen months later

4.2 On the Beach

To protect the beach from encroaching into the tourist complex, we used two species for hedging: vetiver and *Casuarina equisetifolia.* A woven bamboo screen (crentin) separated the two plants. Before planting, we levelled both sides of the sand dune to serve as a level planting "platform". Through one full season, both species seem to function well in dry and saline soils (Photos 3 and 4).

Photo 3 New vetiver and C*asuarina equisetifolia* hedge (20.09.2002)

Photo 4 Fourteen months later vetiver (right) in combination with C*asuarina equisetifolia*

4.3 On the Dunes

We used polyethylene roll and vetiver to stabilize shifting sand dunes:

- In dry seasons, the method consisted of planting vetiver in poly bags, which had a minimum growth of 45 days. All plants used for dune stabilization were transplanted from poly bags because of the salinity and harshness of the environment.
- A roll of polyethylene, 0.50m wide, was fixed with 1m sticks every two meters over the length of the hedge.
- The space between the furrows and the roll was 30 cm and the roll was positioned perpendicular to the dominant wind direction of; this to avoid the plants from being buried.
- The plants were watered and furrows were reinforced with animal manure at a dosage of 4 kg per linear meter.
- On the dunes, planting also followed the contour lines (Photos 5&6).

Photo 5 Dune site before planting (30.04.2002)

Photo 6 Fourteen months after planting

5 CONCLUSIONS AND RECOMMENDATIONS

Based on research and application for soil and sand dune protection we propose the following recommendations:

- Before planting, select strong and healthy plants with 2 to 3 tillers.
- It is better to pre-soak tillers prior to planting. This will accelerate the growth.
- Pre-soaking basins should be placed in the shade to avoid drying out.
- In nursery, add 20 kg of animal manure per square meter to accentuate growth.
- Preferably, use pig manure or cow dung as they have given the best result.
- When preparing slips, cut back the roots at 10cm and plant the tillers at a depth of 2 to reduce mortality and to reduce termite loss.
- To revitalize the plants, add DAP by 20 g/m_.
- In multiplication in beds, the difference of increased the spacing 40x40cm in staggering rows and 30 x 30 cm, is only 7 slips.
- Vetiver plants will multiply faster in multiplication beds than strip planting or in nursery bags.
- In nursery, avoid planting vetiver in the shade, because loss has been measured as high as 35.
- On dunes, beaches and anti-salt dikes, avoid planting bare roots slips as the survival rate is lower and the plants are slower to take hold.

Acknowledgments

This paper was prepared under the support of Dynaentreprises Chemonics project USAID (DAKAR-VDN).

The author would like to thank DrCriss JULIARD Dynaentreprises BDS and Dr Paul Truong, for their valuables comments and corrections to this paper. Thanks are also due to Ibrahima DIAW, Abdourahmane TAMBA, AW Alassane, Bachir.

References

Information used in this paper was obtained from www.vetiver.org, Criss JULIARD and Paul TRUONG documentations.

A brief Introduction to the first Author

Mamadou SY is a Senegalese agricultural technician who has worked in several business involved in rural develpoment. Since 2001 he has worked with Dynaentreprises, as a rural business development project consultant. Among his tasks were to examine and test vetiver multiplication techniques in a large vetiver nursery and to provie technical assistance for the protection of infrastructures in coastal regions of Senegal.