RESEARCH AND DEVELOPMENT OF VETIVER GRASS

(Vetiver. zizanioides,L.)

IN ETHIOPIA

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Introduction

- Soil erosion is one of the most severe problems affecting the agriculture sector in Ethiopia.
- According to the Ethiopian high lands reclamation study (EFAR, 1991),
  - **over 14 million hectares (or 27% of the area) of the highlands was estimated to be seriously eroded,**
  - **and about 15 million hectares were found to be susceptible to erosion.**
- A preliminary soil loss and run-off study at Melko (JARC)
  - **82.3 ton ha^{-1} soil was eroded annually (Tesfu Kebede and Zebene Mikru, 2006).**
- In Ethiopia, vetiver is used to protect the edges of contour drains, but the plant is becoming increasingly popular as an ornamental around houses.

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- One advantage, widely believed in Ethiopia, is that Bermuda grass and couch grass cannot invade fields through a vetiver hedge., the local Amharic name for vetiver means "stops couch grass" (BOSTID, 1993).
- The present trend of expanding row-planting and light shaded coffee plantation seems to expose the farming system to risk of soil erosion.
- In such conditions lack of appropriate soil and water conservation measure might lead to poor and unsustainable production of coffee and other crops in the area.
- Experiment was conducted to quantify soil loss and runoff under vetiver hedgerow conservation techniques at Melko and hence recommended appropriate erosion control measure
- The purpose of this paper is therefore, to review the results of vetiver in research and development.

Historical Background

- Vetiver grass is distributed mainly in
  - tropical Africa, South Africa, and Central and South America (Greenfield, 1988; Lavania, 2000);
  - India, Southeast Asia,
- It grows luxuriantly
  - in well drained sandy loam soil and
  - with annual rainfall of 1000 – 2000 mm and
  - with temperatures ranging from 21 ^{o}C to 44.50 ^{o}C (Meffei, 2002).

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- Mr. Fernie, a British agronomist arrived at the then Jimma Agricultural Research Center, and Mesfin Amha had traveled to Yamungi, Tanzania in 1971 and on the way back
- They brought with them Vetiver grass to Jimma Research station, Ethiopia for the first time.
- Shortly after introduction of Vetiver grass to Jimma Research station, an observation trial was conducted and samples were sent to Tropical Institute, England for oil content analysis.

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- In 1984/85 vetiver grass was distributed for the first time out of the research station to the nearby
  - coffee state farms and
  - to Menschen für Menschen (MfM) (German based NGO) with the intension of utilising as mulch and as soil and water conservation practices.
- The first nursery was established in the early 90's by MfM in southwestern part of the country.

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- **In subsequent years, vetiver grass was introduced to more areas**
  - **like different weredas of Illubabor,**
  - **Debrezeit, and Holleta Research Center mainly for erosion control.**
  - **In 1980 EC Vetiver grass was distributed throughout the country including wolayta and Tigray,**
  - **Vetiver grass is being used**
    - **by farmers, rural road experts,**
    - **urban dwellers small-scale cottage industries and**
    - **wet lands development project.**

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- There are about 250 NGOs, in the country working in different programs and
- of them, 110 are working in the field of natural resource conservation.
- 80 % of them are now using the grass for their soil and water conservation program.
- This has brought the number of NGOs involved in the distribution of vetiver from one in 1991 to 88 in 1999.
- Today one of the biggest vetiver promotion projects has been launched by financial assistance of two bilateral organizations, GTZ and SIDA, in the northern part of the country (Alemu, 2000).

Materials and Methods

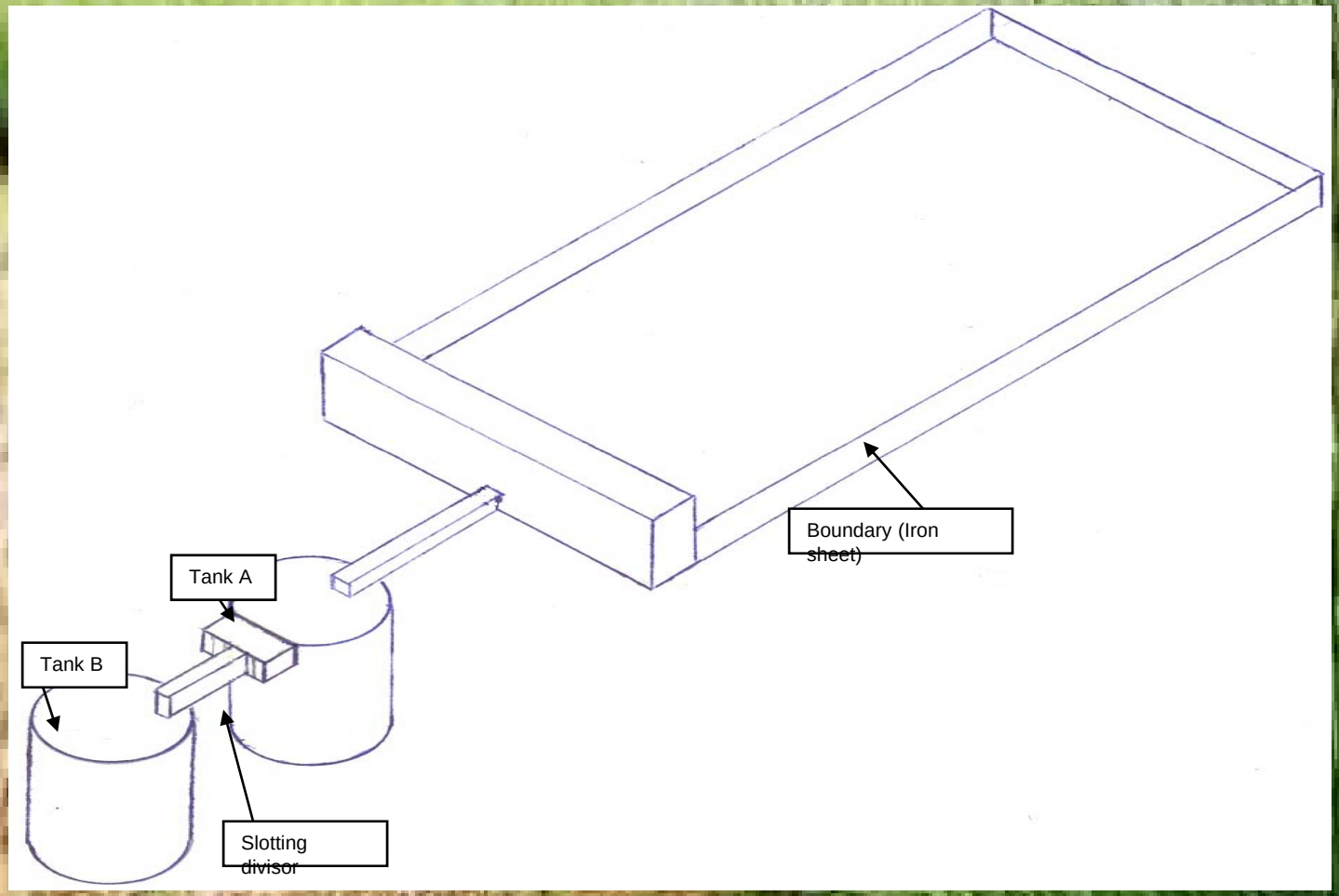
The study area

- The experimental site, Jimma Agricultural Research Center (JARC),
  - is located on 7° 39’ 56.4’’ latitude north and 36° 46’ 56.4’’ longitude east and
  - laid at an altitude of 1753 m.a.s.l.
- The landform of Melko is
  - hilly and rugged
  - having dark reddish brown color
  - Developed from the underlying basaltic formation.
- The soil type of the area is
  - Eutric Nitosols (clay, deep, well drained,
  - pH 5-6 and
  - medium to high in exchangeable cataion).

Experimental Setting

- The Vetiver hedge row was tasted and compared with bare-fallow using a hydrological bounded runoff plot
- The plots were laid out on 20% land slope
- dimension of 30m length and 4 m width
- plot boarders - pieces of iron sheets
- Runoff and sediment collecting ditch and slotting devisor- at lower end of the plot

Runoff Plot



The treatments consist of:

- **Control (Bare plot):**
  - The plot was kept bare by continuously weeding.
- **Bare land Vetiver grass hedgerow:**
  - Bare land with out any crop cover was planted with vetiver grass hedgerow as barrier of surface runoff.
  - The grass was planted in double rows in an intermingled pattern. The space with in and between rows was 20cm.
  - The space between consecutive hedgerows inside the plot was about 8 meters.
- **Vetiver grass hedgerow in stumped coffee:**
  - Stumped coffee was planted with vetiver grass hedgerow as a barrier of surface runoff.
  - The grass was planted in double rows in intermingled pattern.
  - The space with in and between rows was 20cm.
  - The space between consecutive hedgerows in side the plot was about 8 meters.

Runoff and soil loss collection

- Volume of runoff collected in both tanks was measured using a calibrated measuring stick following each storm.
- The clear portion of the runoff collected in Tank A was siphoned out.
- The remaining sediment was stirred thoroughly and weighed, and known amount of sediment sample was taken for gravimetric moisture analysis.
- The samples were oven dried at 105 ^{0}C for 24 hours.
- The volume of runoff in tank B was measured, stirred thoroughly and one liter sample taken for sediment concentration analysis.
- The sediment concentration was multiplied by the total volume of run-off to estimate the total amount of soil losses from each rainstorm.

Runoff and soil loss collection

(*RT*) was calculated as:

$$R_T = R_A + \frac{R_B}{X}$$

Where: *RT* is total runoff calculated

***RA* is runoff volume recorded in tank A**

***RB* is runoff volumes recorded in tank B**

X **is fraction of runoff entered into runoff collector Tank B from Tank A**

$S_T = S_D + S_A + S_B$

Runoff and soil loss collection

The total soil loss (ST) was calculated as:

$$S_T = S_D + S_A + S_B$$

Where: *ST*: weight of total soil loss calculated

***SD*: weight of dry soil loss calculated from runoff collecting ditch**

***SA*: weight of dry soil loss calculated in tank A**

***SB*: weight of dry soil loss calculated in tank B**

$S_T = S_D + S_A + S_B$

Results and discussion

Developmental Activities

- The result of past research activities clearly demonstrated that Vetiver grass was found good mulch material.
- It was also found effective in controlling couch grass (trouble some weed of coffee) in controlling the movement of couch grass from plot to plot.
- Moreover, vetiver grass has been used as shade for nursery beds and roof cover for houses
- More than 50000 clumps were produced and about 10ha of farmland were planted for soil and water conservation purpose (Alemu, 2000).

$S_T = S_D + S_A + S_B$

Table1. Nurseries established by governmental and non-governmental organizations till end 1999 Nursery

Year	Nursery (No)			Total (No)	Production (million)	Area treated (ha)	Beneficiaries (H.H.)
	NGO	GO	Private				
1991	1			1	0.05	10	5
1992	5	2		7	0.75	60	80
1993	17	5		22	7.20	258	2500
1994	27	19	3	49	5.80	1821	10760
1995	35	34	5	74	657.00	11073	68494
1996	58	54	13	125	768.00	22846	76890
1997	69	70	17	156	844.00	34215	134162
1998	80	73	22	175	965.00	38720	256196
1999	89	101	31	221	1300.00	41890	450161
Total	381	358	91	830	4587.80	150894	999348

Source: Alemu Mekonen, 2000

✵ *The first nursery was established in 1991 by MfM in the southwest part of the country.*

Splitting vetiver shoot for propagation

Two months after planting in the bag

Containerised propagation, good for survival

$S_T = S_D + S_A + S_B$

Contd…

- **According to the latest information from bureau of Agriculture and Rural development capacity of Ilu Ababora zone,**
  - **the majority of the farmers in almost all werdas are now using vetiver grass for soil water conservation (SWR) program.**
  - **During the year 1998-2008, 908.23 km vetiver grass hedgerows were planted in 4957 household farmers.**
  - **Besides, 19,987 km vetiver was planted by Menschen für Menschen (MfM) form 1986-2000, and have involved 17,751 house hold farmers.**
  - **The biggest vetiver promotion project is practiced widely in Bure, Yayu, Dedessa, Alle, Metu and Chora woredas.**

$S_T = S_D + S_A + S_B$

Table 2. Vetiver grass development in 20 weredas at Illu Ababora zone Southwestern Ethiopia

a. Illu Ababora zone

Year	Vetiver planted, km	No of farmer participated (house hold)
1998	45	100
1999	16.5	167
2000	60	112
2001	57.74	314
2002	Na	Na
2003	Na	Na
2004	98.3	325
2005	195.85	365
2006	152.69	Na
2007	144.5	268
2008	137.65	3306

b. Menschen für Menschen (MfM)

1986-2000	19987	17751

Source: Ministry of Agriculture Illu Ababora werda office 2009

$S_T = S_D + S_A + S_B$

Runoff study at JARC

Table 3 Runoff affected by vetiver grass hedgerow

Years	Annual rainfall (mm)	Runoff (mm)		
		Bare land	Vetiver on bare land	Vetiver with coffee
2001	1595.7	226.2	160.3	167.1
2002	1450.9	182.8	89.8	65.3
2003	1348.0	139.4	36.8	17.3

$S_T = S_D + S_A + S_B$

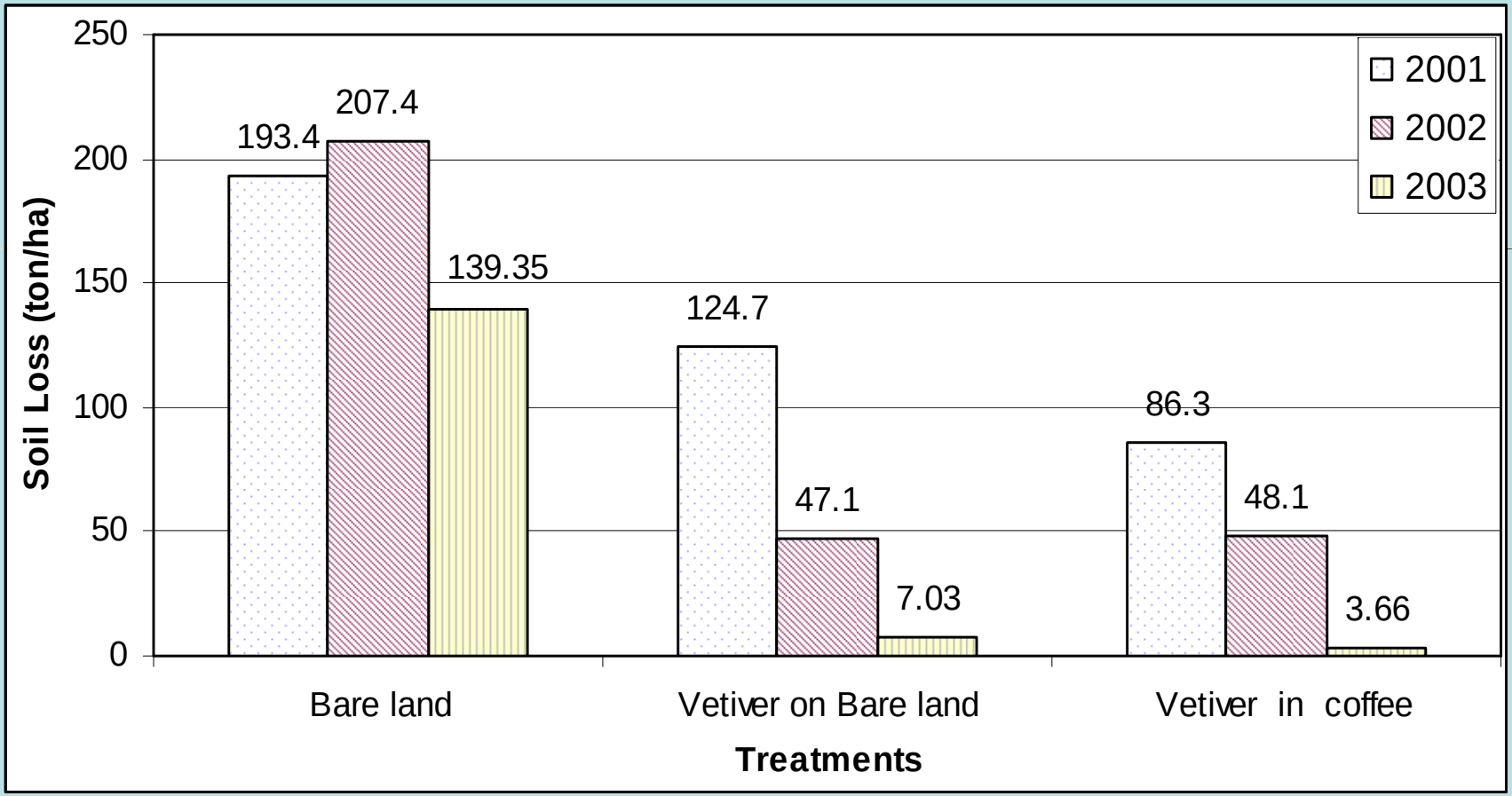
Runoff study at JARC

Table 4 Rainfall and Runoff received during experimental period

Years	Rainfall (mm)	Runoff (mm) Bare land	Runoff (%)	
			Vetiver on bare land	Vetiver with coffee
2001	1034	226.2	15.5 (29)	16.16 (26)
2002	848.1	182.8	10.59 (51)	7.7 (61)
2003	668.9	139.4	5.5 (74)	2.58 (88)

$S_T = S_D + S_A + S_B$

Figure 1. Soil loss as affected by vetiver grass hedgerow on bare land and in coffee farms



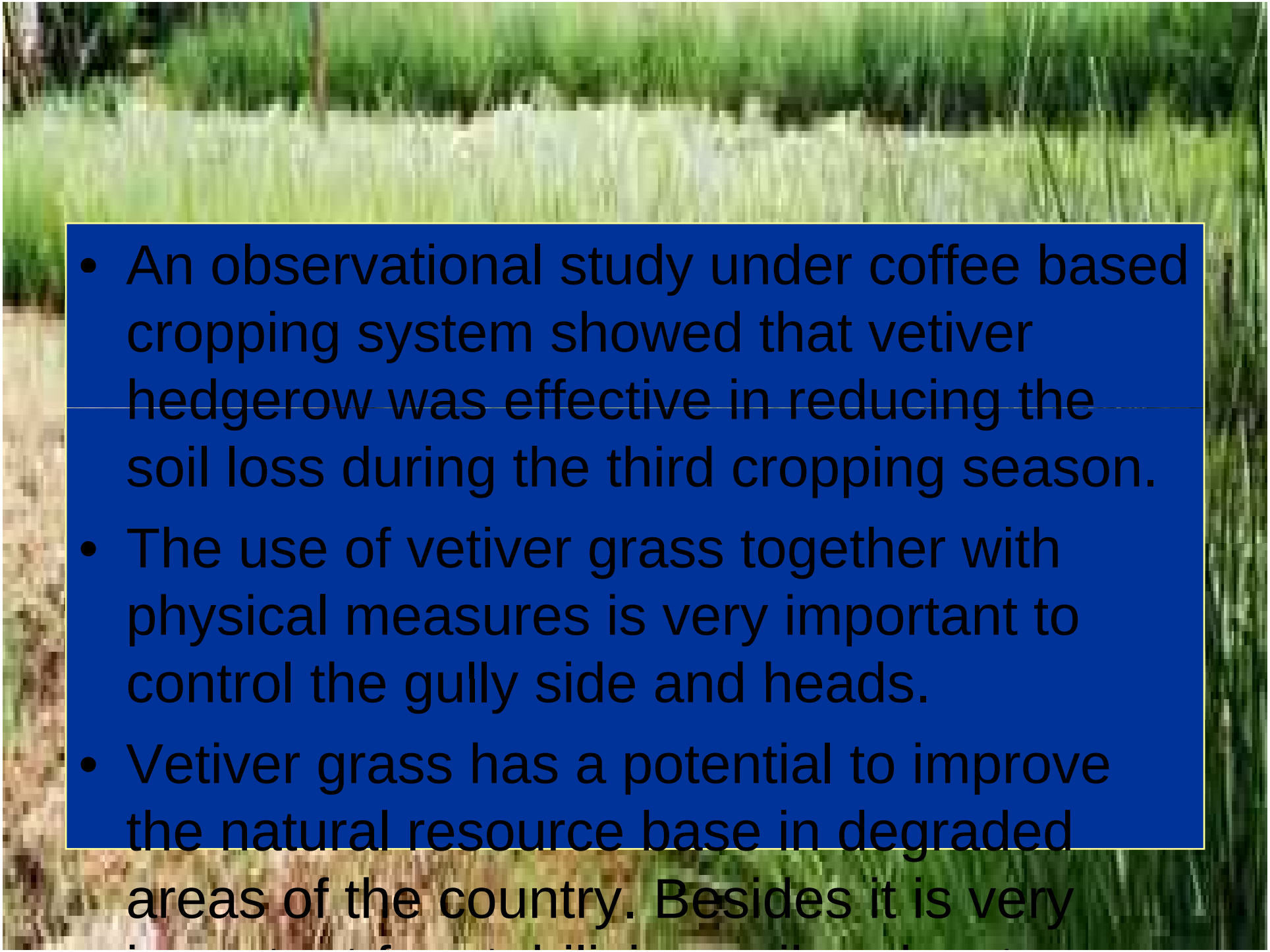
$S_T = S_D + S_A + S_B$

Contd…

- In 2001, 2002 and 2003 the soil loss in vetiver hedgerow on bare land plot as compared with bare land plot reduced 36, 77, and 95% respectively.
- Similarly, for the same year the soil loss in coffee vetiver hedgerow plot reduced 55, 77, and 97% in comparison with that of the bare land plot.
- In 2001 and 2002, the soil losses of vetiver hedgerow plots were not in the acceptable soil loss range (86.3 and 48.1 ton/ha/year)
- Nonetheless, the hedgerows were effective and in the acceptable range (3.66 ton/ha/year) in 2003.
- The vetiver hedge rows plots reduced the soil loss better in the second and third cropping season than that of the first and
- this result proved that the treatment effect in reducing the soil loss increase in successive years.

Conclusion and recommendation

- An observational study under coffee based cropping system showed that vetiver hedgerow was effective in reducing the soil loss during the third cropping season.
- The use of vetiver grass together with physical measures is very important to control the gully side and heads.
- Vetiver grass has a potential to improve the natural resource base in degraded areas of the country. Besides it is very important for stabilizing soil and water conservation practices in the entire watershed to bring abut long term impact.
- Parallel to planting the vetiver grass for soil water conservation purpose supplementary leguminous fodder crops should be planted along the hedgerow to increase the feed value of the grass and soil fertility maintenance.



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- The present need of getting the limited nursery may not be sufficient to fulfil the demand. As multiplying and distributing the grass from the limited nursery resource of the center (JARC), MfM and other sources could not meet the demand of the farmers in the region and elsewhere, other options and techniques of mass propagation should be explored and made available with out much delay.
- Finally, further research on vetiver grass should also aim at refining the already available technologies and at other potential use of grass that may help to enhance its utilization and integration in various farming systems.


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