Mulching grasses are cut in the rangeland, dried and collected in bundles to be transported to banana and coffee plantation. (Godfrey Baraba (DED Bukoba District Coumcil, Box 491, Bukoba.))

Enhanced mulching in banana and coffee plantation (Tanzania, United Republic of)

Okwalila ebinyasi omukibanja

DESCRIPTION

Application of Thatch and Hyperrhenia Rufa grass mulch in banana and coffee plantation to reduce soil erosion, improve soil fertility and moisture and ensure high productivity

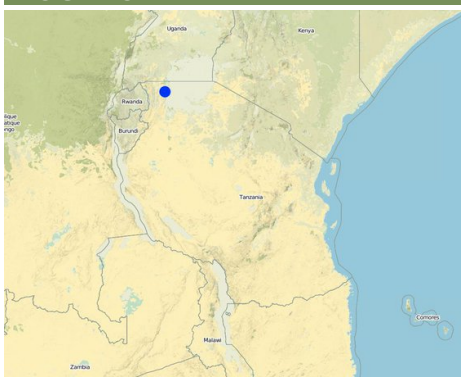
The technology is applied in coffee and banana fields in the sub humid climate. The technology objective is prevention of land degradation specifically nutrient improvement, erosion control, soil moisture and soil health (soil's living organisms) improvement. The materials applied are very variable perennial grass from 60-240 cm high. Panicle loose and narrow up to 50 cm long, with slightly spreading or contiguous racemes with shortly hairy or nearly glabrous spikelets 3.5-5 mm long. The materials are spreaded to 15cm thickness, manually across the slpoe, once per year, at the beginig of short rains.

Purpose of the Technology: The purpose of the technology is to retain moisture content in soil by promoting water infiltration during and after the rains, promoting water holding capacity through decay and formation of organic matter. Grass mulch control soil erosion by intercepting raindrops (splash erosion) that detach soil particles. Grass mulch technology improves soil nutrient through grass decomposition.

Establishment / maintenance activities and inputs: There is no establishment activities for the technology only maintenance activities (operational activities) are required once a year. Maintenance activities include collection of mulching grasses -The grass is cut and collected by household or hired labor. The quantity of grass required per hectar is 1,500 cubic metre equivalent to 375 bundles.
To spread/apply mulching grasses -Grass is spread manually across the slope preferably to 15cm thickness. Dry grasses are spread across the slope with thickness of maximum 15cm. It is recommended to apply mulch grass around 15cm from the banana trunks.This is done once annually before the onset of short rains (during Augost and September)

Natural / human environment: The technology is applied on coffee/banaana fields. The Rainfall is 1000-1500mm, the subhumid climate (temp 26 -30 degree centigrade) and two growing seasons. The technology is meant for soil water evaporation contol and is tolerant in dry spell season while sensitive to excessive rains.

LOCATION



Location: Bukoba District (Karong village), Tanzania, Tanzania, United Republic of

No. of Technology sites analysed:

Geo-reference of selected sites
- 31.65085, -1.48262

Spread of the Technology: evenly spread over an area (approx. 1-10 km2)

In a permanently protected area?:

Date of implementation: more than 50 years ago (traditional)

Type of introduction
- ☐ through land users' innovation
- ☑ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☐ through projects/ external interventions

Dry mulch grasses are spread manually across the slope, but there is a need of close visiting to emphasize the recomended space from the plant stem. (Godfrey Baraba (box 491, bukoba))

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Cropland

- Annual cropping: cereals - maize, legumes and pulses - beans, root/tuber crops - sweet potatoes, yams, taro/cocoyam, other, root/tuber crops - cassava
- Perennial (non-woody) cropping
- Tree and shrub cropping: avocado, coffee, open grown, mango, mangosteen, guava, Maesopsis

Number of growing seasons per year: 2

Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [x] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

biological degradation - Bl: loss of soil life

water degradation - Ha: aridification

SLM group

- improved ground/ vegetation cover

SLM measures

agronomic measures - A7: Others

TECHNICAL DRAWING

Technical specifications

What is the use of mulching?; Source: Müller-Sämann and Kotschi (1994)

Location: Karonge Village. Bukoba District Council

Date: 26 Feb 2014

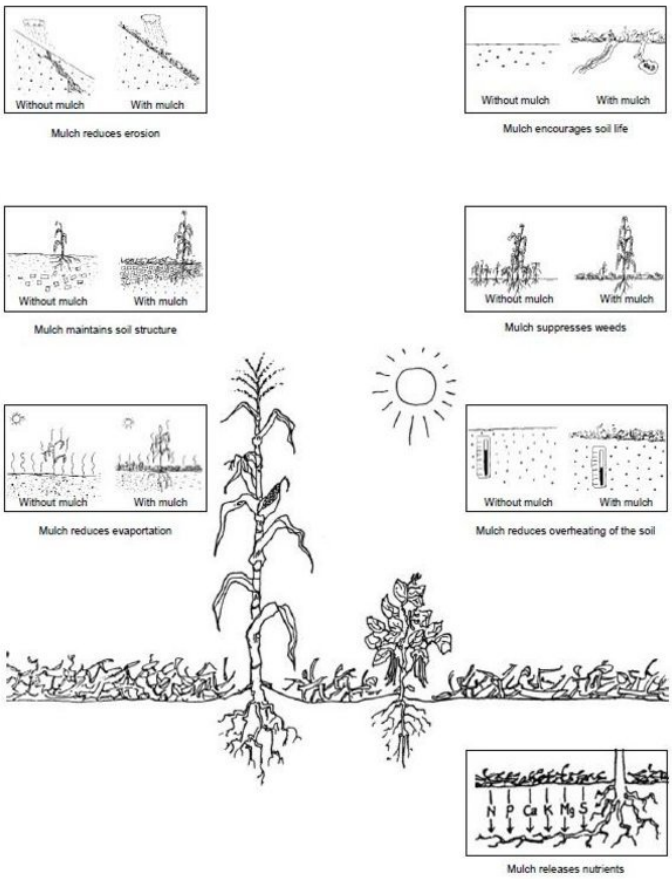
Technical knowledge required for field staff / advisors: low

Technical knowledge required for land users: low

Main technical functions: control of raindrop splash, control of dispersed runoff: impede / retard, increase of infiltration, increase / maintain water stored in soil

Secondary technical functions: increase in organic matter, increase in nutrient availability (supply, recycling,...)

Mulching
Material/ species: Dried grasses (Thatch and Hyperrhenia Rufa grass)
Quantity/ density: 1500m3/ha
Remarks: Spreading across the slope



Author: Godfrey Baraba, DED Bukoba District Council, Box 491, Bukoa.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **USD**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: 1.25

Most important factors affecting the costs

Cost of purchasing mulch grass is the most determinate factor. Mostly due to long distance to fetch the grass and the scatered nature due to degradation and encroachment by tree planting.

Establishment activities

n.a.

Maintenance activities

1. Collection of mulching materials (Timing/ frequency: May-June)
2. Application of mulching materials (spreading) (Timing/ frequency: June-August)
3. Weeding (Timing/ frequency: July and January)
4. De trashing (Timing/ frequency: February and September)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Collection and Apllication of mulching materials	persons/day/ha	16.0	1.5625	25.0	100.0
Construction material					
Mulch	ha	1.0	117.0	117.0	100.0
Total costs for maintenance of the Technology				**142.0**	
Total costs for maintenance of the Technology in USD				*142.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Short rains Sept-November, long rains March-May,length of dry period 180 days
Thermal climate class: tropics

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [x] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [x] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [x] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [x] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [x] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓	good
education	poor	✓	good
technical assistance	poor	✓	good
employment (e.g. off-farm)	poor	✓	good
markets	poor	✓	good

energy	poor ✓ good	
roads and transport	poor ✓ good	
drinking water and sanitation	poor ✓ good	
financial services	poor ✓ good	
Church	poor ✓ good	

IMPACTS

Socio-economic impacts

Crop production	decreased ✓ increased	
fodder quality	decreased ✓ increased	Hyperrhamia rufa is un palatable, hence its dominance implies reduced fodder quality.
animal production	decreased ✓ increased	Unpalatability of Hyperrhamia rufa implies reduced nutrient intake, hence animal production is reduced.
risk of production failure	increased ✓ decreased	
demand for irrigation water	increased ✓ decreased	
expenses on agricultural inputs	increased ✓ decreased	Quantity before SLM: 0 Quantity after SLM: 135 Purchase of mulch grass, without transport and labor for spreading mulch.
workload	increased ✓ decreased	

Socio-cultural impacts

food security/ self-sufficiency	reduced ✓ improved	Increased banana productivity, labores earn income for purchasing food
SLM/ land degradation knowledge	reduced ✓ improved	Practiced farmers respected as inovators as well as progressive farmers
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened ✓ improved	Quantity before SLM: 0 mandays Quantity after SLM: 10 mandays Cutting mulching grasses are income generating activities for young men and women.
livelihood and human well-being	reduced ✓ improved	Improved coffee/banana mulching increases farm income. Additional revenue is spent for child's education and health services
Working in distant unconducive environment	increased ✓ decreased	

Ecological impacts

surface runoff	increased ✓ decreased	
evaporation	increased ✓ decreased	
soil moisture	decreased ✓ increased	
soil compaction	increased ✓ reduced	
soil organic matter/ below ground C	decreased ✓ increased	
beneficial species (predators, earthworms, pollinators)	decreased ✓ increased	Soil's living organisms

Off-site impacts

downstream siltation	increased ✓ decreased	
damage on neighbours' fields	increased ✓ reduced	Surface water run-off is combated in the area, hence neighbor's fields face only rain direct rain drops.
Nutrient transfer from grassland to crop land	increased ✓ decreased	

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Benefits compared with maintenance costs

Short-term returns	very negative ✓ very positive	
Long-term returns	very negative ✓ very positive	

No establishment costs, recurrent costs for mulching Technology for three years consecutively, can increase productivity in two folds and be maintained for more than ten years.

CLIMATE CHANGE

Gradual climate change
annual temperature increase — not well at all ✓ very well

Climate-related extremes (disasters)
local rainstorm — not well at all ✓ very well
local windstorm — not well at all ✓ very well
drought — not well at all ✓ very well

Other climate-related consequences
reduced growing period — not well at all ✓ very well
not well at all very well Answer: not known

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- [ ] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [x] > 50%

Number of households and/ or area covered
1766 households (68 percent of land users in stated area)

Of all those who have adopted the Technology, how many have done so without receiving material incentives?
- [ ] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [x] 91-100%

Has the Technology been modified recently to adapt to changing conditions?
- [ ] Ja
- [ ] Nee

To which changing conditions?
- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view
- Increase in soil moisture especially during the dry season

  How can they be sustained / enhanced? Perform regularly maintenance activities
- Reduced weeds

  How can they be sustained / enhanced? Apply mulch grasses at the depth of 15 cm twice a year for the first 3 years consecutively
- Fertility increase

  How can they be sustained / enhanced? Soft loan of livestock to be provided to farmers

Strengths: compiler's or other key resource person's view
- Esy to implement and maintain

  How can they be sustained / enhanced? Promote extended use of the technology (knowledge sharing)
- Multiple ecological benefits: improved soil organic matter, soil moisture and soil biodiversity

  How can they be sustained / enhanced? Educate farmers on diversified mulching materials and systems e.g. intercropping, cover crops, minimum tillage
- Prevent soil erosion

  How can they be sustained / enhanced? Combine other conservation technologies e.g. contour construction with mulching.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome
- Does not stay longer, it can persist for one season, hence requires twice application Apply the correct quality and quantity material.
- Not readily available to all farmers simply because range land has been allocated to well to do farmers. Land tenure system and land use planning
  should be revisited
- Increased manual labour (cutting, transportation spreading) Plant grasses like vertiva

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome
- Grass mulch available only to farmers with grassland Other measures should be encouraged (use of chopped banana,pseudo stem, leaves and sheaths)
- Degradation of grassland Promotion of SLM Technologies for grassland conservation

REFERENCES

Compiler
Iwona Piechowiak

Editors

Reviewer
David Streiff
Alexandra Gavilano

Date of documentation: Des. 5, 2012

Last update: Aug. 6, 2019

Resource persons
Iwona Piechowiak - SLM specialist
Bertha Munyaga - Government
Babylus Mashauri - Government
Dominick Rutatinisibwa - Government
Raphael Rwezahura - Government
Fidelis Kaihura - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1184/

Linked SLM data
Approaches: Indigenous knowledge transfer https://qcat.wocat.net/af/wocat/approaches/view/approaches_2472/

Documentation was faciliated by

Institution
- Bukoba district council (Bukoba district council) - Tanzania, United Republic of
- Food and Agriculture Organization of the United Nations (FAO) - Italy

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

Links to relevant information which is available online
- Kagera TAMP project website: http://www.fao.org/nr/kagera/en/