



Succession of anti erosion Trenches with Grass strips (Ngenzi Guy (RAB/South))

Trenches combined with living hedges or grass lines (Ruanda)

Imiringoti

DESCRIPCIÓN

Trenches combined with living hedges or grass lines are slow-forming terraces to control soil erosion by changing the length of the slope and progressively reducing the slope gradient; the slope steepness decreases progressively by hydric and tillage erosion.

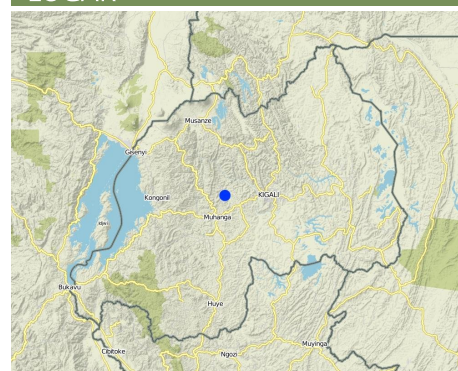
Trenches combined with living hedges or grassed lines are less labour-intensive method that is practiced in the highlands of Rwanda. The method involves digging trenches which have grass-stabilized banks, or simply planting grass strips and vegetative barriers across the slope to reduce runoff. This method, locally referred to as 'progressive terracing', is more adaptable by individual farmers across the country. In the study conducted by Kagabo et al. (2013) in the highlands of Buberuka Region of Rwanda, it was noted that net increment in yields and returns on investment increased with the age of terraces, since the capital costs of terracing were easily recovered. These terraces also showed more resilience, some being over 30 years old and still effective. Along the contour band, soil from the upper parts of the slope is removed and deposited above by creating a series of discontinuous trenches in order to extend the flat terrain. Over 5-10 years, the terraces become enlarged and form a terrace along the contour, such that the slopes are transformed over time into level bench terraces (but never %).

Purpose of the Technology: The main purpose of this technology is to reduce runoff and soil erosion on the slope and to improve soil quality and soil moisture retention. Grass strips or living hedgerows are intended to both trap sediments and facilitate the slow formation of terraces.

Establishment / maintenance activities and inputs: The establishment of trenches combined with living hedges or grassed lines is less labor intensive and requires less skilled labor. Regular maintenance banks on which living hedges are planted, to seasonally stream living hedges to minimize the competition of nutrients and water with plants. To efficiently use these terraces it is advisable to introduce intensive and rentable cropping systems or agroforestry with fruits and forage trees.

Natural / human environment: This technology was reported to be very resilient as trenches combined with living hedges or grassed lines of 20+ year old are still effective in controlling soil erosion. However, the soil quality on these formed terraces between alleys does not homogenize 100% over the course of time. Large soil fertility gradients with marked spatial difference in both soil quality and crop yield from their upper parts downwards of the terraces is observed. The soil in the lower parts of the terraces showed as much as 57% more organic carbon content and 31% more available phosphorous than the soil in the upper parts of the terraces (Kagabo et al. 2013).

LUGAR



Lugar: Kamonyi District (Southern Province), Rwanda, Ruanda

No. de sitios de Tecnología analizados:

Georreferencia de sitios seleccionados

• 29.79856, -1.95477

Difusión de la Tecnología: distribuida parejamente sobre un área (approx. 10-100 km2)

Fecha de la implementación: 10-50 años atrás

Tipo de introducción

- ☐ mediante la innovación de usuarios de tierras
- ☐ como parte de un sistema tradicional (> 50 años)
- ☐ durante experimentos/ investigación
- ☐ mediante proyectos/ intervenciones externas
- ☒ Government



Landscape view of the anti-erosion trenches and grass lines (Ngenzi Guy (RAB/South))



Detailed view of trench combined with grass line (Kagabo Desire and Ngenzi Guy (RAB))

CLASIFICACIÓN DE LA TECNOLOGÍA

Propósito principal

- ☐ mejorar la producción
- ☒ reducir, prevenir, restaurar la degradación de la tierra
- ☐ conservar el ecosistema
- ☐ proteger una cuenca hidrográfica/ áreas corriente abajo – en combinación con otras Tecnologías
- ☐ preservar/ mejorar biodiversidad
- ☐ reducir el riesgo de desastres naturales
- ☐ adaptarse al cambio climático/ extremos climáticos y sus impactos
- ☐ mitigar cambio climático y sus impactos
- ☐ crear impacto económico benéfico
- ☐ crear impacto social benéfico

Uso de tierra



Tierras cultivadas - Cosecha anual, Cosecha de árboles y arbustos

Cosechas principales (comerciales y de subsistencia): mayor cash crop: Coffee and cassava major food crop: Banana and beans other: Maize

Provisión de agua

- ☒ de secano
- ☐ mixta de secano – irrigada
- ☐ totalmente irrigada

Número de temporadas de cultivo por año: n.d.

Uso de las tierras antes de implementar la Tecnología: Grazing land:

Ge: Extensive grazing land

Densidad del ganado: 10-25 LU /km²

Propósito relacionado a la degradación de las tierras

- ☒ prevenir la degradación de la tierra
- ☒ reducir la degradación de la tierra
- ☐ restaurar/ rehabilitar tierra severamente degradada
- ☐ adaptarse a la degradación de la tierra
- ☐ no aplica

La degradación considerada



erosión de suelos por agua - Wt: pérdida de capa arable/ erosión de la superficie , Wg: erosión en cárcavas, Wo: efectos de degradación fuera del sitio

Grupo MST

- cobertura de suelo/ vegetal mejorada
- medida de pendiente transversal

Medidas MST



medidas vegetativas - V1: Cubierta de árboles y arbustos , V2: Pastos y plantas herbáceas perennes



medidas estructurales - S3: Acequias graduadas, canales, vías fluviales

DIBUJO TÉCNICO

Especificaciones técnicas

Trenches are dug in trapezoidal shape with 40 cm of height, 30 cm of base length and 50 cm of top lengths. An empty space of 40 cm is left between two consecutive trenches along a contour line.

Location: Kamonyi/Giko. Southern province

Date: 2012

Technical knowledge required for field staff / advisors: high (Special training should be provided to field staff to be able to make an adequate design and teach land users)

Technical knowledge required for land users: low (Land users are required to only implement the technology under the supervision of field staff)

Technical knowledge required for Farmer representative: high (These farmers need to be trained so that they can easily supervise the work)

Main technical functions: control of concentrated runoff: retain / trap, reduction of slope length, improvement of topsoil structure (compaction), increase of infiltration, sediment retention / trapping, sediment harvesting

Secondary technical functions: control of concentrated runoff: impede / retard, reduction of slope angle

Aligned: -contour

Vegetative material: G : grass

Number of plants per (ha): 11114

Vertical interval between rows / strips / blocks (m): 1

Spacing between rows / strips / blocks (m): 6

Vertical interval within rows / strips / blocks (m): 0.3

Width within rows / strips / blocks (m): 0.2

Aligned: -along boundary

Vegetative material: T : trees / shrubs, F : fruit trees / shrubs, G : grass

Number of plants per (ha): 84

Vertical interval between rows / strips / blocks (m): NA

Spacing between rows / strips / blocks (m): NA

Vertical interval within rows / strips / blocks (m): 20

Width within rows / strips / blocks (m): NA

Trees/ shrubs species: Grevelea/planted

Fruit trees / shrubs species: Avocado/Planted

Grass species: Napier grass/planted

Slope (which determines the spacing indicated above): 20%

If the original slope has changed as a result of the Technology, the slope today is (see figure below): 45%

Gradient along the rows / strips: 0%

Bund/ bank: level

Vertical interval between structures (m): 1.2

Spacing between structures (m): 6

Depth of ditches/pits/dams (m): 0.4

Width of ditches/pits/dams (m): 0.5

Length of ditches/pits/dams (m): 5

Height of bunds/banks/others (m): 0.4

Width of bunds/banks/others (m): 0.4

Length of bunds/banks/others (m): 5

Bund/ bank: graded

Vertical interval between structures (m): 1.2

Spacing between structures (m): 6

Depth of ditches/pits/dams (m): 0.4

Width of ditches/pits/dams (m): 0.5

Length of ditches/pits/dams (m): 5

Height of bunds/banks/others (m): 0.4

Width of bunds/banks/others (m): 0.4

Length of bunds/banks/others (m): 5

Construction material (earth): Soil excavation in farmers land along the contour

Slope (which determines the spacing indicated above): 30%

If the original slope has changed as a result of the Technology, the slope today is: 10%

Lateral gradient along the structure: 0%

Vegetation is used for stabilisation of structures.

ESTABLECIMIENTO/ MANTENIMIENTO: ACTIVIDADES, INSUMOS Y COSTOS

Cálculo de insumos y costos

- Los costos se calculan:
- Moneda usada para calcular costos: **Rwandan Francs**
- Tasa de cambio (a USD): 1 USD = 640.0 Rwandan Francs
- Costo promedio por día del sueldo de la mano de obra contratada: 1000

Factores más determinantes que afectan los costos

The most determining factor affecting the cost is labor (the cost of labor increases with the nature of the soil structure as well as with the land steepness).

Actividades de establecimiento

1. Cuttings (Momento/ frecuencia: Rainy season)
2. Transport (Momento/ frecuencia: Rainy season)
3. Planting (Momento/ frecuencia: Rainy season)
4. Identification of contour lines, digging of trenches and grass planting on risers (Momento/ frecuencia: dry season)

Insumos y costos para establecimiento

Especifique insumo	Unidad	Cantidad	Costos por unidad (Rwandan Francs)	Costos totales por insumo (Rwandan Francs)	% de los costos cubiertos por los usuarios de las tierras
Mano de obra					
Planting	persons/day/ha	20,0	1000,0	20000,0	100,0
Identification of contour lines, digging and planting	persons/day/ha	100,0	1000,0	100000,0	100,0
Equipo					
Transport	ha	10,0	1000,0	10000,0	100,0
Tools	pieces/ha	100,0	1200,0	120000,0	100,0
Material para plantas					
Cuttings	ha	2,0	1000,0	2000,0	100,0
Costos totales para establecer la Tecnología				252'000.0	

Actividades de mantenimiento

1. Weeding (Momento/ frecuencia: Before crop planting/each cropping season)
2. Manure application and transportation (Momento/ frecuencia: Before crop planting/annually)
3. Grass streaming (Momento/ frecuencia: Throughout the year)
4. Clearing the ditches by removing piled up sediments. (Momento/ frecuencia: Rainy season)

Insumos y costos de mantenimiento

Especifique insumo	Unidad	Cantidad	Costos por unidad (Rwandan Francs)	Costos totales por insumo (Rwandan Francs)	% de los costos cubiertos por los usuarios de las tierras
Mano de obra					
Weeding	persons/day/ha	5,0	1000,0	5000,0	100,0
Manure application and transportation	persons/day/ha	10,0	1000,0	10000,0	100,0
Grass streaming	persons/day/ha	2,0	1000,0	2000,0	100,0
Clearing the ditches	persons/day/ha	30,0	1000,0	30000,0	100,0
Equipo					
Tools	pieces/ha	30,0	800,0	24000,0	100,0
Indique los costos totales para mantener la Tecnología				71'000.0	

ENTORNO NATURAL

Promedio anual de lluvia

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1,000 mm
- ☒ 1,001-1,500 mm
- ☒ 1,501-2,000 mm
- ☐ 2,001-3,000 mm
- ☐ 3,001-4,000 mm
- ☐ > 4,000 mm

Zona agroclimática

- ☐ húmeda
- ☒ Sub-húmeda
- ☐ semi-árida
- ☐ árida

Especificaciones sobre el clima

Thermal climate class: tropics

Pendiente

- ☐ plana (0-2 %)
- ☐ ligera (3-5%)
- ☐ moderada (6-10%)
- ☐ ondulada (11-15%)
- ☒ accidentada (16-30%)
- ☒ empinada (31-60%)
- ☐ muy empinada (>60%)

Formaciones telúricas

- ☐ meseta/ planicies
- ☐ cordilleras
- ☒ laderas montañosas
- ☒ laderas de cerro
- ☐ pies de monte
- ☐ fondo del valle

Altura

- ☐ 0-100 m s.n.m.
- ☐ 101-500 m s.n.m.
- ☐ 501-1,000 m s.n.m.
- ☒ 1,001-1,500 m s.n.m.
- ☒ 1,501-2,000 m s.n.m.
- ☐ 2,001-2,500 m s.n.m.
- ☐ 2,501-3,000 m s.n.m.
- ☐ 3,001-4,000 m s.n.m.
- ☐ > 4,000 m s.n.m.

La Tecnología se aplica en

- ☐ situaciones convexas
- ☐ situaciones cóncavas
- ☐ no relevante

Impactos socioculturales

MST/ conocimiento de la degradación de la tierra

disminuyó  mejoró

Cantidad antes de MST: 1

Cantidad luego de MST: 30

The technology improved awareness regarding soil erosion control

mitigación de conflicto

empeoró  mejoró

Cantidad antes de MST: 20

Cantidad luego de MST: 80

Production per unit area increased considerably thus theft between farmers have been reduced

livelihood and human well-being

reduced  improved

Increase in agricultural production has contributed to income generation and provide needed school fees

Impactos ecológicos

cosecha/recolección de agua (escurrimiento, rocío, nieve, etc.)

disminuyó  mejoró

escurrimiento superficial

incrementó  disminuyó

humedad del suelo

disminuyó  incrementó

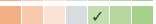
cubierta del suelo

disminuyó  mejoró

pérdida de suelo

incrementó  disminuyó

hazard towards adverse events

improved  reduced

Impactos fuera del sitio

colmatación río abajo

incrementó  disminuyó

daño a campos de vecinos

incrementó  disminuyó

Each farmer use his land without causing damage in the down neighbor's land

ANÁLISIS COSTO-BENEFICIO

Beneficios comparados con los costos de establecimiento

Ingresos a corto plazo:

muy negativo  muy positivo

Ingresos a largo plazo

muy negativo  muy positivo

Beneficios comparados con costos de mantenimiento

Ingresos a corto plazo:

muy negativo  muy positivo

Ingresos a largo plazo

muy negativo  muy positivo

CAMBIO CLIMÁTICO

Cambio climático gradual

temperatura anual incrementó

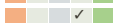
nada bien  muy bien

Extremos (desastres) relacionados al clima

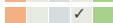
tormenta de lluvia local

nada bien  muy bien

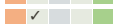
tormenta de viento

nada bien  muy bien

sequía

nada bien  muy bien

inundación general (río)

nada bien  muy bien

Otras consecuencias relacionadas al clima

período reducido de crecimiento

nada bien  muy bien

ADOPCIÓN Y ADAPTACIÓN

Porcentaje de usuarios de la tierra que adoptaron la Tecnología

-  casos individuales / experimentales
-  1-10%
-  10-50%
-  más de 50%

De todos quienes adoptaron la Tecnología, ¿cuántos lo hicieron sin recibir incentivos/ pagos materiales?

-  0-10%
-  10-50%
-  50-90%
-  90-100%

Número de hogares y/ o área cubierta

207 households covering 100 percent of the stated area

¿La tecnología fue modificada recientemente para adaptarse a las condiciones cambiantes?

-  Sí
-  No

¿A qué condiciones cambiantes?

-  cambios climáticos / extremos
-  mercados cambiantes
-  disponibilidad de mano de obra (ej. debido a migración)

CONCLUSIONES Y LECCIONES APRENDIDAS

Fortalezas: perspectiva del usuario de tierras

- To prevent soil erosion

How can they be sustained / enhanced? Maintenance of contour lines

- Grasses provide mulching

How can they be sustained / enhanced? Proper maintenance of grasses on contour lines

Fortalezas: punto de vista del compilador o de otra persona recurso clave

- Mitigation of land degradation due to soil erosion

How can they be sustained / enhanced? Continuous sensitization and enforcement by government to land users to stabilize the technology.

- Increased crop productivity

How can they be sustained / enhanced? Continuous training from government and give all basic necessary support services to land users

- Increased fodder production

How can they be sustained / enhanced? Proper maintenance of the technology by land users

Debilidades/ desventajas/ riesgos: perspectiva del usuario de tierras cómo sobreponerse

- It is hard to implement mainly by older and poor land users It is required to offer communal support or financial support from development partners

Debilidades/ desventajas/ riesgos: punto de vista del compilador o de otra persona recurso clave cómo sobreponerse

- It requires a lot of physical energy, elderly people can't afford Help each other through communal work (umuganda)
- Labor costs Land users with less financial means should join their efforts by working together

REFERENCIAS

Compilador
Desire Kagabo

Editors

Revisado por
David Streiff

Fecha de la implementación: 13 de diciembre de 2012

Últimas actualización: 6 de junio de 2017

Personas de referencia

Desire Kagabo (desirekagabo@yahoo.com) - Especialista MST

Guy Ngenzi (ngguy@yahoo.fr) - Especialista MST

Iwona Piechowiak (iwona.piechowiak@yahoo.co.uk) - Especialista MST

Descripción completa en la base de datos de WOCAT

https://qcat.wocat.net/es/wocat/technologies/view/technologies_1550/

Datos MST vinculados

n.d.

La documentación fue facilitada por

Institución

- Food and Agriculture Organization of the United Nations (FAO) - Italia
- Rwanda Agriculture Board (Rwanda Agriculture Board) - Ruanda

Proyecto

- The Transboundary Agro-ecosystem Management Project for the Kagera River Basin (GEF-FAO / Kagera TAMP)

Referencias claves

- Kagera TAMP project website: <http://www.fao.org/nr/kagera/en/>
- Participatory Integrated Watershed Management in the north-western highlands of Rwanda Mbarushimana Désiré 2013: <http://www.wageningenur.nl/nl/show/Desire-Kagabo-Participatory-Integrated-Watershed-Management-in-the-northwestern-highlands-of-Rwanda.htm>

This work is licensed under [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](#)

