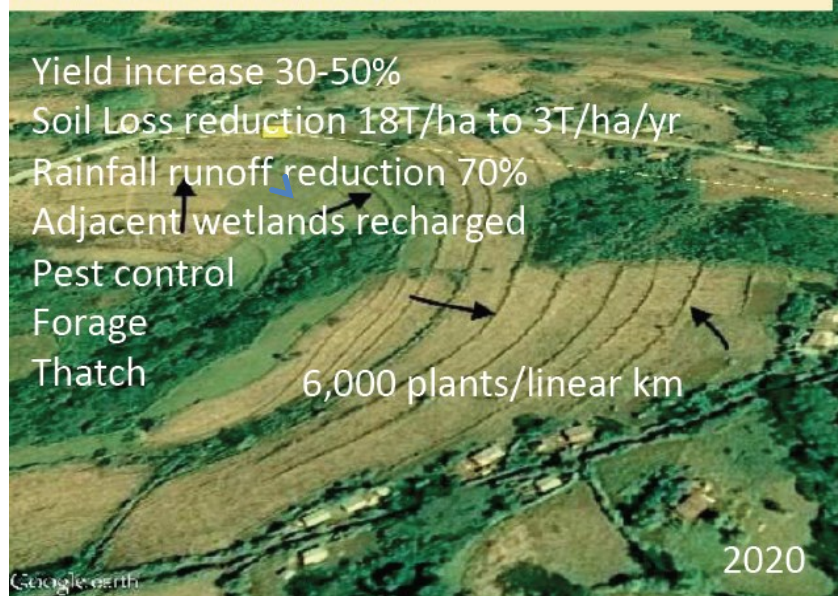


EMBEDDING VETIVER GRASS TECHNOLOGY INTO FARM SYSTEMS.

“An indispensable tool for regenerative agriculture in the tropics”

Over 20,000 farmers planted vetiver hedgerows in the Mettu area of western Ethiopia resulting in significant reduction in soil loss, increased and sustainable crop yields, and reduced conservation maintenance costs



DICK GRIMSHAW - TVNI



WHY EMBED VETIVER??

#1 -- INCREASE SOIL MOISTURE

- REDUCE SOIL LOSS
- INCREASE SOIL ORGANIC MATTER
- IMPROVE SOIL HEALTH
- INCREASE NET FARM INCOME

GET IT RIGHT ON THE FARM -- THEN

DOWN STREAM --- ALL SPECIES (INCLUDING HUMANS)
WILL BENEFIT FROM REDUCED SEDIMENT, REDUCED
CHEMICALS, CLEANER AND MORE WATER

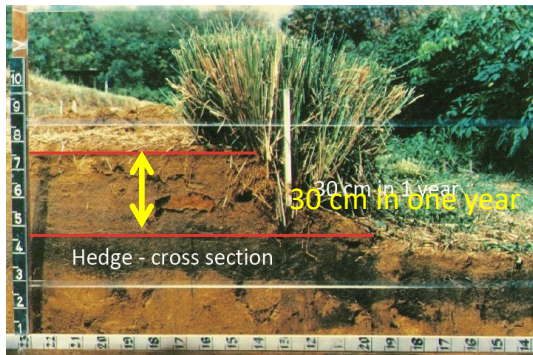
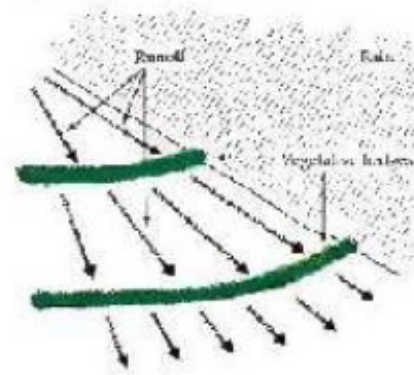
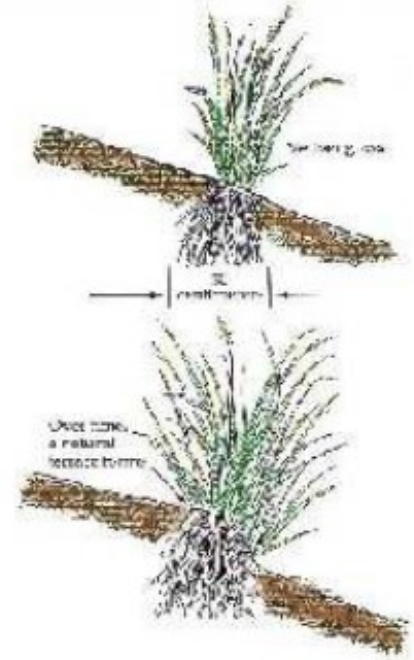


VETIVER GRASS - SOFT – SMART SWC – A NATURE BASED SOLUTION



- LOW MAINTENANCE AND CONSTRUCTION COSTS
- RARELY EXHIBIT FAILURE
- MINIMUM SPACE REQUIREMENT
- DOES NOT DIVERT RAINFALL RUNOFF
- HEALS GULLIES
- HAVE MANY ADD ON BENEFITS

ERODED SEDIMENT & WATER IS SPREAD
EVENLY BEHIND HEDGEROW – RUNOFF
VELOCITY REDUCED TO NEAR ZERO AT
HEDGEROW



VETIVER GRASS TECHNOLOGY **SIX BASIC MODES** OF APPLICATION

1. **TOTAL FARM PROTECTION** WITHIN WHICH OTHER CULTURAL/MANAGEMENT PRACTICES CAN BE APPLIED.
2. **ADHOC HEDGE INSERTION** TO EXISTING CROP MANAGEMENT PRACTICES FOR SWC
3. **INSERTIONS** IN VARIOUS CONFIGURATIONS TO ENHANCE CROP PERFORMANCE BASED ON A SPECIFIC VETIVER CHARACTERISTIC (SOIL BUILDING AND SOIL HEALTH)
4. **BIOENGINEERING APPLICATIONS** TO SUPPORT FARM INFRASTRUCTURE AND GENERAL ENHANCEMENT OF FARM ECOSYSTEM
5. **MITIGATE NON CROP POLLUTION** ASSOCIATED WITH FARM ACTIVITIES
6. **SPECIFIC NON CROP** RELATED VETIVER BUSINESS ACTIVITIES



1. A SWC SYSTEM FOR THE **TOTAL FARM PROTECTION** WITHIN WHICH OTHER CULTURAL/MANAGEMENT PRACTICES CAN BE APPLIED.

A LONG LIVING * VETIVER HEDGE CAN:

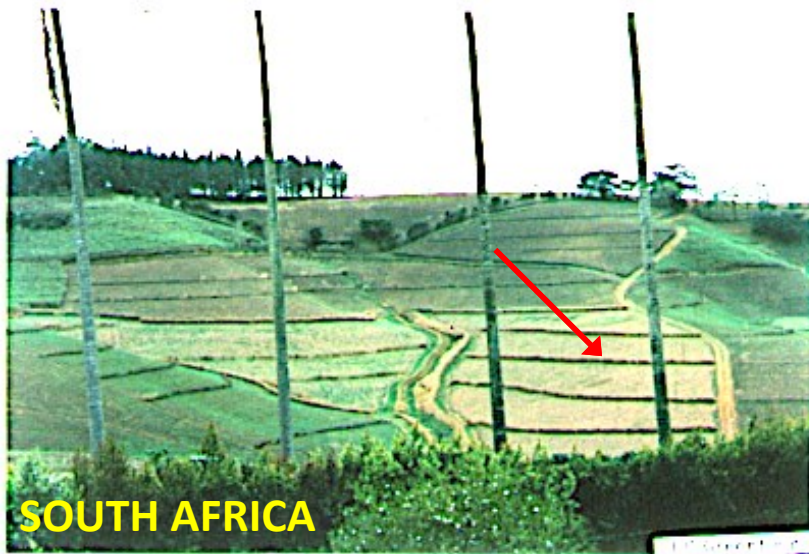
1. **REDUCE RAINFALL LOSSES** (RUNOFF REDUCTION UP TO 70%)
2. **SPREADS WATER RUNOFF BEHIND THE HEDGE**
3. INCREASE **SOIL MOISTURE** TO ENHANCE PLANT GROWTH AND IN TIMES OF **DROUGHT** INCREASES CROP TIME TO WILTING
4. IMPROVE **INFILTRATION** AT AND BETWEEN HEDGEROWS
5. INCREASE **GROUND WATER RECHARGE**, ENHANCE WATER TABLES AND REHABILITATE FARM RELATED WETLANDS
6. REDUCE **EROSION** AND SOIL (BY UP TO 90%).
7. CREATE **NATURAL TERRACES** > SLOPE DECREASES > EROSION DECREASES
8. **PROVIDE A PERMANENT KEY LINE** FOR CONTOUR CULTIVATION AND CROP MANAGEMENT PRACTICES
9. **REHABILITATE DEGRADED FARM LAND**
10. **WITHSTAND EXTREME RAINFALL EVENTS**



*Minimum of 20 + years if maintained



VGT APPLICATION – TOTAL FARM PROTECTION - SWC – SLOPING LANDS



VGT APPLICATION - TOTAL FARM PROTECTION - SWC – FLAT LANDS

BLACK CRACKING AND ERODIBLE VERTISOLS

Hedgerows 100 meters apart on flat land



FOR LARGE SCALE PLANTINGS – MECHANICAL DEVICES



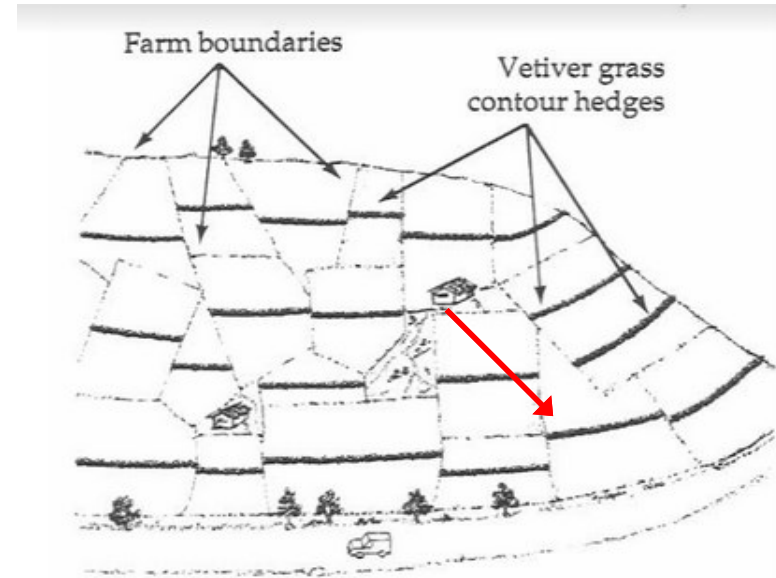
Left: machine planting; below:
machine digging of nursery
propagated plants.
AUSTRALIA



2. AS AN **ADHOC HEDGE INSERTION** TO EXISTING CROP MANAGEMENT PRACTICES FOR SWC



ADHOC HEDGE INSERTION FOR FARM PROTECTION



VETIVER HEDGES CAN FIT ANYWHERE WITH NO NEGATIVE EFFECT DOWN SLOPE



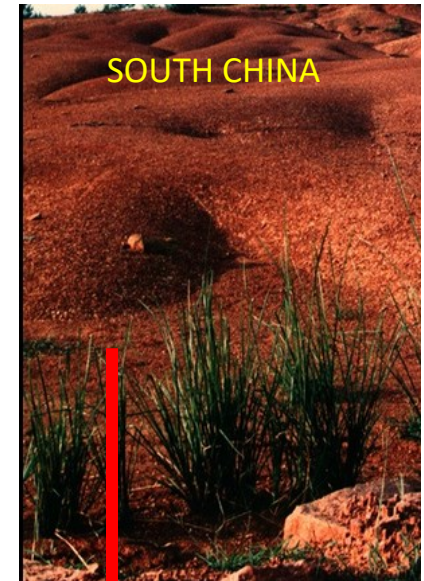
VGT -- ADHOC HEDGE INSERTION FOR FARM PROTECTION



INCREASES SOIL MOISTURE



MANY FARMS HAVE DEGRADED LAND – CAN BE REHABBED WITH VETIVER



LAND REHAB – BEFORE AND AFTER (ABOUT 6-8 years)



3. VETIVER PLANT(S) **INSERTIONS** IN VARIOUS CONFIGURATIONS TO ENHANCE CROP PERFORMANCE BASED ON A **SPECIFIC** VETIVER CHARACTERISTIC(S) AND FARM **NEEDS**

- **MULCH: SOM – SOC - SOIL MOISTURE – SOIL TEMPERATURE**
- **SOIL NUTRIENT RECYCLING - - SOIL HEALTH – ARBUSCULAR MYCORRIZA**
- **IMPROVED SOIL MICRO FLORA/FAUNA**
- **SYMBIOTIC PLANTING WITH INDIVIDUAL PLANT**
- **HABITAT FOR BENEFICIAL INSECTS & FAUNA**
- **PEST CONTROL – STEM BORER RICE and MAIZE +++**
- **TOXIC CHEM REMOVAL - ARBUSCULAR MYCORRIZA - 90% STORED IN ROOTS**
- **BARRIER TO EXTERNAL TOXIC SOIL CHEMICALS (++ ORGANIC FARMING CERT?)**
- **ENHANCES BIODIVERSITY – PARTICULARLY IN “WINTER MONTHS” WHEN LAND IS BARE**
- **FORAGE**



WITH AND WITHOUT VETIVER – NUTRIENT and MOISTURE ENHANCEMENT



!4 month with Vetiver



14 month
without vetiver



without vetiver – no banana fruit



with vetiver – planted at the same time
as above – fruited two months earlier –
improved soil moisture



A TAMARIND TREE

Below: Tree of the same age,
without help from vetiver.

Above: One year old Tamarind, circled
with vetiver (Chiang Rai Research
Station, Thailand). Arbuscular
mycorrhizal activity, associated with
vetiver roots, results in better soil nutrient
translocation at depth. The latter
combined with improved soil moisture
and more soil micro-fauna activity
results in better tree growth



Planted in association with vetiver:

- Arbuscular mycorrhiza cycles NPK
- Improved soil moisture
- Greater micro fauna activity
- Possible reduced pests (nematodes)
- Soil temperature reduction



IN-SITU MULCH – INCREASED: SOIL ORGANIC MATTER & **SOIL MOISTURE**.

- REDUCED: SOIL EROSION, SOIL TEMPERATURES, PEST DAMAGE

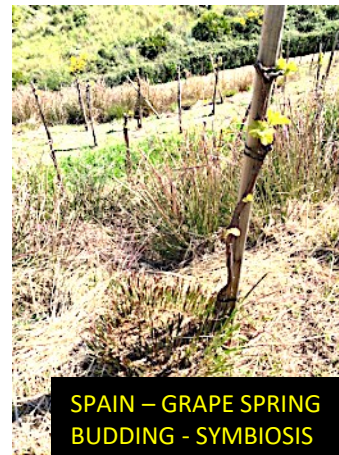
NOTE: THE STEEPER THE SLOPE - THE CLOSER THE HEDGES - THE GREATER AMOUNT OF MULCH MASS



VGT – IMPROVED SOIL MOISTURE, PEST CONTROL



PAPAYA



**SPAIN – GRAPE SPRING
BUDDING - SYMBIOSIS**

**CUT AND DROP
MULCH**



PEPPER



VETIVER CAN BE THE PRIMARY LAYER AND INITIAL “DRIVER” OF FOOD FORESTS



VETIVER CAN CONTROL SOME PESTS

DEAD END TRAP CROP:

- STEM BORER OF MAIZE AND SORGHUM (*Chilo partellus*)
- STEM BORER OF RICE – Pink (*Sesamia inferens*) and Striped stem borer (*Chilo suppressalis*)
- STEM BORER OF SUGAR CANE? Anecdotal
- FALL ARMYWORM – attracts but not preferential over maize

HOSTS BENEFICIAL INSECTS:

- PARASITIC WASPS
- LADY BIRDS
- SPIDERS

OTHER PESTS

- VETIVER DETERS APPEARS TO DETER NEMATODES AND TERMITES
- WHITE FLY ON BRASSICAS

GENERAL OBSERVATION – CROPS /VEGETABLES IN THE VICINITY OF VETIVER NEARLY ALWAYS LOOK “CLEAN” DO NOT NEED A CONTINUOUS HEDGE (3x25 m)

SEPTEMBER 2021

THE VETIVER NETWORK INTERNATIONAL



CHINA RICE STEM BORER CONTROL *Sesamia inferens* and *Chilo suppressalis*



SOUTH AFRICA/ETHIOPIA STEM BORER CONTROL OF MAIZE/SORGHUM *Chilo partellus*





Vetiver feed values compared to other forage grasses

Analytes	Units	Vetiver grass			Rhodes	Kikuyu
		Young	Mature	Old	Mature	Mature
Energy (Ruminant)	kCal/kg	522	706	969	563	391
Digestibility	%	51	50	-	44	47
Protein	%	13.1	7.93	6.66	9.89	17.9
Fat	%	3.05	1.30	1.40	1.11	2.56
Calcium	%	0.33	0.24	0.31	0.35	0.33
Magnesium	%	0.19	0.13	0.16	0.13	0.19
Sodium	%	0.12	0.16	0.14	0.16	0.11
Potassium	%	1.51	1.36	1.48	1.61	2.84
Phosphorus	%	0.12	0.06	0.10	0.11	0.43
Iron	mg/kg	186	99	81.40	110	109
Copper	mg/kg	16.5	4.0	10.90	7.23	4.51
Manganese	mg/kg	637	532	348	326	52.4
Zinc	mg/kg	26.5	17.5	27.80	40.3	34.1

VETIVER AS FORAGE

NEEDS TO BE PROPERLY MANAGED THROUGH
REGULAR CUTTING OR GRAZING

DROUGHT TOLERANT MAINTENANCE FODDER



STREAM BANK BUFFERS REDUCES POLLUTANTS MOVING DOWN STREAM



FARM/FIELD VETIVER BOUNDARY HEDGES ALSO STOPS POLLUTION
FROM NEIGHBORS ENTERING LAND



VETIVER REMOVES TOXIC AGRO CHEMICALS FROM WATER MOVING OFF FARM FIELDS

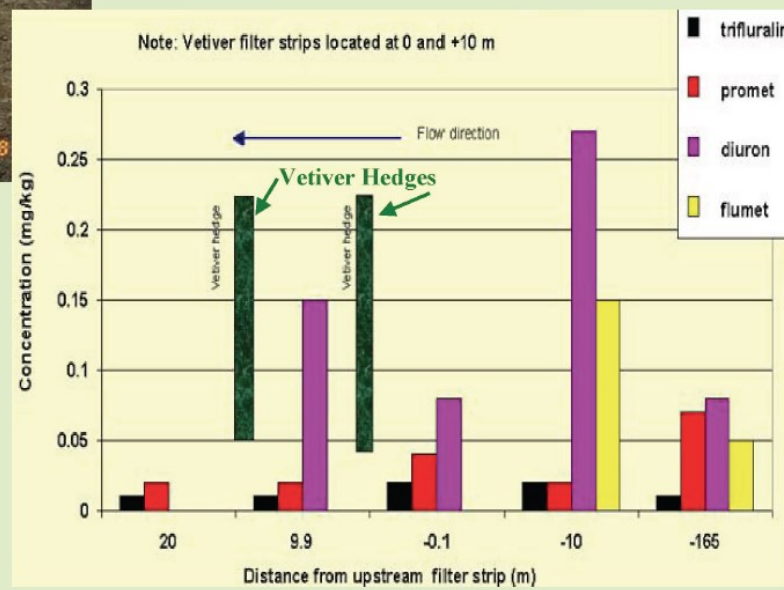
EVERY VETIVER PLANT CAN TAKE UP EXCESS N&P, PESTICIDES, & HEAVY METALS

PLANTING VETIVER HEDGEROWS ON FIELD BOUNDARIES, DRAIN BANKS, AND STREAM BANKS, WILL HELP MAINTAIN
“ORGANIC” CERTIFICATION



Above: Drain associated hedgerows are effective in trapping sediment. **Right:** reduction in herbicide concentration when drainage water passes through vetiver filter hedges.

Vetiver hedges will trap and reduce toxic agric chemicals from runoff – sediment.



MULCHING WITH VETIVER IMPROVES SOIL ORGANIC MATTER AND SOIL HEALTH



4 - BIOENGINEERING APPLICATIONS TO SUPPORT FARM INFRASTRUCTURE AND GENERAL ENHANCEMENT OF FARM ECOSYSTEM



Farm dam stabilization and protection



Left: 6 months after planting with vetiver.



Right: 1 year after planting with vetiver.



- FARM PONDS
- BUILDING SITES
- DAM WALLS & SPILLWAYS
- ROAD SIDE
- GULLY REHAB
- CANAL BANKS
- RIVER BANKS
- DRAINS

Gully remediation



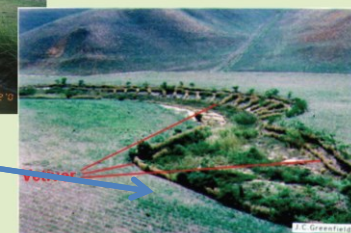
Top left: typical gully problem on a farm. Above: The fix using vetiver. Bottom left: the result – a stabilized gully



Australia - Queensland



Zimbabwe - Hippo Valley



South Africa - Natal



5 - MITIGATE **NON CROP POLLUTION** ASSOCIATED WITH FARM/DOMESTIC ACTIVITIES



PHYTO TRANSPIRATION TERTIARY LATRINE EFFLUENT



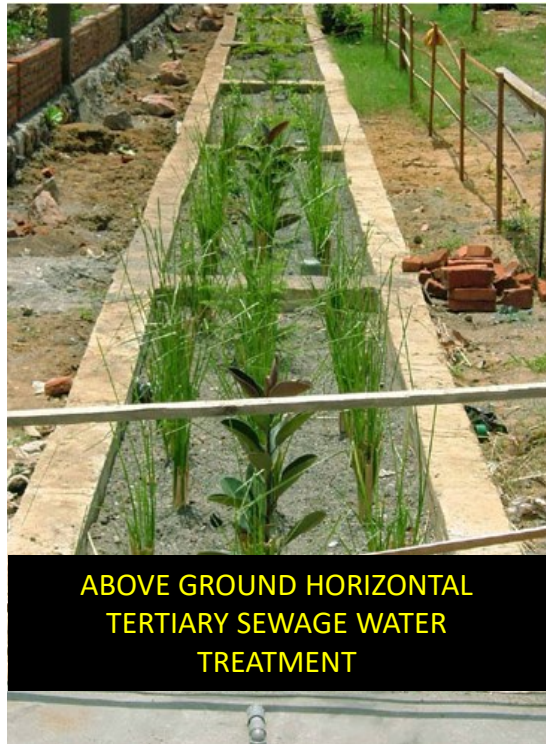
ABOVE GROUND HORIZONTAL GREY WATER TREATMENT



FARM TRASH DUMP



PIT LATRINE, STABILIZATION, LEAHATE TREATMENT



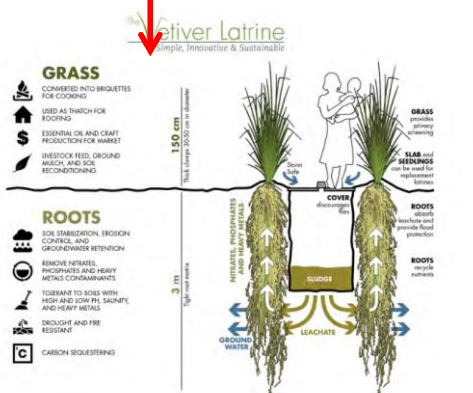
ABOVE GROUND HORIZONTAL TERTIARY SEWAGE WATER TREATMENT



FARM TRASH DUMP AFTER VETIVER TREATMENT



TREATMENT OF PIGGERY WASTE LAGOON



6 - SPECIFIC NON CROP RELATED **VETIVER BUSINESS** ACTIVITIES

- **OFF FARM SALES** OF VETIVER PLANTS
- **BIOENGINEERING APPLICATIONS**
- **CONTRACTOR** FOR OFF FARM APPLICATIONS
- **VETIVER DESIGN** CONSULTANT
- **THATCH** and **THATCHING CONTRACTS**
- **FORAGE**
- **BIOMASS FOR ENERGY**
- **VETIVER OIL** PRODUCTION AND SALES
- **HANDICRAFTS** FROM VETIVER LEAVES AND ROOTS



The Antahova family in the Mangarivotra Village proudly displayed their Vetiver nursery where they reached their target of 110,000 plants.

